STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

CITY OF SAN ANTONIO
CAPITAL IMPROVEMENTS MANAGEMENT SERVICES

FORT SAM HOUSTON TRANSPORTATION PROJECTS
BEXAR COUNTY
HWY: HARRY WURZBACH HWY, CITY STREET BURR ROAD, CITY STREET WINANS ROAD, CITY STREET RITTIMAN ROAD

PROJECT NO: 40-00015
CONTROL NO: 915-12-471, ETC
LIMITS: IN SAN ANTONIO ON HARRY WURZBACH HWY FROM RAPHIAL DR. TO BYRNES DR
ROADWAY LENGTH:
BURR ROAD = 259.86 FT = 0.049 MI
HARRY WURZBACH HWY = 1200.00 FT = 0.227 MI
WINANS ROAD = 441.88 FT = 0.084 MI
HARRY WURZBACH HWY = 1575.00 FT = 0.298 MI
RITTIMAN ROAD = 719.48 FT = 0.136 MI
HARRY WURZBACH HWY = 1983.00 FT = 0.376 MI

TOTAL LENGTH = 6179.22 FT = 1.170 MI

END PROJECT: 40-00015
CONTROL: 915-12-480
HARRY WURZBACH STA. 88+33.00

END PROJECT: 40-00015
CONTROL: 915-12-480
RITTIMAN RD. STA. 21+50.00

BEGIN PROJECT: 40-00015
CONTROL: 915-12-480
RITTIMAN RD. STA. 14+30.52

BEGIN PROJECT: 40-00015
CONTROL: 915-12-480
END PROJECT: 40-00015
CONTROL: 915-12-470
HARRY WURZBACH STA. 68+50.00

END PROJECT: 40-00015
CONTROL: 915-12-470
WINANS RD. STA. 14+80.00

BEGIN PROJECT: 40-00015
CONTROL: 915-12-470
WINANS RD. STA. 10+38.12

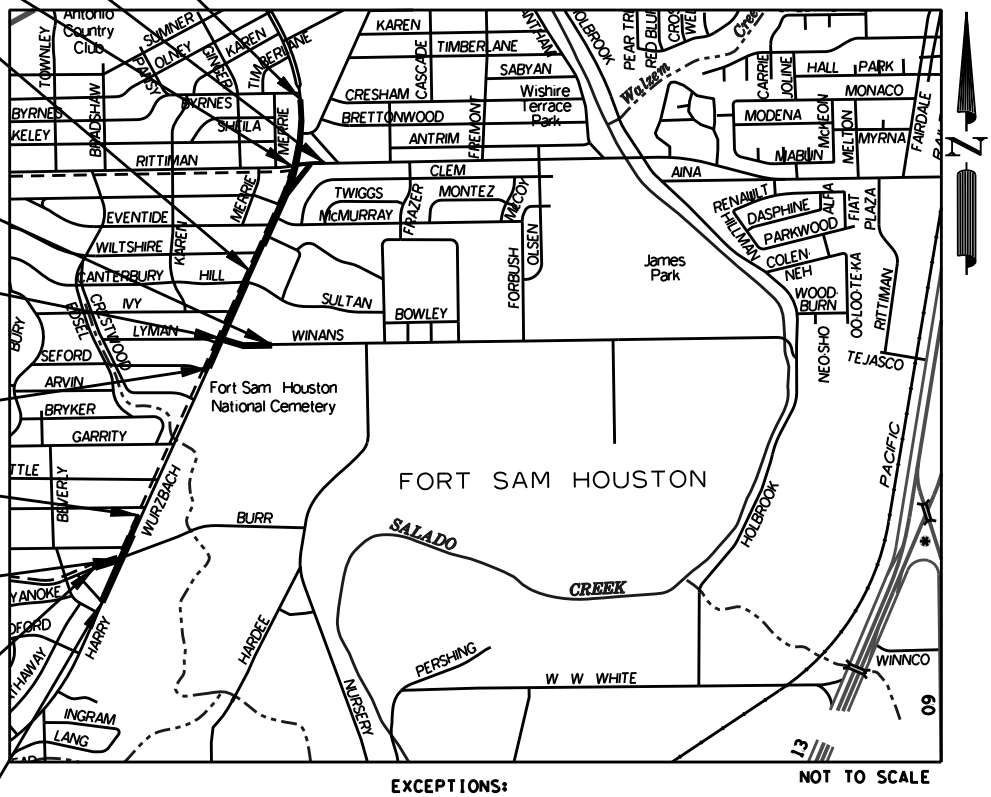
BEGIN PROJECT; 40-00015
CONTROL: 915-12-470
HARRY WURZBACH STA. 52+75.00

END PROJECT: 40-00015
CONTROL: 915-12-471
HARRY WURZBACH STA. 28+00.00

END PROJECT: 40-00015
CONTROL: 915-12-471
BURR RD. STA. 17+09.86

BEGIN PROJECT: 40-00015
CONTROL: 915-12-471
BURR RD. STA. 14+50.00

BEGIN PROJECT; 40-00015
CONTROL: 915-12-471
HARRY WURZBACH STA. 16+00.00



NOT TO SCALE

EXCEPTIONS:
EQUATIONS:
RR X-ING'S:

TDLR INSPECTION REQUIRED
TDLR NO.

TETRATECH
TBPE F-3924
700 N. ST. MARY'S STREET SUITE 300
SAN ANTONIO, TX 78205
TELEPHONE: (210) 226-2922
FAX: (210) 226-8497
WEBSITE: WWW.TETRATECH.COM

COSA LOCAL AREA MANAGED PROJECT PROPOSAL TABLE OF CONTENTS

SPECIAL PROVISION	“SCHEDULE OF LIQUIDATED DAMAGES” (000-1493-COSA)
SPECIAL PROVISION	“ON-THE-JOB TRAINING PROGRAM” (000-1676-COSA)
SPECIAL PROVISION	“DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL AID CONTRACTS” (000-1966-COSA)
SPECIAL PROVISION	“DETOURS, BARRICADE, WARNING SIGNS, SEQUENCE OF WORK, ETC.” (000-2001-COSA)
SPECIAL PROVISION	“IMPORTANT NOTICE TO CONTRACTORS” (000-2002-COSA)

SPECIAL PROVISION TO ITEM 1 (001---015-COSA)
SPECIAL PROVISION TO ITEM 3 (003---033-COSA)
SPECIAL PROVISION TO ITEM 4 (004---017-COSA)
SPECIAL PROVISION TO ITEM 6 (006---COSA)
SPECIAL PROVISION TO ITEM 6 (006---002-COSA)
SPECIAL PROVISION TO ITEM 6 (006---003-COSA)
SPECIAL PROVISION TO ITEM 6 (006---030-(1)-COSA)
SPECIAL PROVISION TO ITEM 6 (006---030-(2)-COSA)
SPECIAL PROVISION TO ITEM 7 (007---119-COSA)
SPECIAL PROVISION TO ITEM 7 (007---708-COSA)
SPECIAL PROVISION TO ITEM 7 (007---806-COSA)
SPECIAL PROVISION TO ITEM 7 (007---1179-COSA)
SPECIAL PROVISION TO ITEM 8 (008---999-COSA)
SPECIAL PROVISION TO ITEM 9 (009---009-COSA)
SPECIAL PROVISION TO ITEM 9 (009---015-COSA)
SPECIAL PROVISION TO ITEM 100 (100---002-COSA)
SPECIAL PROVISION TO ITEM 166 (166---001-COSA)
SPECIAL PROVISION TO ITEM 260 (260---002-COSA)
SPECIAL PROVISION TO ITEM 275 (275---002-COSA)
SPECIAL PROVISION TO ITEM 300 (300---032-COSA)
SPECIAL PROVISION TO ITEM 302 (302---010-COSA)
SPECIAL PROVISION TO ITEM 316 (316---016-COSA)
SPECIAL PROVISION TO ITEM 318 (318---010-COSA)
SPECIAL PROVISION TO ITEM 330 (330---001-COSA)
SPECIAL PROVISION TO ITEM 340 (340---003-COSA)
SPECIAL PROVISION TO ITEM 341 (341---024-COSA)
SPECIAL PROVISION TO ITEM 360 (360---003-COSA)
SPECIAL PROVISION TO ITEM 360 (360---007-COSA)
SPECIAL PROVISION TO ITEM 416 (416—001-CoSA)
SPECIAL PROVISION TO ITEM 420 (420---002-COSA)
SPECIAL PROVISION TO ITEM 421 (421---035-COSA)
SPECIAL PROVISION TO ITEM 424 (424---002-COSA)
SPECIAL PROVISION TO ITEM 440 (440---005-COSA)
SPECIAL PROVISION TO ITEM 441 (441---006-COSA)
SPECIAL PROVISION TO ITEM 442 (442---016-COSA)

SPECIAL PROVISION TO ITEM 448 (448---002-COSA)
SPECIAL PROVISION TO ITEM 450 (450---001-COSA)
SPECIAL PROVISION TO ITEM 462 (462---011-COSA)
SPECIAL PROVISION TO ITEM 464 (464---003-COSA)
SPECIAL PROVISION TO ITEM 465 (465---001-COSA)
SPECIAL PROVISION TO ITEM 500 (500---005-COSA)
SPECIAL PROVISION TO ITEM 502 (502---033-COSA)
SPECIAL PROVISION TO ITEM 506 (506---013-COSA)
SPECIAL PROVISION TO ITEM 512 (512---002-COSA)
SPECIAL PROVISION TO ITEM 610 (610---010-COSA)
SPECIAL PROVISION TO ITEM 620 (620---001-COSA)
SPECIAL PROVISION TO ITEM 624 (624---014-COSA)
SPECIAL PROVISION TO ITEM 628 (628---003-COSA)
SPECIAL PROVISION TO ITEM 636 (636---014-COSA)
SPECIAL PROVISION TO ITEM 643 (643---001-COSA)
SPECIAL PROVISION TO ITEM 672 (672---034–COSA)
SPECIAL PROVISION TO ITEM 682 (682---001–COSA)
SPECIAL PROVISION TO ITEM 682 (682---002–COSA)
SPECIAL PROVISION TO ITEM 685 (685---014–COSA)
SPECIAL PROVISION TO ITEM 687 (687---004 –COSA)
SPECIAL PROVISION TO ITEM 1134 (1134–COSA)
SPECIAL PROVISION TO ITEM 1135 (1135–COSA)
SPECIAL PROVISION TO ITEM 1136 (1136–COSA)
SPECIAL PROVISION TO ITEM 6266 (6266---017–COSA)

16. **SPECIAL SPECIFICATIONS**

ITEM XXXX INTERNALLY ILLUMINATED STREET NAME SIGNS
ITEM 1134 IMPERMEABLE LINER
ITEM 1135 WATER TANK AND PUMP
ITEM 1136 STEEL OR POLYETHYLENE MOBILE WATER STORAGE TANK
ITEM 5010 TRANSPORTABLE CELLULAR TELEPHONES
ITEM 6266 VIDEO IMAGING VEHICLE DETECTION SYSTEM
ITEM 6525 EMERGENCY VEHICLE TRAFFIC SIGNAL PRIORITY CONTROL SYSTEM
ITEM 6834 PORTABLE CHANGEABLE MESSAGE SIGN
ITEM 8245 MODEL 2070 CONTROLLER UNIT
ITEM 8317 BATTERY BACK-UP SYSTEM FOR SIGNAL CABINETS
ITEM 8643 TYPE 2070 CONTROLLER CABINET ASSEMBLIES
ITEM 8703 ACCESSIBLE PEDESTRIAN SIGNAL UNITS
ITEM 9500 SAWS SANITARY SEWER
ITEM 9501 SAWS WATER
ITEM 9502 SAWS ADJUSTMENTS TO RECYCLED WATER FACILITIES
ITME 9503 SAWS HANDLING ASBESTOS CEMENT PIPE
CPS ENERGY REQUIREMENTS AND SPECIFICATIONS FOR CONSTRUCTION OF NATURAL GAS DISTRIBUTION FACILITES ON THE FORT SAM HOUSTON TRANSPORTATION PROJECT

17. APPENDIX A: EXAMPLE OF ENVELOPE 1
18. PROPOSAL TO CITY OF SAN ANTONIO
19. 025 UNIT PRICING FORM
20. APPENDIX B: EXAMPLE OF ENVELOPE 2
21. BID BOND OR CASHIERS CHECK
22. ASSURANCE OF COMPLIANCE WITH EQUAL OPPORTUNITY STATEMENT
23. CERTIFICATION OF NON-SEGREGATED FACILITIES
24. STATEMENT OF PRESIDENT'S EXECUTIVE ORDERS
25. ADDENDUM ACKNOWLEDGMENT FORM
26. DISCLOSURE OF LOBBYING ACTIVITIES
27. CHILD SUPPORT STATEMENT FORM
28. CERTIFICATION OF NON- COLLUSION
29. CERTIFICATION OF INTEREST IN OTHER BID PROPOSALS FOR THIS WORK
30. LITIGATION DISCLOSURE FORM
31. CERTIFICATION OF ABSENCE OF SUSPENSION, DEBARMENT, VOLUNTARY EXCLUSION, OR DETERMINATION OF INELIGIBILITY

32. BID ITEMS

ITEMS 1 TO 9 INCL., GENERAL REQUIREMENTS AND COVENANTS
ITEM 100 PREPARING RIGHT OF WAY (103)
ITEM 104 REMOVING CONCRETE
ITEM 105 REMOVING STABILIZED BASE AND ASPHALT PAVEMENT
ITEM 110 EXCAVATION (132)
ITEM 112 SUBGRADE WIDENING (132)
ITEM 132 EMBANKMENT (100)(204)(210)(216)(400)
ITEM 162 SODDING FOR EROSION CONTROL (166)(168)
ITEM 168 VEGETATIVE WATERING
ITEM 260 LIME TREATMENT (PLANT-MIXED) (105)(132)(204)(210)(216)(247)(300)(310)(520)
ITEM 316 SURFACE TREATMENTS (210)(300)(302)(520)
ITEM 340 DENSE GRADED HOT MIX ASPHALT (METHOD) (210)(300)(301)(320)(520)(585)
ITEM 354 PLANING AND TEXTURING PAVEMENT
ITEM 356 FABRIC UNDERSEAL (300)
ITEM 402 TRENCH EXCAVATION PROTECTION
ITEM 420 CONCRETE STRUCTURES (400), (421)(427)(438)(440)(448)
ITEM 432 RIPRAP (420)(421)(427)(440)
ITEM 462 CONCRETE BOX CULVERTS AND STORM DRAINS (400)(424)(464)(476)
ITEM 464 REINFORCED CONCRETE PIPE (400)(476)
ITEM 465 MANHOLES AND INLETS (400)(420)(421)(440)(471)
ITEM 476 JACKING, BORING OR TUNNELING PIPE OR BOX (462)(464)
ITEM 496 REMOVING STRUCTURES
ITEM 500 MOBILIZATION
ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING
ITEM 504 FIELD OFFICE AND LABORATORY

ITEM 506 TEMPORARY EROSION, SEDIMENTATION, AND ENVIRONMENTAL CONTROLS
ITEM 508 CONSTRUCTING DETOURS
ITEM 512 PORTABLE CONCRETE TRAFFIC BARRIER (420)(421)(424)(440)(442)
ITEM 529 CONCRETE CURB, GUTTER, AND COMBINED CURB (360)(420)(421)(440)
ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS (247)(260)(263)
(275)(276)(292)(316)(330)(334)(340)(360)(421)(440)
ITEM 531 SIDEWALKS (104)(360)(420)(421)(440)(530)
ITEM 536 CONCRETE MEDIANS AND DIRECTIONAL ISLANDS (420)(421)(427)(440)
(529)
ITEM 610 ROADWAY ILLUMINATION ASSEMBLIES (421)(441)(442)(445)(446)(449)
(616)(620)
ITEM 618 CONDUIT (400)(445)(476)(622)
ITEM 620 ELECTRICAL CONDUCTORS
ITEM 624 GROUND BOXES (421)(440)
ITEM 628 ELECTRICAL SERVICES (441)(445)(449)(618)(620)(627)(656)
ITEM 636 ALUMINUM SIGNS (643)
ITEM 644 SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES (421)(440)
(441)(442)(445)(634)(636)(643)(656)
ITEM 647 LARGE ROADSIDE SIGN SUPPORTS AND ASSEMBLIES
(421)(440)(441)(442)(445)(643)
ITEM 662 WORK ZONE PAVEMENT MARKINGS (666)(668)(672)(677)
ITEM 666 REFLECTORIZED PAVEMENT MARKINGS (316)(318)(662)(677)(678)
ITEM 672 RAISED PAVEMENT MARKERS (677)(678)
ITEM 677 ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS (300)
(302)(316)
ITEM 680 INSTALLATION OF HIGHWAY TRAFFIC SIGNALS
(610)(625)(627)(634)(636)
(656)
ITEM 681 TEMPORARY TRAFFIC SIGNALS (628)(680)
ITEM 682 VEHICLE AND PEDESTRIAN SIGNAL HEADS
ITEM 684 TRAFFIC SIGNAL CABLES
ITEM 686 TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL)
(416)(421)(441)(442)(445)(449)
ITEM 688 PEDESTRIAN DETECTORS AND VEHICLE LOOP DETECTORS (618)(624)
(682)(684)
ITEM 690 MAINTENANCE OF TRAFFIC SIGNALS (416)(421)(476)(610)(618)(620),
(622)(624)(625)(627)(628)(634)(636)(656)(680)(682)(684)(685)(686)(687)(688)
ITEM 6041 INTERNALLY LIGHTED STREET NAME SIGN ASSEMBLIES

CITY OF SAN ANTONIO
FT. SAM HOUSTON – PROJECT NO. 40-00015
(COSA – ROADWAY IMPROVEMENTS)
HARRY WURZBACH FROM BURR ROAD TO RITTIMAN STREET

GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS:	ADOPTED BY THE CITY OF SAN ANTONIO
----------	JUNE 2008. STANDARD SPECIFICATIONS
	ARE INCORPORATED INTO THE CONTRACT
	BY REFERENCE.

INVITATION FOR BID

(IFB)

1. Sealed bid proposals and other required documents will be received at the Office of the City Clerk,(City Hall, 100 Military Plaza, 2nd floor, San Antonio, Texas) will be received for: ___

   _____

   _____

   in accordance with Plans and Specifications on File with the office of Plans and Records, Ninth Floor, Municipal Plaza Building, 114 W. Commerce, San Antonio, Texas.

   Plans and Specifications can be obtained from the office of _____ _____. Plans and Specifications may be purchased at a cost of $_____ per set (tax included). No refund will be made for plan sets that are returned.

2. The following documents constitute the required information to be submitted as a part of the bid proposal:

   1. Envelope #1, furnished by the City, shall contain:
      a. Bid documents and any alternate bids.

   2. Envelope #2, furnished by the City, shall contain:
      a. Bid bond or cashiers check.
      b. Assurance of Compliance with Equal Employment Opportunity Statement.
      c. Certificate of Non-Segregated Facilities.
      d. Statement on President's Executive Order.
      e. Addenda Acknowledgement Form.
      f. Disclosure of Lobbing Activities
      g. Child Support Statement
      h. Certificate of Non-Collusion
      i. Litigation Disclosure Form.
      j. Certificate of Interest In Other Bid Proposals For This Work

   The envelopes furnished by the City shall be clearly marked with the name of the project for which bids are to be submitted.

3. The Bid shall be submitted in duplicate on Proposal Forms provided with the specifications. Envelope #1 shall contain the Bid and shall be clearly identified as: Bid Proposal For:_____

   _____

   Envelopes #1 and #2 will be received in the Office of the City Clerk until 1:00 p.m. on _____ _____. All envelopes will be opened and publicly read aloud at 1:00 p.m.. Any Bids received after that will be returned unopened. The City reserves the right to reject any and all Bids and waive any formalities.

4. A certified or cashier's Check, (if bid is less than $25,000), or an original Bid Proposal Guaranty issued by a corporate surety company licensed to do business in the State of Texas

and payable to the order of the City of San Antonio, Texas, in an amount not less than five percent (5%) of the greatest total amount of the Bid Proposal, must accompany each Bid as a guarantee that if awarded the Contract, the successful Bidder will promptly enter into a Contract and execute payment and performance bonds, on the standard forms provided, as outlined in the specification and Contract Documents.

5. A Performance Bond, in an amount of not less than one hundred percent (100%) of the Contract Price, conditioned upon the faithful performance of the Contract; a Payment Bond, as required by Chapter 2253 of the Texas Government Code, guaranteeing the payment of all persons supplying labor and furnishing materials; and an Extended Warranty Bond, either by separate instrument or incorporated in the foregoing bonds, will be required. Payment and performance bonds provided to the City of San Antonio for these purposes are required to conform with Article 7.19-1 of the Texas Insurance Code. To that end, all bonds provided (i) must be executed by a surety company holding a certificate of authority from the United States secretary of the treasury to qualify on obligations permitted or required under federal law–or- (ii) must be provided by a surety company that is covered by reinsurance for any liability in excess of $100,000.00 from a reinsurer authorized and admitted as a reinsurer in Texas holding a certificate of authority from the United States secretary of the treasury to qualify on obligations permitted or required under federal law.

   A. A listing on the Department of the Treasury Listing of Approved Sureties on the date of bond issuance shall be sufficient proof of the aforesaid certificate of authority.

   B. A copy of the reinsurance contract(s) with accompanying cover letter with original signature shall be sufficient proof of the aforesaid reinsurance.

   Contractor shall provide either a copy of the list as described in “A.” above, or the contract(s) and letter described in “B.” above, together with the payment and performance bonds.

6. Bid Bonds, Performance Bonds, and Payment Bonds issued by a corporate surety company not licensed to do business in the State of Texas will <u>not</u> be accepted.

7. The successful Bidder will be required to execute the Standard Form Working Day (Calendar Day Schedule). Contract prepared and supplied by the City.

8. This is a proposed Public Works Contract, and Chapter 2258 of the Texas Government Code requires that not less than the prevailing wage rate for Work of a similar character in this locality shall be paid all laborers, workmen, and mechanics employed in the construction thereof shall be complied with.

9. "NON-DISCRIMINATION IN EMPLOYMENT. BIDDERS ON THIS WORK WILL BE REQUIRED TO COMPLY WITH THE PRESIDENT'S EXECUTIVE ORDER NO. 11246, "EQUAL EMPLOYMENT OPPORTUNITY," AS AMENDED BY EXECUTIVE ORDER NO. 11375, "AMENDING EXECUTIVE ORDER 11246 RELATING TO EQUAL EMPLOYMENT OPPORTUNITY," AND AS SUPPLEMENTED BY REGULATIONS AT 41 CFR PART 60, "OFFICE OF FEDERAL CONTRACT COMPLIANCE PROGRAMS,

EQUAL EMPLOYMENT OPPORTUNITY, DEPARTMENT OF LABOR. THE REQUIREMENTS FOR BIDDERS AND CONTRACTORS UNDER THIS ORDER ARE EXPLAINED IN THE SPECIFICATIONS"

10. Per Ordinance #69403, the City of San Antonio, its employees, contractors, and subcontractors shall not discriminate on the basis of race, color, religion, national origin, sex, age, or handicap in the award and performance of contracts, Violation of this ordinance is a criminal offense and subject to penalty.

11. Notice is hereby posted that a pre-bid conference will be held in the _____ _____ City of San Antonio, Texas, at_____. This conference will be held to answer questions prospective Bidders may have regarding the intent of the plans and/or specifications.

12. This construction Contract is being funded with federal funds and is subject to all applicable federal labor standards provisions pertaining to payment of prevailing wage rates, anti-kickback provisions, overtime provisions, etc., as required by federal laws and regulations, in addition to labor standards applicable under State and local law.

City of San Antonio
General Specifications
Version 2004

These City of San Antonio General Specifications Items 1 through 9 will replace the General Provisions Items 1 through 9 in the Texas Department of Transportation's Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges.

DIVISION I
GENERAL REQUIREMENTS AND COVENANTS
SPECIFICATIONS FOR 2004
TABLE OF CONTENTS

ITEM 1

DEFINITION OF TERMS

1.1. Definitions. Wherever the following terms are used in these specifications or other contract documents, the intent and meaning shall be interpreted as shown below:

1.2. Abbreviations:

AAN	American Association of Nurserymen.
AAR	Association of American Railroads.
AASHTO	American Association of State Highway and Transportation Officials.
ACPA	American Concrete Pipe Association.
AITC	American Institute of Timber Construction.
ANSI	American National Standards Institute.
API	American Petroleum Institute.
AREA	American Railroad Engineers Association.
ASTM	American Society for Testing and Materials.
AWG	American Wire Gage.
AWPA	American Wood Preservers Association.
AWPB	American Wood Preservers Bureau.
AWPI	American Wood Preservers Institute.
AWS	American Welding Society.
AWWA	American Water Works Association.
DFPA	Douglas Fir Plywood Association.
IES	Illuminating Engineering Society.
IMSA	International Municipal Signal Association.
ITE	Institute of Transportation Engineers.
NBFU	National Board of Fire Underwriters.
NEC	National Electrical Code (Published by NBFU).
NEMA	National Electrical Manufacturers Association.
NFPA	National Forest Products Association.
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
SFPA	Southern Forest Products Association.
SPIB	Southern Pine Inspection Bureau.
TxDOT	Texas Department of Transportation
UL	Underwriters Laboratory, Inc.
WWPA	Western Wood Products Association.

1.3. Arterial Highway. A general term denoting a highway primarily for through traffic, usually on a continuous route.

1.4. Authorization To Proceed. A written notice given by Owner to Contractor establishing the date on which the Contract Time will commence to run and on which Contractor shall start to perform Contractor's obligations under the Contract Documents. (Also referred to as Notice to Proceed or Work Project Authorization).

1.5. Bid Error. A mathematical mistake by the prime contractor in the unit price entered into the bid proposal.

1.6. Bidder. An individual, partnership, limited liability company, corporation or any combination thereof submitting a bid proposal.

1.7. Bridges. Structures of over 20-foot span measured from face to face of abutments, or in case of copings, from face to face of copings, and multiple span structures of over 20-foot length, measured between inside of end walls along the centerline of the roadbed.

1.8. Certificate of Insurance. City of San Antonio approved form covering insurance requirements stated in the contract.

1.9. Change Order (See Field Alteration). A written description by the Department covering modifications to the original contract necessary to complete the contracted work

1.10. City. The City of San Antonio, Texas and "Owner" of this Project. Whenever in this Contract is found the term "City" or "Owner" or other designation of any City institution, officer, employee or title, or a pronoun in its, his or their place, the same shall, unless indicated otherwise, be understood to mean the City of San Antonio or its successors, or the governing body, or the person or persons now or hereafter holding or exercising the duties of such designated official position, office, employment or title, in said City, or any person or persons acting lawfully in the corresponding official capacity on behalf of the City at such time and within the powers and authority held by him or them.

1.11. City Council. The duly elected members of the council of the City of San Antonio, Texas.

1.12. Commission. The Texas Transportation Commission.

1.13. Construction Bulletin C-5. Manual of procedures and requirements for manual welding and submerged arc welding for the fabrication of structural steel.

1.14. Construction Bulletin C-6. Manual of testing requirements for the qualification of welders for structural and reinforcing steel.

1.15. Construction Bulletin C-8. Manual of procedures for driving and test loading piling.

1.16. Construction Bulletin C-9. Manual of procedures for constructing and test loading drill shafts.

1.17. Construction Bulletin C-11. Manual of procedures to be followed in the design and control of portland cement concrete.

1.18. Construction Bulletin C-14. All references to Construction Bulletin C-14 for the design of asphaltic concrete pavement shall be understood to denote Test Method Tex-204-F. All references to Construction Bulletin C-14 for the calibration of cold aggregate feeds shall be understood to denote the plant manufacturer's recommended calibration procedures or other method acceptable to the Engineer.

1.19. Construction Observer/Inspector "COI." The authorized representative of the Director of Public Works assigned by the Owner to observe and inspect any or all parts of the Project and the materials to be used therein. (Same as Inspector)

1.20. Consultant. A person registered as a professional engineer pursuant to Article 3271a, V.T.C.S., employed to provide professional engineering services and having overall responsibility for the design of a project or a significant portion thereof, together with administrative supervision of any subconsultants Consultant may retain. The term "Consultant," unless the context clearly indicates otherwise, means an engineer in private practice retained for a specific project under a contractual agreement with the Owner.

1.21. Contract. The agreement between the City and the Contractor covering the furnishing of materials and performance of the work. The contract will include, but not be limited to the Plans, Standard Specification incorporated by reference, Special Provisions, Special Specifications, Contract Bonds, Supplemental Agreements and Field Alterations.

1.22. Contract Documents. The Contract Documents consist of Bidding Documents such as: the Advertisement or Invitation to Bid, the Instructions to Bidders, the Contractor's completed Bid Proposal form, the Addenda, the Contract, the Conditions of the Contract (General, Supplemental and Special Conditions), the Plans, the Specifications, the Field Alterations, the Payment and Performance. The Contract Documents form the complete CONTRACT, which represents the entire and integrated agreement between the Owner and the Contractor and

supersedes all prior negotiations, representations or agreements, either written or oral.

1.23. Contract Sum. The total compensation payable to the Contractor for performing the Work as originally contracted or as subsequently adjusted by Field Alterations.

1.24. Contract Time. The total time allowed the Contractor for completion of the Work.

1.25. Contractor. The individual, firm or corporation or any combination thereof, Party of the Second Part, with which the contract is made by the City.

1.26. Controlled Access Highway. Any highway to or from which access is denied or controlled, in whole or in part, from or to abutting land or intersecting streets, roads, highways, alleys or other public or private ways.

1.27. Control of Access. The condition where the right to access of owners or occupants of abutting land or other persons in connection with a highway is fully or partially controlled by public authority.

> **.1 Full Control.** Full control of access means that the authority to control access is exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections.
>
> **.2 Partial Control.** Partial control of access means that the authority to control access is exercised to give preference to through traffic to a degree that, in addition to access connections with selected public roads; there may be some crossings at grade and some private driveway connections.

1.28. County. A political subdivision of the State.

1.29. Culvert. Any structure, other than a bridge, which provides an opening under a roadway for drainage or other purposes.

1.30. Debar (Debarment). To disqualify (the disqualification of) a Contractor from bidding on or entering into a contract, or from participating as a Contractor or Subcontractor.

1.31. Department. The Department of Public Works, City of San Antonio, Texas.

1.32. Departmental Material Specifications. Specifications for various materials published by the Materials and Pavement Section of the Construction Division of TxDOT. Departmental Material Specifications are now referred to as DMS-XXXX in lieu of D-9-XXXX.

1.33. Disadvantaged Business Enterprise (DBE) Joint Venture. A DBE firm and one or more other firm(s) to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks and profits of the joint venture are commensurate with its ownership interest.

1.34. Disadvantaged Business Enterprise. A small business concern, certified through the Texas Unified Certification Program in accordance with 49CFR Part 26, which is fifty-one (51) percent owned by one or more minorities or women, or in the case of a publicly owned business, at least fifty-one (51) percent of the stock is owned by one or more minorities or women, and whose management and daily business operations are controlled by one or more such individuals.

1.35. Disadvantaged Business Enterprise Liaison Officer (DBELO). The individual responsible for implementing all aspects of the Disadvantaged Business Enterprise Program for the City of San Antonio.

1.36. Engineer. The City Engineer, or his duly authorized representative, either or both being a duly authorized representative of the Director of Public Works.

1.37. Expressway. A divided arterial highway for through traffic with full or partial control of access and generally with grade separations at intersections.

1.38. Federal-Aid Contract. Any contract between the City/State and a Contractor, which is paid for in whole or in part with U. S. Department of Transportation (DOT) financial assistance.

1.39. Field Alteration. A written order issued by the City to the Contractor authorizing additions, deletions, or revisions to the Work to be performed by Contractor within the general scope of construction services outlined in the Contract Documents.

1.40. Freeway. An expressway with full control of access.

1.41. Frontage Street or Frontage Road. A local street or road auxiliary to and located along an arterial highway for service to abutting property and adjacent areas and for control of access (sometimes known as a Service Road, Access Road or Insulator Road).

1.42. Hazardous Materials/Waste. Hazardous materials/waste include, but are not limited to, such materials as: explosives, compressed gas, flammable liquids, flammable solids, combustible liquids, oxidizers, poisons, radioactive materials, corrosives, etiologic agents and other material classified as hazardous by 40CFR261, or applicable state and federal regulations.

1.43. Highway, Divided. A highway with separate roadways intended to move traffic in opposite directions.

1.44. Highway, Street or Road. General terms denoting a public way for purposes of vehicular travel, including the entire area within the right of way. Recommended usage: in urban areas is highway or street and in rural areas is highway or road.

1.45. Inspector. The person assigned by the Engineer to inspect any or all parts of the work and the materials to be used therein. (Same as COI)

1.46. Intersection. The area embraced within the prolongation or connection of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways, of two highways which join one another at, or approximately at, right angles; or the area within which vehicles traveling upon different highways joining at any other angle may come in conflict.

1.47. Island. An area within a roadway for which vehicular traffic is intended to be excluded, together with any area at the approach thereto occupied by protective deflecting or warning devices.

1.48. Invitation for Bids (IFB). A published notice that the City will be accepting bid proposals on a project. The notice states the project name, where the project plans and specifications can be obtained, the cost of the plans and specifications, when and where the bid proposals are to be submitted.

1.49. Laboratory. The testing laboratory that may be designated or approved by the Director of Public Works.

1.50. Local Street or Local Road. A street or road primarily for access to residence, business or other abutting property.

1.51. Major Bid Item. Any individual Bid Item submitted by Contractor that constitutes a five (5) percent minimum of the total Contract Sum proposed by the successful low Bidder Contractor. In spite of the general criteria above, the Owner and Consultant reserve the right to identify or exclude specific Bid Items as being “Major” in the Contract Documents for each Project.

1.52. Major Street or Major Highway. An arterial highway with intersections at grade and direct access to abutting property, and on which geometric design and traffic control measures are used to expedite the safe movement of through traffic.

1.53. Manual of Testing Procedures. Texas Department of Transportation Division of Materials and Tests manual outlining testing methods and procedures.

1.54. Materials. Definitions of materials and material properties are as found in Test Method Tex-100-E, Part I.

1.55. Mathematically Unbalanced Bid. A bid containing lump sum or unit bid items, which do not reflect reasonable actual costs plus a reasonable proportionate share of the Bidder's anticipated profit, overhead costs and other indirect costs.

1.56. Materially Unbalanced Bid. A bid which generates a reasonable doubt that award to the Bidder submitting a mathematically unbalanced bid will result in the lowest ultimate cost to the Owner.

1.57. Median. The portion of a divided highway separating the traffic lane(s) in opposite directions.

1.58. Nonhazardous Recyclable Material. A material that has been recovered or diverted from the nonhazardous waste stream for purposes of reuse or recycling in the manufacture of products that may otherwise be produced using raw or virgin materials.

1.59. Nonresident Bidder. A Bidder whose principal place of business is not in Texas; includes a Bidder whose ultimate parent company or majority owner does not have its principal place of business in Texas.

1.60. Owner. See “City.”

1.61. Owner's Representative. The Director of Public Works or his Designee.

1.62. Pavement. That part of the roadway having a constructed surface for the facilitation of vehicular traffic.

1.63. Payment Bond. The security furnished by the Contractor through the Surety in the full amount of the Contract Sum for the protection of all persons supplying labor and material in the prosecution of the Work who properly follow statutory requirements for perfecting claims against such security.

1.64. Performance Bond. The security furnished by the Contractor through the Surety in the full amount of the Contract Sum as a guaranty that the Work will be faithfully performed and completed and that the Owner will be saved harmless from all costs and damages which the Owner may suffer by reason of the Contractor's default or failure to perform the Work.

1.65. Plans. The Plans, drawings, details and supplemental drawings, or reproductions thereof, produced and sealed by the Consultant and approved by the Owner, showing the location, character, dimensions and details of the Work and which are a part of the Contract. Plans include standard details issued and sealed by the City Engineer or his representative.

1.66. Power of Attorney for Surety Bonds. An instrument under corporate seal, which appoints an attorney-in-fact to act in behalf of a Surety Company in signing bonds.

1.67. Project. Work site and Work elements with all appurtenances and construction to be performed thereon under the Contract.

1.68. Bid Proposal. The offer of the Bidder, made out in duplicate on the prescribed forms, giving prices for performing the work described in the plans and specifications.

1.69. Bid Proposal Guaranty. The security designated in the bid proposal and furnished by the Bidder as a guaranty that the Bidder will enter into a contract if awarded the work.

1.70. Ramp. A section of highway over which traffic passes for the primary purpose of making connections

with other highways.

1.71. Registered Professional Engineer. A person who has been duly licensed and registered by the Texas State Board of Registration for Professional Engineers to engage in the practice of engineering in this state.

1.72. Rental Rate Blue Book for Construction Equipment. Equipment rental rates published by Dataquest (also known as the Rental Rate Blue Book or the Blue Book).

1.73. Right of Way. The land provided for a highway, street or road.

1.74. Roadbed. The graded portion of a highway, which is prepared as foundation for the pavement structure and shoulders. On divided highways, the depressed median type and the raised median type highways will be considered to have two roadbeds. Highways with a continuous two-way left turn lane will be considered to have one roadbed.

1.75. Roadway. The portion of the highway within the limits of construction.

1.76. Samples. Physical examples furnished by the Contractor to Owner to illustrate intended or anticipated materials, equipment or workmanship, and to assist Owner and Consultant in the establishment of workmanship and quality standards by which the Work will be judged.

1.77. Sequence of Construction. The logical and proper order in which the Contractor shall accomplish the Work by Owner directed stages and phases, as shown in the Contract Documents, unless Owner orders otherwise by a properly executed Field Alteration.

1.78. Screens and Sieves. As defined by the ASTM.

1.79. Shop Drawings. Drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are furnished by the Contractor and prepared by Contractorwhich illustrates and details some portion of the Work.

1.80. Shoulder. That portion of the roadway contiguous with the traffic lane(s) for accommodation of stopped vehicles for emergency use and/or for lateral support of base and surface courses.

1.81. Special Provisions. Additions and/or revisions to the Standard Specifications or Special Specifications.

1.82. Special Specifications. Supplemental Specifications applicable to the individual project, not covered by the Standard Specifications.

1.83. Specifications. The specific instructions to the Contractor as to the requirements for materials, equipment, certain construction systems, standards and quality of workmanship for the Work and performance of related services and forming a part of the Contract.Where the phrases such as “or directed by the Engineer”, “or as approved by the Engineer” or “or to the satisfaction of the Engineer” occur, it is understood that the directions, orders or instructions to which they relate are within the limitations of and authorized by the contract. Special provisions and special specifications will cover work pertaining to a particular project and included in the bid proposal but not covered by the Standard Specifications. Where reference is made to Departmental Material Specifications, specifications of ASTM, AASHTO or Bulletins and Manuals of the Department, it shall be construed to mean the latest standard or tentative standard in effect on the date of the bid proposal. Incorporation of subsequent changes to the above documents will be considered by the Engineer in accordance with Item 4, “Scope of Work,” as appropriate.

1.84. State. The State of Texas.

1.85. Subcontractor. An individual, partnership, limited liability company, corporation or any combination thereof to which the Contractor sublets, or proposes to sublet, any portion of a contract.

1.86. Subgrade. That portion of the roadbed upon which the subbase, base or pavement structure is to be placed.

1.87. Substantial Completion. The date certified by the Owner when the Construction of the Project or a specified part thereof is sufficiently completed in accordance with the Contract Documents so that the Project, or specified part thereof could be utilized for the Owner's purposes for which it is intended.

1.88. Substructure. That part of the structure below the bridge seats or below the springing lines of arches. Parapets, backwalls and wingwalls of abutments shall be considered as parts of the substructure.

1.89. Superintendent. The on project site representative of the Contractor authorized to receive and fulfill instructions from the City's Construction Observer/Inspector ("COI"). The Superintendent or his designee shall supervise and direct the construction Work.

1.90. Superstructure. That part of the structure above the bridge seats or above the springing lines of arches.

1.91. Surety. The corporate body licensed to conduct business in the State of Texas that provides assurance that the Contractor, or his substitute will faithfully perform the Work covered by the Contract and make payment of any due, unpaid, eligible labor and supply claims arising there under.

1.92. Temporary Structures. All temporary bridges, culverts and structures required to maintain traffic during the construction of work.

1.93. Texas Commission on Environmental Quality (TCEQ). Texas Natural Resource Conservation Commission (TNRCC) has changed its name to TCEQ. Therefore all references to TNRCC now refer to TCEQ.

1.94. Texas Unified Certification Program (TUCP). A "one stop" certification process for Disadvantaged Business Enterprises (DBE's).

1.95. THD Test Method (TxDOT). Materials and Test Division manual outlining testing methods and procedures.

1.96. TMUTCD. Texas Manual on Uniform Traffic Control Devices for Streets and Highways.

1.97. Traffic Lane. The strip of roadway intended to accommodate the forward movement of a single line of vehicles.

1.98. Traveled Way. The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

1.99. Underground Facilities. All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, sewage and drainage removal, traffic or other control systems.

1.100. Unit Price Work. Work to be paid for by Owner on the basis of Contractor quoted unit prices in the Bid Proposal based upon Owner estimated quantities.

1.101. The Work. The work shall include the furnishing of all labor, materials, equipment and other incidentals necessary or convenient to the successful completion of the project and the carrying out of all the duties and obligations imposed by the contract.

1.102. Work Element Pay Item. An Item for which a unit cost is requested.

1.103. Working Day (Calendar Day Schedule). This is a seven (7) calendar days per week definition. A

working day is defined as a calendar day, not including City holidays as designated by City Council each fiscal year in October.

.1 Time will be charged for all working days regardless of weather conditions, materials, or supplies, which could impede the prosecution of the work.

.2 The Engineer may suspend the work and the "Time Charge" in accordance with Article 8.6, "Suspension of Work by Owner" when conditions not under the control of the Contractor, other than those described above, prohibit the performance of the critical activity or activities which control the completion of the project as determined by the schedule submitted in accordance with Article 8.1, "Prosecution of Work."

.3 The Engineer may suspend the work and the "Time Charge," in accordance with Article 8.6, on any holiday, on the day(s) preceding the holiday and/or on the day(s) following the holiday if the Engineer and the Contractor mutually agree the Contractor should not work. Such suspension shall be based upon (a) past experience as to the volume of holiday traffic that may be expected and (b) the hazard that project operations would present to the traveling public and/or the Contractor's personnel.

.4 Work on City holidays will not be permitted except with the written permission of the Engineer. If work on City holidays is permitted, working time will be charged on the same basis as described above.

1.104. Written Notice. Shall be considered to have been duly given if delivered in person to an authorized representative of the Contractor or Owner, or to an officer of the corporation for whom it is intended, or if delivered at, or sent by registered or certified mail to the last business address known to the person who gives the notice.

ITEM 2

INSTRUCTIONS TO BIDDERS
LOCAL AGENCY MANAGED PROJECTS (LAM)

2.1. Introduction. The 2004 Specifications for the General Provisions (Items 1 – 9) are written in passive voice, indicative mood. The Special Provisions for the General Provisions are written in active voice, imperative mood. The subject of imperative sentences is understood to be "The Contractor." Phrases such as "as approved," "unless approved," "upon approval," "as directed," "as verified," "as ordered," and "as determined" refer to actions of the Engineer unless otherwise stated, and it is understood that the directions, orders, or instructions to which they relate are within the limitations of and authorized by the Contract.

2.2. Bid Proposal Documents. Sealed bid proposals and other required documents will be received at the Office of the City Clerk (City Hall, 100 Military Plaza, 2nd Floor, San Antonio, Texas), as set forth in the Invitation for Bids (IFB). Information and Bidding documents are obtainable from the Consultant as set forth in the published IFB. Bidding documents are also on file in the Office of Plans and Records (Municipal Plaza Building, 9th Floor, 114 W. Commerce).

.1 The following documents constitute the required information to be submitted as a part of the bid proposal:

a. Envelope #1, furnished by the City shall contain:
   Bid document and any alternate bids
b. Envelope #2, furnished by the City, shall contain:
   Bid bond or cashiers check
   Assurance of Compliance with Equal Employment Opportunity Statement
   Certificate of Non-Segregated Facilities
   Statement on President's Executive Order
   Addenda Acknowledgement Form
   Disclosure for Lobbying Activities
   Child Support Statement
   Certificate of Non-Collusion
   Certificate of Interest In Other Bid Proposals For This Work
   Litigation Disclosure Form

The envelopes furnished by the City shall be clearly marked with the name of the project for which bids are to be submitted.

2.3. Bid Proposal Forms. The Bid shall be submitted in duplicate on Bid Proposal Forms provided with the specifications. Envelope #1 shall contain the Bid Proposal and shall be clearly identified as: Bid Proposal For:____

_____

Envelopes #1 and #2 will be received in the Office of the City Clerk until 1:00 p.m. on _____
_____. All envelopes will be opened and publicly read aloud at 1:00 p.m. Any Bids received after that will be returned unopened. The City reserves the right to reject any and all Bids and waive any formalities.

2.4. Bidder Findings of Discrepancies or Ambiguities. Prospective Bidders shall notify Consultant and Owner in writing at least five (5) calendar days prior to scheduled Bid Opening date if discrepancies and ambiguities or omissions are found in the Project Plans and/or Specifications, or if further information or interpretation is desired.

2.5. Addenda. Answers by Consultant and/or Owner will be given in writing to all prospective Bidders in Addendum form. All provisions and requirements of such addenda will supersede or modify affected portions of the Project Plans and/or Specifications. All addenda will be incorporated in and bound with the Contract Documents. No other explanation or interpretation will be considered official or binding upon the Owner.

.1 Addendum Acknowledgement Form. The Contractor's submitted Bid Proposal shall be based on Contractor's investigation and knowledge of the conditions at the Project site, the Specifications, the Plans and any Addenda to the Specifications and/or Plans issued during time of advertisement prior to bidding. The Bidders shall sign and submit the Addendum Acknowledgement Form with the Bid Packet.

2.6. Bid Proposal to City of San Antonio (Form 9-12). The bid proposals shall be submitted in duplicate on Form 9-12 (Rev. May 2003), "Bid Proposal to City of San Antonio." The envelope containing any Bid Proposal and other documents shall be endorsed as stipulated in the Invitation For Bids.

2.7. Proposal Guaranty. Unless the bid is under $25,000, an original Bid Proposal Guaranty issued by a corporate surety company licensed to do business in the State of Texas and payable to the order of the City of San Antonio, Texas, in an amount of not less than five (5) percent of the greatest total amount of the Bid Proposal, must accompany each bid as a guarantee that if awarded the Contract the successful Bidder will promptly enter into a Contract and execute bonds on the standard forms provided, as outlined in the specifications and Contract Documents.

.1 For Bids Less Than $25,000. Bidders shall submit either a cashier's or certified check in lieu of the Bid Bond only if the bid amount is less than $25,000.

2.8. Omissions in Bid Proposals. Bid proposals will be submitted in duplicate copy on the City forms furnished, except as provided below. Bid proposals containing omissions (except in unit prices as described in Article 2.12), alterations of City's wording contained in Contract Documents, conditional bids or qualifications, which modify the Bidder's bid proposal from the Owner's IFB, will be rejected as non-responsive.

2.9. Computer Printout For Unit Prices. Bidders, at their option, in lieu of hand writing the unit prices in words in ink on the bid proposal form, may submit an original computer printout sheet bearing certification by and authorized signature for the bidding firm. The unit prices shown on acceptable printouts will be unit prices used to tabulate the bid and used in the contract if awarded by the City. As a minimum, computer printouts must contain the information and in the arrangement shown on the "Example of Bid Prices Submitted by Computer Printout" form at the end of this section. Bid proposals with unit prices by computer printout will be considered as non-responsive if:

a. The bid proposal does not bear the certification verbatim, as shown on the example in the bid proposal.
b. The computer printout does not have an authorized signature on behalf of the firm proposing the bid.
c. The computer printout omits or alters required bid items or includes items not shown in the bid proposal.
d. The bid proposal issued by the City is not fully executed as provided above.

.1 If the bid proposal, submitted by the Bidder, contains both the form furnished by the City and a computer printout, completed according to the instructions, only one will be considered. In this situation, the bid prices shown on the computer printout will be used to determine the bid.

2.10. Bid Alternates. Bidders shall submit a unit price for each Work element pay item for which a bid is requested, except in the case of an alternate. In such a case, the procedure is as follows:

.1 Additive Alternate. In the case of Additive Alternates, unit prices must be submitted for the base bid and the items in all proposed additive alternates.

.2 Substitute Alternate. In the case of a Substitute Alternate (these alternates appear in sets of two or more related alternates), unit prices must be submitted for all the items in the base bid and for all the items in one of the related substitute alternates in each set.

2.11. Extensions in Unit Prices. The unit price shall be inserted on the Bid Proposal sheet in words (not figures) in the "DESCRIPTION AND UNIT PRICE BID" column. Extensions, which are the unit prices multiplied

by the approximate quantities for each item, shall be inserted in figures in the "EXTENSION" column. Bids shall be submitted only on the City's bid proposal form or approved computer printout sheets. Bids not so submitted will be considered non-responsive. Conditional bids will also be considered non-responsive.

2.12. Blank Unit Prices. All applicable blank spaces in the Bid Proposal Form shall be completed. The Signature shall be in longhand. Any interlineation, alteration or erasure must be initialed by the signatory on the Bid Proposal. In the event additional or extra blank spaces remain after completion of the various forms, Contractor shall enter the terms "none" or "not applicable" on any remaining blank spaces to indicate that the Contractor has considered City requests for information on every line presented. Any blank unit prices will be tabulated and evaluated as "no cost" to the City.

2.13. Signature Requirement. Each copy of the Bid shall include the legal name of Bidder and a statement whether Bidder is a sole proprietor, a partnership, or corporation, or any other legal entity, and each copy shall be signed by the person or persons legally authorized to bind the Bidder to a Contract. A Bid by a corporation shall further give the state of incorporation and affix the Corporate Seal thereto. A Bid submitted by a corporate agent for Bidder shall be accompanied by a valid Power of Attorney, attached, certifying the agent's authority to bind Bidder.

2.14. Amendments Past Bid Opening. Bid proposal amounts may not be amended or modified in any manner after the time set for the bid opening in the published IFB.

2.15. Right To Reject Bids. The City expressly reserves the right to reject any or all Bid Proposals submitted, to interpret any Bidder ambiguities to the City's advantage, or to award the Contract to the Bidder who, in the City's opinion, offers the most advantageous Bid Proposal under applicable law for the purpose intended by the City.

.1 Reasons For Determining Bids Non-Responsive. Any proposal that has one or more of the deficiencies listed in Articles 2.8, 2.9, 2.11 or below will be considered non-responsive and will not be read publicly.

a. The person or, in the case of a joint venture, persons do not sign the proposal.
b. The proposal guaranty does not comply with the requirements contained in Article 2.7, "Proposal Guaranty."
c. The proposal is in a form other than the official proposal form issued to the Bidder or Bidders or acceptable computer printout.
d. The proposal was not in the hands of the letting official at the time and location specified in the advertisement.
e. The proposal submitted has the incorrect number of items.
f. A computer printout, when used is not signed in the name of the Bidder (or joint Bidders, in the case of a joint venture), is not in the proper format, or omits required Items or includes an Item or Items not shown in the proposal.
g. The Bidder submits more than one proposal, under the same or different name, for a specific proposed Contract. (A Bidder may submit a bid proposal and participate as a material supplier, subcontractor or both to any or all Bidders contemplating submitting a proposal for this work.)
h. The Bidder fails to acknowledge or improperly acknowledges receipt of all addenda issued.
i. The Bidder modifies the proposal in a manner that alters the conditions or requirements for work as stated in the proposal form.
j. The Bidder did not attend a specified mandatory pre-bid conference.

2.16. Termination of Bid. No Bid shall be withdrawn or terminated by Bidder without consent of the Owner for a period of ninety (90) calendar days after the opening of bids by the City.

2.17. Bid Proposal Guaranties of Three Lowest Bidders. Bid proposal guarantees of the first, second and third low Bidders will be retained until after the Contract Agreement and Bonds have been executed. Bid Proposal Guaranties in the form of any certified or cashier's check of all except the three lowest Bidders will be returned by mail to unsuccessful Bidders upon certification of the three low Bidders, unless there is a justifiable reason for Owner to hold them for the full ninety (90) calendar day period.

2.18. Time Requirement. Bid Proposals received after the time specified in the IFB will be ineligible for opening and will be returned unopened to the prospective Bidder.

2.19. Prospective Bidders' Field Examination. Each Bidder shall satisfy himself by personal field examination of the location of the proposed Work, and by any other means to enable him to develop his Bid Proposal intelligently and to his advantage. The Bidder shall make himself familiar with all of the Contract Documents and other Owner instructions including Bidder's ability to submit Pre-Bid inquiries to Owner and Design Consultant before submitting his Bid Proposal in order that no Contractor misunderstanding shall exist in regard to the nature and character of the Work to be performed. No allowance will be made by the City for any Bidders to claim that the Bid Proposal is based upon incomplete information as to the nature and character of the site or the Work involved. The submittal of the Bid by Bidder shall constitute an admission by the Bidder that he has carried out the foregoing stipulations to his entire satisfaction.

2.20. Bidder Inquiry Notification. After investigating the Project site and comparing the Plans and Specifications and other Contract Documents with the existing conditions, the prospective Bidder should immediately notify the Consultant of any conditions for which the requirements of labor and materials are not clear, or about which there is any prospective Bidder question regarding the quantity and extent of the Work involved. Bidder inquiry notifications to the Owner and/or Consultant must be made in writing at least five (5) calendar days prior to the scheduled Bid opening date.

2.21. Reasonable Work Site Investigation. It is understood and acknowledged by Bidder that full and complete allowance for conditions under which the Contractor will be required to perform construction, or that will in any manner affect Work under this Contract, are included in the Bidder's Bid Proposal and reflected in the proposed Contract Sum. A soils investigation (if applicable) may have been conducted as a potential aid to the Consultant in preparation of the Contract Plans and Specifications. THIS INFORMATION IS AVAILABLE TO PROSPECTIVE BIDDERS WITHOUT EXPRESS OR IMPLIED REPRESENTATION, ASSURANCE, WARRANTY OR GUARANTEE BY OWNER OR CONSULTANT THAT IT IS COMPLETE OR CORRECT OR THAT IT REPRESENTS A TRUE, OR APPROXIMATELY TRUE, PICTURE OF THE SUB-SURFACE CONDITIONS TO BE ENCOUNTERED ACROSS THE PROPOSED WORK SITE. THIS INFORMATION IS SPECIFICALLY NOT PART OF THE CONTRACT DOCUMENTS. This information is available to prospective Bidders for review at the Project Consultant's office. Copies may be purchased from the Consultant. This Bidder cost is non-refundable. Before submitting his Bid, each Bidder may, at his own expense, make reasonable Work site investigations and tests as the Bidder may deem necessary to determine his Bid for performance of the Work in accordance with the Contract Documents. Access for such investigations and tests must be reasonably coordinated with the Owner.

2.22. Child Support Order Compliance. A child support obligor who is more than thirty (30) days delinquent in paying child support and a business entity in which the obligor is a sole proprietor, partner, shareholder or owner with an ownership interest of at least twenty-five (25) percent is not eligible to receive payments from state funds under a contract to provide property, materials, or services; or receive a state-funded grant or loan.

.1 By signing the contract, the Contractor, under penalty of perjury under the laws of the State of Texas, certifies that the sole proprietor, partner, shareholder or owner of the firm is not thirty (30) or more days delinquent in providing child support.

.2 By signing the contract, the Contractor makes material representation of fact upon which reliance is placed as the Department enters into the contract. If it is later determined that the Contractor knowingly rendered an erroneous representation, in addition to other remedies available, the Department may terminate the contract for cause or default.

.3 The Contractor shall provide immediate written notice to the Department if at any time it learns that its representation was erroneous when submitted or has become erroneous by reason of changed circumstances.

City of San Antonio / Public Works
Project Name:_____
Job #_____

ITEM NO.	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	SEQUENCE NUMBER
100	MOBILIZATION	LS		$101,974	$101,974	1
101	PREPARATION OF RIGHT -OF- WAY	LS		$936	$936	2
105	CHANNEL EXCAVATION	CY	5963	$3.56	$2,228.28	3

NOTE: To help the bid tabulation process, please skip a line after the eleventh item, the twenty-second item, and after succeeding multiples of eleven.

TOTAL BID AMOUNT _____

NOTE: CERTIFICATION STATEMENT TO APPEAR ON LAST PAGE ONLY.

(*YOUR FIRM'S NAME)* certifies that the unit prices shown on this complete computer print-out for all the bid items and the alternates contained in this proposal are the unit prices intended and that its bid will be tabulated using these unit prices and no other information from this print-out. *(YOUR FIRM'S NAME)* acknowledges and agrees that the total bid amount shown will be read as its total bid and further agrees that the total bid amount will be determined by multiplying the unit bid prices shown in this print-out by the respective estimated quantities shown in the proposal and then totaling all the extended amounts.

Signed: _____

Title: _____

Date: _____

EXAMPLE OF BIDS PRICES SUBMITTED BY COMPUTER PRINTOUT

ITEM 3

AWARD AND EXECUTION OF CONTRACT

3.1. Right of the Owner. The Owner may make such investigations as he deems necessary to determine the ability and responsibility of the Bidder to perform the Work, and the Bidder shall furnish to the Owner reasonable information and data (including Financial Statement) for this purpose as the Owner may reasonably request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is responsible to carry out the obligations of the Contract and to complete the Work contemplated therein.

3.2. Performance Evaluation System. The City has implemented a Contractor performance evaluation system. The evaluation will cover: accomplishment of the Project with adequate manpower, ability to meet schedule, adequacy of materials and equipment; citizen complaint response; adjacent-to-Project, property Owner relations; and attendance at public Project meetings. The Contractor's evaluation history may also be used by the City Staff as a basis for recommendations of award to the City Council.

3.3. Time for Awarding Bid. The City agrees that should the Contract be awarded, it will be awarded within ninety (90) calendar days of the Bid opening date, unless otherwise stated in the Owner's IFB.

3.4 Awarding Bid. The City shall award the Contract to the lowest responsive and responsible Bidder. The City reserves the right to reject any or all proposals and to waive technicalities in the best interest of the City.

> **.1 Determining Low Bidder.** If no additive alternates are included in the Bid, the City shall award the Contract to the lowest total Bidder. If there are additive alternates included in the Bid, the City retains the right to chose all, none, or any combination of additive alternates, regardless of order, in accepting and awarding the Contract. The City shall award the Contract to the Bidder with the lowest total bid which includes the base and any selected additive alternates.
>
> **.2 Tie Bids.** If the official total bid amount for two (2) or more Bidders is equal and those bids are the lowest submitted, each tie Bidder shall be given an opportunity to withdraw their bid. If two (2) or more Bidders do not withdraw their bids, the low Bidder shall be determined by a coin toss. If all tie Bidders request withdrawal of their bids, no withdrawals shall be allowed and the low Bidder shall be determined by a coin toss.

3.5 Construction Contract. The successful Bidder will be required to execute and return a Construction Contract prepared and supplied by the City within twenty (20) calendar days after the date appearing on the City's forwarding cover letter that transmits the Contract Documents sent by Owner to Contractor and he will further be required to commence Project Work within seven (7) calendar days after City issuance of the written Authorization to Proceed.

3.6. Bonds. The successful Bidder to whom the Contract is awarded will be required to furnish a Performance Bond and a Payment Bond, issued by a corporate surety company licensed to conduct business in the State of Texas, for the Contract Sum as set forth in the IFB. Substitute originals provided by the City shall be used by Contractor and his surety in submitting the actual Project Bonds to the City.

3.7. Performance Bond. Contractor hereby agrees to execute with corporate sureties and deliver to the City, at once, a "Performance Bond" from a City-approved surety in the total amount of the Contract Sum, approved by the City as to form and general sufficiency, conditioned that Contractor shall faithfully perform, observe and comply with all the terms, conditions and stipulations, undertakings and provisions of the Contract Documents.

3.8. Payment Bond. Contractor hereby agrees to execute with corporate sureties and to deliver to the City, at once, a "Payment Bond" from a City-approved surety in an amount at least equal to the Contract Sum, such as shall be satisfactory to the City as to form and general sufficiency, as security for the payment of all persons supplying labor and material in the prosecution of the Work provided for in the Contract Documents.

3.9. Contractor and Sureties Still Bound. No assignment, transfer or subletting, without the written consent of said City, and no order of said City for or approval of any alterations or modifications in said Specifications, Plans, or Work, and no change in the requirements or order for extra work made by the City as provided in this Contract, shall ever in any manner release or diminish the responsibility of Contractor or any Surety on any bond of Contractor, but on the contrary, such responsibility shall extend to and comprehend all such changes and other matters. If any Surety upon any bond furnished in connection with the Contract becomes insolvent, or otherwise not authorized to do business in this State, the Contractor shall within forty-five (45) calendar days furnish equivalent substitute forms of security while seeking substitute bonding, to protect the interests of the City and of persons supplying labor or materials in the prosecution of the Work contemplated by the Contract, or may be liable for breach of Contract and default termination.

3.10. Certificates of Insurance. Before starting Work, the successful Bidder to whom the Contract is awarded will be required to furnish Owner with original Certificates of Insurance Coverage as set forth in Item 7 and any Special or Supplemental Conditions that may be applicable.

3.11. Workers Compensation Coverage. Prior to award of the Contract, the apparent successful Bidder shall be required to provide certificates of workers compensation coverage through a group plan or other method satisfactory to the Owner as set forth in Item 7 and the Texas Workers Compensation Commission, rule 110.110.

3.12. Execution and Approval of Contract. The contract will be approved and signed under authority of the City Council and the City Manager or designee.

3.13. Failure to Execute Contract, Bonds, Certificate of Insurance, Furnishing Ownership Information, DBE/HUB Information and the List of Quoting Suppliers and Subcontractors. Should the Bidder to whom the contract is awarded refuse or neglect to execute and file the contract, bonds, Certificate of Insurance, furnish ownership information, DBE/HUB information and the list of quoting suppliers and subcontractors within twenty (20) calendar days after written notification of the award of the contract, the bid proposal guaranty filed with the bid shall become the property of the Owner, not as a penalty, but as liquidated damages. A Bidder who forfeits his bid proposal guaranty in accordance with this Article will not be considered in future bid proposals for the same work unless there has been a substantial change in design of the project subsequent to the forfeiture of the bid proposal guaranty. In addition, the City may impose sanctions against the Bidder for failure to enter into the contract or honor the bid proposal guaranty.

3.14. Beginning of Work. The Contractor shall not begin work until authorized by the Owner in writing to do so. Authorization notification will be by work project authorization.

3.15. Antitrust. The successful Bidder, by virtue of signing the contract, assigns to the City any and all claims for overcharges associated with the contract, which arise under the antitrust laws of the United States, 15 U.S.C.A., Section 1, et seq. (1973).

ITEM 4

SCOPE OF WORK

4.1. Intent of the Contract Documents. The intent is to describe a functionally complete Project (or integral component part thereof) to be constructed in accordance with the Contract Documents. Any work, materials or equipment that may reasonably be inferred from the Contract Documents, as being required to produce the intended result will be supplied by Contractor whether or not specifically called for by City or its Consultant. When words, which have a well-known technical or trade meaning, are used to describe work, materials or equipment, such words shall be interpreted in accordance with that meaning. Where phrases "directed by", "ordered by", "to the satisfaction of", "the Consultant" or "the City's Construction Observer/Inspector" (COI) occur, it is to be understood that the directions, orders, or instructions to which they relate are within the scope of, and authorized by the Contract Documents. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or Laws or Regulations in effect at the time of opening of Bids except as may be otherwise specifically stated.

4.2. Changes in The Work. The Contract Sum and/or the Contract Time may be increased or decreased only by written Field Alteration. A Field Alteration signed by the Contractor indicates his acceptance and approval thereof including the adjustment in the Contract Sum and/or the Contract Time. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract and applicable law consisting of additions, deletions or other revisions and the Contract Sum and/or the Contract Time will be adjusted accordingly. All such changes in the Work shall be authorized by written Field Alteration and shall be performed by Contractor under the applicable provisions of the Contract Documents.

.1 Major Changes In The Work. Any significant change in a Major Bid Item constitutes a major change in The Work and shall be implemented by a Field Alteration that shall be binding on the Owner and Contractor. A significant change shall be defined as follows:

a. An increase or decrease of five (5) percent or more in the number of units of each Major Bid Item as included in the Consultant's estimated quantities included in the Bid Documents;
b. An increase or decrease of five (5) percent or more in the dollar value of a lump sum, Major Bid Item.

Any change in the Contract Sum resulting from a major change in the work, which reflects among other things, quantity changes, market price changes, and any quantity/volume discounts that might apply, shall be determined as specified in Article 9.3.

.2 Minor Changes In The Work. The City's "COI" will have authority to order minor changes in the Work <u>not</u> involving an adjustment in the Contract Sum or Contract Time and <u>not</u> inconsistent with the intent of the Contract Documents. Such changes shall be implemented by a written directive and shall be binding on the Owner and Contractor. The Contractor shall carry out any undisputed written directive promptly.

a. If the Contractor does not agree with the City's "COI" that a minor change in the work will result in no adjustment in Contract Sum or Contract Time, he must so notify the Owner in writing within seven (7) calendar days of issuance of the written directive.

.3 If the City's "COI," Consultant, Owner and Contractor are unable to agree as to the extent, if any, of an increase or decrease in the Contract Sum or any extension or reduction of the Contract Time that should be allowed as a result of a disputed written directive or Field Alteration, the Contractor shall perform the disputed Work as requested by the Owner and a Contractor claim may be made.

4.3. Extra Work. Changes or Credits for the Work covered by an approved Field Alteration shall be determined by the method described in Articles 9.4 and 9.5.

4.4. Limit to Extra Work. The entire cost of extra Work resulting from Field Alterations including the incremental cost of extra Work resulting from any prior Field Alterations, modifications, or additions so ordered, shall not cumulatively exceed twenty-five (25) percent of the original Contract Sum, and provided further that the price is agreed upon in writing by Owner and Contractor before materials are furnished or the Work is done.

4.5. Maintenance of Traffic. The Contractor shall do such work as may be necessary to provide and maintain detours and facilities for safe public travel in accordance with the Traffic Control Plan and these specifications. There shall be provided and maintained in passable condition, as specified under Articles 7.7 and 7.10, such temporary roads and structures as may be necessary to accommodate public travel. Temporary approaches and crossings of intersecting highways shall be provided and maintained in a safe and passable condition by the Contractor at his expense. The Contractor will be responsible for the cost of normal maintenance of detours constructed under this contract. Any maintenance required to repair deterioration of the pavement structure due to faulty design will be at the expense of the City.

.1 The City will be responsible for the cost of maintenance of existing streets, roadways or traffic control devices that are required to be used for detours or handling traffic, regardless of whether they are within or outside the project limits. Other existing streets, roadways or traffic control devices, which are damaged by the Contractor's operations, will be maintained and repaired by the Contractor at his expense.

4.6. FinalCleanup. The Contractor shall at all times keep the Project premises safe and free from accumulation of waste materials or rubbish caused by the Work under this Contract.

.1 Final Inspection. Upon completion of the Work and prior to the Owner's final inspection, the Contractor shall present the premises in a neat and clean condition, prepared for acceptance by Owner.

.2 Restoration of Project Site. Prior to final acceptance of the Work, the Contractor shall reasonably restore the Project site to its pre-Project condition (accounting for such restoration concerns as, but not limited to, cosmetic appearance, landscaping, drainage gradients, accessibility) to the extent permitted by the Project improvements. All of this incidental Work to be performed by Contractor to the satisfaction of the City's "COI."

4.7 Disputes. Prior to any anticipated litigation between the Owner and the Contractor, both hereby agree that disputed matters shall first be submitted to Owner administrative appellate procedures as described below:

.1 Except as otherwise provided in this Contract, any dispute concerning a question of fact arising under this Contract which is not disposed of by mutual agreement shall be initially decided by the Owner (as represented by the decision of the Director of Public Works) who shall reduce his decision to writing and promptly mail or otherwise furnish a copy thereof to the Contractor. The decision of the Owner shall be final and conclusive unless within thirty (30) calendar days from the date of issuance of such decision by Owner the Contractor mails or otherwise furnishes to the Owner a written notice of appeal addressed to the City Manager, City of San Antonio, whose appellate decision on behalf of the City shall be the final and conclusive City decision. In connection with any appeal under this Article, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of the appeal to persons to be promptly appointed by the City Manager to review such disputed matters. The City department sponsoring the Project will also be allowed to present information supporting Owner's position.

.2 Pending final City Manager decision after a dispute hearing, the Contractor shall proceed diligently with the performance of the Contract and in accordance with the City Manager's decision. Neither the City or the Contractor is precluded from resorting to litigation or other remedy at law or in equity to perfect a legal filing prior to the expiration of an applicable statute of limitations or after the Owner's administrative review process is completed.

4.8. Claims for Additional Costs. If the Contractor wishes to make a claim for an increase in the Contract Sum prior to final Contract Settlement, he shall give the Owner written notice thereof with a simultaneous information copy to the Consultant within sixty (60) calendar days after the Contractor knows, or should have

known, of the events giving rise to such Contractor claim. This notice shall be presented in writing to the Owner and Consultant by the Contractor before proceeding to execute the disputed Work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Article 7.7.4. No such Contractor claim shall be valid unless the Contractor follows the procedure outlined herein. If the Director of Public Works and the Contractor cannot agree on the amount of the adjustment in the Contract Sum, if any, it shall be determined by administrative procedures as provided below. Any change in the Contract Sum resulting from such claim shall be authorized by Field Alteration.

.1 If the Contractor claims that additional cost will be incurred because of, but not limited to, (1) any written Owner or Consultant interpretation of the Contract Documents, (2) any order by the Owner to stop the Work pursuant to Article 8.6 where the Contractor was not at fault, (3) any written order involving a perceived minor change in the Work issued pursuant to Article 4.2.2, the Contractor shall make such claim.

4.9. Use of Materials Within the Right-Of-Way. The Contractor, with the approval of the City's "COI" and Consultant, may use in the Work any suitable stone, gravel, or sand found in the excavation that otherwise meets or exceeds Contract Specifications. The Contractor shall not over excavate any material from within the right-of-way, which is not within the excavation limits, if any, as may be indicated by the lines and grades, without written authorization from the Director of Public Works.

4.10. Salvageable Material. Salvageable material as determined by the Specifications or the City's "COI" shall remain the property of the City and shall be relocated and stored by Contractor as directed by the City's "COI" provided that such relocation and storage does not increase the Contract Sum to Owner. Otherwise, Owner and Contractor may negotiate a Field Alteration to accomplish same.

ITEM 5

CONTROL OF THE WORK

5.1 Plans and Specifications. The plans and the accompanying specifications are essential parts of the Contract and a requirement occurring in one is as binding as though occurring in all. They are intended to be cumulative and complementary and to provide for a complete Work. In cases of disagreement, figured dimensions shall govern over scaled dimensions, detailed Plan Drawings and accompanying notations shall govern over General Plan Drawings, Specifications shall govern over Plan Drawings, and Special Conditions Provisions shall govern over Specifications and Plan Drawings.

5.2 Conformity with Plans, Specifications and Special Provisions. All work performed and all materials furnished shall be in reasonably close conformity with the lines, grades, cross sections, dimensions, details, gradations, physical and chemical characteristics of materials in accordance with tolerances shown on the plans or indicated in the specifications and special provisions. The limits establishing reasonably close conformity will be as defined in the respective items of the contract or if not defined, as determined by the Engineer.

.1 In the event the Engineer finds the work performed or the materials used are not within reasonably close conformity with the plans, specifications and special provisions, the affected material or product shall be removed and replaced or otherwise satisfactorily corrected by and at the expense of the Contractor.

.2 Any deviations from the plans and approved working drawings will be made only with the approval of the Engineer.

5.3. Plans and Specifications at the Work Site. The Contractor shall maintain at the Work site at least one copy of all Plans Specifications, Addenda, approved Shop Drawings and Field Alterations, in good order and marked to record all changes to the Plans and/or existing physical conditions made during construction.

5.4. Superintendent. The Contractor shall keep on-site a competent Superintendent or his designee and any necessary assistants for the duration of the project, all satisfactory to the Director of Public Works. Any Superintendent designee shall be identified in writing to the Director promptly after Owner-issued written Authorization to Proceed. The Superintendent or his designee shall represent the Contractor and all directions given to him shall be binding. Other Oral directions from the City representatives involving critical situations or Work elements shall be immediately confirmed in writing by Owner to the Contractor. Other oral directions shall be confirmed by Owner on written request in each case. The Contractor shall give sufficient supervision to the Work using his best skill and attention.

5.5. Construction Staking and Layout.

.1 The owner will have appropriate Temporary Bench Marks (TBM) and baseline (horizontal and vertical) established. As of the date of the notice to proceed, it will be the Contractor's responsibility to protect, preserve and reestablish (if required) the TBM and/or baseline. Construction staking and tolerances shall be in accordance with the “Manual of Practice for Land Surveying in the State of Texas Category 5.”

.2 The contractor shall layout his work from established baseline and TBM indicated on the drawings and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to layout any part of the work. The Contractor shall be responsible for maintaining and preserving baseline and TBM indicated on the drawings for duration of construction. If such marks are destroyed, the Contractor shall replace them at his own expense. At the end of Construction of the project, the Contractor shall provide the City a grade certificate prepared by a Registered Professional Land Surveyor. This certificate should state that the infrastructure is constructed in accordance to the construction documents or as approved by the owner and Engineer of Record, which are noted on the record plan set.

5.6. Authority and Duties of Inspectors. Inspectors will be authorized to inspect all work done and all materials furnished. Such inspection may extend to all or to any part of the work and to the preparation or manufacture of the materials to be used. An Inspector will be assigned to the work by the Engineer and will report to the Engineer as to the progress of the work and the manner in which the work is being performed. The Inspector will also report to the Engineer whenever it appears that the materials furnished and the work performed by the Contractor fail to fulfill the requirements of the specifications and contract and call the attention of the Contractor to any such failure or other infringement. Such inspection will not relieve the Contractor from any obligation to perform the work in accordance with the requirements of the specifications. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector will have the authority to reject materials or suspend work on the operation or materials in dispute until the question at issue can be referred to and decided by the Engineer. The Inspector will not be authorized to revoke, alter, enlarge or release any requirement of these specifications, nor to approve or accept any portion of work, nor to issue instructions contrary to the plans and specifications. The Inspector will in no case act as foreman or perform other duties for the Contractor nor interfere with the management of the work.

5.7. Inspection. The Contractor shall provide sufficient, safe and proper facilities at all reasonable times for the observation/inspection of the Work by the duly authorized representative of the Owner. The Consultant and the Owner may make visits to the site at intervals appropriate to the various stages of construction to observe the progress of the executed Work and to determine, in general, if the Work is proceeding in general accordance with the Contract Documents.

.1 Consultant will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Consultant's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will generally conform to the Contract Documents. On the basis of such visits and on-site observations as an experienced and qualified design professional, Consultant will keep Owner informed of the progress of the Work and will endeavor to guard Owner against obvious defects and deficiencies in the Work which is the responsibility of the Contractor to prevent and/or cure.

.2 No Approval of any phase of the construction Project by any of the City's representatives or observer/inspectors shall relieve the Contractor from full compliance with the Contract Documents regarding the ultimate Work product. Any additional cost, damages, or delays occasioned by patent or latent defects in the Work, and/or failure to meet the requirements of the Contract Documents, at any Project phase, shall be borne by the Contractor.

5.8. Final Acceptance. Final Inspection and acceptance of the Project will be considered only after all stipulations, requirements and provisions of this Contract are faithfully completed and the Project is delivered to the City by Contractor in an acceptable condition for the intended use by Owner. In the event that all major Contract pay items are complete and only minor clean-up operations remain for Contract completion, the Director of Public Works has the discretionary authority to issue a Letter of Conditional Approval. Should the Director's Letter of Conditional Approval contain conditions for the final Acceptance of the Work, Contract Time will continue to be charged against the Contractor until such conditions have been corrected to the satisfaction of the Director of Public Works.

5.9. Federal Inspection. When the United States Government is to pay a portion of the cost of the work covered by the contract, the work will be subject to inspection by United States Government representatives. Such inspection will in no sense make the United States Government a party to the contract.

5.10. Removal of Defective and Unauthorized Work. All work, which has been rejected as being in nonconformance with the plans and specifications, shall be remedied or removed and replaced in an acceptable manner by the Contractor at his expense. Work done beyond the lines and grades given or as shown on the plans, except as herein provided, or any extra work done without written authority will be considered as unauthorized and done at the expense of the Contractor and will not be paid for. Work so done may be ordered removed at the Contractor's expense. Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this Article, the Engineer will have authority to cause defective work to be remedied or removed and replaced and unauthorized work to be removed and the cost thereof may be deducted from any moneys

due or to become due to the Contractor.

5.11. Record Drawings. Before final payment to the Contractor, the Contractor who has control of the Work and is in a position to know how the Project was constructed, shall submit to the Consultant a set of clearly marked Plans and related documents suitable for Consultant's use in preparing Owner's final “Record Drawings” on reproducible mylar for the City's permanent file.

5.12. Partial Acceptance. Partial acceptance by Owner for beneficial occupancy of any completed part of the Work, which has specifically been identified in the Contract Documents as being eligible for early Owner Acceptance, or which Owner, Consultant and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Final Acceptance of the total Work subject to the following:

.1 Owner may at any time request to the Contractor in writing to permit Owner to beneficially occupy any such part of the Work, which Owner believes to be, ready for its intended use, substantially complete and ready for Final Acceptance. If Contractor agrees, Contractor will certify to Owner and Consultant that said part of the Work is substantially complete and request City to issue a Letter of Conditional Approval or Final Acceptance for that part of the Work. Within a reasonable time after either such request, Owner, Contractor and Consultant shall make an inspection of that part of the completed and Finally Accepted Work to determine its status of completion.

.2 Owner may at any time request Contractor in writing to permit Owner to take over operation of any such Owner part of the Work although it is not Substantially Complete. A copy of such request will be sent to the Consultant and within a reasonable time thereafter, Owner, Contractor and Consultant shall make an inspection of that part of the Work affected by the request to determine its status of completion and will jointly prepare a list of the items remaining to be completed or corrected before Final Acceptance. If Contractor does not object in writing to Owner and Consultant that such part of the Work is not ready for separate operation by Owner, or that separate operation by Owner will significantly interfere with Contractor's remaining operations, Owner will finalize the list of items to be completed or corrected and will deliver such list to Contractor together with a written recommendation as to the division of responsibilities pending Final Acceptance with respect to security, operation, safety, maintenance, utilities, insurance, and retainage for that part of the Work taken over for operation by Owner. During such operation, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

ITEM 6

CONTROL OF MATERIALS

6.1. Sources of Supply and Quality of Materials. The source of supply of each of the materials shall be approved by the Engineer before delivery is started and at the option of the Engineer, may be sampled and tested for determining compliance with the governing specifications by the Engineer before delivery is started. If it is found after trial that sources of supply previously approved do not produce uniform and satisfactory products, or if the product from any source proves unacceptable at any time, the Contractor shall furnish materials from other approved sources. Only materials conforming to the requirements of these specifications and approved by the Engineer shall be used in the work. All materials being used are subject to inspection or test at any time during preparation or use. Any material which has been tested and accepted at the source of supply may be subjected to a check test after delivery and all materials which, when retested, do not meet the requirements of the specifications, will be rejected. No material, which after approval, has in any way become unfit for use shall be used in the work. If, for any reason, the Contractor selects a material which is approved for use by the Engineer by sampling and testing or other means, and then decides to change to a different material requiring additional sampling and testing for approval, the expense for such sampling and testing may be deducted from any moneys due or to become due to the Contractor.

.1 Warranties or Guarantees. If the normal trade practice for manufacturers is to furnish warranties or guarantees for the materials and equipment specified herein, the Contractor shall turn the guarantees and warranties over to the Engineer for potential dealing with the manufacturers. The extent of such warranties or guarantees will not be a factor in selecting the successful Bidder.

.2 Buy America. All manufacturing processes for steel or iron materials or for applying a coating to steel or iron materials (coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of the steel or iron material) incorporated into the finished project must occur in the United States except (a) The requirements do not prevent a minimal use of foreign materials, if the cost of such materials used does not exceed one-tenth of one (0.1) percent of the total contract cost or $2,500, whichever is greater; and, (b) When shown on the plans, steel or iron products or application of a coating to steel or iron materials (coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of the steel or iron material) will have alternate bid items for foreign materials.

a. All manufacturing process are defined as all process required to change the raw ore or scrap metal into the finished, in-place steel product. The Contractor shall furnish, to the Engineer, certified mill test reports on the base metal and producer's certifications on all subsequent manufacturing processes stating compliance with the applicable specification(s) and that all manufacturing processes occurred in the United States. Producer's certifications shall bear the notarized signature of a responsible authorized representative of the producer

.3 Nonhazardous Recyclable Materials (NRMs). Hazardous recycled materials will not be allowed as replacement materials in TxDOT specification items. Use of Nonhazardous Recyclable Materials (NRMs) is allowed and sources of such materials will be considered by the Engineer in the same manner as other sources submitted for approval by the Contractor unless the specification for that item of work includes specific instructions regarding use of such NRMs. If the material contains constituents not normally found in the virgin material it is replacing, the Contractor must establish to the satisfaction of the Engineer that these constituents will not adversely affect the performance of the item of construction, threaten the waters of the state, cause a nuisance, or endanger human health and/or welfare.

a. The Contractor shall also determine if NRMs being used are regulated under 30 Texas Administrative Code (TAC) Chapters 312, 330, 332, 334, or 335 and shall be responsible for complying with all general prohibitions, notification requirements, and shipping and reporting requirements stipulated therein.
b. The Contractor shall furnish to the Engineer a written certification sealed by a Texas Licensed Professional Engineer that the NRMs are used in accordance with TxDOT requirements as stipulated in the DMS 11000, "Guidelines for Evaluating and Using Nonhazardous Recyclable

Materials (NRMs)." Certain NRMs routinely in use in TxDOT construction and maintenance projects including crushed concrete, reclaimed asphalt pavement (RAP), fly and bottom ashes from electrical utility plants, ground granulated blast furnace slag, cement, tire rubber, plastics, ceramics, and glass are exempt from TxDOT's certification requirements, as long as the NRMs have not come in contact with hazardous materials. Materials that are TxDOT property are also exempt from the certification requirements.

c. The City reserves the right to review the analytical data for any NRM and to perform verification tests, as desired.

6.2. Material. Unless otherwise specified, all materials incorporated in the permanent Work shall be new, and both workmanship and materials shall be of good quality in accordance with Specifications. The Contractor shall, if required, furnish satisfactory evidence as to the supply or manufacture, and quality of materials supplied.

6.3. Disposal, Recycling, and Reuse of Construction Materials and Waste. The Contractor shall be responsible for quantifying volumes and identifying reuse, recycling, or disposal locations of all materials removed from the construction site, including soil, rock, gravel, excavation spoils, construction debris, and contaminated materials through the use of trip tickets, manifests, or other methods, as appropriate for the type of material. Where the material has been identified in the Plans and Specifications or is suspected to be contaminated by hazardous waste, toxic waste, petroleum storage tank waste, or other regulated material, the contractor shall appropriately characterize the material for disposal, reuse, or recycling at a Texas Commission on Environmental Quality (TCEQ) and City-approved facility prior to removal from the project site. The City reserves the right to devise and require use of certification forms in this regard. The City encourages reuse and recycling of materials, where applicable. The Contractor shall also be responsible for the safe and proper reuse and recycling of materials in accordance with all federal state, and local regulations, when reuse or recycling is appropriate. The City retains the right to require the Contractor to provide evidence to the City's satisfaction that all waste materials have been disposed of at an approved landfill, or as legally appropriate. No waste material shall be deposited in any natural drain, creek, river or other water course. Reclamation of low areas may be performed only with the approval of the Director of Public Works. The Contractor shall, as directed by the Inspector, remove at the Contractor's own expense any fill that is blocking drainage which fill blockage has resulted from the Contractor's operations.

6.4. Sampling, Testing and Inspection. All materials, before being incorporated in the work, shall be inspected, tested and approved by the Engineer, and any work in which materials are used without prior test and approval or written permission of the Engineer may be ordered removed and replaced at the Contractor's expense. Sampling and testing of all materials proposed to be used will be made by the Engineer. The selection of the method of test will be designated by the City. Where tests are required, other than those made in the laboratory, for the purpose of control in the manufacture of a construction item, the Contractor shall be required to furnish such facilities and equipment as may be necessary to perform the tests and inspection and shall be responsible for calibration of all test equipment required. When requested, the Contractor shall furnish a complete written statement of the origin, composition and/or manufacture of any or all materials that are to be used in the work. If the Contractor chooses to use materials or products requiring inspection and approval at the point of manufacture or source and such inspection will require abnormal expense, i.e., out of the contiguous forty-eight United States, the additional expense of such inspection over the normal cost of such services will be borne by the Contractor and will be deducted from any moneys due or to become due to the Contractor.

.1 Special Testing. The Owner or the Consultant may require special inspection, testing or approval of material or Work for determining compliance with the requirements of the Contract Documents. Upon Owner-authorized direction of the Consultant, the Contractor shall promptly arrange for such special testing, inspection or approval procedure. Should the material or Work fail to comply with the requirements of the Contract Documents, the Contractor shall bear all costs of the special testing, inspection or approval as well as the cost of replacement of any unsatisfactory material or Work, otherwise, should the Work prove not defective, the Owner shall bear such costs and an appropriate Field Alteration shall be issued. The costs of routine testing shall be borne by the Owner.

.2 Pretested Materials. Subject to conditions established in a written agreement between a supplier and Engineer, pretested and approved materials may be incorporated into the work.

6.5. Plant Inspection and Testing. If the volume of the work, construction progress and other considerations warrant, the Engineer may undertake the inspection of materials at the source. It is understood, however, that no obligation is assumed to inspect materials in that manner.

.1 Plant inspection will be undertaken only upon the following conditions:

a. The cooperation and assistance of the Contractor and the producer with whom he has contracted for materials is assured;
b. The representative of the Engineer shall have full entry at all times to such parts of the plant as may concern the manufacture or production of the materials ordered;
c. When required by the Engineer, the material producer shall furnish an approved weatherproof building for the use of the Inspector. The building shall be constructed or furnished near the plant, at a location acceptable to the Engineer and may be either an independent structure or, if a portion of the structure is used by the material producer, the City office or laboratory area shall not interconnect with material producer utilized rooms. Access to the office or laboratory shall be by direct outside entrance, controlled by the Engineer. The building shall be adequately lighted, heated, air conditioned and ventilated. Adequate rest room facilities shall be provided;
d. The Contractor shall be responsible for furnishing and calibrating scales, measures and/or other equipment as may be required by the Engineer for the inspection of materials;
e. Materials produced under City inspection shall be for City use only unless released in writing by the Engineer; and,
f. In those cases where inspection of any item is requested for periods other than daylight hours, the inspection shall be provided under the following conditions: (a) Continuous production of materials for City use is necessary due to the production volume being handled by the plant; and (b) The lighting provided by the plant is approved by the Engineer to be adequate to allow satisfactory inspection of the material being produced.

6.6. Shop Drawings and Samples.

.1 Contractor shall reasonably check and verify all field measurements and after complying with applicable procedures specified in the Contract Documents, Contractor shall submit (in accordance with the Contractor's schedule of Shop Drawing submissions submitted to the Owner and Consultant for information purposes), to Consultant for review and approval or for other appropriate action, five (5) copies, of all Shop Drawings bearing a stamp or specific written indication that Contractor has satisfied the Contractor's responsibilities under the Contract Documents with respect to his review of his submission. All Contractor submissions will be clearly identified as required by the Consultant. The Contractor data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable Consultant to review the information.

.2 Contractor shall also promptly submit to Consultant for review and approval any Samples required by the Contract Documents. All Samples will be accompanied by a specific written indication that Contractor has satisfied Contractor's responsibilities under the Contract Documents with respect to the review of the submission, identity of materials, suppliers, and other pertinent data such as catalog numbers, and use for which intended.

.3 Before Contractor's submission of each Shop Drawing or sample, Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

a. At the time of each Contractor submission, Contractor shall give Consultant specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and, in addition, shall cause a specific Contractor notation to be made

on each Shop Drawing submitted to Consultant for review, approval, or other appropriate action highlighting each such variation.

b. Shop drawings for alternate designs not shown in the plans shall be reviewed and approved by the Engineer and shall not be implemented without an approved Field Alteration.

c. Consultant will review, approve, or take other appropriate action with the Shop Drawings and samples with reasonable promptness so as to cause no delay in the Work. Consultant's review, approval, or other appropriate action regarding Contractor's submissions will be only to check conformity with the design concept of the Project and for compliance with the information contained in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate component item will not indicate approval of the assembly into which the item is functionally integrated. Contractor shall make corrections required by Consultant, and shall return the required number of corrected copies of Shop Drawings to the Contractor. Contractor may be required to resubmit as required revised Shop Drawings or Samples for further review and approval. Contractor shall direct specific attention in writing to any new revisions not specified by Contractor on previous Contractor submissions.

.4 Consultant's review, approval, or other appropriate action regarding Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Consultant's attention to each such variation at the time of submission as required by Article 6.6.2.b and Consultant has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by Consultant relieve Contractor from responsibility for Contractor errors or omissions in the Shop Drawing submissions or from Contractor's responsibility to comply with the provisions of Article 6.6.2.c.

.5 Where Consultant requires by written request an approved Contractor Shop Drawing or Sample, any related Work performed by Contractor prior to Consultant's review and approval of the affected submission will be at the risk of Contractor.

6.7. Storage of Materials. Materials shall be so stored as to insure the preservation of quality and fitness for the work. When considered necessary by the Engineer, the materials shall be placed on wooden platforms or other hard, clean surfaces and not on the ground. The materials shall be placed under cover when so directed. Stored materials shall be so located as to facilitate prompt inspection. When approved by the Engineer, selected materials or products may be pretested and approved for use, provided they are stored in an area meeting the requirements set forth by the Engineer.

6.8. Imported Fill Material. The Contractor shall provide to the City the name and location of the borrow source for all fill materials imported to the construction site, including, but not limited to, rock, gravel, sand, soils, select fill, topsoil, etc. The City reserves the right to reject any proposed imported fill materials considered not acceptable by the City due to the physical or environmental nature of the material. The Contractor shall provide documentable evidence, to the City's satisfaction, as to the source, quantity, and quality of the fill material in the form of trip tickets, manifests, receipts, analytical results, etc., as required by the City. The City reserves the right to secure such information on a form devised by the City and require the Contractor's certification in this regard

6.9. Defective Materials. All materials not conforming to the requirements of these specifications will be rejected and shall be removed immediately from the site of the work unless permitted to remain by the Engineer. Rejected materials, the defects of which have been subsequently corrected, shall have the status of new material. Upon refusal on the part of the Contractor to comply with any order of the Engineer made under the provisions of this Item, the Engineer will have authority to remove and replace defective material and to deduct the cost of removal and replacement from any moneys due or to become due to the Contractor.

6.10. Hazardous Materials. Materials imported to the project shall be free of any hazardous material as defined in Item 1, "Definition of Terms."

.1 Materials Existing On Work Site. When the Contractor encounters existing materials on sites owned or controlled by the City or in required material sources that are suspected by visual observation or smell to contain hazardous materials, the Contractor shall immediately notify the Engineer.

.2 Materials Delivered To Work Site. When materials delivered to the project are suspected by visual observation or smell to contain hazardous materials as defined in Item 1, they shall be sampled and analyzed to the Engineer's satisfaction to confirm the materials suitability for use. When materials delivered to the project are found to be unsuitable for use, the material shall be removed and disposed of by the Contractor. The testing for and removal or disposition of such hazardous materials delivered to the project by the Contractor shall be at the Contractor's expense. No suspending of the "Time Charges" and no extensions of working time will be granted to the Contractor resulting from hazardous material, which he has delivered.

.3 Indemnify. The Contractor shall indemnify and save harmless the City and its representatives, for the generation and/or disposition of hazardous materials generated by the Contractor on all work done by the Contractor on City owned or controlled sites. Further, the Contractor shall indemnify and save harmless the City and its representatives from any liability or responsibility arising out of the generation or disposition of any hazardous materials obtained, processed, stored, shipped, etc., on sites not owned or controlled by the City. Should the City be required to make any payments or pay any costs or fees or make restitution as a result of the Contractor's actions, the Contractor shall reimburse the City for any and all payments of moneys.

.4 Regulations. The rules, regulations, policies, procedures, standards, applications and reports of the various State agencies including but not limited to the Texas Commission on Environmental Quality (TCEQ), the Railroad Commission (RRC), and of the applicable federal departments and agencies including but not limited to the Environmental Protection Agency (EPA), Department of Energy (DOE), DOT and OSHA shall apply to all operations of the Contractor, including but not limited to the following: sampling, characterization of waste, transportation of waste, recycling and disposal.

6.11. Construction Loads on Structures. Construction loads on structures, which will remain in service by the traveling public during or after completion of the project, for the purpose of performing construction operations, such as cranes erecting beams in adjacent spans, may be allowed if necessary. Prior to any operation which may require placement of such equipment of a bridge, the Contractor shall prepare and submit for approval detailed erection analyses, prepared by a Registered Professional Engineer.

.1 The erection analyses shall include all axle loads, tire loads, outrigger placements, center of gravity, equipment weight, and predicted loads on such tires and/or outrigger for all planned movements, swings, or boom reaches. The City will make available to the Contractor any available plans and material reports for the existing structure. The analyses shall demonstrate that no overstresses will occur in excess of those normally allowed for occasional overweight loads.

6.12. Hauling of Divisible Materials Paid for by Weight or Truck Measure. Any vehicle, truck, truck-tractor, trailer or semi-trailer or combination of such vehicles, when used to deliver materials to a project, shall comply with the State laws concerning the legal gross and axle weights. If the vehicle or combination has a valid yearly overweight tolerance permit which allows small percentages over legal gross and axle weights, such tolerance is also applicable to delivery of materials to a project. However, such tolerance is not applicable to the Interstate System of Highways.

.1 The Contractor shall provide to the Engineer, upon demand, all copies of the yearly overweight tolerance permits for any vehicle to be used to deliver materials to a project.

.2 The Contractor shall request, in writing to the Engineer, permission to haul overweight divisible loads within the limits of a project for hauling routes on which the traveling public is excluded. If, after evaluation by the City, no damage or overstresses in excess of those normally allowed for overweight loads will result to roadbeds or structures which will continue in use after project completion, permission

will be granted.

.3 When hauling overweight divisible loads within the limits of a project which exceed the legal loads allowed by State law, including yearly overweight tolerance permit, the loads must be hauled such that only a single vehicle is on any span or continuous unit at one time. Barricades, fences, or other positive method shall be used to prevent other vehicles from access to any bridge at the time the overweight divisible load is on any span or continuous unit, which is being used as part of a haul route.

.4 When divisible loads are hauled such that the haul route is accessible to the traveling public, and haul tickets are issued and used for payment purposes, the net weight of the load for acceptance purposes under this Item shall be as follows:

a. If the gross vehicle weight is less than the maximum allowed by State law, including any applicable yearly overweight tolerance permit, the net weight of the load shall be determined by deducting the tare weight of the vehicle from the gross weight.
b. If the gross vehicle weight is more than the maximum allowed by State law, including any applicable yearly overweight tolerance permit, the net weight of the load shall be determined by deducting the tare weight of the vehicle from the maximum gross weight allowed.

.5 When divisible loads are hauled such that the haul route is not accessible to the traveling public, advance permission is obtained in writing from the Engineer, and haul tickets are issued and used for payment purposes, then the net weight of the load for acceptance purposes under this Item shall be as follows:

a. If the gross vehicle weight is less than the maximum overweight allowed by advance written permission from the Engineer, the net weight of the load shall be determined by deducting the tare weight of the vehicle from the gross weight.
b. If the gross vehicle weight is more than the maximum overweight allowed by advance written permission from the Engineer, the net weight of the load shall be determined by deducting the tare weight of the vehicle from the maximum overweight allowed.

.6 Continued overloading in excess of the maximums described in Article 6.12.4.b and Article 6.12.5.b will be grounds for rejection of such load and/or suspending hauling operations until the Engineer is satisfied that only loads not exceeding the maximums are hauled.

.7 Any bridges which are load posted, which will remain in service by the traveling public during or after the completion of the project, that are proposed to be used as a portion of a haul route, will be evaluated by the City for structural capability to handle the proposed hauling loads. These bridges will be subject to the same maximum stress limitations, as would any non-load posted bridge.

.8 The Contractor shall furnish a certified tabulation of measurements, tare weights and allowable legal gross weight calculations for all trucks, etc., prior to their use on the project. Each truck shall be identified by a permanent and plainly legible number located on the truck and on the bed of the truck and/or trailer. When the specifications establish measurement of and payment for materials by truck measurement, the Engineer may require the weighing of the various types of loaded vehicles used by the Contractor to transport the material. This weight will be used to determine the maximum volume of the material being hauled that each type of vehicle may transport. The cost of such weighing shall be considered subsidiary to the pertinent bid item.

.9 The above requirements are applicable to vehicles hauling materials over existing roadbeds and structures within the project limits where the roadbeds or structures will continue in use after project completion, except as controlled by specifications and special provisions in the contract. The requirements do not apply to the transportation of materials from a borrow or base source, concrete plant, asphalt plant, etc., where the haul route does not require travel over public roads outside the project limits or existing roadbeds or structures within the project limits that will continue in use after project

completion.

6.13. Construction Traffic on Structures. Construction traffic on existing bridges and culverts outside the limits of a project shall be subject to the same maximum size and weight limitations as any other vehicle, which has no connection to the project. Overweight permit requests shall be handled through normal methods for all non-divisible loads delivering materials to the project.

.1 Construction traffic on bridges and culverts within the limits of a project, including any structures under construction, which will remain in service by the traveling public during or after the completion of the project, shall be subject to the same size and weight limitations as structures outside the limits of the project.

.2 Construction equipment and vehicles which exceed size and weight limitations, including applicable yearly overweight tolerance permits, may be authorized to cross structures provided the Contractor requests, in writing to the Engineer, permission to move such construction equipment across structures within the project limits. If, after evaluation by the City, no damage or overstresses in excess of those normally allowed for overweight loads will result to roadbeds or structures which will continue in use after project completion, permission may be granted. These same provisions shall apply to any load posted highway or bridge.

.3 Where a detour is not readily available or economically feasible to use, an occasional crossing of a structure outside the project limits with overweight equipment may be allowed for relocating equipment only, but not for hauling divisible material, provided a structural analysis of the structure using the exact equipment in question indicates that no damage or overstresses in excess of those normally allowed for overweight loads will result to roadbeds or structures which will continue in use after project completion. This structural analysis will be performed by the City, or at the option of the Contractor, a structural analysis shall be prepared by a Registered Professional Engineer, using the exact equipment in question. When the City performs the structural analysis, the Contractor shall notify the City, in writing, sufficiently in advance of the anticipated crossing and the Contractor shall furnish the manufacturer's certificate of equipment weight, including the weight distribution on the various axles and including any additional parts such as counterweights. Temporary matting and/or other requirements may be imposed by the Engineer when an occasional crossing is allowed.

.4 The Contractor shall be responsible for protection of existing bridges and other structures, which will remain in use by the traveling public during and after the completion of the project. Any such structure damaged by the use of construction equipment shall be restored to its original condition or replaced by the Contractor. Additional temporary fill may be required by the Engineer for protection of certain structures.

ITEM 7

LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

7.1. Laws to be Observed. The Contractor in the performance of the Work shall comply with all pertinent Ordinances of the City of San Antonio, Laws of the State of Texas and of the United States, including Rules and Regulations of the United States Department of Labor, pertaining to Occupational Safety and Health Administration standards as presently existing or as may hereinafter be modified or amended.

.1 Where construction projects cross or run along state highways, the Contractor shall comply with governing TxDOT Regulations as outlined in State Permits for each crossing. In cases where State Regulations do not apply, City Regulations shall be binding.

7.2. Permits, Licenses, and Taxes. The Contractor shall procure all permits and licenses; pay all charges, fees, and taxes; and give all notices necessary and incidental to the due and lawful prosecution of work, except for permits provided by the City and specified by Articles 7.3 and 7.19.

.1 State Sales Tax. The Owner qualifies for exemption from state and local sales tax and will furnish the Contractor with a tax exemption certificate. It is the Contractor's responsibility to claim exemption from payment of applicable state and local sales taxes by complying with such procedures as may be prescribed by the State Comptroller of Public Accounts. The Contract separates the cost of materials and tangible equipment from skill, labor and other associated costs of construction. This is in accordance with the Texas Tax Code to allow tax exemption on the Contract Price for materials. Certain construction equipment that is owned or rented by the CONTRACTOR may be subject to State and Local Sales Tax.

7.3. Royalties and Patents. The Contractor shall pay all royalties and license fees, and defend all suits or claim for infringement of any patent rights and shall save the City harmless from loss on account thereof, except that the City shall be responsible for all such royalties and license fees and loss when a particular design or process, or the product of a particular manufacturer or manufacturers is specified; provided, however, if the Contractor has reason to believe the design, process or product specified constitutes an infringement of a patent, he shall be responsible for such royalties, license fees and loss unless he promptly gives such information to the Owner.

7.4. Prevailing Wage Rate. This Contract, in full compliance with the Texas Government Code, Chapter 2258, requiring that not less than the general prevailing wage rate (basic hourly and fringe, if applicable) for Work of a similar character, as has been established by the Davis-Bacon wage rate and City Council, a copy of which wage rates and administrative policies is incorporated into the Supplemental General Conditions, shall be required.

.1 Penalty. In further compliance with the Texas Government Code, Chapter 2258, the Contractor shall forfeit as a penalty to the City the sum of Sixty Dollars ($60.00) for each laborer, workman, or mechanic employed, for each day, or portion thereof, such laborer, workman or mechanic is paid less than the said stipulated rates for any Work done under the Contract, whether by the Contractor himself, or any first tier Subcontractor or subtier Subcontractor working under the Contractor.

7.5. Insurance:

.1 Prior to commencement of any work under this CONTRACT, CONTRACTOR shall furnish an original completed Certificate(s) of Insurance to the CITY's Public Works Department and City Clerk's Office, which shall be completed by an agent authorized to bind the named underwriter(s) and their company to the coverage, limits, and termination provisions shown thereon, and which shall furnish and contain all required information referenced or indicated thereon. The original certificate(s) must have the agent's original signature, including the signer's company affiliation, title and phone number, and be mailed directly from the agent to the City. The CITY shall have no duty to pay or perform under his CONTRACT until such certificate shall have been delivered to the CITY's Public Works Department and the City Clerk's Office, and no officer or employee, other than the CITY's Risk Manager, shall have

authority to waive this requirement.

.2 The CITY reserves the right to review the insurance requirements of this section during the effective period of this CONTRACT and any extension or renewal hereof and to modify insurance coverage and their limits when deemed necessary and prudent by the CITY'S Risk Manager based upon changes in statutory law, court decisions, or circumstances surrounding this Contract, but in no instance will the CITY allow modification whereupon the CITY may incur increased risk.

.3 A CONTRACTOR's financial integrity is of interest to the CITY, therefore, subject to CONTRACTOR's right to maintain reasonable deductibles in such amounts as are approved by the CITY, CONTRACTOR shall obtain and maintain in full force and effect for the duration of this CONTRACT, and any extension hereof, at CONTRACTOR's sole expense, insurance coverage written on an occurrence basis, by companies authorized and admitted to do business in the State of Texas and rated A- or better by A. M. Best Company and/or otherwise acceptable to the CITY, in the following Types and amounts:

TYPE	AMOUNT
a. Worker's Compensation and Employer's Liability	Statutory $500,000/$500,000/$500,000
b. Commercial General (Public) Liability Insurance include coverage for the following: 1. Premises/Operation 2. Independent Contractors * 3. Products/Completed Operations 4. Personal Injury 5. Contractual Liability 6. Explosion, Collapse and underground Property Damage * 7. Broad Form Property Damage, to include Fire Legal Liability *	Combined Single Limit for Bodily Injury and Property Damage of $1,000,000 per occurrence or its equivalent with a $2,000,000 Aggregate
c. Business Automobile Liability 1. Owned/Leased Automobiles 2. Non-owned Automobiles 3. Hired Automobiles	Combined Single Limit for Bodily Injury and Property Damage: $1,000,000 per occurrence or its Equivalent
d. Motor truck carriers pollution liability including cleanup costs	$5,000,000
e. Contractor's Pollution Liability - Including Clean Up	$1,000,000
f. Payment/Performance bond	$(Amount of Contract)

.4 The Contractor shall be liable for the first tier Subcontractors' insurance coverage appropriate to their scope of Work given the above guidelines, and in the event a first tier Subcontractor is unable to furnish insurance in the limits required by the Contractor, the Contractor shall endorse the first tier Subcontractor as an Additional Insured on the applicable Contractor policies. Contractor shall be responsible for obtaining Certificates of Insurance from the first tier Subcontractor, and upon request furnish copies to the Owner.

.5 The CITY shall be entitled, upon request and without expense, to receive copies of the policies and all endorsements thereto as they apply to the limits required by the CITY, and may make a reasonable request for deletion, revision, or modification of particular policy terms, conditions, limitations or exclusion (except where policy provisions are established by law or regulation binding upon either of the parties hereto or the underwriter of any such policies). Upon such request by the CITY, the CONTRACTOR shall exercise reasonable efforts to accomplish such changes in policy coverage, and shall pay the cost thereof.

.6 CONTRACTOR agrees that with respect to the above required insurance; all insurance contracts and Certificate(s) of Insurance will contain the following required provisions.

* Name the CITY and its officers, employees, volunteers and elected representatives and additional insureds as respects operations and activities of, or on behalf of, the named insured performed under contract with the CITY, with the exception of the workers' compensation and professional liability policies;

* The CONTRACTOR's insurance shall be deemed primary with respect to any insurance or self insurance carried by the City of San Antonio for liability arising out of operations under the contract with the City of San Antonio; and

* Workers' compensation and employers' liability policy will provide a waiver of subrogation in favor of the CITY.

.7 CONTRACTOR shall notify the CITY in the event of any notice of cancellation, nonrenewal or material change in coverage and shall give such notices not less than thirty (30) calendar days prior to the change, or ten (10) calendar days notice for cancellation due to non-payment of premiums, which notice must be accompanied by a replacement Certificate of Insurance. All notices shall be given to the CITY at the following address:

CITY OF SAN ANTONIO
Public Works Department
P. O. Box 839966
San Antonio, Texas 78283-3966

CITY OF SAN ANTONIO
City Clerk's Office
P. O. Box 839966
San Antonio, Texas 78283-3966

.8 If CONTRACTOR fails to maintain the aforementioned insurance, or fails to secure and maintain the aforementioned endorsements, the CITY may obtain such insurance, and deduct and retain the amount of the premiums for such insurance from any sums due under the agreement; however, procuring of said insurance by the CITY is an alternative to other remedies the CITY may have, and is not the exclusive remedy for failure of CONTRACTOR to maintain said insurance or secure such endorsement. In addition to any other remedies the CITY may have upon CONTRACTOR's failure to provide and maintain any insurance or policy endorsements to the extent and within the time herein required, the CITY shall have the right to order CONTRACTOR to stop work hereunder, and/or withhold any payment(s) which become due, to CONTRACTOR hereunder until CONTRACTOR demonstrates compliance with the requirements hereof.

Nothing herein contained shall be construed as limiting in any way the extent to which CONTRACTOR may be held responsible for payments of damages to persons or property resulting from CONTRACTOR's or its subconstractors' performance of the work covered under this agreement.

.9 The Contractor shall be required to provide workers compensation coverage through a group plan or other method satisfactory to the city for each employee of the Contractor employed on the Project. The Contractor shall provide all required certificates of coverage for all persons providing services on the project, in accordance with the Texas Workers Compensation Commission, Rule 110.110 (e) (1). The Contractor will be required to:

a. Provide coverage and certificates of coverage for all his employees.
b. Obtain and provide the City all required Certificates of Coverage for all persons providing services on the Project.
c. Notify the City in writing, by certified mail or personal delivery, within ten (10) calendar days after changes that materially affects any provisions of the coverage.
d. Post notices on each project site, and contractually require all subcontractors to do the same.

7.6. Restoration of Surfaces Opened by Permit. The Contractor shall not allow any party to make an opening in the highway unless a duly authorized permit signed by the Public Works' Right-of-Way Division is presented. Until the acceptance of the work, the Contractor shall make all necessary repairs in the roadway where openings have been made by due authority. Such repair work will be performed in accordance with Article 4.5.

7.7. Public Safety and Convenience

.1 Contractor's Safety Program. The Contractor shall be responsible for implementing, maintaining and supervising safety precautions and programs in connection with the Work. The Contractor will provide the City with the name of the person who is responsible for the Contractor's Safety Program. In addition, the Contractor will provide for the City's reference a copy of the Contractor's safety program. The Contractor shall take reasonable precautions for the safety of, and shall provide protection to prevent damage, injury or loss to:

a. All employees on the Work, and all other persons who may reasonably be foreseen to be affected by the Work.
b. All the Work and all materials to be incorporated at street crossings, along proposed detour routes, and at material stockpiles. Where directed by the City Engineer or his representative, the Contractor shall provide and maintain suitable warning signs, barricades and lights, in accordance with the details shown on the Plans, to direct traffic around the Work in progress and to assure the safety of the public. The Contractor shall provide adequate warning signs, barricades, lights and, where necessary, flagmen for the Project or portions of the Project within which operations are being prosecuted in any one day or which will be closed over night.
c. Other property at the site or adjacent thereto including but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

.2 Safety Regulations. The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (Public Law 91-596 and all subsequent amendments) and under Section 107 of the Contract Work Hours and Safety Standards Act (Public Law 91-54 and all subsequent amendments). This project is subject to all of the Safety and Health Regulations (CFR 29, Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974 and CFR 29, Part 1910 and all subsequent amendments, General Industry Safety and Health Regulations Identified As Applicable to Construction. Contractors are urged to become familiar with the requirements of these regulations and any amendments thereto.

.3 Trench Excavation. On trench excavation that exceeds a depth of five feet, trench excavation protection shall be accomplished as required by the most current provisions of part 1926 subpart P - Excavations, trenching, and shoring - of the Occupational Safety and Health's Standards and interpretations and as further defined in the note(s) on the Plans and other Contract Documents.

.4 Emergency Work. In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor resulting from emergency Work shall be considered by Owner in accordance with Items 4 and 8.

.5 Basic First Aid Service. The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to supply basic first aid service to anyone who may be injured in connection with the Work. Such equipment shall comply with the most current regulations of the Occupational Safety and Health Administration of the United States Department of Labor.

.6 Notification of Director of Public Works. The Contractor must promptly report in writing to the Director of Public Works all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on or adjacent to the site which caused death, personal injury, or property damage, giving full details and any statements of witnesses, if documented. In addition, if death, serious injury, or

serious damage is caused, the accident then shall be reported immediately by telephone or messenger to the Director of Public Works.

7.8. Sanitary Provisions. The Contractor shall provide and maintain in a neat, sanitary condition, rest room facilities for the use of his employees and authorized on-site visitors as may be necessary to comply with the requirements and regulations of the City Health Department and of the State Department of Health.

7.9. Use of Explosives. The Contractor may employ the use of explosives on City projects provided he strictly adheres to the following conditions:

.1 For informational purposes only, notify the City Engineer and Consultant in writing of the intended use of explosives on the Project.

.2 Furnish Commercial General Liability Insurance on an occurrence basis in the amounts specified in accordance with Article 7.5.3.b.7.

.3 Obtain an "Explosives Permit" from the City Fire Marshal.

.4 Conform with Chapter 15, Article VIII "Explosives" of the City Code of the City of San Antonio, a copy of which is on file in the Office of the City Clerk.

.5 Employ a person or persons who possess an individual Explosives Permit and who shall have met the experience requirements of the City Fire Marshal.

7.10. Barricades and Danger, Warning and Detour Signs and Traffic Handling. The Contractor shall have the sole responsibility for providing, installing, moving, replacing, maintaining, cleaning and removing upon completion of work all barricades, warning signs, barriers, cones, lights, signals and other such type devices and of handling traffic as shown on the plans or as directed/approved by the Engineer. All barricades, warning signs, barriers, cones, lights, signals and other such type devices shall conform to details shown on the plans or those indicated in the TMUTCD.

.1 The Contractor may provide special signs not covered by the plans to protect the traveling public against special conditions or hazards, provided, however, that such signs are first approved by the Engineer.

.2 Upon completion of the work, with the exception of performance test, maintenance and vegetative establishment periods, all standard barricades and signs and other traffic control devices shall be removed by the Contractor. In those instances where the above mentioned periods are still in effect, the Contractor shall utilize temporary traffic control devices conforming to the TMUTCD to accommodate work performed during these periods.

.3 If, in the opinion of the Engineer, any of the above requirements are not complied with, the Engineer may do such work as he may consider necessary to fulfill these requirements; however, this shall not change the legal responsibilities set forth in this Item. The expense for such work will be borne by the Contractor and the cost thereof shall be deducted from any moneys due the Contractor or to become due to the Contractor.

7.11. Detour Routes. A detour route for through traffic as determined by the City is included in the Plans where the proposed construction is located within the limits of a street designated as "Collector," "Secondary" or "Primary." The Contractor shall not begin construction of the Project or close any streets until adequate barricades and detour signs have been provided, erected and maintained in accordance with the detour route and details shown on the Plans. The Contractor shall notify the City's "COI" forty-eight (48) hours in advance of closing any street to through traffic. Local traffic shall be permitted the use of streets under construction where feasible.

7.12. Responsibility for Damage Claims:

.1 CONTRACTOR covenants and agrees to FULLY INDEMNIFY and HOLD HARMLESS, the CITY and the elected official, employees, officers, directors, volunteers and representatives of the CITY individually or collectively, from and against any and all costs, claims, liens, damages, losses, expenses, fees, fines, penalties, proceedings, actions, demands, causes of action, liability and suits of any kind and nature, including but not limited to, personal or bodily injury or death and property damage, made upon the CITY directly or indirectly arising out of, resulting from or related to CONTRACTOR's activity under this CONTRACT, including any acts or omissions of CONTRACTOR, any agent, officer, director, representative, employee, consultant or subcontractor of CONTRACTOR, and their respective officers, agents, employees, directors, and representatives while in the exercise or performance of the rights or duties under this CONTRACT, all without, however, waiving any governmental immunity available to the CITY under Texas Law and without waiving any defenses of the parties under Texas Law. IT IS FURTHER CONVENANTED AND AGREED THAT SUCH INDEMNITY SHALL APPLY EVEN WHERE SUCH COSTS, CLAIMS, LIENS, DAMAGES, LOSSES, EXPENSES, FEES, FINES, PENALTIES, ACTIONS, DEMANDS, CAUSES OF ACTION, LIABILITY AND/OR SUITS ARISE IN ANY PART FROM THE NEGLIGENCE OF CITY, THE ELECTED OFFICIALS, EMPLOYEES, OFFICERS, DIRECTORS AND REPRESENTATIVES OF CITY UNDER THIS CONTRACT. The provisions of this INDEMNITY are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity. CONTRACTOR shall promptly advise the CITY in writing of any claim or demand against the CITY or CONTRACTOR known to CONTRACTOR related to or arising out of CONTRACTOR's activities under this CONTRACT and shall see to the investigation and defense of such claim or demand at CONTRACTOR's cost. The CITY shall have the right, at its option and at its own expense, to participate in such defense without relieving CONTRACTOR of any of its obligations under this Article.

.2 It is the EXPRESS INTENT of the parties to this contract, that the INDEMNITY provided for in this section, is an INDEMNITY extended by CONTRACTOR to INDEMNIFY, PROTECT and HOLD HARMLESS the CITY from the consequences of the CITY's OWN NEGLIGENCE, provided however, that that INDEMNITY provided for in this section SHALL APPLY only when the NEGLIGENT ACT of the CITY is a CONTRIBUTORY CAUSE of the resultant injury, death, or damage, and shall have no application when the negligent act of the CITY is the sole cause of the resultant injury, death, or damage. CONTRACTOR further AGREES TO DEFEND, AT ITS OWN EXPENSE and ON BEHALF OF THE CITY IN THE NAME OF THE CITY, any claim or litigation brought against the CITY and its elected officials, employees, officers, directors, volunteers and representatives, in connection with any such injury, death, or damage for which this INDEMNITY shall apply, as set forth above.

7.13. Protection of Private Property. The City has secured right-of-way and easements, as shown on the plans, to be occupied by the finished construction, with only such additional temporary construction easements as shown for use by the Contractor in carrying out his Work. The Contractor shall take proper measures to protect all property within all construction easements, and adjacent or adjoining property which might be injured by any process of construction; and, in case of any injury or damage, he shall restore at his own expense the damaged property to a condition similar or equal to that existing before such injury or damage was done, or he shall make good such injury or damage in a manner acceptable to the private or public Owner.

.1 The Contractor shall not, except upon procuring written consent from proper private parties, enter or occupy with men, tools, materials, or equipment any privately owned land except for those on easements provided herein by City.

7.14. Contractor's Responsibilities for Work. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures, and for the implementation of safety precautions and for coordinating all portions of the Work under this Contract.

.1 Quality Control. In connection with the City's visual observation/inspection of the Work or materials testing contemplated herein, it is clearly understood that the Contractor is responsible for his own quality control inspection and testing services to assure Project compliance with plans, specifications and other included instruments. The Contractor shall give the City's "COI" reasonable advanced notice of the

readiness of any Work for observation/inspection, and when practicable, twenty-four (24) hours notice. If any underground Work is performed without the proper prior notification to the "COI," it shall be uncovered for observation/inspection and properly restored at the Contractor's expense.

.2 Notification of Discrepancies. If the Contractor, in the course of the Work, finds any discrepancies between the Plans and the physical conditions of the locality, or any errors or omissions in the Plans or the layout as given by survey points and instructions, he shall immediately inform the City's "COI" and Consultant, in writing, and the Consultant shall promptly investigate the same. Any Work impacted by the discrepancy performed by Contractor after such discovery, until authorized, will be done at the Contractor's risk and/or expense.

.3 Contractor's Risk. Contractor shall be responsible for the complete, timely, performance of the Work under this Contract and compliance with the Contract Documents. Contractor shall be responsible for the safe storage and inventory control of all materials on the project site and/or within off-site storage facilities either owned or leased by the Contractor, if any. Contractor shall protect materials and Work from all theft, loss, vandalism, or damage from any cause whatsoever until final Project completion by Contractor and acceptance by Owner; and shall deliver said Work and improvements to the City in a completed and acceptable condition in accordance with the Contract Documents.

7.15 Electrical Requirements. Electrical work shall be defined as all work performed, either by bid Item or reference Item under the Items 610, 611, 612, 614, 616, 618, 620, 622, 628, 629, 652, 680 and other Items including special specifications that deal with either the distribution of electrical power greater than 50 volts or the installation of conduit and duct bank. Electrical work includes the installation of traffic signal cables, including connections and wiring of all parts of a traffic signal installation. The installation of the conduit system for communication and fiber optic cables will also be considered electrical work. The conduit and wiring associated with the installation of Item 624, "Ground Boxes" and Item 656, "Foundations," is considered electrical work. Electrical work does not include the installation of the communications or fiber optic cable, or the connections of low voltage and inherently power limited circuits such as electronic equipment or communications equipment. Mechanical assemblage of poles, structures or other hardware, or the placement of poles or structures, cabinets, enclosures or manholes under the above Items will not be considered electrical work as long as no wiring, wiring connections or conduit work is done at that time.

.1 Special Electrical Work. Special electrical work is defined as electric work that will include the electrical service and all feeders, sub feeders, branch circuits, controls, raceways and enclosure for all of the following:

Pump Stations
Lift Bridges
Ferry Slips
Motor Control Centers
Type D Structure, Asphalt Mix Control Laboratory
Construction Site Field Offices which will include Types A, B, and C
Rest Area or other Public Buildings
Weigh in Motion Stations
Electrical Services larger than 200 amps or when main or branch circuit breaker sizes are not shown on the plans
Any Three Phase Electrical Power

.2 Certified Person. A certified person is defined as a person that submits the following: A current and valid certification signifying successful completion of the Texas Engineering Extension Service (TEEX) course entitled, "TxDOT Electrical Systems," and passing the associated test, or successful completion of the test only from the above mentioned course.

.3 Licensed Electrician. A licensed electrician is a person that submits the following:

a. A current and valid journeyman's or master's electrical license. The journeyman electrician shall be supervised or directed by a master electrician holding a current and valid master

electrician license. A master electrician need not be on the project at all times work is being done but shall be the owner of the computer or a full-time employee of the Contractor.

b. The journeyman and master electrical licenses shall be issued by a city in Texas with a population of 50,000 or greater, that issues licenses based on the passing of a written test and demonstration of experience. Electrical licenses from other cities, inside or outside Texas, or by other states, will be acceptable if approved by the Engineer. In this case, the Contractor shall submit documentation on the requirements for obtaining that license. The Engineer's decision will be based on sufficient evidence that the license was issued based on the Contractor passing a written test that demonstrates in-depth knowledge of the National Electrical Code and sufficient electrical experience commensurate with general standards for a master and journeyman electrician.
c. The NEC Test for electrical licenses as described above shall be the Block Test, the Southern Building Code Test, or a test of similar difficulty as determined by the Engineer.

.4 Electrical Work Requirements. All workers performing electrical work shall either be licensed electricians or a certified persons as defined above or shall be directly supervised by a person that is either licensed or certified. Directly supervised means that licensed or certified person is present during all electrical work. This requirement applies to work bid under the Items shown above that define electrical work, for electrical work that is subsidiary to other Items of the contract, to other special specifications that involve electrical work, and to conduit and duct banks installed for future use.

a. Conduit installed in precast concrete is excepted from this requirement if the conduit is placed in accordance with approved working drawings or shop drawings.
b. For electrical work consisting of the installation of conduit in cast in place concrete sections, a non-certified person may install the conduit but a certified person shall check the installation of the conduit prior to pouring concrete.
d. All workers performing special electrical work shall be licensed electricians as defined above or shall be directly supervised by a person that is a licensed electrician. Directly supervised means that the licensed person is present during all special electrical work.
e. Special electrical work performed under a maintenance contract must be done by a licensed electrician. Under a maintenance contract, lamp changes for luminaries and signals, starter aid changes, signal head replacements and laminaire head changes may be done by either a certified person or a licensed electrician. Under a maintenance contract, electrical installation or lighting systems when plans and standard sheets are provided by the City, may be done by either a certified person or licensed electrician. All other electrical work under maintenance contract will be done by a licensed electrician.
f. Traffic signal cable, indicator, and controller installation and maintenance is exempted from this requirement if the plans specify other electrical certifications such as IMSA certification or the completion of other electrical installation courses. In this case, a certified person will be required only for the conduit, ground box, electrical services, electrical conductor (bid under Item 620), and the pole grounding.
g. A qualified Contractor need not have an individual with an electrical license or certification to bid on this project but must obtain license or certification prior to beginning electrical work. A copy of licenses or certifications of all persons performing electrical work shall be submitted to the Engineer prior to the beginning of any electrical work.

7.16. Subcontractors. The Contractor shall upon executing the Contract, notify the Director of Public Works in writing of the names of all proposed first tier Subcontractors for the Work.

.1 Subcontractual Relations. By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and the Consultant. Said agreement shall preserve and protect the rights of the Owner and the Consultant under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, the benefit of

all rights, remedies and redress against the Contractor that the Contractor, by these Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the Subcontract, copies of the Contract Documents to which the Subcontractor will be bound by this Article and identify to the Subcontractor any terms and conditions of the proposed Subcontract which may be at variance with the Contract documents. Each Subcontractor shall similarly make copies of such Documents available to his sub-subcontractor.

.2 Subcontracting. The Contractor shall perform work with his own organization on contract bid items amounting to not less than thirty (30) percent of the total original contract price, excluding any specialty items designated by the Engineer. Such specialty items may be performed by subcontract. The amount of any specialty items so performed will be deducted from the total original-contract price before computing the amount of work to be performed by the Contractor's own organization. The cost of equipment counts toward work performed only when the equipment is utilized by the Prime Contractor's employees in performance of the work.

.3 Perform Work with Own Organization. The term "perform work with his own organization" refers to workers employed and paid directly by the Prime Contractor and equipment owned or rented by the Prime Contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the Prime Contractor, or any other assignees. The term may include payments to an employee leasing firm licensed by the Texas Department of Licensing and Regulation in accordance with Chapter 91 of the Texas Labor Code for non-supervisory personnel when the Prime Contractor maintains control over the day-to-day activities of the leased non-supervisory employees and includes them in the certified weekly payroll submissions for federal-aid projects or payrolls maintained by the Contractor for review by the City on City funded projects.

.4 Staff Leasing Services. Staff leasing services provided by employee leasing firms are limited to labor and incidental tools only. In those instances when services provided by an employee leasing firm include materials and/or equipment, the employee leasing firm will be considered a subcontractor and a subcontractor request for approval shall be submitted by the Contractor.

.5 Specialty Items. The term "specialty items" refers to work on contract bid items requiring highly specialized knowledge; abilities or equipment not usually available in the type of contracting organizations qualified and expected to bid on the contract as a whole. These specialty items will be designated by the Engineer.

.4 Costs. The cost of materials paid by the Prime Contractor counts as work performed by that Contractor only when: said materials are incorporated into the project; and the majority of the value of work involved in incorporating each material into the project is performed using the Contractor's own organization.

.5 Verification of Direct Payment. The City reserves the right to require copies of canceled checks and/or certified statements from the Prime Contractor to verify direct payment of labor, equipment, materials and subcontractors sufficient to meet the above requirements.

.6 Subletting. The Contractor shall give assurance that the minimum wage for labor and the maximum amount to be deducted for board, if furnished, as stated in the governing provisions shall apply to labor performed on all work sublet. Written consent to sublet any portion of the contract shall not be construed to relieve the Contractor of any responsibility for the fulfillment of the contract.

.7 Default. In the case when a Contractor is found to be in default of the contract, the requirement that thirty (30) percent of the work be done by the Contractor is suspended, but City approval of all subcontractors continues to be required.

7.17. Responsibilities to the Railroad Companies.

.1 General. Must meet Railroad permit and insurance requirements.

.2 Temporary Crossings. If a temporary crossing is needed, Contractor shall obtain written permission from the railroad company before crossing the tracks. Execute the "Agreement for Contractor's Temporary Crossing" if required by the Railroad Company. Contractor shall ensure that the tracks are left clear of equipment and debris that would endanger the safe operation of railroad traffic. Contractor shall provide a crossing guard on each side of the crossing to direct equipment when hauling across the tracks.

a. Contractor shall stop construction traffic a safe distance away from the crossing upon the approach of railroad traffic.
b. Work for temporary crossings will not be paid for directly, but is subsidiary to Items of the Contract. Work performed by the railroad company for the temporary crossing, except flaggers, will be at the Contractor's expense.

7.18. Assignments and Subletting. Contractor shall not assign, transfer, convey, sublet or otherwise dispose of this Contract, or any portion thereof, or any right, title or interest in, to or under the same, without the previous written consent of the City. The Contractor shall not assign by power of attorney or otherwise any of the monies or other considerations to become due and payable by the City under this Contract, without the previous written consent of the City. In no event shall the City be liable in excess of the consideration of this Contract in the case of any such assignment, transfer, conveyance or subletting of the Work or performance which is the subject hereof.

.1 The City reserves the right to withhold any monthly payment hereafter provided for in the event of an assignment or subletting of a portion of the work without the previous consent and knowledge of the City and by reserving such right, the City shall not be deemed to have waived its right to declare a full breach of this Contract for Contractor's failure to comply with provisions hereof, such remedy being alternative only and exercisable at the option of the City.

7.19. Preservation of Cultural Resources, Natural Resources and the Environment. For all project specific locations (PSL's) (material sources, waste sites, parking areas, storage areas, field offices, staging areas, haul roads, etc.), the Contractor certifies by signing this contract that he and all subcontractors will comply with all applicable laws, rules and regulations pertaining to the preservation of cultural resources, natural resources, and the environment as issued by the following or other agencies:

U.S. Department of Transportation
U.S. Army Corps of Engineers
U.S. Federal Emergency Management Agency
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
Texas Department of Transportation
Texas Historical Commission
Texas Parks and Wildlife Department
Texas Commission on Environmental Quality (TCEQ)

.1 The Contractor and all subcontractors will be required to maintain documentation of certification activities including environmental consultant reports, Contractor documentation on certification decisions, contacts with the resource agencies, and correspondence with the pertinent resource agency. This documentation will be provided upon request.

7.20. Abatement and Mitigation of Excessive or Unnecessary Construction Noise. Contractor will ensure abatement and mitigation of excessive or unnecessary construction noise as prescribed by all applicable state and local laws.

7.21. Public Utilities. The Contractor's attention is hereby specifically directed to the information regarding the existing public utility structures, lines and mains which are known to exist and may be encountered within and/or adjacent to the limits of the Work covered by this Contract. The existence and location of underground utilities

indicated on the Plans are taken from the most current utility records available to the Consultant but are not guaranteed by Owner or Consultant nor do they indicate the location of private service lines, but shall be investigated and field verified by the Contractor and appropriate utility companies before starting Work. All utility companies have been furnished with Plans of the proposed construction. The Contractor is reminded that maintaining continuity of utility service to customers is critical.

.1 Work Clearance Zones. "Work Clearance Zones," as used hereinafter, shall be considered to be the distance on the horizontal axis from the edge of pipe, box or other construction to the outside edge of the excavation shown on the Plans or details or to the outside edge of Contractor's Trench Excavation Protection System. The vertical restrictions of the Work Clearance Zone are subject to excavation limits as shown on the Plans and/or height limitations as required by State statutes. Underground utilities within the Work Clearance Zone are considered to be in conflict with the intended Work and will generally be adjusted by the respective utility at no cost to the Contractor. In the event that existing conflicting utilities cannot be relocated, see Article 7.21.4.

.2 Temporary Clearance. Temporary clearance of high voltage (600 volts and above) and overhead electrical lines is required prior to the operation of equipment within 10 feet of such lines (VTCS 1436C, Sec. 5A & 6). At his own expense, the Contractor shall obtain the necessary temporary clearance from the high voltage line operator or utility company. Temporary clearance shall be a temporary barrier separating and preventing contact of material, equipment, persons, communications with high voltage electrical lines, or temporary de-energization and grounding or temporary relocation, or raising of the lines.

.3 Contractor's Responsibility. The Contractor shall be responsible for any damage to, and protection of existing utilities where shown on the Plans and/or verified by the utility company in the field. Any existing utilities, which cannot be relocated and must remain in service within the Work Clearance Zone are shown on the Plans and shall be protected by the Contractor as part of the original Bid Proposal Price submitted by Contractor. Any damage caused to utilities within the Work Clearance Zone due to neglect on the part of the Contractor, or his Subcontractors, shall be repaired by the utility company and paid for by the Contractor or his Subcontractor. Temporary relocation of utilities by utility companies for the Contractor's convenience shall be paid by the Contractor directly to the affected utility company.

.4 Utilities' Responsibility. Prior to the start of construction, the utility companies shall have adjusted their respective utilities to provide proper clearance for the Project. Prior to start of construction, the utility companies shall inform the Contractor of any remaining adjustments that have not been completed. The utility company shall cooperate with the Contractor to expedite the utility company's adjustment of any remaining utilities so as not to cause a delay to the Contractor. The Contractor shall not be responsible for repair of Contractor-damaged utilities which are not shown on the Plans and/or by subsequent utility company field verification and which lie within the horizontal and vertical limits of construction.

.5 Utilities on Street Projects. The utility companies have adjusted their utility lines for street construction with the exception of manholes, vaults, and valves. The utilities shall create a horizontal and vertical Work Clearance Zone on Street Projects by adjusting their respective facilities at no cost to the Contractor so as not to interfere with the eventual vehicular traffic and/or installation of curbs and sidewalks.

.6 Utilities on Storm and Sanitary Sewer Projects. The utility companies have adjusted their utility lines for the sewer line to be constructed. However, in some instances and as shown on the Plans, adjustment of the utility lines by this Contractor, or a separate contractor, or by City forces will be required concurrently with the construction of the sewer by this Contractor. In these instances the utility companies will be required to cooperate fully with the Contractor in accomplishing these adjustments so as to minimize any delays in the Contractor's progress and inconveniences to the City.

a. In the case of sewer, water, gas, electric, telephone, cablevision cable, or any other utility line which is shown on the Plans, within or crossing the Work Clearance Zone, and which must

remain in service, it shall be the responsibility of the utility company, with the cooperation of the Contractor, to determine the exact location of the utility line. The Contractor will use care in excavating over, under and around such lines and will provide all necessary temporary bridging during construction so as to maintain continuous service of the utility line. The Contractor shall backfill around the main and complete his construction operations in such a manner as to leave the utility line firmly and securely bedded in its original position without damage to any protective coatings.

b. In instances where gas or water mains are exposed during construction, the utility company owning or operating the service shall be given at least twenty-four (24) hours notice by the Contractor prior to backfilling so the protective coating on the mains may be inspected and/or repaired by utility company. If repairs are necessary, all costs incurred are to be borne by Contractor.

.7 Bracing and Supporting. In areas where utilities are known to be near the outside edge of the Work Clearance Zone and could be damaged by soil movement, slips or cave-ins, the Contractor shall take all precautions necessary to protect such utilities from damage and shall pay for the repair of any such damages caused by Contractor failure to properly protect the utility.

7.22. Work in Waters of the United States. Where it becomes necessary for the Contractor to work in waters of the United States or their adjacent wetlands as delineated by the U.S. Army Corps of Engineers, the Contractor should be aware that a Section 404 permit may be required. The City will obtain any Section 404 permits prior to commencement of construction on a project-by-project basis. The Contractor will be required to adhere to any agreements, mitigation plans and standard best management practices required for a permit on any project. If the Contractor makes changes in the project construction method that would result in changes of project impacts to waters of the U.S., the Contractor will notify the City in writing and be responsible for any new Section 404 permit.

7.23. Work in Navigable Waters. Any operations by the Contractor relating to the placement of embankment into, or the placement or rehabilitation of structures in or over navigable waters of the U.S. as designated by the U.S. Army Corps of Engineers or the U.S. Coast Guard, is subject to regulation by these agencies. Approval will be coordinated by the City and construction should not commence until the activity is approved by the regulatory agency. The Contractor will be required to adhere to the stipulations of the permit and the associated best management practices. If the Contractor makes changes in the project construction method that would result in changes of project impacts to navigable waters of the U.S., the Contractor will notify the City in writing and be responsible for any new Section 9 permit from the U.S. Coast Guard.

7.24. Work Over the Recharge Zone of Protected Aquifers. Relating to work over the recharge zones of protected aquifers as defined and delineated by the Texas Water Commission (TWC), the Contractor shall make every reasonable effort to minimize the degradation of water quality resulting from construction impacts in accordance with all applicable state and local laws. The Contractor will be required to follow best management practices and to use and maintain those sedimentation and water pollution control devices as required by the Engineer.

.1 If a Water Pollution Abatement Plan (WPAP) is required by the TWC, modification to the approved WPAP by the Contractor will require the Engineer's approval and be coordinated through the City with the TWC.

7.25. Excluded Parties. The Bidder certifies by signing this bid proposal, that if awarded the contract for the work covered by this bid proposal, he shall not enter into any subcontract with a subcontractor that is debarred or suspended by any federal agency.

ITEM 8

PROSECUTION AND PROGRESS

8.1. Prosecution of Work. Prior to beginning construction operations, a preconstruction conference between the Contractor and the City will be conducted. The Contractor shall begin the work to be performed under the contract within seven (7) calendar days after the date of the authorization to begin work as shown on the work order and shall continuously prosecute same with such diligence as will enable the completion of the work within the time limit specified. The Contractor shall notify the City at least twenty-four (24) hours before beginning work and any new operation. The Contractor shall not start new operations to the detriment of work already begun. The prosecution of the work shall be conducted in such a manner as to impose minimum interference to traffic. The contract time requirement is a key factor to both the City and the Contractor. All time limits stated in the Contract Documents are of the essence of the Contract.

8.2. Commencement of Work. The Work called for in this Contract shall be commenced by Contractor within seven (7) calendar days after receipt by the Contractor of City-issued, written Authorization To Proceed. Under no circumstances shall the Work commence prior to Contractor's receipt of City-issued, written Authorization To Proceed. Computation of Contract Time will begin upon actual commencement of Work by the Contractor during the seven (7) calendar day period referenced above or upon the eighth (8th) calendar day (assuming the eighth (8^{th}) calendar day is a day upon which Work may lawfully and Contractually be performed), whichever occurs first.

8.3. Working Hours. No Work, with the exception of such items as curing of concrete, maintenance of barricades, etc., will be allowed by Owner between the hours of 7:00 p.m. and 6:00 a.m. of the following day, unless directed by Owner or requested in writing by Contractor and approved by the Director of Public Works. Nighttime work is allowed only when shown on the plans or directed or allowed by the Engineer. Nighttime work is defined as work performed from thirty (30) minutes after sunset to thirty (30) minutes before sunrise.

8.4. Completion of Work. After commencement of Work, the Contractor shall prosecute the Work continuously, diligently and uninterruptedly throughout the Contract Time period, during which period of time Contractor binds and obligates himself, his Subcontractors and suppliers at all times to employ sufficient Work force and supervisory diligence to complete said structures, Work and improvements, and to deliver same over to the City in a timely acceptable, completed, undamaged and clean condition. The time of beginning, rate of progress and time of completion of said Work are hereby declared by Owner and understood by Contractor to be "OF THE ESSENCE" to this Contract. The Director of Public Works may suspend said Work either partially or totally as provided for Article 8.6.

8.5. Railroad Construction. As per railroad permit requirement.

8.6. Suspension of Work by Owner

.1 The Director of Public Works may suspend said Work either partially or totally by his written order whenever in his opinion the interests of the City requires the suspension of such Work. In the event that the Director of Public Works totally suspends Project Work, the Contractor hereby acknowledges and agrees that so long as the total suspension(s) is (are) for a period not to exceed ten (10) cumulative calendar days accruing throughout the entire Contract Time, that the Contractor is not entitled to request a negotiated adjustment of the Contract Sum nor an extension of the Contract Time. Such right to totally suspend Project Work for period(s) not to exceed ten (10) cumulative calendar days accruing throughout the entire Contract Time without compensation to the Contractor is expressly reserved by the City.

.2 Any total suspension of Project Work by the Director of Public Works that extends beyond ten (10) cumulative calendar days accrued throughout the entire Contract Time, shall entitle the Contractor to request either a negotiated adjustment of Contract Sum or an extension of Contract Time, or both, as directly attributable to such extended total suspension of Project Work.

.3 Any partial suspension of the Work by the Director of Public Works that extends beyond the mutually determined point in time when the ten (10) cumulative calendar days accruing throughout the entire Contract Time, are effectively exceeded, shall entitle the Contractor to request either a negotiated adjustment of Contract Sum or an extension of Contract Time, or both, as directly attributable to such extended partial suspension of Project Work.

a. In the event that the Director of Public Works partially suspends the Work in such a manner that some Work is able to continue, the Contractor and City hereby agree to discuss the impact of the partial suspensions upon dependent Contract Work, and to mutually determine when the ten (10) cumulative calendar days accruing throughout the entire Contract Time and expressly reserved by the City without compensation to the Contractor, would effectively be exceeded.
b. The City's "COI" shall have the right to stop the Work whenever such stoppage may be necessary to insure proper execution of the Contract. Such temporary stoppage shall be followed by a Written Order as outlined in Article 8.6.1.

8.7. Contract Time Statement. The Director of Public Works, or his authorized representative shall furnish a "Contract Time Statement" to the Contractor after the end of each calendar month showing the number of Calendar Days charged by Owner and of such non-chargeable Days credited to the Contractor during each month. Such statement shall become final and binding upon the Contractor without exception, unless Contractor notifies the Director of Public Works in writing of any Contract Time Statement discrepancies claimed by the twentieth (20th) calendar day following Owner issuance date on the Contract Time Statement.

8.8 Failure to Complete Work On Time. If the Contractor fails to complete the Contract in the time specified by Owner in the Contract Documents and agreed to by Contractor through execution of this Contract, Contract Time charges will continue to be made for each Calendar Day thereafter. The time set forth in the Contract for the completion of the Work is an ESSENTIAL ELEMENT of the Contract. For each Calendar Day that any Work shall not be complete after the expiration of the Calendar Days specified in the Contract (to include Calendar Days charged for correction of Contractor deficiencies found during the final inspection), plus, any extended calendar days allowed by Owner, the amount of liquidated damages assessed per day as stipulated in the Contract will be deducted from the money owed or to become due the Contractor, not as a penalty but as liquidated damages owed the City for extended expenses, loss and public inconvenience resulting from Contractor's failure to complete said Work within the Time Contractor agreed to by execution of this Contract. Contractor and City agree that such liquidated damages are as set prior to the Contract execution for projected reasonable costs that are otherwise difficult for either Party to forecast and will be incurred by the City due to Contractor completion beyond the number of Days Calendar Days calculated herein by the City.

8.9. Workers and Equipment. The Contractor shall furnish such suitable machinery, equipment and construction forces as may be necessary, in the opinion of the Engineer, for the proper prosecution of the work, and failure to do so may cause the Engineer to withhold all estimates, which have or may become due and suspend the work until his requests are complied with. All workers employed by the Contractor shall have such skill and experience as will enable them to properly perform the duties assigned. Any person employed by the Contractor or a subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or who is disrespectful, intemperate, disorderly or otherwise objectionable, shall, at the written request of the Engineer, be forthwith discharged and shall not be employed again on any portion of the work without the written consent of the Engineer.

.1 Flaggers. The Contractor shall have a company representative that has received flagger training through courses such as those offered by the Texas Engineering Extension Service (TEEX) or the American Traffic Safety Services Association (ATSSA). This representative shall be responsible for training or assuring that all flaggers used on this project are qualified to perform flagging duties. A certificate indicating completion of such course shall be available to the Engineer if requested.

a. A qualified flagger is one that has attended courses such as those offered by TEEX, ATSSA, or through training provided by the trained official mentioned above. A list of all qualified flaggers shall be provided to the Engineer prior to beginning any flagging activities. Any modifications to this list shall also be provided to the project Engineer. Any flagger being used

who is not included on the list as provided to the Engineer shall be removed from flagging duties and replaced with one who is qualified and included on the list.

8.10. Termination for Convenience. The City may terminate the contract in whole or in part whenever:

a. The Contractor is prevented from proceeding with the work as a direct result of an executive order of the President of the United States or the Governor of the State.
b. The Contractor is prevented from proceeding with the work due to a national emergency and when the work to be performed under the contract is stopped directly or indirectly because of the freezing or diversion of materials, equipment or labor, as the result of an order or a proclamation of the President of the United States or an order of any Federal Authority.
c. The Contractor is prevented from proceeding with the work by reason of a preliminary, special, or permanent restraining order of a court of competent jurisdiction where the issuance of the restraining order is primarily caused by acts or omissions of persons or agencies other than the Contractor.
d. The City determines that termination of the contract is in the best interest of the City or the public. This includes but is not limited to the discovery of significant hazardous material problems, right of way acquisition problems, or utility conflicts that would cause substantial delays and/or expense to the project.

.1 Procedures and Submittals. The Engineer will deliver to the Contractor a Notice of Termination specifying the extent of termination and the effective date. After receipt of a Notice of Termination the Contractor shall immediately proceed with the following obligations:

a. Stop work as specified in the notice.
b. Place no further subcontracts or orders for materials, services, or facilities, except as necessary to complete the continued portion of the contract.
c. Terminate all subcontracts to the extent they relate to the work terminated.
d. Complete performance of the work not terminated.
e. Settle all outstanding liabilities and termination settlement proposals resulting from the termination for public convenience of this contract.
f. Create an inventory report for the Engineer of all acceptable materials and products obtained by the Contractor for the contract that have not been incorporated in the work that was terminated. The inventory report will include a description, quantity, source and cost for each of the acceptable materials and products. In addition, the report will indicate whether the City has already compensated the Contractor for the materials or products through a previous material on hand payment.
g. The Contractor shall take any action necessary, or that the Engineer may direct, for the protection and preservation of the materials and products related to the contract that are in the possession of the Contractor and in which the City has or may acquire an interest.

.2 Settlement Provisions. When contracts, or any portion thereof, are terminated, and the Contractor is released before all items of work included in the contract have been completed, the Contractor shall submit, within one hundred eighty (180) calendar days of the date of the notice of termination, a final termination settlement proposal to the City with the intent being that an equitable settlement will be made. The Contractor shall maintain and make available all project cost records to the City to the extent necessary to determine the validity and amount of each item claimed. The Engineer will prepare a change order that reduces the affected quantities of work and adds acceptable costs for termination. No claim for loss of anticipated profits shall be considered. The City will pay for:

a. All work completed at the unit bid price and partial payment for incomplete work.
b. Reasonable demobilization costs;
c. Accounting, legal, clerical and other expenses reasonably necessary for the preparation of termination settlement proposals and support data;
d. The termination and settlement of subcontracts, including yard and material leases;

e. Storage, transportation, restocking and other costs incurred reasonably necessary for the preservation, protection, or disposition of the termination inventory.

.3 Failure to Submit Proposal. If the Contractor fails to submit the proposal within the time allowed, the City may determine the amount due to the Contractor and make compensation.

.4 Failure To Agree On Settlement Amount. If the Contractor and the City fail to agree on the settlement amount, the Contractor may file a formal claim with the City in accordance with the contract claim procedure.

.5 Materials. If the contract is terminated, acceptable materials obtained by the Contractor for the work that have been inspected, tested and accepted by the Engineer and that are not incorporated in the work, will be purchased from the Contractor at the actual cost as shown by receipts and the actual cost records at such points of delivery as may be designated by the Engineer.

.6 Surety. Termination of a contract, as stated above, will not relieve the Contractor or his Surety of the responsibility of replacing defective work as required by the contract.

8.11. Contract Termination:

.1 Termination by Contractor. If the Work is stopped by City for a period of ninety (90) consecutive calendar days under an order of any court or other public authority having jurisdiction, or as a result of an act of a higher governmental authority, such as a declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or a subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, then the Contractor may upon ten (10) additional calendar days written notice to the City and the Consultant, terminate the Contract and recover from the Owner payment for all Work previously executed and for any loss sustained upon any materials, equipment, tools, construction equipment and machinery, including reasonable profit and damages related to the Work stoppage. If the Work is recommenced during the ten (10) calendar day notice period, the Contractor may not terminate the Contract but may still pursue a delay claim with the City.

.2 Termination by Owner. If the Contractor is adjudged as bankrupt, or if he makes a general assignment for the benefit of his creditors without the consent of the City or if a receiver is appointed on account of his insolvency, or if he persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction pertaining to the Work, or otherwise is guilty of a substantial violation of a provision of the Contract Documents warranting Owner default of Contractor, then the Owner may, without prejudice to any right or remedy and after giving the Contractor and his Surety, if any, ten (10) calendar days written notice, terminate the employment of the Contractor and/or take possession of the site and of all materials, and may upon order of a court of competent jurisdiction take possession of equipment, tools, construction equipment and machinery thereon owned by the Contractor. Should the Surety fail to pursue completion of the Work with reasonable speed, the Owner may arrange for completion of the Work and deduct the cost thereof from the unpaid Contract Sum remaining, including the cost of additional Owner administration and Consultant services made necessary by such default or neglect, in which event no further payment shall then be made by the Owner until all cost of completing the Work shall have been paid.

.3 Unpaid Balance. If the unpaid balance of the Contract Sum exceeds the costs of finishing the Work, including compensation for the Consultant's additional services made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor or his surety shall pay the difference to the Owner. This obligation for payment shall survive the termination of the Contract.

8.12 Critical Path Method Project Schedule. The Contractor shall create and maintain a Critical Path Method (CPM) Project Schedule showing the manner of prosecution of work that he intends to follow in order to complete the contract within the allotted time. The project schedule shall employ computerized CPM for the planning, scheduling and reporting of the work as described in this specification. The CPM project schedule shall be prepared using the Precedence Diagram Method (PDM). The Contractor shall create and maintain the schedule using Suretrack. The observance of the requirements herein is an essential part of the work to be done under the contract. No direct compensation will be allowed for fulfilling these requirements, as such work is considered subsidiary to the various bid items of the contract.

.1 Personnel. The Contractor shall provide an individual, referred to hereafter as the Scheduler, to create and maintain the Project Schedule. The Scheduler shall be proficient in CPM analysis and shall be able to perform required tasks on the specified software. The Scheduler shall be made available for discussion or meetings when requested by the City.

.2 Project Schedule. At least twenty (20) calendar days prior to the preconstruction conference, the Contractor shall submit a Project Schedule which shall show the sequence and interdependence of activities required for complete performance of the work. All schedule submittals shall be in the electronic form. The Contractor may submit the schedule via electronic mail, CD-Rom, floppy disc, or any other electronic media acceptable to the City. The City will review the Project Schedule within twenty (20) calendar days for compliance with the specifications and notify the Contractor at the conference of its acceptability. No work shall begin until the Project Schedule has been accepted by the City.

a. The Project Schedule shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for assuring all work sequences are logical and show a coordinated plan of the work. The purpose of the City requiring the Project Schedule shall be to:
    i. Ensure adequate planning during the prosecution and progress of the work in accordance with the allowable number ofcalendar days and all milestones;
    ii. Assure coordination of the efforts of the Contractor, City, Utilities and others that may be involved in the project;
    iii. Assist the Contractor and City in monitoring the progress of the work and evaluating proposed changes to the contract; and,
    iv. Assist the City in administering the contract time requirements.
b. Each activity on the Project Schedule shall be described by: an activity number utilizing an alphanumeric designation system tied to the traffic control plans, and that is agreeable to the City; concise description of the work represented by the activity; and, activity durations in whole calendar days with a maximum of twenty (20) calendar days. Durations greater than twenty (20) calendar days may be used for non-construction activities (mobilization, submittal preparation, curing, etc.), and other activities mutually agreeable between the City and Contractor. The Contractor shall provide to the City a legend for all abbreviations. The activities shall be coded so that organized plots of the Project Schedule may be produced. Typical activity coding includes traffic control phase, location and work type. Activity durations shall be based on the quantity for the individual work activity divided by a production rate.
c. Seasonal weather conditions shall be considered and included in the Project Schedule for all work influenced by temperature and/or precipitation. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions. Average historical weather data is available through the National Oceanic and Atmospheric Administration (NOAA). These effects will be simulated through the use of work calendars for each major work type (i.e., earthwork, concrete paving, structures, asphalt, drainage, etc.). Project and work calendars should be updated each month to show days actually able to work on the various work activities.
d. If specified by general note, the Contractor shall plan and incorporate major resources into the Project Schedule. Major resources are defined as crews and equipment that constrain the Contractor from pursuing available work. The resources shall accurately represent the

Contractor's planned equipment and manpower to achieve the productivity rates specified above.

e. Total float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, for each and every activity in the schedule. Float time in the Project Schedule is a shared commodity between the City and the Contractor.
f. Only City responsible delays in activities that affect milestone dates or the contract completion date, as determined by CPM analysis, will be considered for a time extension.

.3 Joint Review, Revision and Acceptance. Within twenty (20) calendar days of receipt of the Contractor's proposed Project Schedule, the City shall evaluate the schedule for compliance with this specification, and notify the Contractor of its findings. If the City requests a revision or justification, the Contractor shall provide a satisfactory revision or adequate justification to the satisfaction of the City within seven (7) calendar days. If the Contractor submits a Project Schedule for acceptance, which is based on a sequence of work not shown in the plans, then the Contractor shall notify the City in writing, separate from the schedule submittal.

a. The City's review and acceptance of the Contractor's Project Schedule is for conformance to the requirements of the contract documents only. Review and acceptance by the City of the Contractor's Project Schedule does not relieve the Contractor of any of its responsibility for the Project Schedule or of the Contractor's ability to meet interim milestone dates (if specified) and the contract completion date, nor does such review and acceptance expressly or by implication warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the Contractor's Project Schedule. In the event the Contractor fails to define any element of work, activity or logic and the City review does not detect this omission or error, such omission or error, when discovered by the Contractor or City shall be corrected by the Contractor at the next monthly schedule update and shall not affect the project completion date.

.4 Updates. The Project Schedule shall be updated on a monthly basis. The Project Schedule update shall be submitted on the tenth (10^{th}) day of each month. The Contractor shall meet with the City each month at a scheduled update meeting to review actual progress made through the data date of the schedule update. The review of progress will include dates activities actually started and/or completed, and the percentage of work completed or remaining duration on each activity started and/or completed. The percentage of work complete shall be calculated by utilizing the quantity and productivity rate information.

.5 Project Schedule Revisions. If the Contractor desires to make major changes in the Project Schedule, the Contractor shall notify the City in writing and submit the proposed schedule revision. The written notification shall include the reason for the proposed revision, what the revision is comprised of, and how the revision was incorporated into the schedule. Major changes are hereby defined as those that may affect compliance with the contract requirements or those that change the critical path. All other changes may be accomplished through the monthly updating process without written notification.

.6 Time Impact Analysis. The Contractor shall notify the City when an impact may justify an extension of contract time or adjustment of milestone dates. This notice shall be made in writing as soon as possible, but no later than the end of the next estimate period after the commencement of an impact or the notice for a change is given to the Contractor. Not providing notice to the City within twenty (20) calendar days after receipt will indicate the Contractor's approval of the time charges as shown on that time statement. Future consideration of that statement will not be permitted and the Contractor forfeits his right to subsequently request a time extension or time suspension unless the circumstances are such that the Contractor could not reasonably have knowledge of the impact by the end of the next estimate period.

a. When changes are initiated or impacts are experienced, the Contractor shall submit to the City a written time impact analysis describing the influence of each change or impact. A "*time impact analysis*" is an evaluation of the effects of changes in the construction sequence, contract, plans,

or site conditions on the Contractor's plan for constructing the project, as represented by the schedule. The purpose of the time impact analysis is to determine if the overall project has been delayed, and if necessary, to provide the Contractor and the City a basis for making adjustments to the contract.

b. A time impact analysis shall consist of one or all of the steps listed below:

Step 1. Establish the status of the project before the impact using the most recent project schedule update prior to the impact occurrence.

Step 2. Predict the effect of the impact on the most recent project schedule update prior to the impact occurrence. This requires estimating the duration of the impact and inserting the impact into the schedule update. Any other changes made to the schedule including modifications to the calendars or constraints shall be noted.

Step 3. Track the effects of the impact on the schedule during its occurrence. Note any changes in sequencing, and mitigation efforts.

Step 4. Compare the status of the work prior to the impact (Step 1) to the prediction of the effect of the impact (Step 2), and to the status of the work during and after the effects of the impact are over (Step 3). Note that if an impact causes a lack of access to a portion of the project, the effects of the impact may extend to include a reasonable period for remobilization.

c. The time impact analysis shall be electronically submitted to the City. If the Project Schedule is revised after the submittal of a time impact analysis but prior to its approval, the Contractor shall promptly indicate in writing to the City the need for any modification to its time impact analysis. One (1) copy of each time impact analysis shall be submitted within fourteen (14) calendar days after the completion of an impact. The City may require Step 1 and Step 2 of the time impact analysis be submitted at the commencement of the impact, if needed to make a decision regarding the suspension of contract time. Approval or rejection of each time impact analysis by the City shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary.

ITEM 9

MEASUREMENT AND PAYMENT

9.1. Estimated Quantities and Measurement. The estimated quantities of the various elements of Work to be done and material to be furnished are approximate only and are provided by Consultant and Owner as a basis for Owner comparison of bid proposals and award of Contract. It is expressly understood and agreed by Owner and Contractor that the actual amounts of Work to be done and material to be furnished may differ somewhat from these estimates. The quantities of Work actually performed by Contractor will be computed on the basis of measurements taken by the Owner's representatives, and these measurements shall be final and binding on Contractor.

9.2 Plans Quantity Measurement. Plans Quantity Measurement. When plans quantity measurement is specified for an item, adjustment of quantities will be made by the following:

If the quantities measured as outlined under "Measurement" vary from those shown in the bid proposal and on the "Estimate and Quantity" sheet by more than five (5) percent (or as stipulated under the measurement Paragraph for the Item), either party to the contract may request, in writing, an adjustment of the quantities by each separate bid item, except that when stated in the particular item, the adjustment will be made based upon a designated element shown in the Item. The party to the contract which requests the adjustment shall present, to the other, one copy of field measurements and calculations showing the revised quantities in question. These revised quantities, when approved by the Engineer, together with all other quantities under the same bid item, shall constitute the final quantity for which payment will be made.

.1 When quantities are revised by a change in design, the "Plan Quantity" will be increased or decreased by the amount involved in the design change through a Field Alteration.

.2 Payment for revised quantities will be paid for at the unit price bid for that bid item, except as provided for in Article 4.2.

9.3. Progress Payments. Each month as the Work progresses on all City Contracts regardless of Contract Sum, said Director of Public Works, or his designated representatives, and Contractor shall determine the cost of the labor and materials incorporated into the Work during that month and actual invoiced cost of Contractor acquired materials stored on the Project site, and/or within off-site storage facilities either owned or leased by the Contractor. Upon receipt of a complete and mathematically accurate Construction Estimate Certification Form from the Contractor, the City shall make payments to Contractor within thirty (30) calendar days on Contracts totaling four hundred thousand ($400,000.00) dollars or less, based upon such cost determination and at the Contract unit prices in a sum equivalent to ninety (90) percent of each such invoice. At the time the last monthly invoice is paid by Owner, a Letter of Conditional Approval may be furnished to the Contractor. The remaining ten (10) percent retainage shall be held by the City until the final Contract Settlement. However, where the Contract amount exceeds four hundred thousand dollars ($400,000.00), installments shall be paid to Contractor at the rate of ninety-five (95) percent of each monthly invoice within thirty (30) calendar days of Owner receipt of a complete and mathematically accurate Construction Estimate Certification Form from the Contractor, and the retainage held until final Contract Settlement shall be five (5) percent. The payments of such installments are payments toward satisfaction of the Contract Sum, and the Contractor invoices upon which such monthly payments are based, are given to Owner by Contractor only for the purposes of fixing the periodic sums to be paid in compliance with Article 9.1. Owner's payment of installments shall not in any way be deemed to be a final acceptance of any part of the Work by Owner, and will not prejudice Owner in the final settlement of Contract account nor relieve the Contractor from completion of the Work as herein provided.

.1 Subcontractors. The Contractor shall pay the subcontractor for work performed within ten (10) days after the Contractor receives payment for the work performed by the subcontractor. Also, any retained monies on a subcontractor's work shall be paid to the subcontractor within ten (10) days after satisfactory completion of all the subcontractor's work. Completion of all the subcontractor's work shall include test, maintenance and other similar periods that are the responsibility of the subcontractor.

a. For the purpose of this Item, satisfactory completion shall have been accomplished when: (1) The subcontractor has fulfilled the contract requirements of both the Department and the subcontract for the subcontracted work, including the submission of all submittals required by the specifications and the Department; and, (2) The work done by the subcontractor has been inspected and approved by the Department and the final quantities of the subcontractor's work have been determined and agreed upon.
b. The inspection and approval of a subcontractors work does not eliminate the Contractor's responsibilities for all the work as defined in Item 7.
c. The above requirements are also applicable to all sub-tier subcontractors and the above provisions shall be made a part of all subcontract agreements.

.2 Failure to comply with any of the above requirements may cause the Engineer to withhold all estimates which have or may become due and the Engineer may suspend the work until his requests are complied with.

.3 For contracts that provide for a separate vegetative establishment, maintenance, or performance period following the completion of all other construction of the improvement, the Department may release a portion of the amount retained provided all other work is completed as determined by the Engineer. Prior to such release, all submissions and final quantities must be completed and accepted for all the other work. The amount retained after such release shall be sufficient to ensure compliance with the contract.

9.4. Payment for Extra Work. Extra work ordered, performed and accepted will be paid for in accordance with the method described below:

.1 Unit Price. Submitted by the Contractor in the original Contractor Bid Proposal as part of the base bid or as a designated additive or deductive alternate, and if agreed to by the Contractor and the Owner, appropriately adjusted either upward or downward to reflect any increases or decreases in the amount of labor, material or equipment as they relate to Major Bid Items.

.2 Agreed Contract Change. Lump Sum Agreement between Owner and Contractor as to the price, quantity and time for changes in the Work.

.3 The cost of such extra Work shall be added to the Contract Sum by a Written Alteration.

9.5 Force Account. If no Agreed Contract Change or unit price can be reached after good faith negotiations between the City and Contractor, the Owner may direct the Work be performed by the Contractor on a Force Account basis, and payment by the City shall be upon the basis of Actual Cost of the Work plus the participation allowances as specified below. When extra work is ordered to be performed on a “Force Account” basis, payment for same will be made as follows:

a. The Contractor and the City will agree in writing before beginning the work on the rate of wage, which the Contractor will receive for all labor and foremen. The Contractor will be paid said rate for each hour that the labor and foremen are actually engaged in the work except that in the event that the particular laborers and foremen anticipated to be used in the work are not available then the individuals involved in the work will be reimbursed at the rate shown on the payrolls. In no case will the rate of wage be less than the minimum shown in the contract for a particular category. The Contractor will receive an additional twenty-five (25) percent as compensation based on the total wages paid said laborers and foremen. The only exception to the percent amount of compensation is for payment of the provisions outlined in the general notes, concerning off-duty peace officers and patrol cruisers, which shall be based on the invoice amount plus five (5) percent. No charge will be made by the Contractor for organization or overhead expenses. For cost of premiums on public-liability and workers-compensation insurance, Social Security and unemployment-insurance taxes, an amount equal to fifty-five (55) percent of the sum of the labor cost, excluding the twenty-five (25) percent compensation provided above, will be paid to the Contractor. The actual cost of the Contractor's

bond on the extra work will be paid. No charge for superintendence will be made unless considered necessary and ordered by the Engineer.

b. The Contractor will receive the actual cost, including freight charges, of the materials used on such work to which cost will be added a sum equal to twenty-five (25) percent thereof as compensation. When material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount.

c. For Contractor owned machinery, trucks, power tools or other equipment, which are necessary for use on force account work, the Rental Rate Blue Book as modified by the following will be used to establish hourly rates. Equipment used shall be at the rates in effect for each section of the Blue Book at the time of use. The following formula shall be used to compute the hourly rates:

$$H = \frac{M \times R1 \times R2}{176} + OP$$

Where H = Hourly Rate
M = Monthly Rate
R1 = Rate Adjustment Factor
R2 = Regional Adjustment Factor
OP = Operating Costs

d. If Contractor-owned equipment is not available and equipment is rented from outside sources, the hourly rate will be established by dividing the actual invoice cost by the actual number of hours the equipment is involved in the work. The City reserves the right to limit the hourly rate to comparable Blue Book rates. When the invoice specifies that the rental rate does not include fuel, lubricants, repairs and servicing, the Rental Rate Blue Book hourly operating cost shall be added for each hour the equipment operates.

e. If a rate has not been established for a particular piece of equipment in the Rental Rate Blue Book, the Engineer will allow the Contractor a reasonable hourly rate, as agreed upon in writing before such work is begun. This price will include the cost of fuel, lubricants and repairs.

f. If the Contractor has to mobilize equipment from an off-project site, rates for the hauling equipment and personnel will be included as part of the force account work.

g. The established equipment hourly rates will be paid for each hour that the equipment is involved in the work to which will be added fifteen (15) percent as compensation. In the event that the equipment is used intermittently during the work, full payment for an eight-hour day will be made if the equipment is not idle more than four (4) hours of the day. If the equipment is idle more than four (4) hours in a day, then payment will be made only for the actual hours worked.

h. The compensation, as herein provided for, shall be received by the Contractor as payment in full for extra work completed on the “Force Account” basis and will include use of small tools, overhead expense and profit. The Contractor's representative and the Inspector shall compare records of extra work completed on the “Force Account” basis at the end of each day. Copies of these records will be made upon suitable forms provided for this purpose by the City and signed by both the City’s and the Contractor's representatives, one copy being forwarded to the Engineer and one to the Contractor. All claims for “Extra Work” performed on the “Force Account” basis shall be submitted to the Engineer by the Contractor upon statements to which shall be attached copies of invoices covering the cost of, and the freight charges on, all materials used in such work, and such statements shall be filed not later than the tenth day of the month following that month in which the work was actually performed.

i. When extra work is ordered to be performed on a “Force Account” basis, and the estimated cost is less than $5,000.00, payment of same may be made on the basis of a certified correct invoice submitted to the Engineer by the Contractor. The invoice shall include the Contractor's actual cost for materials, labor, equipment and incidentals necessary to complete the extra work. The invoice will also include additional compensation allowed above, in this Article, as well as the cost of the Contractor's bond on the extra work.

j. The prime Contractor will be paid for administrative cost only when extra work, ordered by the Engineer, is performed by a subcontractor or a collection of subcontractors. The payment for administrative cost will not exceed five (5) percent of the total subcontracted extra work.

9.6. Final Invoice. Contractor shall not be entitled to receive payment of any sum in excess of the cumulative amounts paid upon such monthly invoices as outlined above until forty-five (45) calendar days after Owner transmittal of the Letter of Conditional Approval and not before all the stipulations, requirements and provisions of this Contract are faithfully performed and complied with by Contractor, and unless and until said structures, Work and improvements shall be entirely completed, and delivered to, and accepted by the City in accordance with the Contract Documents. Completion, delivery and acceptance of the Work is evidenced by the Final Certificate of Acceptance issued by the Director of Public Works and such Certificate of Acceptance is approved by the City Manager. Simultaneous with the transmittal of the Final Certificate of Acceptance, the Director of Public Works shall prepare the final invoice as the basis for final Contract settlement, whereupon the same having been first approved by the signature of the City Manager and Director of Finance, the City shall pay to Contractor the amount of such final invoice, taking into account all amounts previously retained and deducted from monthly invoices and any remaining payables to Contractor. Owner may deduct from the amount of such final invoice and retain any and all sums which are to be deducted by City or paid or allowed by Contractor to City, or which are to be retained by Owner for reasons previously stated in Article 9.9.

9.7. Differing Construction Site Conditions. The Contractor shall promptly, and before such discovered conditions and/or structures are disturbed, notify the Director of Public Works in writing of (1) subsurface or latent physical and/or structural conditions at the site differing materially from those indicated in the Plans, Specifications, and other Contract Documents or (2) newly discovered, unknown physical conditions at the site of an unusual nature differing materially from those geophysical conditions typically encountered in the type Work being performed and generally being recognized as not indigenous to the Bexar County, Texas environs. The Director of Public Works or his designated representative shall promptly investigate the reported physical and/or structural conditions and shall determine whether or not the physical and/or structural conditions do materially so differ and thereby cause an increase or decrease in the Contractor's cost of, and/or the time required for performance of, any part of the Work under this Contract. In the event that the Director of Public Works reasonably determines that the physical and/or structural conditions do materially so differ, a negotiated, equitable adjustment shall be made to either the Contract Time or Contract Sum, or both, and a Contract Field Alteration shall be promptly issued in writing accordingly.

.1 No claim of the Contractor under this clause shall be allowed unless the Contractor has given the written notice called for above, prior to disturbing the discovered conditions and/or structures.

.2 No claim by the Contractor for an equitable adjustment hereunder shall be allowed if claimed by the Contractor after final payment has been made by the City under the terms of this Contract.

.3 No contract adjustment will be allowed under this clause for any effects caused on unchanged work.

9.8. Scope of Payment. The Contractor shall accept the compensation, as provided in the contract, as full payment for furnishing all materials, supplies, labor, tools and equipment necessary to complete the work under the contract; for any loss or damage which may arise from the nature of the work, or from the action of the elements, except as noted in Article 7.16, and as provided in Article 8.7 until the final acceptance by the Engineer, for any infringement of patent, trademark, or copyright; and for completing the work according to the plans and specifications. The payment of any current or partial estimate shall in no way affect the obligation of the Contractor at his expense to repair or renew any defective parts of the construction or to replace any defective materials used in the construction and to be responsible for all damages due to such defects if such defects or damages are discovered on or before the final inspection and acceptance of the work.

9.9. Withholding of Payment. In the event that the Owner discovers evidence of Contractor and/or Work noncompliance with the Contract Documents subsequent to approval of the Construction Estimate Certification Forms, the Owner may revoke or otherwise amend that part of any Construction Estimate Certification Form to such extent as may be necessary to withhold monies to protect the Owner from loss on account of:

a. Defective Work not remedied by Contractor.
b. Persistent and uncured Contractor non-compliance with the administrative provisions of the Contract Documents.
c. Damage to Work of another Contractor.

d. Liquidated Damages assessed by Owner for Contractor failure to maintain scheduled progress in accordance with interim progress milestones, if any are specified in the Contract Documents, and/or Contractor failure to meet final completion date.
e. Receipt of written notice by the Owner of Contractor's unpaid bills, as stipulated in Article 5472a, V.T.C.S., if the Contractor has not provided a payment bond and only if the Contract Sum does not exceed $25,000.00. Any funds so withheld by Owner shall be released to the Contractor if he furnishes either a special indemnity bond to Owner securing release of lien as provided in Article 5472b-1, V.T.C.S., or Contractor proof of payment of disputed bills.
f. "Responsibility for Damage Claims" as provided for in Article 7.12.

.1 When the above Contractor deficiencies are cured, payment will be made by Owner for amounts withheld because of the deficiencies within thirty (30) calendar days.

CITY OF SAN ANTONIO

PROJECT NUMBER: _____
COSA NUMBER: _____

DISADVANTAGED BUSINESS ENTERPRISE PERCENTAGE GOAL

The goal for Disadvantaged Business Enterprise (DBE) participation in the work to be performed under this construction contract is _____% of the contract amount.

CITY OF SAN ANTONIO

CONTRACTOR'S ASSURANCE

(Subcontracts- Federal Aid Projects)

By signing this proposal the contractor is giving assurances that all subcontract agreements of $10,000 or more on this project will incorporate the following provisions:

Special Provision	"Certification of Nondiscrimination in Employment"
Special Provision	"Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity" (Executive Order 11246)
Special Provision	"Standard Federal Equal Employment Opportunity Construction Contract Specifications" (Executive Order 11246)
Form FHWA 1273	"Required Contract Provisions Federal-aid Construction Contracts" (Form FHWA 1273 must also be physically attached to subcontracts and purchase orders of $10,000 or more)
Applicable	"Wage Determination Decision"

CITY OF SAN ANTONIO

Child Support Statement

Under Section 231.006, Family Code, the vendor or applicant certifies that the individual or business entity named in this contract, bid, or application is not ineligible to receive the specified grant, loan, or payment and acknowledges that this contract may be terminated and payment may be withheld if this certification is inaccurate.

CITY OF SAN ANTONIO

Statement on Convict Produced Materials & Convict Labor

Each bidder agrees to abide by the Federal Highway Administration's requirements 23 CFR § 635.120 and 23 CFR § 635.417. Below is a reprint of the requirements. Both items refer to hiring convict labor or buying convict-produced materials.

Sec. 635.117 Labor and employment.

(a) No construction work shall be performed by convict labor at the work site or within the limits of any Federal-aid highway construction project from the time of award of the contract or the start of work on force account until final acceptance of the work by the SHA unless it is labor performed by convicts who are on parole, supervised release, or probation.

(b) No procedures or requirement shall be imposed by any State which will operate to discriminate against the employment of labor from any other State, possession or territory of the United States, in the construction of a Federal-aid project.

(c) The selection of labor to be employed by the contractor on any Federal-aid project shall be by the contractor without regard to race, color, religion, sex, national origin, age, or handicap and in accordance with 23 CFR part 230, 41 CFR part 60 and Exec. Order No. 11246 (Sept. 24, 1965), 3 CFR 339 (1964-1965), as amended.

(d) Pursuant to 23 U.S.C. 140(d), it is permissible for SHA's to implement procedures or requirements which will extend preferential employment to Indians living on or near a reservation on eligible projects as defined in paragraph (e) of this section. Indian preference shall be applied without regard to tribal affiliation or place of enrollment. In no instance should a contractor be compelled to layoff or terminate a permanent core-crew employee to meet a preference goal.

(e) Projects eligible for Indian employment preference consideration are projects located on roads within or providing access to an Indian reservation or other Indian lands as defined under the term ``Indian Reservation Roads'' in 23 U.S.C. 101 and regulations issued thereunder.

The terminus of a road ``providing access to'' is that point at which it intersects with a road functionally classified as a collector or higher classification (outside the reservation boundary) in both urban and rural areas. In the case of an Interstate highway, the terminus is the first interchange outside the reservation.

(f) The advertisement or call for bids on any contract for the construction of a project located on the Federal-aid system either shall include the minimum wage rates determined by the Secretary of Labor to be prevailing on the same type of work on similar construction in the immediate locality or shall provide that such rates are set out in the bidding documents and shall further specify that such rates are a part of the contract covering the project.

Sec. 635.417 Convict produced materials.

(a) Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:

(1) Produced by convicts who are on parole, supervised release, or probation from a prison or

(2) (2) Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facility for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.

(b) Qualified prison facility means any prison facility in which convicts, during the 12-month period ending July 1, 1987, produced materials for use in Federal-aid highway construction projects.

THE CITY OF SAN ANTONIO
LOCAL AGENCY MANAGEMENT PROJECTS

W O R K I N G D A Y C O N T R A C T
(CALENDAR DAY SCHEDULE)
(Standard Form)

THIS AGREEMENT made the _____ day of _____in the year _____by and between _____,, hereinafter called the "Contractor", and the City of San Antonio, Texas, hereinafter called the "City or the "Owner".

WITNESSETH, that the Contractor and the Owner for the consideration hereinafter named agree as follows:

Article 1. Scope of the Work - The Contractor shall furnish all the materials and perform all the Work called for in the Contract Documents and more specifically described in the Plans and Specification for the Project entitled:

Prepared by _____, acting as, and in these Contract Documents entitled, the Project Design "Consultant".

Article 2. Commencement of Work - The Work called for in this Contract shall be commenced by Contractor within seven (7) calendar days after receipt by the Contractor of City-issued, written Authorization to Proceed. The Work to be performed under this Agreement is to be completed by Contractor in _____ **( ) Working Days**. For each Calendar Day that any Work shall not be completed after the expiration of the Calendar Days specified in the Contract (to include Calendar Days charged for correction of Contractor deficiencies found during the final inspection), pulse, any extended calendar days allowed by Owner, the amount of liquidated damages assessed per day as stipulated in the Contract and listed below will be deducted from the money owed or to become due the Contractor.

Amount of Contract	Liquidated Damages per Day
$1,000,001 or Over	$700.00
$ 750,001 to $1,000,000	$600.00
$ 500,001 to $ 750,000	$500.00
$ 250,001 to $ 500,000	$400.00
$ 100,001 to $ 250,000	$300.00
$ 50,001 to $ 100,000	$200.00
$ 1 to $ 50,000	$100.00

Article 3. The Contract Sum - The Owner shall pay the Contractor for the proper performance of the Contract, subject to additions and deduction provided therein, the Contract sum of:

Materials and Services: _____

_____Dollars, ($)

Article 4. Progress Payments - Each month, the Owner shall make a progress payment as approved by the Owner's Representative in accordance with Item 9 of the General Requirements and Covenants.

Article 5. Final Invoice - Final Payment shall be due on final Owner acceptance of the Project Work, provided the Contract has been completed by Contractor as provided in Item 9 of the General Requirements and Covenants.

Before issuance of the final payment, the Contractor shall submit an affidavit and reasonable additional supporting evidence if required, as satisfactory to the Director of Finance, City of San Antonio, that all labor payrolls, construction materials and supply bills, subcontractors, and other indebtedness connected with the Work have been paid in full, or that an outstanding debt is being disputed and that the corporate surety or its agent is processing the outstanding claim and is willing to defend and/or indemnify the City should the City make final Contract payment.

Article 6. Contract Documents - The Contract Documents consist of Bidding Documents such as: the Advertisement or Invitation to Bid, the Instructions to Bidders, the Contractor's completed Bid Proposal form, the Addenda; the Contract, the Conditions of the Contract (General, Supplemental and Special Conditions); the Plans, the Specifications, the Field Alterations, the Payment and Performance Bonds. The Contract Documents form the complete CONTRACT, which represents the entire and integrated agreement between the Owner and the Contractor and supersedes all prior negotiations, representations or agreements, either written or oral.

IN WITNESS WHEREOF, said City of San Antonio has lawfully caused these presents to be executed by the City Manager of said City, and the corporate seal of said City to be hereunto affixed and this instrument to be attested to by the City Clerk;

EXECUTED and SEAL APPLIED at San Antonio, Texas, on the day and year first written above.

CITY OF SAN ANTONIO

By:_____
City Manager

ATTEST:

_____
City Clerk

IN WITNESS WHEREOF, said Contractor affirms that Contractor has thoroughly read and understands this Agreement and the Contract Documents and the nature of this legal commitment and lawfully caused these presents to be executed by Contractor's legally authorized representative and does hereby deliver this legally binding instrument;

EXECUTED at San Antonio, Texas, on the day and year first written above.

(Seal if Agreement is with Corporation)

_____
Contractor

ATTEST: BY: _____

_____ _____
Secretary Title

STATE OF TEXAS }

COUNTY OF BEXAR }

This instrument was acknowledged before me on this the _____day of _____20____

by _____. _____ of _____a

_____ on behalf of said _____.

_____
NOTARY PUBLIC in and for the State of T E X A S

_____
NOTARY'S PRINTED SIGNATURE

_____
MY COMMISSION EXPIRES:

PERFORMANCE BOND

STATE OF TEXAS }
COUNTY OF BEXAR } Know all men by these presents:
CITY OF SAN ANTONIO }

1. That we _____, acting by and through _____, (Title)

as Principal, and

_____

as Sureties, do hereby acknowledge ourselves to be held and firmly bound unto the City of San Antonio, a municipal corporation of the County of Bexar and State of Texas in the sum of $_____ for payment of which sum well and truly to be made in and unto said City of San Antonio, we do hereby bind and obligate ourselves, our heirs, executors, administrators, assigns, and successors, jointly and severally:

2. THE CONDITIONS OF THIS BOND, HOWEVER, ARE SUCH THAT WHEREAS, the said

hereinafter called Contractor or Principal, has made and does this day make and enter into a certain contract in writing with said City of San Antonio, for the construction and completion for said City of certain structures, work and improvements generally described as

and for the performance and observance of diverse other matters and things in connection with said work; all as more fully described in said contract and its included instruments which are expressly made a part of this obligation.

3. NOW THEREFORE, if Contractor, the principal party to this obligation shall faithfully construct and complete said structures, work and improvements, and shall observe, perform and comply with all the terms, conditions, stipulations, undertakings and provisions of said contract and all included instruments, according to their intent and purpose insofar as the same relate to or are incident to the construction and completion of said structures, work and improvements then and thereupon this obligation shall be and become null and void, but otherwise to remain in full force and effect; and it is hereby further understood and agreed that this bond shall be a continuous obligation against the principal and each member of said principal party hereto, and each and all sureties hereon, and that successive recoveries may be had hereon for each and every breach of this bond until the full amount thereof shall have been exhausted; and the liability of the sureties on this bond shall not be in any manner released or diminished by any changes in the work which may be authorized or directed by the City, nor by the exercise or failure to exercise by or on behalf of the City any right or remedy provided by the contract or specifications or by any law or ordinance.

4. IN TESTIMONY WHEREOF, witness our hands and the seal of any incorporated surety hereon this

_____ day of _____ A.D. 20 _____.

5. The foregoing bond is approved and accepted

this _____ day of_____,

2005.

By: _____
(Title)

_____
City Manager

_____
Surety

(SEAL)

By:_____

_____
Address of Surety for Service Purposes

PAYMENT BOND

STATE OF TEXAS }
COUNTY OF BEXAR } Know all men by these presents:
CITY OF SAN ANTONIO }

1. That we **_____, acting by and through_____, (Title),**

as Principal, and _____

as Sureties, do hereby acknowledge ourselves to be held and firmly bound unto the City of San Antonio, a municipal corporation of the County of Bexar and State of Texas in the sum of **$_____** for payment of which sum well and truly to be made in and unto said City of San Antonio, we do hereby bind and obligate ourselves, our heirs, executors, administrators, assigns, and successors, jointly and severally:

2. THE CONDITIONS OF THIS BOND, HOWEVER, ARE SUCH THAT WHEREAS, the said

hereinafter called Contractor or Principal, has made and does this day make and enter into a certain contract in writing with said City of San Antonio, for the construction and completion for said City of certain structures, work and improvements generally described as

and for the performance and observance of diverse other matters and things in connection with said work, and, interalia, therein entered into covenants and agreements to promptly pay all persons supplying labor, materials and services in the prosecution of the work provided for in said contract; all as more fully described in said contract and its included instruments which are expressly made a part of this obligation;

3. NOW THEREFORE, if Contractor, the Principal party to this obligation shall promptly make payment to all persons supplying labor and materials in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation shall be and become null and void, but otherwise to remain in full force and effect: and it is hereby further understood and agreed that this bond shall be a continuous obligation against the principal and each member of said principal party hereto, and each and all sureties hereon, and that successive recoveries may be had thereon for each and every breach of this bond until the full amount thereof shall have been exhausted; and the liability of the sureties on this bond shall not be in any manner released or diminished by any changes in the work which may be authorized or directed by the City, nor by the exercise or failure to exercise by or on behalf of the City any right or remedy provided by the contract or specifications or by any law or ordinances.

4. It is further understood that this obligation is incurred pursuant to Chapter 2253 of the Texas Government Code, and that this obligation is for the benefit and sole protection of all persons supplying labor and materials in the prosecution of said contract.

5. IN TESTIMONY WHEREOF, witness our hands and the seal of any incorporated surety hereon this ____day of _____ _____ A.D. 200__.

6. The foregoing bond is approved and accepted this _____ day of _____, 20 _____

By: _____
(Title)

_____
City Manager

_____
Surety

By: _____

(SEAL)

_____
Address of Surety for Service Purposes

10/01

PWDBE Form 4901
Rev. 8/2004

City of San Antonio
Disadvantaged Business Enterprise (DBE) Program
Commitment Agreement Form

This commitment is subject to the award and receipt of a signed contract from the City of San Antonio for the subject project.

Project #:	**County:**	**Contract-CSJ:**

Items of work to be performed***** (attach a list of work items if more room is required):
***All hauling quantities and units of measure should match the bid tab item whenever possible. If listing items by hours, or by lump sum amounts, please provide calculations to substantiate the quantities listed.**

Bid Item #	Item Description	Unit of Measure	Unit Price	Quantity	Total Per Item

Total Commitment Amount (including attachments):	$

If the DBE is a material supplier on this project, the following information is required:

1. Is the material to be supplied to be modified, blended, quarried, or fabricated by the DBE? **If Yes, Please explain in detail.**	1.
If you answered Yes to Question 1 above, you do not need to answer questions 2 - 5.	
2. Where, and from whom, is the DBE material supplier getting the materials?	2.
3. Where does the DBE material supplier store or warehouse the material before it is delivered to the project site?	3.
4. Whose equipment will be used to deliver the DBE's material to the project site? **Explain in detail** any arrangements the DBE has with other distributors, hauling firms, and freight companies.	4.
5. Is the DBE going to be paid with a joint check for materials supplied? If yes, **explain in detail.**	5.

IMPORTANT! The signatures of the prime contractor and the DBE, and the total commitment amount must always be on the same page.

Prime Contractor:	Name/Title (please print):
Address:	Signature:
Phone:	Date:
DBE:	Name/Title (please print):
Vendor No.:	
Address:	Signature:
Phone:	Date:
Subcontractor, if the DBE will be a second tier sub. Subcontractor:	Name/Title (please print):
Address:	Signature:
Phone:	Date:

The City of San Antonio maintains the information collected through this form. With few exceptions, you are entitled on request, to be informed about the information that is collected about you. Under Sections 552.021 and 552.023 of the Texas Government Code, you also are entitled to receive and review the information. Under Section 559.004 of the Government Code, you are also entitled to have us correct information about you that is incorrect. To insure prompt and efficient handling of your project file we are requesting that all commitments be presented to the Public Works Department, Fiscal Planning Management Division, DBE Liaison Officer using this basic format.

PWDBE Form 4903
(Rev. 4/2004)

City of San Antonio
DBE Monthly Progress Report

Project: _____ Contract CSJ: _____

County: _____ District: _____

Letting Date: _____ For Month of: (Mo./Yr.): _____

Contractor: _____ Contract Amount: _____

DBE Goal: _____ % DBE Goal Dollars _____

Vendor Number	Name of DBE or Sub/Supplier	* D	Type of Work	** DBE $ Amt Paid for Work Performed this Period	*** $ Amt Paid to Non-DBE 2nd Tier Subs and Haulers	Amt Paid to DBE to Date

* All payments to DBEs are required to be reported (D=DBE)

** Goal/commitment progress report amount and/or race-neutral amount. Do not subtract non-DBE second-tier subcontractors and haulers from this column.

*** Report amount of payment DBE subcontractors paid to non-DBE subcontractors/haulers.

If using a non-DBE hauling firm that leases from DBE truck owner-operators, payments made to each owner-operator must be reported separately.

Any changes to the DBE commitments approved by the department must be reported to the area engineer.

Submission of this report for periods of negative DBE activity is required. This report is required until all DBE subcontracting or material supply activity is completed.

I hereby certify that the above is a true and correct statement of the amounts paid to the DBE firms listed above.

Signature: _____ Date: _____

Company Official

This report must be sent to the DBE Liaison's office within 15 days following the end of the calendar month.

The City of San Antonio maintains the information collected through this form. With few exceptions, you are entitled on request, to be informed about the information that is collected about you. Under Sections 552.021 and 552.023 of the Texas Government Code, you also are entitled to receive and review the information. Under Section 559.004 of the Government Code, you are also entitled to have us correct information about you that is incorrect.

City of San Antonio
DBE Final Report

The DBE final report form should be filled out by the contractor and submitted to the DBE Liaison's office upon completion of the project. One copy of the report must be submitted to the Project Manager's office. The report should reflect all DBE activity on the project. The report will aid in expediting the final estimate for payment. If the DBE goal requirements were not met, documentation supporting good faith efforts must be submitted.

Project: _____ Contract CSJ: _____

County: _____ Control Project: _____

Letting Date: _____ DBE Goal: _____ %

Contractor: _____ Contract Amount: _____

Vendor number	Name of DBE Sub/Supplier	* D	** DBE goal – total $ amt pd to date	*** $ amt pd to non-DBE 2nd tier subs & haulers

* All payments to DBEs are required to be reported (D=DBE)

** Goal/commitment progress report amount and/or race-neutral amount. Do not subtract non-DBE second-tier subcontractors and haulers from this column.

*** DBE subcontractors paid to non-DBE subcontractors/haulers.

This is to certify that _____% of the work was completed by Disadvantaged Business Enterprises and/or Historically Underutilized Businesses as stated above.

By _____ Per: _____
Name of General Contractor Contractor's Signature

Subscribed and sworn to before me, this _____ day of _____, A.D. _____.

Notary Public _____ County

My commission expires: _____.

The City of San Antonio maintains the information collected through this form. With few exceptions, you are entitled on request, to be informed about the information that is collected about you. Under Sections 552.021 and 552.023 of the Texas Government Code, you also are entitled to receive and review the information. Under Section 559.004 of the Government Code, you are also entitled to have us correct information about you that is incorrect.

The City of San Antonio
DBE Prime Contractor Payments to Non-DBE Subcontractors

PWDBE Form 4902
(Rev. 4/2004)

Project: _____ Contract CSJ: _____

County: _____ District: _____

Letting Date: _____ For Month of: (Mo./Yr.): _____

Contractor: _____ Contract Amount: _____

Name of Non-DBE Subcontractor	$ Amount Paid This Period	Total $ Amount Paid to Date

Send this report to the DBE Liaison Officer. Report is due within 15 days following the end of each calendar month.

Signature: _____ Date: _____
Company Official

The City of San Antonio maintains the information collected through this form. With few exceptions, you are entitled on request, to be informed about the information that is collected about you. Under Sections 552.021 and 552.023 of the Texas Government Code, you also are entitled to receive and review the information. Under Section 559.004 of the Government Code, you are also entitled to have us correct information about you that is incorrect.

ENGINEER SEAL

Control **0915-12-470, etc.**

Project

Highway **CS (Harry Wurzbach)**

County **BEXAR**

The enclosed Texas Department of Transportation Specifications, Special Specifications, Special Provisions, General Notes and Specification Data in this document have been selected by me, or under my responsible supervision as being applicable to this project. Alterations of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.

The seal appearing on this document was authorized by ROLANDO ESCAMILLA, P.E. June 7, 2010

**********GENERAL NOTES**********
2004 Specification Book (Revised January 5, 2011)

========== Basis of Estimate ==========

- The Following Is For Information Only - Non Pay-

Item	Description	Rate/Area	Quant-Unit
204	Sprink (Emb)	60 Gal/SY Rate	
213	Roll (Surf)	1 Hr/3000 SY/Crse Rate	

========== Asphalt Concrete Pavement ==========

Type	Location	Depth	Rate/Area	Quant-Tons
HMAC TY B PG 64-22	Main Rdwy	9 in.	1320 lbs/40447 sy	26695
HMAC TY C PG 64-22	Main Rdwy	2 in	220 lbs/53,984 sy	5,938

========== Surface Treatment Data ==========

Description	1st Course	2nd Course
Area	53,984 sy	N/A

-----See Bid Item-----

Asphalt—Type	AC-5 or 10, CRS/HFRS-2, RS/CRS-1P	N/A
Asphalt—Rate (gal/sy)	0.3/1 = 16,195 gal	N/A
Aggregate—Type /Gr	PE Grade 4	N/A
Aggregate—Rate (cy/sy)	1/100 = 940 cy	N/A

The following State, District, Local and/or Utility Standards have been modified: N/A

Steel Wrapped or Asbestos Utility Lines:

Existing steel wrapped natural gas and/or asbestos cement (AC) water lines that will no longer be in service are usually abandoned in place (AIP). However, if any of these lines have to be removed for whatever reason (in the way of other construction, to make tie-ins, etc.) comply with all federal, state and local laws, ordinances and regulations regarding the management of these materials. At a minimum:

1. Contact the Engineer.

2. Remove the minimum amount of pipe needed to perform the proposed work.

3. Cover and secure the ends of the pipe with a double layer of 6 mil plastic. If the pipe is damaged, cover the entire pipe.

4. Move the pipe to an approved temporary site within the project.

5. The Engineer will determine the owner (utility company) of the pipe and will coordinate removal from the project. The contractor will load the pipe onto the removal vehicles but will NOT be responsible for removing the pipe from the project.

6. Removal of the pipe from the trench is subsidiary to the work that created the need for the removal (excavation for structures, roadway, a new line, tie-ins, etc.). The work performed in handling the pipe after it has been removed from the trench (covering with plastic, hauling to the temporary site and later loading on to the disposal vehicles will be paid for through the Force Account procedure.

Contact the Engineer or the City when construction operations are within 400 feet of a signalized intersection to determine/verify the location of loop detectors, conduit, ground-boxes, etc. Repair or replace any signal equipment damaged by construction operations. The method of repair or replacement shall be pre-approved and inspected. Depending on the type and extent of the damage, the Engineer reserves the right to perform the repair or replacement work and the Contractor will be billed for this work.

Remove existing raised pavement markings as the work progresses or as approved. This work is subsidiary to the various bid items. Properly dispose materials removed.

To better fit field conditions, the cross sections may be varied when approved.

If there are waste areas or material source areas, follow the Texas Aggregate Quarry and Pit Safety Act requirements.

Any materials removed and not reused and determined to be salvageable shall be stored within the project limits at an approved location or delivered undamaged to the storage yard as directed. Properly dispose unsalvageable materials in accordance with local, state, and federal regulations. Deface traffic signs so that they will not reappear in public as signs.

Any sign panels that are adjusted or removed and replaced, shall be done the same workday unless otherwise approved.

Notify the Engineer at least two weeks prior to a proposed traffic pattern change(s) that will require a revision to traffic signals.

Hurricane Evacuation

Hurricane Season is from June 1 thru November 30. As the closest metropolitan city inland from the Texas Coast, the City of San Antonio is a major shelter destination during mandatory hurricane evacuations. As such, planned work zone lane or road closures may be restricted and/or suspended during mandatory hurricane evacuation operations. The District will coordinate these restrictions at a minimum H-120 from any projected impact to the Texas Coast.

No time charges will be made if the Engineer determines that work on the project was impacted by the hurricane.

The Engineer may order changes in the Traffic Control Plan to accommodate evacuation traffic, and may suspend the work, all or in part, to ensure timely completion of this work. All work to implement changes in the Traffic Control Plan will be paid through existing bid prices or through Item 9.5, Force Account. However, the Department will not entertain any request for delay damages, loss of efficiency that may be attributed to the restriction or suspension of road or lane closures, or to changes in the Traffic Control Plan.

--Item 5--
Reference all existing striping and other pavement markings to allow these markings to be re-established. Ensure the markings (lane lines, edge lines, ramp gores, etc.) are in line with signs, TMS arrows, etc. located on overhead sign supports.

Taper ACP placed at curb inlets, traffic inlets and slotted drains.

Prior to letting, bidders may obtain a free computer diskette or a computerized transfer of files (from the Engineer's office) that contains the earthwork information. If copies of the cross-sections in addition to, or instead of, the CD are requested, they will be available at the Engineer's office for borrowing by copying companies at the bidder's expense.

When working near aerial electrical lines or utility poles, comply with Federal, State and local regulations. For electrical lines and poles shown in the plans, if the lines need to be de-energized or if poles need to be braced, contact the electrical company. Work pertaining to de-energizing lines, bracing poles and other protective measures will not be paid by City.

Considering location of existing overhead lines for construction and design purposes. Sleeving of overhead primary lines will be a cost to the contractor. The shielding/sleeving of lines is for reference, not for protection from electrical shock.

The General contractor accepts full responsibility to protect the integrity of CPS Energy poles, Overhead Primary and all associated facilities of the CPS Energy electric system, when working around CPS Energy Overhead facilities during the duration of the Civic Improvement project.

Prevention of Migratory Bird Nesting

It is anticipated that migratory birds, a protected group of species, may try to nest on bridges, culverts, vegetation, or gravel substrate, at any time of the year. The preferred nesting season for migratory birds is from February 15 through October 1. When practicable, schedule construction operations outside of the preferred nesting season. Otherwise, nests containing migratory birds must be avoided and no work will be performed in the nesting areas until the young birds have fledged.

Structures

Bridge and culvert construction operations can not begin until swallow nesting prevention is implemented, until after October 1 if it’s determined that swallow nesting is actively occurring, or until it’s determined swallow nests have been abandoned. If the State installed nesting deterrent on the bridges and culverts, maintain the existing nesting deterrent to prevent swallow nesting until October 1 or completion of the bridge and culvert work, whichever occurs earlier. If new nests are built and occupied after the beginning of the work, do not perform work that

can interfere with or discourage swallows from returning to their nests. Prevention of swallow nesting can be performed by one of the following methods:

1. By February 15 begin the removal of any existing mud nests and all other mud placed by swallows for the construction of nests on any portion of the bridge and culverts. The Engineer will inspect the bridges and culverts for nest building activity. If swallows begin nest building, scrape or wash down all nest sites. Perform these activities daily unless the Engineer determines the need to do this work more frequently. Remove nests and mud through October 1 or until bridge and culvert construction operations are completed.

2. By February 15 place a nesting deterrent (which prevents access to the bridge and culvert by swallows) on the entire bridge (except deck and railing) and culverts.

No extension of time or compensation payment will be granted for a delay or suspension of work caused by nesting swallows. This work is subsidiary to the various bid items.

Provide a non-intrusive back-up alarm system on all heavy equipment used in close proximity to if residential areas. This item is subsidiary to various bid items.

--Item 6--
Show the stockpile lot and/or sub lot numbers on all tickets for all materials.

--Item 7--
The project's total disturbed area is 14.22 AC (68,865 SY). The disturbed area in all project locations and Contractor project specific locations (PSL's), within 1/4 mile of the project limits, will further establish the authorization requirements for storm water discharges. The department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities shown on the plans. Obtain any required authorization from the TCEQ for any PSL's on or off the ROW. When the total area disturbed on the project and PSL's within 1/4 mile of the project exceeds 5 acres, provide a copy of the Contractor NOI for PSL's to the Engineer (to the appropriate MS4 operator when the project is on an off-state system route).

Notify the Engineer of the disturbed acreage within one (1) mile of the project limits. Obtain authorization from the TCEQ for Contractor PSL's for construction support activities on or off ROW.

--Item 8--
Working days will be computed and charged in accordance with Article 8.3.A. Five (5)-Day work week.

Locate and reference with station and offset all manholes and valves within the construction area. Each manhole and valve shall be identified by its owner (SAWS, CPS, etc.). No roadwork will begin until this list has been submitted. Gas valves have to be accessible at all times, therefore; temp. CTB, material stock piles, etc. can not be placed over these valves.

Construct all manholes and valves to final pavement elevations prior to the final mat of ACP. If, between the final elevation adjustment and the final mat of ACP, the manholes and valves are going to be exposed to traffic, place temporary asphalt around the manhole and valve to provide a +/- 50:1 taper. The cost of elevation adjustment will be part of the manhole and valve work, and asphalt tapers are part of the ACP work.

--Item 9--
When approved, provide uniformed, off-duty law enforcement officers with marked vehicles during work that requires a lane closure. The officer in marked vehicles shall be located as approved to monitor or direct traffic during the closure. The method used to direct traffic at signalized intersections shall be as approved. Additional officers and vehicles may be provided when approved or directed.

Complete the daily tracking form provided by the department and submit invoices that agree with the tracking form for payment at the end of each month approved services were provided.

Minimums, scheduling fees, etc. will not be paid; City will consider paying cancellation fees on a case by case basis.

--Item 100--
Begin clearing operations after trees and other areas of vegetation to be protected have been identified and approved. Install fencing around features to be protected as shown in the plans or directed. Coordinate all right of way clearing operations with the SW3P.

Trim and remove brush and trees as needed for construction operations. Obtain approval for proposed method of tree and brush trimming and removal. Vertical flailing equipment is not allowed. Treat damaged or cut branches, roots and/or stumps of all oak trees with a commercial tree wound dressing. Disinfect all pruning tools with a solution of 70% alcohol before moving from one tree to another. Unless otherwise approved remove all resulting vegetative debris from the ROW within 24 hours. The Engineer can stop all construction operations if the dressing, cut and removal requirements are not followed.

Remove and reset existing steel pipe railing at sta. 77+00.00 LT to complete proposed construction. This work is subsidiary

--Item 110--
Where excavation extends beyond a right of way fence, remove and replace the fence to a comparable condition.

--Item 160--
Approximately 264 CY of existing topsoil may be windrowed or stockpiled (as approved) for later use under this Item. Place erosion control measures for the stockpile and/or windrow.

--Item 162--
Furnish and place Bermuda grass sod.

In drought conditions do not place sod as vegetation unless directed by the Engineer.

--Item 166--
Use a fertilizer with an analysis of 13-13-13 (50% of the total N must be sulfur coated urea) to apply 60 lbs of actual N per acre. This requires 460 lbs of 13-13-13 per acre or .095 lbs per SY of area.

--Item 168--
Apply vegetative watering as needed to supplement natural rainfall during the vegetation establishment period. Plan quantity of irrigation water is based on the application of a total of

1.3 gal of water each week for each sq. yd. of area that is sodded or seeded. Establishment time is estimated to be 12 weeks for both sod and permanent seed mixes. Temporary seeding will require less time for establishment. Provide a schedule and coordinate watering cycles and rates per cycle with the Engineer. Obtain approval if the quantity of water to be applied is expected to exceed the plan quantity. Adjust the amount of water applied with each cycle and the number of cycles each wk. according to actual site conditions. Drought or other conditions, as determined by the Engineer, may require the application of supplemental irrigation during hours other than normal working hours.

--Item 169--
Do not use soil retention blankets made from carpet backing material.

--Item 247--
There is no minimum PI requirement for this project.

--Item 260 & 263--
Lime trucks may be randomly selected to be re-weighed at public scales. If the weight of the trucks varies by more than 2%, payment will be as determined by the public scales.

--Item 300--

The asphalt binder used in the manufacture of all types of hot mix asphalt concrete, shall be PG 64-22.

--Item 302--
Previously tested aggregates found to contain excessive quantities of dust (more than 0.5 percent passing the No. 40 sieve) during precoating, stockpiling or hauling operations, may be rejected. Use Test Method Tex-200-F, Part I for testing.

Precoated Aggregate Type PE shall consist of crushed slag, crushed stone or natural limestone rock asphalt.

The Engineer will utilize the Ignition Oven Method (Tex 236-F) for aggregate gradation, with the option of utilizing belt or vacuum extraction gradation in the event the ignition oven malfunctions.

--Item 305--
All reclaimable asphalt pavement (RAP) material will be retained by the Contractor.

--Item 314--
Use emulsified asphalt in the final flexible base finishing process. The amount used shall be as approved, but not less than 2 percent of the total mixture.

--Item 316--
When using latex asphalt, avoid drifting of asphalt onto traffic and adjacent properties.

Asphalt season will be year around, but meet sections 316.4.D.1 through 3.
Ensure that the asphalt for precoating the aggregate and the asphalt used for the surface treatment will not result in a reaction that may adversely affect the bonding of the aggregate and asphalt during the surface treatment operation.

Do not add bag house fines in the production of precoated material.

Clean all concrete curbs, islands, medians, etc. that get coated with asphalt.

--Item 320--
Construct all longitudinal ACP joints adjacent to a travel lane with a joint maker device that will create a 3:1 to 6:1 taper. For placement of 2 inches or more, the device shall provide a maximum ½
inch vertical edge. Taper outside edges (next to the grass) or backfill (shoulder-up) the same day.

Provide a material transfer device capable of providing a continuous flow of material to the paver. The material transfer device will consist of a windrow elevator or better.

--Item 330--
The asphalt plant shall have truck scales as defined in Item 520. Give three weight tickets bearing the date, the truck number, and the gross, net & tare weights to the truck driver, for the State inspector at the spreading and finishing operation. Trucks may be required to weigh on public scales or portable platform scales to verify the weight of the ticket.

Use trap rock or crushed slag as the special aggregate for LRA.

If LRA is stockpiled where it might get contaminated with foreign materials, the bottom of the stockpile can not be used. A set of standard truck scales will be used to determine the quantity of contaminated material that will be deducted. Unless approved, do not stockpile LRA more than 10 days prior to lay-down operations.

The fluxing material shall be either an emulsified combination of asphalt and softening agent added individually (the softening agent may also be an emulsion), or a material meeting the requirements of Item “Asphalt’s, Oils and Emulsions”. The material(s) selected shall be approved.

--Item 340, 341 Or 344--
Table 6, in Item 340, Table 8 in Item 341 and Table 8 in Item 344, Hamburg Wheel Test Requirements tested in accordance with Tex-242-F are changed for PG 64-22 or lower and PG 70-22. Minimum number of passes at 1/2” Rut Depth, Tested at 122 degrees F will be 5,000 and 10,000 respectively.

Design all mixture types using a target laboratory-molded density of 96.5%.

The asphalt plant shall have truck scales as defined in Item 520. Give three weight tickets bearing the date, the truck number, the gross, net & tare weights to the truck driver for the State inspector at the spreading and finishing operation. Trucks may be required to weigh on public scales or portable platform scales to verify the weight of the ticket.

Submit a copy of the Tex 233-F production charts on a weekly basis. At the end of the ACP work, provide all originals.

Crushing of aggregate for hot mix and immediate use for production of the mix is not allowed. Stockpile the aggregate until enough material is available for five days of production unless prior approval is provided. Hold a pre-placement meeting one month prior to the placement of the hot mix.

The main purpose of hot mix cores taken by the State are for payment calculations. If (for quality control purposes) the core information is needed sooner, take additional cores.

. Do not use diesel or solvents as asphalt release agents in production, transportation, or construction. A list of approved asphalt release agents is available from the District Laboratory.

No more than one hot mix lot will be open for any specific type of hot mix, unless authorized. After a lot is open and the Contractor gets approval to change plants, the previous lot will be closed and a new lot will be opened. The numbering for the lots produced at the new plant will start with No. 1. If allowed to switch back to the original or previous plant, the next lot from that plant will resume numbering sequentially from the last lot produced by that plant.

Schedule lay-down placement where uneven travel lanes are minimized and eliminated weekly.

If asphalt material is obtained from other than a commercial source presently inspected by City, furnish a Type D structure for the asphalt mix control laboratory for the Engineer's use. Provide a minimum height of 8 feet and a minimum of 400 square feet of gross floor area for permanently located asphalt plants or 200 square feet for a temporary plant. The floor area will be partitioned into a minimum of two rooms, with a minimum of two windows per room. The floor shall have an impervious cover and sufficient strength to support the testing equipment. Portable structures shall be support blocked for stability and shall be tied down.

Minimum Roadway Placement Temperature
--Item 340, 342, 344, 346, 3127 & 3142--
Place mixture when the roadway surface temperature is equal to or higher than listed in Table 1 unless otherwise approved or shown on the plans. Measure the roadway surface temperature with a handheld infrared thermometer. Placement may be allowed to begin prior to the roadway surface reaching the required temperature if conditions are such that the roadway surface will reach the required temperature within 2 hrs. of beginning placement operations. Place mixtures only when weather and moisture conditions of the roadway surface are suitable in the opinion of the Engineer.

Table 1
Minimum Pavement Surface Temperatures

		Minimum Pavement Surface Temperatures in Degrees Fahrenheit *	
Specification Item Number	High Temperature Binder Grade	Subsurface Layers or Night Paving Operations	Surface Layers Placed in Daylight Operations
Items 340 & 344	PG 64	45	50
	PG 70	55	60

	PG 76	60	60
Items 342 and 346 SS 3127 & SS 3142	PG 76	65	70
	Asphalt Rubber (A-R)	65	70

* Except for PG 64, may pave at temperatures 10º F lower than the values shown in Table 1when utilizing a paving process or equipment that eliminates thermal segregation. In these cases, use either an infrared bar attached to the paver, or a hand held thermal camera, or a hand held infrared hermometer operated in accordance with Text Method 244-F to demonstrate that the uncompacted mat has no more than 10º F of thermal segregation.

--Item 354--

Retain planed material.

--Item 401--
A shrinkage compensator is not required for when used for backfilling pipes. Strength of the Flowable Backfill will be verified by the District Laboratory. Field testing is not required, unless deemed necessary.

--Item 420--
Mass concrete will be measured in place.

--Item 421--

Poly-fiber reinforced concrete may be used as an option, with the approval by the Engineer, for riprap, sidewalk, curb/gutter, and mow strip. Use a City approved manufacturer or producer for the poly-fiber. The poly-fibers shall be combined with the concrete in proportions as recommended by the manufacturer. A concrete mix design must be approved by the Engineer.

--Item 432--
In all riprap slopes, provide 3 inch diameter weep holes at 10 foot maximum spacing and backed with loose graded gravel or crushed stone and galvanized hardware cloth.

Match the slope of the Riprap (Mow Strip) to the slope of the adjacent roadway.

--Item 462--
Use concrete aggregate with two sacks of Portland cement per cubic yard for fill between pre-cast boxes.

The following structures shall be pre-cast:
All Structures are considered to be cast in place unless otherwise approved by engineer.

--Item 465--
Concrete Class B invert shaping is required at all inlets, manholes and junction boxes in order to insure positive flow. The material and work performed for the placement of the inverts shall be considered subsidiary to this item.

Provide for the safety and health of employees and abide by all OSHA Standards and Regulations. All costs incurred for proper management, shall be subsidiary to this Item.

--Item 500--
"Materials on Hand" payments will not be considered in determining percentages for mobilization payments.

--Item 502--
Place standard markings no later than 14 days after surface treatment operations are completed.

When advanced warning flashing arrow panels and/or changeable message sign is specified, have one standby unit in good condition at the job site.

Treat the pavement drop-offs as shown in the TCP.

After written notification, the time frame to provide properly maintained signs and barricades before considered in non-compliance is 48 hours from receipt of the notification.

There are traffic signals at the intersection of Burr Rd./Harry Wurzbach, Winans Dr./Harry Wurzbach, and Rittiman Rd./Harry Wurzbach. Keep the signals in operation except when necessary for specific installation operations.

Moving an existing sign to a temporary location is subsidiary to this Item. Installations with permanent supports at permanent locations will be paid for under the applicable bid item (s).

Mount temporary mailboxes on plastic drum in accordance with Compliant Work Zone Traffic Control Devices, Section K. Mounting and moving the mailbox as needed for the various construction phases is subsidiary to this Item.

Notify the Engineer 5 business days in advance of any temporary or permanent lane, ramp, etc. closures/detours, restrictions to lane widths, alterations to vertical clearances, or modifications to radii. Any other modifications to the roadway that may adversely affect the mobility of oversized/overweight trucks also require 5 business days advance notice to the Engineer. Unless shown in the TCP, no lane, ramp, etc. closures are allowed during special events. At least one lane has to remain open at all times. For all lane closures, provide written closure information by 1:00PM on the business day prior to the closure. For closures on a Monday or following a Holiday, furnish the information the workday prior to the closure. Lane closures will not be allowed if this reporting requirement is not met.

For closures not listed in the TCP; the lane closures are limited to Weekend hours between 10 PM Friday through 5 AM Monday and at least one lane has to remain open at all times.

Avoid placing stockpiles within the roadway’s horizontal clear zone. If a stockpile is placed within the clear zone, address in accordance with the TMUTCD.

Do not place barricades, signs, or any other traffic control devices where they interfere with sight distance at driveways or side streets.

In addition to providing a Contractor's Responsible Person and a phone number for emergency contact, have an employee available to respond on the project for emergencies and for taking

corrective measures within 2 hours or within a reasonable time frame as specified by the Engineer.

--Item 529--
Class "C" concrete is required for machine extruded curb.

Curb inlets and extensions are based on an exposed curb height of 7 inches. The roadway curb height and shape will be transitioned to the inlet's curb with a 40: 1 taper.

--Item 531--

The curb ramp locations shown in the plans have taken into account the geometric features of the intersection, traffic signals, and the pavement markings. If anything changes during construction, the location of curb ramps must be adjusted to ensure they meet TAS requirements.

The contractor shall stop all construction related activities to prevent noise from interfering with funeral services at the fort Sam Houston cemetery as determined by the engineer. Adequate vehicular access to the cemetery facility especially during funeral processions will be provided at all times. Contractor shall coordinate with ft Sam Houston cemetery representatives throughout the construction phasing.

--Item 585--
Ride quality requirements are waived.

--Item 618--
It might be necessary to cut concrete for placement of conduit. Saw cut existing concrete, remove the concrete from the steel reinforcement (bars or fabric) and bend the steel to install the conduit. After the conduit has been placed, bend the steel back to its original position and back-fill the trench with an approved concrete. This work is subsidiary to this Item.

The conduit depth for illumination under the City of San Antonio streets is 36 inches.

Do not use cast iron junction boxes in single slope traffic barriers.

Use materials from Material Producers list as shown on the Construction Division's (CST) web site. Category is "Roadway Illumination and Electrical Supplies."

The polymer concrete barrier box will not be paid for separately, but will be considered subsidiary to ITEM 618, "CONDUIT".

--Item 624--
Legibly imprint the ground box cover with the words "Danger High Voltage" as required by the "Electrical Details" State Standard Sheet(s). In addition, imprint "Traffic Signal", "TMS", "Illumination", or whatever other system will be housed in the ground box. The ground box locations shown on the plans are approximate and can be adjusted to better fit field conditions when approved.

--**Item 628--**

Make all arrangements for electrical service, and compliance with local standards and practices for proper installations.

--Item 644--
The wedge anchor system shown on State Standard Sheet SMD (TWT) are not allowed.

--Item 647--
Note: Contractor to provide engineering drawings and calculations for design of large sign and foundation relocation. Complete cost including labor, materials, equipment and professional engineering drawings (signed and sealed by professional engineer) will be included in the cost of this item. Refer to Signing and Pavement Marking Sheet 215 for location of existing signs**.** The Engineer shall provide the new location of the sign.

--Item 658--
CTB reflectors will not be paid for directly but will be considered subsidiary to the barrier.

--Item 666 & 8251--
If TY II material is used (vs. an acrylic or epoxy) as the sealer for the TY I markings, place the TY II a minimum of 14 calendar days (to provide adequate curing) before placing the TY I markings.

--Item 672--
Place all adhesive material directly from the heated dispenser to the pavement. Do not use portable or non-heated containers. Use adhesive of sufficient thickness so that when the marker is pressed into the adhesive, 1/8" or more adhesive will remain under 100% of the marker. The adhesive should extend not less than 1/2" but not more than 1 1/2" beyond the perimeter of the marker.

--Item 677--
Obtain approval before using the mechanical method for the elimination of existing thermoplastic pavement markings.

--Item 680--
Furnish and install all required materials and equipment necessary for the complete and operating traffic signal installation at the following intersections:
Burr Rd./Harry Wurzbach, Winans Dr./Harry Wurzbach, and Rittiman Rd./Harry Wurzbach.

The locations shown on the plans for signal pole foundations, controller foundations, conduit and other items may be adjusted to better fit field conditions as approved.

Provide lamps form the pre-qualified Materials Producers List- Roadway Illumination and Electrical Supplies located at TxDOT website-Business with TxDOT-Materials Information.

Demonstrate that the field wiring is properly installed, install the controller assembly, connect the wiring and turn on the controller.

--Item 682--
Provide all signal heads from the same manufacturer. Pedestrian signals may be by a different manufacturer than the vehicle signal heads.

Cover all signal faces until placed in operation.

All pedestrian signal faces shall be single section LED Type. Die cast polycarbonate is acceptable in lieu of die cast aluminum. All mounting attachments shall be constructed of steel pipe and mounted as shown on the plans.

For all proposed mast arm pole assemblies, use mounting bracket assembly Option "C" as shown on the State Standard Sheet(s) "Single Mast Arm Assemblies".
--Item 684—
Provide all signal heads from the same manufacturer. Pedestrian signals may be by a different manufacturer than the vehicle signal heads.

Cover all signal faces until placed in operation.

All pedestrian signal faces shall be single section LED Type. Die cast polycarbonate is acceptable in lieu of die cast aluminum. All mounting attachments shall be constructed of steel pipe and mounted as shown on the plans.

For all proposed mast arm pole assemblies, use mounting bracket assemble Option “C” as shown on the State Standard Sheet(s) “Single Mast Arm Assemblies”.

--Item 684--
Provide an extra 10’ for each cable terminating in the controller cabinet. All cables shall be continuous without splices from terminal point to terminal point. All proposed signal cable shall be #12 AWG stranded copper.

--Item 686 & 687—
Provide all signal poles from the same manufacturer. Pedestrian poles may be from a different manufacturer.

--Item 688—
The sealant used must be approved.

The pedestrian push button shall be raised or flush and a minimum of 2 inches in the smallest dimension. The force to activate the control shall be no greater than 5 lb/f. the button placement has to be coordinated with the concrete pad to access the button. The concrete pad (if required) shall be paid separately.

The pedestrian push button shall be wired with a 2/C#14 lop detector cable in lieu of a #12 A.W. G. XHHW wire.

--Item 730—
Spot mow and hand trim the right of way, including newly seeded or sodded areas, when vegetation reaches a height of 16” or when directed. Removal of brush sprouts growing within guardrail, concrete barriers or at other locations where mowing or hand trimming is done within the limits of construction is required and subsidiary to this item. Moving may be required more often in newly sodded or seeded areas than in other parts of the project because of the supplemental irrigation these areas receive and the resulting weed growth. Coordinate mowing to avoid rutting or compaction of the soil when mowing where supplemental irrigation is being used. Use mowing equipment that will not adversely affect soil retention blankets or mulches that have been applied. Work performed under this item does not replace the mowing required

when placing permanent seeding in an area that has established temporary seeding as described in Article 164-3, Construction.

--Item 6007—
All existing signal equipment with the exception of the signal controller and equipment become the property of the Contractor and disposed of in accordance with the specifications. Deliver the controller and related equipment to the Signal Shop, located at 233 S. Cherry Street, San Antonio, Texas or to the Area Office as directed.

1.) TREE PERMIT (REQUIRED)

2.) TREE PRESERVATION PLAN/MITIGATION PLAN (IF REQUIRED). PRESERVATION PLAN TO INCLUDE BUT NOT LIMITED TO: TREE SURVEY, TREE INVENTORY, TREE PROTECTION NOTES, TREE PROTECTION DETAILS, PRUNING DETAIL, ALTERNATIVE CONSTRUCTION METHODS INCLUDING SIDEWALKS, AND TREATMENT MEASURES WHERE APPLICABLE, I.E., FERTILIZATION, MULCH, SOIL DECOMPACTION, ETC.

CITY OF SAN ANTONIO
FT. SAM HOUSTON – PROJECT NO. 40-00015
(COSA – ROADWAY IMPROVEMENTS)
HARRY WURZBACH FROM BURR ROAD TO RITTIMAN STREET

GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS

ITEM NO.	DESCRIPTION
ITEMS 1 TO 9	INCL., GENERAL REQUIREMENTS AND COVENANTS

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS: ADOPTED BY THE CITY OF SAN ANTONIO
---------- JUNE 2008. STANDARD SPECIFICATIONS ARE INCORPORATED INTO THE CONTRACT BY REFERENCE.

ITEM NO.	DESCRIPTION
ITEM 100	PREPARING RIGHT OF WAY (103)
ITEM 104	REMOVING CONCRETE
ITEM 105	REMOVING STABILIZED BASE AND ASPHALT PAVEMENT
ITEM 110	EXCAVATION (132)
ITEM 112	SUBGRADE WIDENING (132)(204)
ITEM 132	EMBANKMENT (100)(204)(210)(216)(400)
ITEM 162	SODDING FOR EROSION CONTROL (166)(168)
ITEM 168	VEGETATIVE WATERING
ITEM 260	LIME TREATMENT (PLANT-MIXED) (105)(132)(204)(210)(216) (247)(300)(310)(520)
ITEM 316	SURFACE TREATMENTS (210)(300)(302)(520)
ITEM 340	DENSE GRADED HOT MIX ASPHALT (METHOD) (210)(300)(301) (320)(520)(585)
ITEM 354	PLANING AND TEXTURING PAVEMENT
ITEM 356	356 - FABRIC UNDERSEAL (300)
ITEM 402	TRENCH EXCAVATION PROTECTION
ITEM 420	CONCRETE STRUCTURES (400)(421)(427)(438)(440)(448)
ITEM 432	RIPRAP (420)(421)(427)(440)
ITEM 462	CONCRETE BOX CULVERTS AND STORM DRAINS (400)(424)(464)(476)
ITEM 464	REINFORCED CONCRETE PIPE (400)(476)
ITEM 465	MANHOLES AND INLETS (400)(420)(421)(440)(471)
ITEM 476	JACKING, BORING OR TUNNELING PIPE OR BOX (462)(464)
ITEM 496	REMOVING STRUCTURES (430)

ITEM 500	MOBILIZATION
ITEM 502	BARRICADES, SIGNS, AND TRAFFIC HANDLING
ITEM 504	FIELD OFFICE AND LABORATORY
ITEM 506	TEMPORARY EROSION, SEDIMENTATION, AND ENVIRONMENTAL CONTROLS
ITEM 508	CONSTRUCTING DETOURS
ITEM 512	PORTABLE CONCRETE TRAFFIC BARRIER (420)(421)(424)(440)(442)
ITEM 529	CONCRETE CURB, GUTTER, AND COMBINED CURB (360)(420)(421)(440)
ITEM 530	INTERSECTIONS, DRIVEWAYS, AND TURNOUTS (247)(260)(263)(275)(276)(292)(316)(330)(334)(340)(360)(421)(440)
ITEM 531	SIDEWALKS (104)(360)(420)(421)(440)(530)
ITEM 536	CONCRETE MEDIANS AND DIRECTIONAL ISLANDS (420)(421)(427)(440)(529)
ITEM 610	ROADWAY ILLUMINATION ASSEMBLIES (421)(441)(442)(445)(446)(449)(616)(620)
ITEM 618	CONDUIT (400)(445)(476)(622)
ITEM 620	ELECTRICAL CONDUCTORS
ITEM 624	GROUND BOXES (421)(440)
ITEM 628	ELECTRICAL SERVICES (441)(445)(449)(618)(620)(627)(656)
ITEM 636	ALUMINUM SIGNS (643)
ITEM 644	SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES (421)(440)(441)(442)(445)(634)(636)(643)(656)
ITEM 647	LARGE ROADSIDE SIGN SUPPORTS AND ASSEMBLIES (421)(440)(441)(442)(445)(643)
ITEM 662	WORK ZONE PAVEMENT MARKINGS (666)(668)(672)(677)
ITEM 666	REFLECTORIZED PAVEMENT MARKINGS (316)(318)(662)(677)(678)
ITEM 672	RAISED PAVEMENT MARKERS (677)(678)
ITEM 677	ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS (300)(302)(316)
ITEM 680	INSTALLATION OF HIGHWAY TRAFFIC SIGNALS (610)(625)(627)(634)(636)(656)
ITEM 681	TEMPORARY TRAFFIC SIGNALS (628)(680)
ITEM 682	VEHICLE AND PEDESTRIAN SIGNAL HEADS
ITEM 684	TRAFFIC SIGNAL CABLES
ITEM 686	TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL) (416)(421)(441)(442)(445)(449)
ITEM 688	PEDESTRIAN DETECTORS AND VEHICLE LOOP DETECTORS (618)(624)(682)(684)
ITEM 690	MAINTENANCE OF TRAFFIC SIGNALS(416)(421)(476)(610)(618)(620) (622)(624)(625)(627)(628)(634)(636)(656)(680)(682)(684)(685)(686)(687)(688)

SPECIAL PROVISIONS: SPECIAL PROVISIONS WILL GOVERN AND TAKE

---------- **PRECEDENCE OVER THE SPECIFICATIONS NUMERATED HEREON WHEREVER IN CONFLICT THEREWITH.**

REQUIRED CONTRACT PROVISIONS, FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, MARCH, 1994)

WAGE RATES

SPECIAL PROVISION "PARTNERING" (000---002--COSA)
SPECIAL PROVISION "NOTICE TO ALL BIDDERS" (000---003--COSA)
SPECIAL PROVISION "NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY" (000---004--COSA)
SPECIAL PROVISION "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS" (000---006--COSA)
SPECIAL PROVISION "CERTIFICATION OF NONDISCRIMINATION IN EMPLOYMENT" (000---009--COSA)
SPECIAL PROVISION "NOTICE OF CHANGES TO U.S. DEPARTMENT OF LABOR REQUIRED PAYROLL INFORMATION" (000--1483--COSA)
SPECIAL PROVISION "SCHEDULE OF LIQUIDATED DAMAGES" (000--1493--COSA)
SPECIAL PROVISION "ON-THE-JOB TRAINING PROGRAM" (000--1676--COSA)
SPECIAL PROVISION “DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL AID CONTRACTS” (000-1966--COSA)
SPECIAL PROVISION “DETOURS, BARRICADE, WARNING SIGNS, SEQUENCE OF WORK, ETC.” (000-2001--COSA)
SPECIAL PROVISION “IMPORTANT NOTICE TO CONTRACTORS” (000-2002--COSA)
SPECIAL PROVISIONS TO ITEM 1 (001---015--COSA)
SPECIAL PROVISION TO ITEM 3 (003---033--COSA)
SPECIAL PROVISION TO ITEM 4 (004---017--COSA)
SPECIAL PROVISIONS TO ITEM 6 (006---003--COSA)
SPECIAL PROVISION TO ITEM 6 (006---030--COSA)
SPECIAL PROVISION TO ITEM 7 (007---119--COSA)
SPECIAL PROVISIONS TO ITEM 7 (007---806--COSA)
SPECIAL PROVISIONS TO ITEM 8 (008---999--COSA)
SPECIAL PROVISIONS TO ITEM 9 (009---009--COSA)
SPECIAL PROVISIONS TO ITEM 9 (009---015--COSA)
SPECIAL PROVISION TO ITEM 100 (100---002--COSA)
SPECIAL PROVISION TO ITEM 166 (166---001--COSA)
SPECIAL PROVISION TO ITEM 260 (260---002--COSA)
SPECIAL PROVISION TO ITEM 275 (275---002--COSA)
SPECIAL PROVISION TO ITEM 300 (300---032--COSA)
SPECIAL PROVISION TO ITEM 302 (302---010--COSA)
SPECIAL PROVISION TO ITEM 316 (316---016--COSA)
SPECIAL PROVISION TO ITEM 318 (318---010--COSA)
SPECIAL PROVISION TO ITEM 330 (330---001--COSA)
SPECIAL PROVISION TO ITEM 340 (340---003--COSA)
SPECIAL PROVISION TO ITEM 360 (360---003--COSA)
SPECIAL PROVISION TO ITEM 360 (360---007--COSA)
SPECIAL PROVISION TO ITEM 400 (400—004--COSA)
SPECIAL PROVISION TO ITEM 416 (416—001--COSA)

SPECIAL PROVISION TO ITEM 420 (420---002--COSA)
SPECIAL PROVISION TO ITEM 421 (421---035--COSA)
SPECIAL PROVISION TO ITEM 424 (424---002--COSA)
SPECIAL PROVISION TO ITEM 424 (424---014--COSA)
SPECIAL PROVISION TO ITEM 440 (440---005--COSA)
SPECIAL PROVISION TO ITEM 441 (441---006--COSA)
SPECIAL PROVISION TO ITEM 442 (442---016--COSA)
SPECIAL PROVISION TO ITEM 448 (448—002--COSA)
SPECIAL PROVISION TO ITEM 462 (462—011--COSA)
SPECIAL PROVISION TO ITEM 464 (464---003--COSA)
SPECIAL PROVISION TO ITEM 462 (462---011--COSA)
SPECIAL PROVISION TO ITEM 500 (500---005--COSA)
SPECIAL PROVISION TO ITEM 502 (502---033--COSA)
SPECIAL PROVISION TO ITEM 506 (506---013--COSA)
SPECIAL PROVISION TO ITEM 512 (512---002--COSA)
SPECIAL PROVISION TO ITEM 610 (610---010--COSA)
SPECIAL PROVISION TO ITEM 620 (620---001--COSA)
SPECIAL PROVISION TO ITEM 624 (624---014--COSA)
SPECIAL PROVISION TO ITEM 628 (628---003--COSA)
SPECIAL PROVISION TO ITEM 636 (636---014--COSA)
SPECIAL PROVISION TO ITEM 643 (643---001--COSA)
SPECIAL PROVISION TO ITEM 681 (681---002--COSA)
SPECIAL PROVISION TO ITEM 682 (682---001--COSA)
SPECIAL PROVISION TO ITEM 682 (682---001--COSA)
SPECIAL PROVISION TO ITEM 685 (685---014--COSA)
SPECIAL PROVISION TO ITEM 6266 (6266---017--COSA)

SPECIAL SPECIFICATIONS:

ITEM XXXX INTERNALLY ILLUMINATED STREET NAME SIGNS
ITEM 1134 IMPERMEABLE LINER
ITEM 1135 WATER TANK AND PUMP
ITEM 1136 STEEL OR POLYETHYLENE MOBILE WATER STORAGE TANK
ITEM 5010 TRANSPORTABLE CELLULAR TELEPHONES
ITEM 6266 VIDEO IMAGING VEHICLE DETECTION SYSTEM
ITEM 6525 EMERGENCY VEHICLE TRAFFIC SIGNAL PRIORITY CONTROL SYSTEM
ITEM 6834 PORTABLE CHANGEABLE MESSAGE SIGN
ITEM 8245 MODEL 2070 CONTROLLER UNIT
ITEM 8317 BATTERY BACK-UP SYSTEM FOR SIGNAL CABINETS
ITEM 8643 TYPE 2070 CONTROLLER CABINET ASSEMBLIES
ITEM 8703 ACCESSIBLE PEDESTRIAN SIGNAL UNITS
ITEM 9500 SAWS SANITARY SEWER
ITEM 9501 SAWS WATER
ITEM 9502 SAWS ADJUSTMENTS TO RECYCLED WATER FACILITIES
ITEM 9503 SAWS HANDLING ASBESTOS CEMENT PIPE

CPS ENERGY REQUIREMENTS AND SPECIFICATIONS FOR CONSTRUCTION OF NATURAL GAS DISTRIBUTION FACILITES ON THE FORT SAM HOUSTON TRANSPORTATION PROJECT

GENERAL: THE ABOVE-LISTED SPECIFICATION ITEMS ARE THOSE UNDER WHICH ---------- PAYMENT IS TO BE MADE. THESE, TOGETHER WITH SUCH OTHER PERTINENT ITEMS, IF ANY, AS MAY BE REFERRED TO IN THE ABOVE LISTED SPECIFICATION ITEMS, AND INCLUDING THE SPECIAL PROVISIONS LISTED ABOVE, CONSTITUTE THE COMPLETE SPECIFICATIONS FOR THIS PROJECT.

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

Section I, paragraph 2;
Section IV, paragraphs 1, 2, 3, 4, and 7;
Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:

a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.

3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed

in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.

5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.

6. **Training and Promotion:**

a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.

7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:

a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.

8. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

(4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. The contractors will submit an annual report to the SHA

each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the job training is being required by special provision, the contractor will be required to collect and report training data.

III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of $10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. **General:**

a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. **Classification:**

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. **Payment of Fringe Benefits:**

a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

4. **Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:**

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers:

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under a approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. **Apprentices and Trainees (Programs of the U.S. DOT):**

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. **Withholding:**

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. **Overtime Requirements:**

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. **Violation:**

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. **Withholding for Unpaid Wages and Liquidated Damages:**

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. **Compliance with Copeland Regulations (29 CFR 3):**

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. **Payrolls and Payroll Records:**

a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less that the applicable wage rate and fringe benefits or cash equivalent for the classification of worked performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than $1,000,000 (23 CFR 635) the contractor shall:

a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).

a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of

a subcontractor, assignee, or agent of the prime contractor.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more that $10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of $100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. **Instructions for Certification - Primary Covered Transactions:**

(Applicable to all Federal-aid contracts - 49 CFR 29)

a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this

transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and

d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

2. **Instructions for Certification - Lower Tier Covered Transactions:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions of $25,000 or more - 49 CFR 29)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and

frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

ATTACHMENT A - EMPLOYMENT PREFERENCE FOR APPALACHIAN CONTRACTS

(Applicable to Appalachian contracts only.)

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph 1c shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph 4 below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which he estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, he shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within 1 week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph 1c above.

5. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

GENERAL DECISION: TX20100041 03/12/2010 TX41

Date: March 12, 2010
General Decision Number: TX20100041 03/12/2010

Superseded General Decision Number: TX20080041

State: Texas

Construction Types: Heavy and Highway

Counties: Bell, Bexar, Brazos, Comal, Coryell, Guadalupe, Hays, McLennan, Travis and Williamson Counties in Texas.

Heavy (excluding tunnels and dams) and Highway Construction Projects (does not include building structures in rest area projects). *NOT TO BE USED FOR WORK ON SEWAGE OR WATER TREATMENT PLANTS OR LIFT/PUMP STATIONS IN BELL, CORYELL, McLENNAN AND WILLIAMSON COUNTIES.

Modification Number	Publication Date
0	03/12/2010

SUTX2005-001 01/03/2005

	Rates	Fringes
Air Tool Operator	$ 16.00	0.00
Asphalt Distributor Operator	$ 12.09	0.00
Asphalt paving machine operator	$ 11.82	0.00
Asphalt Raker	$ 9.96	0.00
Asphalt Shoveler	$ 10.56	0.00
Broom or Sweeper Operator	$ 9.74	0.00
Bulldozer operator	$ 11.04	0.00
Carpenter	$ 12.25	0.00
Concrete Finisher, Paving	$ 10.53	0.00
Concrete Finisher, Structures	$ 10.95	0.00
Concrete Paving Curbing Machine Operator	$ 14.00	0.00
Concrete Paving Finishing Machine Operator	$ 12.00	0.00
Concrete Rubber	$ 10.88	0.00
Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator	$ 13.66	0.00
Electrician	$ 24.11	0.00
Flagger	$ 9.49	0.00
Form Builder/Setter, Structures	$ 10.88	0.00
Form Setter, Paving & Curb	$ 9.89	0.00
Foundation Drill Operator, Truck Mounted	$ 15.00	0.00
Front End Loader Operator	$ 11.36	0.00
Laborer, common	$ 9.34	0.00
Laborer, Utility	$ 10.12	0.00
Mechanic	$ 14.74	0.00
Mixer operator, Concrete Paving	$ 15.25	0.00
Mixer operator	$ 10.83	0.00
Motor Grader Operator, Fine Grade	$ 15.26	0.00

Motor Grader Operator, Rough	$ 12.96	0.00
Oiler	$ 14.71	0.00
Painter, Structures	$ 11.00	0.00
Pavement Marking Machine Operator	$ 11.52	0.00
Pipelayer	$ 10.49	0.00
Planer Operator	$ 17.45	0.00
Reinforcing Steel Setter, Paving	$ 15.50	0.00
Reinforcing Steel Setter, Structure	$ 14.00	0.00
Roller Operator, Pneumatic, Self-Propelled	$ 9.34	0.00
Roller Operator, Steel Wheel, Flat Wheel/Tamping	$ 9.60	0.00
Roller Operator, Steel Wheel, Plant Mix Pavement	$ 10.24	0.00
Scraper Operator	$ 9.93	0.00
Servicer	$ 11.41	0.00
Sign Installer (PGM)	$ 14.85	0.00
Slip Form Machine Operator	$ 15.17	0.00
Spreader Box operator	$ 10.39	0.00
Structural Steel Worker	$ 13.41	0.00
Tractor operator, Crawler Type	$ 11.10	0.00
Traveling Mixer Operator	$ 10.04	0.00
Trenching machine operator, Heavy	$ 14.22	0.00
Truck Driver Tandem Axle Semi-Trailer	$ 10.95	0.00
Truck driver, lowboy-Float	$ 15.30	0.00
Truck driver, Single Axle, Heavy	$ 11.88	0.00
Truck driver, Single Axle, Light	$ 9.98	0.00
Wagon Drill, Boring Machine, Post Hole Driller Operator	$ 14.65	0.00
Welder	$ 14.26	0.00
Work Zone Barricade Servicer	$ 11.15	0.00

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can

be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SPECIAL PROVISION
000---002-CoSA
Partnering

1. General. It is the intent of this provision to encourage the use of a Partnering arrangement between the City and the Contractor. The use of Partnering on this project is voluntary, unless shown on the plans, and its use must be acceptable to both City and Contractor personnel. Partnering can be initiated by TxDOT or the Contractor. The Partnering concept promotes an environment of trust, mutual respect, integrity and fair-dealing.

2. Procedures for Initial Partnering Meeting. The Partnering Workshop initial meeting may last from 2 hours to 2 days and may contain one or more of the partnering modules selected by the Engineer and the Contractor, and may be prior to or combined with the pre-construction conference.

(1) Mutually agree upon an agenda (outline main elements-see modules for agenda contents), a location (city, hotel, etc.) and the scope and attendees. (The list of attendees will include the job title of each person, a contact, telephone and fax number.) The City will furnish a recommended location list.

(2) Use of facilitator:

(a) The facilitator is to act as a neutral party seeking to advance proactive pre-project planning. There must be no perceived conflict of interest on the part of the facilitator in favor of either Engineer or Contractor.

(b) Contract Facilitator - Select 3 potential facilitators from the City's approved list . The Engineer will select 1 of the 3 proposed facilitators.

(c) Internal Facilitator - The Engineer and the Contractor may choose a facilitator internal to one of their respective organizations to facilitate a workshop. This individual must have technical knowledge and ability to lead and guide discussions. This individual must be acceptable to both the Engineer and the Contractor. No payment will be made for internal facilitators.

(d) The Engineer and the Contractor will provide the facilitator with a list of attendees. The meeting arrangements (meeting space, A/V equipment, etc.) will be the responsibility of the contract facilitator.

The Contractor and the City will be responsible for any arrangements for any expenses incurred by their respective employees, including but not limited to meals, travel and lodging.

(e) The Engineer and the Contractor should contact the facilitator at least 3 weeks prior to the workshop, and should have a conference call with the facilitator at least 10

calendar days prior to the workshop to discuss ideas and to finalize the agenda. The agenda will be based on the needs of the team, and may be as specific as deemed necessary. The facilitator is responsible for developing the full agenda in conjunction with both parties.

3. **Participation in Partnering.** It is the responsibility of the Engineer and the Contractor to compile a list of and invite the key project personnel (inspectors, foremen, superintendents, bookkeepers, project engineers, etc.) to participate in the initial partnering workshop. It is also important to have representatives of all interested parties in attendance. Examples include but are not limited to subcontractors, material suppliers, city and county officials, and utility companies. In addition, the Contractor and Engineer should actively encourage district staff to participate as well. The Contractor and Engineer must agree that each of their personnel identified will be assigned to the project for its duration.

4. **Payment.** The cost of the partnering workshop will be shared equally by the Contractor and the City. Be responsible for the partnering workshop expenses (meeting room, AV, supplies, cost of facilitator, etc.). The City will reimburse the Contractor for 1/2 of the partnering workshop expenses as extra work on the next monthly estimate.

5. **Partnering Performance.** If the partnering agreement is not followed and after reasonable efforts to salvage it have been unsuccessful, either party may withdraw from the partnering agreement by written notice to the other party. The sole remedy for non-performance of the partnership shall be termination of the partnering agreement.

SPECIAL PROVISION

000---003-CoSA

Notice to All Bidders

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (DOT) operates the above toll-free “hotline” Monday through Friday, 8:00 a.m. to 5:00 p.m., eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the “hotline” to report such activities.

The “hotline” is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

SPECIAL PROVISION

000---004-CoSA

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)

1. **General.** In addition to the affirmative action requirements of the Special Provision titled "Standard Federal Equal Employment Opportunity Construction Contract Specifications" as set forth elsewhere in this proposal, the Bidder's attention is directed to the specific requirements for utilization of minorities and females as set forth below.

2. **Goals.**

   a. Goals for minority and female participation are hereby established in accordance with 41 CFR 60-4.

   b. The goals for minority and female participation expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Goals for minority participation in each trade (per-cent)	Goals for female participation in each trade (per-cent)
See Table 1	6.9

   c. These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction. The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Standard Federal Equal Employment Opportunity Construction Contract Specifications Special Provision and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority and female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

d. A contractor or subcontractor will be considered in compliance with these provisions by participation in the Texas Highway-Heavy Branch, AGC, Statewide Training and Affirmative Action Plan. Provided that each contractor or subcontractor participating in this plan must individually comply with the equal opportunity clause set forth in 41 CFR 60-1.4 and must make a good faith effort to achieve the goals set forth for each participating trade in the plan in which it has employees. The overall good performance of other contractors and subcontractors toward a goal in an approved plan does not excuse any covered contractor's or subcontractor's failure to make good faith efforts to achieve the goals contained in these provisions. Contractors or subcontractors participating in the plan must be able to demonstrate their participation and document their compliance with the provisions of this Plan.

3. Subcontracting. The Contractor shall provide written notification to the City within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation pending concurrence of the City in the award. The notification shall list the names, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

4. Covered Area. As used in this special provision, and in the contract resulting from this solicitation, the geographical area covered by these goals for female participation is the State of Texas. The geographical area covered by these goals for other minorities are the counties in the State of Texas as indicated in Table 1.

5. Reports. The Contractor is hereby notified that he may be subject to the Office of Federal Contract Compliance Programs (OFCCP) reporting and record keeping requirements as provided for under Executive Order 11246 as amended. OFCCP will provide direct notice to the Contractor as to the specific reporting requirements that he will be expected to fulfill.

Table 1

County	Goals for Minority Participation	County	Goals for Minority Participation
Anderson	22.5	Concho	20.0
Andrews	18.9	Cooke	17.2
Angelina	22.5	Coryell	16.4
Aransas	44.2	Cottle	11.0
Archer	11.0	Crane	18.9
Armstrong	11.0	Crockett	20.0
Atascosa	49.4	Crosby	19.5
Austin	27.4	Culberson	49.0
Bailey	19.5	Dallam	11.0
Bandera	49.4	Dallas	18.2
Bastrop	24.2	Dawson	19.5
Baylor	11.0	Deaf Smith	11.0
Bee	44.2	Delta	17.2
Bell	16.4	Denton	18.2
Bexar	47.8	DeWitt	27.4
Blanco	24.2	Dickens	19.5
Borden	19.5	Dimmit	49.4
Bosque	18.6	Donley	11.0
Bowie	19.7	Duval	44.2
Brazoria	27.3	Eastland	10.9
Brazos	23.7	Ector	15.1
Brewster	49.0	Edwards	49.4
Briscoe	11.0	Ellis	18.2
Brooks	44.2	El Paso	57.8
Brown	10.9	Erath	17.2
Burleson	27.4	Falls	18.6
Burnet	24.2	Fannin	17.2
Caldwell	24.2	Fayette	27.4
Calhoun	27.4	Fisher	10.9
Callahan	11.6	Floyd	19.5
Cameron	71.0	Foard	11.0
Camp	20.2	Fort Bend	27.3
Carson	11.0	Franklin	17.2
Cass	20.2	Freestone	18.6
Castro	11.0	Frio	49.4
Chambers	27.4	Gaines	19.5
Cherokee	22.5	Galveston	28.9
Childress	11.0	Garza	19.5
Clay	12.4	Gillespie	49.4
Cochran	19.5	Glasscock	18.9
Coke	20.0	Goliad	27.4
Coleman	10.9	Gonzales	49.4
Collin	18.2	Gray	11.0
Collingsworth	11.0	Grayson	9.4
Colorado	27.4	Gregg	22.8
Comal	47.8	Grimes	27.4
Comanche	10.9	Guadalupe	47.8

County	Goals for Minority Participation	County	Goals for Minority Participation
Hale	19.5	Lavaca	27.4
Hall	11.0	Lee	24.2
Hamilton	18.6	Leon	27.4
Hansford	11.0	Liberty	27.3
Hardeman	11.0	Limestone	18.6
Hardin	22.6	Lipscomb	11.0
Harris	27.3	Live Oak	44.2
Harrison	22.8	Llano	24.2
Hartley	11.0	Loving	18.9
Haskell	10.9	Lubbock	19.6
Hays	24.1	Lynn	19.5
Hemphill	11.0	Madison	27.4
Henderson	22.5	Marion	22.5
Hidalgo	72.8	Martin	18.9
Hill	18.6	Mason	20.0
Hockley	19.5	Matagorda	27.4
Hood	18.2	Maverick	49.4
Hopkins	17.2	McCulloch	20.0
Houston	22.5	McLennan	20.7
Howard	18.9	McMullen	49.4
Hudspeth	49.0	Medina	49.4
Hunt	17.2	Menard	20.0
Hutchinson	11.0	Midland	19.1
Irion	20.0	Milam	18.6
Jack	17.2	Mills	18.6
Jackson	27.4	Mitchell	10.9
Jasper	22.6	Montague	17.2
Jeff Davis	49.0	Montgomery	27.3
Jefferson	22.6	Moore	11.0
Jim Hogg	49.4	Morris	20.2
Jim Wells	44.2	Motley	19.5
Johnson	18.2	Nacogdoches	22.5
Jones	11.6	Navarro	17.2
Karnes	49.4	Newton	22.6
Kaufman	18.2	Nolan	10.9
Kendall	49.4	Nueces	41.7
Kenedy	44.2	Ochiltree	11.0
Kent	10.9	Oldham	11.0
Kerr	49.4	Orange	22.6
Kimble	20.0	Palo Pinto	17.2
King	19.5	Panola	22.5
Kinney	49.4	Parker	18.2
Kleberg	44.2	Parmer	11.0
Knox	10.9	Pecos	18.9
Lamar	20.2	Polk	27.4
Lamb	19.5	Potter	9.3
Lampasas	18.6	Presidio	49.0
LaSalle	49.4	Rains	17.2

County	Goals for Minority Participation	County	Goals for Minority Participation
Randall	9.3	Webb	87.3
Reagan	20.0	Wharton	27.4
Real	49.4	Wheeler	11.0
Red River	20.2	Wichita	12.4
Reeves	18.9	Wilbarger	11.0
Refugio	44.2	Willacy	72.9
Roberts	11.0	Williamson	24.1
Robertson	27.4	Wilson	49.4
Rockwall	18.2	Winkler	18.9
Runnels	20.0	Wise	18.2
Rusk	22.5	Wood	22.5
Sabine	22.6	Yoakum	19.5
San Augustine	22.5	Young	11.0
San Jacinto	27.4	Zapata	49.4
San Patricio	41.7	Zavala	49.4
San Saba	20.0		
Schleicher	20.0		
Scurry	10.9		
Shackelford	10.9		
Shelby	22.5		
Sherman	11.0		
Smith	23.5		
Somervell	17.2		
Starr	72.9		
Stephens	10.9		
Sterling	20.0		
Stonewall	10.9		
Sutton	20.0		
Swisher	11.0		
Tarrant	18.2		
Taylor	11.6		
Terrell	20.0		
Terry	19.5		
Throckmorton	10.9		
Titus	20.2		
Tom Green	19.2		
Travis	24.1		
Trinity	27.4		
Tyler	22.6		
Upshur	22.5		
Upton	18.9		
Uvalde	49.4		
Val Verde	49.4		
Van Zandt	17.2		
Victoria	27.4		
Walker	27.4		
Waller	27.3		
Ward	18.9		
Washington	27.4		

SPECIAL PROVISION

000---006--CoSA

Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North American and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U. S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its

obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing contracts in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the contract is being performed. Goals are published periodically in the Federal Register in notice form and such notices may be obtained from any Office of Federal Contract Compliance Programs office or any Federal procurement contracting officer. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral Process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and Collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of

applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both

minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. Nondiscrimination programs require that Federal-aid recipients, subrecipients, and contractors prevent discrimination and ensure nondiscrimination in all of their programs and activities, whether those programs and activities are federally funded or not. The factors prohibited from serving as a basis for action or inaction which discriminates include race, color, national origin, sex, age, and handicap/disability. The efforts to prevent discrimination must address, but not be limited to a program's impacts, access, benefits, participation, treatment, services, contracting opportunities, training opportunities, investigations of complaints, allocations of funds, prioritization of projects, and the functions of right-of-way, research, planning, and design.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

16. In addition to the reporting requirements set forth elsewhere in this contract, the Contractor and the subcontractors holding subcontracts, not including material suppliers, of $10,000 or more, shall submit for every month of July during which work is per-formed, employment data as contained under Form PR 1391 (Appendix C to 23 CFR, Part 230), and in accordance with the instructions included thereon.

SPECIAL PROVISION

000---009--CoSA

Certification of Nondiscrimination in Employment

By signing this proposal, the bidder certifies that he has participated in a previous contract or subcontract subject to the equal opportunity clause, as required by Executive Orders 10925, 11114, or 11246, or if he has not participated in a previous contract of this type, or if he has had previous contract or subcontracts and has not filed, he will file with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance, a Federal Government contracting or administering agency, or the former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements.

Note: The above certification is required by the Equal Employment Opportunity Regulations of the Secretary of Labor (41 CFR 60-1.7(b)(1)), and must be submitted by bidders and proposed subcontractors only in connection with contracts and subcontracts which are subject to the equal opportunity clause. Contracts and subcontracts which are exempt from the equal opportunity clause are set forth in 41 CFR 60-1.5. (Generally only contracts or subcontracts of $10,000 or under are exempt.)

Currently, Standard Form 100 (EEO-1) is the only report required by the Executive Orders or their implementing regulations.

Proposed prime contractors and subcontractors who have participated in a previous contract or subcontract subject to the Executive Orders and have not filed the required reports should note that 41 CFR 60-1.7(b)(1) prevents the award of contracts and subcontracts unless such contractor submits a report covering the delinquent period or such other period specified by the Federal Highway Administration or by the Director, Office of Federal Contract Compliance, U. S. Department of Labor.

SPECIAL PROVISION

000---011--CoSA

Department Division Mailing and Physical Addresses

For this project, Item 000, "Department Division Mailing and Physical Addresses," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Use the information in Table 1 to contact the Department Divisions referenced in the Standard Specifications or Special Provisions and Special Specifications in the Contract. This listing is for the purposes of providing addresses for transmission of information in accordance with the specifications. Unless otherwise stated in the specifications, address all correspondence and transmission of information to the Engineer responsible for the oversight of construction. Submit bidding documents to the location shown in the official advertisement. Address changes will be posted on the Department's Internet site at http://www.dot.state.tx.us/.

Table 1
Department Division Mailing and Physical Addresses

Division/Section Name	U.S. Post Office Address	Physical Address
Bridge Division		
	Texas Department of Transportation Bridge Division 125 E 11th Street Austin TX 78701-2483	Bridge Division Fabrication Branch 118 E. Riverside Dr. Austin, Texas 78704 (512) 416-2187
Construction Division		
Construction Section	Texas Department of Transportation Construction Division Construction Section 200 E. Riverside Drive Austin TX 78704	Construction Division 200 E. Riverside Dr. 1st floor, 1B.1 Austin, TX 78704 (512) 416-2490 1-800-687-3525
Materials & Pavements Section	Texas Department of Transportation Construction Division Materials & Pavements (CP51) 125 E 11th Street Austin TX 78701-2483	Construction Division Materials & Pavements Cedar Park Campus, Bldg. 51 9500 Lake Creek Parkway Austin, TX 78717 512-506-5800

Division/Section Name	U.S. Post Office Address	Physical Address
Maintenance Division		
Maintenance Section	Texas Department of Transportation Maintenance Division Maintenance Section 125 E 11th Street Austin, TX 78701	Maintenance Division Maintenance Section 150 East Riverside Drive Fourth Floor, North Tower Austin, TX 78704 (512) 416-3185
Vegetation Management Section	Texas Department of Transportation Maintenance Division Vegetation Management Section 125 E 11th Street Austin, TX 78701	Maintenance Division Vegetation Management Section 150 East Riverside Drive Fourth Floor, North Tower Austin, TX 78704 (512) 416-3093
Traffic Operations Division		
Traffic Operations Division	Texas Department of Transportation Traffic Operations Division 125 E 11th Street Austin TX 78701	Texas Department of Transportation Traffic Operations Division 200 E. Riverside Bldg. 118 Austin, Texas 78704 512-416-3200
Traffic Engineering	Texas Department of Transportation Traffic Operations Division Traffic Engineering Section 125 E 11th Street Austin TX 78701	Texas Department of Transportation Traffic Operations Division Traffic Engineering Section 200 E. Riverside Bldg. 118 Austin, Texas 78704 (512) 416-3118
Traffic Management-ITS Branch	Texas Department of Transportation Traffic Operations Division Traffic Management Section 125 E 11th Street Austin TX 78701	Texas Department of Transportation Traffic Operations Division Traffic Management Section Cedar Park Campus, Bldg. 51 9500 Lake Creek Parkway Austin, TX 78717 512-506-5100
Traffic Management-Signal/Radio Branch	Texas Department of Transportation Traffic Operations Division Traffic Management Section-Signal/Radio Branch 125 E 11th Street Austin TX 78701	Texas Department of Transportation Traffic Operations Division Traffic Management Section-Signal/Radio Branch Cedar Park Campus, Bldg. 51 9500 Lake Creek Parkway Austin, TX 78717 512-506-5100

SPECIAL PROVISION
000---016--CoSA
Electronic Equipment Dating Format

1. General. The purpose of this special provision is to ensure that all products supplied and installed under this contract are compliant with the requirements of the Year 2000 electronic equipment dating format.

2. Definitions. For purposes of this warranty, the following definitions apply:

(1) "Accurately" are defined to include:

(a) Calculations correctly performed using 4 digit year processing.

(b) Functionality on-line, batch, including but not limited to, entry, inquiry, maintenance and updates support 4 digit year processing.

(c) Interfaces and reports shall support 4 digit year processing.

(d) Successful translation into year 2000 with valid date (e.g., CC/YY/MM/DD) without human intervention. Additional representations for week, hour, minute and second, if required, complies with the international standard ISO 8601:1998, "Data elements and interchange formats - Information exchange Representation of dates and time". When ordinal dates are used, the ISO standard format CCYYDDD is used.

(e) Processing with 4 digit year after transition to any date beyond the year 2000 without human intervention.

(f) Correct results in forward and backward date calculations spanning century boundaries; correct forward and backward date calculations spanning century boundaries, including conversion of previous years stored, recorded or entered as 2 digits.

(2) "Date integrity" shall mean all manipulations of time-related data (dates, duration, days of week, etc.) will produce desired results for all valid date values within the application domain.

(3) "Explicit century" shall mean date elements in interfaces and data storage permit specifying century to eliminate date ambiguity.

(4) "Extraordinary actions" shall be defined to mean any action outside the normal documented processing steps identified in the product's reference documentation.

(5) "General integrity" shall mean no value for current date will cause interruptions in desired operation, especially from the 20th to 21st centuries.

(6) "Implicit century" shall mean for any data element without century, the correct century is unambiguous for all manipulations involving that element.

(7) "Product" or "products" shall be defined to include, but is not limited to, any supplied or supported hardware, software, firmware and/or micro code.

(8) "Valid Date" shall be defined as a date containing a four digit year, a 2 digit month and a 2 digit day, or the ISO 8601:1988, Data elements - Information Exchange - Representation of dates and times. When ordinal dates are used, ISO standard format of CCYYDDD is used.

3. Warranty. Warrant that products delivered and installed under this contract will be able to accurately process valid date data when used in accordance with the product documentation provided by the vendor and require no extraordinary actions on the part of the City or its personnel. Products under this contract must possess general integrity, date integrity, explicit and implicit century capabilities. If the contract requires that specific products must perform as a system in accordance with the foregoing warranty, then the warranty will apply to those listed products as a system. The duration of this warranty and the remedies available to the City for breach of this warranty will be as defined in, and subject to, the terms and conditions of the vendor's standard commercial warranty or warranties contained in this contract; provided, that notwithstanding any provision to the contrary in such commercial warranty or warranties, the remedies available to the City under this warranty will include repair or replacement of any supplied product whose non-compliance is discovered and made known to the Contractor in writing within 90 days after final acceptance, as that term is defined elsewhere in the contract. Nothing in this warranty will be considered to limit any rights or remedies the City may otherwise have under this contract with respect to defects other than Year 2000 performance.

4. Documentaiton. Certify that all custom software, reuse software and commercial off-the-shelf software supplied under this contract will function within the requirements of this provision by requiring validation from originating sources such as a software company's published statement.

Submit documentation demonstrating compliance for all products supplied under this contract within 30 days after the authorization to begin work.

SPECIAL PROVISION

000—1483--CoSA

Notice of Changes to U.S. Department of Labor Required Payroll Information

Do not include employee addresses and social security numbers on the payroll submissions to the City. In lieu of the social security number, include an individually identifying number for each employee (Example: last four digits of the individual's social security number).

Maintain the full social security number and current address of each covered employee in files for 3 years after project completion and make the information available upon the City's request.

Form FHWA 1273 and optional form WH-347 will be revised in the future to reflect these changes.

SPECIAL PROVISION

000—1493--CoSA

Schedule of Liquidated Damages

For Amount of Original Contract		Amount of Daily Contract Administration Liquidated
From More Than	**To and Including**	**Damages per Working Day**
$0	100,000	**425**
100,000	500,000	**500**
500,000	1,000,000	**525**
1,000,000	2,000,000	**625**
2,000,000	5,000,000	**800**
5,000,000	10,000,000	**1100**
10,000,000	15,000,000	**1400**
15,000,000	25,000,000	**1550**
25,000,000	Over 25,000,000	**2800**

SPECIAL PROVISION
000--1676--CoSA
On-the-Job Training Program

1. **Description.** The primary objective of this Special Provision is the training and advancement of minorities, women and economically disadvantaged persons toward journey worker status. Accordingly, make every effort to enroll minority, women and economically disadvantaged persons to the extent that such persons are available within a reasonable area of recruitment. This training commitment is not intended, and shall not be used to discriminate against any applicant for training, whether or not he/she is a member of a minority group.

2. **Trainee Assignment.** Training assignments are determined based on the past contract volume of federal-aid work performed with the City's. Contractors meeting the selection criteria will be notified of their training assignment at the beginning of the reporting year by the Department's Office of Civil Rights.

3. **Program Requirements.** Fulfill all of the requirements of the On-the-Job Training Program including the maintenance of records and submittal of periodic reports documenting program performance. Trainees shall be paid at least 60% of the appropriate minimum journey worker's rate specified in the contract for the first half of the training period, 75% for the third quarter and 90% for the last quarter, respectively. Contractors may be reimbursed $0.80 per training hour at no additional cost to the City.

4. **Compliance.** The Contractor will have fulfilled the contractual responsibilities by having provided acceptable training to the number of trainees specified in their goal assignment. Noncompliance may be cause for corrective and appropriate measures pursuant to Article 8.6., "Abandonment of Work or Default of Contract," which may be used to comply with the sanctions for noncompliance pursuant to 23 CFR Part 230.

SPECIAL PROVISION

000—1966--CoSA

Disadvantaged Business Enterprise in Federal Aid Contracts

1. Description. The purpose of this Special Provision is to carry out the U. S. Department of Transportation's (DOT) policy of ensuring nondiscrimination in the award and administration of DOT assisted contracts and creating a level playing field on which firms owned and controlled by individuals who are determined to be socially and economically disadvantaged can compete fairly for DOT assisted contracts. If the Disadvantaged Business Enterprise (DBE) goal is greater than zero, Article A, "Disadvantaged Business Enterprise in Federal Aid Contracts", of this Special Provision shall apply to this contract. If there is no DBE goal, Article B, "Race-Neutral DBE Participation", of this Special Provision shall apply to this contract. The percentage goal for DBE participation in the work to be performed under this contract will be shown on the proposal.

A. Article A. Disadvantaged Business Enterprise in Federal Aid Contracts.

1. Policy. It is the policy of the DOT and the City of San Antonio (henceforth the "City") that DBEs, as defined in 49 CFR Part 26, Subpart A and the City's DBE Program, shall have the opportunity to participate in the performance of contracts financed in whole or in part with Federal funds. The DBE requirements of 49 CFR Part 26, and the City's DBE Program, apply to this contract as follows:

a. The Contractor will solicit DBEs through reasonable and available means, as defined in 49 CFR Part 26, Appendix A and the City's DBE Program, or show a good faith effort to meet the DBE goal for this contract.

b. The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

c. The requirements of this Special Provision shall be physically included in any subcontract.

d. By signing the contract proposal, the Bidder is certifying that the DBE goal as stated in the proposal will be met by obtaining commitments from eligible DBEs or that the Bidder will provide acceptable evidence of good faith effort to meet the commitment. The City will determine the adequacy of a Contractor's efforts to meet the contract goal, within 10 business days,

excluding national holidays, from receipt of the information outlined in this Special Provision under Section 1.A.3, "Contractor's Responsibilities." If the requirements of Section 1.A.3 are met, the conditional situation will be removed and the contract will be forwarded to the Contractor for execution.

2. Definitions.

a. "Broker" is an intermediary or middleman that does not take possession of a commodity or act as a regular dealer selling to the public.

b. "Disadvantaged Business Enterprise" or "DBE" is defined in the standard specifications, Article 1, Definition of Terms.

c. "DBE Joint Venture" means an association of a DBE firm and 1 or more other firm(s) to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

d. "DOT" means the U.S. Department of Transportation, including the Office of the Secretary, the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Federal Aviation Administration (FAA).

e. "Federal Aid Contract" is any contract between the City of San Antonio and a Contractor which is paid for in whole or in part with DOT financial assistance.

f. "Good Faith Effort" means efforts to achieve a DBE goal or other requirement of this Special Provision which, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement.

g. "Manufacturer" is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications."

h. "Race-conscious" means a measure or program that is focused specifically on assisting only DBEs, including women-owned businesses.

i. "Race-neutral DBE Participation" means any participation by a DBE through customary competitive procurement procedures.

j. "Regular Dealer" is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a regular dealer, the firm must be an established, regular business that engages in, as its principal business and under its own name, the purchase and sale or lease of the products in question.

A regular dealer in such bulk items as steel, cement, gravel, stone, and petroleum products need not keep such products in stock if it owns and operates distribution equipment for the products. Any supplementing of regular dealers own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis. Brokers, packagers, manufacturers' representatives, or other persons who arrange or expedite transactions shall not be regarded as a regular dealer.

k. "Texas Unified Certification Program" or "TUCP" provides one-stop shopping to applicants for certification, such that applicants are required to apply only once for a DBE certification that will be honored by all recipients of federal funds in the state. The TUCP by Memorandum of Agreement established six member entities to serve as certifying agents for Texas in specified regions.

3. Contractor's Responsibilities. These requirements must be satisfied by the Contractor.

a. After conditional award of the contract, the Contractor shall submit a completed Form SMS.4901 "DBE Commitment Agreement", From SMS 4901-T "DBE Trucking Commitment Agreement", or Form SMS.4901-MS "DBE Material & Supplier Commitment Agreement" for each DBE he/she intends to use to satisfy the DBE goal or a good faith effort to explain why the goal could not be reached, so as to arrive in the Department's Office of Civil Rights (OCR) in Austin, Texas not later than 5:00 p.m. on the 10th business day, excluding national holidays, after the conditional award of the contract. When requested, additional time, not to exceed 7 business days, excluding national holidays, may be granted based on documentation submitted by the Contractor.

b. DBE prime Contractors may receive credit toward the DBE goal for work performed by his/her own forces and work subcontracted to DBEs. A DBE prime must make a good faith effort to meet the goals. In the event a DBE prime subcontracts to a non-DBE, that information must be reported on Form SMS.4902.

c. A Contractor who cannot meet the contract goal, in whole or in part, shall make adequate good faith efforts to obtain DBE participation as so stated and defined in 49 CFR Part 26, Appendix A. The following is a list of the types of action that may be considered as good faith efforts. It is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.

- Soliciting through all reasonable and available means (e.g. attendance at prebid meetings, advertising, and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the contract. The solicitation must be done within sufficient time to allow the DBEs to respond to it. Appropriate steps must be taken to follow up initial solicitations to determine, with certainty, if the DBEs are interested.

- Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Contractor might otherwise prefer to perform the work items with its own forces.
- Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
- Negotiating in good faith with interested DBEs to make a portion of the work available to DBE subcontractors and suppliers and select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiations includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.
- A Bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional cost involved in finding and using DBEs is not in itself sufficient reason for a bidders failure to meet the Contract DBE goal as long as such cost are reasonable. Also, the ability or desire of the Contractor to perform the work of the Contract with its own organization does not relieve the Bidder of the responsibility to make good faith effort. Contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.
- Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The Contractor’s standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate cause for the rejection or non-solicitation of bids and the Contractors efforts to meet the project goal.
- Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
- Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.
- Effectively using the services of available minority/women community organizations; minority/women Contractors' groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs.

- If the Program Manager of the OCR determines that the Contractor has failed to meet the good faith effort requirements, the Contractor will be given an opportunity for reconsideration by the Director of the OCR.

d. Should the bidder to whom the contract is conditionally awarded refuse, neglect or fail to meet the DBE goal or comply with good faith effort requirements, the proposal guaranty filed with the bid shall become the property of the state, not as a penalty, but as liquidated damages to the City.

e. The preceding information shall be submitted directly to the Office of Civil Rights, Texas Department of Transportation, 125 E. 11th Street, Austin, Texas 78701-2483.

f. The Contractor shall not terminate for convenience a DBE subcontractor named in the commitment submitted under Section 1.A.3.a, of this Special Provision. Prior to terminating or removing a DBE subcontractor named in the commitment, the Contractor must have a written consent of the City.

g. The Contractor shall also make a good faith effort to replace a DBE subcontractor that is unable to perform successfully with another DBE, to the extent needed to meet the contract goal. The Contractor shall submit a completed Form 4901 "DBE Commitment Agreement", From SMS 4901-T "DBE Trucking Commitment Agreement", or Form SMS.4901-MS "DBE Material & Supplier Commitment Agreement" for the substitute DBE firm(s). Any substitution of DBEs shall be subject to approval by the City. Prior to approving the substitution, the City will request a statement from the DBE concerning it being replaced.

h. The Contractor shall designate a DBE liaison officer who will administer the Contractor's DBE program and who will be responsible for maintenance of records of efforts and contacts made to subcontract with DBEs.

i. Contractors are encouraged to investigate the services offered by banks owned and controlled by disadvantaged individuals and to make use of these banks where feasible.

4. Eligibility of DBEs.

a. The member entities of the TUCP certify the eligibility of DBEs and DBE joint ventures to perform DBE subcontract work on DOT financially assisted contracts.

b. The City maintains the Texas Unified Certification Program DBE Directory containing the names of firms that have been certified to be eligible to participate as DBE's on DOT financially assisted contracts. This Directory is available from the City's OCR. An update of the Directory can be found on the Internet at http://www.dot.state.tx.us/business/tucp/default.htm.

c. Only DBE firms certified at the time commitments are submitted are eligible to be used in the information furnished by the Contractor as required under

Section 1.A.3.a. and 3.g. above. For purposes of the DBE goal on this project, DBEs will only be allowed to perform work in the categories of work for which they are certified.

d. Only DBE firms certified at the time of execution of a contract/subcontract/purchase order, are eligible for DBE goal participation.

5. Determination of DBE Participation. When a DBE participates in a contract, only the values of the work actually performed by the DBE, as referenced below, shall be counted by the prime contractor toward DBE goals:

a. The total amount paid to the DBE for work performed with his/her own forces is counted toward the DBE goal. When a DBE subcontracts part of the work of its contract to another firm, the value of the subcontracted work may be counted toward DBE goals only if the subcontractor is itself a DBE. Work that a DBE subcontracts to a non-DBE firm does not count toward DBE goals.

b. A Contractor may count toward its DBE goal a portion of the total value of the contract amount paid to a DBE joint venture equal to the distinct, clearly defined portion of the work of the contract performed by the DBE.

(1) A Contractor may count toward its DBE goal only expenditures to DBEs that perform a commercially useful function (CUF) in the work of a contract or purchase order. A DBE is considered to perform a CUF when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a CUF, the DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself.

In accordance with 49 CFR Part 26, Appendix A, guidance concerning Good Faith Efforts, contractors may make efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services. Contractors may not however, negotiate the price of materials or supplies used on the contract by the DBE, nor may they determine quality and quantity, order the materials themselves, nor install the materials (where applicable), or pay for the material themselves. Contractors however, may share the quotations they receive from the material supplier with the DBE firm, so that the DBE firm may negotiate a reasonable price with the material supplier.

In all cases, prime or other non-DBE subcontractor assistance will not be credited toward the DBE goal.

(2) A DBE does not perform a CUF if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation.

Consistent with industry practices and the DOT/City's DBE program, a DBE subcontractor may enter into second-tier subcontracts, amounting up to 70% of their contract. Work subcontracted to a non-DBE does not count towards DBE goals. If a DBE does not perform or exercise responsibility for at least 30% of the total cost of its contract with its own work force, or the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, it will be presumed that the DBE is not performing a CUF

(3) A DBE trucking firm (including an owner operator who is certified as a DBE is considered to be performing a CUF when the DBE is responsible for the management and supervision of the entire trucking operation on a particular contract and the DBE itself owns and operates at least 1 fully licensed, insured, and operational truck used on the contract.

(a) The Contractor receives credit for the total value of the transportation services the DBE provides on a contract using trucks it owns, insures, and operates using drivers it employs.

(b) The DBE may lease trucks from another DBE firm, including an owner operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract.

(c) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit for the total value of transportation services provided by non-DBE lessees not to exceed the value of transportation services provided by the DBE-owned trucks on the contract. Additional participation by non-DBE lessees receive credit only for the fee or commission it receives as result of the lease arrangement

(d) A lease must indicate that the DBE has exclusive use of and control over the trucks giving the DBE absolute priority for use of the leased trucks. Leased trucks must display the name and identification number of the DBE.

(4) When a DBE is presumed not to be performing a CUF the DBE may present evidence to rebut this presumption.

(5) Project materials or supplies acquired from an affiliate of the prime contractor can not directly or indirectly (2^{nd} or lower tier subcontractor) be used for DBE goal credit.

c. A Contractor may count toward its DBE goals expenditures for materials and supplies obtained from a DBE manufacturer, provided that the DBE assumes the actual and contractual responsibility for the materials and supplies. Count

expenditures with DBEs for materials or supplies toward DBE goals as provided in the following:

(1) If the materials or supplies are obtained from a DBE manufacturer, count 100% of the cost of the materials or supplies toward DBE goals. (Definition of a DBE manufacturer found at 1A.c.(1) of this provision.)

For purposes of this Section (1.A.c.(1)), a manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.

(2) If the materials or supplies are purchased from a DBE regular dealer, count 60% of the cost of the materials or supplies toward DBE goals.

For purposes of this Section (1.A.5.c.(2)), a regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business:

(A) To be a regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.

(B) A person may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone or asphalt without owning, operating, or maintaining a place of business as provided in the first paragraph under Section 1.A.5.c.(2), if the person both owns and operates distribution equipment for the products. Any supplementing of regular dealers' own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis.

(C) Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not regular dealers within the meaning of Section 1.A.5.c.(2).

(3) With respect to materials or supplies purchased from DBE which is neither a manufacturer nor a regular dealer, count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site, toward DBE goals, provided you determine the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services.
Do not count any portion of the cost of the materials and supplies themselves toward DBE goals.

(4) Count the entire amount of fees or commissions charged by a DBE firm for providing a bona fide service, such as professional, technical, consultant or managerial services, or for providing bonds or insurance specifically required for the performance of a DOT-assisted contract, toward DBE goals, provided you determine the fee to be reasonable and not excessive as compared with fees customarily allowed for similar services.

d. If the Contractor chooses to assist a DBE firm, other than a manufacturing material supplier or regular dealer, and the DBE firm accepts the assistance, the Contractor may act solely as a guarantor by use of a two-party check for payment of materials to be used on the project by the DBE. The material supplier must invoice the DBE who will present the invoice to the Contractor. The Contractor may issue a joint check to the DBE and the material supplier and the DBE firm must issue the remittance to the material supplier. No funds shall go directly from the Contractor to the material supplier. The DBE firm may accept or reject this joint checking arrangement.

The Contractor must obtain approval from the City prior to implementing the use of joint check arrangements with the DBE. Submit to the City, Joint Check Approval Form 2178 for requesting approval. Provide copies of cancelled joint checks upon request. No DBE goal credit will be allowed for the cost of DBE materials that are paid by the Contractor directly to the material supplier.

e. No DBE goal credit will be allowed for supplies and equipment the DBE subcontractor leases from the contractor or its affiliates.

f. No DBE goal credit will be allowed for the period of time determined by the City that the DBE was not performing a CUF. The denial period of time may occur before or after a determination has been made by the City. In case of the denial of credit for non-performance of a CUF of a DBE, the Contractor will be required to provide a substitute DBE to meet the contract goal or provide an adequate good faith effort when applicable.

6. Records and Reports.

a. The Contractor shall submit monthly reports, after work begins, on DBE payments to meet the DBE goal and for DBE or HUB race-neutral participation. Report payments made to non-DBE HUBs. The monthly report is to be sent to the Area Engineer. These reports will be due within 15 days after the end of a calendar month. These reports will be required until all DBE subcontracting or material supply activity is completed. Form SMS.4903, "DBE Progress Report," is to be used for monthly reporting. Form. SMS.4904, "DBE Final Report," is to be used as a final summary of DBE payments submitted upon completion of the project.

The original final report must be submitted to the OCR and a copy must be submitted to the Area Engineer. These forms may be obtained from the City or may be reproduced by the Contractor. The City may verify the amounts

being reported as paid to DBEs by requesting copies of cancelled checks paid to DBEs on a random basis. Cancelled checks and invoices should reference the City's project number.

b. DBE subcontractors and/or material suppliers should be identified on the monthly report by Vendor Number, name, and the amount of actual payment made to each during the monthly period. Negative reports are required when no activity has occurred in a monthly period.

c. All such records must be retained for a period of 3 years following completion of the contract work, and shall be available at reasonable times and places for inspection by authorized representatives of the City or the DOT. Provide copies of subcontracts or agreements and other documentation upon request.

d. Prior to receiving final payment, the Contractor shall submit Form SMS.4904, "DBE Final Report". If the DBE goal requirement is not met, documentation supporting Good Faith Efforts, as outlined in Section 1.A.3.c of this Special Provision, must be submitted with the "DBE Final Report."

e. Provide a certification of prompt payment in accordance with the City's prompt payment procedure to certify that all subcontractors and suppliers were paid from the previous months payments and retainage was released for those whose work is complete. Submit the completed form each month and the month following the month when final acceptance occurred at the end of the project.

7. Compliance of Contractor. To ensure that DBE requirements of this DOT assisted contract are complied with, the City will monitor the Contractor's efforts to involve DBEs during the performance of this contract. This will be accomplished by a review of monthly reports submitted to the Area Engineer by the Contractor indicating his progress in achieving the DBE contract goal, and by compliance reviews conducted on the project site by the City.

The Contractor shall receive credit toward the DBE goal based on actual payments to the DBE subcontractor. The Contractor shall notify the Area Engineer if he/she withholds or reduces payment to any DBE subcontractor. The Contractor shall submit an affidavit detailing the DBE subcontract payments prior to receiving final payment for the contract.

Contractors' requests for substitutions of DBE subcontractors shall be accompanied by a detailed explanation which should substantiate the need for a substitution. The Contractor may not be allowed to count work on those items being substituted toward the DBE goal prior to approval of the substitution from the City.

The prime Contractor is prohibited from providing work crews and equipment to DBEs. DBE Goal credit for the DBE subcontractors leasing of equipment or purchasing of supplies from the prime contractor or its affiliates is not allowed.

When a DBE subcontractor named in the commitment under Section 1.A.3.a. of this Special Provision, is terminated or fails to complete its work on the contract for any reason, the prime contractor is required to make good faith efforts to find another DBE subcontractor to substitute for the original DBE. These good faith efforts shall be directed at finding another DBE to perform at least the same amount of work under the contract as the DBE that was terminated, to the extent needed to meet the contract goal.

A Contractor's failure to comply with the requirements of this Special Provision shall constitute a material breach of this contract. In such a case, the City reserves the right to terminate the contract; to deduct the amount of DBE goal not accomplished by DBEs from the money due or to become due the Contractor, or to secure a refund, not as a penalty but as liquidated damages to the City or such other remedy or remedies as the City deems appropriate.

Forward Form 2371, "DBE Trucking Credit Worksheet," completed by the DBE trucker every month DBE credit is used.

B. Article B. Race-Neutral Disadvantaged Business Enterprise Participation. It is the policy of the DOT that Disadvantaged Business Enterprises (DBE) as defined in 49 CFR Part 26 Subpart A, be given the opportunity to compete fairly for contracts and subcontracts financed in whole or in part with Federal funds and that a maximum feasible portion of the City's overall DBE goal be met using race-neutral means. Consequently, if there is no DBE goal, the DBE requirements of 49 CFR Part 26, apply to this contract as follows:

The Contractor will offer DBEs as defined in 49 CFR Part 26, Subpart A, the opportunity to compete fairly for contracts and subcontractors financed in whole or in part with Federal funds. Race-Neutral DBE and non-DBE HUB participation on projects with no DBE goal shall be reported on Form SMS.4903, "DBE or HUB Progress Report" and submitted to the Area Engineer each month and at project completion. Payments to DBEs reported on Form SMS.4903 are subject to the requirements of Section 1.A.5, "Determination of DBE Participation."

The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

Attachment B

2010 Specifications

SPECIAL PROVISION
Local Government / RMA / Non-Standard Contracts

Disadvantaged Business Enterprise in Federal-Aid Construction

Description. The purpose of this Special Provision is to carry out the U. S. Department of Transportation's (DOT) policy of ensuring nondiscrimination in the award and administration of DOT assisted contracts and creating a level playing field on which firms owned and controlled by individuals who are determined to be socially and economically disadvantaged can compete fairly for DOT assisted contracts. If the Disadvantaged Business Enterprise (DBE) goal is greater than zero, Article A, "Disadvantaged Business Enterprise in Federal-Aid Construction", of this Special Provision shall apply to this contract. If there is no DBE goal, Article B, "Race-Neutral DBE Participation", of this Special Provision shall apply to this contract. The percentage goal for DBE participation in the work to be performed under this contract will be shown on the proposal.

Article A. Disadvantaged Business Enterprise in Federal-Aid Construction.

1. **Policy.** It is the policy of the DOT and the Texas Department of Transportation (henceforth the "Department") that DBEs, as defined in 49 CFR Part 26, Subpart A and the Department's DBE Program, shall have the opportunity to participate in the performance of contracts financed in whole or in part with Federal funds. The DBE requirements of 49 CFR Part 26, and the Department's DBE Program, apply to this contract as follows:

   a. The prime contractor (Contractor) will solicit DBEs through reasonable and available means, as defined in 49 CFR Part 26, Appendix A and the approved DBE Program, or show a good faith effort to meet the DBE goal for this contract.

   b. The Contractor, sub-recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT financially assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Entity deems appropriate subject to review by the Department.

   c. The requirements of this Special Provision shall be physically included in any subcontract.

   d. By signing the contract proposal, the Bidder is certifying that the DBE goal as stated in the proposal will be met by obtaining commitments from eligible DBEs or that the Bidder will provide acceptable evidence of good

faith effort to meet the commitment. The Entity will determine the adequacy of a Contractor's efforts to meet the contract goal, within 10 business days, excluding national holidays, from receipt of the information outlined in this Special Provision under Article A.3, "Contractor's Responsibilities." If the requirements of Article A.3 are met, the conditional situation will be removed and the contract will be forwarded to the Contractor for execution.

2. Definitions.

a. "Department" means the Texas Department of Transportation.

b. "DOT" means the U.S. Department of Transportation, including the Office of the Secretary, and including the operating administrations, i.e. the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Federal Aviation Administration (FAA).

c. "Federal-Aid Contract" is any contract between the Texas Department of Transportation and a Contractor at any tier, or Entity and a Contractor at any tier which is paid for in whole or in part with DOT financial assistance.

d. “Entity” means local government agency, MPO, RMA, etc.

e. "DBE Joint Venture" means an association of a DBE firm and 1 or more other firm(s) to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

f. "Disadvantaged Business Enterprise" or "DBE" means a firm certified through the Texas Unified Certification Program in accordance with 49 CFR Part 26 Subparts D and E.

g. "Good Faith Effort" means efforts to achieve a DBE goal or other requirement of 49 CFR Part 26 Subpart C and this Special Provision which, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement.

h. "Manufacturer" is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.

i. "Regular Dealer" is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.

To be a Regular Dealer, the firm must be an established, regular business that engages in, as its principal business and under its own name, the purchase and sale or lease of the products in question.

A Regular Dealer in such bulk items as steel, cement, gravel, stone, and petroleum products need not keep such products in stock if it owns and operates distribution equipment for the products. Any supplementing of Regular Dealer's own distribution equipment shall be by a long-term lease agreement and not on an ad hoc or contract-by-contract basis. *Brokers, packagers, manufacturers' representatives, or other persons who arrange or expedite transactions shall not be regarded as a Regular Dealer.

***"Broker" is an intermediary or middleman that does not take possession of a commodity or act as a Regular Dealer selling to the public.

j. "Race-neutral DBE Participation" means any participation by a DBE through customary competitive procurement procedures.

k. "Race-conscious" means a measure or program that is focused specifically on assisting only DBEs, including women-owned DBEs.

l. "Texas Unified Certification Program" or "TUCP" provides one-stop shopping to applicants for certification in their region, such that applicants are required to apply only once for a DBE certification that will be honored by all recipients of federal funds in the state. The TUCP by Memorandum of Agreement established six member entities, including TxDOT, to serve as certifying agents for Texas in specified regions. Applicants for DBE certification may be directed to the TUCP internet site for more information at:

//www.txdot.gov/business/business_outreach/tucp.htm

3. Contractor's Responsibilities. These requirements must be satisfied by the Contractor.

a. After conditional award of the contract, the Contractor shall submit a completed Form No.SMS.4901, "DBE Commitment Agreement" for each DBE he/she intends to use to satisfy the DBE goal or a good faith effort to explain why the goal could not be reached, so as to arrive in the Entity's contracting office not later than 5:00 p.m. on the 10th business day, excluding national holidays, after the conditional award of the contract. When requested, additional time, not to exceed seven (7) business days, excluding national holidays, may be granted based on documentation submitted by the Contractor. The Entity shall submit the DBE Commitment Agreement package to the Department's Office of Civil Rights in Austin, Texas not later than 5:00 p.m. on the 30th business day, excluding national holidays, after the conditional award of the contract. The DBE Commitment Agreement package is subject to review, comment and approval by TxDOT prior to and as a condition of execution of the contract.

b. DBE prime contractors who subcontract with DBEs may receive credit toward the DBE goal for work performed by the DBE's own forces and work subcontracted to DBEs. A Contractor must make a good faith effort to meet the goals. In the event a DBE prime subcontracts to a non-DBE, that information must be reported on Form No. SMS.4902. The completed form is provided to the Entity with a copy to the TxDOT District Office responsible for overseeing the project.

c. A Contractor who cannot meet the contract goal, in whole or in part, shall make adequate good faith efforts to obtain DBE participation as so stated and defined in 49 CFR Part 26, Appendix A. The following is a list of the types of action that may be considered as good faith efforts. It is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.

- Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising, and/or written notices) the interest of all certified DBEs who have the capability to perform the work of the contract. The solicitation must be done within sufficient time to allow the DBEs to respond to it. Appropriate steps must be taken to follow up initial solicitations to determine, with certainty, if the DBEs are interested.
- Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Contractor might otherwise prefer to perform the work items with its own forces.
- Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
- Negotiating in good faith with interested DBEs to make a portion of the work available to DBE subcontractors and suppliers and select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiations includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.
- A Bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional cost involved in finding and using DBEs is not in itself sufficient reason for a Bidders failure to meet the Contract DBE goal as long as such cost are reasonable. Also, the ability or desire of the

Contractor to perform the work of the contract with its own organization does not relieve the Bidder of the responsibility to make good faith effort. Contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

- Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The Contractor's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. nonunion employee status) are not legitimate cause for the rejection or non-solicitation of bids and the Contractors efforts to meet the project goal.
- Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
- Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.
- Effectively using the services of available minority/women community organizations; minority/women Contractors' groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs.
- If the Entity determines that the Contractor has failed to meet the good faith effort requirements, the Contractor will be given an opportunity for reconsideration by the TxDOT District Office responsible for overseeing the project. Opportunity for further appeals will be addressed by the TxDOT Office of Civil Rights.

d. Should the Bidder to whom the contract is conditionally awarded refuse, neglect or fail to meet the DBE goal or comply with good faith effort requirements, the Entity can take remedial financial action as provided by the Entity's/Department's rules or practices or reference to 43 TAC §9.56, as a guideline when the Entity does not have uniform rules or practices for non-compliance with the terms of its contracts.

All contract and project information shall be submitted directly to the Entity and with a copy to the TxDOT District or Office responsible to oversee the project.

e. The Contractor shall not terminate for convenience a DBE subcontractor named in the commitment submitted under Article A.3.a. of this Special Provision. Prior to terminating or removing a DBE subcontractor named in the commitment, the Contractor shall make a good faith effort to replace a DBE subcontractor that is unable to perform successfully with another DBE to the extent needed to meet the contract goal. The Contractor shall submit a completed Form No.4901, "DBE Commitment Agreement," and Form No. 2228 "Disadvantaged Business Enterprise (DBE) Request for Substition for the substitute DBE firm(s). Any substitution of DBEs shall be subject to approval by the Entity. Prior to approving the substitution, the Entity will request a statement from the DBE about the circumstances

of its subcontract's termination. The contractor must have a written consent prior to substitution. A copy of all documentation shall be provided to the TxDOT District Office responsible to oversee the project.

f. The Contractor shall designate a DBE liaison officer who will administer the Contractor's DBE program and who will be responsible for maintenance of records, reports, efforts and contacts made to subcontract with DBEs.

g. Contractors are encouraged to investigate the services offered by banks owned and controlled by disadvantaged individuals and to make use of these banks where feasible.

4. Eligibility of DBEs.

a. The member entities of the TUCP certify the eligibility of DBEs and DBE joint ventures to perform DBE subcontract work on DOT financially assisted contracts.

b. The Department maintains the Texas Unified Certification Program DBE Directory containing the names of firms that have been certified to be eligible to participate as DBE's on DOT financially assisted contracts. This Directory is available from the Department's OCR. An update of the Directory can be found on the Internet at

http://www.dot.state.tx.us/business/tucpinfo.htm.

c. Only DBE firms certified at the time commitments are submitted are eligible to be used in the information furnished by the Contractor as required under Article A.3.a. and 3.g. above. For purposes of the DBE goal on this project. DBEs will only be allowed to perform work in the categories of work for which they are certified.

d. Only DBE firms certified at the time of execution of a contract, subcontract, or purchase order are eligible for DBE goal participation.

5. Determination of DBE Participation. When a DBE participates in a contract, only the values of the work actually performed by the DBE, as referenced below, shall be counted by the Contractor toward DBE goals:

a. The total amount paid to the DBE for work performed with the DBE's own forces is counted toward the DBE goal. When a DBE subcontracts part of the work of its contract to another firm, the value of the subcontracted work may be counted toward DBE goals only if the subcontractor is itself a DBE. Work that a DBE subcontracts to a non-DBE firm does not count toward DBE goals.

b. A Contractor may count toward its DBE goal a portion of the total value of the contract amount paid to a DBE joint venture equal to the distinct, clearly defined portion of the work of the contract performed by the DBE.

(1) A Contractor may count toward its DBE goal only expenditures to DBEs that perform a commercially useful function (CUF) in the work of

a contract or purchase order. A DBE is considered to perform a CUF when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a CUF, the DBE must also be responsible, with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material, and installing (where applicable) and paying for the material itself.

A minimum of one CUF Project Site Review (CUFPSR) will be conducted by the Entity using Department Form 2182 on all DBE firms working on the project.

In accordance with 49 CFR Part 26. Appendix A. guidance concerning Good Faith Efforts, Contractors may make efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services. Contractors may not however, negotiate the price of materials or supplies used on the contract by the DBE, nor may they determine quality and quantity, order the materials themselves, nor install the materials (if applicable), or pay for the material themselves. Contractors however, may share the quotations they receive from the material supplier with the DBE firm, so that the DBE firm may negotiate a reasonable price with the material supplier.

In all cases, Contractor or other non-DBE subcontractor assistance will not be credited toward the DBE goal.

(2) A DBE does not perform a CUF if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation.

Consistent with industry practices and the DOT/Department's DBE program, a DBE subcontractor may enter into second-tier subcontracts, amounting up to seventy percent (70%) of their contract. Work subcontracted to a non-DBE does not count towards DBE goals. If a DBE does not perform or exercise responsibility for at least thirty percent (30%) of the total cost of its contract with its own work force, or the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved, it will be presumed that the DBE is not performing a CUF.

(3) A DBE trucking firm who is certified as a DBE is considered to be performing a CUF when the DBE is responsible for the management and supervision of the entire trucking operation on a particular contract and the DBE itself owns and operates at least one (1) fully licensed, insured, and operational truck used on the contract.

(a) The entity shall verify ownership of all trucks prior to commencement of work of the DBE trucking firm.

(b) The Contractor receives credit for the total value of the transportation services the DBE provides on a contract using trucks it owns, insures, and operates with drivers it employs.

(c) The DBE may lease trucks from another DBE firm, including an owner operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract.

(d) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit for the total value of transportation services provided by non-DBE lessees not to exceed the value of transportation services provided by the DBE-owned trucks on its sub-contract. Additional participation by non-DBEs receive credit only for the fee or commission it receives as result of the lease arrangement.

(e) A lease must indicate that the DBE has exclusive use of and control over the trucks giving the DBE absolute priority for use of the leased trucks. Leased trucks must display the name and identification number of the DBE.

(f) The DBE Trucking Firm shall submit Form 2371, "Trucking Credit Worksheet", within 10 calendar days of the end of the month to the Prime Contractor. The prime shall submit a copy of Form 2371 with the DBE Monthly Progress Report.

(4) When a DBE is presumed not to be performing a CUF the TxDOT District Office responsible to oversee the project will be notified. The DBE may present evidence to rebut this presumption.

c. A Contractor may count toward its DBE goals expenditures for materials and supplies obtained from a DBE manufacturer, provided that the DBE assumes the actual and contractual responsibility for the materials and supplies. Count expenditures with DBEs for materials or supplies toward DBE goals as provided in the following:

(1) If the materials or supplies are obtained from a DBE manufacturer, count 100% of the cost of the materials or supplies toward DBE goals. (The definition of a DBE manufacturer is found at Article A.2.h. of this Special Provision.)

(2) If the materials or supplies are purchased from a DBE Regular Dealer, count 60% of the cost of the materials or supplies toward DBE goals. (The definition of a DBE Regular Dealer is found at Article A.2.i. of this Special Provision.)

(3) With respect to materials or supplies purchased from DBE which is neither a manufacturer nor a Regular Dealer, count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the

delivery of materials or supplies required on a job site, toward DBE goals, provided you determine the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services. Do not count any portion of the cost of the materials and supplies themselves toward DBE goals.

(4) Count the entire amount of fees or commissions charged by a DBE firm for providing a bona fide service, such as professional, technical, consultant or managerial services, or for providing bonds or insurance specifically required for the performance of a DOT financially assisted contract, toward DBE goals, provided you determine the fee to be reasonable and not excessive as compared with fees customarily allowed for similar services.

d. Should the DBE firm request assistance in the form of a joint check and the contractor chooses to assist the DBE firm, other than a manufacturing material supplier or Regular Dealer, the Contractor may act solely as a guarantor by use of a two-party check for payment of materials to be used on the project by the DBE. The material supplier must invoice the DBE who will present the invoice to the Contractor. The Contractor may issue a joint check to the DBE and the material supplier and the DBE firm must issue the remittance to the material supplier. No funds shall go directly from the Contractor to the material supplier. The DBE firm may accept or reject this joint checking arrangement.

The Contractor must obtain approval from the Entity, prior to implementing the use of joint check arrangements with the DBE. The Contractor shall submit to the Entity, Joint Check Approval Form 2178 and provide copies of cancelled joint checks to the Entity upon request if the joint check arrangement is approved. No DBE goal credit will be allowed for the cost of DBE materials that are paid by the Contractor directly to the material supplier. A copy of the completed form is to be provided to the TxDOT District Office responsible for overseeing the project.

e. No DBE goal credit will be allowed for supplies and equipment the DBE subcontractor leases from the contractor or its affiliates.

f. No DBE goal credit will be allowed for the period of time determined by the Entity that the DBE was not performing a CUF. The denial period of time may occur before or after a determination has been made by the Entity. In case of the denial of credit for non-performance of a CUF of a DBE, the Contractor will be required to provide a substitute DBE to meet the contract goal or provide an adequate good faith effort when applicable and as required under Article A.3.e.

6. Records and Reports.

a. The Contractor shall submit monthly reports, after work begins, on DBE payments to meet the DBE goal and for DBE race-neutral participation. Report payments made to non-DBE firms. The monthly report is to be

sent to the Entity with a copy to the TxDOT District Office responsible to oversee the project. These reports will be due within fifteen (15) days after the end of a calendar month. These reports will be required until all DBE subcontracting or material supply activity is completed. Form No. SMS.4903, DBE Progress Report, is to be used for monthly reporting. Form No. SMS.4904, DBE Final Report, is to be used as a final summary of DBE payments submitted upon completion of the project. The original final report must be submitted to the Entity with copies to the TxDOT District Office responsible for overseeing the project and to the TxDOT Office of Civil Rights. These forms may be obtained from the Department or may be reproduced by the Contractor. The Entity may verify the amounts being reported as paid to DBEs by requesting copies of cancelled checks paid to DBEs on a random basis. Cancelled checks and invoices should reference the Entity's or Department's project number, as applicable.

b. DBE subcontractors and/or material suppliers should be identified on the monthly report by Vendor Number, name, and the amount of actual payment made to each during the monthly period. Negative reports are required when no activity has occurred in a monthly period.

c. All such records must be retained by the Contractor and the Entity for a minimum of four (4) years following completion of the contract work, and shall be available at reasonable times and places for inspection by authorized representatives of the Department or the DOT operating administration.

d. Prior to receiving final payment, the Contractor shall submit Form No. SMS.4904. DBE Final Report. If the DBE goal requirement is not met, documentation supporting Good Faith Efforts, as outlined in Article A.3.c. of this Special Provision, must be submitted with the DBE Final Report. A copy of the completed form is provided to the TxDOT District Office responsible for overseeing the project.

7. Compliance of Contractor.

a. To ensure that DBE requirements of this DOT financially assisted contract are complied with, the Entity will monitor the Contractor's efforts to involve DBEs during the performance of this contract. This will be accomplished by a review by the Entity of monthly reports submitted to the Entity by the Contractor indicating his progress in achieving the DBE contract goal and by compliance reviews conducted on the project site by the Entity and by the Department, as needed.

b. The Contractor shall receive credit toward the DBE goal based on actual payments to the DBE subcontractor. The Contractor shall notify the Entity if it withholds or reduces payment to any DBE subcontractor. The Contractor shall submit an affidavit detailing the DBE subcontract payments prior to receiving final payment for the contract. Copies of these documents will be provided to the Entity and to the TxDOT District Office responsible for overseeing the project.

c. Contractors' requests for substitutions of DBE subcontractors shall be accompanied by a detailed explanation which should substantiate the need for a substitution. The Contractor may not be allowed to count work on those items being substituted toward the DBE goal prior to approval of the substitution from the Entity.

d. The Contractor is prohibited from providing work crews and equipment to DBEs. DBE Goal credit for the DBE subcontractors leasing of equipment or purchasing of supplies and/or materials from the Contractor or its affiliates is not allowed.

e. When a DBE subcontractor, named in the commitment under Article A.3.a. of this Special Provision, is terminated or fails to complete its work on the contract for any reason, the Contractor is required to make good faith efforts to find another DBE subcontractor to substitute for the original DBE. These good faith efforts shall be directed at finding another DBE to perform at least the same amount of work under the contract as the DBE that was terminated, to the extent needed to meet the contract goal.

f. A Contractor's failure to comply with the requirements of this Special Provision shall constitute a material breach of the contract. In such a case, the Entity or the Department, as appropriate, reserves the right to terminate the contract; to deduct the amount of DBE goal not accomplished by DBEs from the money due or to become due the Contractor, or such other remedy or remedies as the Entity deems appropriate, subject to review by the Department.

Article B. Race-Neutral Disadvantaged Business Enterprise Participation.

1. Policy. It is the policy of the DOT that Disadvantaged Business Enterprises (DBE), as defined in 49 CFR Part 26 Subpart A, be given the opportunity to compete fairly for contracts and subcontracts financed in whole or in part with Federal funds and that a maximum feasible portion of the Department's overall DBE goal be met using race-neutral means.

a. If there is no DBE goal, the DBE requirements of 49 CFR Part 26, apply to this contract as follows:

The Contractor will offer DBEs as defined in 49 CFR Part 26, Subpart A, the opportunity to compete fairly for contracts and subcontractors financed in whole or in part with Federal funds.

b. The Contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT financially assisted contracts. Failure by the Contractor to carry out these

requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Entity deems appropriate, subject to review by the Department.

2. **Reports.** Race-Neutral DBE participation on projects with no DBE goal shall be reported on Form No. SMS.4903, DBE Progress Report and submitted to the Entity each month and at project completion. Copies of payment documents should be sent to the TxDOT District Office responsible for project oversight. Payments to DBE firms are reported on Form No. SMS.4903 are subject to the requirements of Article A.5, "Determination of DBE Participation."

SPECIAL PROVISION

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DETOURS, BARRICADE, WARNING SIGNS, SEQUENCE OF WORK, ETC.

I. SEQUENCE OF CONSTRUCTION

THE CONTRACTOR SHALL PERFORM ALL CONSTRUCTION OPERATIONS ON THE ROADWAYS AND INTERSECTIONS DURING REGULAR DAYLIGHT HOURS EXCEPT FOR WORK DEFINED BY THE PLANS OR THE ENGINEER TO REQUIRE ROAD CLOSURES WILL BE DONE DURING WEEKEND CONSTRUCTION HOURS.

WEEKEND CONSTRUCTION HOURS WILL BE FROM FRIDAY 10:00 PM TO MONDAY 5:00 AM.

THE CONTRACTOR'S PARTICULAR ATTENTION IS DIRECTED TO REQUIREMENTS OF ITEM 7, "LEGAL RELATIONS AND RESPONSIBILITIES", OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES, 2004.

IT IS THE CONTRACTORS RESPONSIBILITY TO IDENTIFY AND LOCATE ALL UTILITIES PRIOR TO CONSTRUCTION OF EACH PHASE.

AT LOCATIONS WHERE BARRIER IS NOT INDICATED AT THE EDGE OF EXCAVATION, ADJACENT TO THE TRAVELED ROADWAY, A MINIMUM 3:1 SIDE SLOPE SHALL BE PLACED AT THE END OF EACH WORKDAY. THE MATERIAL USED SHALL BE TEMPORARY AND SHALL BE SUITABLY COMPACTED FOR A VEHICLE RECOVERY SLOPE.

THE CONTRACTOR SHALL STOP ALL CONSTRUCTION RELATED ACTIVITIES TO PREVENT NOISE FROM INTERFERING WITH FUNERAL SERVICES AT THE FORT SAM HOUSTON CEMETERY AS DETERMINED BY THE ENGINEER. ADEQUATE VEHICULAR ACCESS TO THE CEMETERY FACILITY ESPECIALLY DURING FUNERAL PROCESSIONS WILL BE PROVIDED AT ALL TIMES. CONTRACTOR SHALL COORDINATE WITH FT SAM HOUSTON CEMETERY REPRESENTATIVES THROUGHOUT THE CONSTRUCTION PHASING.

PRIOR TO THE BEGINNING OF EACH PHASE AND STAGE, PLACE ALL TRAFFIC CONTROL DEVICES AND/OR WORK ZONE PAVEMENT MARKINGS AS SHOWN AND/OR AS GIVEN BY THE ENGINEER. PROJECT BARICADES WILL BE INSTALLED REFERENCING TXDOT STANDARD BC SHEETS. CONSTRUCTION WILL NOT BEGIN UNTIL APPROVAL IS GIVEN BY THE ENGINEER.

PORTABLE MESSAGE BOARDS WILL BE USED AS DIRECTED BY THE ENGINEER TO NOTIFY THE PUBLIC OF UPCOMING CONSTRUCTION ACTIVITES.

PROVIDE UNIFORMED, OFF-DUTY LAW ENFORCEMENT OFFICERS WITH MARKED VEHICLES DURING WORK THAT REQUIRES A LANE CLOSURE. THE OFFICER IN MARKED VEHICLES SHALL BE LOCATED AS APPROVED TO MONITOR OR DIRECT TRAFFIC DURING THE CLOSURE. THE METHOD USED TO DIRECT TRAFFIC AT SIGNALIZED INTERSECTIONS SHALL BE AS APPROVED. ADDITIONAL OFFICERS AND VEHICLES MAY BE PROVIDED WHEN APPROVED OR DIRECTED. POLICE OFFICERS WILL BE REQUESTED BY THE ENGINEER TO DIRECT TRAFFIC AS NECESSARY.

UTILITY PHASE:

COMPLETE PROPOSED GAS RELOCATION DURING WEEKEND CONSTRUCTION HOURS USING DAILY LANE CLOSURES AND REFERENCING TRAFFIC CONTROL SHEET STANDRDS TCP (2-1)-98 AND TCP (2-3)-03. STORM SEWER LINES (SN-17 AND SN-19B) AND WATER LINE CROSSINGS (16" AND 20") WITHIN THE PROPOSED HARRY WURZBACH PHASE 1 STAGE 1 DETOUR WILL BE COMPLETED SIMULTANIOUSLY WITH THE PROPOSED GAS LANE CLOSURE WORK PRIOR TO COMMENCING PHASE 1 STAGE 1. RESTORE PAVEMENT USING FLOWABLE FILL, PLACE STEEL PLATES, AND OPEN TO TRAFFIC

PHASE 1 STAGE 1:

PRIOR TO THE BEGINNING OF THIS PHASE, PLACE ALL TEMPORARY TRAFFIC SIGNALS AT BURR RD, WINANS RD, AND RITTIMAN RD AS SHOWN ON THE PLANS. CONSTRUCTION WILL NOT BEGIN UNTIL APPROVAL IS GIVEN BY THE ENGINEER.

OBLITERATE A PORTION OF THE EXISTING CONCRETE ISLAND AT RITTIMAN RD AND CONSTRUCT TEMPORARY PAVEMENT IN ITS PLACE AS SHOWN ON THE PLAN(S).

CONSTRUCT TEMPORARY WIDENING ALONG RIGHT SIDE OF EXISTING EOP OF HARRY WURZBACH FROM STA 55+97.35 TO STA 77+03.79, FROM STA 77+66.30 TO STA 16+76.54 (RITT ALIGN), AND FROM STA 80+38.52 TO STA 87+27.08 AS SHOWN IN THE PLAN(S).

CONSTRUCT TEMPORARY WIDENING ON HARRY WURZBACH AT EXISTING MEDIAN FROM STA 74+37.88 RT TO STA 77+19.92 RT, FROM 80+23.06 RT TO STA 83+52.91 RT, 83+96.26 RT TO STA 88+88.35 LT, STA 89+21.55 LT TO STA 94+04.36 LT, AND FROM STA 94+35.49 TO STA 96+07.12 LT AS SHOWN IN THE PLAN(S).

CONSTRUCT TEMPORARY WIDENING ALONG THE RIGHT SIDE OF EXISTING EOP OF RITTIMAN RD FROM STA 17+38.36 RT TO STA 22+39.62 RT AS SHOWN IN THE PLAN(S).

DETOUR TRAFFIC ON HARRY WURZBACH AND ON RITTIMAN RD AS SHOWN ON THE PLAN(S) FOR THE CONSTRUCTION OF THE ROAD WORK AND UTILITIES.

PRIOR TO CONSTRUCTION OF THE STORM SEWER, RELOCATE EXISTING 16" WATER LINE ALONG RITTIMAN RD FROM STA 21+49.70 TO THE COMPLETED UTILITY PHASE LIMITS AND 20" WATER LINE FROM STA 15+99.29 TO STA 14+34.63.

COMPLETE WATER LINE WITHIN THE LIMITS OF CONSTRUCTION TCP PHASE 1 STAGE 1 CONSTRUCTIO WORKZONE.

DURING WEEKEND CONSTRUCTION HOURS CLOSE WB APPROACH AND EB DEPARTURE OF THE RITTIMAN HARRY WURZBACH INTERSECTION TO ALLOW OPEN CUT CONSTRUCTION OF STORM SEWER LINE SN-29B ACROSS RITTIMAN. PRIOR TO INSTALLATION OF PROPOSED STORM SEWER LINE CONTACT AT&T TO CONCRETE ENCASE EXISTING FACILITIES. CONTRACTOR TO SCHEDULE CONRETE ENCASEMENT WITH AT&T A MINIMUM OF 3 WEEKS PRIOR TO INSTALLATION. TRAFFIC WILL BE DETOUR AS SHOWN ON ROAD CLOSURE DETOUR SHEET UNDER TCP PHASE 1 STAGE 1 EASTBOUND AND ESTBOUND RITTIMAN RD UTILITY TRENCH CONSTRUCTION DETOUR. REMOVE EXISTING CULVERT HEADWALL AT STA 17+76.19, 43.35' RT AND PORTION OF EXISTING CULVERT AND INSTALL STORM SEWER LINE SN-29B. RESTORE PAVEMENT USING FLOWABLE FILL AND STEEL PLATES AND OPEN BACK UP TO TRAFFIC.

PRIOR TO INSTALLATION OF PROPOSED STORM SEWER LINE SN-28 CONTACT AT&T TO CONCRETE ENCASE EXISTING FACILITIES. CONTRACTOR TO SCHEDULE CONRETE ENCASEMENT WITH AT&T A MINIMUM OF 3 WEEKS PRIOR TO INSTALLATION.

PRIOR TO INSTALLATION OF PROPOSED STORM SEWER LINE CONTACT AT&T TO CONCRETE ENCASE EXISTING FACILITIES. CONTRACTOR TO SCHEDULE CONRETE ENCASEMENT WITH AT&T A MINIMUM OF 3 WEEKS PRIOR TO INSTALLATION. INSTALL LINE SN-29C AND SN-2BD TO MAINTAIN TEMPORARY DRAINAGE. CAP THE EXISTING STRUCTURE (LOCATED AT APPROXIMATELY STA. 17+76.19, 43.35' RT) AT BOTH ENDS.

INSTALL STORM SEWER LINES SN-29A, SN-18 AND THE REMAINING PORTIONS OF SN-19B AND SN-17 (SEE UTILITY PHASE).

INSTALL STORM SEWER LINES SN-45, SN-16B, SN-17B, SN-16A, SN-15, SN-14, SN-13, SN-12B, SN-40, SN-12, SN-11, SN-9, SN-08B, SN-36, SN-08A2, SN-39, SN-08A, SN-07, SN-06, SN-05, SN-04B, SN-35, SN-04A2, SN-38, SN-04A, SN-03, SN-01, SN-34, SN-43, SN-23, SN-24, AND SN-46. LOCAL RESIDENTIAL STREETS WILL BE CLOSED DURING THE CONSTRUCTION OF THE STORM SEWER AND ROAD IMPROVEMENTS AND TRAFFIC WILL BE DETOURED AS SHOWN IN ROAD CLOSURE DETOUR SHEETS FOR PHASE 1 STAGE 1.

INSTALL STORM SEWER LINE SN-21 AND TEMPORALLY CAP INLET CI 21, CI 20, AND SN-21 AS SHOWN IN THE PLANS UNTIL PHASE 2 CONSTRUCTION.

DETOUR TRAFFIC DURING WEEKEND CONSTRUCTION HOURS AS SHOWN UNDER THE ROAD CLOSURE DETOUR TCP PHASE 1 STAGE 1 SHEET(S) TO CONSTRUCT STORM SEWER AND PROPOSED ROADWAY AT MORNINGSIDE DR, WILTSHIRE AVE, AND CANTERBURY HILL ST. ADJACENT STREETS WILL NOT BE ALLOWED TO BE CLOSE SIMULTANEOUSLY BUT ALTERNATING STREET CLOSURES WILL BE ALLOWED.

PHASE 1 STAGE 2

THIS PHASE IS TO BE COMPLETED DURING WEEKEND CONSTRUCTION HOURS CONSTRUCTION.

DETOUR TRAFFIC AS SHOWN ON TCP/SW3P LAYOUT PHASE 1 STAGE 2 SHEET(S) AND ROAD CLOSURE TCP PHASE 1 STAGE 2 SHEET(S) AND CONSTRUCT FULL DEPTH PAVEMENT.

PHASE 1 STAGE 3

THIS PHASE IS TO BE COMPLETED DURING WEEKEND CONSTRUCTION HOURS CONSTRUCTION.

DETOUR TRAFFIC AS SHOWN ON TCP/SW3P LAYOUT PHASE 1 STAGE 3 SHEET(S) AND ROAD CLOSURE TCP PHASE 1 STAGE 3 SHEET(S) AND CONSTRUCT FULL DEPTH PAVEMENT.

INTERPHASE TRAFFIC SWITCH

DETOUR TRAFFIC AS SHOWN ON TCP/SW3P LAYOUT PHASE INTERPHASE SHEET(S) AND CONSTRUCT FULL DEPTH PAVEMENT.

ADJUST TEMPORARY TRAFFIC SIGNAL HEADS ACCORDINGLY.

PHASE 2 STAGE 1

PRIOR TO BEGINNING OF PHASE II, ADJUST TEMPORARY TRAFFIC SIGNALS AT BURR RD AND WINANS DR. AS SHOWN ON THE PLANS.

AT RITTIMAN RD, THE PHASE 1 TEMPORARY TRAFFIC SIGNAL SHALL BE LEFT IN PLACE AND UTILIZED UP UNTIL THE BEGINNING OF PHASE 2. AFTER THE COMPLETION OF THE PHASE 2 STAGE 1 TRAFFIC SWITCH ALONG RITTIMAN RD, THE CONTRACTOR SHALL INSTALL THE PHASE 2 TEMPORARY TRAFFIC SIGNAL AS SHOWN ON THE PLANS. HOWEVER, IT SHOULD BE NOTED THAT THE PHASE 2 TEMPOARY TRAFFIC SIGNAL AT RITTIMAN RD WILL REQUIRE PORTIONS OF THE PERMANENT TRAFFIC SIGNAL TO BE INSTALLED AND OPERATIONAL; THIS WORK SHALL BE COMPLETED DURING PHASE 1.

DETOUR TRAFFIC AND CONSTRUCT ROADWAY ON HARRY WURZBACH, BURR RD, WINANS RD AND RITTIMAN RD AS SHOWN ON THE PLANS.

PRIOR TO INSTALLATION OF STORM SEWER RELOCATE AT&T AND CONCRETE ENCASE DUCTS. CONTRACTOR TO SCHEDULE RELOCATION WITH AT&T A MINIMUM OF 3 WEEKS PRIOR TO INSTALLATION. INSTALL STORM SEWER LINE SN-20, SN-44, AND SN-19A AS SHOWN IN THE PLAN(S)

OBLITERATE THE EXISTING CONCRETE ISLAND AT WINANS RD AND CONSTRUCT TEMPORARY PAVEMENT IN ITS PLACE AS SHOWN ON THE PLAN(S).

CONSTRUCT TEMPORARY WIDENING ON WINANS RD FROM STA 11+87.59 RT TO STA 15+97.75 RT AND FROM STA 12+93.11 LT TO STA 15+95.97 LT AS SHOWN IN THE PLAN(S). DETOUR TRAFFIC AND CONSTRUCT ROADWAY ON WINANS RD AS SHOWN ON THE PLAN(S).

PHASE 2 STAGE 2

DETOUR TRAFFIC AND CONSTRUCT ROADWAY ON BURR RD AND WINANS RD WHILE THE DETOUR IS MAINTAINED ON HARRY WURZBACH PER PREVIOUS PHASE.

PHASE 3 - FINAL SURFACE

UPON COMPLETION OF PHASE 2, THE CONTRACTOR MAY PROCEED WITH THIS PHASE. PRIOR TO THE BEGINNING OF THIS PHASE, PLACE ALL TRAFFIC CONTROL DEVICES AND WORK ZONE PAVEMENT MARKINGS AS SHOWN AND/OR AS GIVEN BY THE ENGINEER. CONSTRUCTION WILL NOT BEGIN UNTIL APPROVAL IS GIVEN BY THE ENGINEER.

FINAL STAGE

PLACE FINAL OVERLAY AND PERMANENT PAVEMENT MARKINGS, MARKERS, AND SIGNS AND PROJECT LIMITS UTILIZING TCP (3-1)-98.

CONSTRUCT THE FINAL SURFACE AND FINAL PAVEMENT MARKINGS THROUGHOUT THE ENTIRE PROJECT LIMITS AS SHOWN ON PLANS. ERECT PERMANENT SIGNS.

II. FINAL CLEAN UP

UPON COMPLETION OF THE WORK AND BEFORE FINAL ACCEPTANCE IS MADE, THE PROJECT WILL BE THOROUGHLY CLEANED OF ALL CONSTRUCTION MATERIALS AND ALL STOCKPILE LOCATIONS.

UPON COMPLETION OF THE WORK AND BEFORE FINAL ACCEPTANCE IS MADE, SHAPE AND FINISH SUCH PORTIONS OF THE RIGHT-OF-WAY WHICH MAY HAVE BEEN DISTRIBUTED IN MAKING THE PROVISION FOR TRAFFIC. LEAVE THE ENTIRE RIGHT-OF-WAY IN A SMOOTH, NEAT AND SIGHTLY CONDITION.

III. PAYMENT

ALL BARRICADES, SIGNS, AND OTHER ADDITIONAL SIGNS AND BARRICADES AS DIRECTED BY THE ENGINEER WILL NOT BE PAID FOR DIRECTLY BUT WILL BE SUBSIDIARY TO ITEM 502 "BARRICADES, SIGNS, AND TRAFFIC HANDLING."

ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE PAID FOR UNDER ITEM 506 "TEMPORARY EROSION, SEDIMENT, AND ENVIRONMENTAL CONTROLS."

ALL NECESSARY FLAGGERS AND APPROPRIATE SIGNING TO SAFELY GUIDE TRAFFIC WILL NOT BE PAID FOR DIRECTLY BUT BE SUBSIDIARY TO ITEM 502 "BARRICADES, SIGNS AND TRAFFIC HANDLING."

ALL WORK AND MATERIALS REQUIRED FOR WORK ZONE PAVEMENT MARKINGS WILL BE PAID FOR UNDER ITEM 662 "WORK ZONE PAVEMENT MARKINGS."

ALL OTHER WORK AND MATERIALS REQUIRED BY THESE PROVISIONS WILL NOT BE PAID FOR DIRECTLY, BUT WILL BE CONSIDERED SUBSIDIARY TO THE VARIOUS BID ITEMS OF THE CONTACT, UNLESS OTHERWISE INDICATED IN THE PLANS OF SPECIFICATIONS.

IV. GENERAL NOTES

1) REFER TO THE BARRICADES, SIGNS & TRAFFIC HANDLING SHEET FOR APPLICABLE QUANTITIES, NOTES, AND OTHER INFORMATION.

2) REFER TO BARRICADE DETAILS SHEET FOR SIGN MOUNTING REQUIREMENTS.

3) SIGNS CANNOT BE MOUNTED ON BARRICADES.

4) ALL EXISTING TRAFFIC CONTROL SIGNS SHOULD BE MOUNTED ON PORTABLE STANDS AND ADJUSTED AS NECESSARY DURING THE PROJECT AND SHOULD BE SUBSIDIARY TO ITEM 502 - BARRICADES.

5) ALL TRAFFIC CONTROL WORK SHOULD BE IN ACCORDANCE WITH THE LATEST VERSION OF THE TEXAS MANUAL OF UNIFORM TRAFFIC.

6) REFERENCE TXDOT TCP(2-3)-03 AND (2-5)-03 FOR WORK ZONE SIGN AND DELINEATION

SPECIAL PROVISION

001---015--CoSA

Definition of Terms

For this project, Item 001, "Definition of Terms," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

The following Articles are voided and replaced by the following:

1.34. Disadvantaged Business Enterprise (DBE). A small business certified through the Texas Unified Certification Program in accordance with 49 CFR Part 26, that is at least 51% owned by one or more socially and economically disadvantaged individuals, or in the case of a publicly owned business, in which is at least 51% of the stock is owned by one or more socially and economically disadvantaged individuals, and whose management and daily business operations are controlled by one or more of the individuals who own it.

1.85. Subcontractor. A Subcontractor is defined as an individual, partnership, limited liability company, corporation, or any combination thereof that the Contractor sublets, or proposes to sublet, any portion of a Contract, excluding a material supplier, a hauling firm hauling only from a commercial source to the project, truck owner-operator, wholly owned subsidiary, or specialty-type businesses such as security companies and rental companies.

This Item is supplemented by the following:

1.105. Additive Alternate. A bid item contained in a proposal that is not a regular item or a designated alternate bid item. The additive alternate item(s) include work that may be added to the base bid work.

1.106. Base Bid. The total bid (includes regular bid items or corresponding alternate bid items if lower) amount without additive alternates.

1.107. Affiliates. Two or more firms are affiliated if:

- they share common officers, directors, or stockholders;
- a family member of an officer, director, or stockholder of one firm serves in a similar capacity in another of the firms;
- an individual who has an interest in, or controls a part of, one firm either directly or indirectly also has an interest in, or controls a part of, another of the firms;

- the firms are so closely connected or associated that one of the firms, either directly or indirectly, controls or has the power to control another firm;

- one firm controls or has the power to control another of the firms; or,

- the firms are closely allied through an established course of dealings, including but not limited to the lending of financial assistance.

1.68. Bid Proposal. The offer of the bidder for performing the work described in the plans and specifications including any changes made by addenda.

1.69. Bid Proposal Guaranty. The security furnished by the bidder as a guaranty that the bidder will enter into a contract if awarded.

1.108. Family Member. A family member of an individual is the individual's parent, parent's spouse, step-parent, step-parent's spouse, sibling, sibling's spouse, spouse, child, child's spouse, spouse's child, spouse's child's spouse, grandchild, grandparent, uncle, uncle's spouse, aunt, aunt's spouse, first cousin, or first cousin's spouse.

SPECIAL PROVISION

003---033--CoSA

Award and Execution of Contract

For this project, Item 003, "Award and Execution of Contract," of the Standard Specifications, is amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed.

Article 3.6. Bonds. The first paragraph is supplemented by the following:

Sample versions of the standard performance and payment bonds may be viewed on the department's Internet site at:

http://www.txdot.gov/txdot_library/consultants_contractors/forms/contractors.htm

SPECIAL PROVISION

004---017--CoSA

Scope of Work

For this project, Item 4, "Scope of Work," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 4.2. Changes in the Work. The first paragraph is supplemented by the following:

The Contractor is responsible for notifying the sureties of any changes to the contract.

Article 4.2. Changes in the Work. The sixth paragraph is voided and replaced by the following:

When the quantity of work to be done under any major item of the Contract is less than 75% of the original quantity stated in the Contract, then either party to the Contract may request an adjustment to the unit price. When mutually agreed, the unit price may be adjusted by multiplying the Contract unit price by the factor in Table 1. If an adjusted unit price cannot be agreed upon, the Engineer may determine the unit price by multiplying the Contract unit price by the factor in Table 1.

Table 1
Quantity-Based Price Adjustment Factors

% of Original Quantity	Factor
≥ 50 and < 75	**1.05**
≥ 25 and < 50	**1.15**
< 25	**1.25**

Article 4.4. Requests and Claims for Additional Compensation, Section A., Delay Claims is voided and replaced by the following:

A. Damages. Damages occur when impacts that are the responsibility of the City result in additional costs to the contractor that could not have been reasonably anticipated at the time of letting. Costs of performing additional work are not considered damages. For contractor damages, the intent is to reimburse the Contractor for actual expenses arising out of a compensable impact. No profit or markups, other than labor burden, will be allowed. For damages, labor burden will be reimbursed at 35% unless the Contractor can justify higher actual cost. Justification for a higher percentage must be in accordance with the methodology provided by the City, submitted separately for project overhead labor and direct labor, and determined and submitted by a Certified Public Accountant (CPA). Submit CPA-prepared labor burden rates directly to the Contract Letting and Contractor Prequalification Branch of the Construction Division.

1. **Delay Damages.** If the Contractor requests compensation for delay damages and the delay is determined to be compensable, then standby equipment costs and project overhead compensation will be based on the duration of the compensable delay and will be limited as follows:

   a. **Standby Equipment Costs.**

      - Standby costs will not be allowed during periods when the equipment would have otherwise been idle.
      - No more than 8 hr. of standby will be paid during a 24-hr. day, nor more than 40 hr. per week, nor more than 176 hr. per month.
      - For Contractor-owned equipment, standby will be paid at 50% of the rental rates found in the Rental Rate Blue Book for Construction Equipment and calculated by dividing the monthly rate by 176 and multiplying by the regional adjustment factor and the rate adjustment factor. For leased equipment on standby, 100% of the invoice cost of the leased equipment will be paid. Operating costs will not be allowed.

   b. **Project Overhead.** Project overhead is defined as the administrative and supervisory expenses incurred at the work locations. When delay to project completion occurs, reimbursement for project overhead for the prime contractor will be made using the following options:

      - reimbursed at 6% (computed as daily cost by dividing 6% of the original contract amount by the as-let number of working days) or
      - actual documented costs for the impacted period.

      Project overhead for delays impacting sub-contractors will be determined from actual documented costs submitted by the Contractor.

      The granting of time extensions and suspensions alone will not be justification for reimbursement for project overhead.

   c. **Home Office Overhead.** The City will not compensate the Contractor for home office overhead.

Article 4.4. Requests and Claims for Additional Compensation, Section B., Dispute or Claims Procedure is voided and replaced by the following:

B. Dispute or Claims Procedure. Work with the Engineer to resolve or escalate all issues in accordance with the procedures outlined at the pre-construction conference. Establish with the Engineer an issue escalation ladder and adhere to the following:

1. **Project Pledge.** At a minimum, Contractor representatives at the level of foreman and above will certify in writing they will approach the construction of this project in a manner consistent with delivering a high quality project in a safe, cost-effective, and timely manner, and they will be committed to not allowing personality conflicts or personal interests to interfere with providing the public with a quality project. Failure to uphold this commitment may result in grounds for removal from the project by the District Engineer.

2. **Issue Resolution Process.** An issue is any aspect of the contract where representatives of the participants in the contract do not agree. The individuals identified at the lowest level of the issue escalation ladder will initiate the issue resolution process by escalating any issue that remains unresolved within the time frame outlined in the issue escalation ladder.

   Use the City's automated issue tracking system to submit and track issues escalated to the area engineer or above. Do not use the automated issue tracking system for routine issues resolved on the project.

   Once the issue is recorded in the automated issue tracking system, the issue will be escalated to the district engineer within 15 calendar days.

   The district engineer will issue written direction within 7 calendar days.

Work with the district to resolve all issues during the course of the contract. In the event the district and the Contractor cannot resolve an issue, the Contractor may file a contract claim after the completion of the contract to be handled in accordance with the City's contract claim procedure. Contract claims will not be presented to the Contract Claims Committee for consideration prior to the final payment to the Contractor. It is the Contractor's responsibility to prove or justify all claims and requests in a timely manner.

The deadline for filing a claim in accordance with 43 TAC Section 9.2, is the earlier of 1 year after the date of final acceptance, date of default, or date of termination except that claims for warranty enforcement can be made up to 1 year after expiration of the warranty period.

SPECIAL PROVISION
006---CoSA
Control of Materials

For this project, Item 006 "Control of Materials," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 6.10. Hazardous Materials.

If/When the Contractor encounters existing materials within the project limits or in required material sources that are suspected by visual observation or overt odors to contain hazardous materials/waste, immediately notify the CoSA representative.

a. The Contractor is responsible for all work within the limits identified in the Waste Management Plan (WMP). Item 416, "Excavation Area", related work within the limits of the WMP shall be measured and paid for as specified under the respective items. Within the limits of the WMP, field screening tests of soil for contamination; construction equipment decontamination costs; other items, that involve handling contaminated soil or water, if necessary; contaminated wastewater storage, contaminated water dewatering; and, any hazardous materials/waste collection, handling, storage, and transportation costs shall be paid for under Contractor, Force Account.

b. CoSA will be responsible for the testing and disposition of hazardous materials/waste, except as noted in **a.** above, related to work within the limits of the WMP.

The CoSA representative may suspend the work wholly or in part during the testing, removal or disposition of hazardous materials/waste.

This Item is supplemented by the following:

Article 6.11. Waste Management Plan.

1.0 Overview

Construction of the planned stormdrain and water improvements for this project will require monitoring and management of potential Volatile Organic Compounds (VOCs) impacted soils. The environmental subsurface investigation was conducted by the City of San Antonio, Environmental Management Division (EMD) consultant to determine the absence or presence of hydrocarbon released from former gasoline service station operations at Money Mart Pawn Shop, located at 2403 Harry Wurzbach between Station Numbers 14+95 and 15+49 and between Station Numbers 80+23.18 and 80+50.80. A subsurface investigation was also conducted to determine the absence or presence of VOCs from a former drycleaners located at 923/927

Rittiman Road near the intersection of Rittiman Road and Harry Wurzbach, between Station Numbers 14+95 and 15+49 and between Station Numbers 80+23.18 and 80+50.80. Results of this investigation identified VOCs between 13' and 14'below ground surface (bgs) in the subsurface soils within the project limits as described in Tables 1 and 2, and as shown in the Plan figure 2). Subsurface utility crossings of the area of concern are identified in Figure 2 and Figure 3 of the Plans.

Contaminated soils encountered in the project limits may be categorized as special waste. VOC waste contaminants may be encountered in subsurface soils generated by construction activities. All potentially impacted soils must be managed according to applicable environmental rules, regulations, and the guidelines set forth in this plan. Construction practices must comply with all applicable regulations concerning the prevention of storm water pollution, as detailed in the project's Storm Water Pollution Prevention Plan (SWP3).

CoSA or their designated representatives shall be on site to confirm field-screening of excavated soils conducted by the Contractor's Representative. Monitoring of excavations will cease outside the limits unless contamination is detected. Field Screening activities will consist of soils inspection, incidental odors, and use of Photo Ionization Detector (PID).

CoSA shall be notified immediately when suspect contaminated soils and/or groundwater are encountered at locations not identified in this report. The notification should include the station number, type of contaminated media, evidence of contamination, and measures taken to contain the contaminated media and prevent public access. Contaminated soil and/or groundwater shall not be removed from the location without prior approval.

Soils excavated from areas not addressed in this report and that do not exhibit signs of contamination shall be handled as non-contaminated material and managed separately from suspect contaminated soils.

Surface intrusion water within the Area of Concern as described in Table 1, Table 2, and as shown in the Plans will require management in accordance with the waste practices described in this WMP.

Soils, sediments, or surface intrusion water from potentially contaminated areas will not become the property of the Contractor.

2.0 Site Contaminants and Concentrations.

Table 1 identifies the contaminant of concern by location and media with the approximate limits identified by station number. Table 2 identifies the analytical information for the Area of Concern. A soil vapor survey was not performed during this investigation.

TABLE 1

PROJECT DATA SUMMARY
Environmental Data
Fort Sam Transportation Projects: San Antonio, Texas

AOC 1	From Station No.	To Station No.	Location	Contamination	Contaminant Type On-Site Monitoring Required
				Groundwater / Soil	
1) Former Dry Cleaner Vacant Clothing store 923/927 Rittiman Road	*14+95	* 15+49	Adjacent to a former Dry Cleaners	Yes 8 ft bgs / Yes 13-14 ft bgs	Special Waste/ Yes

* See Exhibit Nos. 1, 2, and 3 for specific station numbers and estimated quantity

TABLE 2

PROJECT CONTAMINATION RESULTS
(Maximum Concentrations)
Fort Sam Transportation Projects: San Antonio, Texas, San Antonio, Texas

	AOC 1 Soil (mg/kg)	**Soil Impacted depth**	**AOC 1** Groundwater (mg/L)	**Groundwater impacted depth**
TPH, TX1005, C6-C12	**BRL**	**13'-14'**	**7.13**	**8'**
TPH, TX1005, >C12-C28	**BRL**	**13'-14'**	**BRL**	**8'**
TPH, TX1005, >C28-C35	**BRL**	**13'-14'**	**10.8**	**8'**
TPH, TX1005, >C6-C35	**BRL**	**13'-14'**	**BRL**	**8'**
Butylbenzene	**0.133**	**13'-14'**	**0.041**	**8'**
secButlybenzene	**0.056**	**13'-14'**	**0.018**	**8'**
Isopropylbenzene	**0.145**	**13'-14'**	**0.087**	**8'**
Propylbenzene	**0.279**	**13'-14'**	**0.147**	**8'**
Acetonitrile	**0.018**	**13'-14'**	**BRL**	**8'**
Napthalene	**0.015**	**13'-14'**	**BRL**	**8'**

BRL – Below Reporting Limits

3.0 Soil Management Procedures within Contaminated Locations.

These procedures are applicable to the locations identified in Table 1. The best available engineering controls shall be utilized to minimize potential on-site and off-site impacts to human health and the environment from construction in locations with known or suspected contamination. Management of this waste shall be governed at a minimum by the following management procedures and guidelines.

CoSA or their designated representatives shall be on site to confirm field-screening of excavated soils conducted by the Contractor's Representative. The field screening activities shall be conducted during the excavation activities throughout the Area of Concern. Monitoring excavations will cease outside the limits unless contamination is detected. Field Screening activities will consist of soils inspection, incidental odors, and using a field-screening device.

Area of Concern 1 as described in Table 1, Table 2, and as shown in the Plans (figures 1 and 2). Soils removed from the excavation area from 13' bgs to 14' bgs are considered impacted. Soils above 13 feet, including asphalt, sub-base material, and soil, are deemed clean. However, asphalt material is a regulated material and shall be disposed of according to all applicable regulations. Excavation, loading, transporting, and disposal of the impacted soils should be conducted by a specialty contractor. A specialty contractor is employed by CoSA. A minimum of a one-week notification for scheduling of the Specialty Contractor is required. Daily schedules will be coordinated in a preconstruction conference prior to excavation in this location and as construction progresses.

All excavated soil shall be appropriately managed in accordance with this Waste Management Plan. No unprotected, excavated contaminated soils shall remain on site at the end of the workday without CoSA approval. Excavations shall be opened and closed within the same working day to minimize surface water contact with potentially contaminated soils. Excavations that are left open overnight with CoSA approval shall be bermed to prevent run-on and controlled (i.e. fencing, trench covers, warning signs, barricades) to prevent public access.

4.0 Groundwater Management and Surface Water Intrusion Procedures.

The maximum concentrations of constituents detected in the groundwater samples within the project limits are presented in Table 2. Constituents were detected in the groundwater sample adjacent to the ROW. Depth to groundwater within the proposed construction may vary with seasonal changes. Groundwater was encountered during environmental investigation of the site at a depth of 8ft. below ground surface in the area of concern.

Groundwater removed from any location within the impacted Area of Concern identified in Table 1 may potentially contain Volatile Organic Compounds (VOCs), Total Petroleum Hydrocarbons (TPH) and must be collected, containerized, and tested to determine disposal options.

All surface intrusion water, including water from broken water lines in contact with soils within the AOC, shall be collected, transported, and managed in an appropriate tank provided by the contractor, as approved. CoSA will be responsible for testing and disposal of impacted water. Pumps and tanks shall be decontaminated by the Contractor before reuse at other impacted locations or clean locations.

A secured temporary storage tank area shall be located within the project limits for a minimum of one 6,500-gallon temporary storage tank. This tank shall be of sufficient capacity to handle and segregate the volume of construction-generated wastewater. The tank shall be placed on pavement or a liner of PVC, LLPDE, HDPE, or a product approved to prevent spills from making contact with soils. Tank leaks shall be repaired immediately. The secured temporary storage tank area will require a management plan to prevent surface water from entering the tank

area and to contain any minor spills from wastewater handling. This Plan and secured tank storage location must be submitted to the Engineer in writing for approval.

The contractor shall notify CoSA when the capacity of the tank is estimated at 75% of capacity. Upon notification, CoSA shall perform analysis of the tank contents. Non-contaminated, non-sediment laden water may be discharged into the CoSA storm sewer system. CoSA shall dispose of contaminated water. Estimated time for analysis and disposal is two weeks.

5.0 Stormwater Pollution Prevention (SWP3) Requirements.

These requirements for an SWP3 herein as presented to prevent degradation of receiving waters in accordance with the planned construction activities to comply with Federal, State and local regulations. Review, understand, implement and inspect both the general SWP3 and the following additional SWP3 requirements presented below for the contaminated locations and associated staging areas identified in this section.

The following SWP3 requirements are specific to construction activities that will occur within all locations identified in Table 1. This subsection describes construction practices within the contaminated locations, soil stockpile, and water containment areas and specific requirements for locations identified as potentially containing contaminated wastes.

Decontamination procedures shall be selected and implemented by the Contractor. Decontamination measures shall be incorporated into the SWP3. Decontamination of equipment must be conducted prior to moving from a suspect contaminated area to a non-contaminated area.

Limit tracking soil from contaminated areas into non-contaminated areas by minimizing wet soil removal operations. Construct a decontamination pad or a method of decontamination that will be used to prevent offsite tracking of contaminants during construction activities. Remove excess soil from equipment and trucks prior to exiting contaminated locations either by dry decontamination or by cleaning at a decontamination pad with a pressure washer. Dry decontamination methods, i.e., using a broom to remove visible soil, are preferred. If wet methods are employed, utilize methods to minimize waste generation and contain all fluids from running off the site.

The contractor is required to document decontamination of heavy equipment when moving from a suspect contaminated to a non-contaminated area. Soils from potential impacted areas shall not be tracked on roadways. Any soils tracked onto roadways shall be immediately removed. These decontamination wastes shall be placed into appropriate containers for characterization and profiling prior to final disposal. The Contractor, at his discretion, will place the decontamination waste with the suspect contaminated soil. CoSA is responsible for waste disposal associated with the contaminated areas.

6.0 Health and Safety Plan Requirements.

Prudent safety and health measures and monitoring should be conducted during construction activities in the area described in Table 1 and Table 2.

The work includes potential exposure to soil contaminants. The Contractor shall prepare and follow a Site Health and Safety Plan (SHSP) that has been written in accordance with and in fulfillment of Occupational Safety and Health Administration (OSHA) regulations, and all other applicable laws, ordinances, and regulations. The Contractor shall be solely responsible for their SHSP and compliance with its requirements in performing the work. A copy of the SHSP, including any revisions or changes, and any required documentation shall be maintained on site and be available for review by the Engineer. Upon request, the SHSP, including any revisions or changes, and any required documentation shall be provided to the Engineer.

SPECIAL PROVISION

006---002--CoSA

Control of Materials

For this project, Item 006, "Control of Materials," of the Standard Specifications, is amended hereby with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 6.1.4. Sources of Supply and Quality of Materials, is supplemented by the following:

Within 15 days after execution of contract, furnish the Engineer a copy of a purchase order showing the approximate delivery date from the manufacturer proposed to provide the signal controllers, signal heads, signal poles, and/or light poles. Obtain approval for any exception to this requirement in writing from the Engineer before expiration of the 15-day time limit.

SPECIAL PROVISION
006---003--CoSA
Control of Materials

For this project, Item 006, "Control of Materials," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 6.4. Sampling, Testing and Inspection is supplemented by the following:

Reimburse the City for the cost of sampling and testing performed by the City for:

- the convenience of the Contractor,
- information only,
- additional testing due to failed materials, or
- testing of more than one mix design verification for the same mix

Schedule 1 will be used to determine the amount of the reimbursement. Testing charges will be deducted from any money due or to become due the Contractor. Test charges include equipment and labor for handling, processing, testing and reporting. Cost to sample and transport materials may be accessed at the hourly rate indicated in Schedule 1.

Schedule 1

Test Procedure Description	Test Method	City Test Charge Amount
Bituminous Materials Test Charges		
Sand Equivalent	Tex-203-F	$ 50
Design of Bituminous Mixtures	Tex-204-F	$ 1,300
Laboratory Method of Mixing Bituminous Mixtures	Tex-205-F	$ 100
Compacting Test Specimens of Bituminous Mixtures (set of 3 molded specimens)	Tex-206-F	$ 200
Determining Density of Compacted Specimens (Set of Three)	Tex-207-F	$ 160

Test Procedure Description	Test Method	City Test Charge Amount
Determining Density of Compacted Specimens (Core Specimens) (Set of Three)	Tex-207-F	$ 120
Test for Stabilometer Value of Bituminous Mixtures-(Set of Three)	Tex-208-F	$ 200
Determining Asphalt Content of Bituminous Mixtures by Extraction	Tex-210-F	$ 320
Moisture Content (Bituminous Mixtures)	Tex-212-F	$ 80
Hydrocarbon Volatile Content (Bituminous Mixtures)	Tex-213-F	$ 160
Flakiness Index	Tex-224-F	$ 160
Theoretical Maximum Specific Gravity of Bituminous Mixtures (per sample)	Tex-227-F	$ 160
Determining Asphalt Content of Bituminous Mixtures by the Nuclear Method	Tex-228-F	$ 160
Static Creep Test - Set of Three	Tex-231-F	$ 600
Determining Asphalt Content from Asphalt Paving Mixtures by Ignition Method	Tex-236-F	$ 200
Effect of Water on Bituminous Paving Mixtures	Tex-530-C	$ 160
Prediction of Moisture Induced Damage to Bituminous Paving Materials Using Molded Specimens	Tex-531-C	$ 750
Hamburg Wheel-Tracking Test	Tex-242-F	$ 800
Aggregate Materials Test Charges		
Preparing Soils and Flexible Base Materials for Testing	Tex-101-E	$ 160
Determining Liquid Limit of Soils	Tex-104-E	$ 200
Determining Plastic Limit of Soils	Tex-105-E	$ 200
Calculating the Plasticity Index of Soils	Tex-106-E	$ 10
Linear Shrinkage	Tex-107-E	$ 40
Particle Size Analysis of Soils, Part I	Tex-110-E	$ 240
Particle Size Analysis of Soils, Part II	Tex-110-E	$ 240
Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials	Tex-113-E	$ 320
Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade and Embankment Soils	Tex-114-E	$ 320

Test Procedure Description	Test Method	City Test Charge Amount
Ball Mill Method for Determining the Disintegration of Flexible Base Material	Tex-116-E	$ 160
Triaxal Compression for Disturbed Soils and Base Materials	Tex-117-E	$ 600
Soil-Cement Testing (To Include Tex-113-E)	Tex-120-E P+I	$ 1,200
	Tex-120-E P+II	$ 200
Soil-Lime Testing (To Include Tex-114-E)	Tex-121-E	$ 1,200
	Tex-121-E P+II	$ 200
Molding, Testing, and Evaluating Bituminous Black Base Materials	Tex-126-E	$ 800
Sieve Analysis of Fine and Coarse Aggregate	Tex-401-A	$ 80
Fineness Modulus (includes 401-A)	Tex-402-A	$ 80
Unit Weights of Aggregates	Tex-404-A	$ 80
Material Finer than 75 micrometers (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)	Tex-406-A	$ 80
Organic Impurities	Tex-408-A	$ 40
Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate	Tex-411-A	$ 480
Texture Depth	Tex-436-A	$ 20
Accelerated Polish Test for Coarse Aggregate	Tex-438-A	$ 300
Determining Crushed Face Particle Count	Tex-460-A	$ 100
Concrete Materials Test Charges		
Obtaining and Testing Drilled Cores of Concrete (per core)	Tex-424-A	$ 160
Compressive Strength of Cylindrical Concrete Specimens (set of two)	Tex-418-A	$ 160
Additional Charges		
Transportation and Sampling Time (per hour)		$ 40

SPECIAL PROVISION

006---030 –(1) COSA

Control of Materials

For this project, Item, Item 006, "Control of Materials," of the Standard Specifications is amended hereby with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 6.10. Hazardous Materials is supplemented by the following:

.5. Painted Steel Requirements. As shown on the plans, existing paint on steel may contain hazardous materials. Perform work in accordance with the following:

1. Removing Paint from Steel.

a. Cleaning and Painting Steel. For contracts that are primarily for painting existing steel, perform the work in accordance with Item 446, "Cleaning and Painting Steel."

b. Other Contracts. For all other projects when an existing paint must be removed to perform other work, perform paint removal work in accordance with Item 446, "Cleaning and Painting Steel" unless the paint is shown or determined to contain hazardous materials. If the paint is shown or determined to contain hazardous materials, the Department will provide for a separate contractor to remove paint prior to or during the Contract to allow dismantling of the steel for the Contractor's salvaging, reuse, or recycling or where paint must be removed to perform other work. For steel that is dismantled by unbolting, no paint stripping will be required. Use care to not damage existing paint. When dismantling is performed using flame or saw-cutting methods to remove steel elements coated with paint containing hazardous materials, the plans will show stripping locations. Coordinate with the separate contractor for stripping work to be performed during the Contract.

2. Removal and Disposal of Painted Steel. For Contracts where painted steel is to be removed and disposed of by the Contractor, painted steel may be reused or disposed of at a steel recycling or smelting facility. If the paint is shown or determined to contain hazardous materials, maintain and make available to the Engineer invoices and other records showing the reuse owner or for recycling, records obtained from the recycling or smelting facility showing the received weight of the steel and the facility name. Painted steel to be retained by the Department will be shown on the plans.

6.11. Construction Loads on Structures is supplemented by the following:

.1 Stockpiling of Materials. Do not store or stockpile material on bridge structures without written permission. If required, submit a structural analysis and supporting documentation by a licensed professional engineer for review by the Engineer. Permission may be granted if the Engineer finds that no damage or overstresses in excess of those normally allowed for occasional overweight loads will result to structures that will remain in use after Contract completion. Provide temporary matting or other protective measures as directed.

SPECIAL PROVISION
006-030-(2)-CoSA
Control of Materials

For this project, Item 006 "Control of Materials," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

This Item is supplemented by the following:

6.14. Waste Management Plan.

7.0 Soil Reuse and Disposal Requirements.

Soils from the areas identified in paragraph 3.0 above, may be reused in the project area. At the discretion of the Port Authority, soils from the areas identified in paragraph 3.0 above may be relocated to Port Authority fill locations identified on the map in the attachments or at other locations within the area controlled by the Port Authority.

7.1 Pre-characterization of Soils.

Soils to be removed from the project site will be pre-characterized for disposal at a landfill. The Contractor will provide access for the Port Authority in obtaining any required samples of the soil being removed. Following receipt of the characterization of the soils, the Port Authority will determine if confirmation samples are required for soils being hauled to the landfill. The Contractor will provide access for the Port Authority, any regulatory agency or the landfill to obtain the samples. The Port Authority will provide manifests to the Contractor for use in delivering the soil to the receiving landfill.

SPECIAL PROVISION
007---119--CoSA
"Legal Relations and Responsibilities to the Public"

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks and the number of regularly scheduled trains per day passing the site of this work has a direct bearing on the premium rates for the Railroads' Protective Liability: Property Damage and Physical Damage to Property Insurance as required by Table 2 of the Special Provision to Item 7, "Legal Relations and Responsibilities."

BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY

CPM 456-2-22

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 7 regularly scheduled trains and no (0) switching movements per day at this location on FM 27 in Freestone County.

CPM 1147-2-24

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 6 regularly scheduled trains and no (0) switching movements per day at this location on FM 977 in Leon County.

The corporate name and address of the Railroad Company in whose name the Railroads' Protective Liability and Property Damage and Physical Damage to Property Insurance is to be issued is as follows:

BURLINGTON NORTHERN AND SANTA FE RAILWAY COMPANY
5800 N. Main St.
Fort Worth, Texas 76159

UNION PACIFIC RAILROAD COMPANY

CPM 1210-2-9

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 12 regularly scheduled trains and no (0) switching movements per day at this location on FM 979 in Robertson County.

CPM 1563-2-14

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 23 regularly scheduled trains and no (0) switching movements per day at this location on FM 1644 in Robertson County.

CPM 2337-1-17

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 20 regularly scheduled trains and no (0) switching movements per day at this location on FM 1644 in Robertson County.

CPM 2479-1-16

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 11 regularly scheduled trains and no (0) switching movements per day at this location on FM 2549 in Robertson County.

CPM 395-1-28

The estimated cost of the work to be performed by the Contractor within 50 feet of the operating track or tracks is 0.1 percent of the estimated contract cost.

There are 29 regularly scheduled trains and two (2) switching movements per day at this location on SH 150 in Walker County.

The corporate name and address of the Railroad Company in whose name the Railroads' Protective Liability and Property Damage and Physical Damage to Property Insurance is to be issued is as follows:

UNION PACIFIC RAILROAD COMPANY
1416 Dodge St.
Omaha, Nebraska 68179

SPECIAL PROVISION

007---806--CoSA

Legal Relations and Responsibilities

For this project, Item 7, "Legal Relations and Responsibilities" of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 7.4. Insurance and Bonds is voided and replaced by the following:

As specified in Article 3.4, "Execution of Contract," provide the City with the City's Certificate of Insurance verifying the types and amounts of coverage shown in Table 1.

Table 1
Insurance Requirements

Type of Insurance	Amount of Coverage
Commercial General Liability Insurance	$600,000 combined single limit
Business Automobile Policy: Bodily Injury Property Damage	 $250,000 each person $500,000 each occurrence $100,000 each occurrence
Workers' Compensation	Statutory
Builder's Risk Insurance [1]	100% of Contract Price

1 . For building-facilities contracts only

By signing the Contract, the Contractor certifies compliance with all applicable laws, rules, and regulations pertaining to workers' compensation insurance or legitimate alternates. This certification includes all subcontractors. Pay all deductibles stated in the policy. Subcontractors must meet the requirements of Table 1 either through their own coverage or through the Contractor's coverage.

Insurances must cover the contracted work for the duration of the Contract and must remain in effect until final acceptance. Failure to obtain and maintain insurance for the contracted work may result in suspension of work or default of the Contract. If the insurance expires and coverage lapses for any reason, stop all work until the City receives an acceptable Certificate of Insurance.

Commercial general liability and business automobile policies must include an endorsement naming the State as an additional named insured. Policies issued for coverage listed in Table 1 must include a waiver of subrogation endorsement in favor of the State.

For building-facilities contracts, provide Builder's Risk Insurance to protect the City against loss by storm, fire or extended coverage perils on work and materials intended for use on the project including the adjacent structure. Name the City under the Lost Payable Clause.

Provide a substitute Surety on the Contract bonds in the original full Contract amount within 15 days of notification if the Surety is declared bankrupt or insolvent, the Surety's underwriting limitation drops below the Contract amount or the Surety's right to do business is terminated by the State. The substitute Surety must be authorized by the laws of the State and acceptable to the City. Work will be suspended until a substitute Surety is provided. Working day charges will be suspended for 15 days or until an acceptable Surety is provided, whichever is sooner.

Article 7.8. Hauling and Loads on Roadways and Structures is supplemented by the following:

D. Stockpiling of Materials. Do not store or stockpile material on bridge structures without written permission. If required, submit a structural analysis and supporting documentation by a licensed professional engineer for review by the Engineer. Permission may be granted if the Engineer finds that no damage or overstresses in excess of those normally allowed for occasional overweight loads will result to structures that will remain in use after Contract completion. Provide temporary matting or other protective measures as directed.

Article 7.14. Contractor's Responsibility for Work, Section B. Appurtenances is voided and replaced by the following:

B. Appurtenances.

1. **Unreimbursed Repair.** Except for destruction (not reusable) due to hurricanes, reimbursement will not be made for repair of damage to the following temporary appurtenances, regardless of cause:
   - signs,
   - barricades,
   - changeable message signs, and
   - other work zone traffic control devices.

   Crash cushion attenuators and guardrail end treatments are the exception to the above listing and are to be reimbursed in accordance with Section 7.14.B.2, "Reimbursed Repair."

   For the devices listed in this section, reimbursement may be made for damage due to hurricanes. Where the contractor retains replaced appurtenances after completion of the project, the City will limit the reimbursement to the cost that is above the salvage value at the end of the project.

2. **Reimbursed Repair.** Reimbursement will be made for repair of damage due to the causes listed in Section 7.14.A, "Reimbursable Repair," to appurtenances (including temporary and permanent crash cushion attenuators and guardrail end treatments).

Article 7.15. Electrical Requirements, Section A. Definitions, Section 3. Certified Person is voided and replaced by the following:

3. Certified Person. A certified person is a person who has passed the test from the TxDOT course TRF450, "TxDOT Roadway Illumination and Electrical Installations" or other courses as approved by the Traffic Operations Division. Submit a current and valid TRF certification upon request. On June 1, 2011, Texas Engineering Extension Service (TEEX) certifications for "TxDOT Electrical Systems" course will no longer be accepted. All TRF 450 certifications that have been issued for "TxDOT Roadway Illumination and Electrical Installations" course that expire before June 1, 2011 will be accepted until June 1, 2011.

Article 7.15. Electrical Requirements, Section A. Definitions, Section 4. Licensed Electrician is voided and replaced by the following:

4. Licensed Electrician. A licensed electrician is a person with a current and valid unrestricted master electrical license, or unrestricted journeyman electrical license that is supervised or directed by an unrestricted master electrician. An unrestricted master electrician need not be on the work locations at all times electrical work is being done, but the unrestricted master electrician must approve work performed by the unrestricted journeyman. Licensed electrician requirements by city ordinances do not apply to on state system work.

The unrestricted journeyman and unrestricted master electrical licenses must be issued by the Texas Department of Licensing and Regulation or by a city in Texas with a population of 50,000 or greater that issues licenses based on passing a written test and demonstrating experience.

The Engineer may accept other states' electrical licenses. Submit documentation of the requirements for obtaining that license. Acceptance of the license will be based on sufficient evidence that the license was issued based on:

- passing a test based on the NEC similar to that used by Texas licensing officials, and
- sufficient electrical experience commensurate with general standards for an unrestricted master and unrestricted journeyman electrician in the State of Texas.

Article 7.19. Preservation of Cultural and Natural Resources and the Environment is supplemented by the following:

G. Asbestos Containing Material. In Texas, the Department of State Health Services (DSHS), Asbestos Programs Branch, is responsible for administering the requirements of the National Emissions Standards for Hazardous Air Pollutants, 40 CFR, Subpart M (NESHAP) and the Texas Asbestos Health Protection Rules (TAHPR). Based on EPA guidance and regulatory background information, bridges are considered to be a regulated "facility" under NESHAP. Therefore, federal standards for demolition and renovation apply.

Provide notice to the City of demolition or renovation to the structures listed in the plans at least 30 calendar days prior to initiating demolition or renovation of each structure or load bearing member. Provide the scheduled start and completion date of structure demolition, renovation, or removal.

When demolition, renovation, or removal of load bearing members is planned for several phases, provide the start and completion dates identified by separate phases.

DSHS requires that notifications be postmarked at least 10 working days prior to initiating demolition or renovation. If the date of actual demolition, renovation, or removal is changed, the City will be required to notify DSHS at least 10 days in advance of the work. This notification is also required when a previously scheduled (notification sent to DSHS) demolition, renovation or removal is delayed. Therefore, if the date of actual demolition, renovation, or removal is changed, provide the Engineer, in writing, the revised dates in sufficient time to allow for the City's notification to DSHS to be postmarked at least 10 days in advance of the actual work.

Failure to provide the above information may require the temporary suspension of work under Article 8.4, "Temporary Suspension of Work or Working Day Charges," due to reasons under the control of the Contractor. The City retains the right to determine the actual advance notice needed for the change in date to address post office business days and staff availability.

Article 7.20, **Agricultural Irrigation.** This Item is supplemented by the following:

Regulate the sequence of work and make provisions as necessary to provide for agricultural irrigation or drainage during the work. Meet with the Irrigation District or land owner to determine the proper time and sequence when irrigation demands will permit shutting-off water flows to perform work.

Unless otherwise provided on the plans, the work required by these provisions will not be paid for directly but shall be considered as subsidiary work pertaining to the various bid items of this contract.

SPECIAL PROVISION

007—1179--CoSA

Legal Relations and Responsibilities to the Public

For this project, Item 007, "LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 7.1, Laws to be Observed, the first paragraph is supplemented by the following:

The work includes potential exposure to soil contaminants. Prepare and follow a Site Health and Safety Plan (SHSP) that has been written in accordance with and in fulfillment of Occupational Safety and Health Administration (OSHA) regulations, and all other applicable laws, ordinances and regulations. The Contractor shall be solely responsible for their SHSP and compliance with its requirements in performing the work. A copy of the SHSP, including any revisions or changes, and any required documentation shall be maintained on site and be available for review by the Engineer. Upon request the SHSP, including any revisions or changes, and any required documentation shall be provided to the Engineer.

SPECIAL PROVISION
008 - 999 – COSA-1
Prosecution and Progress

For this project, Item 8, "Prosecution and Progress" of the City of San Antonio's Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Guidance to Contractors in preparing LAM Project Schedules

All Contractor CPM schedules shall be calculated and delivered to COSA in Primavera Systems, Inc. software. Acceptable versions are Primavera 5.0 and above or Primavera Contractor version 4.1 and above.

8.12 Critical Path Method is voided and replaced with the following:

8.12 Critical Path Method Project Schedule. The Contractor shall create and maintain a Critical Path Method (CPM) Project Schedule showing the manner of execution of work that he intends to follow in order to complete the contract within the allotted time. The project schedule shall employ computerized CPM for the planning, scheduling and reporting of the Work as described in this specification. The CPM project schedule shall be prepared using the Precedence Diagram Method (PDM). The Contractor shall create and maintain the schedule using Primavera Project Manager 5.x or Primavera Contractor 4.1 or above. The observance of the requirements herein is an essential part of the work to be done under the contract. No direct compensation will be allowed for fulfilling these requirements, as such work is considered subsidiary to the various bid items of the contract.

.1 Personnel. The Contractor shall provide an individual, referred to hereafter as the Scheduler, to create and maintain the Project Schedule. The Scheduler shall be proficient in Critical Path Method (CPM) analysis as demonstrated through certification from Project Management Institute (PMI), Association for the Advancement of Cost Engineering (AACE) or possess sufficient experience to be able to perform required tasks on the specified software and be able to prepare and interpret reports from the software. The Scheduler shall be made available for discussion or meetings when requested by the City.

.2 Project Schedule. At least twenty (20) calendar days prior to the preconstruction conference, the Contractor shall submit a Project Schedule which shall show the sequence and interdependence of activities required for complete performance of the work. All schedule submittals shall be in the electronic form to include PDF plots of the schedule, a PDF plot defining the

Critical Path and two week look-ahead, and include the native Primavera file format. The Contractor shall submit the schedule via electronic mail, CD-Rom, floppy disc, or any other electronic media acceptable to the City. The City will review the Project Schedule within twenty (20) calendar days for compliance with the specifications and notify the Contractor at the conference of its acceptability. No work shall begin until the Project Schedule has been accepted by the City.

a. The Project Schedule shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for assuring all necessary work items are included and work sequences are logical and show a coordinated plan of the work. The purpose of the City requiring the Project Schedule shall be to:
    i. Ensure adequate planning during the execution and progress of the work in accordance with the allowable number of calendar days and all milestones;
    ii. Assure coordination of the efforts of the Contractor, City, Utilities and others that may be involved in the project and that activities are included in the schedule highlighting coordination points with others;
    iii. Assist the Contractor and City in monitoring the progress of the work and evaluating proposed changes to the contract; and,
    iv. Assist the City in administering the contract time requirements.

b. Each activity on the Project Schedule shall be described by: an activity number utilizing an alphanumeric designation system tied to the traffic control plans, and that is agreeable to the City; concise description of the work represented by the activity; and, activity durations in whole calendar days with a maximum of twenty (20) calendar days. Durations greater than twenty (20) calendar days may be used for non-construction activities (mobilization, submittal preparation, curing, etc.), and other activities mutually agreeable between the City and Contractor. The Contractor shall provide to the City a legend for all abbreviations. The activities shall be coded so that organized plots of the Project Schedule may be produced. Typical activity coding includes traffic control phase, location and work type. Show an estimated production rate per working day for each work activity. Activity durations shall be based on the production rates shown.

c. Seasonal weather conditions shall be considered and included in the Project Schedule for all work influenced by temperature and/or precipitation. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions. Average historical weather data is available through the National Oceanic and Atmospheric Administration (NOAA). These effects will be simulated through the use of work calendars for each major work type (i.e., earthwork, concrete

paving, structures, asphalt, drainage, etc.). **Project and work calendars should be updated each month to show days actually able to work on the various work activities.**

d. Total float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, for each and every activity in the schedule. Float time in the Project Schedule is a shared commodity between the City and the Contractor.

e. Only City responsible delays in activities that affect milestone dates or the contract completion date, as determined by CPM analysis, will be considered for a time extension.

f. The project shall be grouped by PROJECT and the original and remaining duration shall be displayed. The grouping band will, by default, report work days planned. Two additional level of effort activities shall be added to the schedule as "time calculators," one with a seven day calendar without holidays and the other with a seven day calendar with City holidays. The calculation of their days will show up in the duration columns in Primavera.

g. Work shall be scheduled based upon the contractor's standard work week utilizing the appropriate calendar assignments in Primavera software. If the Contractor initial baseline plan is to perform the Work on a six or seven day work week, then the appropriate calendar in Primavera must be used and the Engineer must be notified in writing through the Submittal process. This does not affect the total calendar days allotted by the contract.

h. Setting Up working day calendar. Assign working calendars for the days you plan to work. Designate all City holidays (12) as non-working days (holidays). For dates beyond the current calendar year assume that the City holidays are the same as the current calendar year.

i. Organization and coding:
    i. Code and organize all work by Work Breakdown Structure (WBS). An example WBS will be provided by the City.

j. Submittals shall be included in the schedule with a logical tie to what each drives. Rejected submittals that are re-submitted constitute adding an activity to the schedule to represent the re-Submittal and the activity number should equal the Submittal number i.e., if the original Submittal was 100, then the activity number should be 100 as well. If the re-Submittal number is 100A, then the activity number should be 100A as well.

k. Approved Change Orders shall be added to the schedule.

l. Constraints are limited to project start, project finish, material delivery, and use on Submittals. If a schedule requires additional constraints, then an explanation shall accompany the schedule Submittal.

m. The schedule shall include activity milestones for material delivery.

n. Default progress is disallowed.

o. If work is performed out of sequence, then an explanation must be included in the project narrative.

.3 Joint Review, Revision and Acceptance. Within twenty (20) calendar days of receipt of the Contractor's proposed Project Schedule, the City shall evaluate the schedule for compliance with this specification, and notify the Contractor of its findings. If the City requests a revision or justification, the Contractor shall provide a satisfactory revision or adequate justification to the satisfaction of the City within seven (7) calendar days. If the Contractor submits a Project Schedule for acceptance, which is based on a sequence of work not shown in the plans, then the Contractor shall notify the City in writing, separate from the schedule submittal.

a. The City's review and acceptance of the Contractor's Project Schedule is for conformance to the requirements of the contract documents only. Review and acceptance by the City of the Contractor's Project Schedule does not relieve the Contractor of any of its responsibility for the Project Schedule or of the Contractor's ability to meet interim milestone dates (if specified) and the contract completion date, nor does such review and acceptance expressly or by implication warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the Contractor's Project Schedule. In the event the Contractor fails to define any element of work, activity or logic and the City review does not detect this omission or error, such omission or error, when discovered by the Contractor or City shall be corrected by the Contractor at the next monthly schedule update and shall not affect the project completion date.

.4 Updates. The Project Schedule shall be updated on a monthly basis. The Project Schedule update shall be submitted one week prior to the pay application submittal. The Contractor shall meet with the City each month at a scheduled update meeting to review actual progress made through the data date of the schedule update. The review of progress will include dates activities actually started and/or completed, the percentage of work completed, the remaining duration of each activity started and/or completed, and the amount of work to complete with an analysis of the relationship between the remaining duration of the activity and the quantity of material to install over that given period of time with a citation of past productivity. The percentage of work complete shall be calculated by utilizing the quantity installed divided by the budgeted quantity from the baseline schedule. The monthly schedule update

package shall include a progress narrative explaining progress, defining the Critical Path, identification of any potential delays, etc.

The project schedule update shall be grouped by Project, then WBS. The layout shall include the following columns:

a. Activity ID

b. Activity Description

c. Original Durations

d. Remaining Durations

e. Start and Finish Dates

f. Baseline Start and Finish Dates

g. Total Float

h. Performance Percent Complete

i. Display logic and target bars in the Gantt bar chart view

Narrative Requirements

a. General progress for the update period

b. Identify work performed out of sequence

c. Change to project's logic

d. Identify constraints

e. Define critical path of project

f. Identify delays that occurred and potential delays

The narrative shall be completed using the narrative template provided.

.5 Project Schedule Revisions. If the Contractor desires to make major changes in the Project Schedule, the Contractor shall notify the City in writing and submit the proposed schedule revision. The written notification shall include the reason for the proposed revision, what the revision is comprised of, and how the revision was incorporated into the schedule. Major changes are hereby defined as those that may affect compliance with the contract requirements or those that change the critical path. All other changes may be accomplished through the monthly updating process without written notification.

.6 Time Impact Analysis. The Contractor shall notify the City when an impact may justify an extension of contract time or adjustment of milestone dates. This notice shall be made in writing as soon as possible, but no later than the end of the next estimate period after the commencement of an impact or the notice for a change is given to the Contractor. Not providing notice to the City within twenty (20) calendar days after receipt will indicate the Contractor's approval of the time charges as shown on that time statement. Future consideration of that statement will not be permitted and the Contractor forfeits his right to subsequently request a time extension or time suspension unless the circumstances are such that the Contractor could not reasonably have knowledge of the impact by the end of the next estimate period.

a. When changes are initiated or impacts are experienced, the Contractor shall submit to the City a written time impact analysis describing the influence of each change or impact. A “time impact analysis” is an evaluation of the effects of changes in the construction sequence, contract, plans, or site conditions on the Contractor's plan for constructing the project, as represented by the schedule. The purpose of the time impact analysis is to determine if the overall project has been delayed, and if necessary, to provide the Contractor and the City a basis for making adjustments to the contract.

b. A time impact analysis shall consist of one or all of the steps listed below:

   Step 1. Establish the status of the project before the impact using the most recent project schedule update prior to the impact occurrence.

   Step 2. Predict the effect of the impact on the most recent project schedule update prior to the impact occurrence. This requires estimating the duration of the impact and inserting the impact into the schedule update. Any other changes made to the schedule including modifications to the calendars or constraints shall be noted.

   Step 3. Track the effects of the impact on the schedule during its occurrence. Note any changes in sequencing, and mitigation efforts.

   Step 4. Compare the status of the work prior to the impact (Step 1) to the prediction of the effect of the impact (Step 2), and to the status of the work during and after the effects of the impact are over (Step 3). Note that if an impact causes a lack of access to a portion of the project, the effects of the impact may extend to include a reasonable period for remobilization.

c. The time impact analysis shall be electronically submitted to the City. If the Project Schedule is revised after the submittal of a time impact analysis but prior to its approval, the Contractor shall promptly indicate in writing to the City the need for any modification to its time impact analysis. One (1) copy of each time impact analysis shall be submitted

within fourteen (14) calendar days after the completion of an impact. The City may require Step 1 and Step 2 of the time impact analysis be submitted at the commencement of the impact, if needed to make a decision regarding the suspension of contract time. Approval or rejection of each time impact analysis by the City shall be made within fourteen (14) calendar days after receipt unless subsequent meetings and negotiations are necessary.

PROJECT SCHEDULE NARRATIVE

PROJECT NAME:	
CONTRACTOR NAME:	
PERIOD ENDING:	
SUBMITTAL DATE:	
PREPARED BY:	

Evaluation Summary	
NTP:	
Data Date:	
Contractual Completion Date:	
Current Scheduled Completion Date:	
Previous Period Scheduled Completion Date:	
Contract Calendar Days:	

Yes	No	
		Contractor has included both a hard copy (pdf) and the native Primavera file format?
		Project calendars have been updated to reflect actual charged working days for the progress period, according to the contract time statement?
		Schedule update reflects approved change orders for the progress period?
		Have any major changes been made to the schedule? *(A major change is defined as those that may affect compliance with the contract requirements or those that change the critical path. If yes, written notification is required to include the reason for the proposed revision, what the revision is comprised of, and how the revision was incorporated into the schedule.)* If yes, provide details in Section 3 & 5 below.
		Are any delays included in this schedule submittal for which the Contractor intends to submit a Time Impact Analysis (TIA) for a claim delay? If yes, provide details in Section 6 below.

1. Identify general progress for the update period.
2. Identify work performed out of sequence and provide an explanation for the reason.

3. Describe any changes made to the project's logic and the reason for the change(s).
4. Identify any new constraints used and provide an explanation for their use.
5. Define the critical path of the project, including any changes from the previous update.
6. Identify any delays that have occurred for the progress period, the reason for the delay, and current status.
7. Identify any potential delays and possible mitigation efforts.
8. Other comments.

SPECIAL PROVISION
009---009--CoSA
Measurement and Payment

For this project, Item 009, "Measurement and Payment," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 9.6. Progress Payments, Section A, Retainage is voided and replaced by the following:

A. Retainage. Retainage will not be withheld on this project.

Article 9.6. Progress Payments, Section B, Payment Provisions for Subcontractors is voided and replaced by the following:

B. Payment Provisions for Subcontractors. For the purposes of this Article only, the term subcontractor includes suppliers and the term work includes materials provided by suppliers at a location approved by the City. Pay the subcontractors for work performed within 10 days after receiving payment for the work performed by the subcontractor. Also, pay any retainage on a subcontractor's work within 10 days after satisfactory completion of all of the subcontractor's work. Completed subcontractor work includes vegetative establishment, test, maintenance, performance, and other similar periods that are the responsibility of the subcontractor.

For the purpose of this Section, satisfactory completion is accomplished when:

- the subcontractor has fulfilled the Contract requirements of both the City and the subcontract for the subcontracted work, including the submittal of all information required by the specifications and the City; and
- the work done by the subcontractor has been inspected, approved, and paid by the City.

The inspection and approval of a subcontractor's work does not eliminate the Contractor's responsibilities for all the work as defined in Article 7.14, "Contractor's Responsibility for Work."

The City may pursue actions against the Contractor, including withholding of estimates and suspending the work, for noncompliance with the subcontract requirements of this Section upon receipt of written notice with sufficient details showing the subcontractor has complied with contractual obligations as described in this Article.

These requirements apply to all tiers of subcontractors. Incorporate the provisions of this Article into all subcontract or material purchase agreements.

SPECIAL PROVISION

009---012--CoSA

Measurement and Payment

For this project, Item 009, "Measurement and Payment," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 9.6. Progress Payments, Section A, Retainage is voided and replaced by the following:

A. Retainage. Retainage will not be withheld on this project.

Article 9.6. Progress Payments, Section B, Payment Provisions for Subcontractors is voided and not replaced.

SPECIAL PROVISION

009---015--CoSA

Measurement and Payment

For this project, Item 9, "Measurement and Payment," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 9.5. Force Account, B. Insurance and Taxes is replaced by the following:

B. Labor Burden. An additional 55% of the labor cost, excluding the 25% compensation provided in Section 9.5.A, "Labor," will be paid as compensation for labor insurance and labor taxes including the cost of premiums on non-project specific liability (excluding vehicular) insurance, workers compensation insurance, Social Security, unemployment insurance taxes, and fringe benefits.

SPECIAL PROVISION

009---016--CoSA

Measurement and Payment

For this project, Item 9, "Measurement and Payment," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 9.7. Payment for Material-on-Hand (MOH). The first sentence is voided and replaced by the following:

If payment for MOH is desired, request compensation for the invoice cost of acceptable nonperishable materials, or asphalt binders, that have not been used in the work before the request, and that have been delivered to the work location or are in acceptable storage places.

Article 9.7. Payment for MOH is supplemented by the following:

MOH payments will only be considered for asphalt cement (AC) binders or performance graded (PG) binders. MOH payments will not be made for emulsified asphalt or cutback asphalt. MOH payment for asphalt will only be considered 60 days after materials were received on the project and is subject the following additional requirements:

A. Binder Preapproval. Purchase binder that has been pre-approved by the City of san Antonio, as indicated by a passing City test report for the source and grade of material required. The test report must be current at the time that the binder is purchased.

Binder purchased must be dedicated to the project for which the MOH payments have been made, and may not be used on other projects without written approval of the Engineer. Binder that is used on other projects will not be eligible for payment and will be removed from the estimate. The City may require reimbursement for interest lost on MOH payments previously made.

B. Storage. Store asphalt binders in covered tanks at a facility in close proximity to the project and associated with the project. Equip storage tanks with equipment to heat the binder to usable temperature and to maintain that temperature. Equip the heating apparatus with a continuously recording thermometer located at the highest temperature point. When it is practical to do so, allow the binder to cool and harden, and then reheat it to fluidity prior to use.

Equip tanks with convenient sampling ports at least 3 ft. above the bottom of the tank. AASHTO T40 shows recommended designs for sampling valves.

Provide a mechanism for attaching a seal to the inlet line of the tank. Seal the tank with a numbered railroad type seal at the time the material is delivered, and document the seal number on the request for MOH. Payments for material added to the tank after the initial purchase will only be allowed if the new binder is pre-approved, of the same grade, and from the same source. Reseal the tank after new material is added, and document the seal number on any additional MOH payment requests.

If binder types are used which require agitation during storage, equip tanks to provide agitation of the product.

Other types of storage facilities are only allowed by written permission of the Engineer.

C. Sampling and Testing. If binders have been stored for more than 60 days, or any new material is added to the tank, sample the material in accordance with Tex-500-C. The Engineer must witness all sampling. Submit the sample to the Engineer for testing by the Construction Division. Repeat this sampling process every 60 days until the material is consumed.

If the binder is allowed to cool such that it is not fluid enough to obtain a sample, periodic resampling is waived. Submit a sample of the binder after it has been reheated, allowing enough time for testing to be completed before the binder is used in the work.

Stored binder which fails to meet the requirements for the grade specified will not be eligible for payment.

MOH sampling and testing will not be considered as part of other quality systems, such as supplier quality control plans, City quality ratings, or regular field sampling.

The City reserves the right to conduct sampling and testing of the material at any time.

D. Eligible MOH Expenses for Asphalt. Only source asphalt invoice price and shipping cost will be allowed for MOH payments for asphalt. Storage, heating, and handling cost will not be allowed.

SPECIAL PROVISION
100---002--CoSA
Preparing Right of Way

For this project, Item 100, "Preparing Right of Way," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 100.4. Payment. The second paragraph is voided and replaced by the following:

Total payment of this Item will not exceed 10% of the original contract amount until final acceptance. The remainder will be paid on the estimate after the final acceptance under Article 5.8, "Final Acceptance."

SPECIAL PROVISION

161---005-CoSA

Compost

For this project, Item 161, "Compost," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 161.2. Materials. Table 1 is voided and replaced by the following:

Furnish compost that meets the requirements of DMS-6360, "Compost." Material not conforming to quality monitoring program under DMS-6360, may be used only when tested by the Engineer and approved before use.

In general use compost incorporated into landscape planting beds, a soluble salt content up to 10 dS/m will be acceptable.

Article 161.4. Measurement. Measurement is supplemented with the following:

When "Erosion Control Compost" or "General Use Compost" are measured by the square yard, they are plans quantity measurement Items. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurement or calculations will be made if adjustments of quantities are required.

SPECIAL PROVISION

164---002

Seeding For Erosion Control

Item 164, "Seeding For Erosion Control," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 164.3. Construction. The following is added after the first sentence:

Use approved equipment to vertically track the seedbed as shown on the plans or as directed by the Engineer.

SPECIAL PROVISION
166---001--CoSA
Fertilizer

Item 166, "Fertilizer," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 166.2. Materials is voided and replaced by the following:

Use a complete fertilizer containing nitrogen (N), phosphoric acid (P), and potash (K) nutrients unless otherwise specified on the plans. At least 50% of the nitrogen component must be a slow–release sulfur coated urea. Ensure that fertilizer is in an acceptable condition for distribution in containers labeled with the analysis. Fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service in accordance with the Texas Fertilizer Law.

Article 166.3. Construction is voided and replaced by the following:

Deliver and apply the complete fertilizer uniformly at a rate equal to 60 lb. of nitrogen per acre or at the analysis and rate specified on the plans.

Apply fertilizer as a dry material and do not mix with water to form a slurry.

Incorporate fertilizer during seedbed preparation as specified in the plans.

SPECIAL PROVISION
169---002--CoSA
Soil Retention Blankets

For this project, Item 169, "Soil Retention Blankets," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 169.2 Materials. The first sentence is voided and replaced by the following:

Provide only SRB that meet the requirements of DMS-6370 and are on the Approved Products List, "Erosion Control Approved Products."

Article 169.2. Materials, Section B. Class 2 – Flexible Channel Liners is voided and replaced with the following:

1. **Type E.** Biodegradable materials with shear stress less than 2.0 lbs. per square foot,
2. **Type F.** Biodegradable materials with shear stress less than 4.0 lbs. per square foot,
3. **Type G.** Non-biodegradable materials with shear stress less than 6.0 lbs. per square foot,
4. **Type H.** Non-biodegradable materials with shear stress less than 8.0 lbs. per square foot.

Article 169.3. Construction is voided and replaced by the following:

Provide a copy of the manufacturer's installation instructions to the Engineer prior to placement of the material. Place the SRB within 24 hr. after the seeding or sodding operation, or when directed. Installation and anchorage of the SRB shall be in strict accordance with the recommendations contained within the manufacturer's published literature. Installation includes the repair of ruts, reseeding or resodding, and the removal of rocks, clods, and other foreign materials which may prevent contact of the blanket with the soil.

SPECIAL PROVISION

192---006--CoSA

Landscape Planting

For this project, Item 192, "Landscape Planting," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 192.5. Payment. The first paragraph is voided and replaced by the following:

192.5. Payment. The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Plant Material" of the size, "Plant Material" of the type, "Plant Material" of the size and type specified, "Plant Material" of the group specified or "Palm Material" of the type specified. This price is full compensation for furnishing the plant, mulch, plant soil mix, landscape edge, plant bed preparation and vegetation barrier, unless mulch, plant soil mix, landscape edge, plant bed preparation and vegetation barrier are specified as separate items. Payment for "Plant Material" and "Palm Material" will be handled in the following manner:

Article 192.5. Payment. D. Final Payment. The second paragraph is voided and replaced by the following:

D. Final Payment. When mulch, plant soil mix, landscape edge, plant bed preparation and vegetation barrier are specified as separate pay items, the work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Mulch" or "Mulch" of the type specified, "Plant Soil Mix" or "Plant Soil Mix" of the type specified, "Landscape Edge" or "Landscape Edge" of the type specified, "Plant Bed Preparation" or "Plant Bed Preparation" of the type specified, and "Vegetation Barrier" or "Vegetation Barrier" of the type specified. Each price is full compensation for materials, equipment, labor, tools, and incidentals.

SPECIAL PROVISION

247---033--CoSA

Flexible Base

For this project, Item 247, "Flexible Base," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 247.2. Materials, Section A. Aggregate, Table 1. Material Requirements is replaced by the following:

Table 1
Material Requirements

Property	Test Method	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Master gradation sieve size (cumulative % retained)	Tex-110-E				As shown on the plans	
2-1/2 in.		–	0	0		0
1-3/4 in.		0	0–10	0–10		0-5
7/8 in.		10–35	–	–		10–35
3/8 in.		30–50	–	–		35–65
No. 4		45–65	45–75	45–75		45–75
No. 40		70–85	60–85	50–85		70–90
Liquid Limit, % max.[1]	Tex-104-E	35	40	40	As shown on the plans	35
Plasticity Index, max.[1]	Tex-106-E	10	12	12	As shown on the plans	10
Plasticity index, min.[1]		As shown on the plans				
Wet ball mill, % max.[2]	Tex-116-E	40	45	–	As shown on the plans	40
Wet ball mill, % max. increase passing the No. 40 sieve		20	20	–	As shown on the plans	20
Classification, max. [3]	Tex-117-E	When shown on the plans	When shown on the plans	–	As shown on the plans	-
Min. compressive strength, psi	Tex-117-E				As shown on the plans	
lateral pressure 0 psi		45	35	–		–
lateral pressure 3 psi		–	–	–		90
lateral pressure 15 psi		175	175	–		175

1. Determine the plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2. When a soundness value is required by the plans, test material in accordance with Tex-411-A.
3. When Classification is required by the plans, a triaxial Classification of 1.0 or less for Grades 1 and 2.3 or less for Grade 2 is required. The Classification requirement for Grade 4 will be as shown on the plans.

Article 247.2. Materials, Section A. Aggregate, Section 3. Recycled Material, Section b. Recycled Material (Including Crushed Concrete) Requirements, Section (1), Contractor Furnished Recycled Materials is supplemented by the following:

Provide recycled materials that have a maximum sulfate content of 3000 ppm when tested in accordance with Tex-145-E.

Article 247.4. Construction, Section C. Compaction is supplemented by the following:

Before final acceptance, the Engineer will select the locations of tests and measure the flexible base depth in accordance with Tex-140-E when Complete in Place measurement is specified. Correct areas deficient by more than 1/2 in. in thickness by scarifying, adding material as required, reshaping, recompacting, and refinishing at the Contractor's expense.

Article 247.4. Construction, Section C. Compaction, Section 2. Density Control first paragraph is replaced by the following:

Compact to at least 100% of the maximum dry density determined by Tex-113-E, unless otherwise shown on the plans. Maintain moisture during compaction at not less than 1 percentage point below the optimum moisture content determined by Tex-113-E. Determine the moisture content of the material in accordance with Tex-115-E or Tex-103-E during compaction daily and report the results the same day to the Engineer, unless otherwise shown on the plans or directed.

SPECIAL PROVISION

260---002--CoSA

Lime Treatment (Road-Mixed)

For this project, Item 260, “Lime Treatment (Road-Mixed),” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 260.2. Materials, Section A. Lime. The first two sentences are voided and replaced by the following:

A. Lime. Furnish lime that meets the requirements of DMS-6350 "Lime and Lime Slurry," and DMS-6330, "Prequalification of Lime Sources." Use hydrated lime, commercial lime slurry, quicklime, or carbide lime slurry as shown on the plans.

Article 260.3. Equipment, Section B. Slurry Equipment. The last sentence of the second paragraph is voided and replaced by the following:

Equip the distributor truck with a sampling device in accordance with Tex-600-J, Part I, when using commercial lime slurry or carbide lime slurry.

Article 260.4. Construction, Section C. Application of Lime, Section 2. Slurry Placement. The first paragraph is voided and replaced with the following:

Provide slurry free of objectionable materials, at or above the minimum dry solids content, and with a uniform consistency that will allow ease of handling and uniform application. Deliver commercial lime slurry or carbide lime slurry to the jobsite, or use hydrated lime or quicklime to prepare lime slurry at the jobsite or other approved location, as specified. When dry quicklime is applied as a slurry, use 80 percent of the amount shown on the plans.

Article 260.5. Measurement, Section A. Lime is supplemented by the following:

4. Carbide Lime Slurry. Lime slurry will be measured by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

Article 260.6. Payment. The first paragraph is voided and replaced by the following:

The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid in accordance with Section 260.6.A, “Lime,” and Section 260.6.B, “Lime Treatment.”

Article 260.6. Payment, Section A. Lime. The first sentence is voided and replaced by the following:

A. Lime. Lime will be paid for at the unit price bid for "Lime" of one of the following types:

- Hydrated Lime (Dry),
- Hydrated Lime (Slurry),
- Commercial Lime Slurry,
- Quicklime (Dry),
- Quicklime (Slurry), or
- Carbide Lime Slurry.

Article 260.6. Payment, Section B. Lime Treatment is voided and replaced by the following:

B. Lime Treatment. Lime treatment will be paid for at the unit price bid for “Lime Treatment (Existing Material),” “Lime Treatment (New Base),” or “Lime Treatment (Mixing Existing Material and New Base),” for the depth specified. No payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, applying lime, compacting, finishing, curing, curing materials, blading, shaping and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.

SPECIAL PROVISION

275---002--CoSA

Cement Treatment (Road-Mixed)

For this project, Item 275, "Cement Treatment (Road-Mixed)," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 275.4. Construction, Section E. Compaction. The first paragraph is voided and replaced by the following:

Compact the mixture in one lift using density control unless otherwise shown on the plans. Complete compaction within 2 hours after the application of water to the mixture of material and cement.

Article 275.6 Payment. The first paragraph is voided and replaced by the following:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid in accordance with Section 275.5.A, "Cement," and Section 275.5.B, "Cement Treatment."

Article 275.6 Payment, Section B. Cement Treatment is voided and replaced by the following:

B. Cement Treatment. Cement treatment will be paid for at the unit price bid for "Cement Treatment (Existing Material)," "Cement Treatment (New Base)," or "Cement Treatment (Mixing Existing Material and New Base)," for the depth specified. No payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, applying cement, compacting, finishing, curing, curing materials, blading, shaping and maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary subgrade, water, equipment, labor, tools, and incidentals.

SPECIAL PROVISION

300---032--CoSA

Asphalts, Oils, and Emulsions

For this project, Item 300, "Asphalts, Oils, and Emulsions," of the Standard Specifications is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 300.2. Materials. The first paragraph is voided and replaced by the following:

Provide asphalt materials that meet the stated requirements when tested in accordance with the referenced Department, AASHTO, and ASTM test methods. Unless otherwise shown in the plans and specifications, provide asphalt materials that have been preapproved for use by the Construction Division, in accordance with Tex-545-C, "Asphalt Binder Quality Program."

SPECIAL PROVISION

302---010-CoSA

Aggregates For Surface Treatments

Item 302, "Aggregates for Surface Treatments," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 302.2. Materials, Section A. Aggregate. The fourth paragraph is voided and replaced by the following:

Furnish aggregates that meet the quality requirements shown in Table 3, unless otherwise shown on the plans. When Limestone Rock Asphalt (LRA) is used, furnish in accordance with DMS-9210, "Limestone Rock Asphalt (LRA)." Provide aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC). If a source is not listed in the catalog or its listed ratings do not meet requirements of the plans, material from that source may be used only when tested by the Engineer and approved before use. Allow 30 calendar days for testing of material from such sources.

Article 302.2. Materials, Section A. Aggregate, Table 2 is voided and replaced by the following:

Table 2
Aggregate Gradation Requirements (Cumulative % Retained[1])

Sieve	Grade								
	1	2	3S[2]	3		4S[2]	4	5S[2]	5[3]
				Non-lightweight	Lightweight				
1"	-	-	-	-	-	-	-	-	-
7/8"	0-2	0	-	-	-	-	-	-	-
3/4"	20–35	0–2	0	0	0	-	-	-	-
5/8"	85–100	20-40	0–5	0–5	0–2	0	0	-	-
1/2"	-	80–100	55–85	20–40	10–25	0–5	0–5	0	0
3/8"	95–100	95–100	95–100	80–100	60–80	60–85	20–40	0–5	0–5
1/4"	-	-	-	95–100	95–100	-	-	65–85	-
#4	-	-	-	-	-	95-100	95-100	95-100	50-80
#8	99–100	99–100	99–100	99–100	98–100	98–100	98–100	98–100	98–100

1. Round test results to the nearest whole number.
2. Single-size gradation.
3. Grade 5S may be substituted for Grade 5 for LRA only, unless otherwise approved by the Engineer.

Article 302.2. Materials, Section A. Aggregate. Table 3 is voided and replaced by the following:

Table 3
Aggregate Quality Requirements

Property	Test Method	Requirement	Remarks
SAC	AQMP	As shown on the plans	
Deleterious Material, %, Max	Tex-217-F, Part I	2.0	Not required for lightweight aggregate.
Decantation, %, Max	Tex-406-A	1.5	
Flakiness Index, Max	Tex-224-F	17	Unless otherwise shown on the plans
Los Angeles Abrasion, %, Max	Tex-410-A	35	
Magnesium Sulfate Soundness, 5 Cycle, %, Max	Tex-411-A	25	
Micro-Deval Abrasion, %, Max	Tex-461-A	–	Not used for acceptance purposes. Used by the Engineer as an indicator for further investigation.
Coarse Aggregate Angularity, 2 Crushed Faces, %, Min	Tex-460-A, Part I	85	Unless otherwise shown on the plans. Only required for crushed gravel
Additional Requirements for Lightweight Aggregate			
Dry Loose Unit Wt., lb./cu. ft.	Tex-404-A	35–60	
Pressure Slaking, %, Max	Tex-431-A	6.0	
Freeze-Thaw Loss, %, Max	Tex-432-A	10.0	
Water Absorption, 24°hr., %, Max	Tex-433-A	12.0	Unless otherwise shown on plans.

Article 302.2. Materials, Section B. Precoating. First paragraph is voided and replaced with the following:

When precoating is shown on the plans, precoat aggregate uniformly and adequately with asphalt material to the satisfaction of the Engineer. When shown on the plans, specific aggregates may be prohibited from being precoated. Meet Table 2 and 3 requirements before precoating. Furnish precoated aggregate that spreads uniformly using approved mechanical spreading equipment.

Article 302.2. Materials, Section B. Precoating, Section 1. Asphalt Material is voided and replaced with the following:

1**. Asphalt Material.** Precoat the aggregates with asphalt material that meets the requirements of Item 300, "Asphalts, Oils, and Emulsions." Unless a specific precoat material is specified on the plans, use any asphalt material that meets the requirements of Item 300.

SPECIAL PROVISION
316---016--CoSA
Surface Treatments

For this project, Item 316, "Surface Treatments", of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 316.3.A.3. Computerized Distributor. This section is voided and not replaced.

Article 316.4.D.3. Asphalt Material Designed for Winter Use. This section is voided and replaced by the following:

A. Cold Weather Surface Treatments. When asphalt application is allowed outside of the above temperature restrictions, the Engineer will approve the binder grade and the air and surface temperatures for asphalt material application. Apply surface treatment at air and surface temperatures as directed.

Article 316.5.A. Asphalt Material. This section is voided and replaced by the following:

B. Asphalt Material. Asphalt material will be measured at the applied temperature by strapping the tank just before and just after road application and determining the net volume in gallons from the distributor's calibrated strap stick. The quantity to be measured for payment will be the number of gallons used, as directed, in the accepted surface treatment.

SPECIAL PROVISION

318---010-CoSA

Hot Asphalt-Rubber Surface Treatments

For this project, Item 318, "Hot Asphalt-Rubber Surface Treatments", of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 318.3.A. Distributor. The second sentence is voided and not replaced.

Articles 318.3.I. Truck Scales. This article is voided and not replaced.

Article 318.5. Measurement. The first paragraph is voided and replaced by the following:

A. A-R Binder. A-R binder, including all components, will be measured at the applied temperature by strapping the tank just before and just after road application and determining the net volume in gallons from the distributor's calibrated strap stick. The quantity to be measured for payment will be the number of gallons used, as directed, in the accepted surface treatment.

SPECIAL PROVISION

330---001--CoSA

Limestone Rock Asphalt Pavement

For this project, Item 330, "Limestone Rock Asphalt Pavement," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 330.2. Materials is voided and replaced by the following:

A. LRA Mixture. Furnish LRA according to DMS-9210 of the type, grade, and surface aggregate classification shown on the plans.

B. Tack Coat. Unless otherwise shown on the plans or approved, furnish CSS-1H, SS-1H, or a performance-graded (PG) binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use. If required, verify that emulsified asphalt proposed for use meets the minimum residual asphalt percentage specified in Item 300.

The Engineer will obtain at least one sample of the tack coat per project and test the sample for specification compliance. The Engineer will obtain the sample from the asphalt distributor, immediately before use.

Article 330.3 Equipment is voided and replaced by the following:

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

Article 330.4 Construction, Section A. QCP is voided and replaced by the following:

A. Quality Control Plan (QCP). Develop a written QCP and submit to the Engineer for approval prior to beginning production. Follow QCP in detail. Obtain approval from the Engineer for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Include the following items in the QCP:

1. **Project Personnel.** For project personnel, include:
   - a list of individuals responsible for quality control with authority to take corrective action and
   - contact information for each individual listed.

2. **Loading and Transporting.** For loading and transporting, include:
   - type and application method for release agents and
   - truck and rail car loading procedures to avoid segregation.

3. **Placement and Compaction.** For placement and compaction, include:
   - proposed arrangements for any required prepaving meetings, including dates and locations;
   - type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
   - procedures for the transfer of mixture into the paver while avoiding segregation and preventing material spillage;
   - process to balance production, delivery, paving, and compaction to achieve continuous placement operations;
   - paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
   - procedures to construct quality longitudinal and transverse joints.

Article 330.4 Construction, Section B. Stockpiling of Aggregates and LRA is voided and replaced by the following:

B. Stockpiling of LRA. If storing LRA at the project site, provide a smooth and well-drained area, cleared of trash, weeds, and grass. Stockpile, handle, and load LRA in a manner that will minimize aggregate degradation and segregation. Avoid contamination and mixing of stockpiles. The Engineer may reject stockpiled materials that come in contact with the earth or other objectionable material.

Article 330.4 Construction, Sections C. Storage and Heating of Fluxing Material, D. Job-Mix Formula, and E. Mixing are deleted and remaining Sections renumbered accordingly.

Article 330.5. Measurement is voided and replaced by the following.

LRA pavement will be measured by the ton of composite LRA pavement of the type actually used in the completed and accepted work in accordance with the plans and specifications for the project. Measure on scales in accordance with Item 520, "Weighing and Measuring Equipment." Keep records on tare weight, gross weight, and net weight of the LRA paving mixture for each load of the same type of mixture. The Construction Division will measure and report the moisture content of the LRA paving mixture used to determine payment at the plant. All water and light hydrocarbon volatiles in the mixture, in excess of 6.0% by weight at the time of weighing, will be deducted from the net weight to determine the quantity for payment.

SPECIAL PROVISION

340---003--CoSA

Dense-Graded Hot-Mix Asphalt (Method)

For this project, Item 340, "Dense-Graded Hot-Mix Asphalt (Method)," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 340.2. Materials, Section A. Aggregate, Section 2. RAP is voided and replaced by the following:

2. RAP. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush or break RAP so that 100% of the particles pass the 2-in. sieve.

Use of Contractor-owned RAP including HMA plant waste is permitted, unless otherwise noted in the plans. Department-owned RAP stockpiles are available for the Contractor's use when the stockpile locations are shown on the plans. Department-owned RAP generated through required work on the Contract is available for the Contractor's use when shown on the plans. Perform any necessary tests to ensure Contractor or Department-owned RAP is appropriate for use. Unless otherwise shown on the plans, the Department will not perform any tests or assume any liability for the quality of the Department-owned RAP.

Fractionated RAP is defined as having 2 or more RAP stockpiles whereas the RAP is divided into coarse and fine fractions. The coarse RAP stockpile will contain only material retained by processing over a 3/8 in. screen or 1/2 in. screen unless otherwise approved. The fine RAP stockpile will contain only material passing the 3/8 in. screen or 1/2 in. screen unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8 in. screen or 1/2 in. screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse or fine fractionated RAP or the combination of both coarse and fine fractionated RAP. Utilize a separate cold feed bin for each stockpile of fractionated RAP used.

Determine asphalt content and gradation of RAP stockpiles for mixture design purposes. Perform other tests on RAP when shown on the plans. Unless otherwise shown on the plans, use no more than 10% unfractionated RAP in surface mixtures and no more than 20% unfractionated RAP in non-surface mixtures that are placed within 8 in. of the final riding surface. Use no more than 30% unfractionated RAP in non-surface mixtures that are placed 8 in. or more from the final riding surface. Unless otherwise shown on the plans, use no more than 20% fractionated RAP in surface mixtures and no more than 30% fractionated RAP in non-surface mixtures that are placed within 8 in. of the final riding surface. Use no more than 40% fractionated RAP in non-surface mixtures that are placed 8 in. or more from the final riding surface. "Surface" mixtures are defined as mixtures that will be the final lift or riding surface of the pavement structure."Non-Surface" mixtures are defined as mixtures that will be an intermediate or base layer in the pavement structure. Do not use Department or Contractor owned RAP contaminated with dirt or other objectionable materials. Do not use Department or Contractor owned RAP if

the decantation value exceeds 5% and the plasticity index is greater than 8. Test the stockpiled RAP for decantation in accordance with the laboratory method given in Tex-406-A, Part I. Determine the plasticity index using Tex-106-E if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction.

Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

Article 340.2. Materials, Section A. Aggregate. is supplemented by the following:

4. Recycled Asphalt Shingles (RAS). The contractor may use post-manufactured RAS or post-consumer RAS; however, the use of post-consumer RAS may be restricted when shown on the plans. RAS are defined as processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures. "Post-manufactured RAS" are processed manufacturer's shingle scrap by-product. "Post-consumer RAS," or "tear-offs," are processed shingle scrap removed from residential structures.

Process the RAS by ambient grinding or granulating such that 100% of the particles pass the 1/2 in. sieve when tested in accordance with Tex-200-F, Part I. Add sand meeting the requirements of Table 1 and Table 2 to RAS stockpiles, if needed, to keep the processed material workable. Use a maximum of 4% sand by weight of RAS. Perform a sieve analysis on processed RAS material prior to extraction of the asphalt.

Determine asphalt content and gradation of the RAS material for mixture design purposes in accordance with Tex-236-F. Unless otherwise shown on the plans, use no more than 5% processed RAS of the total mixture weight. When RAS is used, whether in conjunction with RAP or not, calculate and ensure the ratio of the virgin binder to total binder is greater than 65% in surface mixtures and 60% in non-surface mixtures. "Surface" mixtures are defined as mixtures that will be final lifts or riding surfaces of a pavement structure. "Non-Surface" mixtures are defined as mixtures that will be intermediate or base layers in a pavement structure. When RAS is used in conjunction with fractionated RAP, use no more than 20% combined RAS and RAP for surface mixtures, and no more than 30% combined RAS and RAP in non-surface mixtures, unless otherwise shown on the plans. When RAS is used in conjunction with un-fractionated RAP, use no more than 10% combined RAS and RAP for surface mixtures, and no more than 20% combined RAS and RAP in non-surface mixtures, unless otherwise shown on the plans.

Certify compliance of the RAS with specification DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines". If the RAS has not come into contact with any hazardous materials, treat it as an established NRM. Do not use RAS if deleterious materials as measured by Tex-217-F, Part I, are more than 1.5% of the stockpiled RAS.

SPECIAL PROVISION

360---003--CoSA

Concrete Pavement

For this project, Item 360, "Concrete Pavement," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 360.3. Equipment, Section E. Curing Equipment. The third sentence is voided and replaced by the following:

Provide curing equipment that is independent of all other equipment when required to meet the requirements of Article 360.4.I, "Curing."

Article 360.4. Construction, Section H. Spreading and Finishing, Section 2. Maintenance of Surface Moisture. The first and second sentences are voided and replaced by the following:

Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens and the use of evaporation retardants.

Article 360. 4. Construction, Section I. Curing. The first sentence is voided and replaced by the following:

Keep the concrete pavement surface from drying as described in Section 360.4.H.2, "Maintenance of Surface Moisture," until the curing material has been applied.

Article 360. 4. Construction, Section I. Curing, Section 1. Membrane Curing. The first paragraph is voided and replaced by the following:

Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of not more than 180 sq. ft. per gallon. Do not allow the concrete surface to dry before applying the curing compound. Use a towel or absorptive fabric to remove any standing pools of bleed water that may be present on the surface before applying the curing compound. Apply the first coat within 10 min. after completing texturing operations. Apply the second coat within 30 min. after completing texturing operations.

SPECIAL PROVISION

360---007

Concrete Pavement

For this project, Item 360, "Concrete Pavement," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 360.3. Equipment, Section E. Curing Equipment. The third sentence is voided and replaced by the following:

Provide curing equipment that is independent of all other equipment when required to meet the requirements of Article 360.4.I, "Curing."

Article 360.4. Construction, Section H. Spreading and Finishing, Section 2. Maintenance of Surface Moisture. The first and second sentences are voided and replaced by the following:

Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens and the use of evaporation retardants.

Article 360.4. Construction, Section H. Spreading and Finishing, Section 3. Surface Texturing is voided and replaced by the following:

Complete final texturing before the concrete has attained its initial set. Drag the carpet longitudinally along the pavement surface with the carpet contact surface area adjusted to provide a satisfactory coarsely textured surface. Prevent the carpet from getting plugged with grout. Do not perform carpet dragging operations while there is excessive bleed water.

A metal-tine texture finish is required for all areas with a posted speed limit in excess of 45 mph. A metal-tine texture finish is required unless otherwise shown on the plans for areas with a posted speed limit less than 45 mph. Immediately following the carpet drag, apply a single coat of evaporation retardant at a rate recommended by the manufacturer. Provide the metal-tine finish immediately after the concrete surface has set enough for consistent tining. Operate the metal-tine device to obtain grooves spaced at 1 in., approximately 3/16 in. deep, with a minimum depth of 1/8 in., and approximately 1/12 in. wide. Do not overlap a previously tined area. Use manual methods to achieve similar results on ramps and other irregular sections of pavements. Repair damage to the edge of the slab and joints immediately after texturing. Do not tine pavement that will be overlaid or that is scheduled for blanket diamond grinding or shot blasting.

When carpet drag is the only surface texture required by the plans, ensure that adequate and consistent micro-texture is achieved by applying sufficient weight to the carpet and keeping the carpet from getting plugged with grout, as directed by the Engineer. Target a carpet drag texture of .04 in., as measured by Tex 436-A Correct any location with a texture less than .03 in. by

diamond grinding or shot blasting. The Engineer will determine the test locations at points located transversely to the direction of traffic in the outside wheel path.

Article 360. 4. Construction, Section I. Curing. The first sentence is voided and replaced by the following:

Keep the concrete pavement surface from drying as described in Section 360.4.H.2, "Maintenance of Surface Moisture," until the curing material has been applied.

Article 360. 4. Construction, Section I. Curing, Section 1. Membrane Curing. The first paragraph is voided and replaced by the following:

Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of not more than 180 sq. ft. per gallon. Do not allow the concrete surface to dry before applying the curing compound. Use a towel or absorptive fabric to remove any standing pools of bleed water that may be present on the surface before applying the curing compound. Apply the first coat within 10 min. after completing texturing operations. Apply the second coat within 30 min. after completing texturing operations.

SPECIAL PROVISION

400---030--CoSA

Excavation and Backfill for Structures

For this project, Item 400, "Excavation and Backfill for Structures," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 400.2. Excavation, is supplemented by the following:

400.2.(1)(a) Disposal of Excavation, is supplemented by the following:

All materials identified from the contaminated areas shown in the plans and outlined in the Waste Management Plan for the project shall not become the property of the Contractor.

Refer to Special Provision "Important Notice to Contractor's (Contamination Information)" for more details.

400.2.(1)(e) Dewatering of Excavation Area, is supplemented by the following:

In areas of designated contamination, any removal of water from the excavation shall be performed by the Contractor. The contractor shall supply an adequate temporary storage tank for dewatering activities at the site. The contractor shall pump the water into the tank. CoSA representatives shall be responsible for sampling, analysis, and ultimate disposal of the water. The contractor shall be responsible for placing pre-cast members, or pipe on a dry firm bed in coordination with CoSA or their designated representatives by any method approved.

Refer to Special Provision "Important Notice to Contractor's (Contamination Information)" for more details.

Article 400.7. Measurement is voided and replaced by the following:

400.7. Measurement. Except for Structural Excavation (Special), excavation quantities shown on the plans are for information purposes only. Cutting and restoring of pavement will be measured by the square yard. Structural Excavation (Special) and Cement Stabilized Backfill will be measured by the cubic yard.

This is a plans quantity measurement item. The quantity to be paid for will be that quantity shown in the proposal and on the "Estimate and Quantity" sheet of the contract plans, except as may be modified by Article 9.8. If no adjustment of quantities is required, additional measurements or calculations will not be required.

SPECIAL PROVISION

416---001

Drilled Shaft Foundations

For this project, Item 416, "Drilled Shaft Foundations," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 416.5. Payment, Section A. Drilled Shaft is voided and replaced by the following.

A. Drilled Shaft. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Drilled Shaft" or "Drilled Shaft (Non-reinforced)" or "Drilled Shaft (Sign Mounts)" or "Drilled Shaft (High Mast Pole)" or "Drilled Shaft (Roadway Illumination Pole)" or "Drilled Shaft (Traffic Signal Pole)" of the specified diameter, subject to the limitations for overruns authorized by the Engineer given in Section 416.5.A.1, "Overrun."

Article 416.5. Payment, Section A. Drilled Shaft, Section 2. Maximum Plan Length Shaft is supplemented by the following.

- For roadway illumination poles, the maximum plan length shaft is the maximum length shaft, regardless of diameter, for any roadway illumination pole included in the contract.
- For traffic signal poles, the maximum plan length shaft is the maximum length shaft, regardless of diameter, for any traffic signal pole included in the contract.

SPECIAL PROVISION
420---002--CoSA
Concrete Structures

For this project, Item 420, "Concrete Structures," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 420.4. Construction, Section I, "Finish of Bridge Slabs". The tenth paragraph is supplemented with the following:

For bridge approach slabs the carpet drag, burlap drag, or broom finish may be applied either longitudinally or transversely.

Article 420.4. Construction, Section I, "Finish of Bridge Slabs". The first sentence of the fourteenth paragraph is voided and replaced by the following:

Unless noted otherwise, saw-cut grooves in the hardened concrete of bridge slabs, bridge approach slabs, and direct-traffic culverts to produce the final texturing after completion of the required curing period.

Article 420.4. Construction, Section I, "Finish of Bridge Slabs". The fourteenth paragraph is amended by the following:

When saw-cut grooves are not required in the plans, provide either a carpet drag or broom finish for micro-texture. In this case insure that an adequate and consistent micro-texture is achieved by applying sufficient weight to the carpet and keeping the carpet or broom from getting plugged with grout. For surfaces that do not have adequate texture, the Engineer may require corrective action including diamond grinding or shot blasting.

Article 420.4. Construction, Section J. Curing Concrete. The first sentence of the fourth paragraph is voided and replaced by the following:

For upper surfaces of bridge slabs, bridge approach slabs, median and sidewalk slabs, and culvert top slabs constructed using Class S concrete, apply interim curing using a Type 1-D curing compound before the water sheen disappears but no more than 45 minutes after application of the evaporation retardant. Do not allow the concrete surface to dry before applying the interim cure, and do not place the interim cure over standing water.

Article 420.6 Payment. The pay adjustment formula given in the sixth bullet of the fourth paragraph is voided and replaced by the following:

$A = Bp[-5.37(Sa/Ss)^2 + 11.69(Sa/Ss) – 5.32]$

Where:
A = Amount to be paid
Sa = Actual strength from cylinders or cores
Ss = Specified design strength
Bp = Unit bid price

SPECIAL PROVISION

421---035--CoSA

Hydraulic Cement Concrete

For this project, Item 421, "Hydraulic Cement Concrete," of the Standard Specifications is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 421.2.D. Water, Table 1. Chemical Limits for Mix Water is voided and replaced by the following:

Table 1
Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (Cl)	ASTM C 114	
Prestressed concrete		500
Bridge decks and superstructure		500
All other concrete		1,000
Sulfate (SO_4)	ASTM C 114	2,000
Alkalies ($Na_2O + 0.658K_2O$)	ASTM C 114	600
Total Solids	ASTM C 1603	50,000

Article 421.2.B. Supplementary Cementing Materials (SCM) is supplemented with the following:

6. **Modified Class F Fly Ash (MFFA).** Furnish MFFA conforming to DMS-4610, "Fly Ash."

Article 421.2.D. Water, Table 2. Acceptance Criteria for Questionable Water Supplies is voided and replaced by the following:

Table 2
Acceptance Criteria for Questionable Water Supplies

Property	Test Method	Limits
Compressive strength, min. % control at 7 days	ASTM C 31, ASTM C 39[1,2]	90
Time of set, deviation from control, h:min.	ASTM C 403[1]	From 1:00 early to 1:30 later

1. Base comparisons on fixed proportions and the same volume of test water compared to the control mix using 100% potable water or distilled water.
2. Base comparisons on sets consisting of at least two standard specimens made from a composite sample.

Article 421.2.E.1 Coarse Aggregate. The fourth paragraph is voided and replaced by the following:

Unless otherwise shown on the plans, provide coarse aggregate with a 5-cycle magnesium sulfate soundness when tested in accordance with Tex-411-A of not more than 25% when air

entrainment is waived and 18% when air entrainment is not waived. Crushed recycled hydraulic cement concrete is not subject to the 5-cycle soundness test.

Article 421.2.E.2 Fine Aggregate. The fifth paragraph is voided and replaced by the following:

Acid insoluble (%) = {(A1)(P1)+(A2)(P2)}/100
where:

A1 = acid insoluble (%) of aggregate 1
A2 = acid insoluble (%) of aggregate 2
P1 = percent by weight of aggregate 1 of the fine aggregate blend
P2 = percent by weight of aggregate 2 of the fine aggregate blend

Article 421.2.E.2. Fine Aggregate. The final paragraph is voided and replaced by the following:

For all classes of concrete, provide fine aggregate with a fineness modulus between 2.3 and 3.1 as determined by Tex-402-A.

Article 421.2.E. Aggregate is supplemented by the following:

4. **Intermediate Aggregate.** When necessary to complete the concrete mix design, provide intermediate aggregate consisting of clean, hard, durable particles of natural or lightweight aggregate or a combination thereof. Provide intermediate aggregate free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material, and containing no more than 0.5% clay lumps by weight in accordance with Tex-413-A.

   If more than 30% of the intermediate aggregate is retained on the No. 4 sieve, the retained portion must meet the following requirements:

   - must not exceed a wear of 40% when tested in accordance with Tex-410-A.
   - must have a 5-cycle magnesium sulfate soundness when tested in accordance with Tex-411-A of not more than 25% when air entrainment is waived and 18% when air entrainment is not waived.

   If more than 30% of the intermediate aggregate passes the 3/8" sieve, the portion passing the 3/8" sieve must not show a color darker than standard when subjected to the color test for organic impurities in accordance with Tex-408-A and must have an acid insoluble residue, unless otherwise shown on the plans, for concrete subject to direct traffic equal to or greater than the value calculated with the following equation:

$$AIi_a \geq \frac{60 - (AI_{fa})(P_{fa})}{(P_{ia})}$$

   where:

   AI*fa* = acid insoluble (%) of fine aggregate or fine aggregate blend
   P*fa* = percent by weight of the fine aggregate or fine aggregate blend as a percentage of the total weight of the aggregate passing the 3/8" sieve in the concrete mix design
   P*ia* = percent by weight of the intermediate aggregate as a percentage of the total weight of the aggregate passing the 3/8" sieve in the concrete mix design

Article 421.2.F. Mortar and Grout is supplemented by the following:

Section 421.4.A.6, "Mix Design Options," does not apply for mortar and grout.

Article 421.3.A. Concrete Plants and Mixing Equipment is supplemented by the following:

When allowed by the plans or the Engineer, for concrete classes not identified as structural concrete in Table 5 or for Class C concrete not used for bridge-class structures, the Engineer may inspect and approve all plants and trucks in lieu of the NRMCA or non-Department engineer sealed certifications. The criteria and frequency of Engineer approval of plants and trucks is the same used for NRMCA certification.

Article 421.3.A.2. Volumetric Mixers is supplemented by the following:

Unless allowed by the plans or the Engineer, volumetric mixers may not supply classes of concrete identified as structural concrete in Table 5.

Article 421.4.A Classification and Mix Design. The first paragraph is voided and replaced by the following:

Unless a design method is indicated on the plans, furnish mix designs using ACI 211, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete," Tex-470-A, or other approved procedures for the classes of concrete required in accordance with Table 5. Perform mix design and cement replacement using the design by weight method unless otherwise approved. Do not exceed the maximum water-to-cementitious-material ratio.

Article 421.4.A. Classification and Mix Design, Table 5 Concrete Classes is voided and replaced by the following:

Table 5
Concrete Classes

Class of Concrete	Design Strength, Min. 28-day f'_c (psi)	Maximum W/C Ratio[1]	Coarse Aggregate Grades[2,3]	General Usage[4]
A	3,000	0.60	1–4, 8	Inlets, manholes, curb, gutter, curb & gutter, conc. retards, sidewalks, driveways, backup walls, anchors
B	2,000	0.60	2–7	Riprap, small roadside signs, and anchors
C[5]	3,600	0.45	1–6	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, concrete traffic barrier (cast-in-place)
C(HPC)[5]	3,600	0.45	1-6	As shown on the plans
D	1,500	0.60	2–7	Riprap
E	3,000	0.50	2–5	Seal concrete
F[5]	Note 6	0.45	2–5	Railroad structures; occasionally for bridge piers, columns, or bents
F(HPC)[5]	Note 6	0.45	2–5	As shown on the plans
H[5]	Note 6	0.45	3–6	Prestressed concrete beams, boxes, piling, and concrete traffic barrier (precast)
H(HPC)[5]	Note 6	0.45	3–6	As shown on the plans
S[5]	4,000	0.45	2–5	Bridge slabs, top slabs of direct traffic culverts

Class of Concrete	Design Strength, Min. 28-day f'_c (psi)	Maximum W/C Ratio[1]	Coarse Aggregate Grades[2,3]	General Usage[4]
S(HPC)[5]	4,000	0.45	2–5	As shown on the plans
P	See Item 360	0.45	2–3	Concrete pavement
DC[5]	5,500	0.40	6	Dense conc. overlay
CO[5]	4,600	0.40	6	Conc. overlay
LMC[5]	4,000	0.40	6–8	Latex-modified concrete overlay
SS[5]	3,600[7]	0.45	4–6	Slurry displacement shafts, underwater drilled shafts
K[5]	Note 6	0.45	Note 6	Note 6
HES	Note 6	0.45	Note 6	Note 6

1. Maximum water-cement or water-cementitious ratio by weight.
2. Unless otherwise permitted, do not use Grade 1 coarse aggregate except in massive foundations with 4-in. minimum clear spacing between reinforcing steel bars. Do not use Grade 1 aggregate in drilled shafts.
3. Unless otherwise approved, use Grade 8 aggregate in extruded curbs.
4. For information only.
5. Structural concrete classes.
6. As shown on the plans or specified.
7. Use a minimum cementitious material content of 650 lb/cy of concrete. Do not apply Table 6 over design requirements to Class SS concrete.

Article 421.4.A. Classification and Mix Design, Table 6 Over Design to Meet Compressive Strength Requirements. Footnote 3 is supplemented by the following:

For Class K and concrete classes not identified as structural concrete in Table 5 or for Class C concrete not used for bridge-class structures, the Engineer may designate on the plans an alternative over-design requirement up to and including 1,000 psi for specified strengths less than 3,000 psi and up to and including 1,200 psi for specified strengths from 3,000 to 5,000 psi.

Article 421.4.A.1. Cementitious Materials is supplemented by the following:

The upper limit of 35% replacement of cement with Class F fly ash specified by mix design Options 1 and 3 may be increased to a maximum of 45% for mass placements, high performance concrete, and precast members when approved.

Article 421.4.A.3. Chemical Admixtures is supplemented by the following:

When a corrosion-inhibiting admixture is required, use a 30% calcium nitrite solution. The corrosion-inhibiting admixture must be set neutral unless otherwise approved. Dose the admixture at the rate of gallons of admixture per cubic yard of concrete shown on the plans.

Article 421.4.A.4 Air Entrainment is voided and replaced by the following:

Air entrain all concrete except for Class B and concrete used in drilled shafts unless otherwise shown on the plans. Unless otherwise shown on the plans, target an entrained air content of 4.0% for concrete pavement and 5.5% for all other concrete requiring air entrainment. To meet the air-entraining requirements, use an approved air-entraining admixture. Unless otherwise shown on the plans, acceptance of concrete loads will be based on a tolerance of ± 1.5% from the target air content. If the air content is more than 1.5 but less than 3.0% above the target air, the concrete

may be accepted based on strength tests. For specified concrete strengths above 5,000 psi, a reduction of 1% is permitted.

Article 421.4.A Table 7 Air Entrainment is voided.

Article 421.4.A.6. Mix Design Options. The first and second paragraphs are voided and replaced by the following:

For structural concrete identified in Table 5 and any other class of concrete designed using more than 520 lb. of cementitious material per cu. yd., use one of the mix design Options 1–8 shown below, unless otherwise shown on the plans.

For concrete classes not identified as structural concrete in Table 5 and designed using less than 520 lb. of cementitious material per cu. yd., use one of the mix design Options 1–8 shown below, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3, and 4 unless sulfate-resistant concrete is shown on the plans.

Do not use mix design Options 6 or 7 when High Performance Concrete (HPC) is required. Option 8 may be used when HPC is required provided: a minimum of 20% of the cement is replaced with a Class C fly ash; Tex-440-A, "Initial Time of Set of Fresh Concrete" is performed during mix design verification; the additional requirements for permeability are met; and the concrete is not required to be sulfate-resistant.

Article 421.4.A.6.b. Option 2 is voided and replaced by the following:

b. Option 2. Replace 35 to 50% of the cement with GGBFS or MFFA.

Article 421.4.A.6.c. Option 3 is voided and replaced by the following:

c. Option 3. Replace 35 to 50% of the cement with a combination of Class F fly ash, GGBFS, MFFA, UFFA, metakaolin, or silica fume; however, no more than 35% may be fly ash, and no more than 10% may be silica fume.

Article 421.4.A.6.f. Option 6 is voided and replaced by the following:

f. Option 6. Use lithium nitrate admixture at a minimum dosage determined by testing conducted in accordance with Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing." Before use of the mix, provide an annual certified test report signed and sealed by a licensed professional engineer, from a laboratory on the Department's List of Approved Lithium Testing Laboratories, certified by the Construction Division as being capable of testing according to Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing."

Article 421.4.A.6.g. Option 7 is voided and replaced by the following:

g. Option 7. When using hydraulic cement only, ensure that the total alkali contribution from the cement in the concrete does not exceed 3.5 lb. per cubic yard of concrete when calculated as follows:

$$\text{lb. alkali per cu. yd.} = \frac{(\text{lb. cement per cu. yd.}) \times (\%\ Na_2O \text{ equivalent in cement})}{100}$$

In the above calculation, use the maximum cement alkali content reported on the cement mill certificate.

Do not use Option 7 when any of the aggregates in the concrete are listed on the Department's List of Aggregate Sources Excluded from Option 7 ASR Mitigation.

Article 421.4.A.6.h. Option 8 is voided and replaced by the following:

h. Option 8. For any deviations from Options 1–5, perform annual testing on coarse, intermediate, and fine aggregate separately in accordance with ASTM C 1567. Before use of the mix, provide a certified test report signed and sealed by a licensed professional engineer, from a laboratory on the Department's List of Approved ASTM C 1260 Laboratories, demonstrating that the ASTM C 1567 test result for each aggregate does not exceed 0.08% expansion at 14 days.

Do not use Option 8 when any of the aggregates in the concrete are listed on the Department's List of Aggregate Sources Excluded from Option 8 ASR Mitigation. When HPC is required, provide a certified test report signed and sealed by a licensed professional engineer demonstrating that AASHTO T 277 test results indicate the permeability of the concrete is less than 1,500 coulombs tested immediately after either of the following curing schedules:

- Moist cure specimens 56 days at 73ºF.
- Moist cure specimens 7 days at 73ºF followed by 21 days at 100ºF.

Article 421.4.B. Trial Batches is supplemented by the following:

Once a trial batch substantiates the mix design, the proportions and mixing methods used in the trial batch become the mix design of record.

Article 421.4.B. Trial Batches. The fourth sentence of the second paragraph is voided and replaced by the following:

Test at least one set of design strength specimens, consisting of two specimens per set, at 7-day, 28-day, and at least one additional age.

Article 421.4.D. Measurement of Materials, Table 9 is voided and replaced by the following:

Table 9
Measurement Tolerances – Non-Volumetric Mixers

Material	Tolerance (%)
Cement, wt.	-1 to +3
SCM wt.	-1 to +3
Cement + SCM (cumulative weighing), wt.	-1 to +3
Water, wt. or volume	±3
Fine aggregate, wt.	±2
Coarse aggregate, wt.	±2
Fine + coarse aggregate (cumulative weighing), wt.	±1
Chemical admixtures, wt. or volume	±3

Article 421.4.E. Mixing and Delivering Concrete. The first paragraph is supplemented with the following:

Do not top-load new concrete onto returned concrete.

Article 421.4.E.3. Truck-Mixed Concrete. The first paragraph is voided and replaced by the following:

Mix the concrete in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer to produce a uniform concrete mix. Deliver the concrete to the project in a thoroughly mixed and uniform mass and discharge the concrete with a satisfactory degree of uniformity. Additional mixing at the job site at the mixing speed designated by the manufacturer is allowed as long as the requirements of Section 421.4.A.5, “Slump” and Section 421.4.E, “Mixing and Delivering Concrete” are met.

SPECIAL PROVISION

424---002--CoSA

Precast Concrete Structures (Fabrication)

For this project, Item 424, "Precast Concrete Structures (Fabrication)," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 424.3. Construction, Section B. Fabrication, Section 4. Quality of Concrete. The first paragraph is voided and replaced by the following:

Provide concrete in accordance with Item 421, "Hydraulic Cement Concrete," except for the following:

- Air-entrained concrete will not be required in precast concrete members, unless otherwise shown on the plans.
- Use a minimum of 25% Class F fly ash with mix design Option 1 from Section 421.4.A.6, "Mix Design Options," for all precast concrete members.
- Do not use mix design Options 6, 7, or 8 from Section 421.4.A.6., "Mix Design Options" for all precast concrete members.

For each type of structure or unit, use the class of concrete shown on the plans or in the pertinent Item.

SPECIAL PROVISION

440---005---CoSA

Reinforcing Steel

For this project, Item 440, "Reinforcing Steel" of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 440.2 Materials, Section A. Approved Mills is supplemented by the following:

Contact the Construction Division with the name and location of the producing mill for stainless steel reinforcement at least 4 weeks prior to ordering any material.

Article 440.2. Materials, Section D. Weldable Reinforcing Steel is supplemented by the following:

Do not weld stainless reinforcing steel without permission from the Engineer. If welding is required, provide stainless steel reinforcing suitable for welding and submit welding procedures and electrodes to the Engineer for approval.

Article 440.2. Materials, Section G. Mechanical Couplers is voided and replaced by the following:

When mechanical splices in reinforcing steel bars are shown on the plans, use couplers of the type specified in DMS-4510, "Mechanical Couplers for Reinforcing Steel," Article 4510.5.A, "General Requirements."

Furnish only couplers produced by a manufacturer pre-qualified in accordance with DMS-4510. Do not use sleeve-wedge type couplers on coated reinforcing. Sample and test couplers for use on individual projects in accordance with DMS-4510. Furnish couplers only at locations shown on the plans.

Furnish couplers for stainless reinforcing steel with the same alloy designation as the reinforcing steel.

Article 440.2. Materials is supplemented by the following:

H. Fibers. When allowed by the plans, supply fibers at the minimum dosage listed on the Material Producer List maintained by the Materials and Pavements Section of the Construction Division. When shown on the plans, use fibers that do not corrode due to carbonation of concrete or the use of deicing salts.

I. Stainless Steel. When stainless reinforcing steel is required in the plans, provide deformed steel bars of the types listed below and conforming to ASTM A 955, Gr. 60 or higher.

UNS Designation	S31653	S31803	S24100	S32304
AISI Type	316LN	2205	XM-28	2304

Article 440.3.Construction, Section A. Bending is supplemented by the following:

Bend stainless reinforcing steel in accordance with ASTM A955.

Article 440.3.Construction, Section C. Storage is supplemented by the following:

Do not allow stainless steel reinforcement to be in direct contact with uncoated steel reinforcement, nor with galvanized reinforcement. This does not apply to stainless steel wires and ties. Store stainless steel bar reinforcement separately, off the ground on wooden supports.

Article 440.3. Construction, Section D. Splices. The fifth bullet is voided and replaced by the following:

- For box culvert extensions with less than 1 ft. of fill, lap the existing longitudinal bars with the new bars as shown in Table 5. For extensions with more than 1 ft. of fill, lap at least 1 ft. 0 in.

Article 440.3. Construction, is supplemented by the following:

G. Handling and Placing Stainless Steel Reinforcing.
Handle, cut, and place stainless steel bar reinforcement using tools that are not used on carbon steel. Do not use carbon steel tools, chains, slings, etc. when handling stainless steel. Use only nylon or polypropylene slings. Cut stainless steel using shears, saws, abrasive cutoff wheels, or torches. Remove any thermal oxidation using pickling paste. Do not field bend stainless steel without approval.

Use 16 gauge fully annealed stainless steel tie wire conforming to the material properties listed in 440.2.I. “Stainless Steel”. Support all stainless steel on solid plastic, stainless steel, or epoxy coated steel chairs. Do not use uncoated carbon steel chairs in contact with stainless steel.

SPECIAL PROVISION
441---006--CoSA
Steel Structures

For this project, Item 441, "Steel Structures," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 441.3, "Construction," Section A, "General Requirements," Section 1, "Applicable Codes," is voided and replaced by the following:

Perform all fabrication in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1, including fabrication of non-bridge members. Follow all applicable provisions of the appropriate AWS code (D1.5 or D1.1) except as otherwise noted in the plans or in this Item. Weld sheet steel (thinner than 1/8 in.) in accordance with ANSI/AWS D1.3, Structural Welding Code—Sheet Steel. Unless otherwise stated, requirements of this Item are in addition to the requirements of S2.1. In case of a conflict between this Item and S2.1, follow the more stringent requirement. Perform all bolting in accordance with Item 447, "Structural Bolting."

Article 441.3, "Construction," Section A, "General Requirements," Section 5, "Qualification of Plant, Laboratories, and Personnel," Section b, "Nondestructive Examination (NDE)," is voided and replaced by the following:

Personnel performing NDE must be qualified in accordance with the applicable AWS code. Current certification in accordance with ASNT SNT-TC-1A is required for an inspector to be considered qualified. Testing agencies and individual third-party contractors must also successfully complete periodic audits for compliance, performed by the Department. In addition, ultrasound technicians must pass a hands-on test administered by the Construction Division. A technician who fails the hands-on test must wait 6 months before taking the test again. Qualification to perform ultrasonic testing for the Department will be revoked when the technician's employment is terminated, and recertification based on a new hands-on test will be required.

Article 441.3, "Construction," Section A, "General Requirements," Section 9, "Inspection." The second paragraph is voided and replaced by the following:

Provide the Inspector with the helpers and equipment needed to move material to allow inspection. QC is solely the responsibility of the Contractor. The Contractor must have a QC staff qualified in accordance with the applicable AWS code. Welding inspectors must be current AWS Certified Welding Inspectors. The QC staff must provide inspection of all materials and workmanship prior to inspection by the Department.

Article 441.3, "Construction," Section B, "Welding," Section 5, "Nondestructive Examination (NDE)," Section c, "Magnetic Particle Testing." The first sentence is voided and not replaced.

Article 441.3, "Construction," Section D, "Dimensional Tolerances," Section 2, "Flange Straightness." The second sentence is voided and replaced by the following:

Rolled material must meet this straightness requirement before being laid out or worked.

Article 441.3, "Construction," Section D, "Dimensional Tolerances," Section 3, "Alignment of Deep Webs in Welded Field Connection." The first sentence is voided and replaced by the following:

For girders 48 in. deep or deeper, the webs may be slightly restrained while checking compliance with tolerances of S2.1 for lateral alignment at welded field connections.

Article 441.3, "Construction," Section D, "Dimensional Tolerances," Section 4, "Bearings," Section c, "Shoes," is supplemented by the following:

- For a pin and rocker type expansion shoe, the axis of rotation coincides with the central axis of the pin.
- When the shoe is completely assembled, as the top bolster travels through its full anticipated range, no point in the top bolster plane changes elevation by more than 1/16 in. and the top bolster does not change inclination by more than 1 degree, for the full possible travel.

Article 441.3, "Construction," Section D, "Dimensional Tolerances," Section 4, "Bearings," is supplemented by the following:

d. Beam supports. Fabricate beam support planes true to the box girder bearing to 1/16 in. in the short direction and true to the vertical axis of the nesting girders to 1/16 in.

Article 441.3, "Construction," Section G, "Shop Assembly," Section 1, "General Shop Assembly." The first paragraph is voided and replaced by the following:

1. General Shop Assembly. Shop-assemble field connections of primary members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, field connections of floor beams and stringers (including for railroad structures), field-bolted plate diaphragms for curved plate girders and railroad underpasses, and rigid frames. Field-bolted crossframes and rolled-section diaphragms do not require shop assembly. Complete fabrication, welding (except for shear studs), and field splice preparation before members are removed from shop assembly. Obtain approval for any deviation from this procedure. The Contractor is responsible for accurate geometry.

SPECIAL PROVISION
442---016--CoSA
Metal for Structures

For this project, Item 442, "Metal for Structures," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 442.2, "Materials," Section A, "Structural Steel," Section 1, "Bridge Structures." The third sentence is voided and not replaced.

Article 442.5, "Payment," is voided and replaced by the following:

442.5. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Structural Steel" of the type (Rolled Beam, Plate Girder, Tub Girder, Box Girder, Railroad Through-Girder, Railroad Deck-Girder, Miscellaneous Bridge, Miscellaneous Non-Bridge) specified. This price is full compensation for materials, fabrication, transportation, erection, paint, painting, galvanizing, equipment, tools, labor, and incidentals.

SPECIAL PROVISION

448---002---CoSA

Structural Field Welding

For this project, Item 448, "Structural Field Welding," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 448.3 Equipment is voided and replaced by the following:

Provide electrode drying and storing ovens that can maintain the required temperatures specified in Section 448.4.C.1, "Electrode Condition." Each oven must have a door that is sealed and can be latched. Each oven must have a small port that may be opened briefly to insert a thermometer or the oven must be equipped with a thermometer that allows for direct reading of temperature inside the oven without opening the oven. Provide equipment able to preheat and maintain the temperature of the base metal as required and as shown on the plans. Provide approved equipment, temperature indicator sticks, infrared thermometer, etc., for checking preheat and interpass temperatures at all times while welding is in progress. Provide welding equipment meeting the requirements of the approved welding procedure specifications (WPS), if required, and capable of making consistent high-quality welds.

Article 448.4.B.2.Certified Steel Structures Welder. The second bulleted item is voided and replaced by the following:

- Use metal for test plates that meets Item 442, "Metal for Structures," with a minimum yield point of 36 ksi. The minimum width of test plate must be sufficient to accommodate the radiograph inspection of 6 continuous inches of the weld, not counting the ends of the weld.

Article 448.4.C.5. Welding Practice. The second paragraph is voided and replaced by the following:

Use the stringer-bead technique where possible for groove welds. In vertical welding passes, progress upward using a back-step sequence keeping the end of the low-hydrogen electrode contained within the molten metal and shield of flux, unless the electrode manufacturer's specifications indicate otherwise

Article 448.4.C.7. Radiographic Inspection is supplemented by the following:

Meet the requirements specified in Section 441.3.B.5.a, "Radiographic Testing" for radiograph film quality.

SPECIAL PROVISION

462---011--CoSA

CONCRETE BOX CULVERTS AND STORM DRAINS

For this project, Item 462, "Concrete Box Culverts and Storm Drains," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 462.2. Materials, Section A. General. The last two paragraphs are voided and replaced by the following:

Furnish concrete for machine-made precast boxes in accordance with ASTM C 1577 except as noted herein. Furnish concrete component materials for machine-made precast boxes in accordance with the following:

- **Cement.** Furnish cement conforming to DMS-4600, "Hydraulic Cement."
- **Supplementary Cementing Materials (SCM).** Furnish SCM conforming to Item 421, "Hydraulic Cement Concrete."
- **Chemical Admixtures.** Furnish admixtures conforming to DMS-4640, "Chemical Admixtures for Concrete," unless otherwise approved by the Engineer. Do not use calcium chloride.
- **Water.** Furnish water conforming to Item 421, "Hydraulic Cement Concrete."
- **Fine and Coarse Aggregate.** Furnish aggregates conforming to Item 421, "Hydraulic Cement Concrete," except the requirement for gradation will not apply.

When sulfate-resistant concrete is required, use mix design Options 1, 2, 3, or 4 given in Section 421.4.A.6, "Mix Design Options," for machine-made precast boxes using Type I/II, II, V, IP, or IS cement. Do not use Class C fly ash in sulfate-resistant concrete.

Article 462.2. Materials, Section B. Fabrication, 3. Machine-Made Precast. The first sentence is voided and replaced by the following:

Furnish machine-made precast boxes in accordance with ASTM C 1577 except as noted herein.

Article 462.2. Materials, Section C. Testing, 2. Formed Precast is voided and replaced by the following:

Make, cure, and test compressive test specimens in accordance with Tex-704-I.

Article 462.2. Materials, Section C. Testing, 3. Machine-Made Precast. The first paragraph is voided and replaced by the following:

Make compressive test specimens in accordance with ASTM C 497. Make a minimum of 4 test specimens for each day's production run and each mix design. Cure test specimens in the same

manner and for the same duration as the boxes they represent until tested. Test a set of compressive strength specimens, consisting of 2 per set, in accordance with ASTM C 39.

Article 462.2. Materials, Section E. Marking. The first paragraph is voided and replaced by the following:

Mark precast boxes with the following:

- name or trademark of the producer;
- ASTM designation (for machine made boxes);
- date of manufacture;
- box size;
- minimum and maximum fill heights;
- designation “SR” for boxes meeting sulfate-resistant concrete plan requirements (when applicable); and
- match marks for proper installation, when required, under Section 462.2.F, “Tolerances.”

SPECIAL PROVISION
464---003--CoSA
Reinforced Concrete Pipe

For this project, Item 464, "Reinforced Concrete Pipe," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 464.2. Materials, Section A. Fabrication is voided and replaced by the following:

Fabrication plants must be approved by the Construction Division in accordance with DMS-7310, "Reinforced Concrete Pipe Fabrication and Plant Qualification" before furnishing precast reinforced concrete pipe for Department projects. The Construction Division maintains a list of approved reinforced concrete pipe plants.

Furnish material and fabricate reinforced concrete pipe in accordance with DMS-7310, "Reinforced Concrete Pipe Fabrication and Plant Qualification."

Article 464.2. Materials, Section B. Design. 1. General. Table 2 is voided and replaced with the following:

Table 2
Arch Pipe

Design Size	Equivalent Diameter (in.)	Rise (in.)	Span (in.)
1	18	13-1/2	22
2	21	15-1/2	26
3	24	18	28-1/2
4	30	22-1/2	36-1/4
5	36	26-5/8	43-3/4
6	42	31-5/16	51-1/8
7	48	36	58-1/2
8	54	40	65
9	60	45	73
10	72	54	88

Article 464.2. Materials, Section C. Physical Test Requirements is voided and not replaced.

Article 464.2. Materials, Section D. Markings. The first paragraph is voided and replaced with the following:

Furnish each section of reinforced concrete pipe marked with the following information specified in DMS-7310, "Reinforced Concrete Pipe Fabrication and Plant Qualification":

- class or D-Load of pipe,
- ASTM designation,
- date of manufacturer,
- name or trademark of manufacturer and plant location,
- designated manufacturer's approval marking,
- pipe to be used for jacking and boring (when applicable), and
- pipe meeting sulfate-resistant concrete plan requirements (when applicable).

Article 464.2. Materials, Section E. Inspection is voided and replaced with the following:

Provide access for inspection of the finished pipe at the project site before and during installation.

Article 464.2. Materials, Section F. Causes for Rejection is voided and replaced by the following:

Individual sections of pipe may be rejected for any of the conditions stated in the annex of DMS-7310, "Reinforced Concrete Pipe Fabrication and Plant Qualification."

Article 464.2. Materials, Section G. Repairs is voided and replaced by the following:

Make repairs if necessary as stated in the annex of DMS-7310, "Reinforced Concrete Pipe Fabrication and Plant Qualification."

Article 464.2. Materials, Section H. Rejections is voided and not replaced.

SPECIAL PROVISION
465---001--CoSA
Manholes and Inlets

For this project, Item 465, "Manholes and Inlets," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 465.2, Materials. The second paragraph is voided and replaced by the following:

Precast manholes, inlets, risers, and appurtenances are acceptable unless otherwise shown. Alternate designs for precast items must be acceptable to the Engineer and must conform to functional dimensions and dimensions for plan wall, slab and edge beam thicknesses, and reinforcing steel areas. Alternate designs must be designed and sealed by a licensed professional engineer.

SPECIAL PROVISION
500---005--CoSA
Mobilization

For this project, Item 500, "Mobilization," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 500.1. Description is supplemented by the following:

Work for this Item includes submissions required by the Contract.

Article 500.3. Payment, Section A is voided and replaced by the following:

A. Payment will be made upon presentation of a paid invoice for the payment, performance, or retainage bonds, and required insurance. The combined payment for bonds and insurance will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.

Article 500.3. Payment, Section F is voided and replaced by the following:

F. Upon final acceptance, 97% of the mobilization lump sum bid will be paid. Previous payments under this Item will be deducted from this amount.

Article 500.3. Payment is supplemented by the following:

G. Payment for the remainder of the lump sum bid for "Mobilization" will be made after all submittals are received, final quantities have been determined and when any separate vegetative establishment and maintenance, test and performance periods provided for in the Contract have been successfully completed.

SPECIAL PROVISION

502---012--CoSA

Barricades, Signs and Traffic Handling

For this project, Item 502, "Barricades, Signs and Traffic Handling," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 502.2. Construction is supplemented by the following:

Perform all lane closures as required and as necessary to complete this work. All connecting ramp closures require one week notice to the motorist via a portable dynamic message sign if closure will be for more than 1 hour.

Type	Description
1	Lane Closure Type 1 consists of one – One Lane Mainlane Closure
2	Lane Closure Type 2 consists of one – Two Lane Mainlane Closure
3	Lane Closure Type 3 consists of one – Three Lane Mainlane Closure
4	Lane Closure Type 4 consists of one – Four Lane Mainlane Closure
5	Lane Closure Type 5 consists of one – Five Lane Mainlane Closure
6	Lane Closure Type 6 consists of one – One Lane Connecting Ramp Closure
7	Lane Closure Type 7 consists of one – One Lane Entrance/Exit Ramp Closure-Note: If an exit ramp falls within the mainlane closure, the Contractor will only be paid for the mainlane closure and not an exit ramp closure. The reason is that by closing the mainlane automatically closes the exit ramp.
8	Lane Closure Type 8 consists of one – Two Lane Connecting Ramp Closure
9	Lane Closure Type 9 consists of one – One Lane Frontage Road Closure
10	Lane Closure Type 10 consists of one – Two Lane Frontage Road Closure
11	Lane Closure Type 11 consists of one – Three Lane Frontage Road Closure

SPECIAL PROVISION

502---033--CoSA

Barricades, Signs, and Traffic Handling

For this project, Item 502, "Barricades, Signs, and Traffic Handling," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 502.4. Payment, Section C. Maximum Total Payment Prior to Acceptance is voided and replaced by the following:

C. Maximum Total Payment Prior to Acceptance. The total payment for this Item will not exceed 10% of the total Contract amount before final acceptance in accordance with Article 5.8, "Final Acceptance." The remaining balance will be paid in accordance with Section 502.4.E, "Balance Due."

12 Lane Closure Type 12 consists of one Complete Closure of the Upper Level

13 Lane Closure Type 13 consists of one Complete Closure of the Lower Level

14 Off Duty Police Officer consists of one Peace Officer with Escort Motorcycle.

Conduct lane closures at night between the hours of 10:00 P.M. and 5:30 A.M. unless otherwise approved or directed. Follow the San Antonio District Guidelines for night work, including off-duty police officers with escort motorcycles and shadow vehicles with truck mounted attenuators to provide additional traffic control. Closures are not allowed on designated roadways during special events at the Alamodome and the Arena.

Article 502.3. Measurement is voided and replaced by the following:

502.3. Measurement. This Item will be measured as follows:

Lane Closure Type 1 - measured by the each.
Lane Closure Type 2 - measured by the each.
Lane Closure Type 3 - measured by the each.
Lane Closure Type 4 - measured by the each.
Lane Closure Type 5 - measured by the each.
Lane Closure Type 6 - measured by the each.
Lane Closure Type 7 - measured by the each.
Lane Closure Type 8 - measured by the each.
Lane Closure Type 9 - measured by the each.
Lane Closure Type 10 - measured by the each.
Lane Closure Type 11 - measured by the each.
Lane Closure Type 12 - measured by the each.
Lane Closure Type 13 - measured by the each.
Off Duty Police Officer - measured by the each hour.

Article 502.4. Payment is voided and replaced by the following:

502.4. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Barricades, Signs, and Traffic Handling", of the type specified and the unit price bid for "Off-Duty Police Officers." This price includes full compensation for furnishing all labor, materials, supplies, equipment and incidentals. If the Contractor fails, within the time frame established by the Engineer, to provide or properly maintain signs and barricades in compliance with the contract requirements, as determined by the Engineer, the Contractor will be considered in non-compliance with this Item and no payments will be made for this Item for the TCP type in question.

SPECIAL PROVISION

506---013

Temporary Erosion, Sedimentation, and Environmental Controls

For this project, Item 506, "Temporary Erosion, Sedimentation, and Environmental Controls," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 506.2. Materials. Section I. Sandbags. Table 1 is replaced with the following:

Table 1
Sand Gradation

Sieve #	Retained (% by Weight)
4	MAXIMUM 3%
100	MINIMUM 80%
200	MINIMUM 95%

Article 506.4 Construction, B. General, 2. Maintenance, is voided and replaced by the following:

B. General.

2. Maintenance. Perform maintenance in accordance with the plans and the TPDES General Permit. Correct ineffective control measures. Implement additional controls as directed.

An Inspector will perform a regularly scheduled SWP3 inspection once a month. Make corrections as soon as possible before the next anticipated rain event or within 7 calendar days after being able to enter the site to work on each control device. A control device site being "too wet to work" during the entire 7 calendar day time period is the only acceptable reason for not accomplishing the corrections within the 7 calendar day time limit. Provide documentation on the Department's inspection form developed from the Department's inspections or through other approved methods.

If maintenance corrections are not made within this timeframe, work on the project may be suspended by the Engineer. Time charges will continue until SWP3 is brought into compliance and documentation of corrective action is provided. This in no way releases the contractor of liability for noncompliance.

SPECIAL PROVISION

512---002--CoSA

Portable Concrete Traffic Barrier

For this project, Item 512, "Portable Concrete Traffic Barrier," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 512.2. Materials. The first paragraph is supplemented by the following:

For precast concrete traffic barrier,

- Furnish the class of concrete shown on the plans. Air-entrained concrete will not be required, unless otherwise shown on the plans.
- Use a minimum of 25% Class F fly ash with mix design Option 1 from Section 421.4.A.6, "Mix Design Options."
- Do not use mix design Options 6, 7, or 8 from Section 421.4.A.6., "Mix Design Options."

Article 512.3. Construction. The second sentence of the first paragraph is voided and replaced by the following:

Multi-project fabrication plants as defined in Item 424, "Precast Concrete Structures (Fabrication)" that produce concrete traffic barrier, except temporary barrier furnished and retained by the Contractor, must be approved in accordance with DMS-7350, "Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Traffic Barrier."

SPECIAL PROVISION

610---010--CoSA

Roadway Illumination Assemblies

For this project, Item 610, "Roadway Illumination Assemblies," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 610.2. Materials. The fourth paragraph is voided and replaced by the following:

Do not provide shop drawings for complete assemblies that are fabricated in accordance with this Item and the details shown on the plans. Electronically submit shop drawings for optional designs, aluminum pole designs, and special designs. For instructions on submitting electronic shop drawings refer to the "Guide to Electronic Shop Drawing Submittal" located online at:

http://www.txdot.gov/business/contractors_consultants/bridge/shop_drawings.htm

SPECIAL PROVISION
620---001--CoSA
Electrical Conductors

For this project, Item 620, "Electrical Conductors," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 620.2 Materials. The fourth and fifth paragraphs are void and replaced by the following:

Use white insulation for grounded (neutral) conductors, except that grounded conductors AWG No. 4 and larger may be black with white tape marking at every accessible location. Do not use white insulation or marking for any other conductor except control wiring specifically shown on the plans.

Ensure that insulated grounding conductors are green except that insulated grounding conductors AWG No. 4 and larger may be black with green tape marking at every accessible location. Do not use green insulation or marking for any other conductor except control wiring specifically shown on the plans.

SPECIAL PROVISION

624---014--CoSA

Ground Boxes

For this project, Item 624, "Ground Boxes," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 624.1. Description is voided and replaced by the following:

Construct, furnish, and install ground boxes complete with lids. Remove existing ground boxes.

Article 624.2 Construction and Materials. The first paragraph is voided and replaced by the following:

Provide new materials that comply with the details shown on the plans and meet the following requirements:

- Construct cast-in-place concrete ground boxes and aprons in accordance with Item 420, "Concrete Structures," and Item 440, "Reinforcing Steel."
- Provide fabricated precast polymer concrete ground boxes, and precast concrete ground boxes that comply with DMS-11070, "Ground Boxes."
- Construct a concrete apron, when shown on the plans, in accordance with Item 432, "Riprap," and Item 440, "Reinforcing Steel."

Article 624.2. Construction and Materials is supplemented by the following:

Remove existing ground boxes to at least 6 in. below the conduit level. Uncover conduit to a sufficient distance so that 90 degree bends can be removed and conduit reconnected. Clean the conduit in accordance with Item 618, "Conduit" and pull, splice, or terminate new conductors as indicated in the plans. Cleaning of conduit is subsidiary to this Item. Pulling, splicing, or terminating conductors will be paid under Item 620, "Electrical Conductors." Backfill area to ground level with acceptable material upon completing adjacent work related to conduit and conductors.

Article 624.3. Measurement is voided and replaced by the following:

This Item will be measured by each ground box complete in place or by each ground box removed.

Article 624.4. Payment is voided and replaced by the following:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Ground Boxes" of the types and sizes specified and for "Remove Existing Ground Boxes." This price is full compensation for excavating and backfilling; constructing, furnishing, installing, and removing the ground boxes and concrete aprons when required; and equipment, labor, materials, tools, and incidentals.

SPECIAL PROVISION
628---003-CoSA
Electrical Services

For this project, Item 628, "Electrical Services," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 628.5. Payment, **A. Installation** is voided and replaced by the following:

A. Installation. Except as provided for in the following paragraph, this price is full compensation for paying all fees, permits, and other costs; making arrangements with the utility company for all work and materials provided by the utility company; furnishing, installing, and connecting all components including poles, service supports, foundations, anchor bolts, riprap, enclosures, switches, breakers, conduit (from the service equipment including the elbow below ground), fittings, conductors (from the service equipment including the elbow below ground), brackets, bolts, hangers, and hardware; and equipment, labor, tools, and incidentals.

Costs for utility-owned power line extensions, connection charges, meter charges, and other charges will be paid for by the Department. The Department will reimburse the contractor the amount billed by the utility plus an additional 5% of the invoice cost will be paid for labor, equipment, administrative costs, superintendence, and profit.

SPECIAL PROVISION
636---014--CoSA
Aluminum Signs

For this project, Item 636, "Aluminum Signs," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 636.1. Description is voided and replaced by the following:

- **Installation.** Furnish, fabricate, and erect signs. Sign supports are provided for under other Items.
- **Replacement.** Replace existing signs on existing sign supports.
- **Refurbishing.** Refurbish existing signs on existing sign supports.

Article 636.2. Materials, Section A. Sign Blanks is voided and replaced by the following:

A. Sign Blanks. Furnish sign blank substrates in accordance with DMS-7110, "Aluminum Sign Blanks" or DMS-8305, "Fiberglass Sign Substrate," and in accordance with the types shown on the plans. Use single-piece sheet-aluminum substrates for Type A (small) signs. Use either extruded aluminum or fiberglass substrates for Type G (ground-mounted) or Type O (overhead-mounted) signs as shown on the plans.

Article 636.2. Materials, Section B. Sign Face Reflectorization is supplemented by the following:

Ensure that sign legend, symbols, borders, and background exhibit uniform color, appearance, and retroreflectivity when viewed both day and night.

Article 636.2. Materials, Section C. Sign Messages. The last two bullets are voided and replaced by the following:

- Fabricate non-reflective black film legend from materials meeting DMS-8300.
- Furnish direct-applied route markers and other attachments within the parent sign face, unless otherwise specified in the plans.

Article 636.2. Materials, Section D. Hardware is supplemented by the following:

Furnish sign hardware for fiberglass signs in accordance with the fiberglass substrate manufacturer's recommendations.

Article 636.3. Construction, Section A. Fabrication, Part 1. Sign Blanks. The first paragraph is voided and replaced by the following:

Furnish sign blanks to the sizes and shapes shown on the plans and that are free of buckles, warps, burrs, dents, cockles, or other defects. Do not splice individual extruded aluminum or fiberglass panels.

Article 636.3. Construction, Section A. Fabrication, Part 2. Sheeting Application is voided and replaced by the following:

2. Sheeting Application. Apply sheeting to sign blanks in conformance with the sheeting manufacturer's recommended procedures. Meet the fabrication requirements of DMS-8300, Section 8300.7.F, "Sign Fabrication" for white, orientation non-compliant sheeting listed on the Department's Material Producer List entitled "Sign Face Materials." Clean and prepare the outside surface of extruded aluminum or fiberglass flanges in the same manner as the sign panel face.

Minimize the number of splices in the sheeting. Overlap the lap-splices by at least 1/4 in. Use butt splices for Type C microprismatic, Type D, and Type E reflective sheeting. Provide a 1-ft. minimum dimension for any piece of sheeting. Do not splice sheeting for signs fabricated with transparent screen inks or colored transparent films.

Article 636.3. Construction, Section A. Fabrication, Part 3. Sign Assembly. The first paragraph is voided and replaced by the following:

3. Sign Assembly. Assemble extruded aluminum signs in accordance with the details shown on the plans. Assemble fiberglass signs in accordance with the fiberglass manufacturer's recommendations located on the Department's Material Producer List entitled "Fiberglass Sign Substrates." Sign face surface variation must not exceed 1/8 in. per foot. Surface misalignment between panels in multi-panel signs must not exceed 1/16 in. at any point.

Article 636.3. Construction, Section B. Storage and Handling. The last paragraph is voided and replaced by the following:

Store all finished signs off the ground and in a vertical position until erected. Store finished sheet-aluminum substrate signs in a weatherproof building. Extruded aluminum and fiberglass substrate signs may be stored outside.

Article 636.3. Construction, Section E. Replacement is supplemented by the following:

Mounting hardware for fiberglass signs will be per the fiberglass substrate manufacturer's recommendations.

Article 636.3. Construction, Section H. Documentation is added.

H. Documentation. Provide a notarized original of the Signing Material Statement (Form 2273) with the proper attachments for verification of compliance.

Article 636.5. Payment. The first paragraph is voided and replaced by the following:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Aluminum Signs," "Fiberglass Signs," "Signs," "Replacing Existing Aluminum Signs," "Replacing Existing Fiberglass Signs," "Refurbishing Aluminum Signs," or "Refurbishing Fiberglass Signs," of the type specified.

Article 636.5. Payment, Section B. Replacement is voided and replaced by the following:

B. Replacement. This price is full compensation for: furnishing and installing new aluminum or fiberglass signs and hardware; removal of existing signs; fabrication of sign panels; treatment of sign panels required before application of the background materials; application of the background materials and messages to the sign panels; furnishing and fabricating frames, wind beams, stiffeners, or required joint backing strips; furnishing bolts, rivets, screws, fasteners, clamps, brackets, and sign support connections; assembling and erecting the signs; preparing and cleaning the signs; salvaging and disposing of unsalvageable material; and equipment, materials, labor, tools, and incidentals.

SPECIAL PROVISION
643---001--CoSA
Sign Identification Decals

For this project, Item 643, "Sign Identification Decals," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 643.2. Materials. Figure 1 and Table 1 are replaced by the following:

TxDOT												
C	**Fabrication Date**										**T**	**1**
J	F	M	A	M	J	J	A	S	O	N	D	**2**
	200		201		202		203		204			**3**
	0	1	2	3	4	5	6	7	8	9		**4**
Sheeting MFR - Substrate												
A	B	C	D	E	F	G	H	J	K	L	M	**5**
Film/Ink MFR												
A	B	C	D	E	F	G	H	J	K	L	M	**6**
Sheeting MFR - Legend												
A	B	C	D	E	F	G	H	J	K	L	M	**7**
Installation Date												
				0	1	2	3					**8**
	0	1	2	3	4	5	6	7	8	9		**9**
J	F	M	A	M	J	J	A	S	O	N	D	**10**
	200		201		202		203		204			**11**
	0	1	2	3	4	5	6	7	8	9		**12**

Figure 1
Decal Design (row numbers explained in Table 1).

Table 1
Decal Description

Row Explanation
1 – Sign Fabricator
2 – Month Fabricated
3 – First 3 Digits of Year Fabricated
4 – Last Digit of Year Fabricated
5 – Manufacturer of the Sheeting Applied to the Substrate
6 – Film (colored transparent or non-reflective black) or Screen Ink Manufacturer
7 – Manufacturer of the Sheeting for the Legend
8 – Tens digit of Date Installed
9 – Ones Digit of Date Installed
10 – Month Installed
11 – First 3 Digits of Year Installed
12 – Last Digit of Year Installed

Article 643.3. Construction, Section A. Sign Fabricator. Replace the first bullet with the following:

- "C" if fabricated by a commercial sign fabricator or "T" if fabricated by the Department or the Texas Department of Criminal Justice,

Article 643.3. Construction, Section A. Sign Fabricator. Replace the last bullet with the following:

- sheeting, film, and ink manufacturers (codes for these manufacturers are located in the Department's approved Material Producer List, "Sign Face Materials")

Article 643.3. Construction, Section B. Contractor. This section is voided and not replaced.

SPECIAL PROVISION
672---034--CoSA
Raised Pavement Markers

For this project, Item 672, "Raised Pavement Markers," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 672.2. Materials, Section B. Adhesives is supplemented by the following:

- The Contractor may propose alternate adhesive materials for consideration and approval by the Engineer.

Article 672.3. Construction. The sixth paragraph is voided and replaced by the following:

Use the following adhesive materials for placement jiggle bar tile, reflectorized pavement markers, and traffic buttons unless otherwise shown on the plans:

- standard or flexible bituminous adhesive for applications on bituminous pavements.
- epoxy adhesive or flexible bituminous adhesive for applications on hydraulic cement concrete pavements.

Use epoxy adhesive for plowable reflectorized pavement markers.

Article 672.3. Construction is supplemented by the following:

Provide a 30-day performance period that begins the day following written acceptance for each separate location. The date of written acceptance will be the last calendar day of each month for the RPMs installed that month for the completed separate project locations. This written acceptance does not constitute final acceptance.

Replace all missing, broken or non-reflective RPMs. Visual evaluations will be used for these determinations. Upon request, the Engineer will allow a Contractor representative to accompany the Engineer on these evaluations.

The Engineer may exclude RPMs from the replacement provisions of the performance, provided the Engineer determines that the failure is a result of causes other than defective material or inadequate installation procedures. Examples of outside causes are extreme wear at intersections, damage by snow or ice removal, and pavement failure.

Replace all missing or non-reflective RPMs identified during the performance period within 30 days after notification. The end of the performance period does not relieve the Contractor from the performance deficiencies requiring corrective action identified during the performance period.

Article 672.5. Payment is supplemented by the following:

No additional payment will be made for replacement of RPMs failing to meet the performance requirements.

RPMs INSTALLATION RECORD

The 30 day performance period begins the day after written acceptance for each separate location. The date of written acceptance will be the last calendar day of each month for the RPMs installed that month for the completed separate project locations.

COUNTY HIGHWAY	CONTROL PROJECT	LIMITS FROM LIMITS TO	MONTH/YR OF INSTALLATION

Contractor signature _____ _____
Date

Department signature _____ _____
Date

SPECIAL PROVISION
681---002--CoSA
Temporary Traffic Signals

For this project, Item 681, "Temporary Traffic Signals," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 681.4. Payment. The third paragraph is voided and replaced by the following:

Costs for utility-owned power line extensions, connection charges, meter charges, and other charges will be paid for by the Department. The Department will reimburse the contractor the amount billed by the utility plus an additional 5% of the invoice cost will be paid for labor, equipment, administrative costs, superintendence, and profit.

SPECIAL PROVISION

682—001--CoSA

Vehicle and Pedestrian Signal Heads

Specification Item 682, "Vehicle and Pedestrian Signal Heads," is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 682.2. Materials. Section B. General. The first paragraph is void and replaced by the following:

Provide vehicle signal heads in accordance with DMS-11120, "Vehicle Signal Heads" and DMS-11121, "12 Inch LED Traffic Signal Lamp Unit." Provide vehicle signal heads from manufacturers prequalified by the Department. The Traffic Operations Division maintains a list of prequalified vehicle signal head manufacturers.

SPECIAL PROVISION

685---014--CoSA

Roadside Flashing Beacon Assemblies

For this project, Item 685, "Roadside Flashing Beacon Assemblies," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 685.5. Payment. The second paragraph is voided and replaced by the following:

New conduit will be paid for under Item 618, "Conduit", except for conduit in the foundation and within 6 inches of the foundation. New electrical conductors will be paid for under Item 620, "Electrical Conductors." New tray cable will be paid for under Item 621, "Tray Cable." New duct cable will be paid for under Item 622, "Duct Cable." New ground boxes will be paid for under Item 624, "Ground Boxes". New electrical services will be paid for under Item 628, "Electrical Services." New signs will be paid for under Item 634, "Plywood Signs," or Item 636, "Aluminum Signs." New signal heads will be paid for under Item 682,"Vehicle and Pedestrian Signal Heads." New traffic signal cable will be paid for under Item 684, "Traffic Signal Cable."

Article 685.5. Payment, A. Installation is voided and replaced by the following:

A. Installation. This price is full compensation for furnishing, fabricating, galvanizing, assembling, and erecting the roadside flashing beacon assemblies; foundations; conduit in the foundation and within 6 inches of the foundation; furnishing and placing anchor bolts, nuts, washers, and templates; controller; and equipment, materials, labor, tools, and incidentals.

Article 685.5. Payment, B. Relocation is voided and replaced by the following:

B. Relocation. This price is full compensation for removing the roadside flashing beacon assemblies; removing existing foundations; installing new foundations; installing new conduit in the foundation and within 6 inches of the foundation; furnishing, fabricating, and installing any new components as required and replacing the assembly on its new foundations with all manipulations and electrical work; controller; salvaging; disposal of unsalvageable material; loading and hauling; and equipment, material, labor, tools, and incidentals.

SPECIAL PROVISION
687---004--CoSA
Pedestal Pole Assemblies

For this project, Item 687, "Pedestal Pole Assemblies," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 687.2. Materials is supplemented by the following:

C. Pedestrian Push Button Pole Assembly. Provide diameter as shown in the plans, schedule 40 steel pipe or tubing, aluminum pipe (alloy 6061-T6), or rigid metal conduit. Do not use aluminum conduit. Galvanize pedestrian push button post in accordance with Item 445, "Galvanizing," unless otherwise shown on the plans.

Article 687.3 Construction. The second and third paragraphs are voided and replaced by the following:

B. Installation. Install pedestal pole assemblies and pedestrian push button pole assemblies as shown on the plans or as directed. Pedestal pole assemblies include foundation, pole shaft, base, anchor bolts, anchor bolt nuts, anchor bolt template, shims, and miscellaneous components. Pedestrian push button post assemblies include foundation, pole, pedestrian button and post cap and pedestrian sign.

C. Painted Finish. When required, paint pedestal pole and pedestrian push button post assemblies in accordance with details shown on the plans.

Article 687.4 Measurement is voided and replaced by the following:

This Item will be measured by each pedestal pole assembly or each pedestrian push button post assembly."

Article 687.5 Payment is voided and replaced by the following:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Pedestal Pole Assembly" or by the unit bid price for "Pedestrian Push Button Post Assembly."

SPECIAL SPECIFICATION

XXXX

Internally Illuminated Street Name Signs

1. **Description.** Furnish, fabricate, and install internally illuminated street name sign (IISN).
2. **Materials.** Provide new materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

   • Item 445, “Galvanizing”
   • Item 446, “Cleaning and Painting Steel”
   • Item 620, “Electrical Conductors”
   • Item 621, “Tray Cable.”

   Furnish and fabricate internally illuminated street name sign (IISN) assemblies and associated mounting hardware from new materials that comply with this specification. Provide single side message or double side message signs as shown on the plans.

A. **General Requirements.** Ensure sign assembly standard lengths are between 4 feet and 10 feet. Ensure standard viewable heights are between 15 and 30 inches. Use single or double faced signs as required by plans. Ensure maximum weight of the sign does not exceed maximum capacity of IISN support arms.

   Construct sign fixture housing from 5000 or 6000 series aluminum. Powder-coat paint all exterior fixture housing glossy black or as shown on the plans. Ensure paint exceeds 1000-hr. salt-spray test in accordance with ASTM B117. IISN housing must be rated as NEMA type 3R. Use stainless steel screws and hardware.

   Ensure sign panels, light sources, light engines, and power supplies can be replaced without sign removal. The sign shall be capable of continuous operation over a range in temperatures from -10 degrees to +140 degrees Fahrenheit.

B. **LED Requirements.** Provide light-emitting diodes (LED) that are rated to maintain a minimum 70% of their initial lumens after 60,000 hours according to IESNA LM-80-08. Ensure the LED arrays or modules will continue to operate if one LED goes out. Provide light engine and LED arrays or modules that are replaceable without removing the sign.

C. **Sign Panel Requirements.** Ensure the front panel of the sign is ultraviolet, weather, abrasion and impact resistant high impact strength polycarbonate, acrylic or a glass-fiber reinforced polyester fluoride. The front panel will be replaceable for future maintenance purposes. Provide translucent reflective type D sheeting and colored transparent acrylic film as per TxDOT DMS - 8300, “Sign Face Material.”

   As per Texas Manual on Uniform Traffic Control Devices Section 2D.38, street name signs will have a white legend on a green background. A border, if used, will be the same color as the legend. The lettering should be at least 8 inch capital letters, or upper/lower case letters. Supplementary lettering to indicate the type of street (such as Street, Avenue, or Road) or the section of the City (such as SE) may be in smaller lettering, at least 3 inches high. Ensure letter

font type is Clearview - 2W as shown on *Standard Highway Sign Designs for Texas*, D3-1 Overhead Mount.

D. **Electrical and Illumination Requirements.** Provide IISN that will operate at 120 VAC. Ensure product meets standard for electric signs UL 48. The on-board circuitry of an IISN shall include voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003. The IISN and associated on-board circuitry shall meet the requirements of the Federal Communication Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices. Total harmonic distortion induced into an AC power line by an IISN at nominal operating voltage, and at 25°C, shall not exceed 20%. The power supply shall be housed inside the sign enclosure. Power supply shall be UL Class 2 limited output voltage and current plus isolation for safe operation, and UL rated for outdoor damp locations. Power supply shall be IP 64 Outdoor Rated. The light source shall evenly illuminate the sign panel. The average luminance over the entire panel surface will be uniform.

E. **Support Requirements.** The sign shall be designed and constructed to withstand 110 mph wind loads in conformance with the requirements of the AASHTO publication *Standard Specifications for Structural Supports of Highway Signs, Luminaires and Traffic Signals* (5th Edition 2009).

The sign must be supplied with mounting brackets from the manufacturer (swinging or rigid mounting) as shown on the plans.

F. **Color.** The color of the legend, symbols, and background must fall within the CIE (The International Commission on Illumination) color coordinates and reflectance values listed in Table 1, both before and after exposure testing. Color will be determined in accordance with Tex-839-B.

Table 1
CIE Chromaticity Coordinates and Reflectance Values

	White			Green	
x	**y**	**Reflectance**	**x**	**y**	**Reflectance**
0.300	0.290	40 minimum	0.255	0.330	3.5 – 10
280	0.310		0.255	0.520	
0.360	0.360		0.020	0.540	

G. **Workmanship.** The panels must exhibit good workmanship and must be free from objectionable marks or defects that would adversely affect appearance or serviceability.

H. **Warranty.** The manufacturer will replace failed IISNs, when non-operable due to defect in material or workmanship, within five years of installation with a new IISN that passes all testing, delivered and installed at the project location.

3. **Construction.** Fabricate and install internally illuminated street name signs in accordance with the details, dimensions, and requirements of this item and as shown on the plans.

Install in accordance with the latest Electrical Detail Standards. Install signs level and plumb brackets or clamps. Attach IISN to traffic signal poles as per manufacturer's instructions or as shown on the plans.

Use established industry and utility safety practices when installing, relocating, or removing IISNs located near overhead or underground utilities. Consult with the appropriate utility company before beginning work.

Prevent scarring or marring of the poles, mast arms, and IISNs. Replace damaged components. Repair damaged galvanizing in accordance with Section 445.3.D, “Repairs.” Repair damaged painted areas of a roadway illumination assembly in accordance with Item 446, “Cleaning and Painting Steel.”

4. **Measurement.** This Item will be measured by the square foot of the viewable area, either one-sided or two-sided.

5. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement", will be paid for at the unit bid price for "Internally Illuminated Street Name Signs" of the sizes and types specified. This price is full compensation for furnishing, fabricating and installing the signs; support arm clamp assembly; liquid tight flexible metal conduit; and equipment, labor, tools, and incidentals.

   New conduit will be paid for under Item 618, “Conduit.” New conductors will be paid for under Item 620, “Electrical Conductors.” New tray cable, except the tray cable internal to the pole, will be paid for under Item 621, “Tray Cable.”

SPECIAL SPECIFICATION

1134--CoSA

Impermeable Liner

1. Description. This Item shall govern for the furnishing and installation of the impermeable liner (geomembrane) shown on the plans. The geomembrane shall be high-density polyethylene (HDPE) membrane. The geomembrane shall be capable of preventing the migration of petroleum products (benzene, toluene, ethylbenzene, xylene) from soils excavated in contaminated areas. HDPE membrane shall be used in areas designated as contaminated soil stockpile, as shown on the plans. It shall also be used to wrap storm sewer pipe, box culverts, inlets, manholes, junction boxes, utility pipes and manholes, in contaminated areas, as shown on the plans.

2. Materials. Geomembrane.

(1) The geomembrane liner shall be new and comprised of HDPE material manufactured of first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures. The nominal thickness of the HDPE membrane shall be 0.039 of an inch.

(2) At the time of award, submit a certification from the manufacturer of the sheeting, stating that the sheeting meets physical property requirements for the intended application.

(3) The surface of the geomembrane shall not have striation, roughness, pinholes or bubbles and shall be so produced to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any defects shall be reported immediately after discovery and replaced or repaired at the Contractor's expense. If repair is required, extrusion fusion welding technique shall be performed in accordance with the manufacturer's recommendations.

(4) The geomembrane shall be manufactured in a minimum of 22 ft. seamless widths. Labels on the roll shall identify the thickness, length, width and manufacturer's batch and roll number. There shall be no factory seams.

(5) The geomembrane rolls shall meet the minimum values shown in the following chart:

Geomembrane Specifications *

Property	Value	Test Method
Nominal Thickness	0.039 in.	
Actual Thickness (Min)	0.035 in.	ASTM D1593
Density (Min)	0.033 oz/cc	ASTM D1505
Melt Flow Index (Max)	0.014 oz/10 min	ASTM D1238 Condition E (374ºF, 4.76 lb)
Tensile Properties (Typical)		ASTM D638 Type IV Dumb-bell at 2.0 in/min
Tensile Strength at Break	63.1 (lb/in width)	
Tensile Strength at Yield	36.2 (lb/in width)	
Elongation at Break	750%	
Elongation at Yield	13%	
Tear Resistance Initiation (Typical)	28.0 lb	ASTM D1004 Die C
Low Temperature Brittleness (Typical)	-94ºF	ASTM D746 Procedure B
Dimensional Stability Change Each Direction (Max)	± 1%	ASTM D1204 212 F, 1hr.
Environmental Stress Crack. (Min)	2,000 Hours	ASTM D1693 (10% Igepal, 60 C)
Puncture Resistance (Typical)	59.5 lb	FTMS 1010 Method 2065
Coefficient of Linear	0.0002	ASTM D696
Thermal Expansion (Typical)	in/in F	
Thermal Stability Oxidative Induction Time (OIT)	2,000 Minutes	ASTM D3895 266 F, 800.03 PSI Oxygen (Min)
Carbon Black	2-3 %	

* Note: Minimum values, unless otherwise specified, are the average roll values as reported by the specified test methods.

(6) Raw Material. All compound ingredients of the HDPE materials shall be randomly sampled on delivery to the HDPE manufacturing plant to ensure compliance with the required specifications. Tests to be carried out shall include Density ASTM D1505 and Melt Index ASTM D1238, Condition E.

(7) Manufactured Roll Goods. Samples of the production run shall be taken and tested according to ASTM D638 to ensure that tensile strength at yield and break, and elongation at yield and break meet the minimum specifications. A quality control certificate shall be issued with the material.

(8) All welding material shall be of a type recommended by the manufacturer.

3. Construction Methods. The liner method system shall consist of a layer of 0.039 in. HDPE geomembrane. The Engineer reserves the right to inspect the manufacturer's or the fabricator's facilities to ensure compliance with these specifications.

(1) Area Subgrade Preparation. Surfaces to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind and shall be approved prior to liner installation. The surface shall provide a firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or break in grade, except as

shown on the plans. Bends indicated on the plans shall be field fabricated using Manufacturer's recommendation and approved by the Engineer.

No standing water or excessive moisture shall be allowed. Certify in writing that the surface on which the geomembrane is to be installed is acceptable before commencing work.

(2) Weather Conditions. Geomembrane deployment shall proceed between ambient temperatures of 32ºF to 105ºF. Placement can proceed below 32ºF only after it has been verified by the Engineer that the material can be seamed according to the specification. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the Engineer.

(3) Method of Placement. The liner shall not be installed with any equipment or tools than can damage the liner materials by handling, trafficking or other means. The method used to unroll the liner panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil. Panels of geomembrane shall be placed using a method that shall minimize wrinkles.

(4) Field Seams. Individual panels of geomembrane shall be laid out and overlapped by a maximum of 4 in. for an extrusion weld prior to welding or 5 in. for a hot wedge weld prior to welding. Extreme care shall be taken in the preparation of the areas to be welded. The area to be welded shall be cleaned and prepared according to the procedures of the material manufacturer. All sheeting shall be welded together by means of integration of the extrudate bead with the lining material. The composition of the extrudate shall be identical to the lining material, or all sheeting shall be welded together using the hot wedge welding system.

The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material to ensure that changes in environmental conditions will not affect the integrity of the weld. No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped, and an overlap extrusion weld shall be applied.

(5) Field Seam Testing/Quality Control. The Contractor shall employ on-site physical non-destructive testing on 100% of all welds.

A quality-control technician furnished by the Contractor shall inspect each seam. Any area showing a defect shall be marked and repaired in accordance with HDPE repair procedures.

A test weld 3 ft. long from each welding machine shall be run each day prior to liner welding and under the same conditions as exist for the liner welding. The test weld shall be marked with date, ambient temperature, and welding machine number. Samples of weld 1/2 in. to 3/4 in. wide shall be cut from the test weld and pulled by hand in peel. The weld shall not peel. Seams shall exhibit a film tear bond. The weld sample shall be kept for subsequent testing on laboratory tensometer equipment in accordance with the applicable ASTM standards. Random weld samples may be

removed from the installed welded sheeting at a frequency to be approved by the Engineer (example 1/46 ft. of weld).

4. **Measurement and Payment.** The impermeable liner will not be measured or paid for directly. All material, equipment, and labor required, at the Stockpile location and the complete installation for wrapping Storm Sewer pipe, box culverts, inlets, manholes, junction boxes, Utility pipes, and manholes, and at Stockpile Location, as specified, shall be considered subsidiary to Item 400, "Structural Excavation (Special)".

SPECIAL SPECIFICATION

1135--CoSA

Water Tank and Pump

1. **Description.** This Item shall govern for the furnishing and operation of vacuum removal or pumping of contaminated groundwater and intrusion water encountered during construction activities within the designated contamination area into a portable storage tank and transported to an on-site storage tank provided by the Contractor.

2. **Materials.** The pump or vacuum device shall utilize a diaphragm or non-sparking system capable of pumping or withdrawing a minimum of 30 gal. per min. The pump or vacuum device shall be equipped with a meter capable of measuring the amount of water withdrawn or pumped in and out of the portable tank by the gallon.

   The tank must hold a minimum of 450 gal. and be constructed of a material that is non reactive to the contaminates that may be encountered as indicated in the Waste Management Plan Report.

   The portable tank and pump/vacuum system shall be either truck or trailer mounted.

3. **Measurement.** This Item will be measured by the 1,000 gallons delivered to the approved on-site storage tank. Generate a haul ticket indicting the pump meter reading before groundwater is drawn, after the groundwater is pumped into the portable tank and a reading after the groundwater has been relocated to the storage tank.

4. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Water Tank and Pump". This price shall be full compensation for furnishing all equipment, water tank, pump/vacuum system, meters, pumping into the tank, delivering the water to the approved storage tank and for all labor, tools equipment and incidentals necessary to complete the work.

SPECIAL SPECIFICATION

1136--CoSA

Steel or Polyethylene Mobile Water Storage Tank

1. **Description.** This Item shall govern for the furnishing and operation of a steel or polyethylene mobile water storage tank to provide adequate temporary storage for construction water or ground water contaminated with petroleum hydrocarbons that is encountered during construction activities, within the designated contamination area. The tank shall be placed within the project limits or at the temporary stockpile storage site shown on the plans as approved. Tanks shall be certified clean upon delivery. Locks for all intake and discharge points shall be supplied with keys. All intake and discharge points shall be closed and locked when not in use.

2. **Materials.**

   Type I. A Type I tank shall be a 21,000 gal. steel water tank not to exceed 8.5 ft. in width and shall not exceed the tank towering height of 13.5 ft. and the overall length shall not exceed 41 ft. The walls and roof shall be corrugated or externally reinforced. The floors shall be "V" shaped. The tanks shall include a minimum of a 2 ft. man way to access the tank for sampling, gauging and inspection. A minimum 3 in. overflow line is required. The topfill nozzle shall be at least 3 in. in diameter. A minimum 4 in. drain valve shall be located at the tank rear and shall have a maximum 4 in. suction valve at the front center of the tank. The tank shall also be equipped with a minimum 2 ft. steel stairway containing a steel handrail.

   Type II. A Type II tank shall be a 6,500 gal. polyethylene water storage tank and shall have a diameter not to exceed 12 ft., height not to exceed 14 ft. and equipped with a minimum 2 ft. man way. The top nozzle shall not exceed 4 in. in diameter and shall be equipped with a 50 mm PVC air vent.

3. **Measurement.** This Item will be measured by each tank delivered on-site for use in the designated contamination areas on the project.

4. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Mobile Water Storage Tank (Ty I)" or "Mobile Water Storage Tank (Ty II)". This price shall be full compensation for furnishing all equipment, delivery, labor, tools and incidentals necessary to complete the work. CoSA shall be responsible for disposal of any contaminated water.

SPECIAL SPECIFICATION
5010
Transportable Cellular Telephones

1. **Description.** Provide transportable cellular telephones (TCTs).

2. **Equipment.** Furnish TCTs after the receipt of the work order to begin work and before beginning physical work on the project. Provide the number of TCTs specified on the plans. Repair or replace non-operational TCTs within 48 hr. after notification by the Engineer. Provide an operational manual for each TCT. Terminate TCT service upon completion of the project.

   Provide a detailed invoice upon request.

3. **Measurement and Payment.** The work performed, materials furnished, equipment, labor, tools and incidentals will not be measured or paid directly, but will be subsidiary to pertinent Items.

SPECIAL PROVISION
TO
SPECIAL SPECIFICATION
6266--017
Video Imaging Vehicle Detection System

For this project, Special Specification Item 6266, "Video Imaging Vehicle Detection System," is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 1. **Description.** The second paragraph is voided and replaced by the following:

A VIVDS configuration for a single intersection will consist of variable focal length cameras, VIVDS card rack processor system, and all associated equipment required to setup and operate in a field environment including a video monitor and/or laptop (if required), connectors and camera mounting hardware.

Article 6. **Camera Assembly, Section B. Camera and Lens Assembly.** Section 2 is voided and replaced by the following:

2. The enclosure must allow the camera to operate satisfactorily over an ambient temperature range from -30°F to +140°F while exposed to precipitation as well as direct sunlight.

SPECIAL SPECIFICATION

6525

Emergency Vehicle Traffic Signal Priority Control System

1. Description. This Item governs the furnishing and installation of emergency vehicle traffic signal priority control system in field location(s) as shown on the plans and as detailed in the Special Specifications. This system shall enable designated vehicles to remotely cause the traffic signal controller to advance to and/or hold a desired traffic signal display by using existing controller functions.

The system shall consist of the following components:

(1) Emergency Preemption Emitter: This shall be mounted on the emergency vehicle and shall transmit optical energy signals only in the forward direction.

(2) Emergency Preemption Phase Selector: This shall cause the signal controller to advance to and/or hold the desired traffic signal display for the emergency vehicle.

(3) Emergency Preemption Detector: This shall be mounted on or near a traffic signal and shall receive the optical energy signals generated by the vehicle emitter.

(4) Emergency Preemption Detector cable: This is used for communication between Emergency Preemption Detector and Emergency Preemption Phase Selector.

2. Materials. Provide new, corrosion resistance materials for all items furnished, assembled, fabricated or installed under this Item, in strict accordance with the details shown on the plans and in the specifications.

3. Equipment.

(1) Emergency Preemption Emitter.

(a) Functional Requirements.

Provide a compact, single source Emergency Preemption Emitter that shall consist of a high priority emitter and is compatible with all other equipment used for this project.

The Emergency Preemption Emitter shall have isolated power supply and emitter for positive or negative ground vehicle power system.

The Emergency Preemption Emitter shall have discrete, penetrating infrared communication that is directional, consistent day and night transmission, and all weather performance.

The Emergency Preemption Emitter shall also consist of power supply and an Emitter Control Switch assembly. The Emitter assembly will be mounted on a vehicle and shall produce a flashing optical signal with a controlled repetition rate and shall have the capability for adjusting intensity.

The Emergency Preemption Emitter shall comprise of a flash-tube/reflector and housing assembly with an integral power supply and the required cables.

The Emergency Preemption Emitter shall have the capability to be customized through its interface software.

The Emergency Preemption Emitter shall be controlled by a single on/off switch that requires no other adjustments by the operator. The on/off condition shall be indicated by a light located adjacent to the switch.

The Emergency Preemption Emitter shall have a command (high) and advantage (low) priority operation as well as probe frequency capability selected by model and switch combination.

The Emergency Preemption Emitter shall have a remote range setting capability, meet FCC part 15, subpart J, Class A regulations for electromagnetic interference, RS-485, and J1708 serial interface.

The Emergency Preemption Emitter shall be automatically disabled or de-activated by one or a combination of the following: seat switch, emergency brake switch, door switch, and transmission safety switch, and is indicated by slow flashing of the emitter switch indicator light.

The Emergency Preemption Emitter shall separate timed pulses of high intensity light in the infrared and visible wavelengths at the base flash rate of approximately 10, 12, or 14 Hz. It shall also interleave programmed encoded pulses that carry the vehicle class and ID number information.

The Emergency Preemption Emitter shall have a cumulative flash counts available through the interface software

The Emergency Preemption Emitter shall be configured with a grating for precise directionality control

The Emergency Preemption Emitter shall have an optional light-blocking filter

The Emergency Preemption Emitter shall produce optical energy in a cone of not more than 90 degrees horizontal and not more than 30 degrees vertical. The detectors and/or phase selector shall not sense a pre-emption signal from an emitter outside this cone.

The Emergency Preemption Emitter shall have a transmission range up to 2,500 ft. with clear lens and up to 1,800 ft. with visible light filter

Contractor shall supply switches as approved by the engineer and shall be subsidiary to this pay item.

Contractor shall supply the interface software kit including but not limited to instructions manual, cables, interface software, and storage container and shall be subsidiary to this item.

Contractor shall install the software on the workstation at STRATIS. This work shall be subsidiary to this item.

(b) Electrical Requirements.

The Emergency Preemption Emitter shall operate on ten to 15 volts DC input voltage, but shall not be damaged by input voltage surges up to 25 volts DC.

The Emergency Preemption Emitter shall not generate voltage transients on the battery input line which exceed battery voltage by more than four volts.

The Emergency Preemption Emitter shall convert 12 Volt DC vehicle battery power to the high voltage required for operation of the unit.

The Emergency Preemption Emitter shall draw less than 5 amps peak current

(c) Mechanical Requirements.

The Emergency Preemption Emitter shall be a compact, lightweight, weather resistant encoded signal device intended for use on priority and probe vehicles.

The Emergency Preemption Emitter shall have the installation flexibility to mount directly on vehicle or ability to be installed into most lightbars.

The Emergency Preemption Emitter shall operate over an ambient temperature range of minus 30°F. to plus 140°F.

The Emergency Preemption Emitter shall operate in 0 to 95% humidity.

(2) Emergency Preemption Phase Selector.

(a) Functional Requirements.

Provide Emergency Preemption Phase Selector that shall be compatible with all other equipment used for this project.

The Emergency Preemption Phase Selector shall be a plug-in two channel, dual priority, encoded signal device. It shall have the capability to be installed directly into the input file of Type 170 traffic controllers equipped with priority phase selection software and in virtually any other traffic controller equipped with priority phase selection inputs and related software.

The Emergency Preemption Phase Selector shall recognize and discriminate among three distinct emitter frequency rates via Emergency Preemption Detectors: Command priority, Advantage priority and probe vehicles. Within each of these three frequency rates, the Emergency Preemption Phase Selector shall further discriminate among 10 classes of vehicle identification codes, with 1000 individual vehicle codes per class — 10,000 total per frequency rate.

When Emergency Preemption Detector signals are recognized as a valid call, the Emergency Preemption Phase Selector shall cause the signal controller to advance to and/or hold the desired traffic signal display. This is accomplished by utilizing Emergency Preemption Phase Selector circuitry in conjunction with normal internal controller functions.

The Emergency Preemption Phase Selector shall be capable of assigning priority traffic movement to one of two channels on a first-come, first-serve basis. Each channel shall be connected to select a particular traffic movement from those normally available within the controller.

Once a call is recognized, "commit to green" circuitry in the Emergency Preemption Phase Selector shall function so that the desired green indication will be obtained even if optical communication is lost. After serving a priority traffic demand, the Emergency Preemption Phase Selector shall release the controller to follow normal sequence operation.

The phase selector shall not change the timing of the following intervals for any normal controller phase:

Minimum green

WALK

Pedestrian clearance

Yellow change

Red clearance

The Emergency Preemption Phase Selector shall also have the following features:

Two auxiliary detectors per channel

Compatible with encoded signal and non-encoded emitters

Computer-based interface

- RS232 communications front port, and rear backplane
- User-selected communications baud rate 1200 to 9600 bits per second
- Customizable ID code validation

Erasable write-on pads for phase or movement labeling

Unit can be operated without computer configuration

Crystal controlled circuitry

- Accurate optical signal recognition circuitry
- Precise output pulse
- Definitive call verification

Optically isolated outputs

Front panel switches and diagnostic indicators for testing

Multi-function test switch

- High and low test calls
- Reset to default parameters
- Range setting
- Diagnostic test

Internally record each activation of the system. Each entry shall contain the:

- Intersection name
- Date and time of the activity
- Vehicle class code of the activating vehicle
- Activating vehicle’s ID number

Channel called

Priority of the activity

Final green signal indications displayed at the end of the call

Time spent in the final greens

Duration of the activation

Near intersection location information

(b) Electrical Requirements.

The Emergency Preemption Phase Selector shall be powered from AC mains and shall provide 24-volt DC output for its associated Emergency Preemption Detectors.

The Emergency Preemption Phase Selector shall utilize solid state and relay circuitry to interface between the Emergency Preemption Detector and the traffic signal controller.

The Emergency Preemption Phase Selector shall supply power to and receive electrical signals from the Emergency Preemption Detector.

The Emergency Preemption Phase Selector shall be tested to NEMA electrical test specifications

The Emergency Preemption Phase Selector shall operate at a voltage range of 89 to 135 VAC +10% and 60Hz + 3Hz

Provide equipment that is not affected by the transient voltages, surges and sags normally experienced on commercial power lines. It is the Contractor's responsibility to check the local power service to determine if any special design is needed for the equipment. Any extra cost, if required, is subsidiary to this Item.

Install appropriate surge protectors in the cabinet for the Emergency Preemption Phase Selector and Emergency Preemption Detector.

Provide equipment that meets the requirements of Sec. 2.1.6, “Transients, Power Service” of the NEMA Standard TS2-1992, and/or the latest revision.

Provide all wiring to the requirements of the National Electric Code. Cut all wires to proper length. Provide cable slacks to facilitate removal and replacement of assemblies, panels, and modules. Do not double back any wires to take up slack. Neatly lace wires into cable with nylon lacing or plastic straps. Secure cables with clamps.

Provide diodes or other protective devices across the coils of all DC relays, solenoids, and holding coils for transient suppression.

Furnish equipment with readily accessible, manually re-settable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

Design the equipment such that the failures of the equipment shall not cause the failure of any other unit of equipment.

(c) Mechanical Requirements.

Furnish equipment that is modular in design to allow major portions to be readily replaced in the field.

The Emergency Preemption Phase Selector shall have mechanically key modules of unlike functions to prevent insertion into the wrong socket or connector.

Clearly identify all modules and assemblies with name, model number, serial number, and any other pertinent information required to facilitate equipment maintenance.

Make all external connections by means of connectors. Key the connectors to preclude improper hookups. Color code and/or appropriately mark all wires to and from the connectors.

Pleat every conductive contact surface or pin with no less than 20 microns of gold.

Provide equipment that meets all its specified requirements during and after being subjected to any combination of the following requirements:

Ambient temperature range of -35°F to +165°F.

Relative humidity from 0% to 95%.

A card rack shall be supplied with every Emergency Preemption Phase Selector.

The card rack shall be a metallic enclosure with a dedicated card slot for one phase selector with either two or four channel units.

The front panel of the card rack shall include a terminal strip for connecting the detectors, as well as a 9-pin circular connector and harness to connect the phase selector's inputs and outputs.

The card rack shall be subsidiary to the Emergency Preemption Phase Selector.

(3) Emergency Preemption Detector.

(a) Functional Requirements.

Provide Emergency Preemption Detector that is compatible with all other equipment used for this project. Furnish Emergency Preemption Detector that shall seamlessly operate with the vehicle emitters used in the project area.

The Emergency Preemption Detector shall transform the optical energy detected from an approaching, vehicle mounted emitter to an electrical signal. The electrical signal shall be transmitted along an Emergency Preemption Detector Cable to the Emergency Preemption Phase Selector for processing.

The Emergency Preemption Detectors shall permit a direct, unobstructed line-of-sight to vehicle approaches. The Emergency Preemption Detector shall be designed for two direction - the single channel configuration.

The Emergency Preemption Detector shall have a cone of detection of not more than 13 degrees. The Emergency Preemption Detector and/or Emergency Preemption Phase Selector shall not sense a pre-emption signal from an emitter outside this cone.

The Emergency Preemption Detector shall also have the following features:

Solid state circuitry

Advanced electrical transient immunity

The Emergency Preemption Detector shall have a reception range of 200 ft. and is adjustable up to 2500 ft.

(b) Electrical Requirements. The Emergency Preemption Detector shall operate at an electrical voltage of 24 to 28 VDC, 50 MA minimum

(c) Mechanical Requirements.

The Emergency Preemption Detector shall operate at a temperature range of -30ºF to 165ºF.

The Emergency Preemption Detector shall include mounting hardware, as specified, for mast arm mounting, span wire mounting, pole-side mounting, mounting on top of a signal head, or mounting on top of a pipe or pedestal.

The Emergency Preemption Detector shall have an adjustable turret configuration to accommodate skewed approaches.

The Emergency Preemption Detector housing shall be of light weight, durable, high-impact polycarbonate material having stainless steel and brass fittings.

The Emergency Preemption Detector shall operate at a humidity of 5% to 95% relative.

(4) Emergency Preemption Detector Cable.

(a) Functional Requirements.

Provide Emergency Preemption Detector Cable that shall be compatible with all other equipment used for this project.

The Emergency Preemption Detector Cable shall be individually tinned copper strand three-conductor cable with yellow, orange, and blue conductor wires. It shall also have a bare shield drain wire.

(b) Electrical Requirements.

The Emergency Preemption Detector Cable shall be AWG #20 (7x28), stranded with conductor insulation of 600 volt, 75°C (167°F).

The Emergency Preemption Detector Cable shall have a DC resistance not to exceed 11.0 ohms per 1000 ft.

The capacitance from one conductor to other 2 conductors and shield shall not exceed 48 pf./ft..

(c) Mechanical Requirements. The Emergency Preemption Detector Cable shall also have the following features:

Jacket: 600 volts, 80°C (176°F), minimum average wall thickness - 0.045 in.

Finished O.D.: 0.3 in. max.

4. Construction.

(1) General.

(a) Utilize the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality for equipment construction.

(b) Design the equipment for ease of maintenance, with all component parts readily accessible for inspection and maintenance. Provide test points for checking essential voltages and waveforms.

(2) Electronic Components. Furnish all electronic components in compliance with Special Specification, “Electronic Components”.

(3) Mechanical Components.

(a) Use stainless steel for all external screws, nuts, and locking washers; do not use any self-tapping screws unless approved by the Engineer.

(b) Fabricate all parts of corrosion resistant material, such as plastic, stainless steel, anodized aluminum, or brass.

(c) Protect all materials used in construction from fungus growth and moisture deterioration.

(d) Separate all dissimilar metals with an inert dielectric material.

(e) All equipment shall be installed and wired in a neat and orderly manner in conformance with the manufacturers' instructions.

(f) Emergency Preemption Detector Cables shall be installed continuous with no splices between the Emergency Preemption Detector and the cabinet.

(g) Emergency Preemption Detector locations shown on the plan are for illustration purposes only. Exact location shall be determined by the manufacturer or the designated representative or the site engineer for the best possible line of sight.

(h) All connections from the Emergency Preemption Phase Selector to the cabinet wiring shall be made at the termination panel. The termination panel shall have AC+ Lights, AC-, and a switched logic ground. The switched logic ground feeds all the pre-empt inputs to the Emergency Preemption Phase Selector. When switched off by the pre-emption disconnect switch, the traffic controller shall not be affected by pre-empt calls from the optical pre-emption system. A minimum of two test buttons shall be provided. If there are more than two pre-empt runs, a button for each shall be installed. A chart or print out, indicating the program steps and settings shall be provided along with the revised cabinet wiring diagrams.

(4) Testing

(a) Conduct testing in accordance with the Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Sections 2. - 2.(F).

(b) Contractor shall notify and provide copies of test plans to the state 2 weeks prior to the scheduled test date.

(c) If a malfunction is found or the system needs adjustment (such as range, emitter intensity, or detector location), schedule a follow-up test.

(d) All adjustments such as Emergency Preemption Phase Selector range, sensitivity, detector placement, shall be made at the intersection, by the contractor so that the optical pre-emption operates correctly with other major manufacturers' equipment currently owned by the agencies in the project area.

(5) Training.

(a) Provide training in accordance with Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 3.

(b) Contractor shall provide one eight-hour emergency preemption software training session for 10 people at the state specified facility. The contractor shall pay for all expenses incurred during the training. This work shall be subsidiary to various bid items under this special specification.

(6) Documentation Requirements. Provide documentation in accordance with the Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 4.

(7) Warranty. Provide a warranty accordance with the Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 6.

5. Measurement. This Item will be measured as follows:

(1) "Emergency Preemption Emitter" shall be measured as each unit furnished in accordance with these Special Specifications or as directed by the Engineer.

(2) "Emergency Preemption Phase Selector" shall be measured as each unit furnished, installed, made fully operational and tested in accordance with these Special Specifications or as directed by the Engineer.

(3) "Emergency Preemption Detector" shall be measured as each unit furnished, installed, made fully operational and tested in accordance with these Special Specifications or as directed by the Engineer.

(4) "Emergency Preemption Detector Cable" shall be measured in foot of cable furnished, installed, made fully operational and tested in accordance with these Special Specifications or as directed by the Engineer.

6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Emergency Preemption Emitter", "Emergency Preemption Phase Selector", "Emergency Preemption Detector", and "Emergency Preemption Detector Cable". This price will include all equipment described under this

Item with all cables and connectors, all documentation and testing; and includes the cost of furnishing all labor, materials, training, warranty, equipment, and incidentals.

SPECIAL SPECIFICATION

6834

Portable Changeable Message Sign

1. **Description.** Furnish, operate, and maintain portable trailer mounted changeable message sign (PCMS) units.

2. **Materials.** Furnish new or used material in accordance with the requirements of this Item and the details shown on the plans. Provide a self-contained PCMS unit with the following:

   - Sign controller
   - Changeable Message Sign
   - Trailer
   - Power source

   Paint the exterior surfaces of the power supply housing, supports, trailer, and sign with Federal Orange No. 22246 or Federal Yellow No. 13538 of Federal Standard 595b, except paint the sign face assembly flat black.

   A. Minimum Luminance Requirements. All PCMS units shall meet the following luminance requirements measured at the character level in candela as is published in Report 4940-2, "Photometric Requirements for Portable Changeable Message Signs," conducted by the Texas Transportation Institute. Luminance will be tested in accordance with Tex-880.

   - Minimum Daytime Character Luminance of 4000cd/m2 with a contrast ratio of 5.
   - Minimum Nighttime Character Luminance of 30/cd/m2.

   B. Sign Controller. Provide a controller with permanent storage of a minimum of 75 pre-programmed messages. Provide an external input device for random programming and storage of a minimum of 75 additional messages. Provide a controller capable of displaying up to 3 messages sequentially. Provide a controller with adjustable display rates. Enclose sign controller equipment in a lockable enclosure.

   C. Changeable Message Sign. Provide a sign capable of being elevated to at least 7 ft. above the roadway surface from the bottom of the sign. Provide a sign capable of being rotated 360° and secured against movement in any position.

   Provide a sign with 3 separate lines of text and 8 characters per line minimum. Provide a minimum 78 in. high x 126 in. wide sign housing. Provide a minimum 18 in. character height. Provide a 5 x 7 character pixel matrix. Provide a message visibility distance of 750 ft. Provide for manual and automatic dimming light sources.

   The following are descriptions for 3 screen types of PCMS:

- **Character Modular Matrix.** This screen type comprises of character blocks.
- **Continuous Line Matrix.** This screen type uses proportionally spaced fonts for each line of text.
- **Full Matrix.** This screen type uses proportionally spaced fonts, varies the height of characters, and displays simple graphics on the entire sign.

D. Trailer. Provide a 2 wheel trailer with square top fenders, 4 leveling jacks, and trailer lights. Do not exceed an overall trailer width of 96 in. Shock mount the electronics and sign assembly.

E. Power Source. Provide a diesel generator, solar powered power source, or both. Provide a backup power source as necessary.

F. Cellular Telephone. When shown on the plans, provide a cellular telephone connection to communicate with the PCMS unit remotely.

3. Construction. Place or relocate PCMS units as shown on the plans or as directed. The plans will show the number of PCMS units needed, for how many days, and for which construction phases.

Maintain the PCMS units in good working condition. Repair damaged or malfunctioning PCMS units as soon as possible. PCMS units will remain the property of the Contractor.

4. Measurement. This Item will be measured by each PCMS or by the day used. All PCMS units shall be set up on a work area and operational before a calendar day can be considered measurable. When measurement by the day is specified, a day shall be measured for each PCMS set up and operational on the worksite.

5. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Portable Changeable Message Sign." This price is full compensation for PCMS units; set up; relocating; removing; replacement parts; batteries (when required); fuel, oil, and oil filters (when required); cellular telephone charges (when required); software; and equipment, materials, tools, labor, and incidentals.

SPECIAL SPECIFICATION
8245
Model 2070 Controller Unit

1. Description. Furnish Type 2070 Advanced Transportation Controller (ATC) unit. The Advanced Transportation Controller (ATC) is a general purpose programmable controller that is intended for continuous unattended operation in harsh environments.

This specification defines specific, interchangeable modules that are combined to form a Type 2070 ATC that is capable of running control software that might be provided from a variety of providers. This specification defines several module options that can be arranged in a variety of composition configurations to meet the needs of the user.

This specification lays out compositions for Full, NEMA, Lite, and ITS configurations. The Type 2070 version of the ATC is designed such that all components are fully standardized and are therefore interchangeable.

2. Definitions.

A. Controller Housing. The Type 2070 controller defines a controller housing that is intended to fit an EIA 19 in. rack mounted form commonly found in the Type 332 and ITS family of cabinets. A NEMA base module is defined for those NEMA TS1 and TS2 shelf mounted applications.

B. CPU Module. The CPU module consists of the main CPU, memory, software and interfaces to the remainder of the controller. There are three CPU module configurations identified in this standard. The Type 2070-1A is a two-board configuration that has a VME-based CPU board and a Transition Board. The Type 2070-1B configuration consists of a single board module. The Type 2070-1C configuration is intended to interface with the "engine board" specified by the ATC v5.0 standard.

C. Field I/O Module. The Field I/O Module provides a mechanism for input and output interfaces. There are three options for the Field I/O Module. The Type 2070-2A Modules is intended to provide a parallel I/O interface with the Type 332 family of cabinets using the C1S connector. The Type 2070-2B Module is intended to provide a serial I/O interface to the ITS cabinet family and the NEMA interface to TS1 cabinets. The Type 2070-2N is for the NEMA TS2 Type 1 cabinets.

D. Front Panel Module. A controller Front Panel usually contains a keyboard and display that comprise the user field interface. The Front Panel on the Type 2070 controller is optional.

E. This standard identifies three front panel options: the Type 2070-3A Front Panel includes a large character (4 lines of 40 characters) Liquid Crystal Display (LCD), the Type 2070-3B Front Panel includes a small character (8 lines of 40 characters) LCD, and the Type 2070-3C contains only a serial connection for interfacing with a notebook computer or some other handheld computing device.

F. Power Supply Module. A power supply module is used to convert 120 volt power to voltages required to operate the electronics inside the Type 2070 controller unit. This power supply must meet certain minimum electrical characteristics defined herein for its intended use. This standard identifies four options for the Power Supply: The Type 2070-4A identifies a 10 ampere power supply that is needed for those cases there is a need to support the VME cage assembly, and the Type 2070-4B identifies a 3.5 ampere power supply that is typically used in the "Lite" controller configurations. The Type 2070-4N (A and B) identifies the corresponding power supplies needed to support the NEMA TS1 and TS2 standards. This, however, does not preclude a Manufacturer or an DEPARTMENT from requiring a specific power supply form factor so that it is consistent across a wide range of packages that may be employed by that DEPARTMENT.

G. VME Cage Assembly. The VME Cage Assembly is an optional expansion module for the Type 2070 ATC. The Type 2070-5 consists of a five-slot 3U VME card rack. The use of the VME Cage Assembly requires the use of the Type 2070-4A 10-ampere power supply.

H. Communications Modules. This standard includes a variety of serial and modem communications modules. The 2070-6 series of modules are for internal modems and the Type 2070-7 series of modules are for serial communications.

I. NEMA Interface. This standard includes requirements for an optional module to interface with the NEMA TS1 and NEMA TS2 Type 2 cabinets. The Type 2070-8 NEMA Field I/O Module is an external module that attaches to the bottom of the 2070 and provides for the typical "A," "B," and "C" NEMA connectors.

3. General Requirements.

A. General. All furnished equipment must be new and unused. Vacuum or gaseous tubes and electro-mechanical devices (unless specifically called out) must not be used.

B. Interchangeability. Assemblies and their associated devices must be electrically and mechanically interchangeable at both the assembly and device levels:

ASSEMBLIES	ASSOCIATED DEVICES
Type 2070-V Controller Unit (V=unit with VME Cage)	- Type 2070-1 CPU Module - Type 2070-2A or 2B Field I/O Module - Type 2070-3 Front Panel Assembly - Type 2070-4A Power Supply - Type 2070-5 VME Cage Assembly - Type 2070-6 Serial Comm Module - Type 2070-7 Serial Comm Module

Type 2070-L Controller Unit (L=unit with 1B CPU)
- Type 2070-1B CPU Module
- Type 2070-2A or 2B Field I/O Module
- Type 2070-3 Front Panel Assembly
- Type 2070-4B Power Supply
- Type 2070-6 Serial Comm Module
- Type 2070-7 Serial Comm Module

Type 2070-N1 Controller Unit
- Type 2070-1 CPU Module
- Type 2070-2B Field I/O Module
- Type 2070-3 Front Panel Assembly
- Type 2070-4AN Power Supply Module – this power supply has power-up and power-down adjusted to meet NEMA specifications.
- Type 2070-5 VME Cage Assembly
- Type 2070-6 Serial Comm Module
- Type 2070-7 Serial Comm Module
- Type 2070-8 NEMA Module

Type 2070-N2 Controller Unit
- Type 2070-1B CPU Module
- Type 2070-2N Field I/O Module – this module contains 120VAC outlet (accommodates 2070-4 line cord) and has a built-in CPU and memory emulating the 2070-8 NEMA base.
- Type 2070-3 Front Panel Assembly
- Type 2070-4BN Power Supply Module – this power supply has power-up and power-down adjusted to meet NEMA specifications.
- Type 2070-6 Serial Comm Module
- Type 2070-7 Serial Comm Module

C. Documentation

1. Manuals. Two copies of Manual Documentation must be supplied for each item purchased up to 200 manuals per order. The manual must be bound in durable covers made of either 65-pound stock paper or clear plastic. The manual must be printed on 8-1/2 in. by 11 in. paper, with the exception that schematics, layouts, parts lists and plan details may be on 11 in. by 17 in. sheets, with each sheet neatly folded to 8-1/2 in. by 11 in. size. A minimum of Times New Roman or Arial 10 point font must be used for all manual text, excluding drawings and schematics. Drawing text may use a smaller font size.

2. Manual Contents. Each manual must include the following sections in the order listed:

a. Table of Contents

b. Glossary

c. Manufacturer Contact Information
Address
Telephone Number
Fax Number
General Email Address

d. General Description

e. General Characteristics

f. Installation

g. Adjustments

h. Theory of Operation
Systems Description (include block diagram).
Detailed Description of Circuit Operation.

i. Maintenance
Preventive Maintenance.
Trouble Analysis.
Trouble Shooting Sequence Chart.
Wave Forms.
Voltage Measurements.
Alignment Procedures.

j. Parts List (include circuit and board designation, part type and class, power rating, component manufacturer, mechanical part manufacturer, data specification sheets for special design components and original manufacturer's part number).

k. Electrical Interconnection Details & Drawings.

l. Schematic and Logic Diagram

m. Assembly Drawings and a pictorial diagram showing physical locations and identification of each component or part.

n. The date, serial numbers, model numbers and revision numbers of equipment covered by the manuals must be printed on the front cover of the manuals.

3. Draft Manual. A preliminary draft of the manual must be submitted, when required, to the DEPARTMENT for approval prior to final printing.

D. Packaging. Each item delivered must be individually packed in its own shipping container. When loose Styrofoam is used for packing the item, the item must be sealed in a plastic bag to prevent direct contact with the Styrofoam.

E. Delivery. Each item delivered for testing must be complete, including manuals, and ready for testing.

F. Metals. All sharp edges and corners must be rounded and free of any burrs.

1. Aluminum. Sheet must be 63 gauge American Standard (0.060-in.) minimum thick Type 3003-H14 or Type 5052-H32 ASTM Designation B209 aluminum alloy. Rod, Bar and Extruded must be Type 6061-T6, or equal.

2. Stainless Steel. Sheet must be annealed or one-quarter-hard complying with the ASTM Designation: A666 for Type 304, Grades A or B, stainless steel sheet.

3. Cold Rolled Steel. Sheet, Rod, Bar and Extruded must be Type 1018/1020.

a. Plating. All cold roll steel must be plated. All plating must be either cadmium plating meeting the requirements of Federal Specification QQ-P-416C, Type 2 Class l or zinc plating meeting the requirements of ASTM B633-85 Type II SC4.

G. Mechanical Hardware. All bolts, nuts, washers, screws, hinges and hinge pins must be stainless steel unless otherwise specified.

H. Electrical Isolation. Within the circuit of any device, module, or Printed Circuit Board (PCB), electrical isolation must be provided between DC logic ground, equipment ground and the AC- conductor. They must be electrically isolated from each other by 500 megohms, minimum, when tested at the input terminals with 500 VDC.

I. Daughter Boards. Keyboards and LCD/LED Displays are considered daughter boards. Daughter boards must be mechanically secured with a minimum of four spacers/metal screws. Connectors must be either Flat Cable or PCB Headers. Components are to be mounted under the daughter board.

4. Components. All components must be second sourced and must be of such design, fabrication, nomenclature or other identification as to be purchased from a wholesale distributor or from the component manufacturer. When a component is of such special design that it precludes the purchase of identical components from any wholesale distributor or component manufacturer, one spare duplicate component must be furnished with each 20, or fraction thereof, components used. The electronic circuit design must be such that all components of the same generic type, regardless of manufacturer, must function equally in accordance with the specifications.

A. Electronic Components.

1. No device to be socket mounted unless specifically called out.

2. No component to be operated above 80% of its maximum rated voltage, current or power ratings. Digital components must not be operated above 3% over their nominal voltage, current or power ratings.

3. No component to be provided where the manufactured date is three years older than the contract award date. The design life of all components, operating for twenty-four hours a day and operating in their circuit application, must be ten years or longer.

4. Components must be arranged so they are easily accessible, replaceable and identifiable for testing and maintenance. Where damage by shock or vibration exists, a clamp, fastener, retainer, or hold-down bracket must support the component mechanically.

5. The Manufacturer must submit detailed engineering technical data on all components at the request of the Department. The Manufacturer must certify that the component application meets the requirements of this standard.

B. Capacitors. The DC and AC voltage ratings as well as the dissipation factor of a capacitor must exceed the worst-case design parameters of the circuitry by 150%. Capacitor encasements must be resistant to cracking, peeling and discoloration. All capacitors must be insulated and must be marked with their capacitance values and working voltages. Electrolytic capacitors must not be used for capacitance values of less than 1.0 microfarad and must be marked with polarity.

C. Potentiometers. Potentiometers with ratings from 1 to 2 watts must meet Military Type RV4 requirements. Under 1 Watt potentiometers must be used only for trimmer type function. The potentiometer power rating must be at least 100% greater than the maximum power requirements of the circuit.

D. Resistors. Fixed carbon film, deposited carbon, or composition-insulated resistors must conform to the performance requirements of Military Specifications MIL-R-11F or MIL-R-22684. All resistors must be insulated and be marked with their resistance values. Resistance values must be indicated by the EIA color codes, or stamped value. The value of the resistors must not vary by more than 5% between -37 degrees C and 74 degrees C.

1. Special ventilation or heat sinking must be provided for all 2- watt or greater resistors. They must be insulated from the PCB.

E. Semiconductor Devices.

1. All transistors, integrated circuits, and diodes must be a standard type listed by EIA and clearly identifiable.

2. All metal oxide semiconductor components must contain circuitry to protect their inputs and outputs against damage due to high static voltages or electrical fields.

3. Device pin "1" locations must be properly marked on the PCB adjacent to the pin.

F. Transformers and Inductors. All power transformers and inductors must have the manufacturer's name or logo and part number clearly and legibly printed on the case or lamination. All transformers and inductors must have their windings insulated, be protected to exclude moisture, and their leads color coded with an approved EIA color code or identified in a manner to facilitate proper installation.

G. Triacs. Each triac with a designed circuit load of greater than 0.5 Amperes at 120 VAC must be mounted to a heat sink with thermal conductive compound or material, in addition to being mechanically secured.

H. Circuit Breakers. Circuit breakers must be listed by UL or ETL. The trip and frame sizes must be plainly marked (marked on the breaker by the manufacturer), and the ampere rating visible from the front of the breaker. Contacts must be silver alloy and enclosed in an arc-quenching chamber. An ambient air temperature range of from -18 degrees C to 50 degrees C must not influence overload tripping. The minimum Interrupting Capacity must be 5,000 amperes, RMS when the breaker is secondary to a UL approved fuse or primary circuit breaker and both breakers in concert provide the rated capacity. For circuit breakers 80 amperes and above, the minimum interrupting capacity must be 10,000 amperes, RMS. Circuit breakers must be the trip-free type with medium trip delay characteristic (Carlingswitch Time Delay Curve #24 or equal).

1. Load Circuit Breaker Auxiliary Internal Switches. The Load Circuit Breakers used to power Switch Packs must have auxiliary switches. The auxiliary switches must "open" when the load breaker has tripped and the system will transfer the power from the Main Contactor to the Flash or Blank condition.

I. Fuses. All Fuses that are resident in a bayonet style fuse holder must have the fuse size rating labeled on the holder or on the panel adjacent to the holder. Fuses must be easily accessible and removable without use of tools.

J. Switches.

1. Dip. Dual-inline-package, quick snap switches must be rated for a minimum of 30,000 operations per position at 50 milliamperes, 30 VDC. The switch contact resistance must be 100 milliohms maximum at 2 milliamperes, 30 VDC. The contacts must be gold over brass.

2. Logic. The switch contacts must be rated for a minimum of 1-ampere resistive load at 120 VAC and must be silver over brass (or equal). The switch must be rated for a minimum of 40,000 operations.

3. Control. The switch contacts must be rated for a minimum of 5 amperes resistive load at 120 VAC or 28 VDC and be silver over brass (or equal). The switch must be rated for a minimum of 40,000 operations.

4. Power. Ratings must be the same as CONTROL, except the contact rating must be a minimum of 10 amperes at 125 VAC.

K. Terminal Blocks. The terminal blocks must be barrier type, rated at 20 amperes and 600 VAC RMS minimum. The terminal screws must be 0.3125 in. minimum length nickel-plated brass binder head type with screw inserts of the same material. Screw size is called out under the associated file, panel or assembly.

L. Screw Lug and Cam Driven Connectors. Provided the connectors mate, screw lug cam driven devices or crimp pin connectors must be allowable if the interface is part of a harness. For field termination, screw lug and cam driven assemblies are interchangeable for field wiring termination, provided they both accommodate 22-gauge wire on the inputs and 22-gauge wire on the outputs.

M. Wiring, Cabling and Harnesses.

1. Harnesses must be neat, firm and properly bundled with external protection. They must be tie-wrapped and routed to minimize crosstalk and electrical interference. Each harness must be of adequate length to allow any conductor to be connected properly to its associated connector or termination point. Conductors within an encased harness have no color requirements. Printed circuit motherboards are to be used where possible to eliminate or reduce cabinet wiring.

2. Wiring containing AC must be bundled separately or shielded separately from all DC logic voltage control circuits.

3. Wiring must be routed to prevent conductors from being in contact with metal edges. Wiring must be arranged so that any removable assembly may be removed without disturbing conductors not associated with that assembly.

4. All conductors, except those that can be readily traced, must be labeled. Labels attached to each end of the conductor must identify the destination of the other end of the conductor.

5. All conductors must conform to MIL-W-16878E/1 or better and have a minimum of 19 strands of copper. The insulation must be polyvinyl chloride with a minimum thickness of 10 mils or greater. Where insulation thickness is 15 mils or less, the conductor must conform to MIL-W-16878/17.

6. Conductor color identification must be as follows:

AC- circuits – white

Equip. Ground - solid green or continuous green color with 1 or more yellow stripes

DC logic ground - continuous white with a red stripe

AC+ circuits - continuous black or black with colored stripe

DC logic ungrounded or signal - any color not specified

N. Indicators and Character Displays.

1. All indicators and character displays must be readily visible at a radius of up to 4 feet within the cone of visibility when the indicator is subjected to 97,000 lux (9,000 foot-candles) of white light with the light source at 45 degrees (+/-2 degrees) to the front panel.

2. All indicators and character displays must have a minimum 90 degrees cone of visibility with its axis perpendicular to the panel on which the indicator is mounted. All indicators must be self-luminous. All indicators must have a rated life of 100,000 hours minimum. Each LED indicator must be white or clear when off. Indicators supplied on equipment requiring handles must be mounted such that a horizontal clearance is provided.

3. Liquid Crystal Displays (LCD) must be readable at temperatures of -20°C to +70 °C. All controller unit functions are required to operate at temperatures of –37°C to +74°C.

O. Connectors. Connectors must be keyed to prevent improper insertion of the wrong connector where equipment damage or operator injury may result. The mating connectors must be designated as the connector number and male/female relationship, such as C1P (plug or PCB edge connector) and C1S (socket).

1. Type T. Type T connector must be a single row, 10 position, feed through terminal block. The terminal block must be a barrier type with 6-32, 0.25 in. or longer, nickel plated brass binder head screws. Each terminal must be permanently identified as to its function.

2. Plastic Circular and Type M. Pin and socket contacts for connectors must be beryllium copper construction subplated with 1.27 microns nickel and plated with 0.76 microns gold. Pin diameter must be 0.0618 in. All pin and socket connectors must use the AMP #601105-1 or #91002-1 contact insertion tool and the AMP #305183 contact extraction tool or equal.

3. Card Edge and Two Piece PCB.

a. Edge connectors must have bifurcated gold-plated contacts. The PCB receptacle connector must meet or exceed the following:

Operating Voltage:	600 VAC (RMS)
Current Rating:	5.0 Amperes
Insulation Material:	Diallyl Phthalate or Thermoplastic
Insulation Resistance:	5,000 Megohms
Contact Material:	Copper alloy plated with 0.00005 in.
	of nickel and 0.000015 in. of gold
Contact Resistance:	0.006 Ohm maximum

b. The two-piece PCB connector must meet or exceed the DIN 41612.

c. The PCB 22/44 Connector must have 22 independent contacts per side; dual sided with 0.156 in. contact centers.

4. Wire Terminal. Each wire terminal must be solderless with PVC insulation and a heavy-duty short -locking spade type connector. Crimp terminal connectors using a Controlled-Cycle type crimping tool.

5. Flat Cable. Each flat cable connector must be designed for use with 26 AWG cable; have dual cantilevered phosphor bronze contacts plated with 0.00015 in. of gold over 0.00005 in. of nickel; and have a current rating of 1 Ampere minimum and an insulation resistance of 5 Megohms minimum.

6. PCB Header Post. Each PCB header post must be 0.025 in. square by 0.3425 in. high from the plane of the PCB to the end of the pin; be mounted on 0.10 in. centers; and be tempered hard brass plated with 0.00015 in. of gold over 0.00005 in. of nickel.

7. PCB Header Socket. Each PCB header socket block must be nylon or diallyl phthalate. Each PCB header socket contact must be removable, but crimp-connected to its conductor. List the part number of the extraction tool recommended by its manufacturer. Each PCB header socket contact must be brass or phosphor bronze plated with 0.0015 in. of gold over 0.00005 in. of nickel.

P. Surge Protection Device. The surge suppression device must comply with ANSI/IEEE C62.41 (100 Kilohertz Ring Wave, the 1.2/50 microseconds – 8/20 Combination Wave and the EFT Burst) at voltages and currents specified at "Location Category B2" and at "Test Severity" level III (i.e. up to 4.0 Kilovolts, open-circuit).

5. Mechanical Requirements.

A. Assemblies. All assemblies must be modular, easily replaceable and incorporate plug-in capability for their associated devices or PCBs. Assemblies must be provided with two guides for each plug-in PCB or associated device (except relays). The guides must extend to within 0.75 in. from the face of either the socket or connector and front edge of the assembly. If Nylon guides are used, attach the guides securely to the file or assembly chassis.

B. Locking Devices. All screw type fasteners must utilize locking devices or locking compounds except finger screws, which are captive.

C. PCB Design and Connectors. No components, traces, brackets or obstructions are to be within 0.125 in. of the board edge (guide edges). The manufacturer's name or logo, model number, serial number, and circuit issue or revision number must appear and be readily visible on all PCBs.

D. Model and Serial Numbers.

1. The manufacturer's model number, and circuit issue or revision number must appear on the rear panel of all equipment supplied (where such panel exists). In addition to any assignment of model numbers by the manufacturer, the TYPE number must be displayed on the front panel in bold type, at least 0.25 in. high.

2. A permanent label must be affixed to the inside near and center floor of the Type 2070 unit chassis when viewed from the front. The label must display the unit's serial number and be permanent and easy to read.

E. Workmanship. Workmanship must conform to the requirements of this specification and be in accordance with the highest industry standards.

F. Tolerances. The following tolerances must apply, except as specifically shown on the plans or in these specifications:

TYPE	DIMENSIONAL TOLERANCE
Sheet Metal	+/-0.0525 in.
PCB	+0 in., - 0.010 in.
Edge Guides	+/-0.015 in.

*Note: These dimensional tolerances do not apply to material gauge or thickness.

6. Engineering.

A. Human Engineering. The equipment must be engineered for simplicity, ease of operation and maintenance.

1. Knobs must be a minimum of 0.5 in. in diameter and a minimum separation of 0.5 in. edge to edge.

2. PCBs must slide smoothly in their guides while being inserted into or removed from the frame and fit snugly into the plug-in PCB connectors. PCBs must require a force no less than 5 pounds-force or greater than 50 pounds-force for insertion or removal.

B. Design Engineering. The design must be inherently temperature compensated to prevent abnormal operation. The circuit design must include such compensation as is necessary to overcome adverse effects due to temperature in the specified environmental range. The design must take into consideration the protection of personnel from all dangerous voltages.

C. Generated Noise. No item, component or subassembly is to emit an audible noise level exceeding the peak level of 55 dBa when measured at a distance of one meter away from its surface, except as otherwise noted. No item, component or subassembly is to emit a noise level sufficient to interfere with processing and communication functions of the controller circuits.

7. Printed Circuit Boards.

A. Design, Fabrication and Mounting.

1. All contacts on PCBs must be plated with a minimum thickness of 0.00003 in. gold over a minimum thickness of 0.000075 in. nickel.

2. PCB design must be such that when a component is removed and replaced, no damage is done to the board, other components, conductive traces or tracks.

3. Fabrication of PCBs must be in compliance with Military Specification MIL-P-13949, except as follows:

a. NEMA FR-4 glass cloth base epoxy resin copper clad laminates 0.0625 in. minimum thickness must be used.

Inter-component wiring must be by laminated copper clad track having a minimum weight of 0.2 ounces per square foot with adequate cross section for current to be carried. All copper tracks must be plated or soldered to provide complete coverage of all exposed copper tracks. Jumper wires to external PCB components must be from plated-through padded holes and as short as possible.

b. All PCBs must conform to Section 3.3 of Military Specification MIL-P-13949G Grade of Pits and Dents and be of Grade B quality (3.5.1.3) or better. The class of permissible bow or twist must be Class C (Table V) or better. The class of permissible warp or twist must be Class A (Table II) or better.

c. Omit Sections 4.2 through 6.6 of Military Specification MIL-P-13949G (inclusive) except as referenced in previous sections of this specification.

d. The mounting of parts and assemblies on the PCB must conform to Military Specification MIL-STD-275E, except as follows:

(1) Semiconductor devices that dissipate more than 250 milliwatts or cause a temperature rise of 10°C or more must be mounted with spacers, transipads or heat sinks to prevent contact with the PCB.

(2) When completed, remove all residual flux from the PCB.

(3) The resistance between any two isolated, independent conductor paths must be at least 100 Megohms when a 500 VDC potential is applied.

(4) All PCBs must be coated with a moisture resistant coating.

(5) Where less than 0.25 in. lateral separation is provided between the PCB (or the components of a PCB) and any metal surface, a 0.0625 in. (+/- 0.0005 in.) Thick Mylar (polyester) plastic cover must be provided on the metal to protect the PCB.

e. Each PCB connector edge must be chamfered at 30 degrees from board side planes. The key slots must also be chamfered so that the connector keys are not extracted upon removal of board or jammed upon insertion. The key slots must be 0.045 in. (+/-0.005 in.) for 0.1 in. spacing and 0.055 in. (+/-0.005 in.) for 0.156 in. spacing.

B. Soldering.

1. Hand soldering must comply with Military Specification MIL-STD-2000.

2. Automatic flow soldering must be a constant speed conveyor system with the conveyor speed set at optimum to minimize solder peaks or points. Temperature must be controlled to within +/- 8°C of the optimum temperature. The soldering process must result in the complete coverage of all copper runs, joints and terminals with solder except that which is covered by an electroplating process. Wherever clinching is not used, provide a method of holding the components in the proper position for the flow process.

3. If exposure to the temperature bath is of such a time-temperature duration, as to come within 80% of any component's maximum specified time-temperature exposure, that component must be hand soldered to the PCB after the flow process has been completed.

C. Definitions. Definitions for the purpose of this section on PCBs must be taken from MIL-P-55110D Section 3.3 and any current addendum.

D. Jumpers. Jumpers are not allowed unless called out in the specifications or approved by the Department.

8. Quality Control.

A. Components. All components must be lot sampled to assure a consistent high conformance standard to the design specification of the equipment.

B. Subassembly, Unit or Module. Complete electrical, environmental and timing compliance testing must be performed on each module, unit, printed circuit or subassembly. Components will be tested as a complete controller assembly. Housing, chassis, and connection terminals must be inspected for mechanical sturdiness, and harnessing to sockets to be electrically tested for proper wiring sequence. The equipment must be visually and physically inspected to assure proper placement, mounting, and compatibility of subassemblies.

C. Pre-delivery Repair.

1. Any defects or deficiencies found by the inspection system involving mechanical structure or wiring must be returned through the manufacturing process or special repair process for correction.

2. PCB flow soldering is allowed a second time if copper runs and joints are not satisfactorily coated on the first run. Do not flow solder a PCB more than twice.

3. Hand soldering is allowed for printed circuit repair.

9. Electrical, Environmental and Testing Requirements. The framework of this section, along with the specific test requirements contained herein, is excerpted with modifications from NEMA TS2-2003 - Section 2 by permission of NEMA. Excerpt © 2002 AASHTO / ITE / NEMA.

A. General. This section establishes the limits of the environmental and operational conditions in which the Controller Assembly will perform. This section defines the minimum test procedures that may be used to demonstrate conformance of a device type with the provisions of the standard. These test procedures do not verify equipment performance under every possible combination of environmental requirements covered by this standard. Nothing in this testing profile must be construed as to relieve the requirement that the equipment provided must fully comply with these standards/specifications under all environmental conditions stated herein.

The Department may wish to extend the testing profile or introduce additional tests to verify compliance. (Authorized Engineering Information).

B. Inspection. A visual and physical inspection must include mechanical, dimensional and assembly conformance to all parts of this standard.

C. Testing Certification.

1. A complete quality control / final test report must be supplied with each item. Quality control procedures must be submitted to the Department prior to production. The test report must indicate the name of the tester and be signed by a responsible manager.

2. The quality control procedure and test report format must be supplied to the Department for approval upon request. The quality control procedure must include the following, in the order shown:

(a) Design Acceptance testing of all supplied components.

(b) Physical and functional testing of all modules and items.

(c) Environmental testing reports for all equipment.

(d) Physical and functional testing of all items.

3. Separate certifications must be provided for Design and Production. Design Acceptance testing must be performed with a fully loaded and functional Cabinet Assembly. Production testing must be performed as part of the Department‘s procurement delivery procedures and that testing should be performed at the Major Unit level. (Authorized Engineering Information).

4. Certain portions of the test procedures contained in this standard my cause damage to the unit (e.g. protection devices may be aged) and are not recommended for routine Production testing. (Authorized Engineering Information)

D. Definitions of Major Units of the Cabinet Assembly. For the purpose of this section, "Major units of the Cabinet Assembly” must include the Controller Unit, Application Software for implementing the desired functionality, Cabinet Monitor Unit (CMU), Auxiliary Monitor Unit (AMU), Serial Interface Units (SIUs), Power Distribution Unit (PDA), Switch Packs, Flasher(s), and Detector(s).

E. Environmental and Operating Requirements. The requirements (voltage, temperature, etc.) of this section must apply in any combination.

1. Voltage and Frequency.

a. Operating Voltage. The nominal voltage must be 120 VAC, unless otherwise noted.

b. Operating Frequency. The operating frequency range must be 60 hertz (+/-3.0 hertz), unless otherwise noted.

2. Transients, Power Service. The Test Unit must maintain all defined functions when the independent test pulse levels specified below occur on the alternating-current power service.

a. High Repetition Noise Transients.

(1) The test pulses must not exceed the following conditions:

(a) Amplitude: 300 Volts, both positive and negative polarity.

(b) Peak Power: 2500 watts.

(c) Repetition: 1 pulse approximately every other cycle moving uniformly over the full wave in order to sweep across 360 degrees of the line cycle once every 3 seconds.

(d) Pulse Rise Time: 1 microsecond.

(e) Pulse Width: 10 microseconds.

(f) This test is performed without protection in place or operational.

This test is considered to be a minimum test requirement for the Test Unit complying with ANSI/IEEE C62.41. Regional conditions may warrant additional testing as described in ANSI/IEEE C62.41. (Authorized Engineering Information)

b. Low Repetition High Energy Transients.

(1) The test pulses must not exceed the following conditions:

(a) Amplitude: 600 Volts (+/-5%), both positive and negative polarity.

(b) Energy Source: Capacitor, oil filled, 10 microfarads (+/-10%), internal surge impedance less than 1 ohm.

(c) Repetition: 1 discharge every 10 seconds.

(d) Pulse Position: Random across 360 degrees of the line cycle.

(e) This test is performed with protection in place and operational.

This test is considered to be a minimum test requirement for the Test Unit complying with ANSI/IEEE C62.41. Regional conditions may warrant additional testing as described in ANSI/IEEE C62.41. (Authorized Engineering Information)

c. Nondestructive Transient Immunity.

(1) The Test Unit (with protection in place and operational) must be capable of withstanding a high energy transient having the following characteristics repeatedly applied to the alternating current input terminals (no other power connected to terminals) without failure of the test specimen:

(a) Amplitude: 1000 Volts (+/-5%), both positive and negative polarity.

(b) Energy Source: Capacitor, oil filled, 15 microfarads (+/-10%), internal surge impedance less than 1 ohm.

(c) Repetition: Applied to the Test Unit once every 2 seconds for a maximum of three applications for each polarity.

(d) After the foregoing, the Test Unit must perform all defined functions upon the application of nominal alternating current power.

This test is considered to be a minimum test requirement for the Test Unit complying with ANSI/IEEE C62.41 (100 Kilohertz Ring Wave, the 1.2/50 microseconds – 8/20 Combination Wave and the EFT Burst) at voltages and currents specified at "Location Category B2" and at "Test Severity" level III (i.e. up to 4.0 Kilovolts, open-circuit). Regional conditions may warrant additional testing as described in ANSI/IEEE C62.41. (Authorized Engineering Information)

d. Transients, Input-Output Terminals.

(1) The Test Unit (without protection in place or operational) must maintain all defined functions, when the test pulse occurs on the input-output terminals.

(a) Amplitude: 300 Volts, both positive and negative polarity.

(b) Pulse Source: 1000 ohms nominal impedance.

(c) Repetition: 1 pulse per second, for a minimum of 5 pulses per selected terminal.

(d) Pulse rise time: 1 microsecond.

(e) Pulse width: 10 microseconds.

This test is considered to be a minimum test requirement for the Test Unit complying with ANSI/IEEE C62.41. Regional conditions may warrant additional testing as described in ANSI/IEEE C62.41. (Authorized Engineering Information)

e. Temperature and Humidity. The Test Unit must maintain all programmed functions when the temperature and humidity ambients are within the specified limits defined herein.

(1) Ambient Temperature.

(a) The operating ambient temperature range must be from -37°C to +74 °C. The storage temperature range must be from -45°C to +85 °C.

(b) The rate of change in ambient temperature must not exceed 18 degrees C per hour, during which the relative humidity must not exceed 95%.

(2) Humidity.

(a) The relative humidity must not exceed 95% non-condensing over the temperature range of -37°C to +74°C.

(b) Above +46°C, constant absolute humidity must be maintained. This will result in the relative humidity shown in Exhibit 3-1 for dynamic testing.

Table 1
AMBIENT TEMPERATURE VERSUS RELATIVE HUMIDITY
AT BAROMETRIC PRESSURES (29.92 In. Hg.) (NON-CONDENSING)

Ambient Temperature/ Dry Bulb (in°C)	Relative Humidity (in percent)	Ambient Temperature/ Wet Bulb (in degrees C)
-37.0 to 1.1	10	-17.2 to 42.7
1.1 to 46.0	95	42.7
48.8	70	42.7
54.4	50	42.7
60.0	38	42.7
65.4	28	42.7
71.2	21	42.7
74.0	18	42.7

F. Test Facilities. All instrumentation required in the test procedures, such as voltmeters, ammeters, thermocouples, pulse timers, etc. must be selected in accordance with good engineering practice. In all cases where time limit tests are required, the allowance for any instrumentation errors must be included in the limit test.

1. Variable Voltage Source: A variable source capable of supplying 20 amperes from 100 VAC to 135 VAC.

2. Environmental Chamber: An environmental chamber capable of attaining temperatures of -37°C to +74°C and relative humidity given in Table 1.

3. Transient Generators: Transient generators capable of supplying the transients outlined above.

G. Test Procedure: Transients, Temperature, Voltage, and Humidity

1. Test A: Placement in Environmental Chamber and Check-Out of Hook-Up

a. Place the test unit in the environmental chamber. Connect the test unit AC input circuit to a variable voltage power transformer, voltmeter, and transient generator. The transient generator must be connected to the AC input circuit at a point at least 25 ft. from the AC power source and not over 10 ft. from the input to the test unit.

b. Connect test switches to the appropriate terminals to simulate the various features incorporated into the test unit. Place these switches in the proper position for desired operation.

c. Verify the test hook-up. Adjust the variable-voltage power transformer to 120 VAC and apply power to the test unit. Verify that the test unit goes through its prescribed startup sequence and cycles properly in accordance with the operation determined by the positioning of test switches in item b.

Upon the satisfactory completion and verification of the test hook-up, proceed with Test B.

2. Test B: Transient Tests (Power Service)

a. Program the test unit to dwell. Verify the input voltage is 120 VAC.

b. Set the transient generator to provide high-repetition noise transients as follows:

(1) Amplitude: 300 Volts (+/-5%), both positive and negative polarity.

(2) Peak Power: 2500 watts.

(3) Repetition Rate: One pulse every other cycle moving uniformly over the full wave in order to sweep once every 3 seconds across 360 degrees of line cycle.

(4) Pulse Rise Time: 1 microsecond.

(5) Pulse Width: 10 microseconds.

c. Apply the transient generator output to the AC voltage input for at least 5 minutes. Repeat this test for at least two conditions of dwell for the test unit. The test unit must continue to dwell without malfunction.

d. Program the test unit to cycle through normal operations. Turn on the transient generator (output in accordance with item 2) for 10 minutes, during which time the test unit must continue to cycle without malfunction.

e. Set a transient generator to provide high-repetition noise transients as follows:

(1) Amplitude: 300 Volts (+/-5%), both positive and negative polarity.

(2) Source Impedance: Not less than 1000 ohms nominal impedance.

(3) Repetition: One pulse per second for a minimum of five pulses per selected terminal.

(4) Pulse Rise Time: 1 microsecond.

(5) Pulse Width: 10 microseconds.

Program the test unit to dwell. Verify the input voltage is 120 VAC.

f. Apply the transient generator (output in accordance with item 5) between logic ground and the connecting cable termination of selected Field I/O input/output terminals of the test unit.

A representative sampling of selected input/output terminations must be tested. The test unit must continue to dwell without malfunction.

g. Program the test unit to cycle. Turn on the transient generator (output in accordance with item 5) and apply its output to the selected Field I/O input/output terminations. The test unit must continue to cycle without malfunction.

h. Reinstall protection and set a transient generator to provide low-repetition high-energy transients as follows:

(1) Amplitude: 600 Volts (+/-5%), both positive and negative polarity.

(2) Energy Discharge Source: Capacitor, oil-filled, 10 microfarads.

(3) Repetition Rate: One discharge each 10 seconds.

(4) Pulse Position: Random across 360 degrees of line cycle.

i. Program the test unit to dwell. Verify the input voltage is 120 VAC.

j. Discharge the oil-filled 10-microfarad capacitor ten times for each polarity across the AC voltage input. Repeat this test for at least two conditions of dwell. The test unit must continue to dwell without malfunction.

k. Program the test unit to cycle through normal operations. Discharge the capacitor ten times for each polarity while the test unit is cycling, during which time the test unit must continue to cycle without malfunction.

l. During the preceding transient tests, the test unit must continue its programmed functions.

The test unit must not skip normal program intervals/steps or portions thereof when in normal operation; place false inputs or produce false outputs while in dwell; disrupt normal sequences in any manner; or change parameters.

m. Nondestructive Transient Immunity:

(1) Turn off the AC power input to the test unit from the variable-voltage power source.

(2) Apply the following high-energy transient to the AC voltage input terminals of the test unit (no other power connected to terminals):

(a) Amplitude: 1000 V, both positive and negative polarity.

(b) Peak Power Discharge: Capacitor, oil-filled, 15 microfarads.

(c) Maximum Repetition Rate: Applied to the Cabinet Assembly once every 2 seconds for a maximum of three applications for each polarity.

(3) Upon completion of the foregoing, apply 120 VAC to the test unit and verify that the test unit goes through its prescribed startup sequence and cycles properly in accordance with the programmed functions. The first operation of the over-current protective device during this test is not considered a failure of the test unit.

NOTE—Test C through G follow the profile indicated in Figure 1 to demonstrate the ability of the test unit to function reliably under stated conditions of temperature, voltage, and humidity.

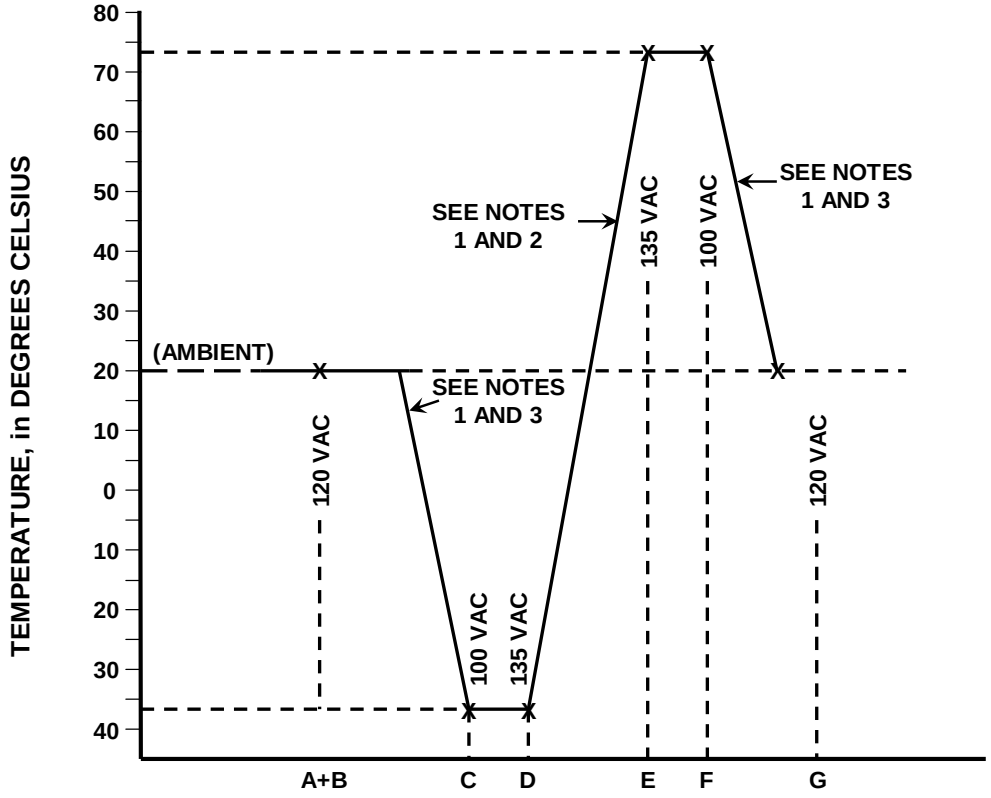


Figure 1
Test Profile

NOTES:

- The rate of change in temperature must not exceed 18°C per hour
- Humidity controls must be set in conformance with the humidity given in Table 1 during the temperature change between Test D and Test E.

- If a change in both voltage and temperature are required for the next test, the voltage must be selected prior to the temperature change.

3. Test C—Low-Temperature Low-Voltage Tests

a. Definition of Test Conditions

(1) Environmental Chamber Door: Closed.

(2) Temperature: -37°C.

(3) Low Voltage: 100 VAC.

(4) Humidity Control: Off.

b. Test Procedure: While at room temperature, adjust the input voltage to 100 VAC and verify that the test unit is still operable.

(1) With the test unit cycling through normal operations, lower the test chamber to -37°C at a rate not exceeding 18°C per hour. Allow the test unit to cycle for a minimum of 5 hours at -37°C with the humidity controls in the off position. Then operate the test switches as necessary to determine that all functions are operable.

(2) Remove power from the test unit for a minimum period of 5 hours. Upon restoration of power, the test unit must go through its prescribed startup sequence and then resume cycling.

(3) With the test unit at -37°C and the input voltage at 100 VAC, evaluate the following items against the respective standards:

(a) Power Interruption Tests

On satisfactory completion of this test, proceed with Test D.

4. Test D—Low-Temperature High-Voltage Tests

a. Definition of Test Conditions

(1) Environmental Chamber Door: closed.

(2) Low Temperature: -37°C.

(3) High Voltage: 135 VAC.

(4) Humidity Controls: Off.

b. Test Procedure: While at -37°C and with humidity controls off, adjust the input voltage to 135 VAC and allow the test unit to cycle for 1 hour. Then operate the test switches as necessary to determine that all functions are operable.

c. With the test unit at -37°C and the input voltage at 135 VAC (humidity controls off), evaluate the following items against the respective standards:

(a) Power Interruption Tests

On satisfactory completion of this test, proceed to Test E.

5. Test E—High-Temperature High-Voltage Tests

a. Definition of Test Conditions

(1) Environmental Chamber Door: Closed.

(2) High Temperature: +74°C.

(3) High Voltage: 135 VAC.

(4) Humidity Controls: In accordance with the humidity given in Table 1.

b. Test Procedure—With the test unit cycling, raise the test chamber to +74°C at a rate not to exceed 18 degrees C per hour. Verify the input voltage is 135 VAC.

c. Set the humidity controls to not exceed 95% relative humidity over the temperature range of +1.1°C to +46°C. When the temperature reaches +46°C, read just the humidity control to maintain constant absolute humidity; +42.7°C wet bulb that results in the relative humidity shown in Table 1. Verify that the test unit continues to cycle satisfactory during the period of temperature increase and at established levels of relative humidity.

(1) Allow the test unit to cycle for a minimum of 15 hours at +74°C and 18 % relative humidity. Then operate the test switches as necessary to determine that all functions are operable.

(2) With the test unit at +74°C and 18 % relative humidity and the input voltage at 135 VAC, evaluate the following items against the respective standards:

(a) Power Interruption Tests

On satisfactory completion of this test, proceed to Test F.

6. Test F—High-Temperature Low-Voltage Tests

a. Definition of Test Conditions

(1) Environmental Chamber Door: Closed.

(2) High Temperature: +74°C.

(3) Low Voltage: 100 VAC.

(4) Humidity Controls: 18 percent relative humidity and +42.7°C wet bulb.

b. Test Procedure: Adjust the input voltage to 100 VAC and proceed to operate the test switches to determine that all functions are operable. With the test unit at +74°C and 18 % relative humidity, +42.7°C wet bulb, and the input voltage at 100 VAC, evaluate the following items against the respective standards:

(a) Power Interruption Tests

On satisfactory completion of this test, proceed to Test G.

7. Test G—Test Termination

a. Program the test unit to cycle.

b. Adjust the input voltage to 120 VAC.

c. Set the controls on the environmental chamber to return to room temperature, +20°C (+/-5°C), with the humidity controls in the off position. The rate of temperature change must not exceed 18°C per hour.

d. Verify the test unit continues to cycle through normal operations properly.

e. Allow the test unit to stabilize at room temperature for 1 hour. Proceed to operate the test switches to determine that all functions are operable.

8. Test H—Appraisal of Equipment under Test

a. A failure is defined as any occurrence that results in other than normal operation of the equipment. (See sub-section item b. below for details.) If a failure occurs, the test unit must be repaired or components replaced, and the test during which failure occurred must be restarted from its beginning.

b. The test unit is considered to have failed if any of the following occur:

(1) If the test unit skips normal program intervals/steps or portions thereof when in normal operation, places false inputs, presents false outputs, exhibits disruption of normal sequence of operations, or produces changes in parameters beyond specified tolerances, or

(2) If the test unit fails to satisfy the requirements of Tests A to G, inclusive.

c. An analysis of the failure must be performed and corrective action taken before the test unit is retested in accordance with this standard. The analysis must outline what action was taken to preclude additional failures during the tests.

d. When the number of failures exceeds two, it must be considered that the test unit fails to meet these standards. The test unit may be completely retested after analysis of the failure and necessary repairs have been made in accordance with item c.

e. Upon completion of the tests, visually inspect the test unit. If material changes are observed which will adversely affect the life of the test unit, the cause and conditions must be corrected before making further tests.

f. Upon satisfactory completion of all of the tests described, test the unit in accordance with Vibration Test.

H. Vibration Test.

1. Purpose of Test. This test is intended to duplicate vibrations encountered by the test unit (individual major components) when installed at its field location.

Fasten the test unit securely to the vibration test table prior to the start of the test.

2. Test Equipment Requirements.

a. Vibration table with adequate table surface area to permit placement of the test unit.

b. Vibration test consists of:

(1) Vibration in each of three mutually perpendicular planes.

(2) Adjustment of frequency of vibration over the range from 5 hertz to 30 hertz.

(3) Adjustment of test table excursion (double amplitude displacement) to maintain a ‗g' value, measured at the test table, of 0.5g; as determined by the following formula:

$$g = 0.0511df^2$$

Where:

d = excursion in inches

f = frequency in hertz

3. Resonant Search

a. With the test unit securely fastened to the test table, set the test table for a double amplitude displacement of 0.015 in.

b. Cycle the test table over a search range from 5 hertz to 30 hertz and back within a period of 12.5 minutes.

c. Conduct the resonant frequency search in each of the three mutually perpendicular planes.

d. Note and record the resonant frequency determined from each plane.

(1) In the event of more than on resonant frequency in a given plane, record the most severe resonance.

(2) If resonant frequencies appear equally severe, record each resonant frequency.

(3) If no resonant frequency occurs for a given plane within the prescribed range, 30 hertz must be recorded.

4. Endurance Test

a. Vibrate the test unit in each plane at its resonant frequency for a period of 1 hour at amplitude resulting in 0.5g acceleration.

b. When more than one resonant frequency has been recorded, the test period of 1 hour must be divided equally between the resonant frequencies.

c. The total time of the endurance test must be limited to 3 hours, 1 hour in each of three mutually perpendicular planes.

5. Disposition of Equipment under Test

a. Examine the test unit to determine that no physical damage has resulted from the vibration tests.

b. Check the test unit to determine that it is functionally operable in all modes of its prescribed operation.

c. The test unit may be removed from the test table. Upon satisfactory completion of the vibration test, proceed with the shock (impact) test.

I. Shock (Impact) Test.

1. Purpose of Test. The purpose of this test is to determine that the test unit is capable of withstanding the shock (impact) to which it may reasonably be subjected during handling and transportation in the process of installation, repair, and replacement. It is to be noted that the test unit is not, at this time, in its shipping carton.

Fasten the test unit firmly to the specimen table. In each of its three planes the test, drop the unit from a calibrated height to result in a shock force of 10g.

2. Test Equipment Requirements.

a. Shock (impact) test fixture equivalent to that suggested by the simplified sketch shown in Figure 2.

b. The test table must have a surface area sufficient to accommodate the test unit.

c. Calibrate the test table and the items tested as indicated. This shock test defines the test shock to be 10g (+/-1g).

(1) Measure calibration of the test equipment for these shock tests by three accelerometers having fixed shock settings of 9g, 10g, and 11g. They must be Inertia Switch Incorporated ST-355, or the equivalent. Attach these devices rigidly to the test table.

(2) Calibration of the fixture for each item to be tested is as follows:

(a) Place a dummy load weighing within 10 % of the test unit on the table.

(b) Reset the three accelerometers and drop the test table from a measured height.

(c) Observe that the accelerometers indicate the following:

- Activate the 9g accelerometer.
- The 10g unit may or may not be actuated.
- The 11g unit must not be actuated.

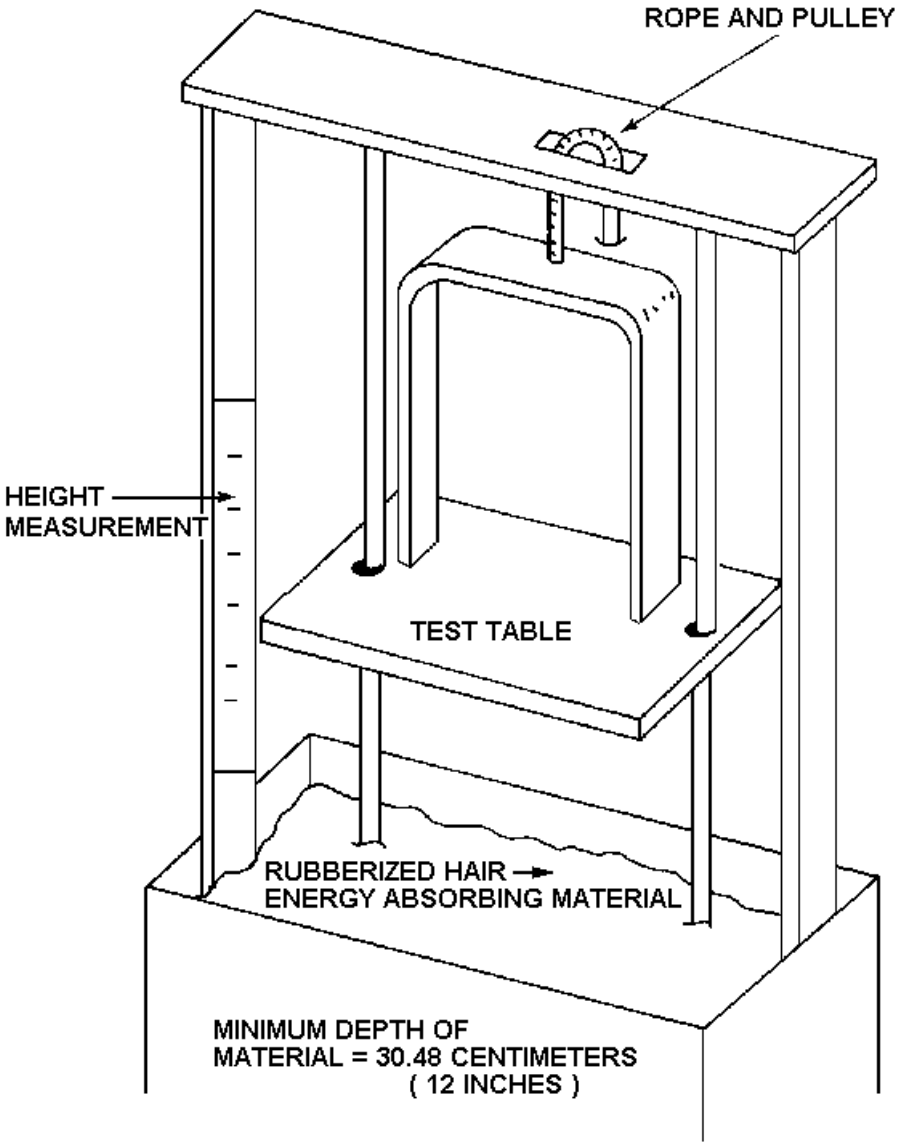


Figure 2
Shock Test Fixture

(3) Repeat calibration test (a) and (b) adjusting the height of the drop until, on ten successive drops, the following occurs:

(a) The 9g unit is actuated ten times.

(b) The 10g unit is actuated between four to eight times.

(c) The 11g unit is not actuated on any of the ten drops.

3. Test Procedure.

a. The calibration height of the drop for the particular item under test as determined in Test Equipment Requirements must be used in this procedure.

b. Secure the test unit to the test table surface so that the test unit rests on one of its three mutually perpendicular planes.

c. Raise the test table to the calibrated height.

d. Release the test table from the calibrated height, allowing a free fall into the box of energy absorbing material below.

e. Repeat the drop test for each of the remaining two mutually perpendicular planes, using the same calibrated height for each drop test of the same test unit.

f. The observations of the accelerometer for the three tests of the test item are:

(1) The 9g unit is actuated for all three tests. (Repeat the calibration if the unit is not actuated.)

(2) The 10g unit may or may not be actuated in these tests.

(3) The 11g unit is not actuated on any drop. (If the unit is actuated, repeat the calibration only if the test unit has suffered damage.)

4. Disposition of Test Unit.

a. Check the test unit for any physical damage resulting from the drop tests.

b. Check the test unit to determine that it is functionally operable in all modes of its prescribed operation.

c. Satisfactory completion of all environmental tests, including the shock (impact) is required.

J. Power Interruption Test Procedures. Conduct the following power interruption tests at low input voltage (100 VAC) and high input voltage (135 VAC) at -37°C, and +74°C.

1. Short Power Interruption. While the Test Unit is cycling through normal operations, remove the input voltage for a period of 475 milliseconds. Upon restoration of the input voltage, check to insure that the Test Unit continues normal operation as though no power interruption has occurred. Repeat this test three times.

2. Voltage Variation. All circuits of the Test Unit must be subjected to slowly varying line voltage during which the Test Unit must be subjected to line voltage that is slowly lowered from a nominal 120 VAC line voltage to 0 VAC at a rate of not greater than 2 Volts per second. The line voltage must then be slowly raised to 100 VAC at which point the Test Unit must resume normal operation without operator intervention. Perform this test at both -37°C and +74°C, at a nominal 120 VAC line voltage. Repeat this test three times.

3. Rapid Power Interruption. Subject the Test Unit to rapid power interruption testing of the form that the power is off for 350 milliseconds and on for 650 milliseconds for a period of 2 minutes. Perform power interruption through electromechanical contacts of an appropriate size for the load.

During this testing, the controller must function normally and continue normal sequencing (operation) at the conclusion of the test. This test must be performed at both -37°C and +74°C, at a nominal 120 VAC line voltage. Repeat this test three times.

10. Type 2070 Controller Unit.

A. General.

1. Module Descriptions. The Controller Unit is composed of the Type 2070 Unit CHASSIS, along with other modules and assemblies. The following is a list of Type 2070 versions, their interface rolls and composition:

Unit Version	Description
Type 2070V	UnitProvides directly driven VME and mates to 170 & ITS cabinets. It consists of: Unit CHASSIS, 2070-1A TWO BOARD CPU, 2070-2A (2B if ITS CABINET) FI/O, 2070-3A FRONT PANEL, 2070-4A POWER SUPPLY, and 2070-5 VME CAGE ASSEMBLY.
Type 2070L	UnitLITE Unit mates to the 170 & ITS cabinets. It consists of: UNIT CHASSIS, 2070-1B CPU, 2070-2A (2B if ITS CABINET), FI/O, 2070-3B FRONT PANEL and 2070- 4A or B POWER SUPPLY.
Type 2070LC Unit	LITE unit mates to ITS cabinets only. It consists of: UNIT CHASSIS, 2070-1B CPU, 2070-2B FI/O, 2070-3C FRONT PANEL and 2070-4 A or B POWER SUPPLY.

2. Unit Configuration. The Type 2070 Controller Unit Version defines the module composition to be delivered as follows:

No.	Item	Description	Composition		
			2070V Unit	2070L Unit	2070LC Unit
1	---	UNIT CHASSIS	Y	Y	Y
2	TYPE 2070-1A	CPU MODULE, MULTIPLE BOARD-VME	Y	---	---
3	TYPE 2070-1B	CPU MODULE, SINGLE BOARD- SERIAL HUB	---	Y	Y

No.	Item	Description	Composition		
			2070V Unit	2070L Unit	2070LC Unit
4	TYPE 2070-2A	FIELD I/O MODULE (FI/O for 170 Cabinet)	Y	Y user selection Y	---
5	TYPE 2070-2B	FIELD I/O MODULE (ITS & NEMA Cabinets)	---		Y
6	TYPE 2070-3A	FRONT PANEL MODULE (FP), DISPLAY A	Y	---	---
7	TYPE 2070-3B	FRONT PANEL MODULE (FP), DISPLAY B	---	Y	---
8	TYPE 2070-3C	FRONT PANEL MODULE (FP), BLANK	---	---	Y
9	TYPE 2070-4A	POWER SUPPLY MODULE, 10 AMP	Y	Y user selection Y	Y user selection Y
10	TYPE 2070-4B	POWER SUPPLY MODULE, 3.5 AMP	---		
11	TYPE 2070-5A	VME CAGE ASSEMBLY	Y	---	---

2070V UNIT	1+2+4+6+9+11	Provides directly driven VME and mates to 170 and ITS cabinets
2070L UNIT	1+3+(4 or 5)+7+(9 or 10)	LITE Unit mated to 170 and ITS cabinets
2070LC UNIT	1+3+5+8+(9 or 10)	LITE unit mates to ITS cabinets only

a. The communications and option modules/assemblies must be called out separately from the unit version. The composition weight must not exceed 25 pounds.

3. Metalwork. The CHASSIS Top and Bottom, Internal Structure Supports, Back Plane Mounting Surface, Module Plates, Power Supply Enclosure, and Front Panel must be made of 63-gauge minimum aluminum sheet. The CHASSIS Side panels must be 80-gauge minimum sheet.

4. Power Fail and Power Restoration Operation. It is noted that the Power Failure Power Restoration operations of this unit are specific to the requirements of the user. All associated modules are to comply to said operations.

5. Power Limitations. 2070 UNIT module / assembly power limitations are as follows:

Types	+5VDC	+12VDC ISO	+12VDC ser	-12 VDC ser
MCB	750 milliamperes	-----	-----	-----
TRANS BD	750 milliamperes	-----	-----	-----
2070-1B CPU	1.0 amperes	250mA		
2070-2A FI/O	250 milliamperes	750 milliamperes	-----	-----
2070-2B FI/O	250 milliamperes	500 milliamperes	-----	-----
2070-3A&B FPA	500 milliamperes	-----	50 milliamperes	50 milliamperes
2070-3C FPA	100 milliamperes	-----	50 milliamperes	50 milliamperes
2070-5 VME Cage	5.0 amperes	-----	200 milliamperes	200 milliamperes
2070-6 All Comm	500 milliamperes	-----	100 milliamperes	100 milliamperes
2070-7 All Comm	250 milliamperes	-----	50 milliamperes	50 milliamperes

6. EIA-485 Communications Circuitry. All circuitry associated with the EIA-485 Communications links must be capable of reliably passing a minimum of 1.0 megabits per second. Isolation circuitry must be by opto- or capacitive-coupled isolation technologies.

7. EIA-485 Line Drivers/Receivers. Through hole EIA-485 Line Drivers/Receivers, when used, must be socket mounted. Surface mounted drivers/receiver must be acceptable. EIA-485 Line Drivers/Receivers must not draw more than 35 milliamperes in active state and 20 milliamperes in inactive state per channel. A 100-Ohm Termination Resistor must be provided across each Differential Line Receiver Input. The Motherboard‘s control signals (e.g., SP1-RTS) must be active, or asserted, when the positive terminal (e.g., SP1-RTS+) is a lower voltage than its corresponding negative terminal (e.g., SP1-RTS-). A control signal is inactive when its positive terminal voltage is higher than its negative terminal. Receive and transmit data signals must be read as a "1" when the positive terminal's (e.g., SP1-TXD+) voltage is higher than its corresponding negative terminal (e.g., SP1-TXD-). A data value is "0" when its positive terminal's (e.g., SP1-TXD+) voltage is lower than its negative terminal (e.g., SP1-TXD-).

8. Sockets. Sockets for devices (called out to be socket mounted) must be "xx" pin AUGAT 500/800 series AG10DPC or equal.

9. SDLC. SP5and SP3 SDLC frame address assignments (Command/Response) are as follows:

		SP5	*SP3*
CPU 2070-1	=	“19”	“19”

FI/O 2070-2A & 8 = "20" —Not Applicable"

CPU Broadcast to all = "255" "255"

All other addresses are reserved by this standard. The SDLC response frame address must be the same address as the Command frame it receives.

B. Type 2070-1 CPU Module.

1. Type 2070-1A Configuration. The TYPE 2070-1A CPU consists of the Main Controller Board, Transition Board, Board Interface Harness, and CPU Module Software.

2. Type 2070-1B Configuration. The TYPE 2070-1B CPU must be a single board module meeting the 2X WIDE board requirements. The module must be furnished normally resident in MOTHERBOARD Slot A5. The module must meet all the requirements listed under this section and Details except for the following:

a. The VME software and hardware bus requirement does not apply nor do the MCB and Board Interface Harness physical requirements.

b. A Dual SCC Device (asynch/synch) and associated circuitry must be furnished to provide two additional system serial ports. The Dual SCC1 must be assigned to the System Serial Port SP1 meeting all requirements called out for SP1. The Dual SCC2 must be assigned as System Serial Port SP8. The SP8 and associated circuitry must interface with the MC68360 address and data structure and serially be connected to the external world via the DB 25 Pin C13S Connector located on the module front panel. The SP8 must meet all SP2 Port requirements including EIA 485 Drivers / receivers and synchronous data rate of 614.4 kilobits per second.

c. The 68360 SCC1 must be reassigned to ETHERNET (ENET) Network meeting ETHERNET 10 MBPS IEEE 802.3 (TP) 10 BASE T Standard Requirements, both hardware and software. The four network lines must be used to route ETHERNET across the MOTHERBOARD to the "A" Connectors. DC Grounding plane around the network connectors and lines to be provided. Network Lines must be assigned as: Network 1 = ENET TX+, Network 2 = ENET TX-, Network 3= ENET RX+, and Network 4 = ENET RX-. In addition, the conditioned ETHERNET must be brought out on RJ 45 C14S Connector mounted on the CPU-1B Front Panel. Four LEDs labeled —TX, RX, TX Collision and TX Status" must be mounted on the front panel signifying ETHERNET operational conditions.

d. The 2070-1B CPU must not draw more than 1.00 Amperes of +5VDC and 250 milliamperes of ISO+12 VDC.

3. Type 2070 – 1C Configuration. The TYPE 2070-1C CPU must be a single board module meeting the 2X WIDE board requirements. The module must be furnished normally resident in MOTHERBOARD Slot A5. The module must meet all the requirements listed under the 2070-1B section of this standard, with the following additions:

a. Engine Board. The TYPE 2070-1C CPU must use an Engine Board compliant to the AASHTO/ITE Next Generation ATC Standard. The Engine Board must be used for execution of the application software. No other microprocessor or memory of the 2070-1C CPU to be used for execution of the application software.

b. Ethernet Ports. The second ETHERNET port of the Engine Board must be brought out on an RJ 45 C15S Connector mounted on the 2070-1C front panel. The front panel LED indicators for the two Ethernet ports must conform to the AASHTO/ITE Next Generation ATC Standard.

c. Universal Serial Bus (USB). The TYPE 2070-1C CPU must include a USB port compliant to the AASHTO/ITE Next Generation ATC Standard, and brought out from the Engine Board to a USB C16S Connector mounted on the 2070-1C front panel.

d. Host Module Identification. The TYPE 2070-1C CPU must implement the host module identification using the Engine Board SPI serial port, compliant to the AASHTO/ITE Next Generation ATC Standard.

4. Main Controller Board (MCB).

a. General. The MCB must be a 3U VME bus compliant board and contain a system controller, an A24-D16 interface, a Master & Slave bus interface, a Multilevel VMEbus Arbiter, a FAIR VMEbus Requester, a system clock driver, and BTO (64).

b. Controller. The CONTROLLER Device must be a Motorola MC68360 or equal, clocked at 24.576 MHz minimum. The Fast IRQ Service System is reserved for DEPARTMENT use only. The Interrupts must be configured as follows:

Level 7 -	VMEbus IRQ7	
Level 6 -	VMEbus IRQ6	ACFAIL
Level 5 -	VMEbus IRQ5	CPU Module Counters / Timers, LINESYNC (auto vectored), Serial Interface Interrupts
Level 4 -	VMEbus IRQ4	
Level 3 -	VMEbus IRQ3	
Level 2 -	VMEbus IRQ2	
Level 1 -	VMEbus IRQ1	

c. Memory Address Organization.

8000 0000 - 80FF FFFF	STANDARD
9000 0000 - 9000 FFFF	SHORT

(1) 16 megabytes of contiguous address space for each specified memory (DRAM, SRAM and FLASH) allocated on an even boundary. The SRAM and FLASH memories must be accessed through the OS-9 Operating System's File Manager, or approved equivalent. The address of each memory block must be specified by the manufacturer and provided with the documentation.

(2) When the incoming +5 VDC falls below its operating level, the SRAM must drop to its standby state; and the SRAM and TOD Clock shift to the +5 VDC Standby Power. An on-board circuit will sense the +5 VDC Standby Power and shift to an On-board CPU Power Source. When the incoming +5 VDC rises to within its operating level, the appropriate MCB Circuitry will shift from standby power to incoming +5 VDC.

d. RAM Memory. Provide a minimum of 8 megabytes of DRAM Memory, organized in 32-bit words. A minimum of 1 megabyte of SRAM is required, of which 512 KiloBytes minimum must be available for Department use as a RAM drive (R0). The time from the presentation of valid RAM address, select lines, and data lines to the RAM device to the acceptance of data by the RAM device must not exceed 80 nanoseconds and be less as required to fulfill zero wait state RAM device write access under all operational conditions.

e. FLASH Memory. Provide a minimum of 8 MB of FLASH memory, organized in 16- or 32- bit words. The MCB must be equipped with all necessary circuitry for writing to the FLASH memory under program control. No more than 2 MB of FLASH Memory to be used for the Boot Image (List) and a minimum of 6 MB be available for DEPARTMENT use. The 2 MB of FLASH Memory must be reserved for the Boot Image only. Flash memory must have a minimum rated capacity of 100,000 read/write cycles and be industrial grade or better.

f. Time-of-Day Clock. Provide a software settable hardware Time-of-Day (TOD) clock. It must maintain an accuracy of +/-1 minute per 30 days at 25°C (77°F) under on-board standby power. The clock must be aligned to a minimum fractional second resolution of 10 milliseconds and track seconds, minutes, hours, day of month, month, and year.

g. CPU Reset. Provide a software-driven CPU RESET signal (Active LOW) to reset other controller systems. The signal output must be driver capable of sinking 30 milliamperes at 30 VDC. Execution of the program module —CPURESET" in the boot image must assert the CPU RESET signal once.

h. CPU Activity Indicator. Provide an open-collector output, capable of sinking 30 milliamperes at 30 VDC, to drive the Front Panel Assembly CPU Activity LED INDICATOR.

i. Tick Timer. The OS-9 Operating System TICK Timer must be derived from each transition of LINESYNC with a tick rate of 120 ticks per second.

j. SRAM and TOD Holdup. The SRAM and TOD Clock Circuitry, under Standby mode, must draw no more than 8 microamperes at 2.5 VDC and 35 degrees C. Supply an On-board Capacitor to hold up SRAM and TOD or a minimum of 7 days.

5. Transition Board. Provide a TRANSITION Board (TB) to transfer serial communication and control signals between the MCB and the Interface Master-board. Said signal and communication lines must be driven/received off and on the module compliant to EIA- 485. The Transition Board must provide a 1 KiloOhm pull-up resistor for the A2 & A3 installed lines. If the DC Ground is not present (slot not occupied) at the CPU EIA-485 line drivers/receivers, the drivers/receivers must be disabled (inactive).

6. Shielded Interface Harness. Provide a SHIELDED INTERFACE HARNESS that includes MCB and Transition Board connectors with strain relief, lock latch, mating connectors, and harness conductors. A minimum of 25 mm of slack must be provided. No power to be routed through the harness. The harness must be 100% covered by an aluminum mylar foil and an extruded black 0.8 mm PVC jacket or equal.

7. DataKey. Provide a DATAKEY Keyceptacle™ (KC4210, KC4210PCB or equal) mounted on the CPU module front panel (or the Transition Board of Type 1A). Power must not be applied to the receptacle if the key is not present.

The Manufacturer must supply a 2-megabyte Memory Size Datakey (SFK2Mb or equal) with each MODEL 1A TB (Transition Board) or 1B CPU module unless specified otherwise. The Datakey must be temperature rated for –40 to +80 degrees C operation, be black in color, and be initialized to the format and default values defined below.

When programmed, the memory on the key of header version 1 must be organized as follows:

Bytes	Description	Default Values
1-2	16 bit Frame Check Sequence (FCS) calculated as defined in clause 4.6.2 of ISO/IEC 3309. This FCS is calculated across bytes 3-64	
3	Key Type	See table below
4	Header Version	1
5-8	Latitude	0.0
9-12	Longitude	0.0
13-14	Controller ID	0xFFFF
15-16	Communication drop number	0xFFFF
17-20	IP Address	10.20.70.51
21-24	Subnet Mask	255.255.255.0
25-28	Default Gateway	10.20.70.254
29	Startup Override	0xFF

Bytes	Description	Default Values
30-64	Reserved for Department use	All bytes set to 0xFF
65 to End	User Data	All bytes set to 0xFF

When programmed, Byte 3 of the header must contain the Key Type value as defined in the following table:

Key Type	Model No.	Memory Size	Sector Size
1	DK1000	1 KiloByte	1 Byte
2	LCK16000	16 KiloBytes	1 Byte
3	SFK2Mb	2 megabytes	64 KiloBytes
4	TBD	4 megabytes	64 KiloBytes
5	TBD	8 megabytes	64 KiloBytes

The data format in the CPU Datakey header for the Latitude and Longitude fields must comply with IEEE/ANSI 754-1985 STD. All the other fields follow a Big Endian Format as implemented by Motorola CPUs.

The Startup Override byte may be used to override the default controller startup procedure.

8. CPU Module Software. The following must be supplied:

- Operating System
- Drivers and Descriptors
- Application Kernel
- Deliverables
- Error Handler

a. Operating System. The CPU Module must be supplied with Radisys/Microware OS-9 Version 3.2, or later, with kernel edition #372 or later. The following modules must be included:

- Embedded OS-9 Real Time Kernel
- Sequential Character File Manager (SCF)
- Stacked Protocol File Manager (SPF)
- Pipe File Manager (PIPEMAN)
- Random Block File Manager (RBF)
- C Shared Library (CSL)

Boot Image must include the following utility modules:

Break	Date	Deiniz	Devs	Free	Copy
Dir	Tmode	Edt	List	Load	Deldir
Dump	Del	Ident	Iniz	Irqs	Events
Echo	Format	Dcheck	Login	Link	Kermit
Tsmon	Mdir	Mfree	Pd	Makdir	Save
Attr	Rename	Procs	Unlink	Sleep	Xmode
Shell	Build	Setime	Merge	grep	

b. Drivers and Descriptors.

(1) Supplied modules must be re-entrant, address independent, and not contain self-modifying code.

Device drivers which require extensions to the standard OS-9 libraries must use the _os_getstat() and _os_setstat() functions.

```
#define SS_2070 0x2070

error_code _os_getstat(path_id path, SS_2070, PB2070 *pb);

error_code _os_setstat(path_id path, SS_2070, PB2070 *pb);

typedef struct

{

    u_int32 code;

    u_int32 param1;

    union

    {

        u_int32 param;

        void    *pointer;

    } param2;

} PB2070, *pb;
```

The following subcodes for use with PB2070.code are also defined:

```
#define GS2070_Status          0x1C
#define SS2070_SSig            0x1A
#define SS2070_IFC             0x22
#define SS2070_OFC             0x23
#define SS2070_Timer_Sig       0x1000
#define SS2070_Timer_Cyc       0x1001
#define SS2070_Timer_Start     0x1002
#define SS2070_Timer_Stop      0x1003
#define SS2070_Timer_Reset     0x1004
```

Note: When PB2070.param2.pointer is used, PB2070.param1 to be loaded with the size of what PB2070.param2.pointer is referencing. When calling _os_getstat() or _os_setstat(), all reserved or unused parameters and fields in PB2070 to be loaded with 0 (zero).

(2) Drivers must be provided to access the FLASH, SRAM, and DRAM memories. The following descriptors must apply:

/f0	FLASH drive	non-volatile, writeable
/dd	FLASH drive	OS-9 default device for /f0
/f0wp	FLASH Drive	as /f0 but, write protection
/f0fmt	FLASH Drive	as /f0 except format enabled
/r0	SRAM Drive	non-volatile ramdisk
/r0fmt	SRAM Drive	as /r0 but format enabled
/r2	DRAM Drive	volatile 1 MB ramdisk, not automatically initialized

(3) A driver to handle each of the four internal timers under the OS-9 Kernel must be provided. Provide access to the MC68360 internal timers through the following device descriptors:

(a) Descriptor names for each timer:

timer1 = access to MC68360's internal timer #1
timer2 = access to MC68360's internal timer #2
timer3 = access to MC68360's internal timer #3
timer4 = access to MC68360's internal timer #4
timer12 = access to MC68360's internal timer #1 & #2 (cascaded)
timer34 = access to MC68360's internal timer #3 & #4 (cascaded)

(b) Timer Standard OS-9 Function Calls:

error_code _os_open (char *timer_desc_name, path_id *path);

error_code _os_read (path_id path, void *timer_value, u_int32 *size);
Note: Prior to calling _os_read(), size must be loaded with the value 4 and timer value must be pointed to a u_int32. _os_read() must read the current timer value and load it into timer_value as μS x 100.

error_code _os_close (path_id path);

(c) Timer Extension to Standard OS-9 Function Calls:

error_code _os_setstat(path_id path, SS_2070, PB2070 *pb);

The timer drivers must support the following modes using the SS_2070 _os_setstat() option code and a custom parameter block structure:

- Send signal after specified time interval. Sets timer to zero and schedules individual one-shot signal.

  pb→code = SS2070_Timer_Sig (0x1000); /* request for one-shot signal */

  pb.param1 = signal; /* signal code to send (0 = do not send a signal and cancel any pending signals) */"

  pb→param2.param = period; /* timer period in microseconds x 100 */
- Send recurring periodic signal. Sets timer to zero and schedules repeating periodic signal.

  pb→code = SS2070_Timer_Cyc (0x1001); /* request for periodic signal */

  pb.param1 = signal; /* signal code to send (0 = do not send a signal and cancel any pending signals) */"

  pb→param2.param = period; /* timer period in microseconds x 100 */
- Start timer. Start the timer if stopped. Timer will free run in a periodic mode, starting at the current timer value as its initial value and timer's maximum allowable time as its timer period (6.5535 seconds for timers 1-4 and 429496.7295 seconds for timers 12 and 34). Timer will not send a signal and any pending signals will be cancelled. Timer mode will be SS2070_Timer_Start. pb.code = SS2070_Timer_Start (0x1002); /* start timer if stopped */"
- Stop timer. Leaves current value in timer. Cancels any pending signals.

  pb→code = SS2070_Timer_Stop (0x1003); /* stop timer if running */
- Reset timer. Stops timer if running, resets timer value to zero, and cancels any pending signals.

  pb→code = SS2070_Timer_Reset (0x1004);/* reset timer (stop and zero) */

(d) Timer Extension to Standard OS-9 Function Calls:

error_code _os_getstat(path_id path, SS_2070, PB2070 *pb);

The timer driver will support the following function using the SS_2070 _os_getstat() option code and custom parameter block structure:

- Retrieve current timer configuration.

```
typedef struct
{
    u_int32 value;
    u_int32 mode;
    u_int32 signal;
    u_int32 period;
} Timer_status;

pb→code = GS2070_Status  (0x1C)      /* Request timer status data */
pb→param1 = sizeof(Timer_status)
pb→param2.pointer = Timer_status*
```

Status data must be returned in the structure pointed to by pb→param2.pointer as follows:

```
pb→param2.pointer→value      /* current timer value in μS x 100 */

pb→param2.pointer→mode       /* SS2070_Timer_Sig if one-shot signal pending,
                                SS2070_Timer_Cyc if periodic signal pending,
                                SS2070_Timer_Start if free running,
                                SS2070_Timer_Stop if not active */

pb→param2.pointer→signal     /* signal code pending if
                                SS2070_Timer_Sig or
                                SS2070_Timer_Cyc, 0 otherwise */

pb→param2.pointer→period     /* timer period in microseconds x 100 if
                                SS2070_Timer_Sig or
                                SS2070_Timer_Cyc, 0 otherwise */
```

(e) All timer periods are specified in units of hundreds of microseconds, i.e. a timer period of 7 = 700 microseconds. The minimum allowed timer period must be 500 microseconds. The maximum timer period for timers 1-4 must be 6.5535 seconds (0xFFFF). The maximum timer period for timer12 and timer34 must be 429496.7295 seconds (0xFFFFFFFF). The driver must return error E$Param from _os_setstat() if the requested timer period is outside the allowable range.

(4) Access and control to the CPU Datakey must be provided through the following descriptor name and OS-9 functions:

Descriptor Name

datakey = access to the CPU Datakey

Function Calls

error_code _os_open (char *datakey_desc_name, path_id *path);

error_code _os_close (path_id path);

error_code _os_read (path_id path, void *data_buffer, u_int32 *data_size);

error_code _os_write (path_id path, void *control, u_int32 *data_size);

error_code _os_seek(path_id path,u_int32 position); sets read / write offset

error_code = _os_ss_erase(path_id path, u_int32 num_sec_erase); /*erases sector(s) if pointer is on a block boundary, returns E$PARAM error if not on a boundary */"

error_code = _os_gs_pos(path_id path,u_int32 *position); /* gets current file pointer position */

error_code = _os_gs_size(path_id path, u_int32 *size); /* gets current datakey size */"

Error Codes Returned by Function Calls

E$NotRdy if datakey is not inserted
E$Seek if Offset plus *data_size is beyond end of CPU Datakey.
E$EOF if upon read or write, the last byte of CPU Datakey has previously been processed."

Note: Use of SCF to implement the Datakey driver is not allowed.

(5) The asynchronous serial communications device drivers must support the six flow control modes (FCM#) described below:

FCM# Description

(0) No Flow Control Mode: The driver transmits data regardless of the state of CTS. Upon a write command, the driver asserts RTS, and de-asserts RTS when data transmission is completed. This is the default mode. When user programs issue the first RTS related command, the driver switches to Manual Flow Control Mode (FCM# 1).

(1) Manual Flow Control Mode: The driver transmits data regardless of the state of CTS. The user program has absolute control of the RTS state. The driver doesn‘t automatically assert or de-assert RTS.

(2) Auto-CTS Flow Control Mode: The driver transmits data only when CTS is externally asserted. The user program has absolute control of the RTS state. The driver doesn‘t automatically assert or de-assert RTS.

(3) Auto-RTS Flow Control Mode: The driver transmits data regardless of the state of CTS. Upon a write command, the driver asserts RTS, and de-asserts RTS when data transmission is completed and any configured RTS extension is elapsed. If the user program asserts RTS, then RTS remains on until the user program de-asserts RTS. If the user program de-asserts RTS before the transmission buffer is empty, the driver holds RTS on until the transmission buffer is empty and any configured RTS extension is elapsed.

(4) Fully Automatic Flow Control Mode: The driver transmits data only when CTS is externally asserted. Upon a write command, the driver asserts RTS and waits for CTS, starts data transmission when CTS is asserted, and de-asserts RTS when data transmission is completed and any configured RTS extension is elapsed. If user program asserts RTS, then RTS remains on until the user program de-asserts RTS. If the user program de-asserts RTS before the transmission buffer is empty, the driver holds RTS on until the transmission buffer is empty and any configured RTS extension is elapsed.

(5) Dynamic Flow Control Mode: The driver transmits data only when CTS is externally asserted. The driver controls RTS based on the status of its receiving buffer. The driver asserts RTS continuously as long as its receiving buffer has sufficient capacity to store incoming data. If the receiving buffer approaches full, the driver de-asserts RTS until enough data has been read from the buffer to create sufficient receive capacity.

(a) The serial device driver must be able to set user options via _os_setstat() and return status via _os_getstat(). To support legacy application programs, the device driver must also be able to set user options via _os_ss_size() and to return status via _os_gs_size():

error_code_os_setstat(path_id path, SS_2070, void *pb);

error_code_os_getstat(path_id path, SS_2070, void *pb);

error_code_os_ss_size(path_id path, u_int32 size);

error_code_os_gs_size(path_id path, u_int32 *size);

Note: The preferred method of accessing serial device drivers is through _os_setstat() and _os_getstat(). The _os_ss_size() and _os_gs_size() interface may not be required by future versions of this specification and is therefore not recommended for new development.

The option subcodes to be passed in pb→code and the data to be contained in pb→param1 are defined as follows. pb→param2 is unused here and should be set to 0 (zero). For _os_ss_size() and _os_gs_size(), the size argument is the same format as pb→param1.

(b) The supported _os_setstat() / _os_ss_size() options must be as follows.

- Subcode passed in pb→code is SS2070_OFC (0x23).
  Data passed in pb→param1 is defined as follows:

Bits	Description
31-24	Auto RTS turn-off extension in number of characters (range:0-255, 0=default).
23-14	Reserved for future use.
13	Inhibit return of error E$Write from _os_write() when transmit buffer full in FCM# 2, 4, 5 (default=0, 0=error, 1=block)
12	Inhibit variable SCC MRBLR (default =0; 0=NO; 1=inhibit).
11	Inhibit SCC TODR (default=0; 0=NO; 1=inhibit).
10-8	Flow Control Mode Number (FCM#) (range:0-5).
7-0	Subcode SS2070_OFC (0x23).

Variable MRBLR (68360 SCC)

To reduce the IRQ handler overhead, the 68360 SCC driver must use variable MRBLR as follows. If SS2070_OFC bit 12 is set to 1, the MRBLR must be fixed at 16 for all baud rates. Variable MRBLR is not required for SP1 or SP8 on the 2070-1B CPU Module.

Baud Rate	MRBLR Setting
1200	1
2400	2

4800	4
9600	8
19200 & Higher	16

TODR (68360 SCC only)

TODR requests processing a new TX buffer immediately. To reduce impact on other serial channel operations, SS2070_OFC bit 11 may be set to 1 to prevent assertion of TODR. TODR is not required for SP1 or SP8 on the 2070-1B CPU Module.

- Subcode passed in pb→code is SS2070_IFC (0x22).
  Data passed in pb→param1 is defined as follows:

Bits	Description
31-11	Reserved for Future Use.
10	DCD must be asserted to receive data (default=0; 0=NO; 1=YES).
9-8	Reserved for Future Use.
7-0	Subcode = SS2070_IFC (0x22).

- Subcode passed in pb→code is SS2070_SSig (0x1A).
  1. If CTS is currently negated and bits 16 – 31 are not all 0:
     Setting the SS2070_SSig parameter block bit 11 (send when CTS is asserted) will cause the controller to send a one-shot signal as soon as CTS is asserted.
     Setting the SS2070_SSig parameter block bit 12 (send when CTS is negated) will cause the controller to send a one-shot signal immediately.
  2. If CTS is currently asserted and bits 16 – 31 are not all 0:
     Setting the SS2070_SSig parameter block bit 11 (send when CTS is asserted) will cause the controller to send a one-shot signal immediately.
     Setting the SS2070_SSig parameter block bit 12 (send when CTS is negated) will cause the controller to send a signal one-shot as soon as CTS is negated.
  3. If both bits 11 and 12 of the SS2070_SSig parameter block are set, and bits 16 – 31 are not all 0:
     The controller will send a one-shot signal upon the next change of CTS state.

  Data passed in pb→param1 is defined as follows:

Bits	*Description*
31-16	A signal number to be sent to calling process when the state of an input changes.
15-13	Reserved for Future Use.
12	Send signal when CTS is de-asserted.
11	Send signal when CTS is asserted.
10-8	Reserved for Future Use.
7-0	Subcode = SS2070_SSig (0x1A).

(c) The supported _os_getstat()_ / _os_gs_size() options must be as follows.

- Subcode passed in pb→code is GS2070_Status (0x1C). Data returned in pb→param1 is defined as follows:

Bits	Description
31-16	Current unfilled transmit buffer character count of the serial device driver.
15-11	Reserved for Future Use.
10-8	Current Flow Control Mode Number (FCM#).
7	Reserved for Future Use.
6	Overrun error –0=no error; 1=error has occur since last GS2070_Status call.
5	Frame error –0=no error; 1=error has occur since last GS2070_Status call.
4	Parity error –0=no error; 1=error has occur since last GS2070_Status call.
3-2	Reserved for Future Use.
1	DCD state –0=de-asserted; 1=asserted.
0	CTS state –0=de-asserted; 1=asserted.

(6) Device drivers compliant with the OS-9 SCFMAN must be provided for CPU Activity LED Indicator and Day Light Savings time correction features. The descriptor names must be as follows:

led = access to CPU Activity LED Indicator

dstclock = access to Daylight Savings Time Clock correction
The standard OS-9 SCFMAN library calls and their functions are as follows:

error_code _os_open (char *desc_name, path_id *path); //open descriptor for command

error_code _os_close (path_id path); //close descriptor

error_code _os_write (path_id path, void *value, u_int32 *data_size); //set value of function

*value = 1, turn on LED or enable DST correction (default)
*value = 0, turn off LED or disable DST correction
set u_int32*data_size to 1

error_code _os_read (path_id path, void *value, u_int32 *data_size); //get current state

set u_int32*data_size to 1

(7) The Manufacturer must provide the following features to support the TOD operation and synchronization.

(a) Leap Year and Daylight Savings Time (DST) Adjustments - The OS-9 System clock / calendar must automatically be adjusted to account for DST and leap years.

(b) Setting Hardware Clock from OS-9 System Clock – Provide a device driver compatible with the OS-9 SCFMAN to allow the hardware TOD clock/calendar to be updated from the OS-9 system clock under application control. The descriptor name must be "ClockUpdate." Opening the descriptor will cause the driver to synchronize the clock to a minimum of 10 milliseconds resolution. The driver must compensate for any time elapsed during the process of updating the hardware clock.

(c) Setting OS-9 System Clock from Hardware Clock - At system power up, the OS-9 system TOD clock/calendar must automatically be updated from the hardware TOD clock. The clocks must be synchronized to a minimum of 10 milliseconds resolution.

(8) The FLASH drive must be protected from corruption. It must be protected using the Write Protect (WP) bit of the Base Register. This bit must be set except when explicitly writing to flash. When writing to the FLASH drive the current sector of FLASH being written must first be backed up in SRAM. The backup sector copy must be invalidated when FLASH write operation is completed.

In case of power failure, the FLASH driver must detect the presence of the valid backup sector copy in SRAM and read sector data from the valid backup sector copy. A user write operation must restore the valid backup sector copy first. Execution of the program module, "FLRESTORE," in the Boot Image must also restore the valid backup sector copy to FLASH drive after a specified delay. "FLRESTORE" must accept a delay parameter in seconds ranging from 0 to 600 seconds. The default delay factor is 30 seconds. No more that 150 KB of SRAM to be dedicated to this purpose.

Warning: Power loss or other interruption while writing to the FLASH drive may cause FLASH drive file and/or disk corruption. It is therefore strongly recommended that the FLASH drive be used to hold controller applications only.

(9) MODEL 2070-1A and 2070-1B CPU modules shall include the following set of standard OS-9 networking modules in the operating system boot image, sufficient to support network configuration, startup, and ftp and telnet servers:

spip, ip0, sptcp, tcp0 spudp, udp0, spraw, raw0, spenet, enet, netdb (dns version), ipstart, ifconfig, route, ndbmod, ftpd, ftpdc, telnetd, telnetdc, pkman, pkdrvr, pk, pks, ping, dhcp.

The boot image shall include a default inetdb module with a module revision of zero. It shall contain the following entries only.

Hosts

```
localhost    127.0.0.1    me
```

Protocols

```
ip              0   IP
icmp            1   ICMP
igmp            2   IGMP
tcp             6   TCP
udp             17   UDP
```

Services

```
ndp             13312/tcp       ndpd
npp             13568/tcp       nppd
echo            7/tcp
echo            7/udp
ftp-data        20/tcp
ftp-data        20/udp
ftp             21/tcp
ftp             21/udp
telnet          23/tcp
telnet          23/udp
nameserver      42/tcp
nameserver      42/udp
tftp            69/tcp
```

tftp 69/udp

The boot image shall include a default inetdb2 module with a module revision of zero. It shall contain the following entry only:

Interfaces

enet0 binding /spqe0/enet (no address, netmask, or broadcast)

On the MODEL 2070-1B CPU module, an OS-9 SPF Ethernet hardware driver and descriptor for the 68360 (SCC1) must be provided in the operating system Boot Image. The descriptor must be named spqe0.

The following OS-9 modules to be included in the /f0/CMDS/BOOTOBJS flash disk directory to allow for standard TCP/IP network communications using Ethernet Protocol over Ethernet hardware and/or Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol over serial links:

(a) Drivers and Descriptors for PPP.

(b) Drivers and Descriptors for SLIP.

(c) LAN Comm Pak modules: spenet, enet, spip, ip0, sptcp, tcp0, spudp, udp0, spraw, raw0, sproute, route0, spipcp, ipcp0, splcp, lcp0, sphdlc, hdlc0, spslip, sps10

(d) Network modules: pkman, pkdvr, pk, pks

(e) Network Trap Handler: netdb_local, netdb_dns

(f) NFS Modules: nfs, nfsnul and nfs_devices.

The following Network utilities must be included and must reside in the /f0/CMDS directory as identified in this specification:

arp, dhcp,ftp, ftpd, ftpdc, idbdump, idbgen, rpcdbgen, ifconfig, inetd, ipstart, ndbmod, netstat, ping, route, routed, telnet, telnetdc, hostname, nfsc, mount, rpcdump, nfsstat, exportfs, portmap, pppd, chat, pppauth, nfsd, mountd, and showmount.

Multi-user functionality:

The boot image init module must be configured with a ―default directory name" as /f0wp. This will allow login and tsmon to provide the user with login prompt from the terminal port or from the network via a telnet session.

The following OS-9 modules to be included in the operating system boot image for the implementation of multi-user mode.

login, tsmon

Network Configuration at boot up:
The modules inetdb, inetdb2 and rpcdb must be generated by the make utility via the use of a makefile and the network configuration files residing the /f0/ETC directory. The generated inetdb, inetdb2 and rpcdb modules to be re-located to the /f0/CMDS/BOOTOBJS directory where they will be pick-up by the network configuration shell scripts located at /f0/SYS. Configure the modules with the network default values as defined in Section 10.B.6. (Data Key) via the interfaces.conf shell script.
Provide a Utility Program named netcfg that reads the CPU Datakey for an IP Address, Subnet Mask and Default Gateway. If the Datakey is present and valid, netcfg will set the IP Address, Subnet Mask and Default Gateway of the Model 2070 Controller when executed by a user at the command line. The netcfg utility will create a new inetdb, inetdb2 and rpcdb database module based on the Datakey network parameters. The new inetdb, inetdb2 and rpcdb modules should be re-located to the /f0/CMDS/BOOTOBJS directory where they will be pick-up by the network configuration shell scripts located at /f0/SYS. The netcfg must also allow the user to read, write and display network parameters to and from the Datakey via the command line prompt.
If the Datakey is not present or invalid, netcfg must display an error and exit without altering the network configuration. The netcfg utility must reside in /f0/CMDS.

Standard Microware File System Configuration:
A user name "super" with password as "user" must be defined in the password file.

The PPP and SLIP descriptors must have baud rates and ports set as follows and be stored in the /f0/CMDS/BOOTOBJS directory,

hdlc0 and spsl0 configured to use /sp1 and 38400 bps
hdlc1 and spsl1 configured to use /sp2 and 115200 bps
hdlc2 and spsl2 configured to use /sp3 and 115200 bps
hdlc3 and spsl3 configured to use /sp4 and 38400 bps

Provide a set of example configuration files consistent with the above networking modules in the /f0/ETC directory. This directory must contain the following text files.

hosts, hosts.equiv, networks, protocols, services, inetd.conf, resolv.conf, hosts.conf, rpc, interfaces.conf, routes.conf.

(10) Standard Microware File System Configuration.

(a) The 2070 must follow Standard Microware File System Configuration. A /f0/CMDS, /f0/CMDS/BOOTOBJS, /f0/ETC and /f0/SYS directories implemented. Execute permission must be included in the attributes of files in the /f0/CMDS directory. Sysgo will set its execution directory to /f0wp/CMDS prior to spawning opexec or other processes. The /f0/CMDS/BOOTOBJS must contain the modules as identified above and other customizable descriptors and modules.

The /f0/SYS must also contain the following four standard OS-9 network configuration shell script files: startspf, startnfs, loadspf and loadnfs.

(b) The /f0/SYS must contain a "password" file. The password file will follow Microware's password file format for the addition and configuration of multiuser functionality and password protection. A user name —super" with password as —user" must be defined in the password file.

(c) The utilities tar, make, vi, fixmod and mshell must be included in the /f0/CMDS directory.

c. Application Kernel.

(1) The provided software must boot OS-9 from SYSRESET. The entire program must be resident in FLASH Memory. Configure the serial port descriptors with the following defaults:

SP1 & 2	1.2 Kbps, 8-bit word, 1 stop, no parity, no pause, no echo
SP 3S	614.4 Kbps
SP4	9.6 Kbps, 8-bit word, 1 stop, no parity, no pause, x on and x off BOTH OFF
SP 5S	614.4 Kbps
SP 6	38.4 Kbps, 8-bit word, 1 stop and no parity

(2) Hardware initialization, preliminary self-test, OS-9 initialization (except Extended Memory Test), and forking OPEXEC must be completed in less than 4 seconds. This startup time will be measured from the release of SYSRESET to the turn on of the CPU LED using a user level program named ONLED. The ONLED program must be the last module loaded into RAM and executed using opexec or a startup file.

(3) Initialization. Configure the boot image init module with the default directory name as /f0wp and sysgo as the first executable module.

Sysgo must operate as follows:

(a) Sysgo must set the execution directory to /f0wp/CMDS

(b) Sysgo must check if the backspace key (0x08) is being received on /sp4 (c50s). If received, Sysgo must:

- Fork a shell on /sp4 using the current directory.
- Remain an active process and monitor the shell for termination. If the shell does terminate, Sysgo must fork another shell on /sp4. Unless Sysgo dies, a shell will always be provided on /sp4.

(c) If the backspace key was not received, Sysgo must check for the presence of a Datakey. If present and valid, Sysgo will check the Startup Override byte in the Datakey header.

If Startup Override is 0x01, Sysgo must:

- Fork a shell that executes a shell script stored on the Datakey in the following format. Immediately following the key header must be a 2-byte value indicating the length of the script. The script must immediately follow the length value, and be stored as ASCII text.
- If there is any error reading or starting the script or if the shell terminates with an error, Sysgo must display an error message on /sp4 and fork another shell as described in step b. If there are no errors executing the script, Sysgo must exit without forking another shell.

If Startup Override is 0x02, Sysgo must:

- Fork an executable module stored on the Datakey immediately following the header.
- If there is any error loading or forking the module, Sysgo must display an error message on /sp4 and fork a shell as described in step b. If there are no errors forking the module, Sysgo must then exit without forking a shell.

(d) If the backspace key was not received and Startup Override was not performed:

- Sysgo must fork the module named /f0wp/OPEXEC if present at /f0wp.
- If there is any error loading or forking OPEXEC, Sysgo must display an error message on /sp4 and fork a shell as described in step b. If there are no errors forking OPEXEC, Sysgo must then exit without forking a shell.

(e) If the backspace key was not received, Startup Override was not performed, and there is no OPEXEC file:

- Sysgo must fork a shell that executes a shell script named /f0wp/startup if present at /f0wp.
- If there is any error reading or starting the script or if the shell terminates with an error, Sysgo must display an error message on /sp4 and fork another shell as described in step b. If there are no errors executing the script, Sysgo must exit without forking another shell.

(f) If the backspace key was not received, Startup Override was not performed, and there is no OPEXEC and no startup file:

- Sysgo must fork a shell as described in step b.

(4) A Short Out is defined as the period of time between ACFAIL/POWER DOWN transition to LOW and back to HIGH without a SYSRESET transition to LOW. ACFAIL/POWER DOWN transitions must generate an interrupt. The interrupt updates an OS-9 event named "ACFAIL". The "ACFAIL" event sets a value 1 indicating an ACFAIL condition occurred for the DOWN transition and set 0 indicating non-ACFAIL condition for the HIGH transition. The IRQ7 and auto-vector 31(7) must not be used to update the "ACFAIL" event.

In addition, the ACFAIL condition must generate the OS-9 auto-vector 30(6) interrupt service. Each interrupt service installed must exit with the "Carry Bit" set allow OS9 to propagate the ACFAIL interrupt. The Manufacturer must supply an interrupt handler at priority 255 that acknowledges and clears the interrupt.

Reserve Priority 1 for the OS-9 system.

(5) A Long Out is defined as ACFAIL transition to LOW follow by a SYSRESET going LOW. The SYSRESET going HIGH must be followed by an operating system reboot.

d. Error Handler.

(1) A Manufacturer may include an error handling routine to save troubleshooting data regarding initialization, power-up test abnormalities and other error conditions. If used, the error report must be stored in the file /r0/ErrorReport and not exceed 11 kilobytes in size.

e. Diagnostic Acceptance Test (DAT).

(1) A DAT Program must be provided resident in the 2070 Unit as the application program.

f. Re-Flash Utility. Provide a Utility Program that would allow the user to upgrade (re-flash) the Boot Image. This utility must provide the capabilities for upgrading the Operating System and drivers when available by the manufacturer. The Utility Program must provide the capability for the user to dynamically upgrade the Boot Image via the command prompt. The Manufacturer must also provide a copy in CD Memory of all files originally stored in the flash drive /f0 so that they can be reloaded as needed.

g. Deliverables.

(1) The following items will be provided to the purchasing DEPARTMENT on a CD disk readable by a PC compatible computer.

(a) Specific hardware memory addresses, including FLASH, SRAM, and DRAM starting addresses, must be specified and provided. Written documentation of addresses must be in PDF form and will have the file name of "Memory Map.pdf"

(b) Copy of all provided written manuals in PDF form.

(c) Copies of the vendor kernel, platform drivers and OS-9 utility executable modules

(d) RE-FLASH Utility and the procedures for its use in PDF form. The PDF documentation of the procedures must have the file name of "Reflash Utility Procedures.pdf".

(2) Fully commented source code of Contractor developed drivers and utilities must be provided.

(3) OS-9 compliant header files must be provided with all driver modules.

C. Type 2070-2 Field I/O Module (FI/O).

1. Type 2070-2A Module. The TYPE 2070-2A MODULE consists of the Field Controller Unit; Parallel Input/Output Ports; other Module Circuit Functions (includes muzzle switch); Serial Communication Circuitry; Module Connectors C1S, C11S, and C12S mounted on the module front plate; VDC Power Supply (+12VDC to +5VDC); and required resident software.

2. Type 2070-2B Module. The TYPE 2070-2B MODULE consists of the Serial Communication Circuitry, VDC Power Supply, and Module Connector C12S mounted on the module front plate only.

3. Field Controller Unit (FCU). The FCU includes a programmable microprocessor/controller unit together with all required clocking and support circuitry. Provide operational software necessary to meet housekeeping and functional requirements resident in socketed firmware.

4. Parallel I/O Ports.

a. The I/O Ports must provide 64 bits of input using ground-true logic. Each input must be read logic "1" when the input voltage at its field connector input is less than 3.5 VDC, and be read logic "0" when either the input current is less than 100 microamperes or the input voltage exceeds 8.5 VDC. Each input must have an internal pull-up to the Isolated +12 VDC and not deliver greater than 20 milliamperes to a short circuit to ground.

b. The I/O Ports must provide 64 bits of output.

(1) Inputs must have the following characteristics:

(a) A voltage between 0 and 4 volts will be considered the Low (True/Operate) state.

(b) A voltage greater than 8 volts will be considered the High (False) state.

(c) The transition from the **Low** state to **High** state (and vice versa) occurs between 4 and 8 volts.

(2) Outputs must have the following characteristics:

(a) The Low (True/Operate) voltage will be between 0 and 3 volts.

(b) Current sinking capability in the Low state will be at least 100 milliamperes.

(c) With an external impedance of 100 kiloOhms or greater, the transition from 4 to 16 volts (and vice versa) and be accomplished within 0.1 millisecond.

(d) The High state impedance must exceed 1 Megohms to 12 volts DC.

c. Each output must latch the data written and remain stable until either new data is written or the active-low reset signal. Upon an active-low reset signal, each output must latch a logic "0" and retain that state until a new writing. The state of all output circuits at the time of Power Up or in Power Down state must be open (logic 0). It must be possible to simultaneously assert all outputs within 100 microseconds of each other. An output circuit state not changed during a new writing will not glitch when other output circuits are updated.

5. Other Module Circuit Functions.

a. A maximum capacitive load of 100 picofarads must be presented to the LINESYNC input signal. The EIA-485 compliant differential LINESYNC signals must be derived from the LINESYNC signal.

b. Provide an External WDT "Muzzle" Jumper on the board. With the jumper in and NRESET transitions HIGH (FCU active), the FCU must output a state change on Output Port 5, bit 8 (Connector C1, pin 103 – Monitor Watchdog Timer Input) every 100 milliseconds for 10 seconds or due to CPU Command. When the jumper is missing (open), the feature will not apply. This feature is required to operate with the Type 210 Monitor Unit only.

c. Provide a WATCHDOG Circuit. The FIELD I/O software at Power Up with a value of 100 milliseconds must enable it. Its enabled state must be machine readable and reported in the FI/O status byte. Once enabled, the watchdog timer must not be disabled without resetting the FI/O. Failure of the FI/O to reset the watchdog timer within the prescribed timeout will result in a hardware reset.

d. One KHz Reference. Provide a synchronizable 1 kilohertz time reference. It must maintain a frequency accuracy of +/-0.01% (+/-0.1 counts per second).

e. Provide a 32-bit MILLISECOND COUNTER (MC) for "timestamping." Each 1 KHz reference interrupt must increment the MC.

f. Provide a LOGIC Switch resident on the module board. The switch must function to disconnect Serial Port 3 (SP3) from the external world, Connector C12S. Its purpose is to prevent multiple use of SP3. Provide an LED on the module front panel labeled "SP3 ON". If LED light ON, SP3 is active and available at C12S.

6. Serial Communications/Logic Circuitry.

a. System Serial Port 5 (SP5) EIA-485 signal lines must enter the I/O Module and be split into two multi-drop isolated ports. Route one to the FCU and the other converted to EIA-485, then routed to Connector C12S.

b. System Serial Port 3 (SP3) EIA-485 signal lines must enter the I/O module and be isolated, converted back to EIA-485 and then routed to connector C12S.

c. LINE SYNC and POWER DOWN lines must be split and isolated, one routed to the FCU for shut down functions and the other changed to EIA-485; then routed to connector C12S for external module use.

d. CPU RESET and POWER UP (SYSRESET) lines must be isolated and "OR'd" to form NRESET. NRESET must be used to reset FCU and other module devices. NRESET must also be converted to EIA-485 then routed to connector C12S.

e. If the Type 2070 module is a –2B, routing to FCU does not apply.

f. Isolation is between internal +5 VDC / Ground #1 and +12 VDC ISO / VDC Ground #2. +12 VDC ISO is for board power and external logic.

7. Buffers. Provide a Transition Buffer capable of holding a minimum of 1024 recorded entries. The Transition Buffer must default to empty. There must be two entry types: Transition and Rollover. The inputs must be monitored for state transition. At each transition (If the input has been configured to report transition), a transition entry must be added to the Transition Buffer. The MC must be monitored for rollover. At each rollover transition ($xxxx FFFF - $xxxx 0000), a rollover entry must be added to the Transition Buffer. For rollover entries, all bits of byte 1 are set to indicate that this is a rollover entry. Transition Buffer blocks are sent to the CPU module upon command. Upon confirmation of their reception, the blocks must be removed from the Transition Buffer. The entry types are depicted as follows:

Input Transition Entry

Description	msb							lsb	Byte Number
Transition Entry Identifier	S	Input Number							1
MC Timestamp NLSB	x	x	x	x	x	x	x	x	2
MC Timestamp LSB	x	x	x	x	x	x	x	x	3

Millisecond Counter Rollover Entry

Description	msb							lsb	Byte Number
Rollover Entry Identifier	1	1	1	1	1	1	1	1	1
MC Timestamp MSB	x	x	x	x	x	x	x	x	2
MC Timestamp NMSB	x	x	x	x	x	x	x	x	3

8. I/O Functions. Each parallel Input/Output function contains all of the functions listed below of both the Input Function and Output Function.

a. Inputs. Input scanning must begin at I0 (bit 0) and proceed to the highest numbered input, ascending from LSB to MSB.

Each complete input scan must finish within 100 microseconds. Once sampled, the logic state of an input must be held until the next input scan. Each input must be sampled 1,000 times per second. The time interval between samples must be 1 millisecond (+/-100 microseconds). If configured to report, each input that has transitioned since its last sampling must be identified by input number, transition state, and timestamp (at the time the input scan began) and be added as an entry to the Transition Buffer. If multiple inputs change state during one input sample, these transitions must be entered into the Input Transition Buffer by increasing input number. The Millisecond Counter must be sampled within 10 microseconds of the completion of the input scan.

b. Data Filtering. If configured, the inputs must be filtered by the FCU to remove signal bounce. The filtered input signals must then be monitored for changes as noted. The filtering parameters for each input must consist of Ignore Input Flag and the ON and OFF filter samples. If the Ignore Input flag is set, no input transitions will be recorded. The ON and OFF filter samples must determine the number of consecutive samples an input must be ON and OFF, respectively, before a change of state is recognized. If the change of state is shorter than the specified value, the change of state must be ignored. The ON and OFF filter values must be in the range of 0 to 255. A filter value of 0, for either or both values, must result in no filtering for this input. The default values for input signals after reset must be as follows:

Input Signals	Default Value
Filtering	Enabled
On and off filter values must be set to	5
Transition monitoring	Disabled (Timestamps are not logged)

c. Outputs. Simultaneous assertion of all outputs must occur within 100 microseconds. Each output must be capable of being individually configured in state to ON, OFF, or a state synchronized with either phase of LINESYNC. The condition of the outputs must only be "ON" if the FI/O continues to receive active communications from the CPU Module. If there is no valid communications with the CPU Module for 2.0 seconds, all outputs must revert to the OFF condition, and the FI/O status byte must be updated to reflect the loss of communication from the CPU Module. The data and control bits in the CPU Module-FI/O frame protocol must control each output as follows:

Output Bit Translation

Case	Output Data Bit	Output Control Bit	Function
A	0	0	Output in the OFF state
B	1	1	Output is a square wave, synchronized to the LINESYNC signal. When LINESYNC is ON (1), the output is OFF, and when LINESYNC is OFF (0), the output is ON.

Case	Output Data Bit	Output Control Bit	Function
C	0	1	Output is a square wave, synchronized to the LINESYNC signal. When LINESYNC is ON (1), the output is ON, and when LINESYNC is OFF (0), the output is OFF
D	1	0	Output is in the ON state.

In Case A above, the corresponding output must be turned OFF if previously ON and if previously OFF remain OFF until otherwise configured. For half-cycle switching (cases B and C), all outputs to be changed must be changed within 50 microseconds after the corresponding LINESYNC transition and must remain in the same state during the entire half cycle. In Case D above, the corresponding output must be turned ON if previously OFF and if previously ON remain ON until otherwise configured. All outputs never change state unless configured to do so.

d. Interrupts. All interrupts must be capable of asynchronous operation with respect to all processing and all other interrupts. MILLISECOND Interrupt must be activated by the 1 kilohertz reference once per milliseconds. An MC timestamp rollover flag set by MC rollover must be cleared only on command. LINESYNC Interrupt - This interrupt must be generated by both the 0-1 and 1-0 transitions of the LINESYNC signal. The LINESYNC interrupt must monitor the MC interrupt and set the MC error flag if there has not been an interrupt from the 1 kilohertz source for 0.5 seconds (>/=60 consecutive LINESYNC interrupts). The LINESYNC interrupt must synchronize the 1 kilohertz time reference with the 0-1 transition of the LINESYNC signal once a second. A LINESYNC error flag must be set if the LINESYNC interrupt has not successfully executed for 0.5 seconds or longer (>/=500 consecutive millisecond interrupts).

e. Communication Service Routine. A low-level communication service routine must be provided to handle reception, transmission, and EIA-485 communication faults. The communication server must automatically:

<u>For Transmission</u>

Generate the opening and closing flags
Generate the CRC value
Generate the abort sequence (minimum of 8 consecutive '1' bits) when commanded by the FCU
Provide zero bit insertion

<u>For Receiving</u>

Detect the opening and closing flags
Provide address comparison, generating an interrupt for messages addressed to the I/O Module, and ignoring messages not addressed to the I/O Module
Strip out inserted zeros

Calculate the CRC value, compare it to the received value, and generate an interrupt on an error
Generate an interrupt if an abort sequence is received

f. Communication Processing. The task must be to process the command messages received from the CPU Module, prepare, and start response transmission. The response message transmission must begin within 4 milliseconds of the receipt of the received message. The time from the receipt of message to the completion of the commanded task must not exceed 70 milliseconds.

g. Input Processing. This task must process the raw input data scanned in by the 1 ms interrupt routine, perform all filtering, and maintain the transition queue entries.

9. Data Communications Protocols.

a. Protocols - All communication with the CPU Module must be SDLC-compatible command-response protocol, support 0 bit stuffing, and operate at a data rate of 614.4 kilobits per second. The CPU Module must always initiate the communication and should the command frame be incomplete or in error, no FI/O response will be transmitted. The amount of bytes of a command or response is dependent upon the I/O Module identification.

(1) The frame type must be determined by the value of the first byte of the message. The command frames type values 112-127 and associated response frame type values 240-255 are allocated to the manufacturer diagnostics. All other frame types not called out are reserved. The command-response Frame Type values and message times must be as follows:

Frame Types

Module Command	I/0 Module Response	Description	Minimum Message Time	Maximum Message Time
0-43	128-171	Reserved for NEMA TS-2		
49	177	Request Module Status	250 microseconds	275 microseconds
50	178	MILLISECOND CTR. Mgmt.	222.5 microseconds	237.5 microseconds
51	179	Configure Inputs	344.5 microseconds	6.8750 milliseconds
52	180	Poll Raw Input Data	317.5 microseconds	320 microseconds
53	181	Poll Filtered Input Data	317.5 microseconds	320 microseconds
54	182	Poll Input Transition Buffer	300 microseconds	10.25 microseconds
55	183	Command Outputs	405 microseconds	410 microseconds
56	184	Reserved	340 microseconds	10.25 milliseconds
57	185	Reserved	340 microseconds	6.875 milliseconds
58	186	Configure Watchdog	222.5 microseconds	222.5 microseconds
59	187	Controller Identification	222.5 microseconds	222.5 microseconds
60	188	I/O Module Identification	222.5 microseconds	222.5 microseconds

Module Command	I/0 Module Response	Description	Minimum Message Time	Maximum Message Time
61-62	189-190	Reserved (note below)	---	---
63	191	Poll variable length raw input	317.5 microseconds	320 microseconds
64	192	Variable length command outputs	405 microseconds	410 microseconds
65	193	Reserved (note below)	---	---
67	195	Reserved (note below)	---	---

(2) Messages 61 / 189, 62 / 190, 65 / 193, and 67 / 195 are reserved for ITS Cabinet Frame Types. Message 63 / Message 191 must be the same as Message 52 / 180 except Byte 2 of Message 180 response must denote the following number of input data bytes. Message 64 / 192 must be the same as Message 55 / 183 except Byte 2 of the Message 55 Command must denote the number of output data bytes, plus the following output control bytes.

b. Request Module Status. The Command must be used to request FI/O status information response. Command/response frames are as follows:

Request Module Status Command

Description	msb							lsb	Byte Number
(Type Number = 49)	0	0	1	1	0	0	0	1	Byte 1
Reset Status Bits	P	E	K	R	T	M	L	W	Byte 2

Request Module Status Response

Description	msb							lsb	Byte Number
(Type Number = 177)	1	0	1	1	0	0	0	1	Byte 1
System Status	P	E	K	R	T	M	L	W	Byte 2
SCC Receive Error Count	Receive Error Count								Byte 3
SCC Transmit Error Count	Transmit Error Count								Byte 4
MC Timestamp MSB	MC Timestamp MSB								Byte 5
MC Timestamp NMSB	MC Timestamp NMSB								Byte 6
MC Timestamp NLSB	MC Timestamp NLSB								Byte 7
MC Timestamp LSB	MC Timestamp LSB								Byte 8

(1) The response status bits are defined as follows:

P Indicates FI/O hardware reset
E Indicates a communications loss of greater than 2 seconds
K Indicates the Datakey has failed or is not present
R Indicates that the EIA-485 receive error count byte has rolled over

T Indicates that the EIA-485 transmit error count byte has rolled over
M Indicates an error with the MC interrupt
L Indicates an error in the LINESYNC
W Indicates that the FI/O has been reset by the Watchdog

(2) The FI/O status byte must be updated (set to '1') to reflect the faults noted in clause 12. Data Communications Protocols – a.(1). Each status bit must only be reset (set to '0') when the corresponding bit of the Request Module Status Command is a '1'. The Request Module Status Response must report the current status (subsequent to reset and sampling).

(3) The FI/O must count the number of errored frames the FI/O Communications Processor reports. Separate counts must be maintained for transmit and received frames. When an individual count rolls over (255-0), the corresponding roll-over flag must be set.

(4) FI/O modules with Datakey: On NRESET transition to High or immediately prior to any interrogation of the Datakey, the FI/O must test the presence of the Key. If absent, Status Bit —K must be set to '1' and no interrogation take place. If an error occurs during the interrogation, Status Bit –K" must be set to '1'. FI/O modules without Datakey: Status Bit "K" must always be set to '1'

(5) The MC timestamp value must be sampled just prior to the Request Module Status Response.

c. MC Management. MC MANAGEMENT frame must be used to set the value of the MC. The 'S' bit must return status '0' on completion. The 32-bit value must be loaded into the MC at the next 0-1 transition of the LINESYNC signal. The frames are as follows:

Millisecond Counter Management Command

Description	msb							lsb	Byte Number
(Type Number = 50)	0	0	1	1	0	0	1	0	Byte 1
New MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 2
New MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 3
New MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 4
New MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 5

Millisecond Counter Management Response

Description	msb							lsb	Byte Number
(Type Number = 178)	1	0	1	1	0	0	1	0	Byte 1
Status	0	0	0	0	0	0	0	S	Byte 2

d. Configure Inputs. The Configure Inputs command frame must be used to change input configurations. The command-response frames are as follows:

Configure Inputs Command

Description	msb							lsb	Byte Number
(Type Number = 51)	0	0	1	1	0	0	1	1	Byte 1
Number of Items (n)	n	n	n	n	n	n	n	n	Byte 2
Item # - Byte 1	E	Input Number							Byte 3(I-1)+3
Item # - Byte 2	Leading edge filter (e)								Byte 3(I-1)+4
Item # - Byte 3	Trailing edge filter (r)								Byte 3(I-1)+5

Configure Inputs Response

Description	msb							lsb	Byte Number
(Type Number = 179)	1	0	1	1	0	0	1	1	Byte 1
Status	0	0	0	0	0	0	0	S	Byte 2

Block field definitions must be as follows:

E — Ignore Input Flag. "1" = do not report transitions for this input, "0" = report transitions for this input

e — A one-byte leading edge filter specifying the number of consecutive input samples which must be "0" before the input is considered to have entered to "0" state from "1" state (range 1 to 255, 0 = disabled)

r — A one-byte trailing edge filter specifying the number of consecutive input samples which must be "1" before the input is considered to have entered to "1" state from "0" state (range 1 to 255, 0 = disabled)

S — return status S = '0' on completion or '1' on input error out of range

e. Poll Raw Input Data. The Poll Raw Input Data frame must be used to poll the FI/O for the current unfiltered status of all inputs. The response frame must contain 8 bytes (2A) or 15 bytes (2B) of information indicating the current input status. The frames are as follows:

Poll Raw Input Data Command

Description	msb							lsb	Byte Number
(Type Number = 52)	0	0	1	1	0	1	0	0	Byte 1

Poll Raw Input Data Response (2070-2A)

Description	msb							lsb	Byte Number
(Type Number = 180)	1	0	1	1	0	1	0	0	Byte 1
Inputs I0 (lsb) to I7 (msb)	x	x	x	x	x	x	x	x	Byte 2
Inputs I8 to I63	x	x	x	x	x	x	x	x	Bytes 3 to 9
MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 10

Description	msb							lsb	Byte Number
MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 11
MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 12
MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 13

Poll Raw Input Data Response (2070-8)

Description	msb							lsb	Byte Number
(Type Number = 180)	1	0	1	1	0	1	0	0	Byte 1
Inputs I0 (lsb) to I7 (msb)	x	x	x	x	x	x	x	x	Byte 2
Inputs I8 to I119	x	x	x	x	x	x	x	x	Bytes 3 to 16
MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 17
MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 18
MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 19
MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 20

f. Poll Filtered Input Data. The Poll Filtered Input Data frame must be used to poll the FI/O for the current filtered status of all inputs. The response frame must contain 8 bytes (2A) or 15 bytes (2B) of information indicating the current filtered status of the inputs. Raw input data must be provided in the response for inputs that are not configured for filtering. The frames are as follows:

Poll Filter Input Data Command

Description	msb							lsb	Byte Number
(Type Number = 53)	0	0	1	1	0	1	0	1	Byte 1

Poll Filter Input Data Response (2070-2A)

Description	msb							lsb	Byte Number
(Type Number = 180)	1	0	1	1	0	1	0	0	Byte 1
Inputs I0 (lsb) to I7 (msb)	x	x	x	x	x	x	x	x	Byte 2
Inputs I8 to I63	x	x	x	x	x	x	x	x	Bytes 3 to 9
MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 10
MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 11
MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 12
MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 13

Poll Filter Input Data Response (2070-8)

Description	msb							lsb	Byte Number
(Type Number = 181)	1	0	1	1	0	1	0	1	Byte 1
Inputs I0 (lsb) to I7 (msb)	x	x	x	x	x	x	x	x	Byte 2

Description	msb							lsb	Byte Number
Inputs I8 to I119	x	x	x	x	x	x	x	x	Bytes 3 to 16
MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 17
MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 18
MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 19
MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 20

g. Poll Input Transition Buffer. The Poll Input Transition Buffer frame must poll the FI/O for the contents of the input transition buffer. The response frame must include a three-byte information field for each of the input changes that have occurred since the last interrogation. The frames are as follows:

Poll Input Transition Buffer Command

Description	msb							lsb	Byte Number
(Type Number = 54)	0	0	1	1	0	1	1	0	Byte 1
Block Number	x	x	x	x	x	x	x	x	Byte 2

Poll Input Transition Buffer Response

Description	msb							lsb	Byte Number
(Type Number = 182)	1	0	1	1	0	1	1	0	Byte 1
Block Number	x	x	x	x	x	x	x	x	Byte 2
Number of Entries	x	x	x	x	x	x	x	x	Byte 3
Item #	S	Input Number							Byte 3(I-1)+4
Item # MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+5
Item # MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+6
Status	0	0	0	0	C	F	E	G	Byte 3(I-1)+7
MC Timestamp MSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+8
MC Timestamp NMSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+9
MC Timestamp NLSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+10
MC Timestamp LSB	x	x	x	x	x	x	x	x	Byte 3(I-1)+11

(1) Each detected state transition for each active input (see configuration data) is placed in the queue as it occurs. The FI/O must set the 'F' bit to '1' when attempting to record a transition and the Transition Buffer is full. While the Transition Buffer is full, all subsequent entries must be discarded. Bit definitions are as follows:

S	Indicates the state of the input after the transition
C	Indicates the 255 transition entries limit has been exceeded
F	Indicates the transition buffer limit has been exceeded
G	Indicates the requested block number is out of monotonic increment sequence
E	Same block number requested, E is set in response

(2) The Block Number byte is a monotonically increasing number incremented after each command issued by the CPU Module.

When the FI/O Module receives this command, it must compare the associated Block Number with the Block Number of the previously received command. If it is the same, the previous buffer must be re-sent to the CPU Module and the 'E' flag set in the status response frame. If it is not equal to the previous Block Number, the old buffer must be purged and the next block of data sent. If the block number is not incremented by one, the status G bit must be set. The block number received becomes the current number (even if out of sequence). The Block Number byte sent in the response block must be the same as that received in the command block. Counter rollover must be considered as a normal increment.

(3) The Timestamp must equal the MC value at the time the Poll Input Transition Buffer Response is generated.

h. Set Outputs. The Set Outputs frame must be used to command the FI/O to set the Outputs according to the data in the frame. If there is any error configuring the outputs, the 'E' flag in the response frame must be set to '1'. If the LINESYNC reference has been lost, the 'L' bit in the response frame must be set. Loss of LINESYNC reference must also be indicated in system status information. The output bytes depend upon field I/O module. These command and response frames are as follows:

Set Outputs Command

Description	msb							lsb	Byte Number
(Type Number = 55)	0	0	1	1	0	1	1	1	Byte 1
Outputs O0 (lsb) to O7 (msb) Data	x	x	x	x	x	x	x	x	Byte 2
Outputs O8 to O103 Data	x	x	x	x	x	x	x	x	Bytes 3 to 14
Outputs O0 (lsb) to O7 (msb) Control	x	x	x	x	x	x	x	x	Byte 15
Outputs O8 to O103 Control	x	x	x	x	x	x	x	x	Bytes 16 to 27

Set Outputs Response

Description	msb							lsb	Byte Number
(Type Number = 183)	1	0	1	1	0	1	1	1	Byte 1
Status	0	0	0	0	0	0	L	E	Byte 2

i. Configure Watchdog. The Configure Watchdog frames must be used to change the software watchdog timeout value. The Command and response frames are as follows:

Configure Watchdog Command

Description	msb							lsb	Byte Number
(Type Number = 58)	0	0	1	1	1	0	1	0	Byte 1
Timeout Value	x	x	x	x	x	x	x	x	Byte 2

Configure Watchdog Response

Description	msb							lsb	Byte Number
(Type Number = 186)	1	0	1	1	1	0	1	0	Byte 1
Status	0	0	0	0	0	0	0	Y	Byte 2

(1) The timeout value must be in the range between 10 to 100 milliseconds. If the value is lower than 10, 10 must be assumed. If the value is greater than 100, 100 must be assumed.

(2) On receipt of this frame, the watchdog timeout value must be changed to the value in the message and the "Y" bit set. The response frame bit (Y) must indicate a '1' if the watchdog has been previously set and a '0' if not.

j. Controller Identification. This is a legacy message command / response for FI/O modules with Datakey resident. Upon command, a response frame containing the 128 bytes of the Datakey See previous sections on Request Module Status for FI/O Status Bit _K' definition. If "K" bit set, only the first two bytes must be returned. The Command and Response frames are as follows:

Controller Identification Command

Description	msb							lsb	Byte Number
(Type Number= 59)	0	0	1	1	1	0	1	1	Byte 1

Controller Identification Response

Description	msb							lsb	Byte Number
(Type Number = 187)	1	0	1	1	1	0	1	1	Byte 1
Status	0	0	0	0	0	0	0	K	Byte 2
Datakey	x	x	x	x	x	x	x	x	Bytes 3 to 130

k. Module Identification. The I/O Module Identification Command frame must be used to request the FI/O Identification value. A response of "1" must be returned by 2070-2A, "2" by 2070-8, "3" is reserved for NEMA TS 2 Type 1 FI/O and "32 to 40" are reserved for ITS Cabinets. The command and response frames are shown as follows:

I/O Module Identification Command

Description	msb							lsb	Byte Number
(Type Number = 60)	0	0	1	1	1	1	0	0	Byte 1

I/O Module Identification Response

Description	msb							lsb	Byte Number
(Type Number = 188)	1	0	1	1	1	1	0	0	Byte 1
FI/O I D byte	x	x	x	x	x	x	x	x	Byte 2

D. Type 2070-3 Front Panel Assembly.

1. General. The Type 2070-3 Front Panel Assembly (FPA) must be delivered with one of the three options as defined in this clause. All options must consist of a panel with Latch assembly and two TSD #1 hinge attaching devices, assembly PCB, external serial port connector(s), CPU active LED indicator, and FP Harness Interface. The options must include the additional features, as follows:

Option 3A	FPA controller, two keyboards, AUX switch, alarm bell and Display A
Option 3B	FPA controller, two keyboards, AUX switch, alarm bell and Display B - required for NEMA compliance (TS-1 & TS-2 type1) 8 x 40 display with 2 keypads
Option 3C	System Serial Port 6 Lines, isolated and vectored to Connector C60S.

2. Keyboards. Provide two KEYBOARDS , one with sixteen keys for hexadecimal alphanumeric entry and the other with twelve keys to be used for cursor control and action symbol entry. Engrave or emboss each key with its function character. Each key must have an actuation force between 50 and 100 grams and provide a positive tactile indication of contact closure. Key contacts must be hermetically sealed, have a design life of over one million operations, be rated for the current and voltage levels used, and stabilize within 5 milliseconds following contact closure.

3. CPU Active Indicator. The cathode of the CPU ACTIVE LED INDICATOR must be electrically connected to the CPU Activity LED signal and be pulled up to +5 VDC.

4. Display. The DISPLAY must consist of a Liquid Crystal Display (LCD), a backlight, and a contrast potentiometer control. Display A must have 4 lines of 40 characters each with a minimum character dimensions of 0.20 in. wide by 0.41 in. high and an electro -luminescent (EL) backlight. Display B must have 8 lines of 40 characters each with minimum dimensions of 0.10 in. wide by 0.17 high and either LED or EL backlight.

a. Each character must be composed of a 5 x 7 dot matrix with an underline row or a 5 x 8 dot matrix. The viewing angle of the LCD must be optimized for direct (90 degrees) viewing, +/-35 degrees vertical, +/-45 degrees horizontal. The LCD must have variable contrast with a minimum ratio of 4:1. The LCD must be capable of displaying, at any position on the Display, any of the standard ASCII characters as well as user-defined characters.

b. The backlight must be turned on and off by the Controller Circuitry. The backlight and associated circuitry must consume no power when in off state. A potentiometer must control the LCD contrast with clockwise rotation increasing contrast. The contrast must depend on the angular position of the potentiometer, which must provide the entire contrast range of the LCD.

c. Cursor display must be turned ON and OFF by command. When ON, the cursor must be displayed at the current cursor position. When OFF, no cursor is to be displayed. All other cursor functions (positioning, etc.) must remain in effect.

5. FPA Controller. The FPA CONTROLLER must function as the Front Panel Device controller interfacing with the CPU Module.

a. Provide a FPA RESET Switch on the Assembly PCB. The momentary CONTROL switch must be logic OR'd with the CPU RESET Line, producing a FPA RESET Output. Upon FPA RESET being active or receipt of a valid Soft Reset display command, the following must occur:

(1) Auto-repeat, blinking, auto-wrap, and auto-scroll must be set to OFF.

(2) Each special character must be set to ASCII SPC (space).

(3) The tab stops must be set to columns 9, 17, 25, and 33.

(4) The backlight timeout value must be set to 6 (60 seconds).

(5) The backlight must be extinguished.

(6) The display must be cleared (all ASCII SPC).

(7) The FPA module must transmit a power up string through /sp6 to the CPU once power is applied to the FPA, or the FPA hardware RESET BUTTON IS PUSHED. The string is —ESC[U”, hex value —1B 5B 50 55”.

b. When a keypress is detected, the appropriate key code must be transmitted to SP6-RxD. If two or more keys are depressed simultaneously, no code is to be sent. If a key is depressed while another key is depressed, no additional code is to be sent.

c. Auto-repeat must be turned ON and OFF by command. When ON, the key code must be repeated at a rate of 5 times per second starting when the key has been depressed continuously for 0.5 second, and must terminate when the key is released or another key is pressed.

d. When the AUX Switch is toggled, the appropriate AUX Switch code must be transmitted to the CPU.

e. The controller circuitry must be capable of composing and storing eight special graphical characters on command, and displaying any number of these characters in combination with the standard ASCII characters. Undefined characters must be ignored. User-composed characters must be represented in the communication protocol on Page 9-7-12. P1 represents the special character number (1-8). Pn's represent columns of pixels from left to right. The most significant bit of each Pn represents the top pixel in a column and the least significant bit must represent the bottom pixel. A logic _1‘ must turn the pixel ON. There must be a minimum of 5 Pn's for 5 columns of pixels in a command code sequence terminated by an "f."

If the number of Pn's are more than the number of columns available on the LCD, the extra Pn's must be ignored. P1 and all Pn's must be in ASCII coded decimal characters without leading zero.

f. Character overwrite mode must be the only display mode supported. A displayable character received must always overwrite the current cursor position on the Display. The cursor must automatically move right one character position on the Display after each character write operation. When the rightmost character on a line (position 40) has been overwritten, the cursor position must be determined based on the current settings of the auto-wrap mode.

g. Auto-wrap must be turned ON & OFF by command. When ON, a new line operation must be performed after writing to position 40. When OFF, upon reaching position 40, input characters must continue to overwrite position 40.

h. Cursor positioning must be non-destructive. Cursor movement must not affect the current display, other than blinking the cursor momentarily and periodically hiding the character at that cursor position.

i. Blinking characters must be supported, and be turned ON and OFF by command. When ON, all subsequently received displayable characters must blink at the rate of 1 Hertz with a 60% ON / 40% OFF duty cycle. It must be possible to display both blinking and non-blinking characters simultaneously.

j. Tab stops must be configurable at all columns. A tab stop must be set at the current cursor position when a SetTabStop command is received. Tab Stop(s) must be cleared on receipt of a ClearTabStop command. On receipt of the HT (tab) code, the cursor must move to the next tab stop to the right of the cursor position. If no tab stop is set to the right of the current cursor position, the cursor must not move.

k. Auto-scroll must be turned ON and OFF by command. When ON, a Line Feed or new line operation from the bottom line must result in the display moving up one line. When OFF, a Line Feed or new line from the bottom line must result in the top line clearing, and the cursor being positioned on the top line.

l. The display must have a buffer. The screen must be refreshed from the buffer at a rate of no less than 20 times per second.

m. The Display back light must illuminate when any key is pressed and illuminate or extinguish by command. The backlight must extinguish when no key is pressed for a specified time. This time must be program selected by command, by a number in the range 0 to 63 corresponding to that number of 10-second intervals. A value of 1 must correspond to a timeout interval of 10 seconds. A value of 0 must indicate no timeout.

n. The Command Codes must use the following conventions:

(1) Parameters and Options: Parameters are depicted in both the ASCII and hexadecimal representations as the letter 'P' followed by a lower-case character or number. These are interpreted as follows:

Pn: Value parameter, to be replaced by a value, using one ASCII character per digit without leading zeros.
P1: Ordered and numbered parameter. One of a listed known parameters with a specified order and number (Continues with P2, P3, etc.)
Px: Display column number (1-40), using one ASCII character per digit without leading zero.
Py: Display line (1-4) one ASCII character
...: Continue the list in the same fashion

Values of 'h' (0x68) and 'l' (0x6C) are used to indicate binary operations. 'h' represents ON (high), 'l' represents OFF (low).

(2) ASCII Representation: Individual characters are separated by spaces; these are not to be interpreted as the space character, which is depicted by SPC.

(3) Hexadecimal Representation: Characters are shown as their hexadecimal values and will be in the range 0x00 to 0x7F (7 bits).

o. The Controller Circuit must communicate via a SP6 asynchronous serial interface. The interface must be configured for 38.4 kilobits per second, 8 data bits, 1 stop bit, and no parity.

p. C50 ENABLE function when grounded by pins 1 and 5, must be brought to Connectors A1, pin B21 for the purpose of disabling the module channel 2, (SP4).

6. Electronic Bell. The Front Panel must include an electronic bell to signal receipt of (0x07). The bell must sound at 2,000 Hertz, with a minimum output rating of 85 dB upon receipt of (0x07). Receipt of all other characters and ESC codes must continue during the time the bell sounds.

D. Type 2070-4 Power Supply Module.

1. General. The Type 2070-4A Power Supply Module must be independent, self contained Module, vented, and cooled by convection only. The Module must slide into the unit‘s power supply compartment from the back of the Chassis and be attached to the Backplane Mounting Surface by its four TSD #3 Devices.

a. The Type 2070-4B Module must meet the same requirements as the 2070-4A, except for 3.5 amperes of +5 VDC.

2. Module Front. An "On/Off" POWER Switch, four LED DC Power Indicators, PS Receptacle POWER Connectors, and the Incoming AC Fuse protection must be provided on the Module Front. The LED DC POWER Indicators must indicate all required DC voltages meet the following conditions: the +5 VDC is within 5% and the 12 VDC is within 8% of their nominal levels.

3. Input Protection. Provide two 0.5-Ohm, 10-watt wire-wound power resistors with a 0.2 micro Henries inductance (one on the AC+ Line & on the AC- Line). Provide three 20 Joule surge arrestors between AC+ to AC-, AC+ to EG, and AC- to EG. A 0.68 µF capacitor must be placed between AC+ & AC- (between the resistor & arrestors).

4. +5VDC Standby Power. Provide +5 VDC STANDBY POWER to hold up specified circuitry during the power down period. It must consist of the monitor circuitry, hold up capacitors, and charging circuitry. Provide a charging circuit that under normal operation, fully charges and float the capacitors consistent with the manufacturers' recommendations. The Hold Up power requirements must be a minimum constant drain of 600 microamperes at a range of +5 VDC to +2 VDC for over 600 minutes.

5. Monitor Circuitry. Provide MONITOR CIRCUITRY to monitor incoming AC Power for Power Failure and Restoration and LINESYNC generation.

a. The ACFAIL/POWER DOWN Output Lines must go LOW (ground true) immediately upon Power Failure. The Lines must transition to HIGH at Power Restoration. The Lines must be driven separately. The SYSRESET/POWERUP Output Lines must transition to LOW 525 +/-25 milliseconds after ACFAIL/POWER DOWN transition to LOW. The Lines must transition to HIGH 225 +/-25 milliseconds after Power Restoration and the supply is fully recovered. The Lines must be driven separately.

b. The monitor circuitry must switch the +5 VDC Standby ON immediately upon Power Failure and isolate (OFF) the line at Power Up.

c. The 60 Hz Square Wave LINESYNC signal must be generated by a crystal oscillator, which must be synchronized to the 60-Hertz VAC incoming power line at 120 and 300 degrees. A continuous square wave signal must be +5 VDC amplitude, 8.333 milliseconds half-cycle pulse duration, and 50 +/-1% duty cycle. The output must have drive sink capability of 16 milliamperes. A 2 K-Ohm pull-up resistor must be connected between the output and +5 VDC. The monitor circuit must compensate for missing pulses and line noise during normal operation.

d. The LINESYNC must continue until SYSRESET transitions LOW and begin when SYSRESET transitions HIGH.

6. Power Supply Requirements.

Voltage	Tolerances	I Minimum	I Maximum
+5 VDC	+4.875 to +5.125 VDC	1.0 ampere	10.0 ampere- MODULE 2070-4A 3.5 ampere– MODULE 2070-4B
+12 VDC Serial	+11. 4 to +12. 6 VDC	0.1 ampere	0.5 ampere
-12 VDC Serial	-11. 4 to –12. 6 VDC	0.1 ampere	0.5 ampere
+12 VDC	+11. 4 to +12. 6 VDC	0.1 AMP	1.0 AMP

a. Line/Load Regulation. Line / Load Regulation must meet the table tolerance values for voltage range of 90 to 135 VAC, the maximum and minimum loads called out in the table and including ripple noise.

b. Efficiency. 70% minimum.

c. Ripple and Noise. Less than 0.2% RMS, 1% peak to peak or 50 millivolts, whichever is greater.

d. Voltage Overshoot. No greater than 5%, all outputs.

e. Overvoltage Protection. 130% V out for all outputs.

f. Circuit Protection. Automatic recovery upon removal of fault.

g. Inrush Current. Cold Start Inrush must be less than 25 amperes at 115VAC.

h. Transient Response. Output voltage back to within 1% in less than 500 microseconds on a 50% Load change. Peak transient not to exceed 5%.

i. Holdup Time. The power supply must supply 30 watts minimum for 550 milliseconds after ACFAIL going LOW. The supply must be capable of holding up the Unit for two 500 milliseconds Power Loss periods occurring in a 1.5-second period.

j. Remote Sense. +5 VDC compensates 250 millivolts total line drop. Open sense load protection required.

E. Unit Chassis and Type 2070-5 VME Cage Assembly.

1. General.

a. The Chassis consists of the metal housing, Serial Motherboard, Back-plane Mounting Surface, Power Supply Module Supports, slot card guides, Wiring Harnesses, and Cover Plate(s).

b. All external screws must be countersunk and be Phillips flat head stainless steel type.

c. The housing must be treated with clear chromate and the slot designation labeled on the back-plane mounting surface above the upper slot card guide.

d. The Chassis must be cooled by convection only. The top and bottom pieces of the housing must be slotted for vertical ventilation.

2. Serial Motherboard. Serial Motherboard must function as support for its connectors, A1 to A5 and FP, and as the interface between the CPU and the dedicated modules/Front Panel carrying both serial communications, logic, and power circuits. The PCB must be multi-layered, with one layer plane assigned to DC Ground.

a. A wiring harness PS2 must be provided between the Type 2070-4 Power Supply and the Motherboard PCB (provide strain relief). Test points must be provided on the FPA side of the Motherboard for PS2 lines.

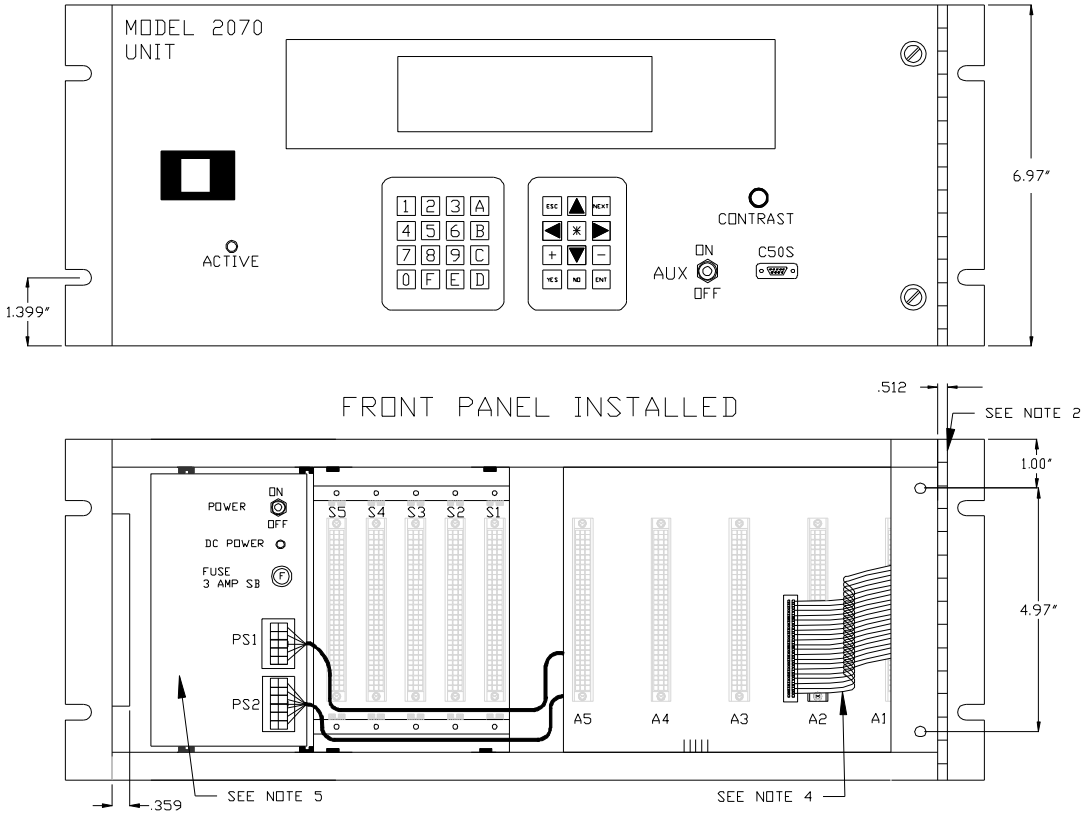
b. A wiring harness FP must be provided, linking the Motherboard with the FPA.

3. Type 2070-5 VME Cage Assembly. Type 2070-5 VME Cage Assembly must consist of 3U five slot/connector VME Cage, Front Mounting Plate, and PS1 Harness. The VME Cage must conform to VME Standard IEEE P1014/D12 for 3U Cage. All slot/connectors must be A24:D16 Interface.

4. Type 2070-1A CPU Main Controller Board. The Type 2070 – 1A CPU Main Controller Board must either be affixed to the Transition Board via at least four stand-off devices or mounted in a one slot VME board assembly (removable). A PS1L Harness must be supplied with one end mating to the PS1 power supply connector and the other end mated to the MCB DIN Connector. A 100-Ohm resistor per line must terminate the VME bus lines.

F. Details.

Table of Contents



NOTES (THIS DETAIL)

1. The unit shall be capable of mounting to a Standard EIA-310B Rack using 4U open end mounting slots.

2. Continuous stainless steel hinge (.157" maximum hinge barrel) that attaches to the Front Panel by two TSD #1 Thumbscrew devices.

3. Actual location of ACTIVE light and contrast control shall be limited to ACTIVE light on the left side of the panel and the contrast control on the right side. They shall be located greater than 1" from other devices, connector or latch.

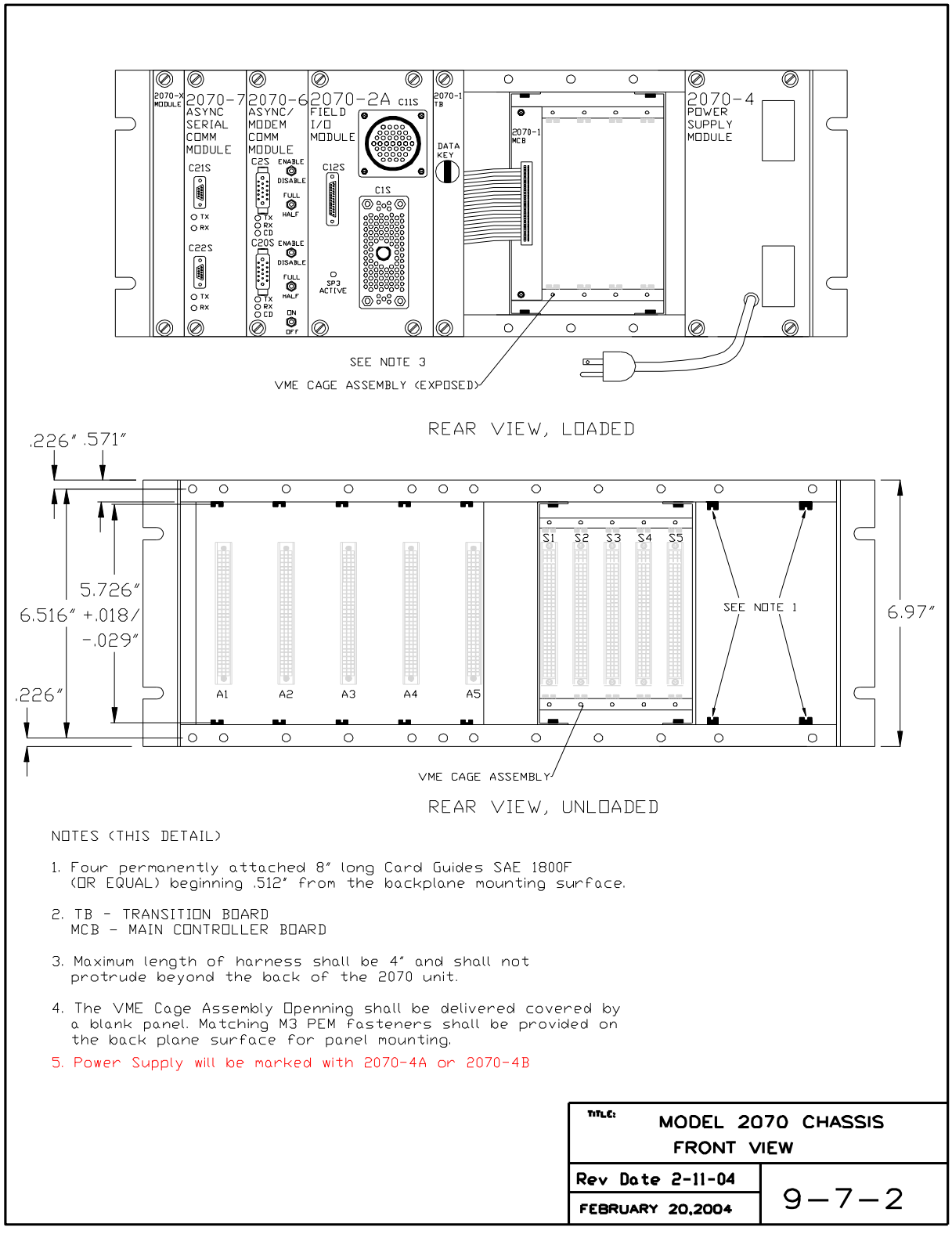
4. The length of the Front Panel Harness shall be no less than 5.00"

5. A LED indicator for each DC voltage shall be provided.

6. With the hinge installed, the distance between the TSD hole center & the CHASSIS Right Side (inside plane) shall be .551"

TITLE: MODEL 2070 CHASSIS FRONT VIEW	
Rev Date 2-11-04	9-7-1
FEBRUARY 20,2004	

Figure 3
Chassis Front View



NOTES (THIS DETAIL)

1. Four permanently attached 8" long Card Guides SAE 1800F (OR EQUAL) beginning .512" from the backplane mounting surface.

2. TB - TRANSITION BOARD
   MCB - MAIN CONTROLLER BOARD

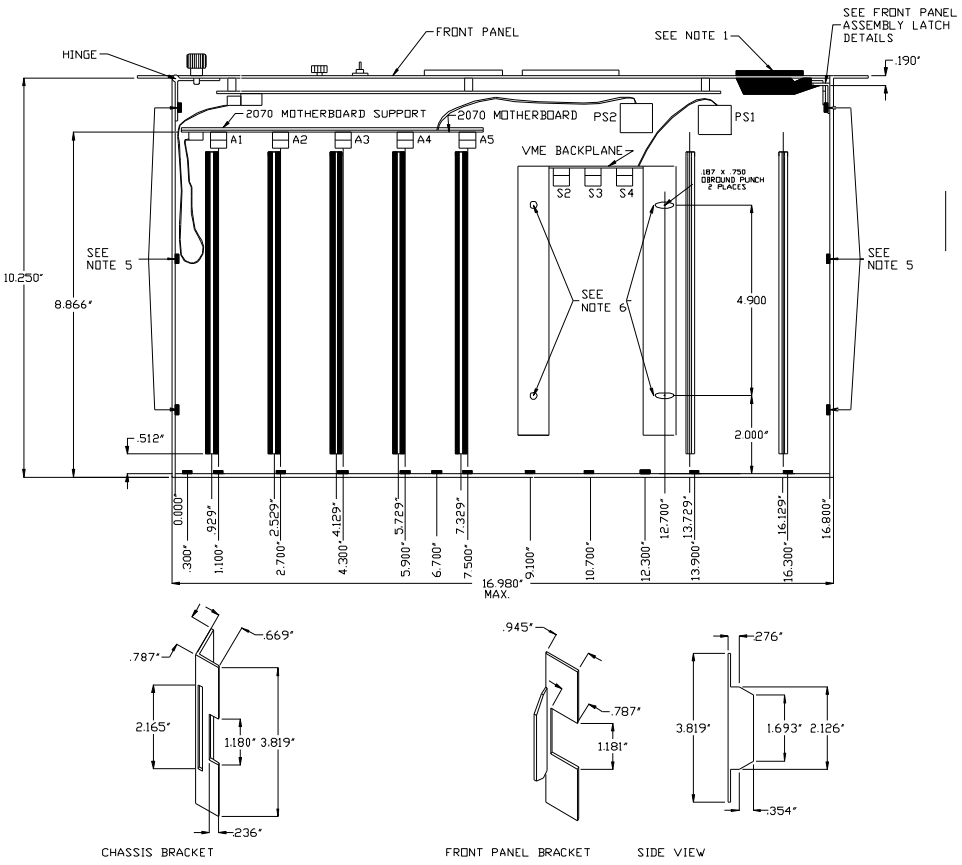
3. Maximum length of harness shall be 4" and shall not protrude beyond the back of the 2070 unit.

4. The VME Cage Assembly Openning shall be delivered covered by a blank panel. Matching M3 PEM fasteners shall be provided on the back plane surface for panel mounting.

5. Power Supply will be marked with 2070-4A or 2070-4B

TITLE: MODEL 2070 CHASSIS FRONT VIEW	
Rev Date 2-11-04	9-7-2
FEBRUARY 20,2004	

Figure 4
Chassis Rear View



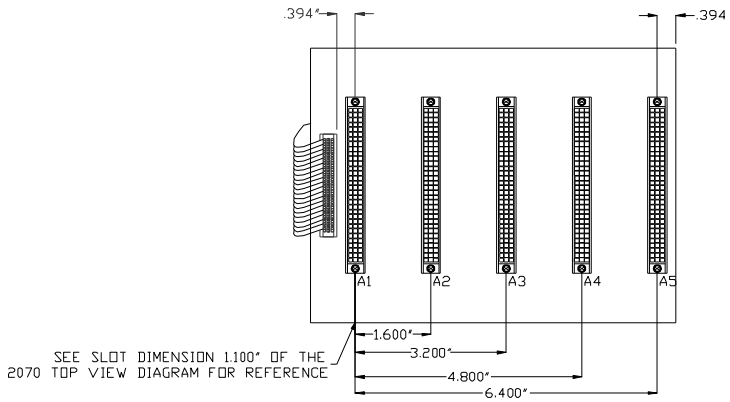
NOTES (THIS DETAIL)

FRONT PANEL ASSEMBLY LATCH DETAILS

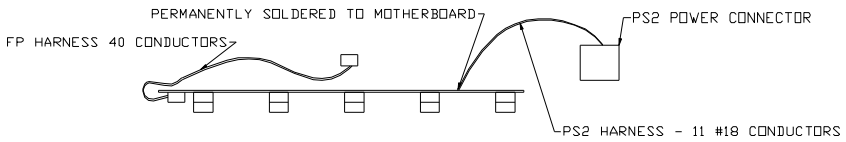
1. Front Panel Assembly Latch mating with and rigidly held in place by Chassis Guide Latch/member shall be provided. The member shall vertically support the Front Panel Assembly in two other points besides the Latch.
2. Nylon card guides, SAE 1800F (OR EQUAL), shall be provided (top and bottom) for Mother Slot/Connectors A1 to A5. The Guides shall begin .512" from the Backplane surface.
3. M3 PEM Self-clinching Miniature Fasteners (OR EQUAL) shall be used for mounting holes located on Backplane Surface.
4. All harnesses shall have a minimum slack of 1.00" when connected.
5. M3 PEM Self-clinching Miniature Fasteners (OR EQUAL) shall be used for mounting holes to match the TSD #3 Thumbscrew Devices on the Model 2070-8 Module. Fastener centers shall be .250" above unit baseline.
6. Eight 6-32 Phillips head counter-sunk screws, 4 top and 4 bottom, shall be used to mount the cage assembly to the 2070 Chassis.
7. The 2070 chassis top & bottom sections shall be constructed with a continuous .621" folded lip along the front perpendicular to the 2070 top and bottom sections. The top and bottom sections of the 2070 chassis shall be recessed .709" as measured from the front surface of the front panel.

TITLE: MODEL 2070 CHASSIS TOP VIEW	
Rev Date 2-11-04	9-7-3
FEBRUARY 20,2004	

Figure 5
Chassis Top View



FRONT VIEW



TOP VIEW

FP HARNESS PIN/WIRING ASSIGNMENT			
PIN	CONNECTOR ROW A	PIN	CONNECTOR ROW B
1	SP4-TXD+	2	SP4-TXD-
3	SP4-RXD+	4	SP4-RXD-
5	SP6-TXD+	6	SP6-TXD-
7	SP6-RXD+	8	SP6-RXD-
9	NA	10	NA
11	NA	12	NA
13	NA	14	NA
15	NA	16	NA
17	NA	18	NA
19	NA	20	NA
21	DC GROUND #1	22	DC GROUND #1
23	+12 VDC SERIAL	24	-12 VDC SERIAL
25	DC GROUND #1	26	DC GROUND #1
27	CPU LED	28	DC GROUND #1
29	CPURESET	30	DC GROUND #1
31	DC GROUND #1	32	C50 ENABLE
33	DC GROUND #1	34	+5 VDC
35	+5 VDC	36	+5 VDC
37	+5 VDC	38	+5 VDC
39	NA	40	NA

PS2 HARNESS PIN/WIRING ASSIGNMENT	
PIN	FUNCTION
1	+5 VDC
2	+12 VDC SERIAL
3	-12 VDC SERIAL
4	DC GND #1 (+5 VDC & 12 SERIAL)
5	+5 VDC STANDBY
6	+12 VDC - ISOLATED
7	DC GROUND #2 (+12 VDC ONLY)
8	POWER DOWN
9	POWER UP / SYS RESET
10	EQUIPMENT GROUND
11	LINESYNC
12	NA

NOTES (THIS DETAIL)

1. The Motherboard shall be a .125" minimum thickness pcb mounted in a vertical position.
2. A1 to A5 receptacle connectors shall be 96 socket contact DIN 41612 connectors (ROBINSON NUGENT #DIN 96RSC or ELCO Series 8477 Three Row Inverted Socket OR EQUAL).
3. The FP Harness may be located on either side of the motherboard. The FP Harness shall either be directly soldered to the motherboard or a header used.

TITLE: MODEL 2070 CHASSIS MOTHERBOARD	
Rev Date 2-11-04	9-7-4
FEBRUARY 20, 2004	

Figure 6
Chassis Motherboard

A1 CONNECTOR PIN OUT			
PIN	A	B	C
1	SP3TXD+	SP6TXD+	SP5TXD+
2	SP3TXD-	SP6TXD-	SP5TXD-
3	SP3RXD+	SP6RXD+	SP5TXC+
4	SP3RXD-	SP6RXD-	SP5TXC-
5	SP3RTS+	SP3TXCO+	SP5RXD+
6	SP3RTS-	SP3TXCO-	SP5RXD-
7	SP3CTS+	SP3TXCI+	SP5RXC+
8	SP3CTS-	SP3TXCI-	SP5RXC-
9	SP3DCD+	SP3RXC+	SP3TXD+
10	SP3DCD-	SP3RXC-	SP3TXD-
11	SP4TXD+	SP4TXD+	SP3RXD+
12	SP4TXD-	SP4TXD-	SP3RXD-
13	SP4RXD+	SP4RXD+	SP3RTS+
14	SP4RXD-	SP4RXD-	SP3RTS-
15	NA	NA	SP3CTS+
16	NA	NA	SP3CTS-
17	NA	NA	SP3DCD+
18	NA	NA	SP3DCD-
19	NA	NA	SP3TXCO+
20	NA	NA	SP3TXCO-
21	DCG #1	C50 ENABLE	SP3TXCI+
22	NETWK1	NA	SP3TXCI-
23	NETWK2	NA	SP3RXC+
24	NA	LINESYNC	SP3RXC-
25	NETWK3	POWERUP	CPURESET
26	NETWK4	POWERDN	FPLED
27	DCG #1	DCG #1	DCG #1
28	+12 SER	-12 SER	+5 STDBY
29	+5 VDC	+5 VDC	+5 VDC
30	DCG #1	DCG #1	DCG #1
31	+12 VDC	+12 VDC	+12 VDC
32	DCG #2	DCG #2	DCG #2

A2 TO A5 CONNECTOR PIN OUT			
PIN	A	B	C
1	SP1TXD+	SP6TXD+	SP5TXD+
2	SP1TXD-	SP6TXD-	SP5TXD-
3	SP1RXD+	SP6RXD+	SP5TXC+
4	SP1RXD-	SP6RXD-	SP5TXC-
5	SP1RTS+	SP1TXCO+	SP5RXD+
6	SP1RTS-	SP1TXCO-	SP5RXD-
7	SP1CTS+	SP1TXCI+	SP5RXC+
8	SP1CTS-	SP1TXCI-	SP5RXC-
9	SP1DCD+	SP1RXC+	SP3TXD+
10	SP1DCD-	SP1RXC-	SP3TXD-
11	SP2TXD+	SP4TXD+	SP3RXD+
12	SP2TXD-	SP4TXD-	SP3RXD-
13	SP2RXD+	SP4RXD+	SP3RTS+
14	SP2RXD-	SP4RXD-	SP3RTS-
15	SP2RTS+	SP2TXCO+	SP3CTS+
16	SP2RTS-	SP2TXCO-	SP3CTS-
17	SP2CTS+	SP2TXCI+	SP3DCD+
18	SP2CTS-	SP2TXCI-	SP3DCD-
19	SP2DCD+	SP2RXC+	SP3TXCO+
20	SP2DCD-	SP2RXC-	SP3TXCO-
21	DCG #1	NA	SP3TXCI+
22	NETWK1	NA	SP3TXCI-
23	NETWK2	NA	SP3RXC+
24	NA	LINESYNC	SP3RXC-
25	NETWK3	POWERUP	CPURESET
26	NETWK4	POWERDN	FPLED
27	DCG #1	DCG #1	DCG #1
28	+12 SER	-12 SER	+5 STDBY
29	+5 VDC	+5 VDC	+5 VDC
30	DCG #1	DCG #1	DCG #1
31	+12 VDC	+12 VDC	+12 VDC
32	DCG #2	DCG #2	DCG #2

NOTES (THIS DETAIL)

1. Functions are referenced to the CPU.
2. DC GND #1 for +5VDC and +12VDC Serial. DC GND #2 for +12VDC ISO.
3. A1 Connector is the furthest A Connector to the left when viewed from the unit back. All A Connectors are pin assigned the same.
4. Connector A2 to A4, pins B21 and B22 shall read "NA".
   Connector A2, pins B23 shall read "A2 Installed".
   Connector A3, pins B23 shall read "A3 Installed".
   Connector A4, pins B23 shall read "NA".
   Connector A5, pins B21 shall read "A2 Installed".
   Connector A5, pins B22 shall read "DCG #1".
   Connector A5, pins B23 shall read "A3 Installed".
5. Pin A24 (DCG #1) is reserved for network protection only, ie., "Ethernet Shield".
6. Connector A2 installed, enables SP1 and SP2.
7. Connector A3 install, enbales SP5.
8. SP3 and SP6 are always enabled.
9. C50 enabled, disconnects SP4 on connector A1.

TITLE: Motherboard A Connector Pin Assignment	
Rev Date 2-11-04	9-7-5
FERBUARY 20, 2004	

Figure 7
Motherboard A Connector Pin Assignment

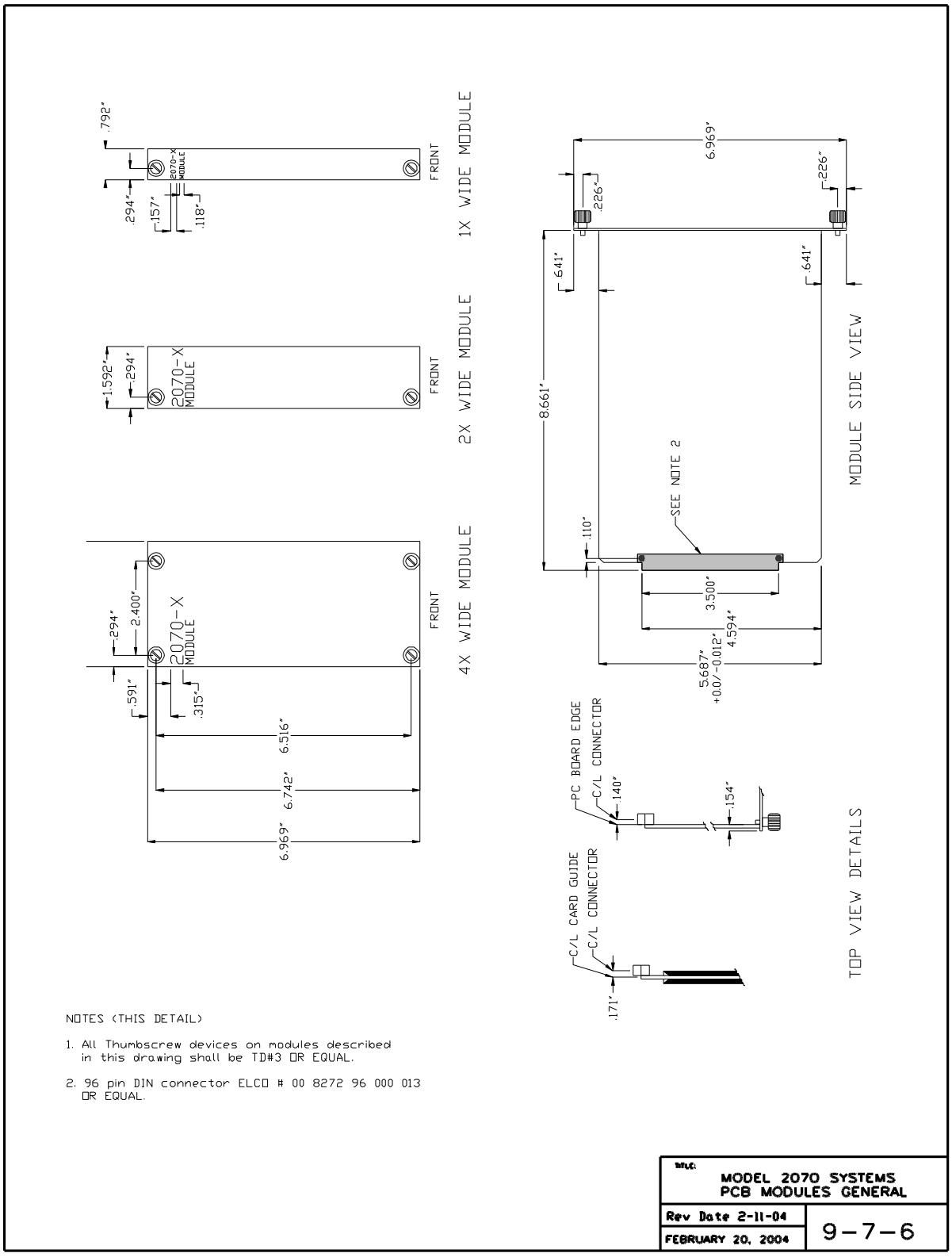
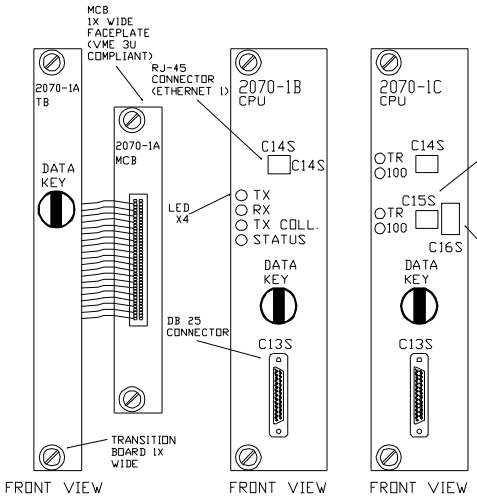


Figure 8
System PCB Modules General

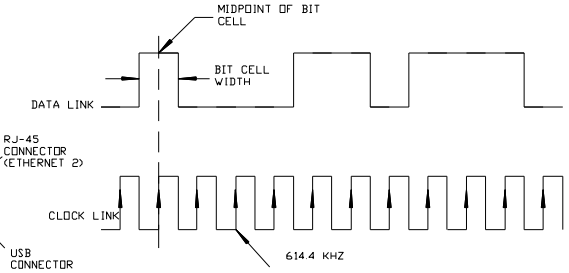
SERIAL PORT REQUIREMENTS

A2 TO A5 CONNECTOR PIN OUT			
LOGICAL PORT	68360 PORT	RATE KBITS	PROTOCOL
SP1	SEE NOTE 4	(1)	ASYNC
SP1S	SEE NOTE 4	(2)	SYNC, HDLC, SDLC
SP2	SCC2	(1)	ASYNC
SP2S	SCC2	(2)	SYNC, HDLC, SDLC
SP3	SCC4	(1)	ASYNC
SP3S	SCC4	153.6, 614.4*	SYNC, HDLC, SDLC
SP4	SMC2	(1), 9.6*	ASYNC
SP5	SCC3	(1)	ASYNC
SP5S	SCC3	153.6, 614.4*	SYNC, HDLC, SDLC
SP6	SMC1	(1), 38.4*	ASYNC
SP8**	SEE NOTE 4	9.6**	ASYNC
SP8**	SEE NOTE 4	153.6, 614.4	SYNC, HDLC. SDLC

SDLC FRAME LAYOUT					
OPENNING FLAG	ADDR	CONTROL	INFORMATION	CRC	CLOSING FLAG
0111 1110	8 BITS	1000 0011	VARIABLE LENGTH	16 BITS	0111 1110



CPU FACE PANELS



SDLC TIMING

C13S PIN ASSIGNMENT			
PIN	FUNCTION	PIN	FUNCTION
1	SP8 TX +	14	SP8 TX -
2	SP8 RX +	15	SP8 RX -
3	SP8 TXC +	16	SP8 TXC -
4	SP8 RXC +	17	SP8 RXC -
5	SP8 RTS + **	18	SP8 RTS - **
6	SP8 CTS + **	19	SP8 CTS - **
7	SP8 DCD + **	20	SP8 DCD - **
8	NA	21	NA
9	LINESYNC +	22	LINESYNC -
10	NRESET +	23	NRESET -
11	PWRDWN +	24	PWRDWN -
12	+5 VDC	25	EQUIP GND
13	DC GND #2		

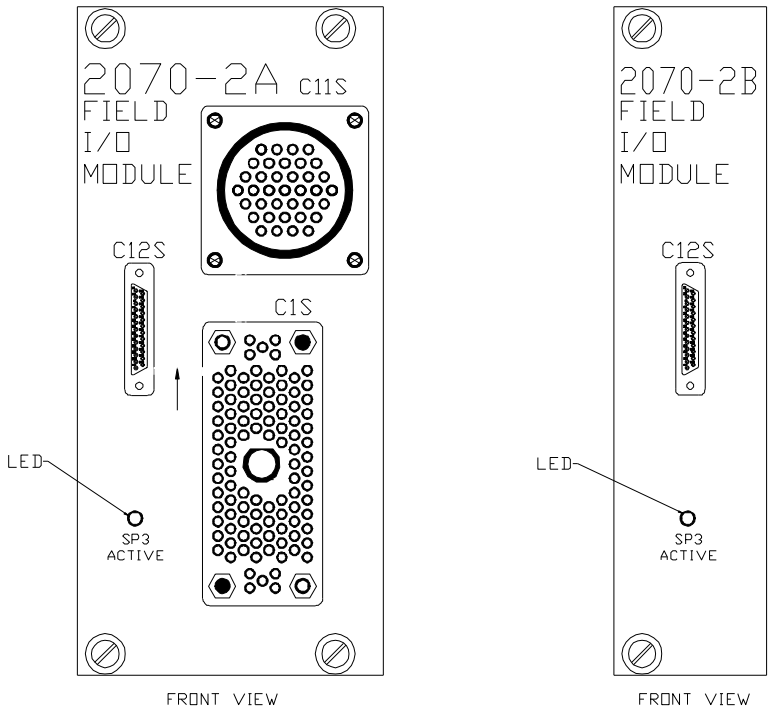
C14S and C15S PIN ASSIGNMENT (ETHERNET)			
PIN	FUNCTION	PIN	FUNCTION
1	TX +	5	NA
2	TX -	6	RX -
3	RX +	7	NA
4	NA	8	NA

NOTES (THIS DETAIL)

1. (1) BPS Rates 1.2* 2.4, 4.8, 9.6, 19.2, 38.4
2. (2) BPS Rates 19.2*, 38.4, 57.6, 76.8, 153.6
3. * Default BPS Rate for indicated Port.
4. SP1 OF THE 2070-1A is 68360 SCC1. SP1 OF 2070-1B, -1C is Dual SCC1 with 68360 SCC1 assigned to ETHERNET. SP8 of the 2070-1B, -1C assigned to the Dual SCC.
5. A Post Header (ROBINSON NUGENT IDA-XX OR EQUAL) Connector with strain relief shall be provided on the MCB Front Plate and the Transition Board for mating with the interface harness. The harness shall be shielded and straight through wired.
6. ** 2070-1B, -1C only

TITLE: MODEL 2070-1C CPU	
Rev Date 11-4-05	9-7-7
FEBRUARY 4,2005	

Figure 9
2070-1A, 2070-1B and 2070-1C CPU Modules



FIELD I/O FACE PANELS

NOTES (THIS DETAIL)

1. 2070-2A Faceplate shall be 4X wide. 2070-2B Faceplate shall be 2X wide. (SEE SYSTEM PCB MODULE, GENERAL DETAILS.)
2. Dark Circles in the C1S Connector denote guide pin locations and open circles denote guide socket locations.
3. Dimension "A" shall be a minimum of .50".
4. C1S - M104 Type
   C11S - 37-Pin Circular Plastic Type
   C12S - 25-Pin DB Socket Type
5. C12S PIN 12 (+5VDC) IS DERIVED from +12 VDC Power Supply

C12S PIN ASSIGNMENT			
PIN	FUNCTION	PIN	FUNCTION
1	TX5 DATA +	14	TX5 DATA -
2	RX5 DATA +	15	RX5 DATA -
3	TX5 CLOCK +	16	TX5 CLOCK -
4	RX5 CLOCK +	17	RX5 CLOCK -
5	TX3 DATA +	18	TX3 DATA -
6	RX3 DATA +	19	RX3 DATA -
7	TX3 CLOCK +	20	TX3 CLOCK -
8	RX3 CLOCK +	21	RX3 CLOCK -
9	LINE SYNC +	22	LINE SYNC -
10	NRESET +	23	NRESET -
11	POWER DOWN +	24	POWER DOWN -
12	+5 VDC	25	EQUIP GND
13	DC GND #2		

TITLE: MODEL 2070-2 FIELD I/O MODULES	
Rev Date 2-11-04	9-7-8
FEBRUARY 20, 2004	

Figure 10
Field I/O Modules

C1S PIN ASSIGNMENT

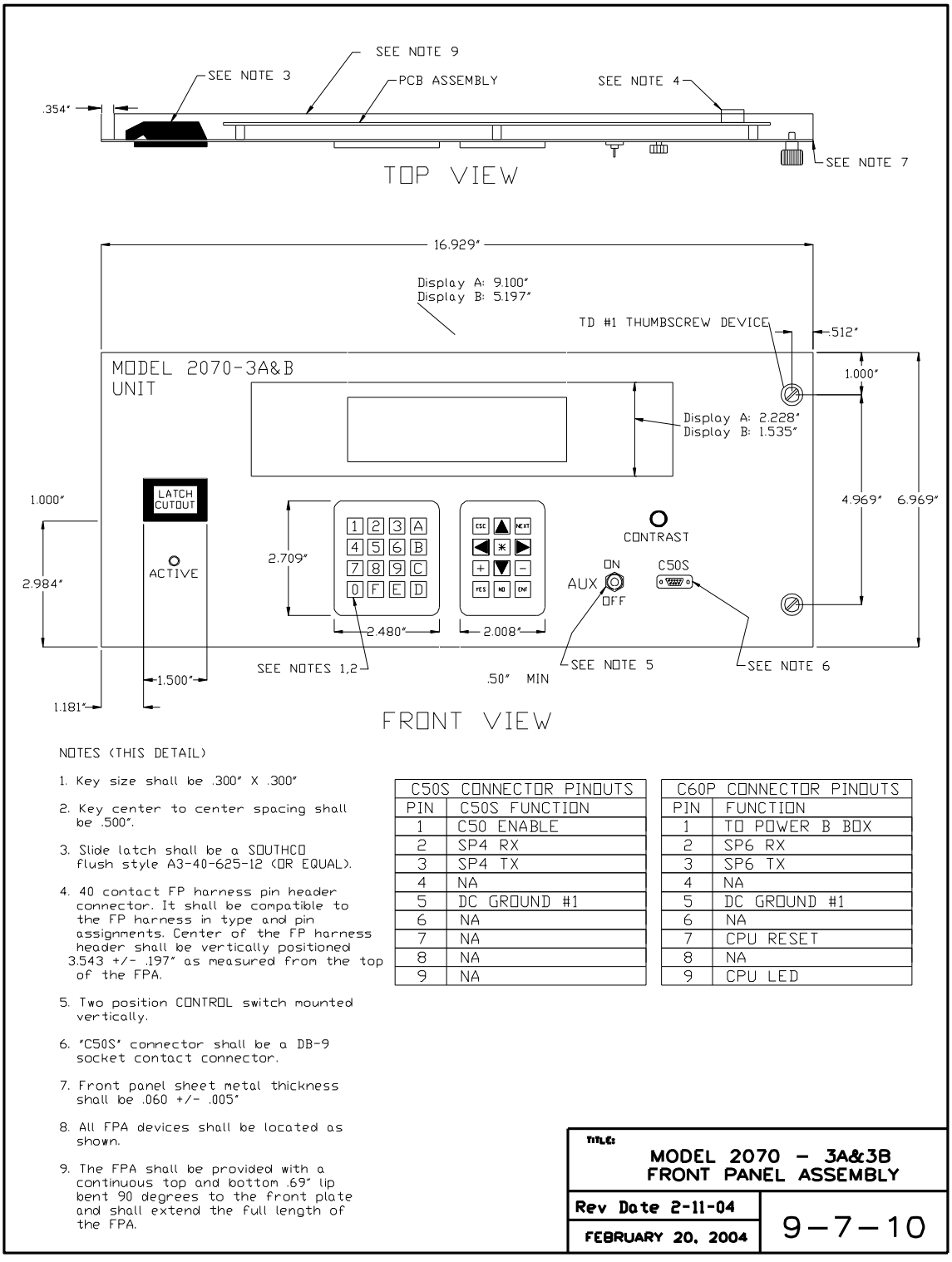
PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT
1	DC GROUND		27	O24	O4-1	53	I14	I2-7	79	I44	I6-5
2	O0	O1-1	28	O25	O4-2	54	I15	I2-8	80	I45	I6-6
3	O1	O1-2	29	O26	O4-3	55	I16	I3-1	81	I46	I6-7
4	O2	O1-3	30	O27	O4-4	56	I17	I3-2	82	I47	I6-8
5	O3	O1-4	31	O28	O4-5	57	I18	I3-3	83	O40	O6-1
6	O4	O1-5	32	O29	O4-6	58	I19	I3-4	84	O41	O6-2
7	O5	O1-6	33	O30	O4-7	59	I20	I3-5	85	O42	O6-3
8	O6	O1-7	34	O31	O4-8	60	I21	I3-6	86	O43	O6-4
9	O7	O1-8	35	O32	O5-1	61	I22	I3-7	87	O44	O6-5
10	O8	O2-1	36	O33	O5-2	62	I23	I3-8	88	O45	O6-6
11	O9	O2-2	37	O34	O5-3	63	I28	I4-5	89	O46	O6-7
12	O10	O2-3	38	O35	O5-4	64	I29	I4-6	90	O47	O6-8
13	O11	O2-4	39	I0	I1-1	65	I30	I4-7	91	O48	O7-1
14	DC GROUND		40	I1	I1-2	66	I31	I4-8	92	DC GROUND	
15	O12	O2-5	41	I2	I1-3	67	I32	I5-1	93	O49	O7-2
16	O13	O2-6	42	I3	I1-4	68	I33	I5-2	94	O50	O7-3
17	O14	O2-7	43	I4	I1-5	69	I34	I5-3	95	O51	O7-4
18	O15	O2-8	44	I5	I1-6	70	I35	I5-4	96	O52	O7-5
19	O16	O3-1	45	I6	I1-7	71	I36	I5-5	97	O53	O7-6
20	O17	O3-2	46	I7	I1-8	72	I37	I5-6	98	O54	O7-7
21	O18	O3-3	47	I8	I2-1	73	I38	I5-7	99	O55	O7-8
22	O19	O3-4	48	I9	I2-2	74	I39	I5-8	100	O36	O5-5
23	O20	O3-5	49	I10	I2-3	75	I40	I6-1	101	O37	O5-6
24	O21	O3-6	50	I11	I2-4	76	I41	I6-2	102	O38 DET RES	O5-7
25	O22	O3-7	51	I12	I2-5	77	I42	I6-3	103	O39 WDT	O5-8
26	O23	O3-8	52	I13	I2-6	78	I43	I6-4	104	DC GROUND	

C11S PIN ASSIGNMENT

PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT	PIN	FUNCTION NAME	FUNCTION PORT
1	O56	O8-1	11	I25	I4-2	21	I54	I7-7	31	DC GROUND	
2	O57	O8-2	12	I26	I4-3	22	I55	I7-8	32	NA	- - -
3	O58	O8-3	13	I27	I4-4	23	I56	I8-1	33	NA	- - -
4	O59	O8-4	14	DC GROUND		24	I57	I8-2	34	NA	- - -
5	O60	O8-5	15	I48	I7-1	25	I58	I8-3	35	NA	- - -
6	O61	O8-6	16	I49	I7-2	26	I59	I8-4	36	NA	- - -
7	O62	O8-7	17	I50	I7-3	27	I60	I8-5	37	DC GROUND	
8	O63	O8-8	18	I51	I7-4	28	I61	I8-6			
9	DC GROUND		19	I52	I7-5	29	I62	I8-7			
10	I24	I4-1	20	I53	I7-6	30	I63	I8-8			

TITLE: MODEL 2070-2A FIELD I/O MODULE C1 & C11 CONNECTORS	
Rev Date 2-11-04	9-7-9
FEBRUARY 20, 2004	

Figure 11
Field I/O Module, C1 & C11 Connectors



NOTES (THIS DETAIL)

1. Key size shall be .300" X .300"
2. Key center to center spacing shall be .500".
3. Slide latch shall be a SOUTHCO flush style A3-40-625-12 (OR EQUAL).
4. 40 contact FP harness pin header connector. It shall be compatible to the FP harness in type and pin assignments. Center of the FP harness header shall be vertically positioned 3.543 +/- .197" as measured from the top of the FPA.
5. Two position CONTROL switch mounted vertically.
6. "C50S" connector shall be a DB-9 socket contact connector.
7. Front panel sheet metal thickness shall be .060 +/- .005"
8. All FPA devices shall be located as shown.
9. The FPA shall be provided with a continuous top and bottom .69" lip bent 90 degrees to the front plate and shall extend the full length of the FPA.

C50S CONNECTOR PINOUTS	
PIN	C50S FUNCTION
1	C50 ENABLE
2	SP4 RX
3	SP4 TX
4	NA
5	DC GROUND #1
6	NA
7	NA
8	NA
9	NA

C60P CONNECTOR PINOUTS	
PIN	FUNCTION
1	TO POWER B BOX
2	SP6 RX
3	SP6 TX
4	NA
5	DC GROUND #1
6	NA
7	CPU RESET
8	NA
9	CPU LED

TITLE:
MODEL 2070 - 3A&3B
FRONT PANEL ASSEMBLY

Rev Date 2-11-04
FEBRUARY 20, 2004

9-7-10

Figure 12
Front Panel Assembly

MODEL 2070-3 AUX SWITCH CODES		
SWITCH POSITION	ASCII DATA (TEXT)	ASCII DATA (HEX)
ON	ESC O T	1B 4F 54
OFF	ESC O U	1B 4F 55

MODEL 2070-3 KEY CODES		
KEY	ASCII DATA (TEXT)	ASCII DATA (HEX)
0	0	30
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
A	A	41
B	B	42
C	C	43
D	D	44
E	E	45
F	F	46
(UP ARROW)	ESC [A	1B 5B 41
(DOWN ARROW)	ESC [B	1B 5B 42
(RIGHT ARROW)	ESC [C	1B 5B 43
(LEFT ARROW)	ESC [D	1B 5B 44
ESC	ESC O S	1B 4F 53
NEXT	ESC O P	1B 4F 50
YES	ESC O Q	1B 4F 51
NO	ESC O R	1B 4F 52
*	*	2A
+	+	2B
-	-	2D
ENTER	CR	0D

TITLE:	MODEL 2070-3 FRONT PANEL ASSEMBLY KEY CODES
Rev Date 2-11-04 FEBRUARY 20, 2004	9-7-11

Figure 13
Front Panel Assembly Key Codes

CONFIGURATION COMMAND CODES

ASCII REPRESENTATION	HEX VALUE	FUNCTION
HT	09	Move cursor to next tab stop
CR	0D	Position cursor at first position on current line
LF	0A	(Line Feed) Move cursor down one line
BS	08	(Backspace) Move cursor one position to the left and write space
ESC [Py ; Px f	1B 5B Py 3B Px 66	Position cursor at (Px, Py)
ESC [Pn C	1B 5B Pn 43	Position cursor Pn positions to right
ESC [Pn D	1B 5B Pn 44	Position cursor Pn positions to left
ESC [Pn A	1B 5B Pn 41	Position cursor Pn positions up
ESC [Pn B	1B 5B Pn 42	Position cursor Pn positions down
ESC [H	1B 5B 48	Home cursor (move to 1,1)
ESC [2 J	1B 5B 32 4A	Clear screen with spaces without moving cursor
ESC c	1B 63	Soft reset
ESC P P1 [Pn ; Pn...f	1B 50 P1 5B Pn 3B...Pn 66	Compose special character number Pn (1-8) at current cursor position
ESC [< Pn V	1B 5B 3C Pn 56	Display special character number Pn (1-8) at current cursor position
ESC [25 h	1B 5B 32 35 68	Turn Character blink on
ESC [25 l	1B 5B 32 35 6C	Turn character blink off
ESC [< 5 h	1B 5B 3C 35 68	Illuminate Backlight
ESC [< 5 l	1B 3B 3C 35 6C	Extinguish Backlight
ESC [33 h	1B 5B 33 33 68	Cursor blink on
ESC [33 l	1B 5B 33 33 6C	Cursor blink off
ESC [27 h	1B 5B 32 37 68	Reverse video on -Note 2
ESC [27 l	1B 5B 32 37 6C	Reverse video off -Note 2
ESC [24 h	1B 5B 32 34 68	Underline on -Note 2
ESC [24 l	1B 5B 32 34 6C	Underline off -Note 2
ESC [0 m	1B 5B 30 6D	All attributes off
ESC H	1B 48	Set tab stop at current cursor position
ESC [Pn g	1B 5B Pn 67	Clear tab stop Pn = 0,1,2 at cursor = 3 all tab stops
ESC [? 7 h	1B 5B 3F 37 68	Auto-wrap on
ESC [? 7 l	1B 5B 3F 37 6C	Auto-wrap off
ESC [? 8 h	1B 5B 3F 38 68	Auto-repeat on
ESC [? 8 l	1B 5B 3F 38 6C	Auto-repeat off
ESC [? 25 h	1B 5B 3F 32 35 68	Cursor on
ESC [? 25 l	1B 5B 3F 32 35 6C	Cursor off
ESC [< 47 h	1B 5B 3C 34 37 68	Auto-scroll on
ESC [< 47 l	1B 5B 3C 34 37 6C	Auto-scroll off
ESC [< Pn S	1B 5B 3C Pn 53	Set Backlight timeout value to Pn (0-63)
ESC [PU	1B 5B 50 55	String sent to CPU when FPA power up

NOTE: 1. Numerical values have one ASCII character per digit without leading zero.
2. Reverse Video & Underline NOT required for Front Panel Assembly Option 3A & B.
Commends shall be available for option 3C (C60).

INQUIRY COMMAND-RESPONSE CODES

COMMAND CPU Module to Front Panel Module		RESPONSE Front Panel Module to CPU Module		FUNCTION
ASCII Representation	HEX Value	ASCII Representation	HEX Value	
ESC [6 n	1B 5B 36 6E	ESC [Py; Px R	1B 5B Py 3B Px 52	Inquire Cursor Position
ESC [B n	1B 5B 42 6E	ESC [P1;P2;.....P6 R	1B 5B P1 3B P2 3B....P6 52	Status Cursor Position P1: Auto-wrap (h,l) P2: Auto-scroll (h,l) P3: Auto-repeat (h,l) P4: Backlight (h,l) P5: Backlight timeout P6: AUX Switch (h,l)
ESC [A n	1B 5B 41 6E	ESC [P1 R	1B 5B P1 52	P1: AUX Switch (h,l)

TITLE: MODEL 2070-3 FRONT PANEL ASSEMBLY KEY CODES	
Rev Date 2-11-04	9-7-12
FEBRUARY 20, 2004	

Figure 14
Front Panel Assembly Key Codes

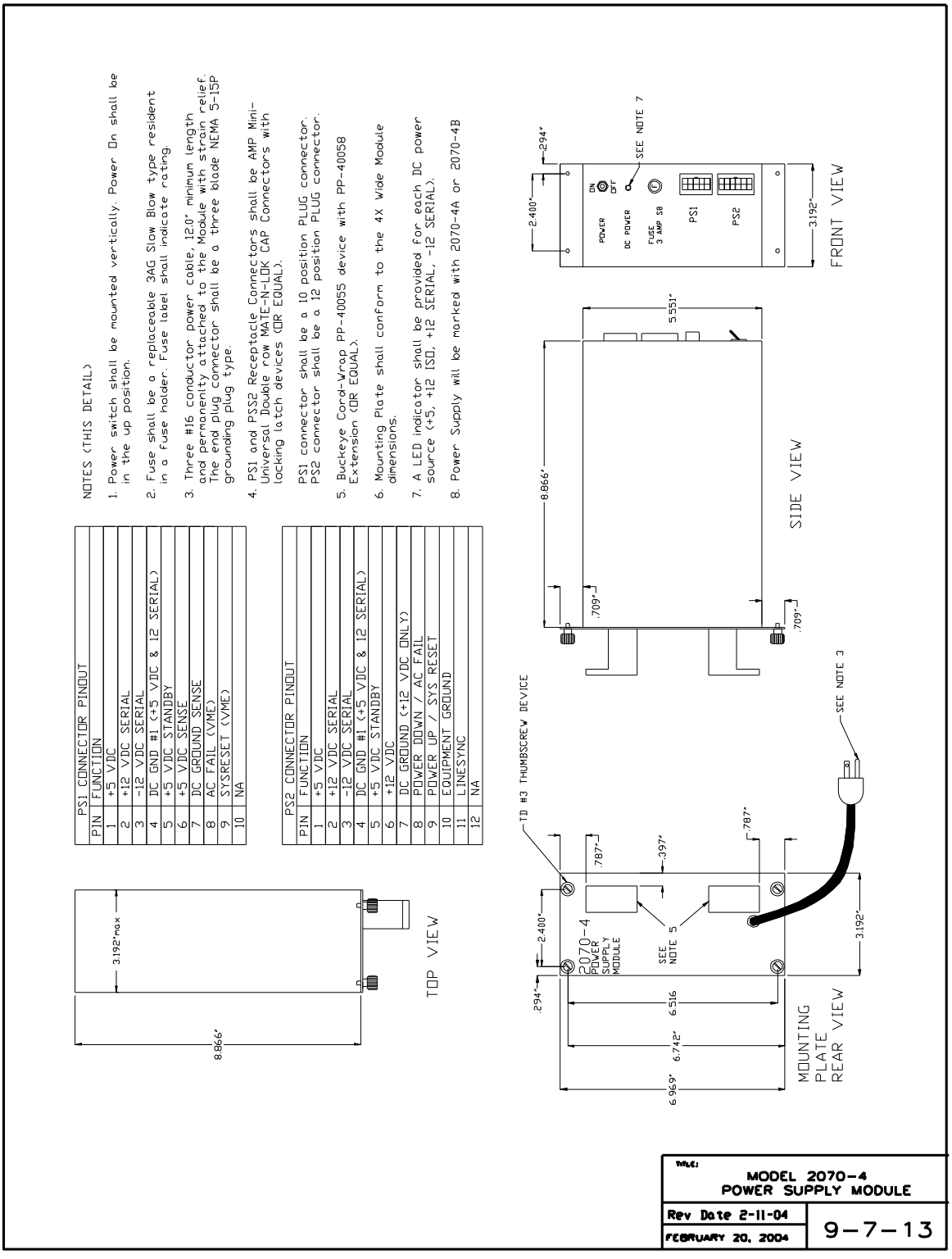
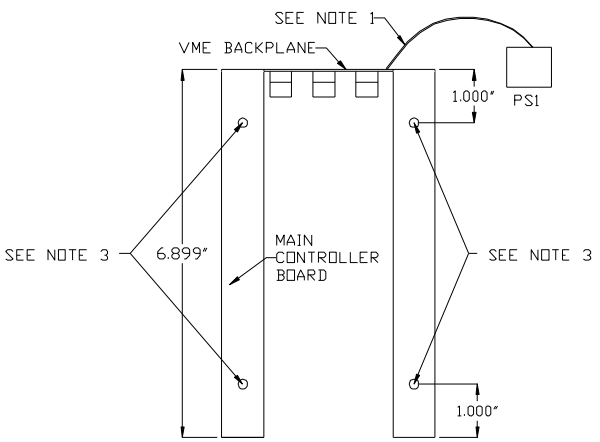
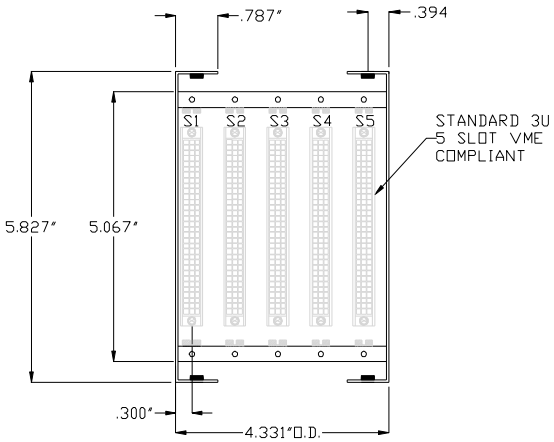


Figure 15
Power Supply Module



TOP VIEW

PS1 CONNECTOR PIN ASSIGNMENT	
PIN	FUNCTION
1	+5 VDC
2	+12 VDC SERIAL
3	-12 VDC SERIAL
4	DC GND #1 (+5 VDC & 12 SERIAL)
5	+5 VDC STANDBY
6	+5 VDC SENSE
7	DC GROUND SENSE
8	AC FAIL (VME)
9	SYSRESET (VME)
10	NA



FRONT VIEW

NOTES (THIS DETAIL)

1. PS1 Harness interfaces between the Model 2070-4 Power Supply Module and the 2070-5 VME Cage Assembly. The harness shall be permanently attached to the Cage Assembly by solder, FASTON or Power Bugs. The Harness wiring shall be 8 #18 conductors for power and 2 #22 conductors for others.

2. The plate shall cover the open area & attach to the Chassis Backplane mounting surface via screws meeting the Chapter 1 external screw requirements. The screws shall mate with the PEM nuts as specified in the Model 2070 Chassis Top View Detail.

3. G-32 PEM Self-clinching Miniature Fasteners (OR EQUAL) shall be used for mounting holes to match the 6-32 screws on the top and bottom of the Model 2070 chassis.

TITLE: MODEL 2070-5 VME CAGE ASSEMBLY	
Rev Date 2-11-04	9-7-14
FEBRUARY 20, 2004	

Figure 16
VME Cage Assembly

11. Type 2070 Peripheral Equipment.

A. General Notes.

1. The 2070-6x and 2070-7x modules must provide circuitry to disable its Channel 2 and EIA-232 control lines (TX, RX, RTS, CTS, and DCD) when a ground true state is present at Connector A1, Pin B21 (C50 Enable). The disable lines must be pulled up on this module.

2. Line drivers/receivers must be socket mounted or surface mounted.

3. Isolation circuitry must be opto- or capacitive-coupled isolation technologies. Each module's circuit must be capable of reliably passing a minimum of 1.0 megabits per second.

4. The Comm modules must be "Hot" swappable without damage to circuitry or operations.

B. Type 2070-6 A & B Async/ Modem Serial Comm Modules

1. Power Requirements. A fused isolated +5 VDC with a minimum of 100 milliamperes power supply must be provided for external use.

Option – Bourns MF – MSMD020 PTC (Positive Temperature Coefficient) Resettable Fuse, or approved equal, allowed.

2. Logic Switches. Two LOGIC switches per circuit must be provided (faceplate mounted).

a. One logic switch must be used to vertically switch between Half-Duplex (Down) and Full-Duplex (Up). In Half-Duplex mode, the Transmit connections must be used for both Receive and Transmit.

b. A MODEM Enable switch must be provided such that when in the UP Position must enable MODEM and disable MODEM in the DOWN Position.

3. Circuitry. Two circuits, designated CIRCUIT #1 and CIRCUIT #2, must be provided. Both circuit functions must be identical, except for their Serial Communications Port and external connector (CIRCUIT #1 to SP1 [or SP3] and C2S Connector and CIRCUIT #2 to SP2 [or SP4] and C20S Connector). The Circuits must convert the 2070 UNIT Motherboard SP EIA-485 signals to/from board TTL level signals, isolate and drive the converted EIA-232 Signals interfacing with their associated MODEM and external connector.

a. Modem Requirements. Each CIRCUIT must have a MODEM with the following requirements:

(1) Data Rate: Baud modulation of 300 to 1200 for Module 2070-6A and 0 to 9600 for Module 2070-6B.

(2) Modulation: Phase coherent frequency shift keying (FSK).

(3) Data Format: Asynchronous, serial by bit.

(4) Line & Signal Requirements: Type 3002 voice-grade, unconditioned Tone Carrier Frequencies (Transmit and Receive):2070-6A - 1.2 KHz MARK and 2.2 KHz SPACE, +/-1% tolerance. 2070-6B - 11.2 KHz MARK and 17.6 KHz SPACE, +/-1% tolerance. The operating band must be (half power, -3 dB) between 1.0 KHz & 2.4 KHz for 2070-6A and 9.9 KHz & 18.9 KHz for 2070-6B.

(5) Transmitting Output Signal Level: 0, -2, -4, -6, and -8 dB (at 1.7 KHz for 2070-6A & 14.7 KHz for 2070-6B) continuous or switch selectable.

(6) Receiver Input Sensitivity: 0 to -40 dB.

(7) Receiver Bandpass Filter: Must meet the error rate requirement specified below and provide 20 dB/octave, minimum active attenuation for all frequencies outside the operating band.

(8) Clear-to-Send (CTS) Delay: 11 +/-3 milliseconds.

(9) Receive Line Signal Detect Time: 8 +/-2 milliseconds mark frequency.

(10) Receive Line Squelch: 6.5 (+/-1) milliseconds, 0 milliseconds (OUT).

(11) Soft Carrier Turn Off Time: 10 +/-2 milliseconds (0.9 kilohertz for 2070-6A and 7.8 kilohertz for 2070-6B). When the RTS is unasserted, the carrier must turn off or go to soft carrier frequency.

(12) Modem Recovery Time: Capable of receiving data within 22 milliseconds after completion of transmission.

(13) Error Rate: Must not exceed 1 bit in 100 kilobits, with a signal-to-noise ratio of 16 dB measured with flat-weight over a 300 to 3,000 Hertz band.

(14) Transmit Noise: Less than -50 dB across 600-ohms resistive load within the frequency spectrum of 300 to 3,000 Hertz at maximum output.

(15) Modem interface: EIA-232 Standards.

4. Control Switch. A CONTROL switch must be provided on the module front panel to turn ON (Up) / OFF (Down) all module power.

C. Type 2070-7A & 7B Async Serial Comm Module

1. Circuitry. Two circuits, designated CIRCUIT #1 and CIRCUIT #2, must be provided. Their functions are identical, except for the CPU Serial Communications Port and external connector (CIRCUIT #1 to SP1 [or SP3] and Connector C21S and CIRCUIT #2 to SP2 [or SP4] and Connector C22S).

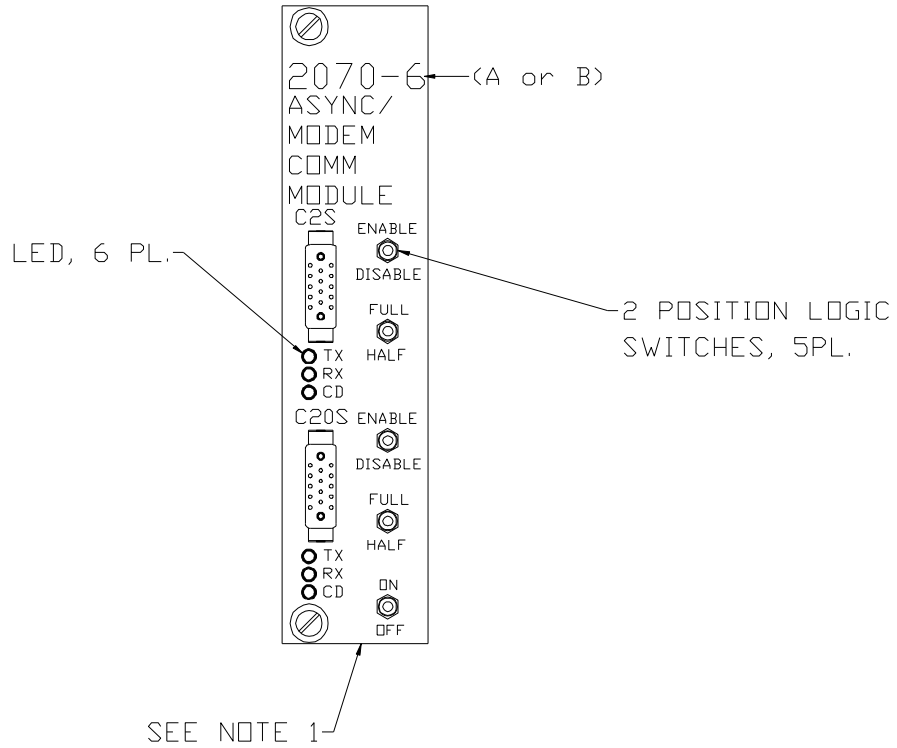
2. 2070-7A. Each circuit must convert its EIA-485 signal lines (RX, TX, RTS, CTS and DCD) to / from board TTL Level Signals; isolate both signal and ground; and drive / receive external EIA-232 devices via C21 / C22 Connectors. Connectors must be DB-9S type.

3. 2070-7B. Each circuit EIA -485 signal lines, (RX, TX, TXC (I), TXC (O) and RXC) and associated signal ground must be board terminated to matching drivers/receivers; isolated both signal and ground, and drive/receiver external EIA-485 devices via C21/C22 Connectors. Connectors must be DB-15S type.

4. Indicators. Each circuit signal TX and RX line must have an LED Indicator mounted on the front plate and labeled to function.

D. Details.

Table of Contents



C2 & C20 CONNECTOR PINOUT			
PIN	FUNCTION	PIN	FUNCTION
A	AUDIO IN	J	RTS
B	AUDIO IN	K	DATA IN
C	AUDIO OUT	L	DATA OUT
D	ISO +5 VDC	M	CTS
E	AUDIO OUT	N	ISO DC GND
F	NA	P	NA
H	CD	R	NA

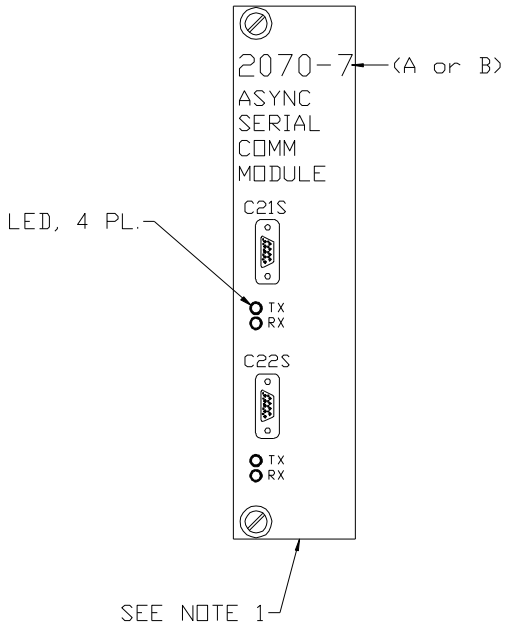
NOTES (THIS DETAIL)

1. 2X Faceplate
(See 2070 System
PCB Module, Detail 9-7-6).

2. Connectors C2S & C20S shall
be mounted on the front plate
and shall be M14 AMP with
Spring Latch supports or
equal.

TITLE: MODEL 2070-6A, 6B ASYNC/MODEM SERIAL COMM MODULE	
Rev Date 2-11-04	10-5-1
FEBRUARY 20, 2004	

Figure 17
Async/Modem Serial Comm Module



2070-7A (DB-9S)	
C21 & C22 CONNECTOR PINOUT	
PIN	FUNCTION
1	DCD
2	RXD
3	TXD
4	NA
5	ISO DC GND
6	NA
7	RTS
8	CTS
9	NA

2070-7B (DB-15S)			
C21 & C22 CONNECTOR PINOUT			
PIN	FUNCTION	PIN	FUNCTION
1	TX DATA +	9	TX DATA -
2	ISO DC GND	10	ISO DC GND
3	TX CLOCK +	11	TX CLOCK -
4	ISO DC GND	12	ISO DC GND
5	RX DATA +	13	RX DATA -
6	ISO DC GND	14	ISO DC GND
7	RX CLOCK +	15	RX CLOCK -
8	NA		

NOTES (THIS DETAIL)

1. 2X Faceplate (See 2070 System PCB Module, Detail 9-7-6).

2. Connectors 21 & 22 are DB 9S for Module 7A & DB 15S for Module 7B.

TITLE: MODEL 2070-7A, 7B ASYNC / SYNC SERIAL COMM MODULE	
Rev Date 2-11-04	10-5-2
FEBRUARY 20, 2004	

Figure 18
Serial Comm Module

12. NEMA Module.

A. Type 2070N Controller Unit.

General. This section covers two versions of Type 2070 / NEMA Standard Controller Units. The versions associate with NEMA TS1 and NEMA TS2 Type 1 Standards as described in 3. General Requirements B.

1. Serial Port 5 Frame Address. The Serial Port 5 Frame Address for 2070-2N and 2070-8 must be "20".

B. 2070-2N Field I/O Module.

1. Interfaces. The 2070-2N Field I/O Module provides a TS2-1 compatible SDLC interface via 2070 Serial Port 3, AC Power to the 2070 Unit and Fault Monitor Logic Output via 2070 Serial Port 5 and Output Frame Byte 9 Bit 6 to the NEMA TS2 Cabinet Monitor Unit (CMU).

2. Type 2070-2N Module Requirements. The Module must meet the 2070–2A Module Requirements with the following exceptions:

No C1, C11 and C12 Connectors on the front panel of the module
No 64 inputs / 64 outputs requirements
Serial Port 5 routed to the FCU MPU Device only
Serial Port 3 must not have a disabling switch

3. Physical. The module must be a 4X type board / front panel with three connectors. The connectors are 10 Pin Connector A, a NEMA 5-15 Receptacle and a 15 Pin DB 15S C14 Connector.

4. Power. Incoming 2070 AC Power is derived from Connector A Pin C (AC+), Pin A (AC-), and Pin H (Equipment Ground). The power is directly routed to the NEMA 5-15 Receptacle. Connector A must intermate with a NEMA TS2 Type 1 (MS3106O-18-1S) cable.

5. Serial Port 3 Isolation. The module must isolate 2070 Serial Port 3 from the A3 Connector and reconvert the lines to external EIA 485 drivers/receivers that must be terminated at C14 Connector. The Port must be clocked at 153.6 kilobits per second.

6. FCU Output. An FCU output must drive an open collector transistor whose output must be routed to Connector A Pin F for use as a FAULT MONITOR Output. The transistor must be capable of sinking 200 milliamperes at 30 VDC.

7. Connector Pin Assignments. Connectors A and C14 pin out and functions are as follows:

Connector A

Pin	Function	Pin	Function	Pin	Function
A	AC Neutral	E	NA	I	NA
B	NA	F	Fault Monitor J	NA	
C	AC Line	G	DC#2 Ground		
D	NA	H	Equip Ground		

Connector C14S

Pin	Function	Pin	Function	Pin	Function
1	TX Data+	6	DC Ground	11	TX Clock -
2	DC Ground	7	RX Clock +	12	Equip Ground
3	TX Clock+	8	DC Ground	13	RX Data -
4	DC Ground	9	TX Data -	14	NA
5	RX Data+	10	NA	15	RX Clock –

8. TS2 BIU Control. Serial Port 3 must control the TS2 BIU Units using SDLC Protocol that meets the NEMA TS2 Type 1 Frame Command / Response Standards.

C. 2070-4N (A or B) POWER SUPPLY MODULE.

1. Requirements. The 2070-4N Power Supply Module supports the NEMA TS1 and TS2 Standards. The module is identical to the 2070-4N (A and B) Power Supply Requirements except for the following:

a. The power cord must have a 15 in. +/- 1 in. length as measured from the panel to the plug tips.

b. The AC Power Fail voltage must be 85VAC +/-2VAC.

c. The AC Power Restore voltage must be 90VAC +/-2VAC.

d. The 2070-4N (A or B) power supply must have proper marking Example "2070 4N (A or B)". A permanent sticker is an acceptable marking method.

D. Type 2070- 8 Field I/O Module.

1. Type 2070-8 Field I/O Module. The Module consists of the Module Chassis, Module Power Supply, FCU Controller, Parallel Input/Output Ports, Serial Communications Circuits and Module Connectors. The Module CHASSIS must be made of 0.06-inch minimum aluminum sheet and treated with clear chromate.

All external screws, except where called out, to be countersunk and be Phillips flat head stainless steel. The matching nuts must be permanently captive on the mating surfaces.

2. Module Front Panel. The MODULE FRONT PANEL must be furnished with the following:

a. ON/OFF POWER Switch mounted vertically with ON in the UP position.

b. 2. LED DC Power Indicator. The indicator must indicate that the required + 5 VDC is within 5% and the +24 VDC is within 8%.

c. Incoming VAC fuse protection.

d. Two DB-25S COMM connectors labeled "EX1" & "EX2."

e. Four NEMA Connectors A, B, C, & D.

3. Label. A permanent LABEL must be affixed to the Front Panel. The label must display the unit's serial number. The number must be permanent and easy to read.

4. Module Power Supply. A MODULE POWER SUPPLY must be provided and located on the right side of the module as viewed from the front. The supply must provide the necessary module internal circuitry DC power plus 2.0 Amperes minimum of +24 VDC for external logic, detector inputs, and output load control. The supply must meet the following requirements:

a. Input Protection (See 10.E.3.).

b. Power Supply Requirements (See 10.E.6.).

c. DC Voltage Tolerances. DC Voltage tolerances must be +/-3%.

5. Incoming AC Power. The supplied INCOMING AC POWER must be derived from Connector A Pins "p" (AC+) and "U" (AC Neutral). External +24 VDC must be at Connector A, Pin "B" and Connector D Pin "NN." AC Power for the 2070 receptacle must be tapped off from the secondary side of the ON Switch / Fuse configuration.

6. Module PC Boards. A MODULE PC Boards must be mounted vertically.

7. Power Down, NRESET, and LINESYNC. Power Down, NRESET, and LINESYNC must be routed to the module via C12 Connector. The state of the module output ports at the time of Power Down transition to LOW State and until NRESET goes HIGH must be an open circuit.

8. Compliance with Type 2070-2 Field I/O Requirements. The Module must meet all requirements under 10.C. with the following exceptions:

a. Parallel Ports. Parallel Ports, consisting of 118 Bits of Input and 102 bits of Output, must be provided. Specification for inputs applies except the voltage is +24 in lieu of +12 and Ground False, "0," exceeds 16.0 VDC. LINESYNC signal is incoming in differential logic.

b. Serial Communication Circuitry. The module must interface with the 2070-2B Field I/O module via HAR 1 Harness meeting EIA-485 Requirements. All signal lines must be isolated. HAR 1 Harness must be 17 lines minimum with a C12P Connector on one end and soldered with strain relief on the other. In addition to the Controller interface, the EIA-485 Signal lines must be routed to EX1 Connector. All necessary driver/receiver and isolation circuitry must be provided.

9. EIA-232 Serial Port. An EIA-232 Serial Port must be provided with rate selection by jumper of 0.3, 1.2, 2.4, 4.8, 9.6, 19.2, & 38.4 kilobits per second asynchronous and be connected at EX1 Connector.

10. HAR 2 Harness. A 22-line minimum HAR 2 Harness must be provided between EX2 Connector and Model 2070-6 Serial COMM Module in the Type 2070 UNIT. This provides two Modems or EIA-232 Interfaces with the 2070 UNIT and the outside world.

11. Fault and Voltage Monitor. FAULT and VOLTAGE MONITOR circuitry – NEMA TS1 Controller FAULT and VOLTAGE MONITOR functions (outputs to cabinet monitor) must be provided.

a. Two 3-input OR gates must be provided. The gate 1 output must be connected to Connector A, Pin A (FAULT MONITOR) and gate 2 output must be connected to Connector A, Pin C. Any FALSE state input must cause a gate output FALSE (+24VDC) state.

b. The FCU Port 10, Bit 7 output must normally change its state every 100 milliseconds. A MODULE Watchdog (WDT) circuit must monitor the output. No state change for 2 +/-0.1 seconds must cause the circuit output to generate a FALSE (+24 VDC) output (input to gates 1 and 2). Should the FCU begin changing state, the WDT output must return to TRUE (0 VDC) state.

c. The module must have a +5 VDC monitoring circuit that monitors the module‘s +5 VDC (+/-0.25). If the voltage exceeds the limits, the circuit output must generate a FALSE output (input to gates 1 and 2). Normal operation must return the output state to TRUE state.

d. The FCU microprocessor output must be assigned to FAULT Monitor (input to gate 1) and another output must be assigned to VOLTAGE Monitor (input to gate 2).

e. CPU Port 5 SET OUTPUT COMMAND Message OUTPUTs O78 and O79 must be assigned to FAULT (O78) and VOLTAGE (O79). The bit logic state “1” must be FCU output FALSE.

f. CPU / FCU operation at POWER UP must be as follows:

(1) FCU Comm Loss Flag set. FAULT and VOLTAGE MONITOR outputs set to FALSE state.

(2) CPU REQUEST MODULE STATUS COMMAND Message with ~~"E"~~ bit set is sent to FCU to clear Comm Loss Flag and responds to CPU with "E" bit reset.

(3) Before the Comm Loss timer expires, the SET OUTPUT COMMAND data must be sent. In that data, the 078 and 079 logically set to "0" will cause the FCU microprocessor port pins assigned for FM and VM outputs to go to their TRUE state. At this point, the signal outputs defined in the message will be permitted at the output connectors. Any number of other messages may be sent between the MODULE STATUS COMMAND and SET OUTPUTS COMMAND.

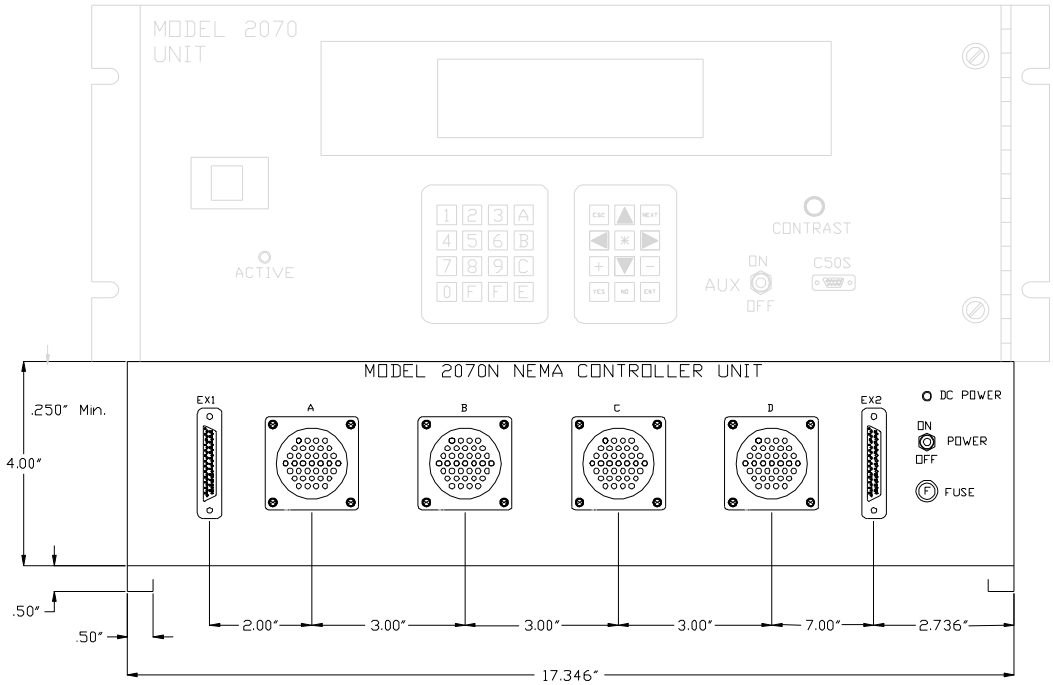
(4) If the above message sequence is not followed, Comm Loss Flag must be set (or remain) and VM & FM must retain the FALSE output state.

(5) Performs items 2 & 3 above User Software.

g. A CPU / FCU Communications Loss during normal operation must cause all outputs to go blank (FALSE state) and must set the Comm Loss Flag. FM and VM outputs must be in FALSE state.

E. Details.

Table of Contents



NOTES (THIS DETAIL)

1. The Model 2070 Controller Unit is shown only for refernce.

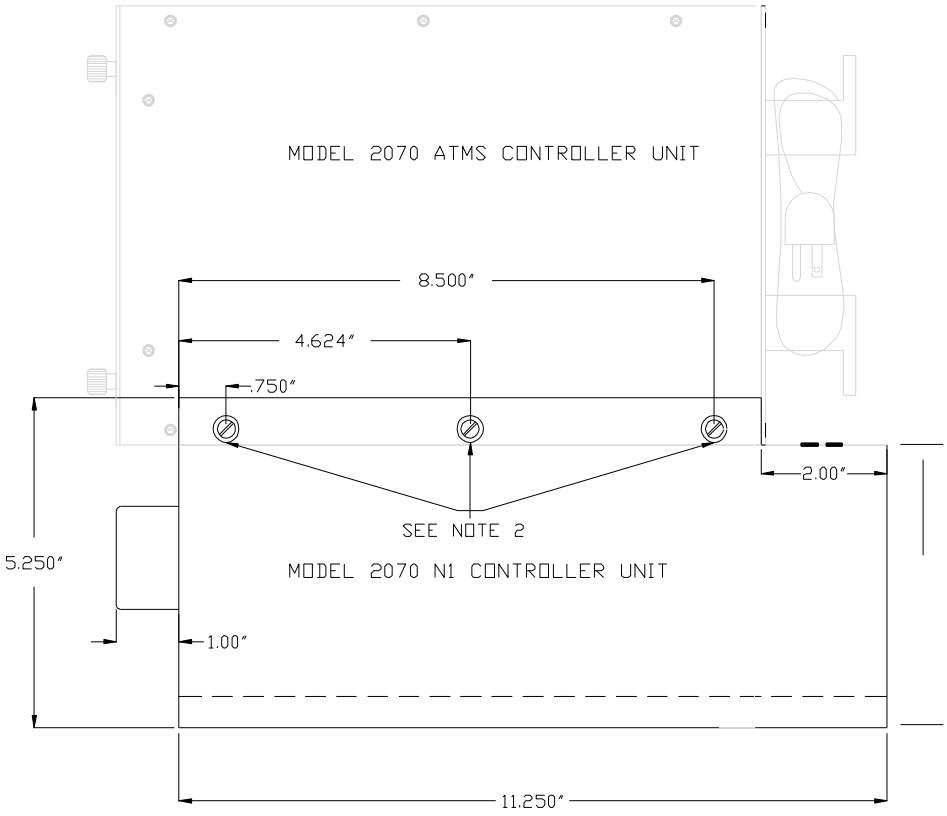
2. The bottom supports shall be double flanged.

3. A = Connector A (MS-3112-22-55P Type)
   B = Connector B (MS-3112-22-55S Type)
   C = Connector C (MS-3112-24-61S Type)
   D = Connector D (MS-3112-24-61P Type)
   EX1 = Connector EX1 (DB-25S Type)
   EX2 = Connector EX2 (DB-25S Type)

4. 2.286 mm wide spacers shall be provided between the inside wall of the 2070-8 Module and the 2070 unit (each side).

TITLE:	2070 (V or L) N1 CONTROLLER UNIT FRONT VIEW
Rev Date 2-11-04	11–5–1
FEBRUARY 20, 2004	

Figure 19
Front View

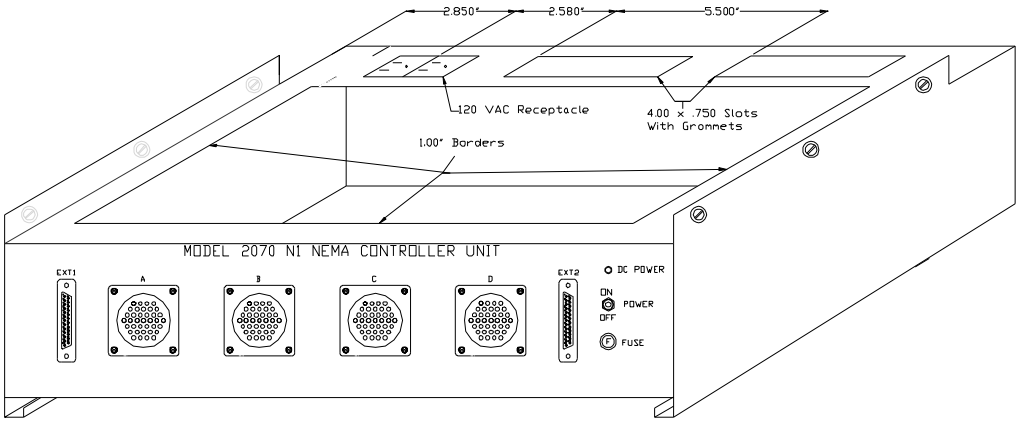


NOTES (THIS DETAIL)

1. The Model 2070 Controller Unit is shown only for reference.
2. TDS #3 Thumbscrew Devices. Module shall provide mating nuts permanently mounted on the module

TITLE: 2070 N1 CONTROLLER UNIT SIDE VIEW	
Rev Date 2-11-04	11-5-2
FEBRUARY 20, 2004	

Figure 20
Side View



NOTES (THIS DETAIL)
1. The module housing bottom shall be slot vented. The top shall be open.

TITLE: 2070 N1 CONTROLLER UNIT ISO VIEW	
Rev Date 2-11-04	11–5–3
FEBRUARY 20, 2004	

Figure 21
Isometric View

CONFIGURATION COMMAND CODES

ASCII REPRESENTATION	HEX VALUE	FUNCTION
HT	09	Move cursor to next tab stop
CR	0D	Position cursor at first position on current line
LF	0A	(Line Feed) Move cursor down one line
BS	08	(Backspace) Move cursor one position to the left and write space
ESC [Py ; Px f	1B 5B Py 3B Px 66	Position cursor at (Px, Py)
ESC [Pn C	1B 5B Pn 43	Position cursor Pn positions to right
ESC [Pn D	1B 5B Pn 44	Position cursor Pn positions to left
ESC [Pn A	1B 5B Pn 41	Position cursor Pn positions up
ESC [Pn B	1B 5B Pn 42	Position cursor Pn positions down
ESC [H	1B 5B 48	Home cursor (move to 1,1)
ESC [2 J	1B 5B 32 4A	Clear screen with spaces without moving cursor
ESC c	1B 63	Soft reset
ESC P P1 [Pn ; Pn...f	1B 50 P1 5B Pn 3B...Pn 66	Compose special character number Pn (1-8) at current cursor position
ESC [< Pn V	1B 5B 3C Pn 56	Display special character number Pn (1-8) at current cursor position
ESC [25 h	1B 5B 32 35 68	Turn Character blink on
ESC [25 l	1B 5B 32 35 6C	Turn character blink off
ESC [< 5 h	1B 5B 3C 35 68	Illuminate Backlight
ESC [< 5 l	1B 3B 3C 35 6C	Extinguish Backlight
ESC [33 h	1B 5B 33 33 68	Cursor blink on
ESC [33 l	1B 5B 33 33 6C	Cursor blink off
ESC [27 h	1B 5B 32 37 68	Reverse video on -Note 2
ESC [27 l	1B 5B 32 37 6C	Reverse video off -Note 2
ESC [24 h	1B 5B 32 34 68	Underline on -Note 2
ESC [24 l	1B 5B 32 34 6C	Underline off -Note 2
ESC [0 m	1B 5B 30 6D	All attributes off
ESC H	1B 48	Set tab stop at current cursor position
ESC [Pn g	1B 5B Pn 67	Clear tab stop Pn = 0,1,2 at cursor = 3 all tab stops
ESC [? 7 h	1B 5B 3F 37 68	Auto-wrap on
ESC [? 7 l	1B 5B 3F 37 6C	Auto-wrap off
ESC [? 8 h	1B 5B 3F 38 68	Auto-repeat on
ESC [? 8 l	1B 5B 3F 38 6C	Auto-repeat off
ESC [? 25 h	1B 5B 3F 32 35 68	Cursor on
ESC [? 25 l	1B 5B 3F 32 35 6C	Cursor off
ESC [< 47 h	1B 5B 3C 34 37 68	Auto-scroll on
ESC [< 47 l	1B 5B 3C 34 37 6C	Auto-scroll off
ESC [< Pn S	1B 5B 3C Pn 53	Set Backlight timeout value to Pn (0-63)
ESC [PU	1B 5B 50 55	String sent to CPU when FPA power up

NOTE: 1. Numerical values have one ASCII character per digit without leading zero.
2. Reverse Video & Underline NOT required for Front Panel Assembly Option 3A & B. Commends shall be available for option 3C (C60).

INQUIRY COMMAND-RESPONSE CODES

COMMAND CPU Module to Front Panel Module		RESPONSE Front Panel Module to CPU Module		FUNCTION
ASCII Representation	HEX Value	ASCII Representation	HEX Value	
ESC [6 n	1B 5B 36 6E	ESC [Py; Px R	1B 5B Py 3B Px 52	Inquire Cursor Position
ESC [B n	1B 5B 42 6E	ESC [P1;P2;....P6 R	1B 5B P1 3B P2 3B....P6 52	Status Cursor Position P1: Auto-wrap (h,l) P2: Auto-scroll (h,l) P3: Auto-repeat (h,l) P4: Backlight (h,l) P5: Backlight timeout P6: AUX Switch (h,l)
ESC [A n	1B 5B 41 6E	ESC [P1 R	1B 5B P1 52	P1: AUX Switch (h,l)

TITLE: 2070-8 FIELD I/O MODULE CONNECTORS A & B	
Rev Date 2-11-04	11-5-4
FEBRUARY 20, 2004	

Figure 22
2070-8 Field I/O Module, Connectors A & B

	CONNECTOR C			CONNECTOR D		
PIN	FUNCTION	I/O	PORT-BIT	FUNCTION	I/O	PORT-BIT
A	Coded Status Bit A (Ring 2)	Out	12-4	Detector 9	In	10-1
B	Coded Status Bit B (Ring 2)	Out	12-5	Detector 10	In	10-2
C	Phase 8 Don't Walk	Out	4-8	Detector 11	In	10-3
D	Phase 8 Red	Out	1-8	Detector 12	In	10-4
E	Phase 7 Yellow	Out	2-7	Detector 13	In	10-5
F	Phase 7 Red	Out	1-7	Detector 14	In	10-6
G	Phase 6 Red	Out	1-6	Detector 15	In	10-7
H	Phase 5 Red	Out	1-5	Detector 16	In	10-8
J	Phase 5 Yellow	Out	2-5	Detector 17	In	11-1
K	Phase 5 Ped Clear	Out	5-5	Detector 18	In	11-2
L	Phase 5 Don't Walk	Out	4-5	Detector 19	In	11-3
M	Phase 5 Next	Out	8-5	Detector 20	In	11-4
N	Phase 5 On	Out	9-5	Detector 21	In	11-5
P	Phase 5 Vehicle Detector	In	1-5	Detector 22	In	11-6
R	Phase 5 Pedestrian Detector	In	2-5	Detector 23	In	11-7
S	Phase 6 Vehicle Detector	In	1-6	Detector 24	In	11-8
T	Phase 6 Pedestrian Detector	In	2-6	Clock Update	In	12-1
U	Phase 7 Pedestrian Detector	In	2-7	Hardware Control	In	12-2
V	Phase 7 Vehicle Detector	In	1-7	Cycle Advance	In	12-3
W	Phase 8 Pedestrian Detector	In	2-8	Max 3 Selection	In	12-4
X	Phase 8 Hold	In	3-8	Max 4 Selection	In	12-5
Y	Force Off (Ring 2)	In	7-1	Free	In	12-6
Z	Stop Timing (Ring 2)	In	7-2	Not Assigned	In	12-7
a	Inhibit Max Timing (Ring 2)	In	7-3	Not Assigned	In	12-8
b	Test Input C	In	9-3	Alarm 1	In	13-1
c	Coded Status Bit C (Ring 2)	Out	12-6	Alarm 2	In	13-2
d	Phase 8 Walk	Out	6-8	Alarm 3	In	13-3
e	Phase 8 Yellow	Out	2-8	Alarm 4	In	13-4
f	Phase 7 Green	Out	3-7	Alarm 5	In	13-5
g	Phase 6 Green	Out	3-6	Flash In	In	13-6
h	Phase 6 Yellow	Out	2-6	Conflict Monitor Status	In	13-7
i	Phase 5 Green	Out	3-5	Door Ajar	In	13-8
j	Phase 5 Walk	Out	6-5	Special Function 1	In	14-1
k	Phase 5 Check	Out	7-5	Special Function 2	In	14-2
m	Phase 5 Hold	In	3-5	Special Function 3	In	14-3
n	Phase 5 Omit	In	5-5	Special Function 4	In	14-4
p	Phase 6 Hold	In	3-6	Special Function 5	In	14-5
q	Phase 6 Omit	In	5-6	Special Function 6	In	14-6
r	Phase 7 Omit	In	5-7	Special Function 7	In	14-7
s	Phase 8 Omit	In	5-8	Special Function 8	In	14-8
t	Phase 8 Vehicle Detector	In	1-8	Preempt 1 In	In	15-1
u	Red Rest Mode (Ring 2)	In	7-4	Preempt 2 In	In	15-2
v	Omit All Red (Ring 2)	In	7-7	Preempt 3 In	In	15-3
w	Phase 8 Ped Clear	Out	5-8	Preempt 4 In	In	15-4
x	Phase 8 Green	Out	3-8	Preempt 5 In	In	15-5
y	Phase 7 Don't Walk	Out	4-7	Preempt 6 In	In	15-6
z	Phase 6 Don't Walk	Out	4-6	Alarm 1 Out	Out	12-7
AA	Phase 6 Ped Clear	Out	5-6	Alarm 2 Out	Out	12-8
BB	Phase 6 Check	Out	7-6	Special Function 1 Out	Out	13-1
CC	Phase 6 On	Out	9-6	Special Function 2 Out	Out	13-2
DD	Phase 6 Next	Out	8-6	Special Function 3 Out	Out	13-3
EE	Phase 7 Hold	In	3-7	Special Function 4 Out	Out	13-4
FF	Phase 8 Check	Out	7-8	Special Function 5 Out	Out	13-5
GG	Phase 8 On	Out	9-8	Special Function 6 Out	Out	13-6
HH	Phase 8 Next	Out	8-8	Special Function 7 Out	Out	13-7
JJ	Phase 7 Walk	Out	6-7	Special Function 8 Out	Out	13-8
KK	Phase 7 Ped Clear	Out	5-7	Not Assigned	---	---
LL	Phase 6 Walk	Out	6-6	Detector Reset	Out	11-8
MM	Phase 7 Check	Out	7-7	Not Assigned	---	---
NN	Phase 7 On	Out	9-7	+24 VDC	---	---
PP	Phase 7 Next	Out	8-7	2070N DC Gnd	---	---

TITLE: 2070-8 FIELD I/O MODULE CONNECTORS C & D

Rev Date 2-11-04

FEBRUARY 20, 2004

11-5-5

Figure 23
2070-8 Field I/O Module, Connectors C & D

EX1 CONNECTOR PINOUT	
PIN	FUNCTION
1	EQ GND
2	TXD FCU
3	RXD FCU
4	RTS FCU
5	CTS FCU
6	NA
7	2070-8 DC GND
8	DCD FCU
9	2070-8 DC GND
10	485 TX Data+
11	485 TX Data-
12	485 TX Clock+
13	485 TX Clock-
14	2070-8 DC GND
15	485 RX Data+
16	485 RX Data-
17	2070-8 DC GND
18	485 RX Clock+
19	485 RX Clock-
20	NA
21	NA
22	NA
23	NA
24	NA
25	NA

EX2 CONNECTOR PINOUT	
PIN	FUNCTION
1	EQ GND
2	TXD 1
3	RXD 1
4	RTS 1
5	CTS 1
6	NA
7	DC GND #1
8	DCD 1
9	AUDIO IN 1
10	AUDIO IN 1
11	AUDIO OUT 1
12	AUDIO OUT 1
13	NA
14	EQ GND
15	TXD 2
16	RXD 2
17	RTS 2
18	CTS 2
19	NA
20	DC GND #1
21	DCD 2
22	AUDIO IN 2
23	AUDIO IN 2
24	AUDIO OUT 2
25	AUDIO OUT 2

TITLE: 2070-8 FIELD I/O MODULE EX1 & EX2 CONNECTORS	
Rev Date 2-11-04	11-5-6
FEBRUARY 20, 2004	

Figure 24
2070-8 Field I/O Module, EX1 & EX2 Connectors

13. Glossary.

A. Terms and Abbreviations. Wherever the following terms or abbreviations are used, the intent and meaning is interpreted as follows:

- A Ampere
- AC Alternating Current
- AC+ 120 Volts AC, 60 hertz ungrounded power source
- AC- 120 Volts AC, 60 hertz grounded return to the power source
- DEPARTMENT The DEPARTMENT director, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties delegated to them.
- ANSI American National Standard Institute
- ASCII American Standard Code for Information Interchange
- Assembly A complete machine, structure or unit of a machine that was manufactured by fitting together parts and/or modules
- ASTM American Society for Testing and Materials
- AWG American Wire Gage
- C Celsius
- C Language The ANSI C Programming Language
- Cabinet An outdoor enclosure generally housing the controller unit and associated equipment
- Certificate of Compliance A certificate signed by the manufacturer of the material or the manufacturer of assembled materials stating that the materials involved comply in all respects with the requirements of the specifications
- Channel An information path from a discrete input to a discrete output.

- Component Any electrical or electronic device

- Contractor The person or persons, Manufacturer, firm, partnership, corporation, vendor or combination thereof, who have entered into a contract with the DEPARTMENT, as party of the second part or legal representative

- Controller Unit That portion of the controller assembly devoted to the operational control of the logic decisions programmed into the assembly

- CPU Central Processing Unit

- CTS Clear To Send

- DAT Program The DEPARTMENT‘s Diagnostic and Acceptance Test Program

- dB Decibel

- dBa Decibels above reference noise, adjusted

- DC Direct Current

- DCD Data Carrier Detect (Receive Line Signal Detector)

- DIN Deutsche Industrie Norm

- DRAM Dynamic random access memory. Random access means that the processor can access any part of the memory or data storage space directly rather than having to proceed sequentially from some starting place. DRAM is dynamic in that it needs to have its storage cells refreshed or given a new electronic charge every few milliseconds.

- EG Equipment Ground

- EIA Electronic Industries Association

- EMI Electro Magnetic Interference

- EPROM Ultraviolet Erasable, Programmable, Read Only Memory Device

- EEPROM Electrically Erasable, Programmable, Read Only Memory Device

- Equal Connectors: comply with physical dimensions, contact material, plating and method of connection. Devices: comply to function, pin out, electrical and operating parameter requirements, access times and interface parameters of the specified device

- ETL Electrical Testing Laboratories, Inc.

- Firmware A computer program or software stored permanently in PROM, EPROM, ROM or semi-permanently in EEPROM

- FLASH A +5 VDC powered IC Memory Device with nonvolatile, electrically erasable, programmable, 100K read/write minimum cycles and fast access time features

- FPA Front Panel Assembly

- HEX Hexadecimal

- Hz Hertz

- IC Integrated Circuit

- I.D. Identification

- IEEE Institute of Electrical and Electronics Engineers

- ISO Isolated

- Jumper A means of connecting/disconnecting two or more conductive by soldering/desoldering a conductive wire or by PCB post jumper

- KB Kilobytes

- Keyed Means by which like connectors can be physically altered to prevent improper insertion.

- Laboratory The established laboratory of the DEPARTMENT or other laboratories authorized by the DEPARTMENT to test materials involved in the contract

- LCD Liquid Crystal Display

- LED Light Emitting Diode

- LOGIC Negative Logic Convention (Ground True) State
- LSB Least Significant Byte
- lsb Least Significant Bit
- MB megabyte
- MSB Most Significant Byte
- msb Most Significant Bit
- m Milli
- MCU/MPU/ IMP Micro Controller Unit, Microprocessor Unit, or Integrated Multiprotocol Processor
- MIL Military Specifications
- MODEM Modulation/Demodulation Unit
- Module A functional unit that plugs into an assembly
- Motherboard A printed circuit connector interface board with no active or passive components
- MOS Metal-Oxide Semiconductor
- MOV Metal-Oxide Varistor
- MS Military Standards
- N Newton: SI unit of force
- N.C. Normally closed contact
- N.O. Normally open contact
- NA Presently Not Assigned. Cannot be used by the Manufacturer for other purposes

- NEMA National Electrical Manufacturer's Association
- NETA National Electrical Testing Association, Inc.
- n nano
- NLSB Next Least Significant Byte
- nlsb Next Least Significant Bit
- NMSB Next Most Significant Byte
- nmsb Next Most Significant Bit
- PCB Printed Circuit Board
- PDA Power Distribution Assembly
- PLA/PAL Programmable Array Logic Device
- Power Failure A Power Failure is said to have occurred when the incoming line voltage falls below 92 +/- 2 VAC for 50 milliseconds. See Power Conditions.
- Power Restoration Power is said to be restored when the incoming line voltage equals or exceeds 97 +/- 2 VAC for 50 milliseconds. See Power Conditions.
- Power Conditions 16.7 ms (one 60 Hertz cycle) reaction period is allowed to be included in the 50 milliseconds timing or added to (67 milliseconds duration). The hysteresis between power failure and power restoration voltage settings must be a min. of 5 VAC with a threshold drift of no more than 0.2 VAC.
- ppm Parts per million
- PWM Pulse Width Modulation
- RAM Random Access Memory
- RF Radio Frequency
- RMS Root-Mean-Square

- ROM Read Only Memory Device
- RTS Request to Send
- R/W Controller Unit Read/Write Control Line
- RxD Received Data
- SCI Serial Communications Interface
- SDLC Synchronous Data Link Control
- S Logic State
- s second
- Second Sourced Produced by more than one Manufacturer
- SRAM Static Random Access Memory Device
- SW Switch
- TB Terminal Block
- TOD Time Of Day Clock
- Triac Silicon-Controlled Rectifier which controls power bilaterally in an AC switching circuit
- TTL Transistor-Transistor Logic
- Thumb Screw Device (TSD) A retractable screw fastener with projecting stainless steel screw, spring and natural aluminum knob finish. (TSD No.2 must be flat black.)

  TSD No.1 - 8-32 SOUTHCO #47-62-301-20 or equal.
  TSD No.2 - 8-32 SOUTHCO #47-62-301-60 or equal.
  TSD No.3 - M3 SOUTHCO #47-82-101-10 or equal.

- TxD Transmitted Data
- u Micro

- UL Underwriter's Laboratories, Inc.
- VAC Voltage Alternating Current (root mean square)
- VDC Voltage Direct Current
- VME Versa Module Eurocard, VMEbus Standard IEEE P1014/D1.2
- x Number Value
- XX Manufacturer's Option
- WDT Watchdog Timer: A monitoring circuit, external to the device watched, which senses an Output Line from the device and reacts

14. Measurement and Payment. The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly, but will be subsidiary to pertinent Items.

SPECIAL SPECIFICATION

8643

Type 2070 Controller Cabinet Assemblies

1. Description. This Item will govern for the furnishing of traffic signal controller cabinet assemblies as shown on the plans in accordance with these specifications and as directed. Type 2070 Controllers are specified under a separate special specification.

2. Materials. Ensure electrical materials and construction methods conform to the current National Electric Code (NEC) and additional local utility requirements.

Furnish new materials. Ensure all materials and construction methods conform to the requirements of this Item and the following pertinent requirements:

- Item 680, “Installation of Highway Traffic Signals”
- Federal Highway Administration Publication FHWA-IP-78-16, December 1978, and "Traffic Signal Control Equipment Specifications" published by the State of California, Business, Transportation & Housing Agency; Department of Transportation (CALTRANS), dated January, 1989, and all current addenda and Revisions. In case of conflict, TxDOT specifications will govern over the CALTRANS specifications which will govern over the FHWA specifications.
- National Electric Code (NEC); the American Society for Testing and Materials (ASTM)
- American National Standards Institute (ANSI)

Provide cabinet assemblies from one single manufacturer listed on the most current CALTRANS "QUALIFIED PRODUCTS LIST" (QPL).

Provide a CALTRANS certification stating that the equipment is included on the most current CALTRANS QPL. TxDOT specific equipment not defined in the CALTRANS Specification is exempt from the QPL requirement.

Provide Cabinet Verification Test Program and Controller Diagnostic Test Program upon request to include:

- Two complete sets of card extenders for all printed circuit boards which attach to the controller by means of an edge connector, including CPU boards, I/O boards, Model 400 modem, program module, power supply boards, etc., for the controller unit, and all plug-in cards in the cabinet including detectors, isolators, and conflict monitor;
- One program module shall be supplied with diagnostic software to test controller, cabinet and conflict monitor. Diagnostic software shall be capable of interfacing with a serial terminal or microcomputer running an ANSI-standard terminal emulation software; and,
- All necessary wrap-around cables, interface cables, and jumpers to perform diagnostic testing of controller and all internal boards, including serial connection from controller to external serial device.

3. Construction.

A. Isolators.

1. DC Isolators shall be Model 242 and shall meet FHWA-IP-78-16 specifications chapter 7. See Section VI L for quantities to be supplied with particular cabinets.

2. AC Isolators shall be Model 252, supplied as specified in Section VI L, and placed in input file slot I11, with marker strip labeled "DOOR ALARM" in each Type 332 and 336 cabinet.

B. Load Switches.

- All load switches shall be solid-state switches and shall turn on and off within ± 5 degrees of the zero voltage point of the AC sinusoidal line. Load switch can be Type 200 in accordance with the specification of FHWA-IP-78-l6.

C. Controller Cabinets (General).

1. This specification defines the cabinets to be used with the Model 2070 controller units. This specification replaces Chapter 11 of Federal Highway Administration Publication FHWA-IP-78-16, Type 170 Traffic Signal Controller System, hereafter referred to as TSCES.

2. Details of alternative designs must be submitted to the Traffic Signal Engineer for approval prior to fabrication.

3. General Cabinet Construction

4. All cabinets shall be rainproof. The cabinet top shall be "crowned" or slanted to prevent standing water.

a. The cabinet and doors shall be fabricated of 0.125-in. minimum thickness aluminum. All exterior seams for cabinet and doors shall be continuously welded. All exterior welds shall be smooth. All edges shall be filed to a radius of 0.03125 in. minimum.

b. Cabinets shall conform to the requirements of ASTM Designation: B 209 for 5052-H32 aluminum sheet.

c. Welding shall be done by the gas metal arc (Mig) or gas tungsten arc (Tig) process using bare aluminum welding electrodes. Electrodes shall conform to the requirements of the American Welding Society (AWS) A5.10 for ER5356 aluminum alloy bare welding electrodes.

d. Procedures, welders and welding operators for welding on aluminum shall be qualified in accordance with the requirements of AWS B3.0, "Welding Procedure and Performance Qualification," and to the practices recommended in AWS C5.6.

e. The surfaces of each aluminum cabinet shall be the original cast-like finish or fabricated finish. Any variations of finish shall be preapproved in writing by the Engineer. Each cabinet shall be equipped with an electric fan with ball or roller bearings and a capacity of at least 100 cu. ft. of free air delivery per minute.

f. The fan shall be mounted within the cabinet and vented out between the top of the cabinet and the front door. The fan shall be thermostatically controlled and shall be manually adjustable to turn on between 33°C and 65°C with a differential of not more than 6°C between automatic turn on and turn off. The cabinet fan circuit shall be protected at 125% of the ampacity of the fan motor.

g. Intake (including filter) and exhaust areas shall pass a minimum of 60 cu. ft. of air per minute.

h. Each cabinet shall be provided with louvered vents in the front door with a removable pleated disposable air filter. The filter shall cover the vents and shall be held firmly in place with bottom and side brackets and a spring-loaded upper clamp.

i. The bottom filter bracket shall be formed into a waterproof sump with drain holes to the outside. The louvered vents shall be designed and constructed such that a stream of water from a pressure head, such as a Rainbird sprinkler or other type sprinkler, will not enter the cabinet.

j. All cabinets shall have a police panel. The police door shall provide access to the "Auto-Flash" and "Signals Off" switches. Police Access shall be limited to these two switches. The police panel door shall be equipped with a lock keyed for a master police key. One key shall be furnished with each cabinet for the police lock. Each police key shall have a shaft at least 1.75 in. in length.

k. Type 332 and 336 cabinets shall have single front and rear doors, each equipped with a lock. When each door is closed and latched, the door shall be locked. The latching handles shall have provision for padlocking in the closed position. The operating handle shall be stainless steel with a 7.5-in. handle and a minimum 0.50 in. stainless steel shank. The cabinet door frame shall be double flanged out on all four sides and shall be provided with strikers to hold tension on and form a firm seal between door gasketing and cabinet door frame.

l. The flange width shall be a minimum of one inch, measured from front edge to flange to cabinet outside surface.

m. Each cabinet will be supplied with locks keyed alike to the standard Corbin #2 core combination. Two keys shall be supplied with each cabinet.

n. The locks shall have rectangular, spring-loaded bolts. The bolts shall have a 0.281-in. throw and shall be 0.75 in. wide by 0.375 in. thick (dimension tolerance is +0.035 in.). The locks shall be left hand on the front door and right hand on the rear door. Keys shall be removable in the locked position only. Locks shall be rigidly mounted with two stainless steel machine screws. In the locked position, the throw shall extend a minimum of 0.25 (+ 0.03) in.. The front portion of the lock shall neither be recessed nor shall it extend more than 0.1875 in. from the face of the door. The locks shall be mounted on the door in such a position that the tumblers are in the upper quadrant.

o. The latching mechanism shall be a three-point draw roller type. The center catch and pushrods shall be plated. Pushrods shall be turned edgewise at the outward supports and cross section shall be 0.25 in. by 0.75 in., minimum.

p. Supports shall be 0.105 in. steel, minimum. Rollers shall have a minimum diameter of 0.875 in. and shall be equipped with ball bearings and nylon wheels. The center catch shall be fabricated of 0.1875-in. plated steel, minimum.

q. Each door shall be equipped with two bolt hinges, minimum 3.5 in. long. Each hinge shall have a fixed pin. All doors shall be provided with catches to hold the door open at both 90 degrees and 180 degrees, $\pm$ 10 degrees. The catches shall be 0.375 in. diameter minimum, plated steel rods. Door latches, in latched position, shall not come in contact with cabinet surface or flange lip. The catches shall be capable of holding the door open at 90 degrees in a 60 MPH wind at an angle perpendicular to the plane of the door.

r. On all cabinets, door hinge pins and bolts shall be made of stainless steel. Door hinges shall be made of aluminum. The hinges shall be bolted to the cabinet and may be welded to the door. The hinge pins and bolts shall be covered by the door edge and shall not be accessible when door is closed. Hinge pins will be welded at each end to form a cap and welds filed or ground smooth.

s. Type 332 cabinets shall be provided with two lifting eyes to be used when placing the cabinet on the foundation. Each eye attached to the cabinet shall have a minimum diameter of 0.75 in. and shall be capable of supporting the cabinet.

t. Gasketing shall be provided on all door openings and shall be dust-tight. Gaskets shall be 0.25 in. minimum thickness closed cell neoprene and shall be permanently bonded to the metal. The mating surface of the gasketing shall be covered with a silicone lubricant to prevent sticking to the mating surface.

5. Power Supply.

a. A power supply shall be provided in the cabinet for all equipment installed in the cabinet except the 170 Controller unit, the Model 210 Monitor and the Models 242 Isolators.

b. All Power Distribution Assemblies (PDA) for 8-phase cabinets shall meet CALTRANS' Traffic Signal Control Equipment Specifications for PDA #2, dated January 1989 or latest revision.

c. The power supply shall be ferro-resonant design having no active components and shall conform to the following requirements:

(1) **Line Regulation:** Two percent from 95 to 135 VAC at 60 Hz, plus an additional 1.6% for each additional one percent frequency change.

(2) Load Regulation: Five percent from one ampere to five amperes with a maximum temperature rise of 30°C above ambient.

(3) **Design Voltage:** +24 (+0.5) VDC at full load and 30°C with 115 VAC input line after 0.5 hour warm-up.

(4) Full Load Current: Five amperes, minimum.

(5) **Ripple Noise:** Two volts peak-to-peak and 500 millivolts rms at full load.

(6) Line Voltage: 95 to 135 VAC.

(7) **Efficiency:** 60%, minimum.

(8) Minimum Voltage: 22.8 VDC.

d. The power supply front panel shall include:

(1) All fuses or circuit breakers.

(2) Pilot lamp.

(3) Test points or meter for monitoring output voltage.

(4) The power supply, including terminals, shall be protected to prevent accidental contact with energized parts.

(5) Wiring for 120 VAC power input to power supply shall be terminated on terminal strips. AC plugs will not be acceptable.

(6) The power supply cage and transformer shall be securely braced with nylon strapping to minimize damage in transit.

6. Flash Transfer Relay.

a. The Flash Relays shall conform to the requirements of these specifications.

b. A leakage resistor, which will permit 3 to 8 volts to be applied to the relay coil, shall be installed across the terminals of each relay socket to overcome the residual magnetism.

c. The flash transfer relay shall transfer field outputs from switchpack output to flash control. Transfer of the flash transfer relay circuit to flash control shall not interrupt the operation of the controller unit.

d. The coils of the flash transfer relays shall be energized only when the signals are in flashing operation and the police panel "ON/OFF" switch is in the "ON" position.

7. Equipment Removal.

a. The following equipment shall be completely removable from the cabinet without removing any other equipment and using only a screwdriver:

(1) Power Supply

(2) Power Distribution Assembly

(3) Input File

(4) Output File

8. Miscellaneous

a. All fuses, circuit breakers, switches, (except police panel switches and fan fuse) and indicators shall be readily visible and accessible when the front door is open.

b. All equipment in the cabinet shall be clearly and permanently labeled. The marker strips shall be made of a material that can be easily and legibly written on using a pencil or ball-point pen. Marker strips shall be located immediately below the item they are to identify and must be clearly visible with the items installed. Glossy marker strips are not acceptable because ink tends to bubble and smear. Resistor/Capacitor transient suppression shall be provided at the relay socket (across relay coils) and in the fan circuit.

8. Cabinet Wiring Diagram.

a. One set of nonfading (comparable to Xerox 2080) readable cabinet wiring diagrams shall be supplied with each cabinet. The diagram shall be nonproprietary. They shall identify all circuits in such a manner as to be readily interpreted. The cabinet drawing shall show the component layout in an elevation view as viewed from the rear of the cabinet with the left and right cabinet walls shown in their relative positions. The diagrams shall be placed in a heavy duty side opening clear plastic pouch and attached to the front cabinet door. The pouch shall be of such design and material that it provides adequate storage and access to the wiring diagram, and shall be constructed of a material which will not react with or stick to xerographic plastic toners used in copy machines.

b. Detailed equipment layout scale drawings and wiring diagrams of all equipment installed in the cabinet shall be submitted to the Traffic Signal Engineer for approval prior to production. This review does not lessen the contractor's responsibility to meet the specifications.

9. Cabinet Light.

a. Each cabinet shall be equipped with a fluorescent lighting fixture mounted inside the top front of the cabinet. The fixture shall have an 8 watt lamp AT5-CW, operated from a normal power factor, U.L. listed ballast. The lamp shall be shaded to diffuse the light. A door switch shall be installed to turn the cabinet light on when the front door is opened. The door switch shall be on a separate circuit by itself, and used only to turn on the light and operate the door alarm.

b. On the Type 332 and 336 cabinets, additional wiring shall be provided from the load (normally open) side of the light switch to Input File location I11D, run AC- to Input File location I11E, and C1-80 shall be wired to IUF for the door alarm circuit.

10. Conductors.

a. Conductors used in cabinet wiring shall terminate with properly sized spring-spade type terminals or shall be soldered to a through-panel solder lug on the rear side of the terminal block. All crimp-style connectors shall be applied with a power tool which prevents opening of the handles until the crimp is completed. Conductors in the controller cabinet between the service terminals and the signal bus breakers including the chassis ground conductor to Power Distribution Assembly shall be No. 8, or larger.

b. All conductors used in controller cabinet wiring shall be No. 22, or larger, with a minimum of 19 copper strands. Conductors shall conform to Military Specification: MIL-W-16878D, Type B or better. The insulation shall have a minimum thickness of 10 mils and shall be nylon jacketed polyvinyl chloride except that Conductors No. 14 and larger may have Type THHN insulation, and shall be stranded with a minimum of seven copper strands.

c. All conductors, except those which can be readily traced, shall be labeled. Labels attached to each of the conductors shall identify the destination of the other end of the conductor.

d. All conductors used in controller cabinet wiring shall conform to the following color-code requirements:

(1) The grounded conductors of AC circuits shall be identified by a continuous white or gray color.

(2) The equipment grounding conductors shall be identified by a solid green color or by a continuous green color with one or more yellow stripes.

(3) The DC logic ground conductors shall be identified by a solid white color with a colored (except green) stripe.

(4) The ungrounded conductors shall be identified by any color not specified above.

e. All cabinet wiring harnesses shall be neat, firm and routed to minimize crosstalk and electrical interference. Printed circuit motherboards may be used to eliminate or reduce cabinet wiring on the input files, only.

(1) Wiring containing AC shall be routed and bundled separately or shielded separately from all logic voltage control circuits.

(2) Cabling shall be routed to prevent conductors from being in contact with metal edges.

f. All conductors, terminals or parts, which could be hazardous to maintenance personnel, shall be protected with suitable insulating material.

g. Within the cabinet wiring, the DC logic ground and equipment ground shall be electrically isolated from the AC grounded conductor and each other by 500 megohms when tested at 250 VDC, with the power line surge protector disconnected.

h. Conductors from Connector C to the input file shall be of sufficient length to allow any conductor to be connected to any detector output terminal (Positions S, F, W). The AC- copper terminal bus shall not be grounded to the cabinet or connected to the logic ground and shall provide a minimum of 10 terminals for connection to field conductors. Nylon screws with a minimum diameter of 0.25 in. shall be used for securing the bus to the service panel.

i. An equipment grounding (earth ground) bus shall be provided in each cabinet. The bus shall be copper and grounded to the cabinet.

j. The output common of the cabinet power supply shall be connected to the DC logic ground bus using a No. 14, or larger, stranded copper wire.

k. The DC ground bus shall be located on the input panel.

l. A No. 8, or larger, copper conductor shall be connected between equipment ground bus and rack rails.

m. Terminals for the signal wires shall be fitted with 90 degree lugs for #14 AWG wire. Lugs shall be the type that the end of the field wire slips into and is held in place with a compression screw on the wire. (Blackburn #L35 or equivalent)

n. Each loop detector lead-in, from the field terminals in the cabinet to the sensor unit rack connector shall be a cable UL Type 2092 or better. The stranded tinned copper drain wire shall be connected to a terminal on the input file terminal block. This input terminal shall be connected to the equipment grounding bus through a single conductor.

o. Each cabinet shall be provided with one harness, terminated at one end with standard C-2 connector plugs, at the other end to a terminal strip, and four feet in length. The harness for the C-2 connector shall contain conductors for the AUDIO IN and AUDIO OUT pairs. Harness shall be terminated at a terminal strip placed near the

bottom of the cabinet, and each AUDIO IN and AUDIO OUT position on the terminal strip shall be protected with an EDCO Model SRA-642C (18 VAC) or approved equal. Harness conductors shall be clearly labeled at the terminal strip.

11. Surge Protection.

a. All cabinets shall be provided with an EDCO Model # SHA-1210 or approved equal. Cabinet shall be wired so filtered AC+ shall be supplied to the 170 unit receptacles (2) and conflict monitor only.

b. Surge protection shall be provided for all cabinet power.

c. All signal output lines shall be protected by a MOV installed at the field wiring terminal block inside the swing down back panel so as to not interfere with the field wiring, between the terminal and earth ground. The MOV shall be Type V150LA20.

12. Conflict Monitor.

a. All cabinets shall be supplied with one or more signal conflict monitors, EDI 2018 KCLiP or equal, conflict monitors that meet or exceed specification FHWA-IP-78-16 Chapter 3. The monitor shall conform to the TEES specification for the Model 2070L controller unit.

b. The monitor shall include the following features:

(1) An A.C. power indicator light mounted on the front panel.

(2) A 24 VDC failure indicator shall be provided. Indicator shall latch in the lit mode upon occurrence of a 24 VDC failure. Once tripped, the 24 VDC monitoring circuits and indicator shall only be resettable by manual reset.

(3) The monitor shall not use the 24VDC power supply being sensed to run any of it's internal circuitry.

(4) Monitoring of red indications, otherwise known as red monitoring, shall be provided with the conflict monitor. Cabling necessary to utilize this feature shall be furnished.

13. Heavy Duty Relays.

a. This specification defines the Model 430 heavy duty relays to be used with the Model 2070 controller unit.

b. This specification replaces chapter 17 of Federal Highway Administration Publication FHWA-IP-78-16, Type 170 Traffic Signal Controller System as follows:

(1) Heavy duty relays shall be the electromechanical type and shall be designed for continuous duty at 95 to 135 VAC.

(2) Each relay shall mate with the eight-pin Jones-type socket as shown on the plans and shall be enclosed in a removable, clear plastic cover.

(3) The manufacturer's name and part number, and electrical rating, shall be provided on the cover. They shall be permanent, durable and readily visible when the relay is mounted in its socket.

(4) Each relay shall be provided with double-pole, double-throw contacts. Contact points shall be of fine silver, silver alloy or superior alternative material. Contact points and contact arms shall be capable of switching at 20 amperes tungsten load per contact, and 120 VAC once every two seconds with a 50% duty cycle, for at least 250,000 operations, without contact welding or excessive burning, pitting or cavitation.

(5) The relay coil shall have a power consumption of 10 volt-amperes or less.

(6) Each relay shall withstand a potential of 1,500 volts at 60 hertz between insulated parts, and between current carrying parts and non-current carrying parts.

(7) Each relay shall have a one-cycle surge rating of 175 amperes RMS.

14. Supply Quantity.

- All cabinets shall be supplied with all necessary equipment for proper operation, including the plug-in items listed in the following table, in all cases, regardless of the intended operation.

	CABINET TYPE		
	303	332	336
Load Switches	6	12	12
DC Isolators	2	3	3
Detectors	4	16	8
Conflict Monitors	1	2	2
AC Isolators	1	1	1

15. Output Files.

a. There shall be eight capacitive dummy loads mounted to a terminal block on the rear of the swing-down back panel. One side of each dummy load shall be tied to AC-. Four of the dummy loads shall be connected at the factory to the center (yellow) output of the load switches assigned to ped signals for Phases 2, 4, 6, and 8.

b. The P20 connector and cable assembly for monitoring the red outputs of all load switches shall be provided and mounted to the swing-down back panel, for future use.

c. Auxiliary output files shall be provided in each Type 332 cabinet. Auxiliary output files shall be supplied in Type 336 cabinets if specified (adequate rack length shall be provided in all 336 cabinets for an aux file in case it is retrofitted at a later date). The file shall accommodate six load switches and two flash relays. The file shall be connected via a cable to the C6 connector on the rear of the standard 12-position output file. Four dummy capacitive loads shall be provided on a terminal block for selective jumping to the outputs of the load switches. The red and yellow signal circuits of switch packs 13, 14, 16, and 17 shall be available at a Molex type 1375 receptacle which shall intermate with a Molex type 1375 plug to allow flash programming. A plug connector, with programming jumpers, shall be furnished for each circuit to allow red or yellow flash programming. Plugs shall be readily accessible without the removal of any other equipment. Plug pins shall be crimped and soldered.

E. Type 332 Cabinet.

1. Rack Assembly.

a. A standard EIA 19-in. rack cage shall be installed inside the cabinet for mounting the controller unit, input file power supply, output file and power distribution assembly. The EIA rack portion of the cage shall consist of two pairs of 53-in. minimum usable, continuous, adjustable equipment mounting angles of 0.1345 in. nominal thickness plated steel tapped with 10-32 threads with EIA universal spacing. The angles shall comply with Standard EIA RS-310-B and shall be supported top and bottom by welded support angles to form a cage. Clearance between rails for mounting assemblies must be 17.75 in.

b. Two plated supporting angles extending from the front to the back rails shall be supplied to support the controller unit. The angles shall be designed to support a minimum of 50 lb. each. The horizontal side of each angle shall be mounted 17.5 in. from the top of the rack and shall be adjustable vertically.

c. The cabinet shall have supporting angles (railing) on either side level with the bottom edge of the door opening to provide horizontal support for the cage. The cage shall be vertically attached to each side of the cabinet at four points, two at the top and two at the bottom of the rails.

d. A minimum of 10.5 in. of EIA rack height and 20 in. of depth (18 in. behind and two in. in front of the mounting ears) shall be provided for the Model 2070 controller unit.

e. A 2-in. tall drawer shall be rack-mounted in each Type 332 cabinet. The drawer shall be provided with a hinged top cover and shall be capable of supporting 50 lb. in the extended position.

2. Input File.

a. The input file shall utilize 5.25 in. of rack height. The input file shall intermate with and support 14 two-channel inputs.

b. The input file shall provide card guides (top and bottom) and a 22-pin single-readout, edge connector centered vertically for each detector. The input file shall allow air circulation through the top and bottom.

c. Pins D, E, F, J, K, L, and W on each edge connector slot shall be terminated on their associated terminal block mounted on the rear of their input file. Pins F and W for each slot shall terminate on the terminal blocks mounted on the rear of the input file and will connect to the proper controller unit inputs in the Connector C1S wiring harness. Common grounding of output emitters will be permitted and common grounding conductor brought out to TB15, Terminal 4 (CTR DC GND).

d. The edge connectors shall be double-sided connectors with the numbered side of each pin shorted to its respective lettered side internally.

e. The card guide shall begin 1.0 (+0.5) in. back from the front face of the file.

f. The input file shall be provided with marker strips to identify isolators and detectors in the file as described in Section VI E.

3. Power Distribution Assembly.

a. The power distribution assembly shall be furnished and mounted on the EIA 19-in. rack utilizing no more than seven inches of rack height. All equipment shall be readily accessible for ease of replacement. The depth of the assembly shall not exceed 10 in. from the front cabinet rails including terminal blocks.

b. The following equipment shall be provided with the power distribution assembly:

(1) 2 - Equipment duplex receptacles (one on the front panel, and another on the back panel readily accessible from back door)

(2) 1 - Controller unit duplex receptacle

(3) 1 - Main circuit breaker

(4) 1 - Six-pole single bus circuit breaker

(5) 1 - Two-pole flash bus circuit breaker

(6) 1 - Equipment circuit breaker

(7) 1 – Non-Mercury Contactor

(8) 1 - Auto/Flash Switch

(9) 1 - Flash Relay and socket

(10) 2 - Flasher Unit sockets

(11) 2 - Model 204 Flasher Units

(12) 1 - Flash Indicator light

(13) Terminal Blocks

c. The main circuit breaker shall be rated for 50 amperes at 120 VAC. The circuit breakers for the equipment receptacles and signal bus shall be rated for 15 amperes at 120 VAC. The flash bus circuit shall be rated for 20 amperes at 120 VAC. Rating of breakers shall be shown on face of breaker or handle. Breaker function shall be labeled below breakers on front panel.

d. Equipment Receptacles shall be NEMA 5-15R duplex type. The Equipment Receptacles shall have ground-fault circuit interruption as defined in the National Electrical Code. Circuit interruption shall occur on 6 milliamperes of ground-fault current and shall not occur on less than four milliamperes of ground-fault current.

e. An "Auto/Flash" switch shall be provided which, when placed in "Flash" position (down), shall energize the Non-Mercury Contactor . When the switch is placed in the "Auto" position (up) the switch packs shall control the signal indications. The switch shall be a single-pole single-throw toggle switch rated for 15 amperes at 120 VAC.

f. A lamp labeled "Flash Operation" shall be provided on the front panel of the assembly. The lamp shall be driven by the Flasher Unit Output through Transfer Relay Circuit No. 1.

g. The Controller Unit Receptacle shall be a hospital grade NEMA 5-15R mounted on the back panel of the assembly. AC+ to the 170 unit receptacle shall be from the filtered outputs of the SHA-1210 surge protector.

h. Terminal Blocks shall be provided and mounted on the back panel of the assembly. The blocks shall be of type specified for signal field wire terminal blocks. All conductors from the power distribution assembly routed to the cabinet wiring shall be connected to the terminal block on the common side, except for the AC power conductor between the service terminal block and main circuit breaker.

i. All internal conductors terminating at the blocks shall be connected to the other side of the blocks. Terminal position assignments shall be as shown on Plan Sheet No. SA170-4, Model 332 T1 and T2 Terminal Block Assignment Detail, modified as follows:

- Add two No. 14 conductors between the back equipment duplex receptacle and the PDA Terminal Blocks (AC+ to T1, Terminal 10; AC- to T2 Terminal 1.)

j. The Flash Relays shall conform to the provisions for "Heavy Duty Relays, Model 430."

k. A leakage resistor, which will permit 3 to 8 volts to be applied to the relay coil, shall be installed across the terminals of each relay socket to overcome the residual magnetism.

4. Output File

a. Card guides shall be provided to support the switch packs and the monitor unit.

b. The output file shall utilize 10.5 in. of rack height and shall be supplied with 12 Model 200 Switch Packs. Four Model 430 Flash Transfer Relays and one Model 210 Monitor Unit shall be furnished with each output file. The depth of the assembly including terminal blocks and relays shall not exceed 14.5 in. from the front cabinet rails.

c. The output file shall be provided with marker strips to identify switch packs when mounted in the file, as specified in Section VI.

d. Switch pack connectors, monitor unit connectors, flash transfer relay sockets and flash programming connectors shall be accessible from the back of the output file without the use of tools.

e. Three field wire terminal blocks shall be mounted vertically on the back of the assembly. The terminal blocks shall be the 12-terminal type.

f. The controller unit outputs to the output file shall be connected through Connector C4.

g. The red and yellow signal circuits of all switch packs assigned to vehicle signals for phases 1 through 8 shall be available at a Molex Type 1375 Receptacle which shall intermate with a Molex Type 1375 plug to allow flash programming. A plug connector, with programming jumpers, shall be furnished for each circuit to allow red or yellow flash programming. Connectors shall be readily accessible without the removal of any other equipment. Plug pins shall be crimped and soldered.

h. The monitor connector shall be rigidly supported printed circuit board edge connector, having two rows of 28/56 independent double readout bifurcated contacts on 0.156 in. centers. The connector shall terminate with the Conflict Monitor Unit.

i. It shall be possible to remove the monitoring device without causing the intersection to go into flashing operation. The cabinet shall be wired so that with front cabinet door closed and with the monitor unit removed, the intersection shall go into flashing operation. The cabinet shall contain a conspicuous warning against operation with the monitor unit removed.

j. The monitor unit connector shall be wired in accordance with the pin assignment shown on the plans.

5. Side Panels.

a. Two panels shall be provided and mounted on the EIA rack parallel to the cabinet sides.

b. In viewing from the back door, the left side panel shall be designated as the "Input Panel" and the right side panel shall be designated as the "Service Panel".

c. All input field terminal blocks for detector field cables and other input conductors, except service conductors, shall be mounted on the "input panel". The "input panel" shall be wired per CALTRANS's August 1983 specification.

6. Terminal Blocks.

a. Terminal blocks shall be provided for terminating field conductors. They shall be readily accessible through the cabinet rear door and shall be rated for 20 amperes at 600 volts RMS, minimum.

b. The terminal blocks for detector field conductors, auxiliary field wires and control wires shall be the barrier type and shall be provided with 8-32 by 5/16 in. minimum nickel plated brass binder head screws and nickel plated brass inserts.

c. The terminal blocks for field wires to the signal indications, power distribution assembly and the required unused position shall be the barrier type and shall be provided with 10-32 by 5/16 in. nickel plated brass binder head screws and nickel plated brass inserts.

d. The terminal blocks for the input file and power supply shall be the barrier type and shall be provided with 8-32 by 5/16 in. nickel plated brass binder head screws and nickel plated brass inserts.

e. The terminals of the power line service terminal block shall be labeled "L1" and "AC-", and shall be covered with a clear insulating material to prevent inadvertent contact. Terminating lugs large enough to accommodate No. 2 conductors shall be furnished for the service terminal block. The terminal block shall be rated for 50 amperes at 600 volts, minimum.

7. Connectors.

a. Connector C1P shall contain 104 pin contacts and shall intermate with connector C1S mounted on the controller unit chassis. Corner guide pins for connector C1P shall be stainless steel and shall be 0.097 in. in length. Corner guide socket assemblies shall be stainless steel and shall be 0.625 in. in length.

b. Connector C4 shall contain 37 contacts and shall be the circular plastic type with quick connect/disconnect capability and thread assist, positive detent coupling. The Plug Connector C4P shall be mounted on the output file.

c. Connector C5 shall contain 24 contacts and shall be the circular plastic type with quick connect/disconnect capability and thread assist, positive detent coupling. The Plug Connector C5P shall be mounted on the input file.

d. Connector blocks for Connector C1 pin and socket connectors shall be constructed of diallylphathalate or better. Contacts shall be secured in the blocks with springs of stainless steel.

F. Type 303 Cabinet.

1. This specification defines the minimum detailed requirements applicable to cabinets and harnesses. The intent of this specification is to set forth the minimum acceptable electrical and mechanical design and requirements within which all equipment must operate satisfactorily and reliably, and the means by which the equipment shall be tested to determine whether it shall so operate.

2. All equipment shall be housed within a rain-proof pole, or post-top mounted cabinet. The cabinet shall be clean-cut in design and appearance and have nominal interior dimensions as follows:

    - DEPTH: 17 in.
    - WIDTH: 20 in.
    - HEIGHT: 36 in.

3. There shall be minimum clearance of 1 1/2 in. between the inside surface of the front door and the front panel of the Model 2070 controller as well as the front panel of modules plugged into the input rack.

4. The housing shall have a door, opening 33 in. high x 20 in. wide with a 2.5 in. space between bottom of opening and bottom of cabinet.

5. All Type 303 cabinets shall be supplied for both pole and pedestal mountings.

6. Cabinets shall have bolt holes drilled in the back for mating with pole mounting hardware, and shall be supplied with all necessary mounting hardware. Mounts to wood poles shall be accomplished by means of stainless steel straps. Stainless steel plugs for the mounting holes shall be provided.

7. Cabinets shall be adequately reinforced in the bottom of the fully-equipped cabinet to withstand a 100 mph wind, and shall have less than 2 in. of deflection at the top when a 100 lb. force is applied horizontally at the top of the cabinet on any of the four planes of cabinet faces. Cabinets shall be drilled for a standard 4 in. slipfitter. The slipfitter and any hardware necessary for pedestal or post top mounting shall be provided.

8. Cabinets shall be supplied with an aluminum electrical box, 8 in. long by 8 in. wide by 6 in. deep drilled to match slipfitter mounting holes in cabinet floor. The box shall be equipped with access cover facing downward. The access cover shall be designed so that when opened, the bottom and one side of the box is accessible, and the cover should hang in the open position. The access cover shall be attached with a full-length piano hinge on one edge and secured with two stainless steel #10 round-head machine screws, with matching threaded holes in the box. The box shall be constructed of 0.125-in. thick aluminum. All corners shall be continuously welded or press-broken, and the door shall be gasketed against dust. A 0.125 in. drain hole shall be provided at the appropriate location.

9. Rack Assembly.

    a. The cabinet shall be constructed with metal mounting rails running the depth of the cabinet along the lower left and right hand bottom of the cabinet. These rails shall be constructed at a height such that the cabinet rack shall rest on the rail when in its normal position, and shall slide along the rail when being installed or removed.

b. A rack with standard EIA spacing shall be inside the cabinet for mounting the processor unit and the rack assembly which will contain the rack, switch pack rack, power supply/power distribution panel. The rack shall consist of two pair of full length, 0.1875 in. nominal thickness aluminum angles tapped with 10-32 threads where required a shown in the cabinet drawing, at the end of this specification. Chassis supporting angles extending behind the front rails shall be part of the rack and support the weight of the processor unit. Each chassis supporting angle shall be 10 in. deep and 3 in. deep.

c. The rack assembly shall be easily removable from the cabinet without use of special tools. By unplugging connector P1, removing the screws securing the rack assembly to the rails, and disconnecting the field wiring, it shall be possible to remove the rack assembly from the cabinet.

10. Input File.

a. Each detector rack shall utilize 5.25 in. of rack-mounting height.

b. The detector rack shall provide card guides (top and bottom) and a 22-pin edge-connector on 0.156 in. centers, mounted vertically for each detector. The detector rack shall allow air circulation through the top and bottom.

c. Four pins (D,E,J,K) on each detector module edge-connector shall be wired to four field terminals to provide for two loop detector channels.

d. Loop 1 and 2 output collectors and emitters (pin F,H,W and X) for each slot shall connect to the proper processor unit inputs in the connector C1S wiring harness.

e. Wiring between the rack and field terminals shall be twisted pair not tightly bundled.

f. The edge connectors shall be double sided connectors with the numbered side of each pin shorted to its respective lettered side internally.

g. Output circuit emitters shall have a common junction and be grounded only by connection to C1P, pin 104, DC Input Ground.

h. A Flasher Assembly Panel shall be located in the left end of the Detector Rack and shall contain the flasher relay.

11. Flasher Relay.

a. A Type 204 solid state flasher relay to be used for alternate opening and closing connections between the applied power and the lamps required for flashing operation.

b. The following Table shall determine the inter-connection between the Solid State Flasher and the switchpacks. Each switchpack shall be assigned to the two Solid State Flasher load circuits as follows:

LOAD CIRCUIT #1	LOAD CIRCUIT #2
S.P. 1	S.P. 4
S.P. 2	S.P. 5
S.P. 3	S.P. 6

12. Maintenance Assembly.

a. A "Flash" switch, so labeled, shall be provided. This switch when placed in the "On" position shall energize the non-mercury contactor. When this switch is placed in the "Off" position the processor unit shall resume control via the switch pack outputs to the field. The Flash switch shall be accessible from the Police Panel Door opening.

b. A "Signal" switch, so labeled shall be provided. This switch, when placed in the "Off" position, shall energize the non-mercury contactor and prevent the flash relay from energizing the flash transfer relays, thereby disconnecting AC to the field terminals. The "Signals" switch shall be accessible from the Police Panel Door opening.

c. Two 24VDC test points for the cabinet power supply shall be provided.

d. The EDI Model 2018 KCLiP, or approved equivalent conflict monitor shall be readily serviceable without special tools.

e. Card guides shall be provided to guide and support the printed circuit board of the monitor module.

f. A rigidly supported printed circuit board edge connector, having two rows of 28/56 interdependent bifurcated contacts on 0.156 in. centers, shall be provided. The connector shall intermate with the 210 conflict monitor unit.

g. A 24VDC relay shall be provided to reverse the relay logic of the monitor module. The output of this relay shall be wired in series with a door switch. The relay shall be mounted in the PDA and be readily serviceable. Servicing shall not require any special tools other than a screwdriver. The relay shall be normally open. Monitor pin 25 shall be wired to DC ground and pin 24 shall be wired to one side of this relay with the other side of the relay going to the ferro-resonant supply.

h. A 110 VAC relay shall be supplied for the activation of the flash relays in the event of loss of AC+ to the load switches.

i. A spring-loaded door switch, shall be wired in series with the output of the relay described in section and in parallel with the CMU interlock.

j. Closing of the front cabinet door with the monitor unit removed shall cause the intersection to go into flashing operation. The cabinet shall contain a conspicuous warning against operation with the monitor unit removed.

k. The stop timing output of the monitor shall go to C1-82 of the processor.

13. Output File.

- The load rack shall intermate with Type 200 solid state switch packs. The rack shall be capable of containing 6 solid state switch packs.

14. Relay Panel.

a. Relays used for this purpose shall have a clear plastic cover.

b. All contact points which make, break and carry current to the signal lamps shall be of silver-cadmium, coin silver or superior alternative material. Contacts shall be capable of making, breaking, and carrying a current of 20 amperes 120 volts, without undue pitting. 120 volt AC relay coils shall be used and shall have a power consumption of 10 volt amperes or less and shall be designed for continuous duty.

c. The transfer relay shall withstand potential of 1500 volts at 60 hertz between insulated parts and between current carrying parts and grounded and non-current carrying parts.

d. Each flash transfer relay shall have a one cycle surge rating of 175 amperes RMS (247.5 amperes peak).

e. Each transfer relay shall be unaffected by electrical noise, having a rise time of up to 200 volts per microsecond. Each relay shall be unaffected by the 500 volt power noise transient test when the dv/dt herein specified is not exceeded.

f. The flash transfer relays shall transfer field signal light circuits (for switch packs 1 thru 6), from the processor unit to flasher and shall permit flashing lights as programmed on the main street or highway and on the cross street or streets. Operation of the flash transfer relay circuit shall not prohibit the operation of the processor, but shall prohibit operation of the field signal light circuits by the processor. The line to the coils of the FTR's shall have a RC suppression device.

g. The flash transfer relay shall be Midtex, 187-02701A or equal, and shall be provided with a connector (Cinch Jones, type #P-408-53 or equal) and intermate with Cinch Jones, type #S-408-53 or equal, using the following pin definitions:

PIN NUMBER	CIRCUIT
1	Coil
2	Coil
3	NC Ckt #2
4	NC Ckt #2
5	Common Ckt #1
6	Common Ckt #2

h. A minimum of 4 program block positions shall be provided for flashing operation. The programming plugs shall be provided to alter whether flashing yellow, flashing red, or absence of flash (white) appears on the output field terminals to the signal heads.

i. Flasher programming shall be provided by the use of a Molex type 1375 receptacle and intermate with a Molex type 1375 plug. Two red, 1 yellow, and 2 white programming plugs shall be provided. Flash programming shall be in compliance with the following:

(a) Red programming plugs shall contain three red jumper wires connecting pins 9 and 15, and 3, 7 and 13.

(b) Yellow programming plugs shall contain three yellow jumper wires connecting pins 1 and 7, 3 and 9, 13 and 15.

(c) White programming plugs shall contain two white jumper wires connecting pins 1, and 3, 13 and 15.

9. Power Distribution Assembly.

a. The main circuit breaker, labeled (Main C.B.) shall be a magnetic breaker, single pole, automatic trip, and trip indicating, rated at 40 amperes at 125VAC.

b. The auxiliary circuit breaker, labeled (AUX EQ C.B.) shall be a magnetic breaker, signal pole, automatic trip, and trip indicating, rated at 15 amperes at 125 VAC.

c. The flasher circuit breaker, labeled (FL C.B.), shall be a magnetic breaker, single pole, automatic trip, and trip indicating, rated at 15 amperes at 125 VAC.

d. The load switch circuit breaker, leveled (LS C.B.), shall be a magnetic breaker, single pole, automatic trip, and trip indicating, rated at 30 amperes at 125 VAC.

e. A 3 ampere fuse, labeled (24 VDC), shall fuse the 24 VDC output of the ferro-resonant power supply.

f. A 1 ampere fuse, labeled (24VPS 110VAC), shall fuse the AC input of the ferroresonant power supply.

g. Four Molex type 1375 receptacles shall be provided and must intermate with a Molex type 1375 plug. The receptacles shall be color coded.

h. Aux. 1 shall contain all wiring to the maintenance panel switches.

i. P1 shall contain all wiring that is external to the rack assembly. By removal of the connector the rack assembly may be removed without disconnecting the wiring from terminals with the exception of the field terminals.

j. P2 shall contain all DC power connections to the rack assembly.

k. P3 shall contain all AC and power control wiring to the rack assembly components.

l. A non-mercury contactor shall be provided and shall be capable of switching a minimum of 30 amperes at 120VAC.

m. A phone jack, which shall mate with a Switchcraft Model 190 plug, shall be provided for automatic cabinet diagnostic testing. When the plug is inserted, a reset signal will be supplied to the conflict monitor. The source of the reset signal shall be C1-97.

n. A ground fault interrupter shall be installed and shall be a NEMA 5-15R duplex type. Circuit interruption shall occur between 4 and 6 milliamperes of ground fault current. The ground fault receptacle shall be of the feed-through type.

o. Terminal blocks shall be so arranged that they shall not upset the entrance and connections of incoming field conductors. There shall be 5 blocks, each having 12 positions with 10-32 screws. Magnum Electric Corp. 481312-04 or equal.

p. The AC+ service connection shall be made directly to the main C.B. in the PDA from the power line service terminal. The terminals of the power line service terminal block shall be labeled "L1" and "AC-", and shall be covered with a clear insulating material to prevent inadvertent contact. Terminating lugs large enough to accommodate No. 2 conductors shall be furnished for the service terminal block. The terminal block shall be rated for 50 amperes at 1000 volts, minimum.

G. Type 336 Cabinet.

1. This section defines the detailed requirements for an 8-phase controller cabinet to be mounted on a post-top or foundation mount.

2. The cabinet shall be designed for either post-top or foundation mount. The design must be flexible enough to allow choosing the mounting type at time of installation, and to allow changing the mounting type at any time in the future. For foundation mounting, the cabinet shall be designed with a square opening in the floor of the cabinet as large as possible and still allow easy access to anchor bolts and a good seal with the foundation. For post-top mounting, an adapter shall be used which mates with the anchor bolt holes, in such a way as to provide a dust-proof attachment. The adapter shall mate with a standard 4 in. slipfitter, and shall be strong enough to meet the stiffness requirements defined below. All cabinets shall be supplied with an adapter and a 4 in. slipfitter, regardless of the stated application of the cabinet.

3. All Type 336 cabinets shall be capable of housing an auxiliary output file ("stretch" version), and one shall be supplied and installed when specified.

4. All Model 336 cabinets shall have both a front and a rear door, keyed with a Corbin #2 lock as described previously in the general cabinet specifications.

5. Cabinets assembled for post-top mounting shall be adequately reinforced in the bottom of the fully-equipped cabinet to withstand a 100 mph wind, and shall have less than 2 in. of deflection at the top when a 100 lb. force is applied horizontally at the top of the cabinet on any of the four planes of cabinet faces.

6. The input file shall have 14 slots, and an input panel used, as previously described for the Type 332 cabinet.

7. The output file shall have 12 output slots.

8. The red and yellow signal circuits of all switch packs assigned to vehicle signals for phases 1 through 8 shall be available at a Molex Type 1375 Receptacle which shall intermate with a Molex Type 1375 plug to allow flash programming. A plug connector, with programming jumpers, shall be furnished for each circuit to allow red or yellow flash programming. Connectors shall be readily accessible without the removal of any other equipment. Plug pins shall be crimped and soldered.

9. The cabinet shall also include 4 flash relays, and 2 flashers.

H. Warranties and Service.

1. The following minimum warranty shall apply:

a. All other equipment shall be warranted for a period of 24 months from date of installation.

2. The warranty shall cover all units, defects, parts, labor, and shipping costs.

I. Documentation.

- Each controller cabinet assembly shall be supplied with operation and maintenance manuals. A minimum of 1 set shall be supplied with each cabinet. Each cabinet shall be supplied with a cabinet drawing and a complete cabinet wiring diagram.

J. Testing and Certification.

1. All controllers and cabinets supplied shall be tested by the manufacturers as complete units as outlined in Chapter 1, Section 8 in FHWA-IP-78-16 and certification provided to the City of San Antonio that such tests were provided.

2. The manufacturer shall provide certification that the units supplied under these specifications are not units rejected by some other municipality or state.

4. **Measurement and Payment.** The work performed, materials furnished, equipment, labor, tools and incidentals will not be measured or paid for directly, but shall be considered subsidiary to Item 680, "Installation of Highway Traffic Signals".

SPECIAL SPECIFICATION

8703

Accessible Pedestrian Signal Units

1. Description. Furnish and install accessible pedestrian signal (APS) units.

2. Materials. Furnish and construct materials in accordance with the following:

- Item 618, "Conduit"
- Item 624, "Ground Boxes"
- Item 682, "Vehicle and Pedestrian Signal Heads"
- Item 684, "Traffic Signal Cables."
- Item 688, "Pedestrian Detectors and Vehicle Loop Detectors."

Furnish all new materials.

Ensure the APS complies with materials Section 688.2.A, "Pedestrian Detectors."

Ensure APS complies with US Access Board's "Draft Guidelines for Accessible Public Rights of Way (PROWAG) Section R306.

Supply an APS that includes a pedestrian sign, a pushbutton, and an audible speaker contained in one unit and with the following features:

- Vibrating tactile arrow with high visual contrast.
- Pushbutton locator tone with a duration of 0.15 seconds or less, repeating at 1-second intervals. The push button locator tones must deactivate when the traffic control signal is operating in a flashing mode. The locator tones must be intensity responsive to ambient sound and be audible (a maximum of 5 dBA louder than ambient sound) up to 6 to12 feet from the pushbutton or to the building line whichever is less.
- Speech walk message for the WALKING PERSON (symbolizing WALK) indication.
- Speech pushbutton information message.

- Audible tone walk indications – consisting of ticks repeating at 8 to 10 times per second at multiple frequencies with a dominant component at 880 Hz ± 20%. It must provide an audible walk indication during the walk interval only. The audible walk indication must be from the beginning of the associated crosswalk and must have the same duration as the pedestrian walk signal except it must be possible to limit the accessible walk indication to the first 7 seconds of the walk interval when the pedestrian signal rests in walk. When the accessible walk indication is limited during rest in walk a button press during the walk interval must recall the walk interval provided the crossing time remaining is greater than the pedestrian change interval.

- Automatic volume adjustment in response to ambient traffic sound level provided up to a maximum volume of 100 dBA. Tone or voice volume measured at 3 ft from the push button shall be 2 dB minimum and 5 dB maximum above ambient noise level and shall be responsive to ambient noise level changes.

- The pushbutton must be ADA compliant and activate both the walk interval and accessible pedestrian signal.

- Actuation indicator-tone and light.

- Extended button press which can be used to request a louder WALK signal and locator tone for subsequent clearance interval.

- Weather-proof speaker protected by a vandal proof screen.

- Pole unit and the central control unit shall be rated for the following temperature range: -30°F to +165°F.

- Accessible pedestrian signal units shall be operationally compatible with TS1, TS2, 170 and 2070 controllers, currently used by the Texas Department of Transportation and any other Texas government entities. In the case of conflicts between specifications, the latest TxDOT specifications will control.

- Supply a central control unit (CCU) for the pushbutton detector unit that resides in the Traffic Signal Controller Cabinet capable of controlling a minimum of 8 units. Ensure the CCU is capable of controlling up to 4 phases. Ensure that all inputs and outputs on the CCU have Transient Voltage Protection.

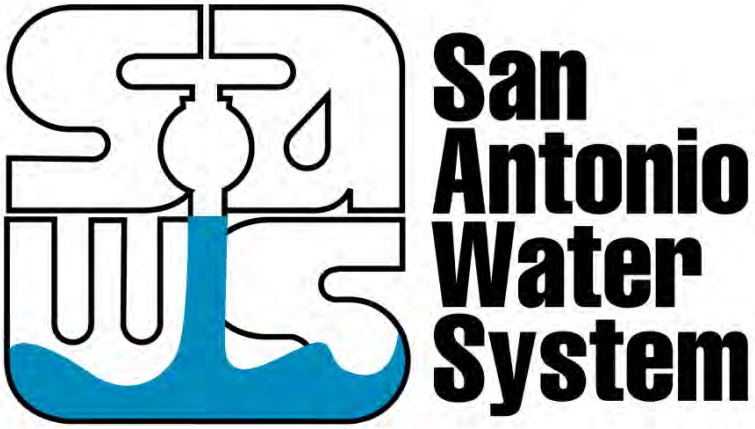
3. Construction. Wire the APS to the nearest splicing point or terminal strip using stranded No. 12 AWG XHHW wire with 600-volt insulation. Do not use terminal connections or splice wire leads except in the hand holes located in the signal pole shaft, in the signal pole base, or at locations approved by the Engineer. All allowed splices must be watertight. Attach wires to terminal posts with solderless terminals. Attach terminals to the wires with a ratchet-type compression crimping tool properly sized to the wire.

4. **Documentation Requirements**. Each APS shall be provided with the following documentation:
   A. Complete and accurate installation wiring guide.
   B. Contact name, address, and telephone number for the representative, manufacturer, or distributor for warranty repair.
   C. If requested by the purchaser, the bidders shall supply schematics for all electronics. One schematic diagram shall be provided for each unit, along with any necessary installation instructions.

5. **Warranty** The Accessible Pedestrian Signal unit shall be warranted against any failure due to workmanship, material defects or intensity within the first 60 months of field operation. Accessible Pedestrian Signal unit shall operate as required above after 60 months of continuous use over the temperature range of -30°F to +165°F in a traffic signal operation. The contractor shall provide a written warranty against defects in materials and workmanship for Accessible Pedestrian Signal unit for a period of 60 months after installation. Replacement of Accessible Pedestrian Signal units shall be provided within 5 days after receipt of failed at no cost to the State, except the cost of shipping the failed modules.

6. **Measurement.** This Item will be measured by each APS installed per intersection.

7. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Accessible Pedestrian Signal Units" of the type specified. This price is full compensation for furnishing, installing, and testing the detectors.



Special Specifications
For
TxDot / LAM Projects
Water Mains and Service Lines

May
2009

SPECIAL SPECIFICATION

Water Mains and Service Lines

Table of Contents

SPECIAL SPECIFICATION

Water Mains and Service Lines

1. Description.

Provide and install a complete water main system in accordance with the plans and specifications and in compliance with the Department's Utility Accommodation Policy (UAP)(Title 43, T.A.C., Sections 21.31-21.55). The water mains shall be of the sizes, materials and dimensions shown on the plans and shall include all pipe, all joints and connections to new and existing pipes, all valves, fittings, fire hydrants, pipe joint restraint systems, blocking, and incidentals, as may be required to complete the work.

The abbreviations AWWA, ASA, ASTM, and ANSI, as used in this specification, refer to the following organizations or technical societies:

- AWWA - American Water Works Association
- ASA - American Standards Association
- ASTM - American Society for Testing and Materials
- ANSI- American National Standards Institute
- NSF – National Science Foundation

Where reference is made to specifications of the above organizations, it is to be construed to mean the latest standard in effect on the date of the proposal.

2. Materials.

All materials used in this project are to be new and unused unless otherwise specified on the plans, specifications or the proposal.

A. Ductile-Iron Pipe and Fittings.

1. Ductile-Iron Pipe: 43-In. through 64-In.

All ductile-iron pipe is to be manufactured by process of centrifugal casting and is to conform to AWWA Standard C151, “American Standard for Ductile-Iron Pipe Centrifugally Cast with push-on or mechanical joints for Water or Other Liquids”, unless otherwise modified or supplemented herein.

Pipe is to conform to the following pressure classes, based on Type 3 bedding conditions, a depth of bury of 6 feet and a working pressure of 150 psi:

3” – 12”	350 psi
16” – 20”	250 psi
24”	200 psi
30” – 64”	150 psi

Dimensions and tolerances for each nominal pipe size shall be in accordance with table 51.5 (push-on) or table 51.5 (mechanical joint) of AWWA Standard C151 for pipe with a nominal laying length of 20 feet.

All pipe is to have a standard water works cement mortar lining in accordance with AWWA Standard C104 with outside coating per Section 51.8.1 of AWWA Standard C151.

Exterior coating is to consist of a nominal one mil thick asphaltic material applied to the outside of the pipe as described in Section 51.8 of AWWA C151.

Rubber joint gaskets utilized on ductile-iron pipe are to conform with AWWA C111 Standard, latest revision.

Each length of pipe shall bear identification markings in conformance with Sec 51.10 of AWWA C151.

Manufacturer is to take adequate measure during pipe production to assure compliance with AWWA C51 by performing quality-control tests and maintain results of those test as outlined in Section 51.14 of that standard.

Water System may at no cost to manufacturer, subject random lengths of pipe for testing by an independent laboratory for compliance with this specification. Any visible defects of failure to meet quality standards here in will be grounds for rejecting entire order.

2. Fittings for Ductile-Iron Pipe.

Unless otherwise modified or supplemented herein, the latest revision of AWWA Standard C110 for Ductile- Iron Fittings, 3-in. through 48-in. for Water and Other Liquids" and AWWA Standard C153 for Ductile-Iron Compact Fittings, is to govern the design, manufacture, and testing of all fittings under this specification.

For 3 through 24-in. size range, the pressure rating of all fittings is to be a minimum of 250 psi. The working pressure for all fittings of size greater than 24-In. is to be a minimum of 150 psi unless a change in pressure rating is shown on plans.

Fittings are to be furnished with the type of end combination specified.

Mechanical joint fittings and anchor type fittings are to be furnished complete, with glands, gaskets, and bolts. Bolts for mechanical joints are to be ASTM A536 specially alloyed and heat treated ductile iron conforming to ANSI/AWWA standard CIII/A21.IL.

Flanged fittings are to be faced and drilled in accordance with ASA Specifications B 16.1, Class 125.

Anchor fittings are to be furnished in size and type or length as specified.

The exterior of all fittings is to be provided with a petroleum asphaltic coating in accordance with AWWA Standard C110. The interior of flanged fittings supplied under this Item is to be either cement-mortar lined in accordance with AWWA Standard C104 or lined with a Standard C104 or lined with a petroleum asphaltic material in accordance with the latest revision of AWWA Standard C110 as specified. The interior of all other fittings supplied under this Item is to be cement-mortar lined in accordance with the latest revision of AWWA Standard C104.

Fittings for 2-in. size are to be manufacturer's standard design, designed in accordance with applicable design standard of AWWA Standard C110.

B. Concrete Steel Cylinder Pipe and Fittings.: 20-in. and larger.

The design, component materials, manufacture and testing of all concrete-steel cylinder pipe and fittings is to conform to AWWA Standard C301 for "Pre-Stressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids". Except where otherwise indicated in the contract documents, all pipe is to be AWWA Class 150 and is to be designed for an internal working pressure of 150 psi and a minimum external load equivalent to 6-ft. of earth cover. Where the depth of bury of the pipe is indicated to be greater than 6-ft. in the contract specifications or on the drawings the design of the pipe is to suitable for the earth loads indicated.

All data submitted by the Contractor is to include a tabulated layout schedule with reference to the stationing and grade lines shown on the plans. The Contractor is to provide a design summary for each size of pipe furnished for each pressure and depth of bury.

Each special length of straight pipe is to have plainly marked on the inside of the bell end the class of pipe and identification marks sufficient to show the proper location of the pipe by reference to layout drawings.

Pipe 20-in. through 42-in. in size is to be furnished in nominal lengths of 20 to 32 ft.; pipe 48-in. through 72-in. in size is to be furnished in nominal lengths of 16-ft. except as this requirement is to be modified by design requirements of the particular job.

Each joint of pipe is to be furnished with a rubber gasket and a 12-in. diaper.

C. Steel Pipe, Fittings and Flanges.

1. Steel Pipe.

Steel pipe with nominal diameters from 6" to 20-inch shall conform to ASTM A 106, A 53 Grade B or A 139 Grade B standard weight class as the minimum

Steel Pipe greater than 20-inches shall conform to AWWA C200 and AWWA M-11 except as modified herein or as required by the engineer for special circumstances.

Pipe shall be designed for a minimum of 150 psi working pressure with an additional 50% of the working pressure allowance for surge pressure unless otherwise specified. Pipe design shall be in accordance with AWWA M-11.

Pipe shall be designed to cover conditions as shown on the plans. The design for deflection shall be in accordance with AWWA M-11.

Pipe for use with sleeve-type couplings shall have plain ends at right angles to the axis.

Pipe ends are to be beveled and suitable for field butt welding except as otherwise specified.

Protective coatings and linings are to conform to AWWA Standard C-203, "Coal-Tar Protective Coatings and Linings for Steel Pipelines - Enamel and Tape Hot Applied".

Pipe length is to be nominal 50-ft. lengths except for specials or as otherwise specified on the plans. Manufacturer is to prepare a lay schedule showing the location of each piece by a mark number with station and invert elevation at each bell end.

2. Fittings for Steel Pipe.

Unless otherwise shown on the Plans, all specials and fittings shall conform to the dimensions of AWWA Standard C208. Pipe material used in fittings shall be of the same material and thickness as the pipe. The minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of the elbow shall not exceed 11 1/4 degrees (One cut elbow up to 22 1/2 deg.). If elbow radius is less than 2.5 x pipe diameter, stresses shall be checked per AWWA M-11 and wall thickness or yield strength increased if necessary. Fittings shall be equal in pressure design strength. Specials and fittings, unless otherwise shown on the Plans, shall be made of segmentally welded sections from hydrostatically tested pipe, with ends compatible with the type of joint or coupling specified for the pipe. All welds made after hydrostatic testing of the straight sections of pipe shall be checked per the requirements of AWWA C-200 Section 5.2.2.1

Joints

a. Rolled-Groove Rubber Gasket Joint: the standard joint shall be rolled-groove rubber gasket joint unless otherwise noted on the plans. Rolled-grooved rubber gasket joints shall conform to AWWA C200 Standard and as shown in Chapter 8 of AWWA M-11.

The o-ring rubber gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200.

The joint shall be suitable for a safe working pressure equal to the class of pipe furnished and shall operate satisfactorily with a deflection angle, the tangent of which is not to exceed 1.00/D where D is the outside diameter of the pipe in inches with a pull-out of 1 inch.

Rolled-Groove Rubber Gasket Joints may be furnished only by a manufacturer who has furnished pipe with joints of similar design for comparable working pressure. Pipe diameter, pipe length, and wall thickness that has been in successful service for a period of at least 5 years.

b. Lap weld: Lap field welded joints shall be used where tied joints are indicated on the plans. The standard bell shall provide for a 2 1/2-inch lap. The minimum lap shall be 1 inch. The design maximum joint deflection or offset shall be a 1" joint pull.

c. Mechanical Couplings: Mechanical couplings where indicated on the plans shall be Smith Blair Style 411, Baker Style 200, Brico Depend-O-Loc or equal. Insulating mechanical couplings where indicated on the plans shall be double insulated Smith Blair Style 416, Baker Style 216, or equal. Mechanical couplings shall be rated to meet or exceed the working pressures and surge pressure of the pipe.

Couplings for buried service shall have all metal parts painted with Epoxy paint and conform to AWWA C219.

Pipe ends for mechanical couplings shall conform to AWWA C200 and M-11. The shop applied outside coating shall be held back as required for field assembly of the mechanical coupling or to the harness lugs or rings. Harness lugs or rings and pipe ends shall be painted with one shop coat of epoxy conforming to AWWA C210. The inside lining shall be continuous to the end of the pipe.

3. Steel Flanges.

Steel pipe flanges, where called for on the plans, are to conform to AWWA Standard C207, "Steel Pipe Flanges" for Class D for operating pressures to 175 psi on 4 inch through 12 inch diameter, and operating pressures to 150 psi on diameters over 12 inches; or Flanges shall be AWWA C207 Class E for operating pressures up to 275 psi; or Flanges shall be AWWA C207 Class F for pressures to 300 psi. (drilling matches ANSI B 16.5 Class 250)

Shop lining and coating shall be continuous to the end of the pipe or back of the flange. Flange faces shall be shop coated with a soluble rust preventive compound.

Gaskets: Full face, 1/8-inch thick, cloth-inserted rubber, Garlock 3000, John Crane Co. Style 777 or equal

Bolts and Nuts for Flanges

a. Bolts for flanges located indoors and in enclosed vaults and structures shall be carbon steel, ASTM A307, Grade B for class B and D flanges and nuts shall be ASTM A563, Grade A heavy hex. Bolts for class E and F flanges shall be ASTM A 193 grade B7 and nuts shall be ASTM A194, grade 2 H, heavy hex.

b. Bolts for buried and submerged flanges and flanges located outdoors above ground or in open vaults in structures shall be TYPE 316 stainless steel conforming to ASTM A193, Grade B8M, Class 1 for class B and D Flanges with ASTM 194, Grade 8M nuts. For Class E and F flanges the bolts shall be ASTM A194 grade 2H nuts with bolt and nuts to be zinc plated in accordance with ASTM B633

4. Linings and Coatings

a. Polyethylene Tape Coating:

(1) Prefabricated Multi-layer Cold Applied Tape Coating - the coating system for straight-line pipe shall be in accordance with AWWA Standard C214. The system shall consist of three layers of polyethylene material with a nominal thickness of 80 mills when complete

(2) Coating Repair: Coating repair shall be made using tape and primer conforming to AWWA Standard C209, Type II. The tape and primer shall be compatible with the tape system used for straight-line pipe.

(3) Coating of Fittings, Specials and Joints:

(a) General – Fittings, specials and joints which cannot be machine coated in accordance with above, shall be coated in accordance with AWWA Standard C209. Prefabricated tape shall be Type II and shall be compatible with the tape system used for straight-line pipe. The system shall consist of 3 layers consisting of the following: Alternate coating methods for fittings specials and field joints would be Shrink sleeves per C-216, or paint per C-210, C-218, or C-222. The field coating shall completely encapsulate the joint bonds on o-ring joints.

(b) Coating Repair - Coating repair for fittings and specials shall be in accordance with the procedure described above for straight-line pipe and as recommended by the manufacturer.

b. Other Coating Systems if specified shall be governed by the appropriate American Water Works Association standard.

c. Cement Mortar per AWWA C205

(1) Cement Mortar Lining of Steel Pipe

(a) Except as otherwise provided in AWWA Standard C205, interior surface of all steel pipe, fittings and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA Standard C205.

(b) The pipe ends shall be left bare where field joints occur as shown on the Plans. Ends of the linings shall be left square and uniform. Feathered or uneven edges will not be permitted.

(c) Defective linings as identified in AWWA C-205 shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather edged joints.

(d) Cement mortar lining shall be kept moist during storage and shipping.

(2) Fittings

(a) Fittings shall be lined and coated per AWWA C205.

5. Steel Casing Pipe

All pipe intended for use as casing pipe shall be of the types and sizes shown on the plans. The diameter and wall thickness is to conform to those shown on the plans.

6. Quality Assurance

Commercial Standards: (All manufacturing tolerances referenced in the below standards apply unless specifically excluded).

ANSI/AWWA C-200 Standard for Steel Water Pipe 6 Inches and Larger.

ANSI/AWWA C-205 Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 in. and Larger-Shop Applied

ANSI/AWWA C-206 Standard for Field Welding of Steel Water Pipe.

ANSI/AWWA C-207 Standard for Steel Pipe Flanges for Water Works Service, 4" - 144".

ANSI/AWWA C-208 Standard for Dimensions for Fabricated Steel Water Pipe Fittings.

ANSI/AWWA C-209 Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

ANSI/AWWA C-210 Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

ANSI/AWWA C-214 Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines.

ANSI/AWWA C-216 Standard for Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

ANSI/AWWA C-218 Standard for Liquid Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.

ANSI/AWWA C-219 Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.

ANSI/AWWA C-222 Standard for Polyurethane Coatings for the Interior and Exterior of Steel Water Pipelines and Fittings.

AWWA M-11 Steel Pipe - A guide for Design and Installation

ASTM A 106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

ASTM E 165 Method for Liquid Penetrant Examination.

ASTM E 709 Guide for Magnetic Particle Examination.

ASME Section V Nondestructive Testing Examination.

ASME Section IX Welding and Brazing Qualification.

AWS B2.1 Standard for Welding Procedure and Welding Qualifications.

7. Qualifications

a. Manufacturers who are fully experienced, reputable, and qualified in the manufacture of the products to be furnished shall furnish all Steel pipe and fittings. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

b. Pipe shall be the product of one manufacturer that has not less than five (5) years successful experience manufacturing pipe in the United States of the particular type and size indicated. All pipe manufacturing including cylinder production, lining, coating and fittings shall be produced by one manufacture. The pipe manufacturer must have a certified quality assurance program. This certified program shall be ISO 9001: 2000 or other equivalent nationally recognized program.

D. Polyvinyl Chloride Pipe and Fittings.

1. Polyvinyl Chloride Pipe, 4-in. through 12-in.

4" through 12" polyvinyl chloride (PVC) pressure pipe is to be made from class 1245A or 1245B compounds as determined by ASTM Standard D1784 and providing for a hydrostatic test basis (HBD) of 4000 psi.

All PVC pipe shall conform to AWWA C900. The Manufacturer shall supply the Engineer an affidavit that the materials supplied comply with all applicable requirements of AWWA C900.

All C900 PVC pipe shall have a pressure rating of 150 psi and a dimension ratio of 18 with cast iron equivalent outside diameters unless otherwise specified. It shall have a sustained pressure requirement of 500 psi and a minimum burst pressure of 755 psi. C900 PVC pipe installed in High Pressure Zones are to have pressure rating of 200 psi and a dimension ration of 14, a sustained pressure requirements of 650 psi and a minimum burst pressure of 985 psi. It shall be furnished in nominal 20-ft. lengths, and shall be self extinguishing.

Dimensions and tolerances for each nominal pipe size is to be in accordance with Section 2.2, table 1 of AWWA C900.

Each pipe shall have an integral bell formed on the pipe end, and be designed to be at least as strong as the pipe wall.

An elastomeric gasket shall be designed with a retainer ring that locks the gasket into integral bell groove and shall be installed at the point of manufacture. The dimensions and design of the gasket joint provided for the PVC pipe shall meet requirements provided in ASTM D3139 and ASTM D2122. The gasket shall be reinforced with a steel band and shall conform to ASTM F477.

Each length of pipe furnished is to bear identification markings in conformance with Section 2.6 of AWWA C900.

2. Polyvinyl Chloride (PVC), 14-in. through 36-in.

a. **Scope.** This product specification covers 14-in. nominal diameter through 36-in. nominal diameter polyvinyl chloride (PVC) potable water transmission pipe with integral bell and spigot joints. The pipe shall be extruded from Class 12454-A or 12454-B PVC compound as defined in ASTM D-1784 and provide for a hydrostatic design basis (HDB) of 4,000 psi. The pipe outside diameters shall conform to dimensions of cast iron pipe (CI). All pipe furnished shall be in conformance with American Water Works Association (AWWA) Standard C905-97, or latest revision thereof.

Pipe shall be homogenous throughout. It shall be free from voids, cracks, inclusions, and other defects. It shall be as uniform as commercially practical in color, density, and other physical properties. Pipe surfaces shall be free from nicks and scratches. Joining surfaces of spigots and joints shall be free from gouges and imperfections that could cause leakage.

b. Definitions. All definitions are defined according to AWWA C905-97 Section 1.2 Definitions.

1. Dimension Ratio (DR) - The ratio of the pipe outside diameter to the minimum wall thickness. The quotient is rounded to the nearest 0.5 when necessary.

2. Pressure Rating (PR) - The nominal pressure rating of transmission pipe is determined from formulas in Section 5: Transmission-Pipe Ratings AWWA C905-97 using a safety factor of 2.0. There is no allowance for surge pressure in the pressure rating.

c. General

1. Except as noted on the plans or procurement specifications for specific jobs, all C-905 PVC pipe shall have a pressure rating of 235 PSI and a dimension ratio of 18 or have the highest pressure rating available for each size of pipe.

2. Dimensions and tolerances for each nominal pipe size shall be in accordance with Table 2 Dimensions for PVC Transmission Pipe with CI Outside Diameter of Section 3 Pipe Requirements in AWWA C905-97. All pipe shall be suitable for use as a pressure conduit.

3. Pipe shall be gauged full length and furnished in standard laying lengths of 20 ft. ± 1 in. unless otherwise noted. Each pipe shall have an integral bell formed on the pipe end, and be designed to be at least as strong as the pipe wall.

4. An elastomeric gasket shall be designed with a retainer ring, which locks the gasket into integral bell groove and shall be installed at the point of manufacture. The dimensions and design of the gasket joint provided for the PVC transmission pipe shall meet requirements provided in ASTM D3139 and ASTM D2122. The gasket shall be reinforced with a steel band and shall conform to ASTM F477.

5. Each length of pipe furnished shall bear identification markings that will remain legible after normal handling, storage, and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Markings shall be applied at intervals of not more than 5 ft. on the pipe. The minimum required markings are given in the list below. Marking requirements shall be in conformance with Section 4.7 Marking Requirements of AWWA C905-97.

   a. Nominal size and OD base (for example, 24 CI).
   b. PVC.
   c. Dimension Ratio (for example, DR 25)
   d. AWWA pressure rating (for example, PR 165)
   e. AWWA designation number for this standard (AWWA C905).
   f. Manufacturer's name or trademark.
   g. Manufacturer's production code, including day, month, year, shift, plant, and extruder of manufacture.

3. C 900 and C 905 Requirements

a. Bundle pipe in pallets for ease of handling and storage. Package Pipe bundles to provide structural supports to insure that weight of upper units do not cause deformation to pipe in lower units. Pipe bundles showing evidence of ultra violet radiation "sunburn" on exposed pipe as may be caused from extended unprotected storage conditions will not be accepted.

b. Manufacturer is to take adequate measures during pipe production to assure compliance with AWWA C900 or C905-97 as applicable by performing quality control-control test and maintaining results of those test as outlined in Section 3 of that standard. Submission of product constitutes certification of compliance with standard.

c. Pipe is intended for use as an underground, direct bury pressure pipe for transport of potable water. The expected life of pipe system after installation is 25 to 50 years.

d. Provide a one year warranty for all material sold and delivered for use and incorporation into water system. Warranty take effect on the date that pipe is received and accepted by Water System authorized representative.

e. Provide user reference and claims history for further investigation, prior to Water System rendering final decision on the acceptance of product furnished.

f. Test.

(1) For both C 900 and C 905, water system may at no cost to manufacturer, subject random lengths of pipe for testing by an independent laboratory for compliance with this specification. Any visible defects of failure to meet quality standards here in will be grounds for rejecting entire order.

(2) For C 905: The manufacturer shall pressure test all pipe, including the joint, which is marked with the designation number of AWWA C905-97 at 73.4º F. +/- 3.6ºF (23ºC +/- 2ºC). Each length of pipe shall be proof tested at twice the pressure rating listed in Table 3 Transmission-Pipe Pressure Rating of AWWA C905-97 Sec. 4.6 Pressure Strength and Hydrostatic Proof

f. References. The documents listed below are referenced in this specification.

(1) AWWA C905-97; Polyvinyl Chloride (PVC) Water Transmission Pipe Nominal Diameters 14 in. through 36 in.

(2) ASTM D1784; Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.

(3) ASTM D2122; Standard Method of Determining Dimensions of Thermoplastic Pipe and Fittings.

(4) ASTM D3139; Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

(5) ASTM F477; Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

4. Bends and Fittings for PVC Pipe 4-in. through 36-in.

All bends and fittings shall conform to the same requirements subparagraphs2. A. 2 Fittings for Ductile-Iron Pipe.

5. Joint Restraint System for PVC C-900/C-905.

a. Scope. This specification covers pipe joint restraint systems to be used on domestic water mains for PVC C-900 pipe sizes 4-in. through 12-in. diameter and PVC C-905 pipe sizes 16-in. through 24-in. diameter, and for Ductile Iron pipe sizes from 4-in. through 24-in. diameter. Joint restraint systems are classified as “compression, “mechanical joint” or “non-metallic restrained joint” for the specific type of pipe joint to be restrained.

b. General Requirements

(1) Underwriter Laboratories (U.L) and Factory Mutual (FM) certifications are required on all restraint systems.

(2) Unless otherwise noted, restraint systems to be used on PVC C-900 and C-905 pipe shall meet or exceed A.S.T.M. Standard F1674-96, “Standard Test Methods for Joint Restraint Products for Use with PVC Pipe,” or the latest revision thereof. Restraint systems used on ductile pipe shall meet or exceed U.L. Standard 194

(3) Non-metallic restrained joint pipe and couplings shall be utilized specifically for C-900 PVC pipe and fittings in sizes 4-in.-12-in.

(4) Each restraint system shall be packaged individually and include installation instructions.

c. Specific Requirements.

(1) Restrainer for PVC C-900/C-905 & Ductile Iron Push-on Type Connections:

(a) Pipe restraints shall be utilized to prevent movement for push-on D.I. or PVC (C-900&C-905) (compression type) bell and spigot pipe connections or where a transition or flexible coupling has been used to join 2 sections of plain-end pipe D.I. or PVC (C-900 C-905). The restrainer may be adapted to connect a plain end D.I. or PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. The restrainer must not be directionally sensitive.

(b) The pipe shall be restrained by a split retainer band. The band shall be cast ductile iron, meeting or exceeding ASTM A536-80, Grade 65-45-12. The inside face or contact surface of the band shall be of sufficient width to incorporate cast or machined non-directionally sensitive serration to grip the outside circumference of the pipe. The serration shall provide full (360 °) contact and maintain pipe roundness and avoid any localized points of stress. The split band casting shall be designed to "bottom-out" before clamping bolt forces (110ft-lb minimum torque) can over-stress the pipe, but will provide full non-directionally sensitive restraint at the rated pressures.

(c) Bolts and nuts used to attach the split retainer ring shall comply with ANSI B 18.2/18.2.2, SAE Grade 5. Tee-bolts, nuts and restraining rods shall be fabricated from high-strength, low-alloy steel per AWWA C111-90, ANSI/AWWA C111/A21.11.

(d) The split ring type non-directionally sensitive restrainer system shall be capable of a test pressure twice the maximum sustained working pressure listed in section D and be for both D.I. and/or PVC C-900.

(e) Restraint systems sizes 6 through 12-in. shall be capable of use for both ductile iron and/or PVC C-900.

(f) The restraint system may consist of 2 types: the two split retainer rings and for new construction use only the 1 split and 1 solid cast backup ring.

(2) Compression Ring Fitting Restrainer for Ductile Iron Pipe & PVC C-900.

(a) Compression ring with follower gland type of restrainer may be utilized in conjunction with Mechanical Joint (MJ) bell end ductile iron pipe fittings for restraining PVC C-900 and ductile iron pipe.

(b) The system shall utilize a standard MJ gasket with a color-coded compression ring and replacement gland conforming to ASTM A 536-80, Grade 65-45-12.

(c) Standard MJ fitting Tee-bolts and nuts shall be fabricated from high strength steel conforming toANSI AWWA C111/A21.11and AWWA C153/A21.53-88.

(d) Standard MJ gasket shall be virgin SBR meeting ASTM D-2000 3 BA 715 or 3 BA 515.

(e) The restraint system shall be capable of a test pressure twice the maximum sustained working pressure listed in section D.

(3) Non-metallic restrained joint pipe and couplings for PVC C-900 Type Connections:

(a) Gasketed restrained coupling connections shall join two sections of factory grooved PVC (C-900) pipe. The restrainer coupling or must not be directionally sensitive.

(b) The coupling shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F-477 and shall be DR-14 Class 200 C-900 PVC in all applications, meeting or exceeding the performance requirements of AWWA C-900, latest revision. The inside face or contact surface of the coupling connection shall be of sufficient width to incorporate a factory machined non-directionally sensitive groove in both pipe and coupling to grip the outside circumference of the pipe. The couplings shall provide full (360 °) contact and maintain pipe roundness and avoid and localized points of stress. The coupling shall be designed with an internal stop to align the precision-machined grooves in the coupling and pipe prior to installation of a non-metallic thermoplastic restraint spleen, and will provide full non-directionally sensitive restraint at the rated pressures.

(c) High-strength flexible thermoplastic spleens shall be inserted into mating precision–machined grooves in the pipe and coupling to provide full non-directional restraint with evenly distributed loading.

(d) The non-metallic restrained joint pipe and couplings for PVC C-900 type non-directionally sensitive restrainer system shall be capable of a test pressure twice the maximum sustained working pressure listed in Section D and be for PVC (C-900) pipe sizes 4 through 12-in.

(e) Non-metallic restrained joint pipe and couplings for PVC C-900 restrained systems sizes 4 through 12-in. shall be capable of use for both Class 150 (DR 18) and 4 through 8-in. for Class 200 (DR 14) PVC C-900 pipe.

(f) The non- metallic restrained joint pipe and couplings for PVC C-900 restraint system shall consist of a pipe and couplings system produced by the same manufacturer meeting the performance qualifications of Factory Mutual (FM) and Underwriters Lab (UL).

(4) Retainer Gland for Ductile Iron Pipe (only):

(a) Radial bolt type restrainer systems shall be limited to ductile iron pipe in conjunction with Mechanical Joint (MJ) bell end pipe of fittings. The system shall utilize a standard MJ gasket with a ductile iron replacement gland conforming to ASTM A 536-80. The gland dimensions shall conform to Standard MJ bolt circle criteria.

(b) Individual wedge restrainers shall be ductile iron heat treated to a minimum hardness of 370 BHN. The wedge screws shall be compressed to the outside wall of the pipe using a shoulder bolt and twist-off nuts to insure proper actuating of the restraining system.

(c) Standard MJ fitting Tee-bolts and nuts shall be high strength steel conforming to AWWA C111/A21.11and C153/A21.53-88.

(d) Standard MJ gasket shall be virgin SBR meeting ASTM D-2000 3 BA 715 or 3 BA 515.

(5) Maximum Sustained Working Pressure Requirement

Table 2

Nominal Diameter	**PVC C-900/C-905**	**Ductile Iron**
4 & 6 in.	150p.s.i. (DR18)/200p.s.i (DR14)	350p.s.i
8 in.	150p.s.i. (DR18)/200p.s.i (DR14)	250p.s.i
10 & 12 in.	150p.s.i. (DR18)/200p.s.i (DR14)	200p.s.i
14 & 16 in.	150p.s.i. (DR 18)/200p.s.i. (DR 21)/235p.s.i. (DR 18)	200p.s.i
20 & 24 in.	150p.s.i. DR18)/200p.s.i (DR 21)/235p.s.i. (DR18)	200p.s.i

(4) Tests. Water System Owner may, at no cost to the manufacturer, subject random joint restraint system products to testing by an independent laboratory for compliance with these standards. Any visible defect of failure to meet the quality standards herein will be ground for rejecting the entire order.

(5) Product List. Other approved equal products from other manufacturers meeting these specifications may be submitted for review.

(a) Slip on Joint Restraint Systems:

Manufacturer	PVC C-900/C905	Ductile Iron (D.I.)	DI, 16" Above
Ford / Uni-Flange Corporation	Series 1390C	Series 1390C	1390C
EBBA Iron Sales, Inc.	1500	1700	1700
Romac Industries, Inc. 4-8 inch	Modle 611	Model,611	47 OSJ
Star Pipe Products	1100	1100	1100

(b) Compression Ring Systems:

Manufacturer	PVC C-900	Ductile Iron
Romac Industries, Inc.	Grip Ring-DI	Grip Ring-DI
Tyler Corporation	MJR Gland	MJR Gland
Star Pipe Products	Ring Lock 3500 Series	

(c) Non-metallic restrained joint pipe and couplings for PVC C-900 RJ Type Connections:

Manufacturer	PVC C-900	Ductile Iron
CertainTeed Corporation, Certa-Lok C-900/RJ	4" – 12"	Class 150 (DR-18)
	4" – 8"	Class 200 (DR-14)

(d) Retainer Gland (MJ):

Manufacturer	PVC C-900	Ductile Iron
EBBA Iron Sales, Inc.	2000 PV	MEGALUG 1100
Romac Industries, Inc.	Not Approved	Not Approved
Ford/UniFlange	UFR-1500-C 4" – 24"	Series 1400
StarPipe Products	Stargrip 4000	Stargrip 4000
Sigma Corporation	One Lok SLC	One Lok SLD

(e) Restrained Flange Adapters

Manufacturer	PVC C-900	Ductile Iron
EBBA Iron Sales, Inc.	2100 Megaflange	2100 Megaflange
Ford/UniFlange	900	200, 400, 420

1. C - 909

This product specification covers molecularly oriented 4" through 12" diameter Polyvinyl Chloride (PVC) pressure pipe manufactured from starting stock pipe made from class 12454A or 12454B compounds as determined by ASTM Standard DI784. The starting stock materials are then oriented through circumferential expansion to provide a hydrostatic design basis of 7,100 psi. Pipe shall be homogenous throughout. It shall be free from voids, cracks, inclusions and other defects. It shall be as uniform as commercially practical in color, density and other physical properties. Pipe surfaces shall be free from nicks and scratches. Joining surfaces of spigots and joints shall be free from gouges and imperfections that could cause leakage. All pipe furnished shall be in conformance with AWWA Standard C-909-02, or latest revision thereof and meet the ANSI/NSF Standard 61 requirements.

2. General Requirement

a. Except as noted on the plans or procurement specifications for specific jobs, all C-909 PVC pipe shall be Class 150 having a sustained pressure requirement of 500 psi (ASTM D2241) and a minimum burst pressure of 755 psi (ASTM D1599.)

b. Dimensions and tolerances for each nominal pipe size shall be in accordance with Section 4.3 Pipe Requirements, Table 1 of AWWA Standard C-909.

c. Pipe shall be furnished in standard laying lengths of 20 feet (plus or minus one inch) unless otherwise noted. Each pipe shall have an integral bell formed on the pipe end, and be designed to be at least as strong as the pipe wall.

d. An elastomeric gasket that "locks" into the integral bell groove shall be installed at the point of manufacture. The gasket shall be in conformance with ASTM F477

e. Each length of pipe furnished shall bear identification markings in conformance with Section 6.1.2 Pipe of AWWA Standard C-909.

f. Pipe shall be bundled in pallets for ease of handling and storage. Pipe bundles units shall be packaged to provide structural support to ensure that the weight of upper units shall not cause deformation to pipe in the lower units.

g. No pipe bundles shall be accepted which show evidence of ultraviolet radiation "sunburn" on exposed pipe as may be caused from extended unprotected storage conditions.

h. The manufacturer shall take adequate measures during pipe production to assure compliance with AWWA C-909 by performing quality-control tests and maintaining results of those tests as outlined in Section 5.2 Quality-Control Records of that Standard. Submission of product shall constitute certification of compliance with this standard.

i. The pipe is intended for use as an underground, direct buy pressure pipe for transport of potable water. The expected life of the pipe is received and accepted by an authorized representative of the San Antonio Water System.

j. A one-year warranty shall be provided for all materials sold and delivered or use and incorporated into the San Antonio Water System. Such warranty shall take effect on the date that the pipe is received and accepted by an authorized representative of the San Antonio Water System.

k. User references and a claims history shall be provided for further investigation, prior to rending a final decision on the acceptance of the product to be furnished.

3. The San Antonio Water System may, at no cost to the manufacturer, subject

random lengths of pipe testing by an independent laboratory for compliance with this specification. Any visible defect of failure to meet the quality standards herein will be grounds for rejecting the entire order.

E. Copper Tubing and Brass Fittings for Copper Service Lines.

1. Copper Tubing.

All 3/4 in., 1 in., 1-1/2 in. and 2-in. copper tubing for underground service is to be of the type commercially known as Type "K" soft and conform to ASTM Designation B88 and NSF Standard 61.

3/4 in. and 1-in. copper tubing is to be furnished in 60-ft. coils or 100-ft coils as specified, 1-1/2-in. is to be furnished in 20-ft. lengths, 40-ft coils or 60-ft. coils as specified, and 2-in. is to be furnished in 20-ft. lengths or 40-ft coils as specified.

2. Brass Fittings.

a. General requirements

Unless otherwise modified herein, water works brass goods consisting of corporation stops, curb stops, couplings, connectors, nipples, etc., will be required in underground installations of service lines in the water distribution system.

The brass composition is to conform to ASTM Designation B62 and the threads are to conform to AWWA Standard C800-01 for "Threads for Underground Service Line Fittings".

All casting is to have a natural, clean uniform and smooth surface, and be free from internal porosity.

All machining is to be done in a workmanlike manner and within the acceptable tolerances.

Unless otherwise specified each fitting is to be furnished with a 1/16-in. thick fiber gasket.

b. Design Criteria for Curb Stop/Angle Valves Ball Type

All Curb Stop, Corporation and Angle valves shall be ball valves. "Inverted/Ground Key," type angle valves will not be accepted.

Ball angle valves will not have a stop.

Laying dimensions the same as present inverted key style or equal to Mueller H-14258.

Reduced port design will be acceptable provided there is no compromise on flow capacity compared to the "Inverted/ Ground Key" type angle valve.

Pack joints will not be acceptable.

APPROVED MANUFACTURER LIST

In Line FIP X FIP
Approved Manufacturers and Models:

2-INCH FIP X FIP

Manufacturer	Model
Ford Meter Box	B11777WR
A.Y. McDonald	6111W
Mueller	B-20200-3
James Jones	J1900

Angle Curb Stop Meter Coupling x Compression
Approved Manufacturers and Models:

	Size			
Manufacturer	¾"	1"	1.5"	2"
A.Y. McDonald	4652BQ	4652BQ		4612BQ
Ford Meter Box	BA43-232WRQ	BA43-344WRQ	BFA43-666WRQ	BFA43777WRQ
Mueller	B24258-R3	B24258-3	B24276-3	B24276-3
James Jones	J1963WSG	J1963WSG	J1975WSGLS	J1975WSGLS
Hays	2520CGJ-R			

F.I.P. X METER SWIVEL NUT/COUPLING
Approved Manufacturers and Models:

Manufacturer	Size
	¾"
A.Y. McDonald	4654B
Ford Meter Box	BA13232WR
Mueller	B24265-R3
James Jones	J-1966WLS
Hays	2521-R

Ball Corporation Valve
Approved Manufacturers and Models:

Manufacturer	CC X CMP	IP X CMP
A.Y. McDonald	4701BQ	4704 BQ
Mueller	B-25008	B-25028
James Jones	1937 SG	1935 SG
Ford Meter Box	FB-1000Q	FB-1100Q

F. Gate Valves, Tapping Valves and Tapping Sleeves.

1. Gate Valves.

a. General Requirements

(1) Except as otherwise modified or supplemented herein, AWWA Standard C509-01 or the latest revision thereof, shall govern the design, component materials, construction; manufacture and testing of all resilient seated gate valves. Valves shall be suitable for frequent operation as well as service involving long periods of inactivity. Valves shall be NSF-61 certified.

(2) The San Antonio Water System reserves the right to limit the purchase of resilient seat gate valves from manufacturers and to the models specified, as shown on ATTACHMENT I, provided such resilient seat gate valves conform to the provision contained herein.

(3) The minimum design working water pressure for gate valves with nominal diameters of 3 in., 4 in., 6 in., 8 in., 10 in., and 12 in. shall be 200 psig unless otherwise specified.

(4) The minimum design working water pressure for gate valves with nominal diameters of 16 in., and 20 in. shall be 150 psig unless otherwise specified.

(5) Valves shall be resilient-seated types, bronze mounted with non-rising stems. The closure member shall be fully encapsulated by an elastomer without thin spots or voids. When open the valve shall have a clear, full-port, unobstructed waterway.

(6) Gray iron, ductile iron, steel, brass and bronze materials shall meet or exceed the material requirements of Section 2: Materials of AWWA C509-01.

(7) Gaskets, O-rings, Coatings, and elastomers shall meet or exceed the material requirements of Section 2: Materials of AWWA C509-01.

(8) The gate valves shall be designed and constructed for installation in either a horizontal or vertical position. Valves shall be designed for buried installation with stem in the vertical position and shall be furnished for mounting in a horizontal pipeline, unless otherwise specified.

(9) Valve components of brass or bronze shall be manufactured to ASTM recognized alloy specifications of low zinc content bronze, as shown in Table 1 of Section 2.2.4. of ANSI/AWWA Standard C509-01 or the latest revision thereof. Materials for the stem have minimum yield strength of 40,000 psi. A minimum elongation in 2 inches of 12% and shall be made of bronze per ASTM B763, alloy number UNS C99500. A maximum zinc content of 2% as shown in Table 2 Chemical Requirements of ASTM B763-96 or the latest revision thereof. Stem nut material shall be ASTM B62 UNS C83600 or ASTM B584 UNS C84400. The stem shall have a visible external marking at the top to indicate low-zinc, high strength material. The marking shall include a red plastic or neoprene washer placed around the top of the stem under the operating nut.

(10) Valve ends shall be either flanged, tapping valve, mechanical joint, push-on joint or any combination thereof, as specified. All mechanical joint valves shall be supplied with glands, bolts, and gaskets. Valve body bolts and nuts shall meet the strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1. The size of the bolt head shall be equal to the size of the nut and shall be stainless steel in accordance with ASTM 276.

(11) All gate valves shall open right (clockwise), unless otherwise specified.

(12) The following parts of the valve shall be made of either gray or ductile iron: bonnet, body, yoke, wrench nut, O-ring packing plate or seal plate, and gland follower. The gate may be made of gray or ductile iron.

(13) If glands and bushings are used for NRS valves they shall be made of ASTM B763 bronze UNS C99500. The stem shall be made of cast, forged, or rolled ASTM B763 bronze UNS C99500. The stem nut material shall be ASTM B62 bronze UNS C83600 or ASTM B584 bronze UNS C84400. The gate may be made of bronze ASTM B763 bronze UNS C99500. Stem seals shall be "O" ring type. The seals shall be designed for dynamic applications.

The design shall be such that the seal above the stem collar can be replaced with the valve under full pressure in the fully open position. Materials for the "O" ring packing plate shall be in accordance with Section 4.8.3 of the ANSI/AWWA C509-01 Standard or the latest revision thereof.

(14) Enclosed and buried valves shall be coated inside and outside with a fusion bonded epoxy having a nominal 8 mils dry film thickness, which meets or exceeds AWWA C550-01 and to the maximum extent possible shall be free of holidays. All coatings in contact with the potable water shall be approved for potable water immersion service per ANSI/NSF Standard 61.

(15) The bidder shall submit with his proposal three sets of certified drawings showing the principal dimensions, general construction and material specification of the valve proposed. The number of turns to open (close) shall be clearly noted in the valve information submitted with the proposal documents. The number of turns to open or close the valve shall be consistent for each valve size for each approved manufacturer.

(16) Valves furnished under this specification shall be supplied from the San Antonio Water System approved manufacturer list. To be included on the qualified product list, the manufacturer shall provide an Affidavit of Compliance in accordance with the Section 1.5 of the ANSI/AWWA C509-01 Standard or latest revision thereof, to include compliance with San Antonio Water System Specification No. 21-02. Records of all tests performed in accordance with Section 6.1 and Section 6.2 of the ANSI/AWWA C509-01 Standard or latest revision thereof will be made available or provided. These records will be representative test results for Section 6.1 and certificate of testing for Section 6.2. An affidavit of testing for the valve assembly as outlined in Section 6.2.2 of the ANSI/AWWA C509-01 Standard, (350 ft-lbs) will also be provided. A copy of the manufacturer's Quality Assurance Program will be submitted. Blueprints and parts list for the valve shall also be provided.

(17) All gate valve parts shall be designed to withstand the following two pressure requirements, without being structurally damaged. (1) An internal test pressure of twice the rated design working pressure of the valve. (2) The full rated internal working pressure when the closure member is cycled once from a fully open to a fully closed position against the full rated unbalanced working water pressure. In addition to these pressure requirements, the valve assembly and mechanism shall be capable of withstanding an input torque as follows: 200 ft.-lbs. for a 3-in. nominal diameter. 200 ft.-lbs. for a 4-in. nominal diameter. 300 ft.-lbs. for a 6-in. nominal diameter. 300 ft.-lbs. for a 8-in. nominal diameter. 300 ft.-lbs. for a 10- in. nominal diameter. And 300 ft.-lbs. for a 12-in. nominal diameter. For sizes larger than a 12 in. nominal diameter refer to the manufacturer's specifications.

(18) Resilient seats shall be applied to the gate and shall seat against a corrosion resistant surface. The non-metallic seating surface shall be applied in a manner to withstand the action of line fluids and the operation of the sealing gate under long-term service. A metallic surface shall have a corrosion resistance equivalent to or better than bronze. A non-metallic surface shall be in compliance with ANSI/AWWA C550. The gate must be fully encapsulated by an elastomer without thin spots or voids. Resilient seats shall be bonded. ASTM D429 either method A or method B shall prove the method used for bonding or vulcanizing. For method A, the minimum strength shall not be less than 250 psi. For method B, the peel strength shall be 75 lb./in.

(19) Flanged Ends: The end flanges of flanged valves shall conform to dimensions and drillings of ANSI/AWWA C110/A21.10 or ANSI B16.1, Class 125.

(20) Mechanical Joint Ends: Mechanical joint bell dimensions shall conform to ANSI/AWWA C111/A21.11.

(21) Push-on Joints: Push-on joints shall conform to the requirements of ANSI/AWWA C111/A21.11.

(22) The tapping valves shall be mechanical joints with tapping flange on the other end. The tapping valves shall be furnished complete with glands, bolts, and gaskets. The tapping valve shall have a clear unobstructed waterway.

(23) The seat rings shall be of a large diameter to the permit entry of the full diameter tapping machine cutters. The valve end which mates with the tapping sleeve shall have an alignment lip to fit the recess in the tapping sleeve flange for proper alignment. The lip will be dimensioned in accordance with MSS SP-60 for valves 20-inch nominal pipe size and smaller.

(24) All interchangeable parts shall conform to their required dimensions and shall be free from defects that could prevent proper functioning of the valve. When assembled, valves manufactured in accordance with this standard shall be well fitted and operate smoothly. All like parts of valves of the same model and size produced by the same manufacturer shall be interchangeable.

(25) All castings shall be clean and sound, without defects that will weaken their structure or impair their service. Plugging, welding, or repairing of cosmetic defects is allowed. Repairing of structural defects is not allowed. Repaired valves shall comply with the testing requirements of this specification after repairs have been made. Repairs within the bolt circle of any flange face are not allowed.

(26) All gate valves shall be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and zero pressure applied to the other side. The test is to be made in each direction across the gate. All tests are to be performed at the manufacturer's plant.

(27) All gate valves shall be operated through a complete cycle in the position for which it was designed to ensure free and proper functioning of all parts in the intended manner. Any defects in workmanship shall be corrected and the test repeated until satisfactory performance is demonstrated. All tests are to be performed at the manufacturer's plant.

(28) A hydrostatic test pressure equal to twice the rated working pressure of the valve shall be applied to all assembled valves with the gates in the open position. The test shall show no leakage through the metal, pressure containing joints, or stem seals. All tests are to be performed at the manufacturer's plant.

(29) A test shall be made from each direction at rated working pressure to prove the sealing ability of each valve from both directions of flow. The test shall show no leakage through the metal, pressure containing joints, or past the seat. All tests are to be performed at the manufacturer's plant.

(30) Markings shall be cast on the bonnet or body of each valve and shall show the manufacturer's name or mark, the year the valve casting was made, the size of the valve, and the designation of working water pressure, for example "200 W".

(31) The San Antonio Water System may, at no cost to the manufacturer, subject random valves to testing by an independent laboratory for compliance with these standards. Any visible defect or failure to meet the quality standards herein will be grounds for rejecting the entire order and removal of the manufacturer from the attached approval list.

(32) The attached qualified product list identifies specified manufacturers that are approved.

b. Workmanship

(1) All parts of the resilient seat gate valve shall be designed and manufactured to the tolerances specified in ANSI/AWWA C509-01 or latest revision thereof and this specification.

(2) All parts of the resilient seat gate valve manufactured by a given manufacturer shall be interchangeable with like parts from another resilient seat gate valve of the same model and size and by the same manufacturer.

(3) All interchangeable parts shall conform to their required dimensions and shall be free from defects that could prevent proper functioning of the valve.

(4) All castings shall be clean and sound, without defects that will weaken their structure or impair their service. Plugging, welding, or repairing of cosmetic defects is allowed. Repairing of structural defects is not allowed. Repaired valves shall comply with the testing requirements of this specification after repairs have been made. Repairs within the bolt circle of any flange face are not allowed.

(5) The resilient seat gate valves shall be well fitted.

(6) Operation of the resilient seat gate valve shall be smooth.

(7) All parts shall be free of structural defects.

(8) The resilient seat gate valve shall be watertight.

c. Painting

(1) All exterior and interior surfaces of the valve shall be coated with epoxy, N.S.F. 61 certified. The epoxy shall have a nominal dry film thickness of 8 mils, and shall be in accordance with AWWA C550, latest revision.

(2) Coating shall be as close to holiday free as is technologically possible.

d. Testing

(1) Hydrostatic Test: Hydrostatic Test shall be performed on the valve in accordance with Section 6.1 Proof of Design Testing of ANSI/AWWA C509-01 or latest revision thereof.

(2) Torque Test: Torque Test for prototype valves shall be performed on the valve in accordance with Section 6.1 Proof of Design Testing of ANSI/AWWA C509-01 or latest revision thereof.

(3) Leakage Test: Leakage Test shall be performed on the valve in accordance with Section 6.1 Proof of Design Testing of ANSI/AWWA C509-01 or latest revision thereof.

(4) Pressure Test: Pressure Test shall be performed on the valve in accordance with Section 6.1 Proof of Design Testing of ANSI/AWWA C509-01 or latest revision thereof.

(5) Operation Test: Operation Test shall be performed on the valve in accordance with Section 6.2 Production Testing of ANSI/AWWA C509-01 or latest revision thereof.

(6) Shell Test: Shell Test shall be performed on the valve in accordance with Section 6.2 Production Testing of ANSI/AWWA C509-01 or latest revision thereof.

(7) Seat Test: Seat Test shall be performed on the valve in accordance with Section 6.2 Production Testing of ANSI/AWWA C509-01 or latest revision thereof.

(8) An Affidavit of Compliance certifying that all required tests have been performed shall be provided in accordance with Section 6.3 Affidavit of Compliance of ANSI/AWWA C509-01.

(9) The Affidavit of Compliance, the results of ASTM testing procedures and requirements for materials, Manufacturer's Quality Assurance Program, and the records of all tests performed on the valve shall be kept and provided by the supplier/manufacturer in a single hard cover bound notebook with the bid or with the shipping documents and shall be approved by the San Antonio Water System.

e. Quality Assurance

(1) Manufacturers shall have an ASME or I.S.O. 9001 registered commercial quality system or is in the process of achieving this certification by June 2001. Noncompliance to this registered commercial quality system requirement by June 2001 will result in removal of the manufacturer's product from Attachment I of this specification. If on receipt of resilient seat gate valves they are found to be non-compliant the manufacturer shall replace the defective resilient seat gate valves according to resilient seat gate valve size with a resilient seat gate valve that meets the San Antonio Water System's specifications. The defective resilient seat gate valve will be returned to the manufacturer, freight collect, and the manufacturer shall replace the resilient seat gate valve, freight prepaid. If San Antonio Water System audits, product inspection and performance data review in accordance with these specifications determine excessive resilient seat gate valve non-compliance, the manufacturer will be subject to removal by the Products Standards Committee. If the resilient seat gate valve becomes defective during the manufacturer's specified warranty period a San Antonio Water System quality assurance and manufacturer review will ensue. If the review determines manufacturing non-conformance the manufacturer shall replace the resilient seat gate valve according to size with a resilient seat gate valve that meets the San Antonio Water System's specifications. The defective resilient seat gate valve removed from the field will be returned to the manufacturer, freight collect, and the manufacturer shall replace the resilient seat gate valve, freight prepaid. If the non-conformance product amounts are excessive and result in increased product replacement by San Antonio Water System field staff the manufacturer may be subject to time and material charges.

f. References

(1) American National Standards Institute and American Water Works Association Standard C509-01 (ANSI/AWWA C509-01).

(2) Manufacturers Standardization Society MSS SP-60.

APPROVED MANUFACTURER **PRODUCTS LIST**

Sizes Three through Twelve Inch

Manufacturer	**Model**
American Flow Control	Series 500
Clow Valve Company	2640
Kennedy Valve	Ken-Seal II
M&H Valve Company	4067
Mueller Company	2360 Series Gate Valve
United States Pipe & Foundry Company	Metroseal 250

Sizes Sixteen through Twenty-Four Inch

Manufacturer	**Model**
United States Pipe & Foundry Company	Metroseal 250

2. Tapping Valves and Tapping Sleeves.

a. Tapping Sleeves

Band shall conform to the minimum OD size ranges and legths specified in this specification. The flange shall be manufactured in compliance with AWWA C223.07, Class D ANSI B.16.1 drilling, recessed for tapping valves MSS_SP60. Mechanical Joint tapping sleeve outlet shall meet or exceed all material specifications as listed below and be suitable for use with Standard mechanical joint x mechanical joint (mjxmj) resilient wedge gate valves per AWWA C 509-94.

(1) General Requirements

(a) Tapping sleeves 4" – 12":

Entire fitting to be stainless steel type 304 (18-8). The body, lug and gasket armor plate to be in compliance with ASTM A240. The flange shall be cast stainless steel in compliance with ASTM A743. The MJ outlet shall be one-piece casting made of stainless steel. The test plug shall be ¾" NTP in compliance with ANSI B2.1 and shall be lubricated or coated to prevent galling. All metal surfaces shall be passivated after fabrication in compliance with ASTM A380.

The gasket is to provide a 360-sealing surface of such size and shape to provide an adequate compressive force against the pipe after assembly, to affect a positive seal under combinations of joint and gasket tolerances. The materials used shall be vulcanized natural or synthetic rubber with antioxidants and antioziant ingredients to resist set after installation. No reclaimed rubber shall be used. A heavy-gauge-type 304-stainless armor plate shall be vulcanized into the gasket to span the lug area.

Lugs are to be heliarc welded (GMAW) to the shell. Lug shall have a pass-through-bolt design to avoid alignment problems and allow tightening from either side of the main. Bolts shall not be integrally welded to the sleeve. Finger Lug designs are not approved; it is the intent of these specifications to allow tapping sleeve that has a lug design similar to the approved models.

Bolts and nuts shall be type 304 (18-8) stainless steel and lubricated or Teflon coated to prevent galling or seizing. Bent or damaged unit will be rejected.

Quality control procedures shall be employed to insure that the shell, Lug, (4" and larger nominal pipe diameter) armor plate, gasket and related hardware are manufactured to be free of any visible defects. Each unit, after proper installation, shall have a working pressure rating up to 200 psi, and a test pressure of 250 psi.

The sleeve construction shall provide a positive means of preventing gasket cold flow and/or extrusion.

Each sleeve shall be stenciled, coded or marked in a satisfactory manner to identify the size range. The markings shall be permanent type, water resistant that will not smear or become illegible.

(b) Tapping Sleeves 16" and large nominal pipe diameter:

The body shall be in compliance with ASTM A285 Grade C or ASTM A36. Test plug shall be ¾" NPT conforming to ANSI B2.1.

The gasket is to provide a watertight sealing surface of such size and shape to provide an adequate compressive force against the pipe. After assembly, the gasket will insure a positive seal under all combinations of joint and gasket tolerances. Gasket shall be formed from vulcanized natural or synthetic rubber with antioxidants ingredients to resist set after installation. No reclaimed rubber shall be used. Bolts and nuts shall be type high strength, corrosion resistant, low alloy per AWWA C111, ANSA A21.11

Quality control procedures shall be employed to insure that the shell, gasket and related hardware are manufactured to be free of any visible defects. Each unit, after proper installation, shall have a working pressure rating up to 150 psi, and a test pressure of 200 psi.

Unless otherwise noted, unit shall be protected by fusion Epoxy 8-10 mil line and coat per AWWA C213.

Units for concrete steel cylinder pipe shall be furnished with load bearing set screws on the gland flange to transfer loads on the outlet away from the steel cylinder and onto the sleeve. Epoxy-coated tapping sleeves do not require grout seal cavity. (AWWA Manual of Practive M-9)

Each sleeve shall be stenciled, coded or marked in a satisfactory manner to identify the size range. The markings shall be permanent type, water resistant that will not smear or become illegible.

(2) Standard Ranges

Nominal Dia (in) x Min Length (in)	Flange Outlet (in)	Range	Min OD Range (in)**
4 x 16	4	A	4.75 – 4.95
		B	4.90 – 5.10
6 x 16	4	A	6.70 – 7.10
		B	7.00 – 740
		C	7.35 – 7.75
6 x 16	6	A	6.80 – 7.15
		B	7.05 – 7.40
		C	7.40 – 7.75
8 x 16	4 & 6	A	9.00 – 9.45
		B	9.35 – 9.70
		C	9.70 – 10.00
8 x 20	8	A	9.00 – 9.35
		B	9.35 – 9.70
		C	9.70 – 10.00
10 x 16	4 & 6	A	11.03 – 11.47
10 x 20	8	B	11.60 – 12.00
10 x 24	10		
12 x 16	4 & 6	A	13.00 – 13.40
12 x 20	8	B	13.40 – 13.80
12 x 24	10	C	14.10 – 14.50
12 x 32	12		
16 x 12	4 & 6		17.33 – 17.87
16 x 16	8		18.62 – 19.19
16 x 20	10		
16 x 24	12		
16x 36	16*		

20 x 12	4 & 6	A	21.51 – 22.15
20 x 16	8	B	23.46 – 24.16
20 x 20	10		
20 x 24	12		
20x 36	16*		
20 x 40	20*		
24 x 12	4 & 6	A	25.71 – 26.41
24 x 16	8	B	28.14 – 28.84
24 x 20	10		
24 x 24	12		
24 x 36	16*		
24 x 40	20*		
24 x 48	24*		
30 x 12	4 & 6	A	29.78 - 30.48
30 x 16	8	B	31.52 – 32.22
30 x 20	10		
30 x 24	12		
30 x 36	16*		
30 x 40	20*		
30 x 48	24 x 30*		

*Range to be specified when ordered

** Ranges may be broadened by not narrowed. For concrete steel cylinder pipe the OD of the pipe and cylinder shall be supplied with the order.

For pipe larger than 30" nominal diameter, tapping sleeves shall be custom fabricated to fit non standard ranges, in conformance with the intent of these specifications.

Water System Owner may, at no cost to the manufacturer, subject random units to testing by an independent laboratory for compliance with these standards. Any visible defect of failure to meet the quality standards herein will be ground for rejecting the entire order.

The attached qualified products lists identified specific manufactured items by catalog number that are approved:

Approved Tapping Sleeve

Manufacturer	Model	Size Range (in)
JCM Industries	#432	4 - 12
	#412	16 and larger
Power Seal	#3490AS or 3490MJSS	4 - 12
	3490MJSS	16 and larger
Romac Industries	SST III	4 - 12
	SST III	16 and larger
Ford Meter Box	FTSS	4 - 12
	FTS	16 and larger
Dresser	Style 610/630	4 - 12
	Style 610/630	16 and larger
Cascade	CST-1	4 - 12
Smith Blair	#622	16 and larger

G. Butterfly Valves.

The design, component materials, construction, manufacture and testing of all butterfly valves of nominal sizes 3-in. through 72-inch is to conform to AWWA Standard C504 for "Rubber Seated Butterfly Valves".

Valves are to be Class 150B of the short body type with a 150 psi bi-directional shut off rating, a 300 psi hydrostatic body shell test and a line velocity of 16-ft. per second for 4" – 20" and 8-ft per second for 24" – 72".

Valves are to be for mounting on a horizontal pipe. Valves are to be for buried service, unless otherwise noted. Valve is to be configured with a horizontal valve shaft and vertical actuator shaft with standard 2" AWWA operating nut. Actuator is to be side mounting.

Valve is to be of such design that the disc will not flutter or vibrate when operated in a throttled position.

Valve body is to be of cast-iron conforming to ASTM Designation A126, Class B.

Valve is to be of such design that the discs will seat at 90 ° with pipe axis.

Valve body ends are to be flat-faced flanged with facing and drilling in accordance with ANSI B16.1, Class 125. All valves are to conform to AWWA C504, Table 2, laying length for flanged valves and minimum body shell thickness for all body types.

Valve disc is to be of Cast Iron A48, class 40 Cast Iron A126, Class B or Ductile Iron ASTM A536, Grade 65-45-12 and is to be of disc design to provide 360 ° uninterrupted seating.

The valve seat is to be natural or synthetic rubber and may be applied integrally to the disc or body. For valves 24-in. or larger, the rubber seat is to be capable of mechanical adjustment in the field and shall be field replaceable. Special tools required for seat adjustment shall be provided with valve. Special tools required for seat replacement shall be furnished with the replacement seat. Mechanical adjustment or attachment of the seat and seat ring does not include welding. The mating seat surface is to be Type 304 or Type 316 stainless steel, NI-chrome or model. Sprayed or plated mating seat surfaces are not acceptable.

Valve shafts are to be Type 304 stainless steel conforming to ASTM A-276 and are to have a diameter equal to or greater than that shown for Class 150B in Table 3 of AWWA C-504. Shafts are to conform to the requirements of Section 3.3, Valves Shaft of AWWA C504 for one-piece or stub shaft types. Connection between the shaft and disc is to be dowel or taper pins, if used, which are mechanically secured.

The valve assembly is to be furnished with a factory-set, non- adjustable disc shaft thrust bearing which maintains that the valve disc is centered within the valve body seat at all times.

Valve shaft bearing is to be permanent, self-lubricated, bearings which provides continuous, low-friction maintenance- free operation. Shaft bearing is to be contained in integral hubs of the valve body.

Valve shaft seal is to consist of “O” rings, “vee” ring or “U” cup packing where the shaft projects through the valve body for the actuator connection.

The valve is to be provided with a fully enclosed, permanently lubricated actuator of the traveling nut or worm gear design. The actuator is to be connected to the valve shaft by means of a key and keyway connection.

All actuators are to have adjustable, mechanical stop limits in accordance with C504 Section 3.8.2. All valve actuators are to be capable of withstanding 450 ft.-lb. of input torque against the open or closed stops without damage.

Valves for above ground applications are to be provided with a handwheel. The handwheel is to have an arrow thereon, indicating the direction of the opening. The handwheel is to be suitably fastened to the actuator input shaft. Actuators equipped with handwheels are to be designed to produce the specified torque with a maximum pull of 80-lb. of the handwheel rim.

The requirement for either wrenchnut or handwheel and direction of opening will be specified on the plans.

All interior wetted ferrous surfaces of the valve, including the disc, are to be coated with epoxy, NFS 61 certified. The epoxy is to have a nominal thickness of 8 mils, and is to be in accordance with AWWA C-550. Coating is to be as close holiday free as is technologically possible.

Valves for below ground applications are to be provided with an AWWA wrenchnut. The wrenchnut is to have an arrow cast thereon indicating the direction of opening. The wrenchnut is to be suitably fastened to the actuator input shaft. If the shaft is splined, the operating nut is to be formed to fit the splined shaft. If the

shaft is smooth, the operating nut is to be fastened to the input shaft by means of a 5-16-in. diameter steel pin passing entirely through the shaft and operating nut. Key with keyway will be acceptable.

The actuator is to be designed to produce the specified torque with a maximum input of 150-ft.-lb. applied to the wrenchnut.

The bidder shall submit with proposal three sets of certified drawings showing the principal dimensions, general construction and material specifications of the proposed valve. The number of turns to open (close) shall be clearly noted in the valve information submitted with the proposal documents.

Supplier/manufacturer shall provide Afdavit of Compliance with applicable sections of AWWA C 504 and this specification including: Results of ASTM testing procedures and requirements for materials when requested, Manufacturer's Quality Assurance Program, leak-tightness testing and proof of design testing of representative actuators in accordance with AWWA C504 Section 3.8.5.2 as modified herein (450 ftlw). Compliance assurance will be required in accordance with AWWA C 504 Section 5.1.2, Affidavits. Results of performance tests, proof of design test, AWWA C504 Section 5.2.4, hydrostatic test, leakage test, and Affidavit of Compliance shall be provided with bid or with the shipping documents and shall be approved by the Water System

Valves furnished under this spec are to be supplied by approved manufacturer:

Manufacturer	Product
Mueller	Lineseal III
Pratt (above ground)	2f II (3" – 20") and XR-70 (24" – 72")
Pratt (below ground)	Ground hog (3" – 72")
DeZuril	BAW
CMB Industries, Inc	K-Flo Model 504 and K-Flo Model 47
Val- Matic	Series 2000

All parts of butterfly valve are to be designed and manufactured to the tolerances specified in ANSI / AWWA C509 or latest revision thereof and this specification.

All parts of butterfly valve manufactured by a given manufacturer are to be interchangeable with like parts from another butterfly valve of the same model and size by the same manufacturer.

The following test shall be performed on each valve in accordance with applicable section in AWWA C504:

Performance test –Section 5.2.1
Leakage test – Section 5.2.2
Hydrostatic test – Section 5.2.3
Proof of Design test – Section 5.2.4

Provide an affidavit of compliance certifying that all tests have been performed. The affidavit of compliance and records of all test performed on valves are to be provided in a single hard cover bound notebook.

Quality Assurance: Manufacturers are to have ASME or ISO 9001 registered commercial quality system. If on receipt of butterfly valves or within manufacturer's specified warranty period they are found to be non-compliant or defective the manufacturer shall replace the defective butterfly valves and no cost to Owner.

All interior and exterior ferrous surfaces of the valve, including the disc, shall be coated with epoxy, N.S.F. 61 certified. The epoxy shall have a nominal thickness of 8 mils, and shall be in accordance with AWWA C550, latest revision.

Coating shall be as close to holiday free as is technologically possible.

H. Butterfly Valve Class 250.

This product specification covers class 250 rubber-seated butterfly valves, 4 inches through 54 inches. All products furnished shall be in conformance with the American National Standards Institute and American Water Works Association C504 (ANSI/AWWA C504) or latest revision thereof; however, the body construction of the valve shall exceed the ANSI/AWWA C504 by the values specified herein. All coatings in contact with potable water shall be certified to N.S.F. 61. A proof of design certification shall be provided upon request.

Valves shall be Class 250 of the short-body type with a 250 psig bi-directional shut-off rating, a 500 psig hydrostatic body shell test and a maximum upstream line velocity rating according to the table listed below unless specified otherwise.

Diameter	**Velocity**
4 inch through 20 inch	16 feet per second
24 inch through 54 inch	8 feet per second

Valve body ends shall be flat-faced flanged in accordance with ANSI B16.1, Class 250 table 2 of Section 3.1 Valve.

Laying lengths for flanged and wafer valves and minimum body shell thickness for all body types by the following: Sizes 4" through 10" - 15% or greater, Sizes 12" through 24" - 20% or greater, and Sizes 30" through 54" - 50% or greater. Ductile iron valve body thicknesses shall conform to the table below. Ductile iron and cast iron laying lengths shall be as specified in the table below unless otherwise specified.

Ductile Iron Valve Diameter Inch	Ductile Iron Thickness	Ductile Iron Laying Lengths Inch
3	.37	5
4	.40	5
6	.43	5
8	.46	6
10	.54	8
12	.58	8
14	.63	8
16	.68	8
18	.79	8
20	.83	8
24	.93	8
30	1.10	12
36	1.22	12
42	1.35	12
48	1.48	15
54	1.63	15
60	1.89	15
66	2.00	18
72	2.375	18

Valve Diameter Cast Iron	Thickness Cast Iron	Laying Length Cast Iron Inch
6 Inch	Per specification	6
8 Inch through 12 inch	Per specification	8
14 Inch through 30 inch	Per specification	12
36 Inch through 54 inch	Per specification	15

I. Valve Boxes.

All valve box assemblies are to conform to the details shown on the plans. Each valve box assembly is to be of cast-iron and is to consist of a base, top section, and lid.

Valve boxes are to be of a single size with a nominal diameter of 6-in..

The valve box lid is to be labeled “water” and is to be so designed so that it will remain firmly seated in place when subjected to vehicular traffic.

The valve box assembly is to be of sufficient toughness and strength to withstand impact loads and shock resulting from vehicular traffic.

The valve box assembly is to be coated with a standard bituminous coating of either coal tar or asphalt base applied to all inside and outside surfaces.

J. Meter Boxes.

For non-traffic bearing locations, the meter box assembly for 5/8-in. through 1-in. meters box and lid is to be black and constructed our of modified polyethylene material for maximum durability and corrosion resistance. The black material is for maximum UV protection and shall be uniform throughout meter box and lid for maximum longevity and not have a foaming agent that creates air pockets within the plastic wall. The body and lid shall withstand a 20,500 lb loading in a non-deliberate and incidental traffic. Plastic Lid is to have the following:

- **a.** "Water Meter" and "SAWS" molded into the lid
- **b.** Seat securely and evenly inside the meter box and shall not overlap the top edge of the meter box
- **c.** "Overlap" and securely and evenly on the existing SAWS cast iron meter box with like dimensions.
- **d.** A diamond pattern for skid resistance and an AMR Slide Mount molded into the lid on the underneath side and off center for placement for an AMR transponder to help in the protection of the radio antenna.
- **e.** A brass worn gear lock that will secure the existing SAWS cast iron meter box of like dimensions and secure the plastic meter box. See detail.
- **f.** A molded receptacle for placement of SAWS key.
- **g.** One (1) piece of ½" rebar secured in lid. See detail.

Plastic body is to have the following:

- **a.** A crush resistant ribbing along the outside of box.
- **b.** A flange around the top opening to help prevent setting and aide in adjustment to grade.
- **c.** Designed to accommodate all plastic lids.

For traffic bearing locations, the meter box assembly for 5/8-in. through 2-in. meters is to consist of cast-iron rectangular boxes box and a steel checkered plate rectangular with raised lug pattern as shown on the plans.

The castings are to be dipped in coal tar at a temperature of 350ºF and the metal is to be at a temperature of 300ºF prior to dipping. The casting is to be dipped and cured independently and the coating is to have ceased to be "tacky" within 72 hours after dipping.

The steel checkered plate rectangular cover is to be hot dip galvanized after fabrication.

The meter box is to have an ultimate tensile strength of 25,000 psi and is not to be brittle.

The casting is to have an "as cast" clean smooth surface and be free from internal porosity; castings that are made smooth by grinding are unacceptable.

Quality Assurance: If on receipt of meter box(es) or lid(s) they are found to be non-compliant, the manufacturer is to replace defective product at no cost to Owner. Any visible defect of failure to meet specification will be grounds for rejecting entire order.

Approved Plastic Meter Box and Lid Manufacturer:

DFW Plastics Inc. Model Numbers: D-1218-RWSBSM-Complete box
D-1218-RWSBSM-lid
D-1218 – body

K. Fire Hydrants.

1. General Requirements

a. The San Antonio Water System (SAWS) reserves the right to limit the purchase of fire hydrants from manufacturers and to the models specified, as shown on Attachment I, provided such fire hydrants conform to the provision contained herein.

b. Each hydrant shall be designed for a minimum working pressure of 200 psig.

c. All parts of the hydrant shall be designed to withstand, without being functionally impaired or structurally damaged, a hydrostatic test of not less than 400 psig or twice the rated working pressure, whichever is greater, with the hydrant completely assembled and pressurized as follows:

(1) With the nozzle caps in place, the main valve open, the hydrant inlet capped, and the test pressure applied to the interior of the hydrant.

(2) With the main valve closed, the hydrant inlet capped, and the test pressure applied at the hydrant inlet.

(3) The design safety factor of the operating mechanism shall not be less than 5 and shall be based on the foot-pounds of torque required for the closing and opening of the hydrant at a working pressure of 200 psig. Hydrants shall be functional and capable of being opened or closed without difficulty following an application of an operating torque of 200 lbf-ft at the operating nut in the opening direction with the hydrant fully opened and the closing direction with the hydrant fully closed. The torque requirements apply only to hydrants of 5-ft bury or less.

d. The length of bury shall be as specified.

e. The fire hydrant shall have 2 hose nozzles and 1 pumper nozzle.

f. The nominal inside diameter of the hose nozzle shall be 2 ½ inches.

g. The nominal inside diameter for the pumper nozzle shall be 4 inches.

h. The outlet-nozzle threads are to conform to the National Fire Protection Association (NFPA) 2003, Standard for Fire Hose Connections.

i. The nominal diameter of the main valve opening shall be 5 ¼ inches.

j. The hydrant shoe shall be provided with a 6 inches mechanical joint connection to fit the connecting pipe.

k. The fire hydrant shall open right (clockwise).

l. The color of the finish paint above the ground line shall be aluminum; however, fire hydrants for private use shall be painted red.

m. The fire hydrant shall have a non-rising stem.

n. No more than one 6" stem extension shall be provided if required to make the base of the fire hydrant grade level.

o. The bonnet section shall be designed so all bearing surfaces and stem threads are sealed in a lubricant reservoir. If oil is used as a lubricant, the reservoir shall be designed to allow for easy filling through a fitting or plug. Where grease is used as a lubricant, the reservoir will be sealed. The reservoir will be adequately sealed with "O" rings or other suitable sealing system approved by the San Antonio Water System.

p. The fire hydrant shall have a safety flange or breakaway flange at the ground line as stipulated in Section 3.1 General Design of ANSI/AWWA C502-05 or latest revision thereof.

q. Fire hydrant nozzle cap chains shall be required and shall be attached permanently to the fire hydrant as stipulated in Section 3.2 Detailed Design of ANSI/AWWA C502-05 or latest revision thereof.

r. Parts that require lubrication and come into contact with water shall be lubricated with a non-toxic food grade lubricant that does not pose a health hazard to the public if consumed.

2. Workmanship

a. All foundry and machine work shall be performed in accordance with good standard practice for the class of work involved and in conformance with accepted drawings, if required. When assembled, hydrants manufactured in accordance with this specification shall be well fitted and shall operate smoothly. The body and shaft shall be watertight.

b. All parts shall conform to the required dimensions and shall be free from defects that could prevent proper functioning of the hydrant.

c. All castings shall be clean and sound without defects that will weaken their structure or impair their service.

3. Paint

a. The exterior surface of the hydrant shall be coated with a coating that shall meet or exceed the requirements of Federal Specification TT-C-494b. A second coat of water based or oil based enamel paint aluminum in color will then be applied from the top of the hydrant to a point 18 to 20 inches below the center line of the pumper nozzle or down to the traffic safety flange connection at the ground line.

b. All interior surfaces, machined surfaces, such as the threaded portion of the stem or stem nut, which must fit closely with the adjacent parts, shall be coated with a coating that shall meet or exceed Federal Specification TT-C-494b. Stem surfaces contained within a lubricant reservoir and not in contact with potable water may be free of coating.

c. The interior and exterior of the hydrant shoe shall be coated with a fusion-bonded epoxy having a nominal dry film thickness of 8 mils, conforming to ANSI/AWWA C550-05, and certified to NSF 61.

d. Coating shall be as close to holiday free as is technologically possible.

4. Testing and Inspection

a. Each assembled hydrant shall be subjected to two shop tests under a hydrostatic pressure of 400 psig or twice the rated working pressure, which ever is greater. One test shall be made with the entire interior of the hydrant under pressure and another test made with the main valve closed and the base under pressure from the inlet side. Under the test procedure, there shall be no leakage through the main valve or seals or through the castings or the joints of the assembled hydrant. Under the test conditions, the leakage through the drain valves shall not exceed 5 fl oz/min. Other leakage or other imperfections found in either test shall be corrected or the hydrant retested. The tests shall be conducted for a sufficient time to allow a check of all points of possible leakage and for a minimum of 30 seconds after all air has been exhausted.

b. Each assembled hydrant shall be operated through a full open-close cycle when not under pressure. The torque required for performing this operation shall not exceed 200 lbf-ft.

c. All fire hydrant tests and inspections shall conform to ANSI/AWWA C502 Section 5.1 Production Testing, ANSI/AWWA C502 Section 5.2 Prototype Testing, and ANSI/AWWA C502-05 Section 5.3 Inspection and Rejection.

d. The manufacturer shall provide an Affidavit of Compliance conforming to Section 1.7 Affidavit of Compliance of ANSI/AWWA C502-05 or latest revision thereof.

5. Quality Assurance

a. Manufacturers shall have an ASME or I.S.O. 9001 registered commercial quality system or is in the process of achieving this certification by June 2001. If on receipt of fire hydrants they are found to be noncompliant the manufacturer shall replace the defective fire hydrants according to fire hydrant size with a fire hydrant that meets this specification. The defective fire hydrants will be returned to the manufacturer, freight collect, and the manufacturer shall replace the fire hydrant, freight prepaid. If the fire hydrant becomes defective during the manufacturer's specified warranty period a San Antonio Water System quality assurance and manufacturer review will ensue. If the review determines manufacturing non-conformance the manufacturer shall replace the fire hydrant according to size with a fire hydrant that meets the San Antonio Water System's specifications. The defective fire hydrant removed from the field will be returned to the manufacturer, freight collect, and the manufacturer shall replace the fire hydrant, freight prepaid. If the non-conformance product amounts are excessive and result in increased product replacement by San Antonio Water System field staff the manufacturer may be subject to time and material charges.

APPROVED FIRE HYDRANT MAINTENANCE KITS

The San Antonio Water System will attempt to use fire hydrant maintenance kits in the approved hydrants. Attachment II of this specification provides the product model numbers.

6. Quality Assurance

The San Antonio Water System will attempt to use fire hydrant maintenance kits in the repair of the approved hydrant. Attachment II of this specification provides the product model number.

7. References

a. American National Standards Institute and American Water Works Association Standard C502-05 (ANSI/AWWA C502-05).

b. American National Standards Institute and American Water Works Association Standard C550-05 (ANSI/AWWA C550-05).

APPROVED MANUFACTURERS

The manufacturers listed below are approved by the San Antonio Water System

Manufacturer	Model
a. American Darling	B84B 5-1/4" (w / metal weather cap)
b. Clow Valve Company	Medallion
c. Kennedy Valve Company	Guardian
d. M & H Valve Company	Reliant Model 929
e. Mueller Company	Super Centurion 250
f. United States Pipe and Foundry, Inc.	Metropolitan
g. Waterous	Pacer 100
h. American AVK Company	Model 2780

The fire hydrant maintenance kits listed are the reference product model numbers.

Manufacturer Model	Model
a. American Darling	B84B 5-1/4" (w / metal weather cap)
b. Clow Valve Company	Medallion
c. Kennedy Valve Company	Guardian
d. M & H Valve Company	Reliant Model 929
e. Mueller Company	Super Centurion 250
f. United States Pipe and Foundry, Inc.	Metropolitan
g. Waterous	Pacer 100
h American AVK Company	Model 2780 Dry

L. Polyethylene Wrapping Material.

Polyethylene wrapping material is to be used to encapsulate all ductile and cast-iron pipe.

Polyethylene wrapping for ductile and cast iron water mains is to consist of a 4 mil tubular section of cross-laminated high-density polyethylene, which has a high dielectric and tensile strength, for use in insulating cast-iron and ductile-iron pipe from the electrolytic action encountered in highly active soils.

Polyethylene wrapping is to consist of opaque cross-laminated high-density polyethylene sheet continuously thermally bonded to form a tubular section. The tubes may be supplied in bulk length on rolls or in individual pre-cut lengths. See attached size and length chart, in accordance with AWWA C 105 (Table 1) for minimum requirements. When supplied in specific pipe lengths, the tubes are to contain a minimum of 4-ft. over the actual pipe length to allow for overlap.

The polyvinyl sheet of film for the tubular wrapping is to be of virgin resins meeting raw and physical properties of ASTM D-1248 and AWWA C105, latest edition. The material is to be 4 mil cross-laminated high-density polyethylene of uniform film thickness and be free of imperfections such as pin holes, etc., after being thermally seamed into tubular form. The finished product will have a nominal thickness of 4 mils, with tolerances of minus ten percent.

The material is to have no volatile constituents, the loss of which may affect ductility. The material is also to have the following properties:

Mechanical: The polyethylene film is to have a tensile strength per latest ASTM D-882 test, of 6300 psi min. The film is to have an elongation of not less than 100% of the test strip per latest ASTM D-882 test. The film is to have an impact resistance 800 gram min per (ASTM D1709 Method B). The film is to have a propagation tear resistance of 250 gf minimum in machine and transverse direction (ASTM D1922).

Dielectric: The film is to have a dielectric strength of 800 volts per mil thickness per ASTM D-149.

Marking Requirements

The polyethylene film supplied shall be clearly marked, at a minimum of every 2-ft along its length, containing the following information.

a. Manufacturer's name or trademark

b. Year of manufacture

c. ANSI/AWWA C105/A21.5

d. Minimum film thickness and material type.

e. Applicable range of nominal pipe diameter size(s).

f. Warning-Corrosion Protection-Repair any Damage.

The San Antonio Water System may at no cost to the manufacturer, subject Random testing by an independent laboratory for compliance with this Specification. Any visible defect of failure to meet the quality standards Herein will be grounds for rejecting the entire order.

4 MIL POLYETHYLENE WRAPPING MATERIALS

SIZE & LENGTH (All sizes lay flat size)

Pipe Size	Product Size Width x Length
4", 6" & 8"	20" x 200/500
8", 10" &12"	27" x 200/500
16" & 18"	37" x 200/500
20"	41" x 200/500
24"	54" x 200/500
30"	67" x 140/500
36"	81" x 120/500
48"	95" x 100/500
54"	108" x 100/500

APPROVED MANUFACTURER AND PRODUCTS LIST

Manufacturer	Product
Van Leer Flexibles Inc.	Valeron
Manufactured Plastics and Distribution Inc.	Cross Tuff 450 Black

M. Mechanical Couplings.

Mechanical coupling of Dresser or similar type is to be used to connect plain ends of concrete steel cylinder pipe and plain ends of steel and ductile-iron pipe in conjunction with the installation of butterfly valves sizes at 20-in. and larger and to connect new and existing ductile iron water main in conjunction with casing installation in accordance with the details shown on the plans.

The mechanical coupling is to consist of a cylindrical steel middle ring, two (2) steel follower rings, two (2) rubber compound gaskets and a set of steel bolts. The middle ring is to be flared at each end to receive the wedge-shaped gasket which is compressed between the middle ring flare and the outer surface of the pipe by pressure exerted on the follower rings through the bolt circle.

The flexible and transition couplings are to be manufactured to fit the type size and class of pipe specified. Bolts are to be high strength low alloy steel meeting the requirements of AWWA Standard C111.

N. Air Release Assemblies.

Valve body and cover is to be cast iron fabricated in accordance with ASTM A48-35 or ASTM A126 Class B. Non-metallic Valve Body shall be fabricated from fiberglass reinforced nylon. Inlet sizes through 2-in. are to be screwed (National Pipe Taper Thread, NPT).Pipe sizes above 3-in.and above are to have flanged

inlets (125 pounds ANSI B16.1). A protective hood or cowl is to be installed on the outlet of flange-bodied valves.

Internal seat trim float arm and pivot pin is to be stainless steel Type 303 or 304 or 316. Floats are to be stainless steel ASTM A240. Other internal parts are to be stainless steel ASTM A240 or ASTM A276.

Non-metallic floats shall be foamed polyethylene with stainless steel type 316 fasteners.

Internal seat or orifice button is to be of Buna-N rubber compounded for water service. Cover gasket is to be composition-type, equal to Armstrong CS-231, Garlock 3000, or Lexide NK-511. Cover bolts are to be alloy steel. Rolling seals shall be furnished for non-metallic valves 2" and below.

Valve body is to have a test pressure rating of 300 psi and working pressure rating of 150 psi.

The air release valve is to be designed to vent accumulated air automatically. The outlet orifice is to be properly sized to facilitate valve operation at pressures up to 150 psi. The air release valve is to be either simple lever or compound lever, depending upon venting volume requirements.

The air and vacuum valve is to be designed with the inlet and outlet of equal cross-sectional area. The valve is to be capable of automatically allowing large quantities of air to be exhausted during the filling cycle and also capable of automatically allowing air to re-enter the system to prevent a negative pressure during the draining cycle. The float is to be guided to minimize premature closure by air and to provide proper alignment for normal closure by floating on the water surface.

Combination valves are to provide for both automatic air release under system pressure and to allow air movement during filling or draining operations. The combination valve may be housed in a single casting. The housing is to be designed to incorporate conventional or kinetic flow principles to properly vent the air without premature closure. Flanged sizes (4-in. and larger) may be furnished in a dual housing. When dual castings are used, a bronze manual isolation valve is to be installed. This will allow the air release valve to be serviced when the system is under pressure.

The Water System may at no cost to manufacturer, subject random valves to testing by an independent laboratory for compliance with these standards. Any visible defect or failures to meet the quality standard herein will be grounds for rejecting the entire order.

The following qualified products list indentified specific manufactured items by catalog number that are approved.

Approved Manufacturers and Models:

A. Air Release Valves (Inlet x Orifice)

Manufacture	1" NPT x 3/16"	2" NPT x 3/16"
Apco Valve Company	200A	200A
G.A. Industries, Inc. (Empire)	920	920
Multiplex Mfg. Co. (Crispin)	P1-10	PL-10A
Val-Matic Mfg. Co.	38	38
PowerSeal Corporation	5401-D	5401-E
ARI Flow Control	S-050 1T	D-040 2T

B. Air & Vacuum Valves (Inlet x Orifice)

Manufacture	2" NPT x 3/16"	4" flg. with cowl
Apco Valve Company	144	152
G.A. Industries, Inc. (Empire)	930	930-C
Multiplex Mfg. Co. (Crispin)	AL20	AL41
Val-Matic Mfg. Co.	102	104
PowerSeal Corporation	5402-B	5402-D
ARI Flow Control	SD-040 2T	K060 C-HF

C. Combination Air Valves (Inlet x Orifice)

Manufacture	1"NPT X 5/64"	2"NPT x 3/32"	4"flg. x 3/32 w/ cowl
Apco Valve Company	143C	145C	149C
G.A. Industries, Inc. (Empire)	945 (1" NPT)	945	960C
Multiplex Mfg. Co. (Crispin)	U10	UL20 (1/4")	UL41 (1/4")
Val-Matic Mfg. Co.	201C	202C	204C
PowerSeal Corporation	5403-A	5403-B	5403-D
ARI Flow Control	D-040 2T	D-040 D-060 C-HF	D-060 C-HF

O. Blow-off Assemblies and Jumper Connections.

The materials required for both permanent and temporary 2-in. and 4-in. blow-off assemblies and 4-in. jumper connections are shown on the plans.

P. Backfill.

1. Where services ¾" – 2" copper are installed, initial backfill shall be sand conforming to the following requirements: Natural sand or sand produced from crushed gravel or crushed rock maximum ¼-inch; 95 percent shall pass No. 4 sieve, free from clay and organic material, with a maximum 8 percent passing the No. 200 sieve. Larger services utilizing DI pipe or PVC (C-900) pipe shall be backfilled the same as mains. Bedding and Initial Backfill for Water Mains.

a. Well graded gravels or crushed stone meeting the following requirements:

Modified Grade 5 gravel:

Retained on ½" sieve	0%
Retained on 3/8" sieve	0 – 5 %
Retained on No. 4 sieve	20 - 80%
Retained on No 10 sieve	75 - 100 %
Retained on No 20 sieve	98 - 100%

The quantity and thickness of lifts and compaction of initial backfill materials is to be in accordance with subsection 3. D. 1 of this specification.

2. Secondary Backfill for Water Mains.

Approved materials excavated from the trench free of brush, debris, large rock or stones and earth clods 6" or larger. Secondary backfill material shall be primarily composed of compactable soil materials.

Q. Asphalt.

All asphaltic concrete used in the replacement of pavement over the trench line is to conform to Item 341, "Dense-Graded Hot-Mix Asphalt (QC/QA), Type "C", except when the use of 6-in. of asphalt treated base is directed., unless otherwise specified on the plans.

R. Concrete.

All concrete used as the trench cap and in sidewalks and blocking mains is to conform to Item 421, "Hydraulic Cement Concrete". Class "A" concrete is to be used in sidewalks and for blocking concrete steel cylinder mains; Class "D" concrete is to be used for the trench cap and for blocking all other types, unless otherwise specified on the plans.

S. Reinforcing Steel.

All bar reinforcement is to be Grades 40 or 60, conforming to the requirements of Item 440, "Reinforcing Steel".

T. Affidavit of Compliance.

Unless otherwise directed, the Contractor is to furnish a manufacturer's affidavit of compliance for each of the materials used in this project. The affidavit is to certify that factory inspection and all specified tests have been made and that the material furnished complies with the requirements outlined herein.

3. Construction Methods.

A. Excavation.

Excavation (trenching) as required to complete the water main installation is to be performed in accordance with Item 400, "Excavation and Backfill for Structures", as outlined herein, as shown on the plans and as directed

1. Trenches.

Trench walls shall be vertical. The practice of undercutting at the bottom or flaring at the top will not be permitted except where it is justified for safety or at the Engineer's and/or Inspector's direction. In special cases, where trench flaring is required, the trench walls shall remain vertical to a depth of at least 1foot above the top of the pipe.

The trench bottom shall be square or slightly curved to the shape of the trenching machine cutters. The trench shall be accurately graded along its entire length to provide uniform bearing and support for each section of pipe installed upon the bedding material. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and bedding installed. The pipe shall rest upon the new bedding material for its full length

Where over-excavation occurs, the under-cut trench shall be restored to grade at no cost to the Owner by replacement with a material conforming to the requirements of the bedding material or a material approved by the Engineer.

The depth of cut indicated on cut sheets, as furnished by the engineer, is from the off-set or cut hub elevation to the invert.

2. Width of Trench.

Minimum Width of Trench. The minimum width of pipe trenches, measured at the crown of the pipe, shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells. The minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections. Such minimum width shall be exclusive of trench supports and not greater than the width at the top of the trench.

Maximum Width of Trench. The maximum allowable width of trench for pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24 inches. A

trench wider than the outside diameter plus 24 inches may be used without special bedding if the Contractor, at his expense, furnishes pipe of the required strength to carry additional trench load. Such modifications shall be submitted to the Owner and approved in writing. Whenever such maximum allowable width of trench is exceeded, except as provided for on the drawings, or in the specifications, or by the written approval of the Owner, the Contractor, at his expense, shall encase the pipe in concrete from trench wall to trench wall, or other pipe bedding material approved by the Owner. Any excavation wider than this maximum width or subsequent Surface or Paving work, will be done at the Contractor's expense.

3. Classification of Excavated Materials.

No classification of excavated materials will be made. Excavation and trench work is to include the removal and subsequent handling of all materials excavated in accordance with Item 400, "Excavation and Backfill for Structures".

4. Grade of Trench Bottom.

The trench is to be over-excavated to a depth of 6-in. below the grade line established for the bottom of the pipe, regardless of the type of pipe. The grade line of the pipe is to then be met by the addition of a layer of approved bedding material as directed.

5. Excavation Below Grade.

Any part of the bottom of the trench excavated below the limits specified in Section 3.A.4., "Grade of Trench Bottom", is to be corrected with approved material and compacted as directed. Should excessive over-excavation occur, except at bell holes, the grade is to be restored in accordance with the methods described in Section 3.A.6, "Unstable Conditions at Grade", at no cost to the owner.

6. Unstable Conditions at Grade.

Where the bottom of the trench at grade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces of fragments or inorganic materials which in the judgment of the Engineer should be removed, the Contractor is to excavate and remove such unsuitable material to the a depth no less than 6-inches below pipe. Before the pipe is laid the grade is to be restored by backfilling with an approved material in layers of 3-in. prior to compaction. The layers are to be slightly moistened and thoroughly compacted so as to provide a uniform and continuous bearing and support for the pipe at every point between bell or collar holes. The finished grade is to be accurately graded to provide uniform bearing and support for each section of pipe at every point along its entire length except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper seating of pipe joints.

7. Trench Excavation Protection.

All trench excavation required on this project is to be accomplished as required by the provisions of Item 402, "Trench Excavation Protection".

8. Caution in Excavation.

The Contractor is to proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures and utilities may be determined whether shown on the plans or not. Machine excavation is not permitted closer than 12-in. on either side of other existing underground

utilities. The Contractor is to be responsible for the repair of such structures and utilities when broken or damaged. He is also to be responsible for adjusting alignment and trench grades with reference to such structures in order to obtain specified clearance for the water main construction.

Whenever the Engineer determines that it is necessary to explore and excavate to determine the location of existing underground structures and utilities, the Contractor is to make explorations and excavations for such purposes at his expense.

9. Protection and Restoration of Underground Structures and Facilities.

The Contractor is to furnish temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work. All underground structures and utilities which are disturbed are to be restored by the Contractor at his expense. Materials and methods used for restoration are to be in accordance with the City Code of San Antonio, Texas for Building, Electrical, and Plumbing and the requirements of the utility agency involved.

In the event that a sanitary sewer is broken by the Contractor's operations the release of sewage into the trench is to be immediately intercepted by the insertion of a section of sheet metal tubing known as a "tin-horn" between the broken ends of the sewer. All leakage at the ends of the "tin-horn" is to be effectively stopped. The "tin-horn" is to remain in place until such time as permanent repairs can be made. It is to be the responsibility of the Contractor to determine sufficiently in advance of his trenching operations the size of all sanitary sewer lines and services which will require this treatment.

All sanitary sewer lines crossing the excavation, whether bridged or replaced, are to have proper support consisting of sound timber supports having a minimum 2-in. nominal thickness and a minimum 6-in. nominal width placed with the width horizontal and extending a minimum of 12-in. into the trench wall on either side.

In all cases where a sewer pipe is replaced or bridged, the backfill material is to be thoroughly compacted to the bottom of the pipe and compacted by hand from this point to a distance of 6-in. above the top of the sewer line being replaced.

The locations of all sewer lines crossing excavations, whether replaced or bridged are to be properly marked, and care is to be taken to avoid damage to the pipe through the use of a hydratamping machine or other mechanical equipment. The Contractor is to be liable for the failure of such lines due to negligence or poor workmanship.

10. Backfill Material Derived from Excavation.

All excavated materials which the Engineer determines are suitable for reuse as trench backfill is to be separated where practicable from the general excavation material, or as directed.

11. Trench Restoration

The surface of the backfilled trench shall be restored to match the previous existing conditions. This shall include final grading, placement of topsoil and seeding, placement of sod (such as at homes or businesses that had maintained lawns), or other unprepared and prepared surfaces. Trenches in alleys actively being used by vehicles (such as trash pickup, vehicle parking, etc.) shall be restored by grading and compacting to 98% or higher with a minimum of 4 inches of flex-base materials for the entire width of the alley. Alleys not actively used by vehicles shall be graded and compacted to 98% or higher, then spread grass seed for entire width of the alley.

12. Pavement.

The Contractor is to remove pavement and surfaces as a part of the trench excavation. The removal of pavement and surfaces and their restoration is to be based on the minimum trench widths as specified, plus 6-in. either side or as otherwise provided herein. The Contractor is to use such methods as sawing, drilling, or chipping to assure the breaking of the pavement along straight lines. If the Contractor removes or damages pavement or surfaces beyond the limits specified above, such pavement and surfaces are to be restored at the expense of the Contractor.

Where water line construction necessitates cutting through existing streets outside the limits of new street construction, said streets are to be replaced in kind as directed.

Where, in the opinion of the Engineer, it is necessary to maintain traffic across a trench, the Contractor is to install temporary metal bridges as necessary to facilitate the movement of traffic.

The street surface adjacent to the trench is to be kept free of surplus spoil. Construction materials are to be placed at locations that will minimize interference with the traveling public.

13. Concrete Sidewalks, Driveways, Etc.

All concrete sidewalks, driveways, etc., are to be cut with a concrete saw. When transverse expansion or "dummy" joints are encountered, the concrete is to be removed to the nearest transverse joint on each side of the trench and restored. The depth of cut is to be such that upon removal of the concrete, the sides of the cut are to be straight and square.

Existing reinforcing wire fabric or bars are to be cut and removed to permit completion of trench excavation, pipe laying, and backfill operations. When the backfill operations have been completed, the existing reinforcement is to be replaced in its original position and satisfactorily spliced prior to the replacement of concrete over the new trench alignment.

Transverse "dummy" joints are to be made by a jointing tool or other means acceptable, and are to match in depth and thickness in the existing transverse joints.

Expansion joint material is to be provided where new construction abuts the existing curb or driveway if the Engineer deems it necessary.

Concrete is to be spaded, tamped, and thoroughly compacted until mortar entirely covers the surface and has a monolithic finish. The top surface is to be floated, troweled, and finished to match the existing concrete surface.

Immediately after finishing, the concrete surface is to be protected by a membrane compound curing agent, or by wetted cotton or burlap mats. Either method is to be subject to approval.

14. Dewatering Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding areas.

1. The contractor shall not allow water to accumulate I excavations or at subgrade level. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades and foundations. Provide and maintain dewatering system components necessary to convey water from excavations.

2. Convey water removed from excavation and rainwater to collecting or runoff areas away form buildings and other structures. Establish and maintain temporary drainage ditches and other diversion outside excavation limits. Do not use trench excavations as temporary drainage ditches.

3. Dewatering devices shall be provided by the Contractor with filters to prevent the removal of fines from the soil. Should the pumping system draw fines from the soil, the Owner shall order immediate shutdown, and remedial measures will be responsibility of the Contractor.

4. Upon completion of the dewatering work, the Contractor shall remove all equipment and leave the construction area in a neat, clean, condition that is acceptable to the Owner.

5. The Contractor shall maintain ground water table at least 12 inches below the finished excavation subgrade.

6. Dewatering Performances. Performances of the dewatering system for lowering ground water shall be measured by observation wells on piezometers installed I conjunction with the dewatering system, and these shall be documented at least daily. The Contractor shall maintain a log of these readings and submit them to the Owner.

   No direct payment shall be made for costs associated with dewatering. All costs in connection therewith shall be included I the applicable contract price for the item to which the work pertains.

B. Pipe Laying.

1. General Requirements.

The Contractor is to start his work at a tie-in point, unless otherwise indicated on the plans. Pipe is to be laid with bell ends facing the direction of lying, unless otherwise authorized or directed. Under no circumstances is pipe to be laid in water and no pipe is to be laid under unsuitable weather or trench conditions. All valves and fire hydrants must be installed as soon as pipe laying reaches their established location. Pipe is to be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations.

Spigots are to be centered in bells or collars, all valves and hydrant stems are to be set plumb, and fire hydrant nozzles are to face as shown on the plans or as directed. No valve or other control on the existing system is to be operated for any purpose by the Contractor unless approved.

The Contractor is to maintain a neat and orderly work area. Complete cleanup is to be maintained at all times as closely behind the pipe laying operations as possible, but in no case is such cleanup be permitted to lag more than 1,000-ft. behind the pipe laying, unless otherwise directed.

2. Crossing other Underground Lines.

New water mains crossing other utilities are to have a minimum of 30-in. of cover over the top of the pipe unless otherwise waived or modified. Excavation around other utilities is to be done by hand for at least 12-in. all around. Any damage to the protective wrap on gas lines or electrodes is to be reported immediately to CPS Energy, phone (210) 353-3333. Any damage to other utilities shall be reported to their proper governing entity.

3. Pipe Grade.

Water mains 16" or smaller shall have a minimum of 48 inches of cover from the proposed final finish ground/street elevation and 60 inches of cover when the main is installed in a parkway or under the pavement where there are no existing/proposed curb or existing drainage facilities. Water mains 20" and above shall have a minimum of 60 inches of cover over the top of the pipe from the proposed final finish ground/street elevation unless otherwise waived or modified by the Engineer. Pipe grades are to be as required on the plans, or as directed. Grades are to be met as specified by Sub article 3.A, "Excavation". Care is to be taken to insure that the pipe barrel has uniform contact with the bedding material for its full length except at couplings. The coupling is not to be in contact with the original trench bottom prior to backfill. Bedding material is to be placed under the coupling and compacted by hand prior to backfilling so as to provide an even bearing surface under the coupling and pipe. Change in grade is to be made only at joints.

4. Bedding and Bedding Materials.

Prior to placing pipe in a trench, the trench is to have been excavated to the proper depth as required in Subarticle 3.A, "Excavation". Approved materials are to be smoothly worked by hand across the entire width of the trench bottom to provide supporting bedding for the pipe.

Structures to Support Pipe: Where as the bottom of a trench at subgrade consist of material that is notably unstable by the Engineer and cannot be removed and replaced with approved material may be properly compacted in place to support the pipe. The Contractor shall also construct a foundation for the pipe consisting of piling, concrete beams, or other supports in accordance with plans prepared by the Engineer. Extra compensation will be allowed for the Contractor for the additional work done. Coordiante with Engineer for approval of extra comensation priorto beginning work.

5. Lowering Materials into Trench.

Proper implements, tools and facilities satisfactory to the Engineer are to be approved and used by the Contractor for the safe and convenient execution of work. All pipe, fittings, valves, and hydrants are to be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and lining. Under no circumstances are water main materials to be dropped or dumped into the trench. Take care to avoid damaging polywrap films. Use of chains or slings is not allowed unless entire sling is wrapped with a protective nylon web sock.

6. Installing Pipe.

Every precaution is to be taken to prevent foreign material from entering the pipe while it is being placed in the line. Under adverse trench conditions, extended period of time and/or otherwise required by the Engineer, a manufactured cap/plug is to be used to prevent any foreign type material entering. Leave the cap/plug in place until a connection is made to the adjacent pipe. Inspect the interior of each pipe for defects and reject if defects are found.

After placing a length of pipe in the trench, the jointed end is to be centered on the pipe already in place, forced into place, brought to correct line and grade, completed in accordance with the requirements specified herein. The pipe is to be secured in place with approved backfill material tamped around it. Pipe and fittings which do not allow a sufficient and uniform space for joints will be rejected and are to

be replaced with pipe and fittings of proper dimensions. Precautions are to be taken to prevent dirt or other foreign matter from entering the joint space.

At times when pipe laying is not in progress the open end of pipe in the trench is to be closed by a watertight plug or other means approved. Pipe in the trench which cannot temporarily be jointed is to be capped or plugged at each end to make it watertight. This provision is to apply during all periods when pipe laying is not in progress. Should water enter the trench, the seal is to remain in place until the trench is completely dry. The contractor is to provide plug & caps of various sizes required.

a. Steel Pipe: Steel pipe shall be installed as specified within "Water Main." The Contractor shall furnish all steel piping including fittings, couplings, specials, pipe supports, eyebolts, nuts, and accessories which are shown on the plans and as required for proper connection to existing piping. The Contractor's attention is directed to the fact that the exact location and elevation of existing piping must be determined in the field prior to fabrication of connecting piping.

All steel pipe and specials may be either mill pipe or fabricated pipe and, in either case, shall be fabricated to the sizes, dimensions and shapes as indicated on the plans and as shown on the plans. Unless otherwise indicated on the plans, all steel pipe, bends, or specials shall have an outside diameter minimum wall thickness and unit weights as shown on plans.

(1) Ends of Sections: Ends of pipe sections, bends, and specials shall be beveled for field welding, unless shown otherwise on the plans.

(2) Seams: All piping shall be made from steel plate rolled into cylinders or sections thereof, with not more than two longitudinal butt welds, or shall be spirally formed and butt welded. Girth seams shall be butt welded and not be closer than 6 feet apart except in specials and bends.

(3) Length tolerance**:** Standard an special section shall be within 1/16 inch (plus or minus) of the specified or theoretical lengths.

(4) Welded Joints: Except where ends are shown on the plans to be joined by mechanical couplings, all joints for steel pipe installed on a bridge structure and in open trench shall be welded.

Welders appointed to do welding on steel pipe shall be certified with 4F and 5G certification. All welds shall be sound, free from embedded scale and slag, shall have a tensile strength across the weld not less than that of the thinner of the connective sections, and be water tight. Use butt welds for all welded joints in line-pipe assemblies and in the fabrication of bends and other specials. Welds are subject to Pre-Manufacturing inspection and available to SAWS by request.

Welding for field joints shall conform to the applicable requirements of the AWWA "Standard Specification for Field Welding of Steel Water Pipe Joints, C206." Parties involved in the construction of main(s) shall pay special attention to the AWWA "Standard Specification for Field Welding of Steel Water Pipe Joints, C206, Control of Temperature Stresses." After welding, the joints shall be prepared, primed and painted, or wrapped in accordance with this specification.

Repair leaks in welds by chipping our defective material and re-welding. Hammering is not permitted.

b. PVC (C-900, C-905 and C-909): Defection of PVC pipe is not allowed. Lay PVC mains to the depths an grades shown on plans. Lay pipe by inserting spigot end into bell flush with insertion line or as recommended by manufacturer. At no time is bell end allowed to go past "insertion line". A gap between end of spigot and adjoining pipe is necessary to allow for expansion and contraction.

7. Defective or Damaged Material.

Pipe and accessories are to be inspected for defects prior to being lowered into the trench. Any pipe section, fitting, or special which shows dents, kinks, abrupt changes of curvature other than specified, or any other damage will be rejected. Any pipe section, fittings, or special section that has been dropped from a truck or crane will be rejected. The Contractor shall, at his expense, replace or recondition each rejected section. Reconditioning procedures must be acceptable to the Engineer. Any defective, damaged, or unsound material is to be repaired or replaced as directed.

Should a damaged piece of pipe furnished by the Contractor be placed in the water main, the Contractor is to furnish, at his expense, all labor and materials required for removing and replacing the defective pipe and restoring the street to its condition just prior to the failure of the pipe. Should the Contractor damage the pipe after installation, the Engineer may permit the damaged section to be cut from the length unless it is the opinion of the Engineer that the entire length was damaged. The cost and replacement of broken pipe is to be at the expense of the Contractor.

8. Holes at Bells and Collars.

Bell holes of sufficient size are to be provided at each joint to permit the joints to be made properly. For mechanical type joints the minimum clearance between the bell and natural ground is to be 6-in. in all directions. Bell holes for concrete steel cylinder pipe are to be of sufficient size to properly joint the pipe and place the required grout. Subject to the above provisions the length of excavation for bell holes below grade of the trench bottom is to be kept to a minimum.

9. Deviations in Line or Grade.

Wherever obstructions, not shown on the plans, are encountered during the progress of the work and such obstructions interfere to such an extent that an alteration on the plan is required, the construction inspector is to have the authority to change the plans and direct a deviation from the line and grade or to arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstruction. Any deviation from the line is to be accomplished by the use of appropriate bends unless such requirements are specifically waived by the construction inspector.

Whenever it is necessary to deflect pipe from a straight line the deflection is to be as directed. In no case are the amounts shown in Table 1, "Maximum Deflections of Ductile-Iron Pipe", for ductile-iron pipe, and Table 2, "Maximum Defections of Concrete-Steel Cylinder Pipe", for concrete pipe to be exceeded.

Table 1
Maximum Deflections of Ductile-Iron Pipe

Norm Pipe Dia	Max Joint Open	Max Defl Angle	Max Deflection in Inches with Pipe Length of:		Approx Rad of Curve in Ft Produced by Succession of Joints with Pipe Lgth of:	
(Inch)	(Inch)	Deg/Min	18ft	20ft	18ft	20ft
6	0.58	4/25	16.7	18.5	234	260
8	0.65	3/51	14.6	16.2	268	297
10	0.75	3/42	14.0	15.5	279	310
12	0.75	3/08	11.9	13.2	327	363
16	0.75	2/21	8.8	9.7	440	488
20	0.75	1/55	7.2	8.0	540	600
24	0.75	1/35	6.0	6.7	648	720

Table 2
Maximum Deflections of Concrete-Steel Cylinder Pipe

Normal Pipe Diameter (Inches)	Maximum Deflection Angle Deg/Min	Maximum Deflection (Inches)		Approx Radius of Curve (Feet)	
		16' Lay Length	20' Lay Length	16' Lay Length	20' Lay Length
16	2/20	-	9.8	-	500
20	1/52	-	7.8	-	600
24	1/34	-	6.6	-	750
30	1/16	-	5.3	-	900
36	1/02	-	4.3	-	1100
42	0/54	-	3.8	-	1300
48	0/47	2.6	-	1170	-
54	0/44	2.5	-	1237	-
60	0/54	3.0	-	1024	-

10. Cutting Pipe.

The cutting of pipe for inserting valves, fittings or closure pieces is to be accomplished in a neat and workmanlike manner so as to produce a smooth end at right angles to the axis of the pipe. Strictly follow the recommendations of the pipe manufacturer. Use qualified and experienced workmen, and under no circumstances is a workman not equipped with proper safety goggles and helmet and other required safety attire permitted to engage in this work.
Asbestos-Cement (AC): No field cutting will be allowed on asbestos-cement pipe. Repairs to AC pipe shall be accomplished by removing one full joint of AC pipe and replacing with appropriate PVC or Ductile Iron pipe and fittings. Information about handling AC pipe may be obtained through the SAWS homepage at http://www.saws.org.

All cuts made on ductile-iron pipe are to be done with a torch or power saw. The cuts are to be made at right angles to the pipe axis and are to be smooth. The edges of the cut are to be finished smoothly with a hand or machine tool to remove all rough edges. The outside edge of pipe should be finished with a small taper at an angle of about 30 °.

Field Cut PVC (C-900, C-905 and C-909) using a power saw with a steel blade or abrasive disc depending on the size of pipe. If a bevel is needed after field cutting, it should be in accordance with Uni-Bell recommendations.

To facilitate future repair work on water mains, no sections less than 3 feet in length between fittings is allowed.

11. Coating and Wrapping Underground Pipe.

a. Steel Pipe.

Steel pipe, bends and special are to be prepared, primed, painted or wrapped in the field as follows.

(1) Exterior Surface Above Ground: Exterior surfaces of new pipe and appurtenances installed are to be thoroughly cleaned to bare metal by high speed wire brushing, scraping or other suitable methods approved by Engineer, given a single coat of industrial grade rust inhibitive primer and two finish coats of aluminum paint.

(2) Exterior Surfaces Under ground: Exterior surface of steel pipe, bends and specials installed in open trench are to be thoroughly cleaned to bare metal by high speed wire brushing, scraping or other suitable methods approved by Engineer, given a single coat rust inhibitive primer and wrapped with polyvinyl tape in accordance with AWWA C203-91 “Protective Coatings for Steel Water Pipelines,” (Appendix C).

(3) The procedure for coating flanged joints and mechanical coupling joints when used with steel pipe is to be as specified.”

(4) Interior Surfaces: The interior surfaces of steel pipe, fittings and specials are to be cleaned by sandblasting and then primed and coated in the shop with coal tar enamel.

b. Ductile-Iron Pipe.

(1) Open Trench: Ductile-iron pipe to be installed in a trench is to be protected in the following manner. Each pipe joint is to be covered with a 4 mil thick polyethylene sleeve that is 2-ft. longer than the pipe joint. The sleeve is to cover the full length of the pipe joint, lap over 1-ft. on each end of the adjoining pipe joints and be secured with a minimum of 2 circumferential turns of pressure sensitive polyvinyl tape. Excess material should be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe and held in place by means of pieces of pressure sensitive tape at approximately 5-ft. intervals. After assembling the joint, the polywrap tube from the previously installed pipe is to be pulled over the joint and secured by the contractor. The polywrap tube from the new joint is to be pulled over the first tube and secured to provide a double seal.

Cast iron and ductile-iron fittings are to be completely wrapped in 8 mil thick polyethylene films with a minimum of 1-ft. overlap on each end and appropriately taped. Laps are to cover joints with adjoining pipe joints or fittings when installed. Fire hydrant barrel from the surface to the valve is to be wrapped as specified herein.

Any damaged areas in the polyethylene film are to be repaired by covering the area with a sheet of polyethylene film large enough to lap over the damaged area 1-ft. minimum in any direction and appropriately taped. Take care at service to locations to insure that tape extends beyond corporation and onto service line pipe 1 foot.

Prior to placing pipe in the trench, a cushion of approved materials is to be placed in the trench as required by Section 3.D., Backfill material is to be carefully placed on the pipe so as to avoid any damage to the polyethylene sleeve.

Use care to protect and preserve polyethylene wrap around ductile iron water mains when installing service corporations. The required method is to wrap pipe tape around pipe over polywrap in the area to be tapped. The tap is to be made through the tape and polywrap. It is not necessary to remove and replace polywrap. All exposed pipe, the corporation and the first 3 feet of the service shall be wrapped and taped to achieve a complete seal. In addition, a sand envelop shall extend over and around the connection to a depth of eight inches above the main.

(2) In Casing: Where ductile-iron pipe is installed in a bore, the pipe is to be to thoroughly clean down to the coal-tar enamel pipe coating by approved methods. Where damaged, a prime coat compatible to the polyvinyl tape to be used is to then be applied to the pipe. Following application of prime coat, wrap pipe with Scotchrap, trantex V-10 polyvinyl tape, or approved equal. Tape shall not be applied until prime coat is completely dry.

Tape is to be spirally and tightly wrapped on each section of pipe with 50% lap. Wrap shall be made to bell on bell end and to a point 6 inches from spigot end. Protect joint with tape 6 inches in width on pipe 12 inches or less in size and 8 inches on width on pipe greater than 12 inches in size

12. Protective Coating and Wrapping on Joints.

All bolts and nuts installed for underground service on valves, fire hydrants, cast-iron mechanical joint fittings, pipe joints, and other ferrous metal appurtenances are to be packed in an approved protective coating material after installation. After the joint has been made and bolts drawn to proper tension, the

joint including glands, flanges, bolt heads, and nuts are to be covered with a Water system approved coating. Such protective coating is supplemental to anti-corrosive sand embedment. Asphaltic coatings such as Talcote is not allowed. Coating and wrapping of joints is to be considered subsidiary to the installation and will not be paid for directly.

a. Steel Pipe Field Welded Joints: After installation of pipe, bends and specials, all end of pipe adjacent to welded field joints, including the weld proper, shall be cleaned, primed, painted or wrapped as specified for the pipe adjacent to the weld.

13. Joint Assembly.

a. Rubber Ring Joints: The installation of pipe and the assembly of rubber ring joints for ductile-iron pipe, concrete-steel cylinder pipe and asbestos cement pipe, is to conform to the pipe manufacturer's assembly instructions. The method of inserting spigot ends of pipe in bells or collars known as "stabbing" is not permitted with pipe larger than 6-in.in size. Spigot ends of pipe larger than 6-in. in size must be properly inserted in the joint by means of suitable pushing or pulling devices.

b. Mechanical Couplings: The installation of mechanical couplings is to be assembled and installed according to the standards recommended by the manufacturer. Prior to the installation of the mechanical coupling, the pipe ends are to be cleaned by wire brush or other acceptable method to provide a smooth bearing surface for the rubber compression gasket. The pipe is to be marked to align the end of the coupling which will center it over the joint. After positioning, the nuts are to be drawn up finger tight. Uniform pressure on the gaskets is to be applied by tightening alternate bolts on the opposite side of the circle in incremental amounts. Final tensioning is to be accomplished with a torque wrench and in a manner similar to the tightening procedure. The coupling is to then be left undisturbed for 24 hours to allow the gaskets to "pack-in". Final torque check is to then be made prior to coating and wrapping the joint. Table 2, Torque for Mechanical Couplings, sets forth the proper torque for various sized mechanical couplings and is included for the convenience of the Contractor.

c. Restrained Joints: Install restraint joints as shown on plans or as directed by Engineer. Install in accordance with manufacturer's recommendations.

Table 2
Torque For Mechanical Couplings

Coupling Size	Bolt Diameter	Torque
2" to 24"	5/8"	75 ft/lb
2" to 24"	3/4"	90 ft/lb
30" and 36" (1/4"x7" Middle Rings)	5/8"	65 ft/lb
30" thru 36" (3/8" & heavier Middle Rings)	5/8"	70 ft/lb
30" to 48"	3/4"	80 ft/lb
48" to 72"	¾"	70 ft/lb

14. Gray Iron and Ductile Iron Fittings.

a. Fittings: Fittings 6-in. through 12-in. in size are to be either mechanical joint, push-on joint short body, or push-on joint compact body unless otherwise stated on the plans. Fittings shall be installed with the thrust blocking or joint restraint shown in standard drawing DD-839 series. Fittings 16-in. through 24-in. in size are to be mechanical joint type unless otherwise specified on the plans. Adaptors are to be used where necessary to provide a transition between asbestos-cement pipe and the fittings. Restraint or thrust blocking is to be provided as specified on the plans or as directed. Anti-corrosion embedment incidental to all installed cast-iron fittings shall be provided as specified in and no separate payment will be made for this embedment.

b. Cleaning Ductile Iron: All lumps, blisters, and excess coal-tar coating is to be removed from the ends of ductile-iron pipe fittings. The outside of the spigot and the inside of the bell is to be wire-brushed and wiped clean, dry, and free from oil and grease before the pipe is laid. The interior of the pipe is to be blown clean with compressed air or swabbed out clean and dry as directed. Immediately prior to placing any pipe in the trench the interior is to be cleaned by an approved brush or swab or with compressed air to remove all dirt and foreign materials. All pipe and fittings are to be inspected by the Contractor for defects while suspended above ground.

15. Corrosion Protection for Ferrous Pipe, Fittings, and Valves

Except as otherwise shown on plans or as direct, anticorrosion embedment is to be provided for all ductile-iron pipe, fittings, and valves and at all valve fittings or outlets for nonferrous or reinforced concrete steel cylinder pipe. The embedding material is to be Modified Grade 5 gravel washed sand which conforms to the requirements set forth in Section 2.O.

Prepare the trench in accordance with applicable provisions of Section 3.A. After subgrade has been prepared, lay pipe to grade in accordance with plans and specification. Pipe, fitting or valve are to be firmly embedded in and surrounded by an insulating blanket of embedding material. The minimum thickness of this blanket is to be 6 inches in every direction

16. Tie-in to Existing Mains.

The Contractor is to make all ties to existing mains shown on plans or as directed. Contractor is responsible for; shutdowns and isolation of existing main, with Water System inspector is on site cutting pipe for connection, dewatering the excavation, customer notification of shutdown, proper material and all other requirements as directed by Engineer or Inspector to provide completion in a safe and secure manner. Tie-ins are to be done during normal work hours, (8 am – 5 pm). During construction, planned shutdown and tie-in shall be coordinated through and approved by Water System Inspector. Planned shutdown and tie-in is to be accomplished at a time which will be at the least inconvenience to customers. No additional compensation will be provided for tie-ins accomplished after normal working hours. Tie-in to existing mains of asbestos cement (AC) pipe, the Contractor shall observe and comply with all federal, state and local laws, ordinances and regulations regarding the management of asbestos containing materials. At the minimum, work involving AC pipe should be overseen by a person who has received asbestos training and is familiar with the National Emissions Standards for Hazardous Air Pollutants (NESHAP). If greater than 260 linear feet of pipe is to be removed, written notification to the Texas Department of Health (TDH) 10 days prior commencing with the removal of AC pipe is required. At each location shown in the plans and/or identified by the Contractor to involve AC pipe, the Contractor will be required to remove the necessary amount of AC pipe to make the connection without creating any friable material. The Contractor shall remove whole sections of AC pipe and make the tie-

in at the nearest joint. The Contractor shall remove the AC pipe and store it in a secure, Engineer approved location for pick up by the owner of the utility. Prior to performing this work, the Contractor shall notify the Engineer and the owner of the utility of the work schedule 48 hours in advance of beginning the work.

17. Abandonment of Old Mains and Valves.

The Contractor is to accomplish all cutting, capping, plugging, and blocking necessary to isolate those existing mains retained in service from those abandoned. The open ends of abandoned mains and all other openings or holes in such mains occasioned by cutting or removal of outlets are to be blocked off by manually forcing cement grout or concrete into and around the openings in sufficient quantity to provide a permanent substantially watertight seal.

Valves abandoned in the execution of the work are to have the valve box and extension packed with sand to within 8-in. of the finished surface. The remaining 8-in. are to be filled with 2,500 psi" concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valve covers are to be salvaged and returned to the Water System Company. Abandoning old mains and valves is to be considered subsidiary to the installation and will not be paid for directly.

18. Jacking, Boring, or Tunneling Pipe.

a. Jacking: Suitable pits or trenches shall be excavated for the purpose of jacking operations for placing end joints of the pipe. When trenches are cut in the side of embankment, such work shall be securely sheeted and braced. Jacking operations shall in no way interfere with the operation of railroads, streets, highways or other facilities and shall not weaken or damage such facilities. Barricades and lights shall be furnished as directed by the Engineer to safeguard traffic and pedestrians.

The pipe to be jacked shall be set on guides to support the section of pipe being jacked and to direct it in the proper line and grade. Embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the opening thus provided. The excavation for the underside of the pipe, for at least ⅓ of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than 2 inches may be provided for the upper half of the pipe.

The distance that the excavation shall extend beyond the end of the pipe shall depend on the character of the material, but it shall not exceed 2 feet in any case.

Generally, the pipe shall be jacked from downstream end. Permissible lateral or vertical variation in the final position of the pipe from line and grade will be as shown on the plans or as determined by the Engineer.

Any pipe that cannot be repaired to its original condition or is damaged in jacking operations shall be removed and replaced at the Contractor's expense. Jacking pits shall be backfilled immediately upon completion of jacking operations.

Excavation for "Boring" pits and installation of shoring shall be as outlined under "Jacking." Boring operations may include a pilot hole which shall be bored the entire length of crossing and

shall be used as a guide for the larger hole to be bored. Water or drilling fluid may be used to lubricate cuttings. Variation in line and grade shall apply as specified under "Jacking."

b. Tunneling: Tunneling may be used when the size of the proposed pipe would make the use of tunneling more satisfactory than "Jacking" or "Boring." The excavation for pits and the installation of shoring shall be as specified under "Jacking." The lining of the tunnel shall be of the material shown on the plans.
Access holes for grouting annular space shall be spaced a maximum of 10 feet.

c. Joints: Joints for pipe for "Jacking," "Boring," or "Tunneling," shall be as specified in "Water Mains", or as shown on the project plans or shop drawings as per pipe manufacturer's recommendation.

d. Grouting of Bores or Tunnels: Annular Space between casing pipe and limits of excavation (borehole) shall be pressure grouted, unless otherwise specified on the plans.

19. Cutting-in Valves.

The work involved in cutting a valve into an existing main is to consist of excavation and backfilling with approved selected material; hauling and disposition of surplus excavation and other materials; installation of the valve, valve box assembly, all pipe cut used to complete cut-in; reaction blocking; polyethylene wrapping where required.

20. Tapping Sleeves and Valves.

Size on size taps is not permitted. The work involved in the installation of a tapping sleeve and valve is to consist of excavation, backfilling the excavation with approved selected material, installing the tapping sleeve, reaction blocking, tapping valve, valve box assembly, concrete collar where subjected to street traffic, and a cast iron lid. New taps will not be permitted closer than 2 feet of a joint or existing tap. The use of a shell type cutter shall be required with tapping sleeves and valves. Whenever working on potable or recycled water system, disinfect the shell cutter with bleach prior to start of work. The cutting edge is to be sharp and round. Inspector will reject defective cutters.

Air test tapping sleeves to 50 psi prior to tapping main line.

Place valve box in such a manner to prevent shock or stress from being transmitted to valve. Center valve box over valves operating nut with box cover flush with finished pavement surface or located at another level as directed by Engineer. Valve boxes located in street or other areas subject to vehicular traffic shall be provided with concrete collars as shown on plans. Form collars around such valve boxes and finish off neatly and in a workmanlike manner.

21. Cutting-in Tees

The work involved in cutting in a tee is to consist of excavation, shut-down and isolation of existing main to which the new main is to be connected, cutting pipe for connection, dewatering the excavation, customer notification of service interruption where required, installation of all pipe used to complete the connection, all necessary tie-ins (connection to existing or new main), fittings, approved reaction blocking required and backfilling the excavation with approved selected materials or flowable backfill if required. Where the installation of a valve is required, payment will be for valve accordance with this specification.

22. Pipe Joint Restraint System

Pipe joint restraints shall be utilized to prevent movement for PVC push-on bell and spigot pipe connections. The restrainer may be adapted to connect a plain end PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. Joint restraint is to be non-directional and installed to fully restrain system.

23. Concrete Encasement, Cradles, Saddles and Collars

Concrete Encasement. When concrete encasement is shown on the plans or when directed, the trench is to be excavated and fine graded to a depth conforming to the details and sections shown on the plans. The pipe is to be supported by pre-cast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation. Encasement concrete is to be placed to a depth and width conforming to details and sections shown on the plans.

Concrete Cradles. When concrete cradles are shown on the plans or when directed, the trench is to be prepared and the pipe supported in the same manner as described in Concrete Cradles, of this Section. The cradle shall be constructed in accordance with details and sections shown on the plans. Strap/Tie Downs shall be No. 4 rebar diameter minimum of better as determined by Water System Inspector.

Concrete Saddles. When shown on the plans or when directed, pipe to receive concrete saddle is to be backfilled in accordance with Section 3.D. of this specification to the spring line and concrete placed for a depth and width conforming to details and sections shown on the plans.

Concrete Collars. When shown on the plans or when directed, concrete collars are to be constructed in accordance with details and sections shown on the plans.

C. Fire Hydrants and Miscellaneous Appurtenances.

1. Fire Hydrants.

Hydrants are to be connected to the main as shown on the plans or as directed by the Engineer. They are to be installed in a manner which will provide complete accessibility and in a sage location where there is a minimum possibility of damage from vehicles or injury to pedestrians.

When the hydrant is placed directly behind the curb the hydrant barrel is to be set so that no portion of the hydrant will be less than 12 inches nor more than 7-ft. from the back of the curb.

When the hydrant is set in the lawn space between the curb and the sidewalk or between the sidewalk and the property line no portion of the hydrant or nozzle cap is to be within 6-in. of the sidewalk. Setting final grade of fire hydrants to match proposed or existing field conditions is the responsibility of the contractor.

Hydrants are to be set in accordance with plans and details are to be set plumb and are to have their nozzles parallel with or at right angles to the curb with the pumper nozzle facing the curb. Drainage and concrete pad are to be provided at the base of the hydrant as shown on the plans. No fire hydrant drainage system or pit is to be connected to a storm sewer or to a sanitary sewer.

a. Restrained Joints: Restrained mechanical joints that require field welding or groove cuts into the pipe barrel for restrain will not be accepted. Restrained joints shall be furnished for pipe at all changes in direction at indicated on plans, details, or as directed. Restrained mechanical joints shall

be locked mechanical joints. Joints shall be capable of test pressure twice the maximum sustained working pressure of 350 psi for ductile iron pipe and PVC

b. .Replacing and Relocating Existing Fire Hydrants: When existing fire hydrants are to be replaced or relocated, the work is to be accomplished by either of the following:

(1) Cutting or installing a tee of the size and type indicated on plans or as directed.

(2) Using a tapping sleeve and valve of the size and type indicated on plans to install a new fire hydrant to an existing or new water main. Size on size taps is not permitted.

(3) Relocating the existing fire hydrant by closing the existing fire hydrant, extending the fire hydrant branch and installing the existing fire hydrant as specified herein.

Salvage the existing fire hydrant and other materials as designated in the field by the Construction Inspector and deliver to Water System material storage yard located at 3930 East Houston Street. Fire hydrant branches are to be abandoned by cutting and capping fire hydrant cast iron tee at the service main and surface restored to its original condition.

After the fire hydrant has been set, paint hydrant with suitable primer and finish with oil-based aluminum paint from top of hydrant to a point 18-20 inches below center line of the pumper nozzle and apply to all exposed metal surfaces above the hydrant base flange. The payment for fire hydrant painting is to be included in the unit cost for installing the fire hydrant.

Pipe, fittings, and valves used in the placement of fire hydrants and connections to the main are to be considered subsidiary to the fire hydrant installation and not a part of the main construction and will not be paid for directly.

2. Valve Boxes, Adjustments.

Valves are to be provided with valve boxes, manholes, or valve pits as shown on the plans.

The valve box is to be placed in such a manner to prevent shock or stress from being transmitted to the valve. It is to be centered and set plumb over the operating nut of the valve with the box cover flush with the surface of the finished pavement or at such other level as may be directed. Valve boxes located in streets or other areas subjected to vehicular traffic are to be provided with concrete collars as shown on the plans. Collars around such valve boxes are to be formed and finished off neatly and in a workmanlike manner.

Valve box is to be located so that the valve operating nut is readily accessible for operation through the opening in the valve box. The valve box is to be set flush with the surface of the finished pavement or at such other elevations as may be specified. Pits are to be constructed to permit minor valve repairs and to afford protection to the valve and pipe from impact where they pass through the pit walls.

Existing valve boxes located within the limits of new street construction which are in conflict are to be adjusted to match proposed finish grades.

Valve boxes installed as part of a new valve and mainline construction project are considered “new valves.” Adjustments to “new valves” are incidental to the installation of the valve. No separate pay will be given to adjust “new valves” to finished grade.

3. Air Release Assembly.

Air release valves and appurtenant items are to be installed at the locations shown on the plans unless otherwise directed.

Install air release assemblies in open trench in accordance with plans and details. Assemblies include the valve, valve box, tapping saddle, pipe fittings, accessories and appurtenances. It also includes service line and tap to main. Air release assemblies installed in parkways or easements and outside of street pavement shall be installed in accordance with plans.

Air release assemblies installed on steel pipe attached to bridge structure includes the outlet on the steel pipe, valve, valve box, pipe fittings, security enclosure, accessories and appurtenances.

4. Blow-offs.

Permanent and temporary blow-off assemblies are to be installed at the locations shown on the plans or where otherwise directed. The permanent blowoff is to consist of all galvanized pipe, valve, and fittings of the various sizes detailed on the plans, 6-in. valve box assembly including the 6-in. valve box and concrete collar around the valve box where subjected to vehicular traffic. The temporary blowoff is to consist of all galvanized pipe, valve, and fittings of the various sizes detailed on the plans. Valve box is to be raised on installed to finished grade in accordance with details.

5. Butterfly Valves

Butterfly valve installation shall include; butterfly valve, coated and wrapped steel pipe nipple with reaction stop ring, concrete reaction blocking, cast-iron boot, valve box extension (ductile iron riser pipe), valve box and lid, concrete collar where subjected to vehicular traffic, all couplings and all coupling adapters required completing the connection. The entire valve except for the operating nut shall be coated with an approved Water System sewer structural coating, and wrapped with Polywrap. Butterfly Valves constructed in terrace shall be constructed with No. 3 bars all around.

The valve box shall be placed in such a manner to prevent shock or stress being transmitted to the valve. All valves located 6 feet and deeper shall include valve key extensions inside the valve box. The Contractor has the option to install fully adjustable valve box and valve key extension systems on all valves located between 6 feet and 13 feet. Adjustable valve box and valve key extension systems shall be centered over the valve's operating nut with the box cover flush with the finished pavement surface or located at another level as directed by the Engineer. Valve boxes located in streets or other areas subject to vehicular traffic shall be provided with concrete collars as shown in plans. Collars around such valve boxes shall be formed and finished off neatly and in a workmanlike manner.

6. Gate Valves

Gate valve installation shall include; valve, reaction blocking when required conforming to plans, cast iron boot, valve box extension (Ductile Iron Riser Pipe), valve box, concrete collar where subjected to vehicular traffic, and valve box lid. Gate Valves constructed in terrace shall be constructed with No. 3 bars all around.

The valve box shall be placed in such a manner to prevent shock or stress being transmitted to the valve. All valves located 6 feet and deeper shall include valve key extensions inside the valve box. The Contractor has the option to install fully adjustable valve box and valve key extension systems, on all valves located between 6 feet and 13 feet. Adjustable valve box and valve key extension systems shall

be centered over the valve's operating nut with the box cover flush with the finished pavement surface or located at another level as directed by the Engineer. Valve boxes located in streets or other area subject to vehicular traffic shall be provided with concrete collars as shown in plans. Collars around such valve boxes shall be formed and finished off neatly and in a workmanlike manner.

Valve pits shall be located so that the valve operating nut is readily accessible for operation through the opening in the valve box. The valve box shall be set flush with the finished pavement surface or at other finish elevations as may be specified. Pits shall be constructed in such a manner to permit minor valve repairs and provide protection to the valve and pipe from impact where penetrating through pit walls. In a High Pressure Distribution System as specified in this specification, all valves 6 inches and larger, shall be supported on a concrete pad in accordance with plans.

7. Anchorage and Blocking.

Suitable reaction blocking or anchorage is to be provided at all dead ends, plugs, caps, tees, crosses, valves and bends as shown on the plans. All mechanical restraints are to be bidirectional. Anchor blocks are to be constructed solidly behind the fitting and symmetrical with the axis of resultant thrust except where this is not possible as in the case of gravity anchorage for vertical bends. Special ties and anchor fittings may be utilized in conjunction with blocking when shown on the plans or as directed.

Thrust blocking is to be a minimum of Class "A" (3,000 psi), concrete placed between solid ground and the fitting except as otherwise shown on the plans. The area of bearing in contact with solid ground is to be that shown on the plans or as directed.

All thrust blocking placed in conjunction with mains and appurtenances constructed in Pressure Zones 9 through 15 shall be in accordance with SAWS Standard Drawings DD-839 Series. In all cases, the design of thrust blocking shall be of sufficient size to withstand a soil pressure of 3000 psf, unless specified otherwise in the job plans or specifications. The maximum soil pressure value that will be allowed for the design of thrust blocking shall be 5000 psf. When soil pressure bearing values of 4000 psf or 5000 psf are recorded for design of thrust blocks, copies of soil tests made for determining the bearing value of the soil is question shall be submitted to the Engineer for verification.

The blocking is to be placed so that pipe and fitting joints will be accessible. Pipe polywrap is to be placed between the pipe or fitting and the concrete.

The reaction block on the unused branch of a tee is to be poured separately from the block across the back of the tee. If they are poured simultaneously, a rigid partition is to be placed between the blocks.

Valves 12-in. and larger in size are to be supported on a concrete pad extending vertically from 12-in. below the bottom of the valve to the lower quarter point of the hub and laterally from face to face of hubs and transversely from wall to wall of the trench.

D. Backfill.

1. Initial Backfill.

Initial backfill is defined as backfill having a thickness in its compacted state from the surface of the bedding to a point 1 foot above the top of pipe. The first lift of initial backfill is to be inspected and approved prior to placement of the second lift. The second lift of initial backfill material is to extend from the spring line of the pipe with a minimum of one foot above the top of the pipe. The second lift is to be evenly spread in a similar manner as the first lift.

For diameters 24 inches and larger, simultaneously spread initial backfill material alongside, under the lower quadrant of pipe and over the pipe in 12 inch lifts to a point sufficient to a minimum of 1 foot above the top of pipe.

Consolidate initial backfill material to assure it is incorporated. A handheld vibrator, commonly used for concrete work, can be used for this purpose. The vibrator shall be inserted every 3 feet on each side of pipe.

2. Secondary Backfill.

Secondary backfill is defined as backfill from 1 foot above the top of pipe to the top if the trench. Secondary back fill is to be constructed in accordance with details shown on plans and these specifications.

Secondary backfill material shall be placed in maximum 12 inch loose lifts or as directed.

3. Sand Backfilling of Cross Trenches and Open Holes.

Blow-offs, tie-ins, air release valves, and service lines, meter boxes, or other specials are to be backfilled with sand and thoroughly consolidated by saturating with water, unless otherwise directed. The use of mechanical tamping equipment for compaction of backfill will not be permitted at such locations. Disposal of surplus excavated material and placement of sand is to be considered subsidiary to trenching and backfilling and will not be paid for directly.

4. Trench Backfill Across Traffic Arteries.

Any trench in or across traffic arteries is to be backfilled immediately after the pipe is installed unless the Engineer determines unusual conditions exist that render immediate backfilling unfeasible.

5. Flowable Backfill.

Instead of normal backfill materials, the Contractor is to backfill the trench with flowable backfill with fly ash material at the locations shown on the plans and/or at locations directed. The flowable backfill material and operation is to be in accordance with Item 401, “Flowable Backfill”.

E. Flushing and Testing Mains.

1. Flushing.

Immediately upon completion of pipe lying, the Contractor is to flush all mains. This flushing is to be at the direction of the Engineer and is to consist of completely filling sections of main between valves and then displacing such initial volumes of water by introducing clear water from existing facilities into and through the main to the point of discharge from the main being flushed. The flow-through is to continue until the Engineer determines all dust, debris, or foreign matter that may have entered during pipe laying operations has been flushed out. The new line is to then be left under system pressure for testing.

To avoid damage to pavement and inconvenience to the public, fire hoses are to be used to direct flushing water from the main into suitable drainage channels or sewers.

2. Operation of Valves.

No valve in the distribution system is to be operated by the Contractor without prior permission. The Contractor is to notify the owner when a valve is to be operated and is to only operate the valve in the presence of the SAWS representative.

3. Hydrostatic Tests.

Except in high pressure sections of the water distribution system where test pressures will exceed 150 psi, all new mains are to be hydrostatically field tested at a maximum test pressure of 150 psi before acceptance by engineer/owner. Where designated as "high pressure area," all new mains shall be hydrostatically field tested at a maximum test pressure of 200 psi before acceptance by the Engineer/SAWSAll joints which are found to leak either by observation or during any test are to be made watertight by the Contractor. In case repairs are required, the hydrostatic field test is to be repeated until the pipe installation conforms to the specified requirements and is acceptable. The expense for tests which meet specified requirements is to be made in accordance with the unit price for the hydrostatic pressure test. No payment is to be made for tests which fail to meet specified test leakage requirements.

After the new main has been laid and backfilled as specified, but prior to chlorination and replacement of pavement, it is to be filled with water for a minimum of 24 hours and then subjected to a hydrostatic pressure test. The specified test pressure is to be supplied by means of a pump connected to the main in a satisfactory manner. The pump, pipe connection, and all necessary apparatus including gauges and meters are to be furnished by the Contractor. Unless otherwise specified, the Water System Company will furnish water for filling lines and making tests through existing mains.

Before applying the specified test pressure, all air is to be expelled from the main. To accomplish this, taps are to be made, if necessary, at the points of highest elevation and afterwards tightly plugged at no cost to the owner. At intervals during the test, the entire route of the new main is to be inspected to locate any leaks or breaks. If any are found, they are to be stopped or repaired. The test is to be repeated until satisfactory results are obtained.

The hydrostatic test is to be made so that the maximum pressure at the lowest point does not exceed the specified test pressure. The duration of each pressure test is to be a minimum of 4 hours for new mains in excess of 1,000-ft. and a minimum of 1 hour for new mains less than 1,000-ft after the main has been brought up to test pressure. The test pressure is to be measured by means of a tested and properly calibrated pressure gauge acceptable to Engineer. All pressure tests are to be continued until the Engineer is satisfied that the new main meets the requirements of these specifications. Should any test of pipe in place disclose leakage greater than listed in Table 3 or 4, Hydrostatic Test Leakage Allowances, the Contractor is to, at his expense, locate and repair the defective joints until the leakage is within the specified allowance. Leakage is defined as the quantity of water supplied into the newly laid main, or any valve section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled. The Contractor is to notify the Engineer prior to beginning the test, and the Water System Company's Inspector is to be present during the pressure test.

PVC pipe leakage allowances shall conform to DI leakage allowances listed on Table 6A, Hydrostatic Test Leakage Allowances.

Table 3
Hydrostatic Test Leakage Allowances (Maximum) @ 150 psi

Pipe	Hydrostatic Test Leakage Allowance (Maximum) @ 150 psi													
	100	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**2000**	**3000**	**4000**	**5000**
6”DI*	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10	2.20	3.30	4.40	5.50
8”DI*	0.15	0.29	0.44	0.59	0.74	0.88	1.03	1.18	1.32	1.47	2.94	4.41	5.88	7.35
12”DI*	0.22	0.44	0.66	0.88	1.10	1.32	1.54	1.76	1.98	2.20	4.40	6.60	8.80	11.00
16”DI*	0.29	0.59	0.88	1.18	1.47	1.76	2.06	2.35	2.65	2.94	5.88	8.82	11.76	14.70
20”DI*	0.39	0.74	1.10	1.47	1.84	2.21	2.55	2.94	3.31	3.68	7.63	11.04	14.72	18.40
20”CSC	0.08	0.16	0.24	0.32	0.40	0.47	0.55	0.63	0.71	0.79	1.58	2.37	3.16	3.95
24”DI*	0.44	0.88	1.32	1.76	2.21	2.65	3.09	3.53	3.97	4.41	8.82	13.23	17.64	22.05
24”CSC	0.10	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.95	1.90	2.85	3.80	4.75
30”DI*	0.55	1.10	1.66	2.21	2.76	3.31	3.86	4.42	4.97	5.52	11.04	16.56	22.08	27.05
30”CSC	0.12	0.24	0.35	0.47	0.59	0.71	0.83	0.94	1.06	1.18	2.36	3.54	4.72	5.90
36”DI*	0.66	1.32	1.99	2.65	3.31	3.97	4.63	5.30	5.96	6.62	13.24	19.86	26.48	33.10
36”CSC	0.14	0.28	0.43	0.57	0.71	0.85	0.99	1.14	1.28	1.42	2.84	4.26	5.68	7.10
42”DI*	0.77	1.54	2.32	3.09	3.86	4.63	5.40	6.18	6.95	7.72	15.44	22.16	30.88	38.60
42”CSC	0.17	0.33	0.50	0.66	0.83	1.00	1.16	1.33	1.49	1.66	3.32	4.98	6.64	8.30
48”DI*	0.88	1.77	2.65	3.53	4.42	5.30	6.18	7.06	7.95	8.83	17.66	26.16	35.32	44.15
48”CSC	0.19	0.38	0.57	0.76	0.95	1.13	1.32	1.51	1.70	1.89	3.78	4.98	6.64	8.30
54”CSC	0.21	0.42	0.63	0.84	1.05	1.26	1.47	1.68	1.89					
60”CSC	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92	2.16					

* DI Pipe includes mechanical and push-on joints.
** GPH for CSC Pipe are manufacturer's maximum.

Note: Leakage allowances may be determined for footages not specifically listed by interpolation and/or by the combination of various tabular data.

Table 4
Hydrostatic Test Leakage Allowances (Maximum) @ 200 psi

Nom Dia-Ty	Allowable Leakage in Gallons Per Hour (GPH) ** Pipe Length in Feet									
Pipe	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**
6”DI*	0.13	0.25	0.38	0.51	0.64	0.76	0.89	1.02	1.14	1.27
8”DI*	0.17	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70
12”DI*	0.26	0.51	0.77	1.02	1.28	1.53	1.79	2.04	2.3	2.55
16”DI*	0.34	0.68	1.02	1.36	1.7	2.04	2.38	2.72	3.06	3.40
20”DI*	0.43	0.85	1.28	1.70	2.13	2.55	2.98	3.40	3.83	4.25
20”CSC	0.08	0.16	0.24	0.32	0.4	0.47	0.55	0.63	0.71	0.79
24”DI*	0.51	1.02	1.53	2.04	2.55	3.06	3.57	4.08	3.59	5.10
24”CSC	0.10	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.95
30”DI*	0.64	1.27	1.91	2.55	3.19	3.82	4.46	5.10	5.73	6.37
30”CSC	0.12	0.24	0.35	0.47	0.59	0.71	0.83	0.94	1.06	1.18
36”DI*	0.76	1.53	2.29	3.06	3.82	4.58	5.35	6.11	6.88	7.64
36”CSC	0.14	0.28	0.43	0.57	0.71	0.85	0.99	1.14	1.28	1.42
42”DI*	0.89	1.78	2.68	3.57	4.46	5.35	6.24	7.14	8.03	8.92
42”CSC	0.17	0.33	0.5	0.66	0.83	1.00	1.16	1.33	1.49	1.66
48”DI*	1.02	2.04	3.06	4.08	5.1	6.11	7.13	8.15	9.17	10.19
48”CSC	0.19	0.38	0.7	0.76	0.95	1.13	1.32	1.51	1.7	1.89
54”CSC	0.21	0.42	0.63	0.84	1.05	1.26	1.47	1.68	1.89	2.10
60”CSC	0.23	0.46	0.69	0.92	1.15	1.38	1.61	1.84	2.07	2.30

* DI Pipe includes mechanical and push-on joints.
** GPH for CSC Pipe are manufacturer's maximum.

Note: Leakage allowances may be determined for footages not specifically listed by interpolation and/or by the combination of various tabular data.

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F. Disinfection of New Mains Utilizing Machine Chlorination.

After the new mains have successfully passed the pressure test specified in Section 3.E.3, "Hydrostatic Tests", the Water System Company will disinfect those mains shown on the plans or otherwise indicated as "Machine Chlorination". This disinfection is to include chlorination, flushing, and placing the mains in service. All other disinfection requirements shall be accomplished by the Contractor. Disinfection by the Contractor is limited to sections of pipe less than 800 feet in length between sections.

1. Operation of Valves.

During and after the disinfection of mains, the Contractor is to be notified by the Engineer sufficiently in advance to enable the Contractor to have a competent representative present whenever valves are to be operated that will affect the pressure in any part of the work for which the Contractor is responsible.

2. Contractor's Personnel and Equipment.

The Contractor is to supply labor and equipment necessary to make all excavations required for chlorination, equipment connections, subsequent flushing, and placing the mains in service.

3. Safeguarding and Backfilling Open Holes.

The Contractor is to be responsible for safeguarding any open holes excavated or left open for flushing and disinfection purposes. Following completion of disinfection, the Contractor is to backfill such holes in accordance with appropriate provisions of Subarticle 3.D, "Backfill".

4. Disinfection of Mains Utilizing Dry Calcium Hypochlorite.

Mains are to be disinfected with dry Calcium Hypochlorite (HTH) where shown on the plans or as directed and shall not exceed a total length of 800 feet. This method will also be followed for main repairs. Contractor shall utilize appropriate safety measures to protect personnel during disinfection operation.

5. Dosage.

The Contractor is to disinfect the new or replaced mains with Calcium Hypochlorite (HTH) of 70 percent available chlorine. Sufficient Calcium Hypochlorite (HTH) is to be used to obtain a minimum chlorine concentration of 50 ppm. The following Table 5, Chlorine Dosage, is included for the convenience of the Contractor:

Table 5
Chlorine Dosage

Diameter of Pipe Inches	Ounces Per Foot To Obtain 50 ppm Chlorine Dosage
6	0.0138
8	0.0233
10	0.0364
12	0.0523
14	0.0708
16	0.0934
18	0.1175
20	0.1455
24	0.2080
30	0.3270
36	0.4690
42	0.6370
48	0.8330
54	1.0575
60	1.308

A heaping tablespoon holds approximately 1/2 ounce, and a standard measuring cup holds approximately 8 ounces.

6. Filling the Main.

Those sections of main to which dry Calcium Hypochlorite (HTH) has been applied is to be filled slowly to allow for the even distribution of the disinfecting material. The manipulation of valves is to be under the supervision of the Engineer's representative in accordance with Section 3.F.1, “Operation of Valves”.

7. Holding Time.

The length of time that sections of main disinfected with Calcium Hypochlorite (HTH) is to be allowed to stand undisturbed will depend upon the particular job and Texas Commission on Environmental Quality (TCEQ) criteria.

When circumstances permit a shutdown with no customers out of service, the required minimum detention time will be 24 hours with a 50 ppm chlorine dosage.

When customers are out of service during a shutdown with no leakage past valves, the required minimum detention time will be 3 hours and the chlorine dosage will be 300 ppm.

When customers are out of service during a shutdown with some leakage past valves, the required minimum detention time will be 30 minutes with a 500 ppm chlorine dosage.

8. Flushing.

Following the expiration of the specified holding time, the treated section of main is to be flushed thoroughly by the Contractor in accordance with the applicable provisions of Subarticle 3.E, “Flushing and Testing Mains”. Flushing is to continue until no chlorine remains detectable by taste or odor or until

the chlorine residual is less than 0.3 ppm. The Contractor must make provisions for the disposal and runoff of the flushing operations in order to minimize erosion or impact to residenets.

9. Preventing Reverse Flow.

Valves are to be manipulated so that the strong chlorine solution in the line being treated will be flushed out of the main and will not flow back into the line supplying the water.

10. Supervision.

All disinfection is to be done under the general supervision of the Water System Company.

11. Additional Treatment.

Should the new main fail to meet minimum public health standards for bacteriological quality after flushing, further treatment is to be as directed. If further disinfection is required, chlorination is to be done in accordance with Subarticle 3.F, "Disinfection of New Mains Utilizing Machine Chlorination". In no case, however, is the new line to be acceptable as complete and satisfactory until the bacteriological quality of the water taken from the main meets the Standards of the TCEQ.

If an open hole is unsafe and does not have proper trench protection, owner's chlorination crew will not chlorinate project until acceptable trench protection is provided.

12. Safeguarding and Backfilling Open Holes.

The requirements for safeguarding and backfilling all holes excavated or left open for chlorinating and sampling is to be as specified in Section 3.F.3, "Safeguarding and Backfilling Open Holes".

G. Service Supply Lines.

Service supply lines and fittings, meter boxes and apperaturences shall conform to material specifications and shall be installed by the contractor as specidied herein, or as directed by the engineer and in accordance with plans.

1. Designation of Service Supply Lines: A service supply line located between the Water main and the inlet side of the water meter is designated as a "water service line". A service supply line located between the outlet side of the water meter to the point of connection within the limits of the Customers lot or property is designated as "Customer's yard piping". Services 2" and smaller are designated "small services"; services 4" and larger are designated "large services".

2. Service Relays: New transfer main(s) to which services are to be relayed and are on the same side of the streets as the Customer's meter are defined as "short relays". New transfer main(s) to which services are to be relayed and are on the opposite side of the street from the Customer's meter are defined as "long relays".

Service Reconnects: New transfer main(s) to which services are to be reconnected and on the same side of the street as the old main are defined as "service reconnects". Existing services on the opposite side of the street to the new main shall be defined as a "long relay".

3. Service Relocates: Service Relocates are defined as services that are relocated

from an alley to a side or front street. New transfer main(s) to which services are to be relocated and are on the same side of the street as the Customer's new meter box location, are designated as "short relocates". New transfer main(s) to which services are to be relocated and are on the opposite side of the street from the Customer's new meter box location, are designated as "long relocates".

4. New Services: If a new main is required to be extended to provide water service for new Customers, the service lines laid to the new main shall be designated as "new services." New laid main(s) to which new services are on the same side of the street as the Customer's new meter box location, are designated as "new short services." New laid main(s) to which new services on the opposite side of the street from the Customer's new meter box location, are designated as "new long services."

5. New Un-metered Services: New Un-metered services are defined as services that are installed on existing mains or new mains to provide service to Customers platted vacant lots. Where the new main or existing main to which new un-metered services are being installed is on the same side of the street as the Customer's new or existing meter box location, (Inspector to set location of new meter box if no existing meter box is set), the services to be laid are designated "new un-metered short services." Where the new main or the existing water main to which new un-metered services are installed is on the opposite side of the street from the Customer's new or existing meter box location, (Inspector to set location of new meter box if no existing meter box is set), the services to be laid are designated "new un-metered long service". New un-metered long services and new un-metered short services will not include "Customer's yard piping" and no meter will be set.

6. Tap Holes: Tap holes are defined as excavations at existing mains, which are required in association with replacements of water service lines bypulling, boring or jacking operations.

All backfill material shall be as specified for main and service line trench excavation.

For service lines and tap holes, payment for bedding, initial backfill and secondary backfill shall be included in the various sizes of each service placed.

7. Service Line Installation: Unless otherwise notified, service relays, service reconnects, service relocates and new services shall be installed as described herein, and in plans. Unless otherwise indicated, existing meter and meter box relocation shall be included in the service line installation.

All service line installation shall include a dielectric union to be installed within the meter box on the outlet side of the meter, as shown in plans.

Cutting, excavation, backfill and replacement of pavement shall be done as specified herein and in accordance with applicable sections of this specification and the contract documents. The minimum trench width for small service lines shall be 8 inches, while the minimum trench width for large service Lines shall be the nominal pipe diameter plus 16 inches, except when specified otherwise by the Engineer. For ¾" to 2" Service lines, minimum bury depth shall be 3 feet. For services greater than 2", minimum depth of bury shall be 4 feet.

All service lines shall be installed in accordance with plans, and specifications, except that two strap service saddle clamps shall be installed for all tap connections made on water mains located within boundaries of Pressure Zones (formally known as Service Levels) 9 through 16.

The Contractor shall use precaution to protect and preserve the polyethylene wrap around Ductile-Iron (DI) water mains when installing service corporations. The required method is, wrap pipe tape around the pipe, over the polywrap, in the area to be tapped. The tap shall be made through the tape and polywrap. It is not necessary to remove and replace polywrap. All exposed pipe, corporation and the first three feet of the service, shall be wrapped and taped to achieve a complete seal. In addition, a sand envelope shall extend over and around the connection to a depth of 8 inches above the main.

Small service lines shall be embedded in sand in accordance with specification

Where approved by the Construction Inspector, the Contractor may lay the new service line from the corporation stop to the curb stop or angle valve. Upon completion, the Contractor shall isolate the new service line by closing the curb stop or angle valve until the meter box is set.

8. Splicing: A long service line single splice may be permitted by means of a 3-part compression or flared coupling only when approved in advance by the Engineer, provided the location of the splice is not under pavement or concrete. The segment added is required to be the same material as the existing service line, unless otherwise directed by the Engineer. Splicing short service lines will not be permitted.

9. Boring or Jacking Service Lines: Service lines which cross paved streets may be installed at the Contractor's option by boring or jacking operations. Where it becomes necessary to widen the main trench section to accommodate a bore pit, such widening shall not extend more than one additional foot into the traffic side of the street.

10. Tapping Asbestos Cement (AC) Water Mains: All necessary service line tapping of AC pipe shall be completed during the period immediately before or after hydrostatic pressure testing operations so that subsequent flushing will maximize the elimination of contaminants associated with the tapping process.

Tapping of AC pipe must be done in accordance with manufacturers' recommendation and done only with tap machine having a built in flush valve and the flush valve must be open during the entire procedure.

11. Abandonment of Service Lines: The Contractor shall accomplish all cutting, capping, and plugging necessary to isolate new service lines transferred to new and existing mains from those abandoned, including service lines designated on the plans as "tap plug" and "tap kill." The corporation stop for an abandoned service line tapped on a ferrous main shall be removed, and the tap at the main shall be plugged with an appropriately sized brass plug. For a non-ferrous main, the corporation stop shall not be removed from the main. Instead, the corporation stop shall be closed and the flared nut shall be removed from the corporation stop. After the appropriately sized copper disc is inserted inside the flared nut, replace the flared nut on the corporation stop. The Contractor shall salvage copper service line tubing, brass fittings, and other materials as directed by the Construction Inspector and return them to the Owner.

12. Tapping PVC (C-900): Tapping of PVC must be done in accordance with Uni-Bell procedures. Direct Tapping will not be allowed. All drill cutting tools must be the "shell type" with internal teeth or

double slots which will retain the coupon. The shell cutters must be designed for C-900 pipe, thus having sufficient root depth to handle the heavier walled pipe.

13. Small Service Lines: Copper tubing shall be used for ¾" through 2" service lines. Brass fittings for ¾" and 1" service lines shall be of the flared or compression type for the use with Type 'K' soft annealed copper tubing. Brass fittings for 1½" and 2" lines shall be of the flared or compression type for use with type 'K' soft annealed copper tubing, except as modified by this specification.

Copper tubing shall be cut squarely by using an approved cutting tool an by avoiding excessive pressure on the cutting wheels which might bend or flatten the pipe walls. Following the copper tubing cut, but before flaring, a reamer shall be used to remove the inside rolled lip from the tubing. Flared ends shall be expanded by the use of a flaring tool using care to avoid splitting, crimping, or overstressing the metal. Pipe adjacent to the fittings shall be straight for at least 10 inches. Bending of tubing shall be accomplished by using an appropriate sized bending tool. No kinks, dents, flats, or crimps will be permitted, and should such occur, the damaged section shall be cut out and replaced. When compression fittings are used, the copper tubing shall be cut squarely prior to insertion into the fitting Final assembly shall be in accordance with the manufacturers recommendations.

14. Small Service Lines on New Mains: Installation of new copper service lines shall consist of all excavation through miscellaneous material encountered; trench excavation protection; drilling and tapping the new main with an approved tapping machine; setting the curb stop or angle valve at the meter; laying the new copper service line at the specified depth between the main and the meter and its tie-in at the corporation and the curb stop or the angle valve; relocating the existing meter and installing a new meter box where required in accordance with this specification, herein; backfilling the trench with approved selected material and disposal of surplus excavated material; capping the tap hole with asphalt treated base, including the outer limits of the main trench line with service line trench; cutting and replacing pavements, curbing and sidewalks of all types over the limits of the main line trench and the completed service line trench.

15. Reconnecting Service Lines: Both old and new water mains at existing service line connections as shown on the plans shall be exposed. The old main shall be exposed for the purpose of gaining access to the existing service corporation stop and the new main for the purpose of installing the new corporation stop. The new main shall be exposed for the purpose of being drilled and tapped with an approved tapping machine, a new corporation stop installed under pressure, and the trench extended laterally to expose a sufficient length of the existing service line to provide slack to bend it to position for tying to the new corporation stop. After suitable notification to the Customer, the Contractor shall "kill" the existing service by closing the corporation stop, removing the existing flare nut, inserting the existing flared nut on the corporation stop if the main is non-ferrous, or plugging the existing service line at the main if the main is ferrous. The Contractor shall then immediately open the stop and restore water service to the Customer. Where it is not possible to obtain sufficient length in the existing service to tie directly to the new main, at the direction of the Engineer, the Contractor shall splice the necessary length of new tubing and tie it to the existing service by means of a compression coupling at a point as close as practicable to the new main.

Cutting and bending of the tubing, introduction of slack to compensate for soil movement, and completion of the installation shall be as specified in this specification.

Where old and new mains are on opposite sides of the street, service lines may be installed under the street pavement by boring rather than trenching.

16. Relaying Service Lines: The existing or new mains shown on plans shall be exposed opposite location stakes placed on site at the direction of the Engineer. The existing or new main shall; be drilled and tapped with an approved tapping machine, a new corporation stop installed, and the trench extended laterally to the location specified for the meter box. The existing meter shall be reset and the meter box and base shall be installed at its staked location and perpendicular to the corporation stop in the water main. The meter box location shall not vary more than 24 inches in any direction from its staked location. The service line shall be installed with sufficient slack to compensate for soil movement. Where the location of the existing meter is not changed, the new service line shall be extended from the main to the existing meter, a new curb stop installed at the end of the service line, and connected to the inlet side of the meter. If disturbed, the existing meter box shall be reset to correct grade. Long service relays may be placed under the street pavement by boring or jacking rather than trenching.

17. Single Service Line - Dual Meters: The single service line - dual meter installation shall consist of a 1" copper service line reducing to two ¾" copper service lines at a tee which shall be set in line with the front edge of meter boxes for ⅝" and ¾" meters. A single service line with dual meters shall be installed in those new residential developments where new ⅝" and ¾" meters are required and in main replacement work where it is necessary to change the location of existing ⅝" and ¾" meters. Single service line - dual meter materials and installation requirements shall conform to requirements established herein.

18. Small Service Lines on Existing Mains: The work involved in the installation of new copper service lines on existing mains shall consist of jacking, boring, tunneling, and, where authorized, open trench operations all excavation through whatever material encountered; trench excavation protection; using the existing corporation when approved by the Construction Observer/Inspector; tapping the existing main and installing the new corporation and setting the curb stop or angle valve at the meter; relocating the existing meter and installing a new meter box where required in accordance with this specification; abandoning the existing corporation stop, removing the existing flared nut, inserting inside the existing flared nut an appropriately sized copper disc and replacing the existing flared nut on the corporation stop if the main is non-ferrous, or plugging the existing service line at the main if the main is ferrous; installing the new service line at the same grade as the existing service line or at the specified grade between the main and the existing meter and its tie-in at the corporation and the curb stop; disposal of surplus excavated material; capping the tap hole with asphalt treated base including the outer limits of the main line trench and the service line trench; cutting and replacing all surfaces of whatever type encountered over the completed service line trench; restoration of the site.

19. Large Service Lines: DI pipe and cast-iron fittings used for metered service lines and non-metered fire service lines larger than 2" shall be installed in accordance with the applicable provisions of this specification, except where otherwise approved by the Engineer.

20. Large Service Lines on New Mains: Work involved in the installation of a new metered service lines and non-metered fire service lines shall consist of all excavation through whatever material encountered; trench excavation protection, installing tees, pipe and fittings of various sizes including main line and service line valves, valve boxes, DI pipe, fittings, in accordance with plans and reaction

block required; backfilling with approved selected material; cutting and replacing pavements, curbing, and sidewalks of all types over the limits of the main line trench and the completed DI service line.

21. Large Service Lines on Existing Mains: The work involved in the installation of the new metered service lines and non-metered fire service lines shall consist of all excavation through whatever material encountered, trench excavation protection, cutting-in tees and installing tapping sleeves and valves, pipe and fittings of various sizes including main line and service valves; valves boxes, DI pipe, fittings and reaction block required; backfilling with approved selected material; cutting and replacing pavements, curbing, and sidewalks of all types over the limits of the main line trench and the completed DI service line.

22. Meter Boxes.

Physical movement of existing meters and meter boxes to new locations may be required where service lines are transferred to new mains in conjunction with main replacement work. Unless specified otherwise, the Contractor shall move existing meters and meter boxes and reconnect and adjust customer's yard piping as part of transferring service lines. A dielectric coupling PVC schedule 80 shall be installed within the meter box between the meter and the customer's yard piping.

Round and oval meter boxes with round covers shall be salvaged and returned to the Owner by the Contractor. The Contractor shall also replace the salvaged meter boxes with the new, appropriately styled oval plastic meter box with oval cover, or rectangular meter box. Unless otherwise specified, the old service line shall be abandoned after the existing meter has been reset in the existing or new meter box.

Where meter boxes are installed in sidewalks or driveways, the Contractor shall install a number one meter box (2 pieces) as shown in the Specification and plans.

New meters will be set by the Owner where mains are extended and new services lines are installed for new or initial customer service. In lieu of the new meter, the Contractor shall furnish and install a meter template in accordance with plans

Meter and meter box configuration, shall have the meter set horizontal, approximately 6 inches below the top of meter box, so that the meter is above the bottom of the meter box and inline with the meter box lid opening. The top of the meter box shall be flush with the existing ground surface. All excess soil above the meter coupling, meter flange and meter nuts inside the meter box shall be removed so that the meter register is clearly visible. The Contractor shall exercise special precautions during excavation at the existing meter location in order to minimize the disturbance of the customer's yard piping. However, if the existing meter elevation is low, the Contractor shall raise the existing meter to conform to the correct configuration indicated herein. Adjustment of meter to proper grade is incidental to the construction and will not be paid for separately.

Where required, pressure reducing valves shall be installed by the customer in accordance with the Uniform Plumbing Code and shall be placed beyond the outlet side of the meter, but not

within the Owner's meter box. The pressure reducing valve shall be the property of the water user who will be responsible for its installation, maintenance, and replacement as required.

The meter box adjustment shall not exceed 10 linear feet from the existing box.

23. Water Service for Fire Lines

Start of Work: Three working days notice will be given to the assigned
Inspector prior to start of a project after permit has been issued. The Contractor shall start his work at a tie-in or point designated by the Engineer. Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise authorized or directed by the Engineer. All valves and fire hydrants must be installed as soon as pipe laying reaches their established location. Pipe shall be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations. Spigots shall be centered in bells or collars, all valves and hydrant stems shall be set plumb, and fire hydrant nozzles shall face as shown on the plans or as directed by the Engineer. No valve or other control on the existing system shall be operated for any purpose by the Contractor unless a representative of the San Antonio Water System is present.

Crossing Other Underground Lines: New fire line services crossing any other utilities shall have a minimum of 48 inches of cover over the top of the pipe unless otherwise waived or modified by the Engineer. Excavation around other utilities shall be done by hand for at least 12 inches all around. Any damage to other utilities shall be reported to their proper governing entity.

Pipe Grade: Fire line services shall have a minimum of 48 inches of cover for mains 16" and below, and 60 inches for mains 20" and above, over the top of the pipe unless otherwise waived or modified by the Engineer. Pipe grades shall be as required by the plans or as directed by the Engineer. Grades shall be met as specified. Precautions shall be taken to insure that the pipe barrel has uniform contact with the Modified Grade 5 for its full length except at couplings. Couplings shall not be in contact with the original trench bottom prior to backfilling. Modified Grade 5 material shall be placed under the coupling and compacted by hand prior to backfilling so as to provide an even bearing surface under the coupling and pipe. Changes in grade shall be made only at joints.

Modified Grade 5 Materials: Prior to placing pipe in a trench, the trench shall have been excavated to the proper depth as required of these specifications. Approved imported materials or Engineer approved materials selected from suitable fines derived from the excavation shall be smoothly worked across the entire width of the trench bottom to provide a supporting cushion.

Structures to Support Pipe: Where as the bottom of a trench at subgrade consist of material that is notably unstable by the Engineer and cannot be removed and replaced with approved material may be properly compacted in place to support the pipe. The Contractor shall also construct a foundation for the pipe consisting of piling, concrete beams, or other supports in accordance with plans prepared by the Engineer.

Lowering Materials into Trench: Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient completion of work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece, by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to water service materials and protective coatings and linings. Under no circumstances shall water service materials, pipes, fittings, etc., be dropped or dumped into the trench. Extreme care shall be taken to

avoid damaging polywrap films. No chains or slings shall be allowed unless the entire sling is wrapped with a protective nylon web sock.

Laying of Pipe: Every precaution shall be taken to prevent foreign material from entering the pipe during its installation. Under adverse trench conditions or otherwise required by the Engineer, a heavy, tightly woven canvas bag of suitably sized shall be placed over each of the pipe.

The Canvas bag shall be left in place until a connection is made to the adjacent pipe. The interior of each pipe shall be inspected for defects, and the pipe shall be rejected if any defects are found.

After placing a length of pipe in the trench, the jointed end shall be centered on the pipe already in place, forced into place, brought to correct line and grade, and completed in accordance with the requirements of these Specifications. The pipe shall be secured in place with approved backfill material tamped around it. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be rejected and shall be replaced with pipe and fittings of proper dimensions. Precautions shall be taken to prevent dirt or other foreign matter from entering the joint space.

At times when pipe laying is halted, the open end of pipe in the trench shall be closed by a watertight plug or other means approved by the Engineer. Pipe in the trench which cannot temporarily be joined shall be capped or plugged at each end to make it watertight. This provision shall apply during all periods when pipe laying is not in progress. Should water enter the trench, the seal shall remain in place until the trench is pumped completely dry. The Contractor shall provide all plugs and caps of the various sizes required.

Deviations in Line or Grade: Wherever obstructions not shown on the plans are encountered during the progress of the work and interfere to an extent that an alteration in the plan is required, the Construction Inspector shall have the authority to change the plans and direct a deviation from the line and grade or to arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstructions. Any deviation from the line shall be accomplished by the use of appropriate bends unless such requirement is specifically waived by Construction Inspector.

Whenever it is necessary to deflect pipe from a straight line, the deflection shall be as directed by the Construction Inspector and as described herein. In no case shall the amounts exceed those shown in Table 1 "Maximum Deflections of Ductile-Iron Pipe" for ductile-iron pipe

Cutting Pipe: The cutting of pipe for inserting valves, fittings, or closure pieces shall be accomplished in a neat and workmanlike manner so as to produce a smooth end at right angles to the axis of the pipe. The recommendations of the pipe manufacturer shall be strictly followed by the Contractor. Only qualified and experienced workmen shall be used and, under no circumstances, shall a workman not equipped with proper safety goggles, helmet and all other required safety attire be permitted to engage in this work.

Asbestos-Cement (AC): No field cutting will be allowed on asbestos cement pipe. Installation of fire line services to AC pipe mains shall be accomplished by removing one full joint of AC pipe and replacing with appropriate PVC or Ductile Iron pipe and fittings. All cuts made on ductile-iron pipe shall be done with a power saw. The cuts shall be made at right angles to the pipe axis and shall be smooth. The edges of the cut shall be finished smoothly with a hand or machine tool to remove all rough edges. The outside edge of pipe should be finished with a small taper at an angle of about 30

degrees. Solid sleeves or cast couplings shall be allowed on precast/prefab vaults only. All other fire line services shall be installed with full joints of pipe.

Joint Assembly:

a. Rubber Ring Joints: The installation of pipe and the assembly of rubber ring joints for Ductile-Iron pipe shall conform to the pipe manufacturer's assembly instructions. The method of inserting spigot ends of pipe in bells or collars known as "stabbing" shall not be permitted. Spigot ends of pipe must be properly inserted in the joint by means of suitable pushing/pulling devices or a manufacture approved method.

b. Mechanical Couplings: Mechanical couplings shall be assembled and installed according to the standards recommended by the manufacturer.

Mechanical coupling consists of a cylindrical steel middle ring, two steel follower rings, two rubber compound gaskets, and a set of steel bolts. The middle ring is flared at each end to receive the wedge-shaped gasket which is compressed between the middlering flare and the outer surface of the pipe by pressure exerted on the follower rings through the bolt circle.

Prior to the installation of the mechanical coupling, the pipe ends shall be cleaned by wire brush or other acceptable method to provide a smooth bearing surface for the rubber compression gasket. The pipe shall be marked to align the end of the coupling which will center it over the joint. After positioning, the nuts shall be drawn up finger tight. Uniform pressure on the gaskets shall be applied by tightening alternate bolts on the opposite side of the circle in incremental amounts. Soap and final tensioning shall be accomplished with a torque wrench and in a matter similar to the tightening procedure after 15 minutes.

c. Restrained Joints: Restrained Joints shall be installed as shown on the plans or as directed by the Construction Inspector. Installation shall conform to the manufacture's recommendations.

H. Installation of the Nonmetallic Pipe Detection System.

The nonmetallic pipe detection system is to be installed concurrently with the proposed pipe placement. Tracer wire shall be utilized for location purposes and taped directly to the pipe. The tracer wire shall be solid core (14 gauge insulated), and shall be taper to the main in 10-inhc increments. Wire shall also come up to the top of valve extensions and fire hydrant stems, as directed by Water System Inspector.

I. High Pressure Zone

Work performed for construction of a high pressure water distribution system, including water mains, services, fire hydrants, and all related appurtenances, is to be done in accordance with this specification. This subsection applies solely to the construction of high pressure water systems and shall govern when in conflict with of subsections of this specification.

1. High Pressure Systems. Each water distribution system that furnishes water in Pressure Zone 9 through 16 shall be designated as a high pressure system. The static water pressure in each in each Service Level shall be not less than 35 psi nor exceed 175 psi with no fire hydrants in use.

2. Locations of High Pressure Levels. Geographically, boundaries of Pressure Zones 9 through 16 conform to the surface contour tabulation shown in Table 6, High Pressure Levels. Most of the area within Pressure Zones 9 through 16 is located north of Loop 1604 between IH-35 North and Bandera Road.

Table 6 – High Pressure Levels

Static Gradient Service Level	Max Ground Elevation (ft)	Ground Elevation (ft)	Ground Elevation 110 psi (ft)	Ground Elevation 150 psi (ft)	Ground Elevation 175 psi (ft)
9	1125	1000	870	780	720
10	1290	1160	1040	940	880
11	1400	1270	1150	1050	1000
12	1520	1390	1270	1170	1120
14	1630	1500	1380	1280	1230
15	1860	1730	1600	1510	1460
16	1990	1860	1740	1640	1590

4. Measurement.

This Item will be measured as follows: "Pipe Water Main (DI)", "Pipe Water Main (CSC)", "Pipe Water Main (PVC)", Pipe Water Main (RCP Casing)" and "Pipe Water Main (Steel Casing)" for water pipe of the various sizes shown on the plans, will be measured by the linear foot as follows: From the centerline intersection of runs and branches of tees to the end of the valve of a dead-end run.

Between the centerline intersections of runs and branches of tees, and where the branch is plugged for future connection, the measurement will include the entire laying length of the branch or branches of the fitting.

The measurement of each line of pipe of each size will be continuous and is to include the full laying lengths of all fittings and valves installed between the ends of such line except that the laying lengths of reducers will be divided equally between the connected pipe sizes. Lines leading to a tapping connection with an existing main will be measured to the center of the main tapped.

"Fire Lines" will be measured by the linear foot for each size and type from the centerline intersection of the fire line with the main distribution line to the property line. The measurement will include the entire laying length of the branch or branches of the fitting and valves. Line leading to a tapping connection with an existing main will be measured to the center of the main tapped.

"Jacking or Boring (Water Main)" will be measured by the linear foot of bore or tunnel as measured from face to face of jacking pits.

Carrier pipe used in bores and tunnels or backed into place will be measured by the linear foot of pipe installed from end to end of pipe to the limits shown on the plans

Casing or liners, where required for plans of the size and material required will be measured by the linear foot actually installed in accordance with plans.

"Butterfly Valve and Box (Complete)" will be measured as each assembly of the various sizes installed.

"Gate Valve and Box (Complete)" will be measured as each assembly of the various sizes installed to finished grade.

"Tapping Sleeve, Valve and Box (Complete)" will be measured as each assembly of the various sizes installed.

"Cut-in Tee (Complete)" will be measured as each assembly of the various sizes of cast-iron tees cut-in to the existing water main.

"Adjust Existing Valve Box" will be measured as each assembly adjusted to correspond to finish grade.

"Concrete encasement, cradles, saddles and collars for pipe" will be measured by the cubic yard as dimensioned on the plans, 6' in depth measured from the outside pire diameter (0.0) or as directed. Reinforcing if required will not be measured for payment.

"Standard Fire Hydrant with 6-in. Valve and Box" will be measured as each fire hydrant installed. Also included will be sufficient pipe, valve and fittings.

"Standard Fire Hydrant with Tapping Sleeve, 6-in. Valve and Box" will be measured as each fire hydrant including the various sizes of tapping sleeves, valves and boxes installed.

"Relocate Fire Hydrant" will be measured as each fire hydrant relocated.

"Permanent Blow-off (Complete)" will be measured as each assembly of the various sizes installed.

"Temporary Blow-off (Complete)" will be measured as each assembly of the various sizes installed.

"Automatic Air Release Valve (Complete)" will be measured as each assembly of the size installed.

"Trench Excavation Protection" will be measured by the linear foot along the centerline of trench where the depth of trench exceeds 5-ft.

"Trench is not greater than 15 feet wide, including manholes and other structures.

"Tie-In (Complete)" will be measured as each of the various sizes and types completed.

"New Short Service" will be measured as each of the various sizes and types of new service lines installed.

"New Long Service" will be measured as each of the various sizes and types of new service lines installed.

"New Unmetered Short Service" will be measured as each of the various sizes and types of new unmetered service lines installed.

"New Unmetered Long Service" will be measured as each of the various sizes and types of new unmetered service lines installed.

“Reconnect Short Service” will be measured as each of the various sizes of service lines reconnected.

“Reconnect Long Service” will be measured as each of the various sizes of service lines reconnected.

“Relay Short Service” will be measured as each of the various sizes of service lines re-laid.

“Relay Long Service” will be measured as each of the various sizes of service lines re-laid.

“Relocate Short Service” will be measured as each of the various sizes of service lines relocated.

“Relocate Long Service” will be measured as each of the various sizes of service lines relocated.

“Relocate Existing Meter and Existing Meter Box” will be measured as each assembly relocated and customer's service reconnected.

“Relocate Existing Meter and New Meter Box” will be measured as each assembly relocated and customer's service reconnected.

“Cut and Replace Concrete Sidewalk, Driveway, Etc.” will be measured by the square foot of surface area of the concrete sidewalk cut and replaced, but not to exceed the minimum trench width specified in Section 3.A.2, “Width of Trench” or as shown on plans.

“Cut and Replace Asphalt Pavement” will be measured by the square foot of surface area of the asphalt pavement cut and replaced, but not to exceed the minimum trench width specified in Section 3.A.2, “Width of Trench” or as shown on plans.

“Cut and Replace Asphaltic Pavement with 6-in. Asphalt Treated Base” will be measured by the square foot of surface area of the asphalt pavement cut and replaced with 6-in. of asphalt treated base, but not to exceed the minimum trench width specified in Section 3.A.2, “Width of Trench” or as shown on plans.

“Hydrostatic Pressure Test” will be measured as each successful test conducted.

“Excavation” will not be measured for payment, but is to be considered subsidiary to the pipe installation.

“Flowable Backfill”. Will be measured by the cubic yard in accordance with Item 401, “Flowable Backfill”.

“Installation of the Nonmetallic Pipe Detection System” will not be measured for payment, but is to be considered subsidiary to the pipe installation.

“Removing and Replacing Chain-Link and/or Wire Fence” will be measured by the foot of fence removed and replaced, regardless of the type or height of the fence, complete in place. The existing fence materials may be reused unless, the existing materials were damaged during removal and should not be reused, the Contractor is to provide new material for the replacement work at his expense.

“Ductile-Iron and Grey-Iron Fittings” will be measured by the weight to the nearest one-hundredth of a ton of the various sizes of fittings installed.

5. Payment.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit prices bid for the items of work hereinafter described. These prices are to be full compensation for furnishing and hauling all materials; for placing or installing the materials; for inspection and testing; and for all other items of material, labor, equipment, tools and incidentals necessary to complete the work in accordance with the plans and specifications.

Payment for "Pipe Water Main (AC)", "Pipe Water Main (DI)", "Pipe Water Main (CSC)", "Pipe Water Main (PVC)", "Pipe Water Main (RCP Casing)" and "Pipe Water Main (Steel Casing)" will be made at the unit price bid per foot of pipe of the various sizes installed by the open cut method. This payment is also to include selected bedding, excavation, backfill materials, polyethylene sleeve, and hauling and disposition of surplus excavated materials.

Removed AC pipe will be manifested and disposed in accordance with standards that may be obtained through the SAWS homepage at http://www.saws.org. Payment for disposal of AC pipe will be made at the unit price bid.

Payment for "Fire Lines" installed will be made at the unit price bid for pipe of various sizes installed. Suchpayment shall include excavation selected embedment material, backfill, compaction of trench backfill, testing of compaction, tie-in, polyethylene sleeve where required, hauling, disposing of surplus excavated material, and restoration of surface. All replacement mains shall include tie-in costs for existing fire lines.

Removed AC pipe will be manifested and disposed in accordances with standards that may be obtained through the SAWS homepage at http://www.saws.org. Payment for disposal of AC pipe will be made at the unit price bid.

Payment for "Jacking or Boring (Water Main)", Jacking, Boring or Tunneling will be paid for at the contract unit price bid per linear foot of jacking, boring or tunneling, which price shall be full compensation for furnishing all materials (except carrier pipe, casings or liners), labor, tools, equipment and incidentals necessary to complete the work, including excavation, grouting, backfilling, restoration to original ground conditions, and disposal of surplus materials.

Carrier pipe shall be paid for at the contract unit price bid for "Carrier Pipe for Jacking, Boring or Tunneling" per linear foot of pipe installed and measured as prescribed above.

Casings or liners shall be paid for at the contract unit price bid for "Casing or Liner" per linear foot of casing or liner installed and measured as prescribed above.

Payment for "Butterfly Valve and Box (Complete)", "Gate Valve and Box (Complete)" and "Tapping Sleeve, Valve and Box (Complete)" will be made at the unit price bid for each such assembly of the various sizes installed. This payment is also to include selected embedment material, anti-corrosion embedment when specified, concrete collar at the valve box where subjected to vehicular traffic, ductile iron riser pipe, cast-iron boot, packing, tarpaper, concrete grout, concrete reaction blocking, asphaltic material for bolts, nuts and ferrous surfaces, polyethylene sleeve, hauling and disposition of excavated surplus material and backfill where required. For butterfly valves only, such payment is also to include mechanical or transition couplings, and coated and wrapped steel pipe nipples required to complete the connection.

Payment for “Cut-in Valve (Complete)” will be made at the unit price bid for each such assembly of the various sizes installed. This payment is to include backfill, installation of valve, valve box assembly, all pipe cut and used to complete cut-in, reaction blocking, and polyethylene sleeve where required.

Payment for “Cut-in Tee (Complete)” will be made at the unit price bid for each of the various sizes of cast iron tees cut-in to ductile and cast iron mains. This payment is also to include necessary tie-ins, protective coating for bolts, nuts, ferrous surfaces, selected embedment material, anti-corrosion embedment when specified, backfill, pipe, fittings, polyethylene sleeve when required, concrete reaction blocking, and site restoration.

Payment for “Adjust Existing Valve Box” will be made at the unit price bid for each valve box adjusted to finish grade.

Payment will be made at the unit price bid for “Concrete Encasement, Concrete Cradles, Concrete Saddles and Concrete Collars” by the cubic yard of concrete placed. Reinforcing, if required, shall not be measured for payment.

Payment for “Fire Hydrant with 6-in Valve and Box”, “Fire Hydrant with Tapping Sleeve, 6-in. Valve and Box” and “Relocate Fire Hydrant” will be made at the unit prices bid for each such assemblies installed. These payments are to include backfill, selected material, anti-corrosion embedment when specified, branch line pipe, fittings exclusive of the tee from the main line pipe, polyethylene sleeve, hauling and disposition of excavated surplus material where required, asphaltic material for ferrous surfaces, concrete reaction blocking, concrete pad restoration of existing fire hydrant sites and installing a new fire hydrant as directed.

Payment for “Permanent Blow-off (Complete)” and “Temporary Blow-off (Complete)” will be made at the unit price bid for each such assembly installed in accordance with the details shown on the plans. Payment for the eccentric reducer will be made at the unit price bid for each ton of fittings of all types and sizes installed. Payment for the pipe nipple with reaction stop ring will be made at the unit price bid for each linear foot of pipe of the various sizes installed by the open cut method. These payments are also to include excavation, anti-corrosion when specified, the housing and disposition surplus excavated materials and approved selected backfill.

Payment for “Automatic Air Release Valve (Complete)” will be made at the unit price bid for each assembly of the various sizes installed in accordance with the details shown on the plans. This payment is also to include selected embedment material, anti-corrosion embedment when specified, excavation and hauling and disposition of surplus excavated materials, blocking and various sizes and types of meter boxes.

Payment for “Cast-Iron Fittings” and “Ductile-Iron Fittings” will be made at the unit price bid for each ton of fittings of all sizes and types installed and will be based upon the weights of fittings shown in Table 7, “Weights of Ductile-Iron and Gray Cast-Iron Fittings”. Such payment shall also include excavation, selected embedment material, anti-corrosion embedment when specified, hauling and disposition of surplus excavated materials, polyethylene sleeve, asphaltic material for ferrous surfaces, all glands, nuts, bolts, gaskets and concrete reaction and thrust blocking. If compact fittings are not manufactured and other fittings are installed, Contractor will provide quantities and unit weights with pay request.

Weigh tables are estimated quantities and can be verified by vender information. Payments will be made by the lesser of the two (weights versus supplier) at the inspectors discretion.

Payment for “Trench Excavation Protection” is to be made on the basis of the unit price bid for each linear foot of “Trench Excavation Protection” in place. Payment is to include all components of the trench protection system which can include, but not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage. Payment is also to include the

additional excavation and backfill required, any jacking, jack removal and removal of the trench support after completion and be full compensation for all other labor, materials, tools, equipment and incidentals necessary to complete the work.

Payment for “Tie-In (Complete)” will be made at the unit price bid for each tie-in of the various sizes and types completed. This payment is to include shutdown and isolation of the existing main to which the tie is to be made, cutting pipe for connection, de-watering the excavation, and customer notification of service interruption where required. Connections between new and existing mains which are made with tapping sleeves and valves by cutting-in tees will be as a no-separate pay item.

Payment for “New Short Service” and “New Long Service” will be made at the unit price bid for each new service line of the various sizes and types installed. This payment is to include reconnection of new service to the existing meter and the adjustment of the meter, meter box, and Customer valve. Such payment shall also include excavation, trench excavation protection, hauling and disposition of surplus excavated materials, sand backfill, cutting pavement and surface structures of whatever type fittings of the various sizes used in the service line relay and copper tubing or ductile iron pipe (4-in. and larger).

Payment for “New Un-metered Short Service” and “New Un-metered Long Service” will be made at the unit price bid for each new un-metered service line of the various sizes and types installed. This payment is to include excavated materials, trench excavation protection, sand backfill, cutting in pavement and surface structures of whatever type encountered and replacement with whatever type specified, a new meter box where required, copper tubing or ductile iron pipe (4-in. and larger), valve and valve box assembly, and fittings of the various sizes used in the installation of new service lines.

Payment for “Reconnect Short Service” and “Reconnect Long Service” will be made at the unit price bid for each service line of the various sizes and types reconnected. This payment is to include excavation, trench excavation protection, hauling and disposition of surplus excavated materials, sand backfill, meter box relocation where required, cutting pavement and surface structures of whatever type encountered and replacement with whatever type specified, copper tubing or ductile iron pipe (4-in. and larger), valve and valve box assembly, and fittings of the various sizes used in the service line reconnection.

Payment for “Relay Short Service” and “Relay Long Service” will be made at the unit price bid for each service line of the various sizes and types relaid. This payment is to include reconnection of new service to existing meter, sand backfill, meter box relocation where required, copper tubing or ductile iron pipe (4-in. and larger), valve and valve box assembly, and fittings of the various sizes used in the service line relay.

Payment for “Relocate Short Service” and “Relocate Long Service” will be made at the unit price bid for each service line of the various sizes relocated. This payment is to include sand backfill, meter box relocation where required, copper tubing or ductile iron pipe (4-in. and larger) when required, valve and valve box assembly when required, and fittings of the various sizes used in the service line relocation.

Payment for “Relocate Existing Meter and Existing Meter Box” will be made at the unit price bid for each assembly relocated. This payment is also to include excavation protection, hauling and disposition of surplus excavated materials, sand backfill, removal and replacement of yard piping with piping of the various sizes and types and in the quantities necessary to complete the connection between the relocated existing meter and existing meter box, and the existing yard piping.

Payment for “Relocate Existing Meter and New Meter Box” will be made at the unit price bid for each assembly relocated. This payment is also to include sand backfill, removal and replacement of yard piping with piping of

the various sizes and types and in the quantities necessary to complete the connection between the relocated existing meter and new meter box, and the existing yard piping.

Payment for the number one meter box installation in sidewalks and driveways shall be paid in the amount difference between the standard meter box and the number on meter box.

Payment for “Cut and Replace Concrete Sidewalk, Driveway, Etc.” will be made at the unit price bid

Payment for “Cut and Replace Asphaltic Pavement” will be made at the unit price bid Payment for “Cut and Replace Asphaltic Pavement with 6-in. of Asphalt Treated Base” will be made at the unit price bid

Payment for “Hydrostatic Test” will be made at the unit price bid for each successful test. Such payment includes all materials and equipment required to conduct test.

Payment for “Flowable Backfill” will be made at the unit price bid for each cubic yard of flowable backfill placed, but not to exceed the minimum trench width specified in Section 3.A.2. “Width of Trench”.

No direct payment will be made for concrete blocking of water mains; coating and wrapping pipe joints; trench excavation below specified limits; excavation and removal of unsuitable material at bottom of trench grade and restoration with approved material; supporting pipe or conduits of public utilities; abandonment of water mains and valves; resetting existing meters and meter boxes in proper configuration; salvaging fire hydrants, valve boxes and meter boxes; flushing water mains; and disinfection of water mains. This work is to be considered subsidiary to the various bid items.

No direct payment will be made for furnishing and installing the nonmetallic pipe detection system. This work and materials are to be considered subsidiary to the various pay items. In addition, the Contractor is to ensure that the detection system is complete and operational to the satisfaction of the Engineer.

No direct payment will be made for furnishing and installing the pipe joint restraint system. This work and materials shall be considered subsidiary to the various bid items.

No direct payment will be made for furnishing and installing the Joint Restraint System for PVC C-905. This work and materials shall be considered subsidiary to the various pay items.

TABLE 7							
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)							
BENDS							
Size (Inches)	**MJ Compact (C153)**	**MJ (C110)**	**FLG SB**	**Size (Inches)**	**MJ Compact (C153)**	**MJ (C110)**	**FLG SB**
1/4 Bend (90 Degrees)				1/8 Bend (45 degrees)			
4	25	55	44	4	21	51	36
6	43	86	67	6	35	75	57
8	61	125	115	8	50	110	105
12	119	258	236	12	96	216	196
16	264	454	478	16	200	345	315
20	447	716	878	20	337	555	485
24	602	1105	1085	24	441	777	730
30	979	1740	1755	30	775	1393	1355
36	1501	2507	2135	36	1140	2163	1755
42	2277	3410	3055	42	1652	2955	2600
48	3016	4595	4095	48	2157	4080	3580
BENDS							
Size (Inches)	**MJ Compact (C153)**	**MJ (C110)**	**FLG SB**	**Size (Inches)**	**MJ Compact (C153)**	**MJ (C110)**	**FLG SB**
1/16 Bend (22-1/2 Degrees)				1/32 Bend (11-1/4 degrees)			
4	18	50	35	4	17	50	40
6	32	75	64	6	30	73	56
8	46	110	90	8	42	109	90
12	85	220	194	12	74	220	193
16	175	354	315	16	153	354	315
20	314	550	505	20	265	553	505
24	414	809	528	24	339	815	760
30	668	1500	1385	30	603	1410	1395
36	963	2182	1790	36	830	2195	1805
42	1354	3020	2665	42	1210	3035	2680
48	1790	4170	3665	48	1523	4190	3695

TABLE 7 CONTINUATION

WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)

TEES

Size (Inches)		Weight		
Run	**Branch**	**MJ** Compact (C153)	**MJ** (C110)	**FLG** Short Body
3	3	26	56	53
4	3	31	76	54
	4	33	80	60
6	4	49	114	90
	6	60	124	98
8	4	65	163	155
	6	76	175	148
	8	89	188	179
12	4	99	316	322
	6	115	325	297
	8	127	339	346
	12	162	407	369
16	6	226	563	573
	8	240	565	555
	12	283	615	590
	16	326	676	635
20	6	344	750	773
	8	371	766	720
	12	427	799	816
	16	503	975	950
	20	566	1068	1005

TABLE 7 CONTINUATION

WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)

TEES

Size (Inches)		Weight		
Run	**Branch**	**MJ** Compact (C153)	**MJ** (C110)	**FLG** Short Body
24	6	466	1035	1089
	8	487	1047	1060
	12	539	1075	1125
	16	625	1109	1070
	20	729	1504	1510
	24	785	1617	1685
30	8	739	1808	-
	12	800	1842	1801
	16	959	1885	-
	20	1026	1941	-
	24	1228	2496	2475
	30	1373	2531	2615
36	24	1548	2710	2255
	30	1901	3545	3000
	36	2012	3686	3160
42	24	2272	3690	3245
	30	2512	4650	4125
	36	3048	5119	5360
	42	3225	6320	5580
48	24	2934	4995	4385
	30	3147	5140	4455
	36	4046	6280	5555
	42	4249	8130	7195
	48	4469	8420	7385

TABLE 7 CONTINUATION

WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)

CROSSES

Size (Inches)		Weight		
Run	**Branch**	**MJ Compact (C153)**	**MJ (C110)**	**FLG Short Body**
3	3	34	70	-
4	3	42	90	-
	4	46	105	-
6	4	63	140	-
	6	74	160	160
8	4	88	185	185
	6	97	205	205
	8	105	239	234
12	4	114	340	-
	6	135	360	360
	8	151	382	385
	12	199	493	495
16	6	250	590	575
	8	270	619	605
	12	332	685	-
	16	409	811	790
20	6	358	760	-
	8	379	822	790
	12	413	883	860
	16	550	1117	1085
	20	598	1274	1230

TABLE 7 CONTINUATION

WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)

CROSSES

Size (Inches)		Weight		
Run	**Branch**	**MJ Compact (C153)**	**MJ (C110)**	**FLG Short Body**
24	6	566	1025	-
	8	578	1085	1045
	12	610	1153	1110
	16	663	1256	1200
	20	975	1733	1675
	24	907	1906	1835
30	8	650	1795	-
	12	870	1925	1865
	16	900	1950	-
	20	1220	2060	-
	24	1497	2776	2675
	30	1808	3188	3075
36	24	1853	2928	2980
	30	2580	3965	-
	36	2698	4370	4370
42	24	2415	3910	-
	30	2920	5040	-
	36	3788	5835	-
	42	3908	6493	7145
48	24	3435	5210	-
	30	4145	5495	-
	36	4873	6790	-
	42	5465	8815	-
	48	5588	9380	-

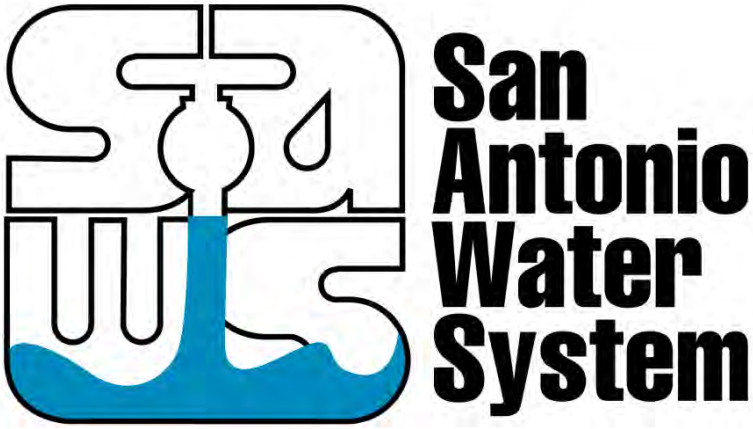
TABLE 7 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
	CAPS		**PLUGS**	
Size (Inches)	**MJ Compact (C153)**	**MJ (C110)**	**MJ Compact (C153)**	**MJ (C110)**
4	10	17	12	16
6	16	29	19	28
8	24	45	30	46
12	45	82	54	85
16	95	160	97	146
20	141	235	146	218
24	193	346	197	350
30	362	644	381	626
36	627	912	688	884
42	893	1322	1200	1222
48	1076	1737	1550	1597

TABLE 7 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
SOLID SLEEVES				
Size (Inches)	**Weight**			
	MJ Short Compact (C153)	**MJ Long Compact (C153)**	**MJ Short (C110)**	**MJ Long (C110)**
4	17	21	35	46
6	28	35	45	65
8	38	48	65	86
12	57	77	113	143
16	127	172	192	257
20	201	258	258	359
24	264	337	340	474
30	500	651	690	1005
36	725	960	947	1374
42	877	1209	1187	1628
48	1406	1516	1472	2033

TABLE 7 CONTINUATION			
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)			
CONCENTRIC REDUCERS			
Size (Inches)			Weight
Large End	Small End	MJ Compact (C153)	MJ (C110)
6	4	27	59
8	4	38	81
8	6	41	95
12	4	70	136
12	6	69	150
12	8	70	167
16	6	134	234
16	8	136	258
16	12	126	310
20	12	213	427
20	16	221	492
24	12	304	562
24	16	315	633
24	20	315	727
30	16	596	1027
30	20	599	1085
30	24	492	1204
36	20	1042	1459
36	24	785	1580
36	30	655	1868
42	24	1356	2060
42	30	1112	2370
42	36	1116	2695
48	30	1722	3005
48	36	1650	3370
48	42	1429	3750

TABLE 7 CONTINUATION		
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)		
2" Tapped Tees and Crosses		
Size (Inches)	Weight	
	MJ Compact (C153)	MJ (C110)
4	24	47
6	36	71
8	54	97
10	69	130
12	87	169
20	-	259
24	-	320

TABLE 7 CONTINUATION		
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)		
OFFSETS		
Size (Inches)	Weight	
	MJ Compact (C153)	MJ (C110)
4 x 6	35	75
4 x 12	55	83
6 x 6	35	110
6 x 12	67	138
6 x 24	96	189
8 x 6	82	164
8 x 12	98	209
8 x 24	141	280
12 x 6	121	320
12 x 12	178	420
12 x 24	240	645
20 x 12	-	1025
20 x 24	-	1245



Special Specifications
For
TxDot / LAM Projects
Sanitary Sewer

May
2009

SPECIAL SPECIFICATION

Sanitary Sewer

Table of Contents

SPECIAL SPECIFICATION

Sanitary Sewers

1. Description.

A. Scope of Work. Provide and install complete sanitary sewer construction and adjustments in conformity with the details shown on the plans, as described herein, in compliance with the Department's Utility Accommodation Policy (UAP)(Title 43, T.A.C., Sections 21.31-21.55) or as directed.

a. Reference specifications of the American Society for Testing and Materials (ASTM), American Water Works Association (AWWA) and American National Standards Institute (ANSI) will mean the latest standard in effect on the date of the proposal.

B. Other Utilities. The data furnished on the plans regarding the size and location of all other utility lines has been obtained from field surveys, the City and the various utility companies. The State does not assume responsibility for the accuracy of the information presented nor does it warrant that all of the utility lines have been shown.

C. Definitions.

a. Sanitary Sewer Main. Sanitary Sewer Main is defined as that portion of the sanitary sewer system which collects the effluent from the service laterals, including stub outs from the nearest manhole, to the point of final destination.

b. Service Lateral. Service Lateral is defined as that portion of the sanitary sewer system beginning at a customer property line or other establishment property line which is the point of origin of the effluent being carried by the system to the sanitary sewer main, including the connection into the sanitary sewer main system.

c. Point Repair. Point Repair is defines as the repair of a small length of pipe section of an existing sewer line which has deteriorated due to settlement or corrosion, or is falling, missing, crushed or broken, or has offset joints. Repairs are to be completed before the installation of a cured-in-place pipe between two adjacent manholes.

d. Rehabilitation. Rehabilitation is defined as the rehabilitation of existing sanitary sewer outfall mains by the Cured-In-Place-Pipe (CIPP) method or by sliplining with Centrifugally Cast Fiberglass Pipe (ASTM D-3262) or by sliplining with hollow Core I-Beam construction Closed Profile PVC Pipe (ASTM D-F794).

e. Rehabilitation of Lines. Rehabilitation of Lines is defined as the rehabilitation of existing sewer mains by the Cured-In-Place-Pipe (CIPP) method. This method consists of inverting a resin-impregnated flexible sewn felt tube into the original conduit by use of hydrostatic head. The resin is cured by circulating hot water within the tube. The Cured-In-Place-Pipe (CIPP) will be continuous and tight

fitting. The work shall be completed with TxDot schedule. Contractors may, when appropriate, elect to use any material that is considered to be equal (i.e. A product that has structural physical properties that are equal or greater than those of the specified products), however, submittal to the design Engineer is required no later than 10 days prior to bid opening.

f. Repair. Repair is defined as the repair of a small length of pipe section of an existing sewer line which has deteriorated due to settlement or corrosion, or is falling, missing, crushed or broken, or has offset joints, Repairs shall be completed before the rehabilitation of pipe between two adjacent manholes.

g. Television Inspection. Television Inspection is defined as furnishing all labor, materials, equipment, tools, logging and incidentals necessary to provide the televising and videotaping of sewer lines utilizing a color closed circuit television inspection unit to determine the condition of the lines.

All new sewer mains will not carry flow until the Engineer and Inspector approve and accept the mains for service.

h. Cleaning Manholes and Mains. Cleaning Manholes and Mains is defines as furnishing all labor, materials, equipment, tools, appliances and incidentals necessary to perform all operations for the cleaning of existing sanitary sewer manholes and mains to facilitate the TV inspection and rehabilitation of the sanitary sewer mains.

The designated sanitary sewer manhole sections and the manholes themselves shall be cleaned using mechanical, hydraulically propelled or high velocity sewer cleaning equipment. The equipment and methods selected by the Contractor shall be approved.

In addition to requirements herein, the Contractor shall maintain the cleanliness of the work and surrounding premises within the work limits so as to comply with federal, state and local anti-pollution laws, ordinances, codes and regulations when cleaning and disposing of waste materials, debris and rubbish.

i. By-Pass Pumping. By-Pass Pumping is defined as furnishing all labor, materials, equipment, tools, appliances and incidentals necessary to perform all operations in connection with by-pass pumping of sewage flow for the purpose of preventing interference with the rehabilitation of the sanitary sewer manholes and mains as well as providing reliable sewer service to the building being served.

The Contractor will be required to provide adequate pumping equipment and force mains in order to maintain reliable sanitary sewer service in all sanitary sewer lines involved. In case of equipment failure, the Contractor shall have on the job site backup pumps and force mains. Under no circumstances shall the flow be interrupted or stopped such that damage is done to either private or public property; or sewage flows or overflows into a storm sewer or natural waterway.

The Contractor shall provide by-pass pumping of sewage around each segment of pipe that is to be televised, replaced or lined and shall be responsible for all required

bulkheads, pumps, equipments, piping, and other related appurtenances to accomplish the sequence of pumping. A qualified person shall man the pumps, on-site, at all times during the by-pass procedure.

All piping, joints and accessories shall be designed to withstand the maximum by-pass system pressure, or a minimum of 50 psi, whichever is greater. During by-pass pumping, no sewage shall be leaked, dumped, or spilled in or onto any area outside of the existing sanitary sewer system. When by-pass pumping operations are complete, all piping shall be drained into the sanitary sewer prior to disassembly.

j. Manhole Rehabilitation. Manhole Rehabilitation is defined as all work, materials, and equipment required for substrate rehabilitation for the purpose of eliminating infiltration, providing corrosion protection, repair of voids, and restoration of the structural integrity of the manhole by applying a monolithic fiber-reinforced structural and structurally enhanced cementious liner to the wall and bench surfaces of brick, concrete, or any other masonry construction material. This Item shall govern for rehabilitation of manholes complete and in place and the materials used therein; including cleaning, interior surface restoration, priming the prepared surface and coating. It shall also include all required by-pass pumping necessary to complete the work.

k. Pipe Bursting or Crushing Replacement Process. The pipe bursting or crushing process is defined as the reconstruction of existing sanitary sewers by the simultaneous insertion (breaking and expanding the old pipe) of liner pipe within the bore of the existing pipe. The pipe bursting or crushing process involves the rehabilitation of deteriorated gravity sewer pipe by installing new pipe material within the enlarged bore created by the use of using s static, hydraulic, or pneumatic hammer “moling” device, suitably sized to break the existing pipe or by using a modified boring “knife” with a flared plug that crushes the existing sewer pipe. Forward progress of the “mole” or the “knife” may be aided by hydraulic equipment or other apparatus. Replacement pipe is either pulled or pushed into the bore. Sewer services are reconnected to the new pipe through small excavations from the surface. Sewage flows from the upstream line and from the services are pumped as required to prevent overflows and provide continual service. All excavations required for reconnecting and pumping service flows, entry pits, exit pits, obstruction removal, point repairs, among others, are to be kept to a minimum and all damage to surface and underground features, facilities, utilities and improvements are to be repaired.

l. Sliplining. Sliplining is accomplished by pulling or pushing liner pipe into existing sewers by use of mechanical or hydraulic equipment. Once in place, liner pipe is allowed time to normalize and is then cut to fit between the manholes. Manhole inverts and benches are re-worked and re-shaped. Existing sewers remain in operation during sliplining process, with sewage flow diverted around operations in progress.

2. Materials. All materials furnished for this project will be new. A manufacturer's certificate of compliance will be acceptable for quality control.

A. Sanitary Sewer Pipe. Materials for sanitary sewer pipe may be either rigid or flexible uness a specific type pipe is called for on the plans. Install materials as specified by the maufacturer.

1. Rigid Pipe. Reinforced concrete, ductile-iron pipe, cast iron pipe, and concrete steel cylinder pipe, for the purpose of this Item, will be known as rigid pipe.

2. Flexible Pipe. Pipe consisting of materials other than those listed above.

a. Any flexible conduit having a deflection of the inside diameter greater than 5 percent after installation will not be accepted. A Go, No-Go deflection Testing Mandrel will be furnished, built and used in testing pipe deflection for acceptance, in accordance with the detail drawing as shown on the plans, unless directed otherwise. The working room for flexible pipe shall be a minimum of 6 inches. Pipe stiffness is to be in accordance with ASTM 3034 SDR 26 [115 psi]

b. When the trench width is greater than the outside diameter of the pipe plus 2- ft. the pipe will be covered with Class B concrete, in accordance with Item 421, or as shown on the plans.

3. Concrete Pipe.

a. Concrete pipe and fittings less than 18-in. in diameter will conform to ASTM Designation C-14.

b. Concrete pipe and fittings, 18-in. diameter and larger will conform to ASTM Designation C-76, Class III or C-655.

c. When the depth of cover over the top of the pipe is over 14-Ft., concrete pipe less than 18-In. in diameter will be extra strength and conform to ASTM Designation C-14, Class III.

d. When the depth of cover over the top of the pipe is over 14-Ft., concrete pipe 18-in. and larger in diameter will conform to ASTM Designation C-76, Class IV or C-655 as a minimum.

e. All joints and joint material for concrete pipe and fittings will conform to ASTM Designation C-443.

4. Asbestos-Cement (AC) Pipe shall not be used. Refer to SAWS website for AC pipe and material handling.

5. Fiberglass reinforce Sewer Pipe, Non-Pressure Type: Fiberglass reinforced sewer pipe, non-pressure type, shall be a factory-formed conduit of polyester resin, continuous roving glass fibers and silica sand built up in laminates and shall

conform to the requirements of ASTM D3262 including the appendix and subsequent specifications, and accordance to SAWS material specifications

Coupling Joints: Joints for pipe and fittings shall be confined compression rubber gasket bell and spigot type joints conforming to the material and performance requirements of ASTM D-4161.

Fittings: Flanges, elbows, reducers, tees, wyes, laterals, and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber reinforced overlays. For pipes 15" or larger in diameter, lateral openings 6 inch or greater in size shall be made using PVC sewer saddles conforming to ASTM D-2661 or insert a Tee connections conforming to ASTM D-3034 or approved equal minimum pipe stiffness shall not be less than 150 psi for direct bury applications.

6. **PMS PVC Pipe**. Poly Vinyl Chloride (PVC) pipe will be made from class 12454-B materials as prescribed in ASTM D-1784. For pipes 4" to 15" in diameter PMS pipe, fittings and joints shall conform to ASTM D-034 and D-3213, with the exception that solvent cement joints shall not be used. All pipe that are 18" to 27" in diameter shall meet requirements of ASTM F-679.

   a. **Force Mains**. PVC force mains, fittings and joints will to meet or exceed the requirements of ASTM Designation D- 2241 with the exception that use of Solvent Cement Joints is not allowed. Pipe shall be made from Class 1254-A or 1254-B, as defined in ASTM D-1784. The pressure rating, size, and pressure class shall be as shown on the plans. Pipe shall have an integral bell and gasket seal with the locked-in type gasket reinforced with a steel band or other rigid material conforming to ASTM F-477. The joint shall comply with the requirements of ASTM D-3139. Pressure pipe/Force mains are required to have modified grade 5 material used as bedding. Pipes also shall be hydrostatically tested at minimum of 100 psi after its construction to ensure its proper construction.

   b. **Water Main Crossings**. Gravity or force main sewers constructed in the vicinity of water mains will comply with the requirements of the "Criteria for Domestic Wastewater Systems," 30 TAC 217.53, as adopted by The Texas Commission on Environmental Quality August 28, 2008.

      Mechanical or compression joints, concrete jointing collars, or non-reinforced rubber adaptors shall be used only as approved by the Owner.

7. **Ductile-Iron Pipe and Fittings**. Ductile-Iron Pipe shall be centrifugally cast of 60-42-10 iron, and will conform to the requirements of A.N.S.I. Standard A21.51 (A.W.W.A. Standard C151), "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-lined Molds, for Water or Other Liquids".

8. **Thickness Design of Ductile-Iron Pipe**. Thickness design will be A.N.S.I. Standard A21.50/AWWA C150. Thickness or class shall be that required for laying condition type 4 or 5, in accordance with actual conditions at the site Fittings for

ductile-iron pipe will have not less than the thickness class or pressure rating specified for ductile-iron pipe. Fittings will be furnished with all necessary glands, gaskets, bolts, etc. as may be required to complete the joints.

Rubber-gasket joints for mechanical joints or 'push-on' type joints will conform to A.N.S.I. Standard A21.11 (A.W.W.A. Standard C-111), "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".

All ductile iron pipe and fittings shall be cement mortar lined or polyethylene lined. The cement mortar shall be in accordance with ANSI A21.4/AWWA C104. The polyethylene lining material for pipe and fitting shall be virgin polyethylene complying with ANSI/ASTM D-1248, compounded with inert filler and with sufficient carbon black to resist ultraviolet rays during storage of the pipe and fittings. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Polyethylene lining in pipe and in fittings shall be 40 mils nominal thickness. Minimum lining thickness shall be 30 mils.

9. **Concrete Steel Cylinder Pipe**. Pre-stressed concrete pipe and fittings will conform to A.W.W.A. Specification C-301 or A.W.W.A. Specification C-303.

10. **Pipe Testing.** All sanitary sewer pipe and fittings produced within the jurisdiction of the SAWS shall be tested by SAWS-approved laboratory method at the source of supply. All shipments of pipe not so tested shall be accompanied by a certificate of compliance to these specifications prepared by an independent testing laboratory and signed by a registered professional engineer

11. **Ductile Iron Pipe with Polybond Lining**. The lining will be a composite lining utilizing a primer coating containing fusion bonded epoxy (FBE) and a surface coating containing fusion bonded polyethylene (FBP). The lining will be Polybond PLUS as manufactured by the American Cast Iron Pipe Company (Birmingham, AL) or an approved equal meeting the requirements of this specification. All lining application must be performed by the pipe manufacturer at the pipe manufacturer's facility. Linings applied by individuals other than the pipe manufacturer are unacceptable and will be rejected.

    a. **Primer**. The primer is to contain fusion bonded epoxy (FBE), which is applied in sufficient quantity to achieve a normal thickness of 5 mils for the pipe or fitting. The FBE material used in the primer formulation should be capable of meeting the following requirements.

TEST PARAMETER	ASTM TEST METHOD	TYPICAL VALUE
Tensile Strength	D-2370	9,300 psi
Compressive Strength	D-695	11,600 psi
Ultimate Elongation	D-2370	6.9 percent
Impact (1/8"x3"x3" panel) 5/8" diameter tup	G-14	160 in.-lbs

b. Surface layer. The surface layer will be comprised of medium density modified fusion bonded polyethylene (FBP) meeting the requirements of ANSI/ASTM D1248 and compounded with an inert filler. The FBP will be formulated to be ultra-violet (UV) resistant for a minimum of three (3) years exposure. The color of the FBP is to have a light reflective value (LRV) of at least 40 percent to aid in the in-situ inspection of the pipeline with video equipment.

The fusion bonded polyethylene used in the surface coating material will be capable of meeting the following requirements:

TEST PARAMETER	ASTM TEST METHOD	TYPICAL VALUE
Tensile Strength	D-638	1,650 psi
Ultimate Elongation	D-638	300 percent
Taber Abrasion Resistance	D-4060	25.0 mg wt. loss/1,000 cycles @ 1,000 gram load
Notched Izod Impact		
@ 23	D-256	8.0 ft.-lbs/in. (No break)
@ 60 C		6.1 ft.-lbs/in. (No break)
Brittleness Temperature	D-746	-76 C

c. Thickness Requirements. Total thickness for the fusion bonded epoxy/fusion bonded polyethylene lining will be 60 mils nominal with a 50 mil minimum in the barrel of the pipe.

d. Lining Coverage. The fusion bonded epoxy/fusion bonded polyethylene lining will cover the interior surface of the pipe and fittings from the interior of the spigot end to a point sufficiently forward in the bell socket such that the Fastite gasket, in the assembled joint, seals over the end of the lining.

e. Joint Surface Coating. The joint surface coatings are to be comprised of a two component epoxy. The use of joint surface coatings containing coal tar is prohibited. Total thickness for the joint coating is to be 8 mils nominal.

The joint surface coating is to cover the spigot end across the end of the spigot bevel and extending over the outer surface of the spigot including the gasket sealing area. The joint surface coating is to also cover the socket from the face of the bell, through the gasket sealing area overlapping onto the edge of the FBE/FBP lining.

For each production lot, the lining is to be tested over 100 percent of the pipe barrel surface with a high voltage spark tester as recommended by ASTM Designation G-62 Method B of the latest version. The minimum test voltage is

to be as determined by Method B, as described in the ASTM Designation Section 11.2.3, which is the recommended voltage for all linings with possible areas thicker than 41 mils:

V=1250 x T 1/2 where V = voltage and
"T" = thickness of lining in mils.

Example: V=1250 x 60 1/2 Minimum Voltage = 9,683 volts

If holidays are found in the lining by the above test at the manufacturing plant, the holiday is to be repaired per the lining manufacturer's recommendation.

The holiday detector is to be a commercially available detector available from holiday detection equipment manufacturers such as SPY, TINKER and RASOR, and ZORELCO.

f. Voltage Confirmation Test. To confirm that the above voltage is sufficient to detect holidays, the following voltage confirmation test should be performed for each shift or change in detector operator. The holiday detector should be set to the calculated minimum voltage shown above. A known holiday should be made in the lining of a randomly selected pipe using a small sharp pin. The operator should demonstrate that the holiday can be consistently and satisfactorily located at this voltage setting and detector wand speed. If the holiday is not detected at the calculated voltage, then the voltage should be slowly increased until the known holiday is consistently detected by the operator. This voltage should then become the minimum voltage at which all pipe linings are to be tested.

g. Testing Voltage Meter. The detector's voltage (and voltage meter) is to be tested once each day by a separate voltmeter and the results certified by the pipe manufacturer, to confirm the accuracy of the detector's voltage meter.

12. High Density Polyethylene (HDPE) Pipe and Fittings. All HDPE will have a minimum pressure rating of 200 psi and a minimum dimension ration of 9 (DR 9).

Where standard ductile iron mechanical joint fittings are coupled to plain-end (square-cut) HDPE pipe, mechanical joint adapters must be used. Use Driscopipe Mechanical Joint Adapter (DIPS) Kit or approved equal.

a. Ductile Iron Bends and Fittings for HDPE Pipe. All bends and fittings will be furnished with the type of joint and end combinations specified. Mechanical joint fittings will be furnished complete with glands, gaskets and bolts. Flanged joint fittings will be furnished complete with gaskets and bolts. All bolts, glands and gaskets will be in accordance with AWWA Standard Specification C111.

All fittings will be furnished with standard outside coatings consisting of coal tar or asphalt base bituminous materials. Fittings will be cement mortar lined and sealed in conformity with AWWA Standard Specification C104.

b. **Pipe Joint Restraint System for HDPE Pipe.** Restraint devices will be used where ductile iron mechanical joint bell fittings are coupled to plain-end (square-cut) HDPE pipe, to prevent movement of pipe connections. The restraint system will have a minimum pressure rating of 250 psi. The restrainer must not be directionally sensitive.

   Underwriter Laboratories and Factory Mutual certifications will be required on the restraint system. Each restraint device will be packaged individually and include installation instructions.

   The pipe will be restrained by a split retainer band that will be cast ductile iron, meeting or exceeding ASTM A536 Grade 65-45-12. The inside face or contact surface of the bank will be of sufficient width to incorporate machined non-directionally sensitive serrations to grip the outside circumference of the pipe. The serrations will provide full (360°) contact and maintain pipe roundness and avoid any points of localized stress. The split bank casting will be designed to bottom-out before clamping forces (110 ft.-lb. minimum torque) can over-stress the pipe, but will provide full non-directionally sensitive restraint at the rated pressure.

   Bolts and nuts used to attach the split retainer ring will comply with ANSI B 18.2/18.2.2, SAE Grade 5. Tee bolts, nuts and restraining rods will be fabricated from high strength, low-alloy steel in accordance with AWWA C111.

   Restraint devices will be Uni-Flange Block Buster 1300C or approved equal.

c. **Water Main Crossing.** Where HDPE force main sewers are constructed in the vicinity of potable water mains, the requirements of the Texas Commission on Environmental Quality (30 TAC 217.53) will be met.

13. Steel Casing Pipe. The component materials, manufacture and testing of all steel pipe will conform to AWWA Standard C200 for "Steel Water Pipe 6-in. and Larger". The specified pipe size will be the actual inside diameter of the pipe, special or fitting in inches. The diameter and wall thickness of all steel pipe will conform to those shown on the plans.

Pipe will be either Grade A or Grade B, conforming to ASTM Designation A53.

Pipe ends will be beveled and suitable for field butt welding except as otherwise specified.

Pipe will receive a protective coating conforming to AWWA Standard C-203, "Coal-Tar Protective Coatings and Linings for Steel Pipelines – Enamel and Tape Hot Applied".

Pipe length will be nominal 40 ft. lengths except for specials or as otherwise specified on the plans. Standard and specials will be within 1/16-in. (plus or minus) of the specified or theoretical lengths.

14. Stainless Steel Casing Spacer. (see attached #2) The Casing Spacers are to be constructed of T-304 stainless steel segments which bolt together forming a shell around the carrier pipe. The spacers are to be designed with risers (when needed) and runners to support the carrier within the casing and maintain a minimum clearance of 0.50-in. between the casing ID and the spacer OD. On carrier pipes with an OD less than 16-in., each spacer is to have four (4) riser and runner combinations - two (2) on each segment. On carrier pipes with an OD of 16-in. and larger, each spacer is to contain six (6) riser and runner combinations - four (4) on the bottom segment and two (2) on the top segment. T-304 stainless steel bolts and nuts are to be supplied with the spacers.

The band is to be manufactured of 8-in. wide, 14 gauge, T-304 stainless steel material. The risers are to be constructed of 10 gauge, T-304 stainless steel having a minimum length of 6-in.

Abrasion resistant runners, having a minimum length of 7-in. and a minimum width of 1-in. are to be attached to each riser to minimize friction between the casing pipe and the carrier pipe as it's installed. Runner material is to be of glass reinforced plastic with compression strength of 25,000 psi, flexural strength of 32,000 psi and tensile strength of 22,000 psi. The ends of all runners are to be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the circular steel shell are to be lined with PVC or EPDM having a minimum thickness of 0.090-in. with a hardness of durometer "A" 85-90.

Spacers will be placed a maximum of 1-ft. on each side of the bell joint and every 8 to12-ft. apart thereafter.

Physical Properties

1. Band and Risers
   a. Band - 14 Gauge, T-304 Stainless Steel
   b. Riser - Minimum 14 Gauge, T-304 Stainless Steel

2. Liner - EDPM or Polyvinyl Chloride
   a. Thickness - .090-in. minimum
   b. Hardness - Durometer "A" 85-90
   c. Dielectric Strength - 1/8-in. thick
   d. 60,000 VPM
   e. Water Absorption - one (1) percent maximum
   f. Overlap edges

3. Studs, Nuts and Washers
   a. T-304 Stainless Steel - 5/16: - 18-in. x 2-in. studs
   b. 5/16-in. hex nuts
   c. 5/16-in. washers SAE 2330

4. Runners
1-in. wide or 2-in. wide glass filled polymer runners

Sizes Available:
Length - 7-in.
Effective heights (all lengths) - 1-in. and 1 1/2-in.

Materials Specifications:
Tensile Strength (ASTM D638) - 22,000 psi
Flexural Strength (ASTM D790) - 32,000 psi
Compression Strength (ASTM D695) - 25,000
Deflection Temperature @ 264 psi (ASTM D648) - 435 F (224 C)
Deformation Under Load, @ 122 F (50C) - 4000 pound Load,
- (ASTM D 648) 1.2 percent.

5. Welding. All risers are to be welded by MIG welding. Welds are to be fully pasivated.

B. Manholes. Material for manholes will conform to the requirements of Item 465, "Manholes and Inlets", as described below and as shown on the plans.

1. **Manhole Structures**. Cast in place concrete structures or pre-cast concrete structures, as detailed on the plans, will be installed where any pipe intercepted is larger than 24-in. in diameter.

2. **Pre-Cast Reinforced Concrete Manhole Sections**. Manhole sections are to conform to the requirements of ASTM Designation C-478. The pre-cast sections will have rubber gasket compression joints conforming to the material and performance requirements of ASTM C-443.

3. **Monolithically Poured Concrete Manholes**. A minimum of two and a maximum of six throat rings shall be used at each manhole for adjustability. All concrete for manholes shall conform to the provisions of "Concrete (Class "A")", Item No. 421, Hydraulic Cement Concrete. All reinforcing steel shall conform to the provisions of "Reinforcing Steel", Item No. 440 – Reinforcing Steel.

4. **Throat Rings**. Adjustment throat rings shall be made of either HDPE or reinforced concrete rings having a maximum thickness of 2 inches. The internal diameter shall not be less than 30 inches, and the width shall be a minimum of 5 inches. Concrete shall conform to the provisions of Concrete (Class "A")", Item No. 421, Hydraulic Cement Concrete. If concrete throat rings are to be installed they must be used in conjunction with a UV stabilized polyethylene liner. I/I barrier must meet the following ASTM standards: ASTM D-790/1505 Density of Polyethylene Materials, ASTM D1238 Melt Flow index, ASTM 638 Tensile Strength @ Yield (50mm/mm), ASTM 790 Flexural Modulus, ASTM 648 Heat Deflection temperature @lgepal, ASTM 1693 EsCR, 100% legpal/10% legpal.

5. **Rings and Covers**. Materials for rings and covers will conform to the requirements of Item 471, "Frames, Grates, Rings and Covers." The rings and covers will be cast iron as manufactured by Trans-Tex Supply Company, No. A-77 (400 pounds) or equal to the

dimensions shown on plans Covers are to contain no holes or openings. Provide lifting bars with slots cast into the covers. Rings and covers shall have a 30 inch (min.) opening per 30 TAC 217.55 (L) (I) A.

a. Watertight manhole rings and covers, when designated on the plans, are to be cast iron as manufactured by Trans-Tex Supply Company, No. A-77 O.R. (Watertight) (400 pounds) or equal. Covers are to contain no holes or openings except as required for bolts. Lifting bars with slots adequate for pick insertion and cast into the covers are to be provided for lifting purposes Covers are required to seat on a minimum 5/16-in. diameter rubber ring gasket conforming to the material requirements of ASTM Designation C-443. The rubber gasket is to rest in a groove cast in the ring. A minimum of four (4), 5/8-in. diameter stainless steel, hex head bolts will be provided for each cover. The four (4) bolt holes in the covers will be evenly spaced and provided with minimum 1-1/2-in. diameter counter sinks for the bolt heads. On the fastened and bolted position the bolt heads will not extend beyond the surface of the cover. Gaskets of a size and material, as approved will be provided for the bolts to insure water tightness. Alignment marks will be cast onto watertight rings and covers for proper bolt alignment.

b. All finished frames and covers will have the bearing surfaces machine ground and sets of rings and covers will be marked in such a way that they can be matched for assembly in the field. All covers will have the words “Sanitary Sewer” cast thereon or as specified in the details.

C. Manhole Rehabilitation. The Contractor shall submit descriptive information including technical data sheet and ASTM test results on each product proposed indicating that the product conforms to and is suitable for its intended use per the specifications. The Contractor may, when appropriate, elect to use any materials that is considered to be equal (i.e. a product that had structural and physical properties that are equal to or greater then those of the specified product). However, submittal to the Engineer is required no later then 10 days prior to bid opening. Should the Contractor elect to use any materials other then those contained herein, they should be completely and clearly identified when making the product submittal. This will expedite the review process, in which the Engineer decides whether the products meet the Contract requirements and the specific use foreseen. The purpose of this process is to expedite review of Contractor product submittals.

Concrete shall conform to Item 420, “Concrete Structures”.

Mortar shall be composed of 1 part Portland cement,1 part masonry cement (or 1/4 part hydrated lime), and masonry sand equal to 2.5 to 3 times the sum of the volumes of the cements and lime used.

Unless otherwise specified, all grouting shall be done with non-shrinking grout.

Reinforcing steel shall conform tot eh requirements of Item 440, ‘Reinforcing Steel”.

Replacement brick for ring adjustment courses shall be of first quality, sound, kiln fired, new unbroken brick.

Structural or High Sulfate resistant lining for rehabilitation shall be Raven 405 Series high build Epoxy Liner minimum 200 mils thick, Spray Wall polyurethane system minimum 250 mils thick or equal (i.e. a product that has structural and physical properties that are equal to or greater than those of the specified product).

D. Cleaning Manholes and Mains.

1. Preparation. The Contractor shall be required to have all materials, equipment and labor necessary to complete the cleaning of the sanitary sewer main and manholes on the job site prior to isolating the sewer manhole or main segment and beginning the cleaning process.

2. Cleaning Materials. Use only cleaning materials recommended by manufacturer of surface to be cleaned. Use each type of cleaning material on only those surfaces recommended by the cleaning materials manufacturer. Use only materials which will not create hazards to health or property or affect treatment plant process.

E. Concrete. All concrete is to meet the requirements of Item 421, "Hydraulic Cement Concrete". Unless otherwise shown on the plans or required by this specification, all concrete will be Class A.

F. Mortar. Mortar is to be composed of one (1) part Hydraulic Cement, two (2) parts sand and sufficient water to produce a workable mixture. When used to plaster manholes, it may be composed of one (1) part cement to three (3) parts sand. Lime up to 10 percent may be used. It will have a consistency such that it can be easily handled and spread.

G. Reinforcing Steel. Reinforcing steel and the placing thereof is to conform to the requirements of Item 440, "Reinforcing Steel", except where welded wire is called for on the plans, the material will be welded wire flat sheets meeting A.S.T.M. A-185. Welded wire rolls will not be used.

H. Cement Stabilized Backfill. Cement stabilized backfill is to be in accordance with Item 400, "Excavation and Backfill for Structures".

I. Flowable Backfill. When indicated on the plans, the trench is to be backfilled to the dimensions shown with flowable backfill. The flowable backfill with fly ash will be Mix Design Type B in accordance with Item 401, "Flowable Backfill", or an acceptable mix as approved.

J. Grout. When shown on the plans for various applications, the grout is to be a cement/sand/water mixture as approved. It will have a consistency such that it will flow into and completely fill all voids.

K. Sewer Main Television Inspection

The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising and a NASSCO-(PACP) standard video, recorded in MPEG-1 format and written to DVD video of sewer lines and manholes utilizing a color, closed-circuit television inspection unit to determine their condition.

The Contractor shall provide a line diagram area sketch and written log for each completed segment of DVD sewer main describing the section being televised, flow and camera direction, position of service connections, description and location of failures, pipe condition, weather conditions, and other significant observations.

Television inspection shall be done one manhole section at a time. Also the flow in the section being televised shall be bypassed if the line is in service and the flow exceeds 25% of the internal pipe diameter. When the depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, the flow shall be reduced to allowable levels by temporarily plugging or blocking the flow or bypass pumping, as approved by

The Contractor shall not be allowed to float the camera. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction. At that time, and prior to proceeding, the Contractor shall contact the Inspector. If the length of sewer line cannot be televised because of obstructions, the Contractor shall clean the system as is necessary. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended, payment shall be made based on the actual televised length, and the remaining televising of the sewer line shall be continued upon successful correction of the blockage by the Contractor at his expense. No additional payment shall be made for additional setups required due to obstructions encountered during televising.

1. **Log Formats.** Each DVD will be permanently labeled with the following:

    - Project Name,
    - Date Televised,
    - Station to Station Location and Size of Sanitary Sewer,
    - Street/Easement Location,
    - Name of Contractor,
    - Date DVD Submitted, and
    - DVD Numbers.

2. **Videotape Quality.** If the Contractor produces a DVD of such poor quality that the Engineer is unable to evaluate the condition of the sanitary sewer main or locate the sanitary sewer service lateral connections, the Contractor will be required to re-televise the sanitary sewer main and provide a new DVD of good quality at no additional cost.

3. **Equipment Required For TV Inspections.** The Contractor will be required to have all materials, equipment and labor necessary to complete all videotaping on job site prior to isolating the sewer manhole segment and beginning videotaping operations. A camera with rotating or panning lens

capabilities is required. The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole. A camera with rotating and panning lens capabilities is required. The camera height shall be centered in the conduit being televised. The speed of the camera through the conduit shall not exceed 40 feet per minute.

The television unit shall also have the capability of displaying in color, on DVD, pipe inspection observations such as pipe defects, sags, points of root intrusion, offset joints, service connection locations, and any other relevant physical attributes.

4. DVD Logs. The Contractor is to provide, with each completed DVD, a TV inspection report which is a written log of all pipe defects, sags, points of root intrusion, offset points, service connection locations and condition recorded on a footage basis. This log is to also denote the section being televised, flow and camera direction, position of taps or failures, pipe condition and weather conditions.

L. Polyethylene Wrapping Material. Polyethylene wrapping material will be used to encapsulate all ductile and cast-iron fittings.

1. Polyethylene wrapping for ductile and cast-iron fittings will consist of a 4 mil tubular section of cross-laminated high-density polyethylene, which has a high dielectric and tensile strength, for use in insulating cast-iron and ductile-iron pipe from the electrolytic action encountered in highly active soils

2. The polyvinyl sheet of film for the tubular wrapping is to be of virgin resins meeting raw and physical properties of ASTM D-1248 and AWWA C105, latest edition. The material is to be 4 mil cross-laminated high-density polyethylene of. uniform film thickness and be free of imperfections such as pin holes, etc., after being thermally seamed into tubular form. The finished product will have a nominal thickness of 4 mils, with tolerances of minus ten percent.

3. Polyethylene wrapping is to consist of opaque cross-laminated high-density polyethylene sheet continuously thermally bonded to form a tubular section. The tubes may be supplied in bulk length on rolls or in individual pre-cut lengths. See attached size and length chart, in accordance with AWWA C 015-99 (Table 1) for minimum requirements. When supplied in specific pipe lengths, the tubes are to contain a minimum of 4-ft. over the actual pipe length to allow for overlap.

4. The material will have no volatile constituents, the loss of which may affect ductility. The material will also have the following properties:

a Mechanical: The polyethylene film is to have a tensile strength per latest ASTM D-882 test, of 6300 psi min. The film is to have an elongation of not less than 100% of the test strip per latest ASTM D-882 test. The film is to have an impact resistance 800 gram min per (ASTM D1709 Method B) The film is to have a

propagation tear resistance of 250 gf minimum in machine and transverse direction (ASTM D1922).

b. Dielectric: The film is to have a dielectric strength of 800 volts per mil thickness per ASTM D-149.

M. Air Release Assemblies. Valve body and cover will be cast iron fabricated in accordance with ASTM A48-35 or ASTM A126 Class B. Non-metallic Valve Body shall be fabricated from fiberglass reinforced nylon. Inlet sizes through 2-in. will be screwed (National Pipe Taper Thread, NPT).

Pipe sizes above 3-in.and above will have flanged inlets (125 Lb. ANSI B16.1). A protective hood or cowl will be installed on the outlet of flange-bodied valves.

Internal seat trim float arm and pivot pin will be stainless steel Type 303 or 304 or 316. Floats will be stainless steel ASTM A240. Other internal parts will be stainless steel ASTM A240 or ASTM A276.

Non-metallic floats shall be foamed polyethylene with stainless steel type 316 fasteners.

Internal seat or orifice button will be of Buna-N rubber compounded for water service. Cover gasket will be composition-type, equal to Armstrong CS-231, Garlock 3000, or Lexide NK-511. If an o-ring is used to seal the cover, it shall be on NSF 61 certified rubber. Cover bolts will be alloy steel. Rolling seals shall be furnished for non-metallic valves 2" and below.

Valve Body will have a test pressure rating of 300 psi and working pressure rating of 150 psi.

The air release valve will be designed to vent accumulated air automatically. The outlet orifice will be properly sized to facilitate valve operation at pressures up to 150 psi. The air release valve will be either simple lever or compound lever, depending upon venting volume requirements.

The air and vacuum valve will be designed with the inlet and outlet of equal cross-sectional area. The valve will be capable of automatically allowing large quantities of air to be exhausted during the filling cycle and also capable of automatically allowing air to re-enter the system to prevent a negative pressure during the draining cycle. The float will be guided to minimize premature closure by air and to provide proper alignment for normal closure by floating on the water surface.

Combination valves will provide for both automatic air release under system pressure and to allow air movement during filling or draining operations. The combination valve may be housed in a single casting. The housing will be

designed to incorporate conventional or kinetic flow principles to properly vent the air without premature closure. Flanged sizes (4-in. and larger) may be furnished in a dual housing if it can be installed within the meter boxes shown on the plans. When dual castings are used, a bronze manual isolation valve will be installed. This will allow the air release valve to be serviced when the system is under pressure. Field service of the valve may also be performed by closing the isolation valve between the air valve and the pipe connection.

The Water System may at no cost to manufacturer, subject random valves to testing by an independent laboratory for compliance with these standards. Any visible defect or failures to meet the quality standard herein will be grounds for rejecting the entire order.

N. Rehabilitation of Lines.

1. Point Repair Pipe.

Pipe Material used for repairs shall be in accordance with Item "Sanitary Sewers". If point repair is located at a service connection, use a full-bodied fitting for the service connection. No field fabrication of fittings allowed.

Joint Material. Use flexible adapters secured with ½ inch stainless steel bands, as manufactured by Fernco, or approved equal

2. Cast-In-Place-Pipe. This Item shall provide for the reconstruction of existing sewer lines by forming a new pipe within an existing structurally deteriorated pipe which has generally maintained its original shape. The CIPP shall provide flow capacity equal to or greater then 100 percent of the original pipe's flow capacity when new. The installation of the CIPP shall be accomplished by the use of the Insituform Process, Inliner U.S.A., Inc., or approved equal process. The process is defined as the reconstruction of sewer line by installation of a thermosetting resin impregnated flexible felt fiber tube which is inverted into the existing sewer line utilizing a fluid column. Curing is accomplished by circulating hot water, or other approved liquid, throughout the length of the inverted tube to cure the thermosetting resin into a hard, impermeable pipe. The pipe shall extend the full length of the original pipe and shall provide a structurally sound, jointless, close fitting, CIPP.

a. Patents. The inversion process is patented and is installed by licensed Contractors. The Contractor shall warrant to the owner and the Engineer that the methods, materials and equipment used herein, where covered by license, are furnished in accordance with such license; and the prices included in this proposal include applicable royalties and fees in accordance with such license. The Contractor shall warrant and save harmless the owner of the sewer line (SAWS) and the Engineer against all claims for patent infringement and any loss thereof.

The Contractor may propose a proven alternate method of CIPP, meeting all criteria of this specification. This alternate approval must come from the SAWS Wastewater Engineering Department.

The Following information shall be submitted to the Engineer a minimum of twenty days prior to construction operations.

- Product Data Design Criteria
- Physical Properties
- Limitations of Process
- Material Specifications
- List of Current and Previous Projects in USA (with size)
- List of Testing Methods
- Third Party Test Data
- List of References
- List of Currently Owned Equipment

3. **Flexible Felt Fiber Tube.** The resin impregnated felt tube shall be manufactured and fabricated, under quality controlled conditions set by the process manufacturer, to a size that, when installed, will snugly fit the internal circumference of the existing sewer, and provide the required thickness when cured with the liquid thermosetting resin, as described later. The minimum length shall be as found necessary by the Contractor, to effectively and fully span the actual field distance between the manholes, with extra allowance as needed for proper stretching and shrinkage due to pressure, expansion, and for lateral service cuttings, etc. Measurement for payment shall be made from the actual field measurements of distance between the centerlines of the manholes.

4. **Resin.** The liquid thermosetting resin used to impregnate the felt tube shall produce a properly cured tube that will be resistant to abrasion and corrosion due to solids, grit, sand, acids, and gases such as hydrogen sulfide, methane, and carbon monoxide. The resin selected shall have proven resistance to normal municipal sewage, especially sulfuric acid corrosion from hydrogen sulfide gas.

   The resin system to be used shall be manufactured by approved companies selected by the CIPP process manufacturer. Relevant information from the resin manufacturer shall include specifications, characteristics and properties, as well as methods of application. This data shall be submitted for approval. A written certification that the resin material complies with the required application, along with curing temperature and duration of the temperature (step cooking temperature or hours at each and final stages) depending upon the sewer size and liner thickness, shall be supplied. A blanket letter may not be sufficient in case of varying liner thickness and lengths, etc. This information is necessary for the Engineer to be satisfied that the curing is being done according to plan and procedure, and it being checked accordingly in the field during installation.

   The Engineer shall also be informed, in advance, for verification and inspection of the resin material at the “wet out” of the felt tube. The inspection shall be at the discretion of the Engineer, which shall not relieve the Contractor of responsibility. The inversion and heating schedule or plan shall be submitted at least 24 hours in advance. Heating shall

continue uninterrupted until the desired temperature is achieved. Temperatures shall be measured at both ends by sensitive and accurate measuring devices.

Correction of failed liner, deemed unacceptable as a result of post-TV inspection or test reports for structural values, thickness, etc., shall be repaired by the Contractor at the Contractor's expenses. The method of repair shall be as approved, which may require field or workshop demonstration.

The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before impregnation of the tube with resin. Individual inversion runs may be made over one or more manhole sections as determined in the field by the Contractor and as approved.

The outside of the tube, before installation, shall have an impermeable plastic coating. This coating will form the inner layer of the finished pipe and is required for enhancement of corrosion, flow and abrasion properties.

The layers which constitute the pipe wall must be such that when the thermosetting resin cures, the total wall thickness must be homogeneous with no internal layer of plastic which might weaken the pipe wall and allow internal shear. When cured, the CIPP must form a mechanical bond with the pipe.

The materials used shall result in an installed CIPP flow capacity which is equal to or greater than 100 percent of the original pipe's low capacity when new.

The existing sewers, where designated or required, shall be lined using materials and workmanship which can be adapted to the restrictions of the work site. The Contractor shall not begin this phase of the work until sufficient materials are on hand to complete the job.

The Contractor shall furnish to the Engineer, prior to use of the lining material, satisfactory certification from an approved testing laboratory as to the results of testing the proposed lining material.

O. Repairs. Pipe materials used for repairs shall be in accordance with Item "Sanitary Sewers"

P. By-Pass Pumping. The Contractor shall provide and maintain adequate pumping equipment, force mains and other necessary appurtenances in order to maintain reliable sanitary sewer service in all sanitary sewer lines as required for construction. The Contractor shall have backup pump(s), force main(s) and appurtenances ready to deploy immediately. Appurtenances and discharge point shall be approved by the Inspector.

Any spillage, backups and/or overflows, etc. as the result of inadequate equipment are the sole responsibility of the Contractor.

The Contractor shall demonstrate that the pumping system is in good working order and is sufficiently sized to successfully handle flows by performing a test run for a period of 24 hours prior to beginning the work.

The Contractor shall be required to have all materials, equipment and labor necessary to complete the repair or replacement on the job site prior to isolating the sewer manhole or line segment and beginning by-pass pumping operations.

Q. Pipe Bursting/Crushing Replacement Process.

1 High Density Polyethylene Pipe (HDPE) related to pipe bursting or pipe crushing for a sanitary sewer or related pipe line rehabilitation:

a. Solid wall HDPE pipe referred to as Drisco 1000, Drisco 8600, Quail Pipe, Poly Pipe, and Plexco Pipe that is in conformance with ASTM F714 and ASTM requirements stated herein are considered approved for this project. HDPE pipe on this project will further be required to have a minimum pipe stiffness of 46 psi for 12-in. to 48-in. diameter pipe and 115 psi for 8-in. to 10-in. diameters as required by SAWS and TCEQ.

Pipe Manufacture. All pipe and fittings will be high density polyethylene pipe and made of virgin material. No re-work except that obtained from the manufacturer's own production of the same formulation will be used. The liner material will be manufactured from a High Density High Molecular weight polyethylene compound which conforms to ASTM D 1248 and meets the requirements for Type III, Class C, Grade P-34, Category 5, and has a PPI rating of PE 3408.

b. The pipe produced from this resin will have a minimum cell Classification of 345434C (Inner wall will be light in color) under ASTM D 3350. A higher number cell classification limit which gives a desirable higher primary property, per ASTM D 3350 may also be accepted by the Engineer at no extra cost to SAWS. The value for the Hydrostatic Design basis will not be less then 1600 psi (11.03 MPA) per ASTM D 2837. Pipe will have ultraviolet protection.

c. Pipe Color and Quality. For television inspection purposes, the polyethylene pipe will have light-colored interior achieved with a homogenous, light-colored material throughout or with a fully bonded light-colored interior liner meeting specifications indicated above. All pipe will be free of visible cracks, holes, foreign material, foreign inclusions, blisters, or other deleterious or injurious faults or defects. Pipe and fittings shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

For interior lined pipe, the liner will be a minimum of 10 mils thick and co-extruded. The bond between the layers will be strong and uniform. It will not be possible to separate the two layers with a probe or point of a knife blade so that the layers separate cleanly at any point, nor will separation of the bond occur, between layers, during testing performed under the requirements of this specification.

d. Pipe Diameter. Polyethylene Plastic Pipe will meet the applicable requirements of ASTM F 714 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, ASTM D 1248, and ASTM D 3550. Internal diameter of the pipe indicated on the plans will be the minimum allowable pipe size.

e. Pipe Dimension Ratios. The minimum wall thickness of the polyethylene pipe will meet the following, as based on the deepest portion of a particular pipe pull, typically between manholes:

Depth of Cover (Feet)	Minimum SDR of Pipe
0-16.0	19
>16.1	17

Wall thickness shall be as indicated on the plans and will be in accordance with Chevron Plexco Industrial Piping System Pipe Data and Pressure Rating Bulletin 301, or approved equal.

f. Pipe Joining. Solid wall pipe shall be produced with plain end construction for heat-joining (butt fusion) conforming to ASTM D 2657. The polyethylene pipe will be assembled and joined at the site using the thermal butt-fusion method to provide a leak proof and structurally sound joint. Threaded or solvent-cement joints and connections are not permitted. All equipment and procedures used will be used in strict compliance with the manufacturer's recommendations. Fusing will be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe or fusing equipment.

The butt-fused joint will be true alignment and will have uniform roll back beads resulting from the use of proper temperature and pressure. The joint surfaces will be smooth. The fused joint will be watertight and will have tensile strength equal to that of the pipe. All joints will be subject to acceptance by the Engineers or his representative prior to insertion. All defective joints will be cut out and replaced at no cost to SAWS. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent of the wall thickness, will not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, if in the opinion of the Engineers or his representative any section of pipe has other defects, including those hereinafter listed, that may indicate damaged, improperly manufactured, faulty, or substandard pipe, said pipe will be discarded and not used. Defects warranting pipe rejection include the following: concentrated ridges, discoloration, excessive spot roughness, and pitting; insufficient or variable wall thickness; pipe damage from bending, crushing, stretching or other stress; pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe, internal roughness characteristics; or any other defect of manufacturing or handling.

Clamps and Gaskets. Clamps shall be stainless steel, including bolts and lugs as manufactured by JCM Industries Type 108 or equal. Furnish full circle, universal clamp couplings with a minimum 3/16-in. thick neoprene, grid-type gasket. Select Clamps to fit outside diameter of pipe. Use minimum clamp length of 30-in. for replacement pipe O.D. of 10.75-in. (10 inch nominal) or greater, and 18-in. for replacement pipe O.D. less than 10.75-in.

Terminal sections pipe that are joined within the insertion pit will be connected with a full circle pipe repair clamp. The butt gap between pipe ends will not exceed 1/2-in.

g. Force Mains. Where applicable, solid wall pipe for sanitary sewer force mains shall have a minimum working pressure rating of 150 psi, and an inside diameter equal to or greater than the nominal pipe size indicated on the Drawings.

h. Augering Pipe. HDPE pipe is not approved in applications requiring augering of sewer pipe.

i. Pipe Marking. Each standard and non-standard length of pipe or fitting shall be clearly marked with pipe size, pipe class, production code, material designation and other relevant identifying information.

j. Pipe Inspections. The Engineer reserves the right to inspect pipes or witness pipe manufacturing. Such inspection shall in no way relieve the manufacturer of the responsibilities to provide products that comply with the applicable standards and these Specifications. Should the Engineer wish to witness the manufacture of specific pipes, the manufacturer shall provide the Engineer with adequate notice of when and where the production of those specific pipes will take place. Approval of the products or tests is not implied by the Engineer's decision not to inspect the manufacturing, testing, or finished pipes.

R. Sliplining.

1. Manufacturers.

a. Liner pipe systems shall be fiberglass reinforces plastic (FRP) or T-Lock Liner concrete pipe, as approved by the SAWS.

b. Acceptable manufacturer for FRP liner pipe: Shall conform to the current Standard Material Specifications accepted by SAWS.

c. Acceptable manufacturer for Amer-Plate T-Lock pipe: Ameron Protective Linings.

2. FRP Liner Pipe and Fittings.

a. Pipe, joint and fitting; ASTM D 3262m Type 1, Liner 2, Grade 3.

b. FRP Liner Pipe: Reinforced plastic mortar pipe manufactured by centrifugal casting process resulting in dense, nonporous, corrosion-resistant, consistent, composite structure. Minimum Stiffness: 72 psi, measured in accordance to ASTM D 2412. use with a stiffness of 72 psi where specified or shown on the drawings.

c. Resin Systems: Thermosetting polyester epoxy resin, with or without filler, meeting ASTM D 3262.

d. Reinforcing Glass Fibers: Commercial Grade E-type glass filaments, with binder and sizing compatible with impregnating resins.

e. Filler: Sand with at least 98 percent silica content, and maximum moisture content of 0.2 percent.

f. Joints: Low-profile FRP jacking bell-and-spigot joints or flush bell and spigot joints, with elastomeric sealing gaskets for watertight joints meeting ASTM D 4161.

g. Dimensions and Tolerances:

1. Pipe outside diameters and tolerances: Comply with ASTM D 3262, Cast Iron Pipe Equivalent Outside Diameters, and table below.

2. When possible, supply pipe in nominal lengths of 20-ft. Where radius curves in existing pipe or limitations in entry pit dimensions restrict pipe length, shorter lengths may be used.

3. FRP pipe minimum outside diameters and minimum wall thickness:

Minimum Existing Sewer Nominal Diamater (Inches)	Minimum Wall Liner O.D. (Inches)	Minimum Wall Thickness 46 p.s.i. Stiffness (Inches)	Thickness 72 p.s.i. Stiffness (Inches)
21	19.50	0.42	0.48
24	21.60	0.46	0.53
30	25.80	0.54	0.63
36	32.00	0.66	0.77
42	38.30	0.78	0.91
48	44.50	0.90	1.05
54	50.80	1.02	1.19
60	57.10	1.14	1.33
66	62.90	1.26	1.47
72	69.20	1.38	1.61
78	75.40	1.50	1.75

4. Fabricate pipe ends square to pipe axis plus or minus 0.25-in., or plus or minus 0.5 percent of nominal diameter, whichever is greater.

h. Fittings.

1. Flanges, elbows, reducers, tees, wyes, and other fittings: Capable of withstanding operating conditions.

2. Fabrication: Contact-molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforces overlays.

3. Liner Pipe Seals at Manholes.

a. Sealer for annular spaced between liner pipes and host sewers at manholes: Oakum strips soaked in Scotchseal 5600 as manufactured by 3M Corporation, or approved equal.

b. Non-Shrink Grout: Strong Seal's QSR patching material or approved equal.

4. Clamps and Gaskets.

a. Clamps: Stainless steel, including bolts and lugs, as manufactured by JCM Industries, Type 108, or equal. Furnish full circle, universal clamp couplings with at least 3/16-in. thick neoprene grid-type gaskets. Select clamps to fit outside diameter of liner pipe as follows.

Liner Pipe O.D. (Inches)	Minimum Clamp Length (Inches)
7.125	15
8.625	18
10.750 or greater	30

5. Bedding Material.

a. Make point repair and remove obstructions, such as roots, rocks and other debris, prior to installing liner pipe.

S. Sliplining Grout

Manufactures/Application:
The applicator of the grout mix shall be certified by the grout mix manufacturer and approved by the SAWS Engineer. The certified applicator shall be regularly engaged in the placement of grout, including completion of pipeline grouting installations having at least 1000 cubic yards in the past 3 years.

Materials:
A. Cement: Comply with ASTM C 150. Pozzolans and other cementitious materials are permitted.
B. Fly Ash: Comply with ASTM C 618; either Type C or Type F shall be used.
C. Sand, if provided, shall conform to ASTM C 144, except as modified below:

U.S. Standard Sieve Size	**Percent Passing By Weight**
No. 16	100
No. 30	60 – 85
No. 50	10 – 35
No. 100	5 – 25
No. 200	- 10

D. Water: Use potable water free from deleterious amounts of alkali, acid, and organic materials which would adversely affect the setting time or strength of the slip-lining grout.

E. Admixtures: Admixtures shall be selected by the slip-lining grout manufacturer to meet performance requirements, improve pumpability, control set time and reduce segregation.

1. Compressive Strength. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C 403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance of ASTM C 495 or C 109.
2. Performance Requirements. The Contractor shall submit the proposed grout mixes, methods, plans and criteria of the grouting operations. The grouting system shall have sufficient gauges, monitoring devices, and test to determine the effectiveness of the grouting operation and to ensure compliance with the liner pipe specifications and design parameters.
3. Mix Designs. One or more mixes shall be developed to completely fill the annular space based, but not restricted to, the following requirements:

   a) Size of annular void
   b) Void (size) of the surround soil
   c) Absence or presence of groundwater
   d) Sufficient strength and durability to prevent movement of the liner pipe.
   e) Provide adequate retardation, and
   f) Provide less than 1 percent shrinkage by volume.

4. Density/Viscosity. The Contractor shall design a grout mix with a density to prevent floating of the liner pipe. The apparent viscosity shall not exceed 20 seconds in accordance with ASTM C 939 unless otherwise approved by the SAWS engineer.

T. Bedding and Backfill

Backfilling for sanitary sewers is divided into three (3 separate zones: (a) bedding: the material in trench bottom in direct contact with the bottom of the pipe; (b) initial backfill: the backfill zone extending from the surface of the bedding to a point 1 foot above the top of the pipe; and (c) secondary backfill: the backfill zone extending from the initial backfill surface to the top of the trench. Materials and placement for each of the zones shall be as described herein

1. Bedding.

a. Stable Material: Existing stable material present during excavation including:

(1) Trench bottom free of water, muck, debris;

(2) Rock in boulder, ledge or coarse gravel (particle size not larger than 1- ¾ inch) formations;

(3) Coarse sand and gravels with maximum particle size of 1- ¾ inch, various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive either wet or dry; and

(4) Fine sands and clayey gravels; fine sand, sand-clay mixtures, clay and gravel-clay mixtures.

b. Unstable Material: Existing unstable materials are: Silt, muck, trash or debris in the trench bottom bearing level; rock, in ledge or boulder, or coarse gravel (minimum particle size larger than 1- ¾ inch) formations.

c. Bedding Material: The existing material at the bearing level shall be removed and replaced to a minimum depth of 6 inches or 1/8 inch of the outside diameter of the pipe, whichever is greater, with bedding material. The bedding material shall extend up the sides of the pipe sufficient to embed the lower quadrant of the pipe. The bedding material shall be composed of well-graded, crushed stone or gravel conforming to the following requirements unless modified by the Engineer:

Sewer Gravel	Percent
Passing 1-1/2 inch sieve	100
Passing 1 inch sieve	95 – 100
Passing 3/8 inch sieve	25 – 60
Passing No. 4 sieve	0 – 10
Passing No. 8 sieve	0 – 5

2. Payment for additional excavation must be approved by the inspector.

3. Initial Backfill: Initial backfill shall consist of gravel which conforms to the requirements for bedding material.

4. Secondary Backfill: Secondary backfill shall generally consist of materials removed from the trench and shall be free of brush, debris and trash. Rock or stones having a dimension larger than 6 inches at the largest dimension shall be sifted out and removed before the material is used in the secondary backfilling zone. Secondary backfill material shall be primarily composed of compactable soil material

3. Construction Methods.

A. Excavation. Excavation as required to complete the work as outlined herein will be performed in accordance with Item 400, "Excavation and Backfill for Structures".

B. Trench Excavation Protection. Excavation greater than 5-ft. in depth is to be protected as specified in Item 402, "Trench Excavation Protection", or Item 403, "Temporary Special Shoring".

C. Trenching.

Trench walls shall be vertical. The practice of undercutting at the bottom or flaring at the top will not be permitted except where it is justified for safety or at the Engineer's and/or Inspector's direction. In special cases, where trench flaring is required, the trench walls shall remain vertical to a depth of at least 1foot above the top of the pipe.

The trench bottom shall be square or slightly curved to the shape of the trenching machine cutters. The trench shall be accurately graded along its entire length to provide uniform bearing and support for each section of pipe installed upon the bedding material. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and bedding installed. The pipe shall rest upon the new bedding material for its full length

Where over-excavation occurs, the under-cut trench shall be restored to grade at no cost to the Owner by replacement with a material conforming to the requirements of the bedding material or a material approved by the Engineer.

1. Width of Trench.

Minimum Width of Trench. The minimum width of pipe trenches, measured at the crown of the pipe, shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells. The minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections. Such minimum width shall be exclusive of trench supports and not greater than the width at the top of the trench.

Maximum Width of Trench. The maximum allowable width of trench for pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24 inches. A trench wider than the outside diameter plus 24 inches may be used without special bedding if the Contractor, at his expense, furnishes pipe of the required strength to carry additional trench load. Such modifications shall be submitted to the Owner and approved in writing. Whenever such maximum allowable width of trench is exceeded, except as provided for on the drawings, or in the specifications, or by the written approval of the Owner, the Contractor, at his expense, shall encase the pipe in concrete from trench wall to trench wall, or other pipe bedding material approved by the Owner. Any excavation wider than this maximum width or subsequent Surface or Paving work, will be done at the Contractor's expense.

2. Grade of Trench Bottom.

The trench is to be over-excavated to a depth of 6-in. below the grade line established for the bottom of the pipe, regardless of the type of pipe. The grade line of the pipe is to then be met by the addition of a layer of approved bedding material as directed.

3. Excavation Below Grade.

Any part of the bottom of the trench excavated below the limits specified in Section 2.T.2. "Grade of Trench Bottom", is to be corrected with approved material and compacted as directed. Should excessive over-excavation occur, except at bell holes, the grade is to be restored in accordance with the methods described in Section 2.T.4, "Unstable Conditions at Grade".

4. Unstable Conditions at Grade.

Where the bottom of the trench at grade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces of fragments or inorganic materials which in the judgment of the Engineer should be removed, the Contractor is to excavate and remove such unsuitable material to the a depth no less than 6-inches below pipe. Before the pipe is laid the grade is to be restored by backfilling with an approved material in layers of 3-in. prior to compaction. The layers are to be slightly moistened and thoroughly compacted so as to provide a uniform and continuous bearing and support for the pipe at every point between bell or collar holes. The finished grade is to be accurately graded to provide uniform bearing and support for each section of pipe at every point along its entire length except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper seating of pipe joints.

D. Bedding and Backfill.

Prior to laying the pipe, the normal or select bedding material will be shaped to conform to the outside diameter of the pipe as shown on the plans Bedding material shall be consolidated to assure it is incorporated from the bottom of the trench up top the pipe centerline. A hand-held vibrator, commonly used for concrete work, can be used for this purpose. The vibrator shall be inserted every 3 feet on each side of the pipe.

For sewer lines up to 24 inches in diameter initial backfill material shall be placed in two lifts above the bedding material the pipe is set on. The first lift shall be spread uniformly and simultaneously on each side and under the bottom quadrant of the pipe to the mid-point or spring line of the pipe. Consolidate the Initial Backfill material as specified for bedding.

Placement of the first lift of initial backfill shall be subject to inspection and approval prior to placement of second lift, which shall extend from the spring line of the pipe to a minimum of 1 foot above the top of the pipe. The second lift shall be evenly spread in a similar manner as the first lift

For diameters 24 inches and larger, initial backfill material shall be evenly and simultaneously spread alongside, under the lower quadrant the pipe and over the pipe in 12 inch lifts to a point sufficient to a minimum of 1 foot above the top of the pipe. Consolidate the Initial Backfill material as specified for bedding.

The secondary backfill material shall be placed in maximum 12 inch loose lifts or as directed by the Design Engineer and/or Inspector.

E. Pipe Installation.

1. **General**. All sanitary sewer mains shall be constructed in accordance with the specifications herein outlined and in conformity with the required lines, grades, and details shown on the plans and as directed by the Engineer. Successful passage of the air test, as described under TCEQ 30 TAC 217.53 Criteria, shall be required for the acceptance of the mains.

   After the trench has been carefully graded and all bell holes excavated, approval is required prior to placing the pipe therein.

   All sewers are to be laid in straight alignment, so that a light can be seen from one manhole to the other even for the smaller size of sewers. The pipe is to be laid accurately to line and grade, with the spigot end downstream entering the bell to full depth and in such a manner as not to drag earth into the annular space. Pipes and fittings are to be fitted together and matched so that they will form a sewer with a smooth and uniform invert. Special care is to be taken to provide uniform bearing for the entire length of pipe.

   Water Main Crossings: Where gravity or force main sewers are constructed in the vicinity of water mains, the requirements of the TCEQ 30 TAC 217.53 (d), shall be met.

2. **Pipe and Fittings**. Proper and suitable tools and appliances for the safe and convenient handling of the pipe and fittings are to be provided and used. Care is to be taken to prevent any damage to the pipe coating. All pipe and fittings will be examined for defects right before placing into the trench and no materials are to be laid that are known to be defective.

   Any defective pipe discovered after being laid is to be removed and replaced with acceptable pipe at the Contractor's expense. Wherever the pipe requires cutting, it is to be done with a standard wheel pipe cutter for pipe 12-in. and smaller. Cutting methods for larger pipes are to be as approved. Each cut is to be smooth and at right angles to the axis of the pipe.

   Pipe Laying: The Contractor shall be required to commence construction and laying of pipe at the downstream end of the sanitary sewer outfall line and proceed non-stop in a forward upstream direction.

   No pipe shall be laid within 10 feet of any point where excavation is in progress. Pipe laying shall proceed upgrade with the tongue or spigot pointing in the direction of flow. Pipe shall be lowered into the trench without disturbing the prepared foundation or the trench sides.

   The drilling of lifting holes in the field will not be permitted. Pipe shall be installed by means of a concentric pressure being applied to the pipe with a mechanical pipe puller. Pulling or pushing a joint of pipe in place by using a crane, bulldozer, or backhoe will not be permitted. Pipe shall be pulled home in a straight line with all parts of the pipe on line and grade at all times. No side movement or up and down movement of the pipe will be permitted during or after the pulling operation.

Should coupled joints of pipe be out of line or off grade, they shall be removed one joint at a time and brought to the proper line and grade. The lifting or moving of several joints of coupled pipe at one time to close a partially open joint or to fine grade under laid joints of pipe will not be permitted.

Laser Beams: The use of laser Beams for vertical control shall be required provided the Contractor makes available to the Inspector, when requested, a level and rod of sufficient sensitivity to accurately determine differences in elevation between points 300 feet apart with one instrument set-up.

No pipe shall be installed in tunnels except as provided on the plans, or with the permission of the Engineer. If the Contractor finds it necessary to install pipe in tunnels not provided on the plans, he shall submit to the Engineer, prior to commencement of work, a detailed outline of procedures, methods, and use of materials depending on existing soil conditions.

No horizontal or vertical curves shall be permitted in conformance with appropriate regulatory agency requirements.

Before leaving the work unattended, the upper ends of all pipelines shall be securely closed with a tight fitting plug or closure. The interior of laid pipe shall be kept free from dirt, silt, gravel, or foreign material at all times. All pipes in place must be approved before backfilling.

When replacing an existing system in place, Contractor shall maintain screens to prevent the entrance of construction debris into the sewer system.

3. Service Connections (Sanitary Sewer Laterals)

a. Sanitary sewer laterals fittings and appurtenances shall conform to the Sanitary Sewer specifications and shall be installed by the Contractor as specified herein, or as directed by the Construction Inspector or the Engineer and in accordance with the plans. Where the lateral is within the Edwards Underground Recharge Zone then it shall be installed in accordance with details.

b. Service line Installation: All service line installations shall be performed in accordance with this specification. For sanitary sewer mains that are 12” in diameter or smaller, all laterals shall be connected using the appropriate size tee/wye placed in line with the main line. For mains larger than 12", insert-a-tee conforming to ASTM 3034-88 or approved or equal may be used.

c. Connection to the Customers end of the lateral shall be preformed using a "Fernco coupling" or approved equal. All Cleanouts at job sites shall have installed an approved heavy duty sanitary sewer cap

d. Service Connections.

1. Provide reconnections of all existing sewer service laterals to new lines installed or to provide connections of new laterals to existing sanitary sewer

mains. Locate laterals and insure service is not interrupted to homes or other establishments.

2. Wyes, bends, tees, stacks, and other hardware required are to be installed for service laterals as shown on the plans or as directed.

4. **HDPE Pipe Joining**. Bending of HDPE pipe will be done in accordance with the manufacturer's instructions.

5. **Pipe Joint Restraint System for HDPE Pipe**. Restraint devices will be used where ductile iron mechanical joint bell fittings are coupled to plain-end (square-cut) HDPE pipe, to prevent movement of pipe connections. Mechanical joint adapters will be required for the HDPE pipe.

   All restraint devices will be installed in accordance with the manufacturer's instructions.

6. **Coating and Wrapping Underground Steel Pipe.** Exterior surfaces of all steel pipe fittings and specials which are to be installed underground and which are not to be encased in concrete will be cleaned to bare metal by wire brushing with a power driven wire brush, sand blasting, or other approved methods. A prime coat compatible to the polyvinyl tape to be used will then be applied to the pipe. Following the application of the prime coat, the pipe will be wrapped with Scotchrap, Trantex V-10 polyvinyl tape, or approved equal. The tape will not be applied until the prime coat in completely dry.

   The tape will be spirally and tightly wrapped on each section of the pipe with a 50 percent lap. The joint will be protected with tape 8-in. in width on pipe greater than 12-in. in size.

   Each section of pipe will be cleaned, primed, and wrapped to within 6-in. of each end. The priming and wrapping will be completed, and the bare pipe wrapped with tape lapped 3-in. over the originally taped sections.

7. **Protective Coating and Wrapping on Joints.** All bolts and nuts installed for underground service on cast-iron mechanical joint fittings and other ferrous metal appurtenances will be packed in an approved asphaltic material after installation. After the joint has been made and bolts drawn to proper tension, the joint including glands, flanges, bolt heads, and nuts will be packed in asphaltic materials such as Talcote, GS-722, or approved equal, to a minimum thickness of 1-in. over all surfaces. Coating and wrapping of joints will be considered subsidiary to the installation and will not be paid for directly.

F. Manhole Construction. Manhole construction is to be in accordance with Item 465, "Manholes and Inlets", and as specified herein.

Footings or bases of manholes shall be a minimum of 6 inches in depth below the bottom of the pipe.

1. All invert channels of manholes are to be constructed and shaped accurately so as to be smooth, uniform and cause minimum resistance to flow. The bench is to be

finished smooth with a slope of 1/2-in./ft. from the manhole walls to the edges of the invert. The top half of all sewer pipes within the invert channel or bench zone are to be removed flush to the inside manhole walls.

2. Joints on sewer pipes are not to be cast or constructed within the wall sections of manholes.

3. Concrete cradles are not required for new pre-cast manholes. Concrete cradles are to be provided for all influent and effluent pipes on new monolithic manhole and sewer pipe systems. Concrete cradles are to extend beyond the outside walls of the manhole a minimum of 36-in.

On new monolithic sewer manhole and pipe systems and new pipe systems connecting to existing manholes, pipes entering a manhole above the lowest sewer are to project 2-in. from the inside wall. Such pipes are to be installed with a joint a minimum of 6-in. and a maximum of 18-in. from the outside manhole wall. A concrete cradle is to be provided for the pipe extending from the manhole wall a minimum distance of 36-in.

4. Where connections to existing manholes are required, the adjacent pipe bedding is to be prepared to proper grade, the existing manhole neatly cut and the new pipe inserted so that the end is projecting 2-in. from the inside wall. The invert is then to be reshaped to properly channel new flows. Debris of any kind is to be kept out of new or existing manholes or mains.

5. Voids between exterior pipe walls and manhole walls at all pipe connections in manholes are to be filled with a non-shrink grout, concrete or mortar as approved or as shown on the plans and inspected prior to backfilling.

6. Monolithically Poured Concrete Manholes. Wall thickness of the manhole is not to be less than 6-in. The structure is to be poured in a manner to produce dense, compacted walls free of honeycomb surfaces throughout the pour. The base is to be poured monolithically with the walls to the manhole.

a. Concrete: All concrete shall conform to the provisions of "Concrete (Class A)", or shall be of the class as noted on the plans.

b. Reinforcing Steel: All reinforcing steel shall conform to provisions of "Reinforcing Steel", Item No. 440.

c. Membrane Curing Compound: All membrane curing compound shall conform to the provisions of "Membrane Curing", Item No. 305, of the City of San Antonio Specifications.

d. Base Diameter: The minimum base diameter shall be 8 inches greater than the outside diameter of the manhole.

e. Cold Joints: A cold joint will be allowed should the manhole invert depth exceed 12 feet. One joint will be allowed per each 12 feet of depth and that joint shall be approved by the Engineer.

f. Backfill: No backfill shall be placed around the manhole until 24 hours after the pour has been completed. Flowable fill shall be used from the base of the manhole to 1 foot below the cone section or otherwise as authorized by SAWS. Backfill for the cone section of the manhole shall conform to the provisions of "Secondary Backfill", Section 2.T.3.

7. Throat rings shall be mortared between all bearing surfaces sufficient to provide a minimum, in place, mortar thickness of ¼ inch. No more than 4 throat rings may be used on any manhole or no more than 21 inches from the top of the cone to the top of the ring and cover.

8. Manhole Ring Encasement. All manhole rings are to be encased with non-reinforced Class B concrete, except for manholes in existing or new roadways. Manhole ring encasements are to extend 6-in below the top of the cone and have a minimum thickness when measured at the manhole ring of 1-ft. The surface of the encasement is to be 4-1/2-in. below the top of the manhole ring as shown on the plans or as approved.

9. Where manholes are constructed in existing or proposed roadways and where directed or shown on the plans, the exterior exposed surfaces of the ring, mortar, throat rings, and manhole surface are to be coated with a 1/8-in. minimum thickness of Trowel Mastic No. 710-23 asbestos fiber as manufactured by Flintkote, or equal prior to placement of concrete.

G. Manhole Rehabilitation. Described are procedures for cleaning, preparation, application, and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementious mix to form a monolithic liner of a minimum 1/2-in. thickness, with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendation and as per this specification, which includes:

- the removal of any loose and unsound material,
- cleaning of the area to be restored with high pressure water,
- repair and filling of voids,
- repair and sealing of invert and benches,
- elimination of active infiltration prior to making the application, and
- spray application of a cementious mix to form a structural or structurally enhanced monolithic liner.

1. Certification. Manufacturer shall certify that applicator has been trained and approved in the handling, mixing and application of the products to be used. Equipment to be used for applying the products by the Applicator shall be certified and approved by the Manufacturer. Five recent references of Applicator indicating successful application of proposed liner on projects of similar size and scope shall be submitted by Contractor.

2. **Surface Preparation.** Proper surface preparation procedures must be followed to ensure adequate bond strength to any surface to be coated. Applicator shall inspect all surfaces specified to receive a liner prior to surface preparation. Applicator shall notify Owner of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the repair mortar or liners. Concrete that is not sound or has been damaged by chemical exposure shall be removed to a sound, concrete surface. All containments, including: All oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed. Surface preparation methods should be based upon the condition of the substrate and the requirements of the liner to be applied.

   Surface to receive liner shall be cleaned and abraded to produce a sound concrete surface with adequate profile and porosity to provide a strong bond between the protective coating and substrate. High pressure cleaning with a minimum of 4,000 psi and 4 gallon per minute using a rotating pencil nozzle, shall be used to clean and free all foreign material within the manhole. Detergent water and cleaning or muriatic acid shall be used when grease and oil are present. All materials resulting from the cleaning of manhole shall be removed prior to application of coating.

   Active water infiltration shall be stopped by using a cementious water plug or hydro-active grout such as Strong-Seal Strong Plug, Quadex Hydra-Plug or approved equal which is compatible with the specified coating. Prepared surfaces should be tested, after cleaning but prior to application of the coating, if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.

3. **Product Handling and Rehabilitation Conditions.** Protective coating materials are to be handled according to their material safety data sheets. Materials are to be kept dry, protected from weather and stored under cover.

   Repair and under-coat materials must be accepted and approved by the protective coating manufacturer for compatibility with the specified liner and shall be used to fill voids, structurally reinforce and rebuild surfaces, etc., as determined necessary. The Engineer shall determine type of manhole rehabilitation to be used according to the following:

   Condition. The manhole is assured to be exhibiting severe structural fatigue and collapse is imminent. Conditions indicating this degree of deterioration would be distortion beyond 10 percent, severe corrosion (exposed reinforcing), or large section (greater than 30 percent) of the structure is missing. An approved structural liner followed by a compatible approved non-structural (sulfate resistant) protective liner shall be used to rehabilitate the manhole. A letter from the manufacturer will be submitted certifying the compatibility of the structural liner with the corrosion resistant protective coating.

4. **Liner Application.** Application procedure shall conform to the recommendations of the liner manufacturer, including materials handling, mixing, environmental controls during application, safety and equipment. The liner application equipment

shall be specifically designed to accurately apply the specified liner material and shall be regularly maintained and in proper working order. The liner material must be applied by a Certified Applicator of the liner manufacturer. The liner shall be applied to minimum thickness or as specified according to the Owner's requirements and Manufacturer's recommendations. Temperature of the surface to be coated shall be maintained between 40° F and 120° F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures exist, care should be taken to apply the liner when the temperature is falling versus rising (late afternoon into evening versus early morning into afternoon).

5. **Warranty.** Contractor shall warrant to the Owner all work against defect in materials and workmanship for a period of 2 years, unless otherwise noted, from the date of final acceptance of the project. Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in material or workmanship which may develop during said 2 year period and any damage to other work caused by such defects for the repairing of same, at their own expense and without cost to the Owner.

H. Cleaning Manholes and Mains. The sanitary sewer lines and structures that are to be rehabilitated shall be cleaned using mechanical, hydraulically propelled or high velocity sewer cleaning equipment. The cleaning process shall remove all grease, sand, silts, solids, debris, etc. from each sewer segment, including the manholes. Selection of cleaning equipment and method for cleaning shall be based on the condition of the sanitary sewer mains at the time work commences and will be subject to approval. All cleaning equipment and devices shall be operated by experienced personnel. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted through the improper use of the cleaning process or equipment. Any damage done to a sewer by the Contractor shall be repaired by the Contractor at the Contractor's expense to satisfaction. Cleaning shall also include washing of the manhole wall by high pressure water jet.

1. **During Construction the Contractor Shall:** Keep the work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish.

   Keep dust generating areas wetted down.

   Provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.

   Dispose of waste, debris and rubbish off site at legal disposal areas.

   Remove and dispose of all excess or waste materials, debris and rubbish from the site, structures and all facilities at the end of working hours.

   The Contractor, when instructed, will be required to demonstrate the performance capabilities of the cleaning equipment proposed for use. If the results obtained by the proposed sanitary sewer cleaning equipment are not satisfactory, the Contractor

shall use different equipment or attachments, as required, to meet specification. More than one type of equipment or attachments may be required at a location. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam or suction shall be constructed in the downstream manhole in such a manner that all solids and debris are trapped for removal.

Whenever hydraulically-propelled cleaning tools which depend upon water pressure to provide their cleaning force, or any tool which retard the flow of water in the sanitary sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved. Any damage of property, as a result of flooding, shall be the liability and responsibility of the Contractor. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed or used when there is a fire in the area. The Contractor shall be responsible for obtaining the water meter and all related charges for the set-up, including the water usage bills from respective water purveyor agency. All expenses shall be considered incidental to the cleaning of the existing sanitary sewer mains.

2. **Hydraulic Cleaning.** Hydraulic propelled devices which require a head of water to operate must utilize a collapsible dam. The dam must be easily collapsible to prevent damage to the sewer, surrounding property, etc. When using hydraulically propelled devices, precautions shall be taken to insure that the water pressure created does not cause damage or flooding to public or private property. The Contractor shall not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or laterals. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.

3. **High Velocity Cleaning.** Cleaning equipment that uses a high velocity water jet for moving debris shall be capable of producing a minimum volume of 50 GPM with a pressure of 1,500 psi for the sanitary sewer line and 3,500 psi for the (manhole) structure at the pump. Any variations to this pumping rate must be approved, in advance. To prevent damage to older sewer mains and property, a pressure less than 1500 psi can be used. A working pressure gauge shall be used on the discharge of all high pressure water pumps. The Contractors shall use, in addition to conventional nozzles, a nozzle which directs the cleaning force to the bottom of the pipe for sewers 18-in. and larger. The Contractor shall operate the equipment so that the pressurized nozzle continues to move at all times. The pressurized nozzle shall be turned off or reduce anytime the hose is held or delayed in order to prevent damage to the line.

4. **Mechanical Cleaning.** Mechanical cleaning, in addition to normal cleaning when required, shall be with approved equipment and accessories driven by power winching devices. The Contractor shall submit the equipment manufacturer's operational manual and guidelines, which shall be followed strictly, unless

modified. All equipment and devices shall be operated by experienced operators so that they do not damage the pipe in the process of cleaning. Buckets, scrappers, scooters, porcupines, kites, heavy duty brushes, metal pigs and other debris removing equipment and accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machines. The use of cleaning devices such as rods, metal pigs, kites, porcupines, root saws, snakes, scooters, sewer balls and other approved equipment, in conjunction with hand winching device, or gas, electric rod propelled devices, shall be considered normal cleaning equipment.

I. Jacking, Boring, Open Cut or Tunneling Pipe.

1. Jacking: Suitable pits or trenches shall be excavated for the purpose of jacking operations for placing end joints of the pipe. When trenches are cut in the side of embankment, such work shall be securely sheeted and braced. Jacking operations shall in no way interfere with the operation of railroads, streets, highways or other facilities and shall not weaken or damage such facilities. Barricades and lights shall be furnished as directed by the Engineer to safeguard traffic and pedestrians.

The pipe to be jacked shall be set on guides to support the section of pipe being jacked and to direct it in the proper line and grade. Embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the opening thus provided. The excavation for the underside of the pipe, for at least ⅓ of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than 2 inches may be provided for the upper half of the pipe.

The distance that the excavation shall extend beyond the end of the pipe shall depend on the character of the material, but it shall not exceed 2 feet in any case.

Generally, the pipe shall be jacked from downstream end. Permissible lateral or vertical variation in the final position of the pipe from line and grade will be as shown on the plans or as determined by the Engineer.

Any pipe that cannot be repaired to its original condition or is damaged in jacking operations shall be removed and replaced at the Contractor's expense. Jacking pits shall be backfilled immediately upon completion of jacking operations.

Excavation for "Boring" pits and installation of shoring shall be as outlined under "Jacking." Boring operations may include a pilot hole which shall be bored the entire length of crossing and shall be used as a guide for the larger hole to be bored. Water or drilling fluid may be used to lubricate cuttings. Variation in line and grade shall apply as specified under "Jacking."

2. Tunneling: Tunneling may be used when the size of the proposed pipe would make the use of tunneling more satisfactory than "Jacking" or "Boring." The excavation for pits and the installation of shoring shall be as specified under "Jacking." The

lining of the tunnel shall be of the material shown on the plans. Access holes for grouting annular space shall be spaced a maximum of 10 feet.

3. Joints: Joints for pipe for "Jacking," "Boring," or "Tunneling," shall be as specified in "Sanitary Sewers", or as shown on the project plans or shop drawings as per pipe manufacturer's recommendation.

4. Grouting of Bores or Tunnels: Annular Space between casing pipe and limits of excavation (borehole) shall be pressure grouted, unless otherwise specified on the plans.

J. Concrete Encasement, Cradles, Saddles and Collars.

1. **Concrete Encasement**. When concrete encasement is shown on the plans or when directed, the trench is to be excavated and fine graded to a depth conforming with the details and sections shown on the plans. The pipe is to be supported by pre-cast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation. Encasement concrete is to be placed to a depth and width conforming with details and sections shown on the plans.

2. **Concrete Cradles**. When concrete cradles are shown on the plans or when directed, the trench is to be prepared and the pipe supported in the same manner as described in Concrete Cradles, of this Section. The cradle constructed in accordance with details and sections shown on the plans. . Strap/Tie Downs shall be No. 4 rebar diameter minimum of better as determined by Water System Inspector.

3. **Concrete Saddles.** When shown on the plans or when directed, pipe to receive concrete saddle is to be backfilled in accordance with Section 3.D. of this specification to the spring line and concrete placed for a depth and width conforming with details and sections shown on the plans.

4. **Concrete Collars**. When shown on the plans or when directed, concrete collars are to be constructed in accordance with details and sections shown on the plans.

K. Adjust or Abandon Manholes. Existing manholes are to be adjusted or abandoned in accordance with Item 479, "Adjusting Manholes and Inlets", and as specified herein.

1. Manholes shall be lowered below subgrade before placing base materials and openings shall be protected by hatch covers.

Existing manhole rings and covers which are determined by the SAWS Inspector to be in an unacceptable condition, will be removed and replaced with new rings and cover. Contractor shall take all necessary measures to prevent damage to existing or new rings, cover, or cone from equipment and materials used in or taken through the work area. If an existing or new manhole cover, ring, or cone is damaged by the Contractor, it shall be replaced (as directed by SAWS inspector) by the Contractor

at his expense. (the contractor shall upgrade the cone and ring to meet 30 TAC 217.55 (2)(2)(a)

Manholes shall be adjusted after the base material has been laid and before placing of the surface course. Manholes that are going to be adjusted on an existing surface course not being replaced will be in accordance to the City of San Antonio Utility Excavation Criteria Manual Standard Drawing No. 8.8. All manholes shall then be raised, or lowered a sufficient height so as to be level with the finished surface course. Adjustment in height will be made by addition or removal of "throat rings" above the manhole "cone" where feasible. A minimum of two and a maximum of six throat rings shall be used at each manhole. Material excavation from around the manholes shall be replaced with concrete in accordance with Standard Drawings, and select materials from the excavation (as shown on the plans or specified by the SAWS). All excess materials shall be disposed of by the Contractor at his own expense an in an approved location.

2. Manholes existing on sewer lines replaced by new sewer piping and which are no longer needed for the revised sewer network are to be classified as "Abandon Manhole". Work required on an abandoned manhole is to consist of installing a permanent concrete plug on all pipes within the manhole, removing the top of the manhole to an elevation of 2-ft. below proposed subgrade or existing grade, whichever is the lower elevation, and backfilling the manhole with a grout material as specified. The ring and cover of the manholes are to be removed and delievered to Sanitry Sewer Owners facility designated by the Engineer. If directed, drainage holes are to be drilled in the bottom of manhole walls prior to backfilling.

L. Cut and Restore Pavement. Where sewers must be installed in streets or other paved areas that are going to remain, the work is required to be in accordance with Item 400, "Excavation and Backfill for Structures".

When allowed by the construction sequence shown on the plans or as directed, a "Temporary Concrete Cap" of the depth and class of concrete as shown on the plans or as directed may be used in lieu of a permanent repair.

M. Concrete Sidewalks, Driveways, Curbs, Medians and Islands Replacement. Existing concrete sidewalks, driveways, curbs, medians and islands required to be removed and replaced solely for sewer installation are to be a part of sewer work. Removal is to be in accordance with Item 104, "Removing Concrete". Replacement is to be in accordance with the plans and with Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter", Item 530, "Intersections, Driveways and Turnouts", Item 531, "Sidewalks", and Item 536, "Concrete Medians and Directional Islands".

Any work done due to damage to curbs, sidewalks, driveways, islands or medians outside the limits shown on the plans or approved in advance will not be measured for payment but is to be restored at the Contractor's expense.

N. Removing and Replacing Chain-Link and/or Wire Fence. Existing chain link or wire fences required to be removed solely for sewer installation is to be replaced as part of the sewer work to a condition comparable to that at removal. The existing fence materials may be reused if they are not damaged during removal. Any removal or damage to

existing fences outside the limits shown in the plans or not approved in advance will not be measured for payment but is to be restored at the Contractor's expense.

O. Abandon Sewer Lines. When shown on the plans, existing sewer lines, including any washouts and voids, are to be abandoned by injecting the line with a flowable cement based grout of at least 100 psi. The grout mix design and method of installation are to be approved prior to beginning operation.

Abandonment of sanitary sewer lines shall be accomplished by installing the grout material with sufficient pressure and in numerous locations. The method of installation shall be able to meet the requirement of completely filling the existing sanitary sewer line and any voids adjacent to the sanitary sewer line. The method shall adequately provide for the removal and legal disposal of existing sewer materials in the system. The method shall provide for the release of air. When intermediate points are required to be constructed for the abandonment of the system, they shall be a part of the abandonment project process.

Sanitary sewer pipes smaller than 15" in diameter are generally not required to be grouted, unless it is required by the plans. Pipes to be abandoned shall be grouted only if required by the plans and payment as per these specifications is provided.

P. Television Inspection. Immediately upon cleaning the sanitary sewers, all new sewer mains are to be televised and videotaped to determine the condition of the line and to locate service connections. The Engineer and Inspector and Contractor will observe the TV inspection in progress. The Contractor is to submit 1 copy of a color DVD of the recordings and logs of the televised inspection to the Engineer.

The Contractor shall not be allowed to float the camera. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction. At that time, and prior to proceeding, the Contractor shall contact the Inspector. If the length of sewer line cannot be televised because of obstructions, the Contractor shall clean the system as is necessary. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended, payment shall be made based on the actual televised length, and the remaining televising of the sewer line shall be continued upon successful correction of the blockage by the Contractor at his expense. No additional payment shall be made for additional setups required due to obstructions encountered during televising..

The Contractor is solely responsible for any damage of sewer mains as a direct result of televising operations. Any repair shall also be the responsibility of the Contractor. The method(s) used for securing passage of the camera are at the discretion of the Contractor, as approved by SAWS. No separate and/or additional payment will be made for any excavation, man entry, or any other method which may be required to retrieve video equipment that may have been hung up, destroyed, and/or lost during the operation.

1. Post-Construction Television Inspection. TV inspection is to be done 1 manhole (structure) section at a time The flow in the section being televised shall be bypassed if the line is in service and the flow exceeds 25% of the internal pipe diameter. When the

depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, the flow shall be reduced to allowable levels by temporarily plugging or blocking the flow or bypass pumping, as approved

2. **Obstructions and Hindrances.** All sections of the new sewer main are to be televised. Contractor is to insure the main is clean and clear of obstructions prior to performing televising activities. Any abnormalities such as, but not limited to, misaligned joints, cracked/defected pipe, rolled gaskets, shall be repaired by the contractor at his expense. Sections requiring repair shall be re-televised to verify condition of repair. No additional payment is to be made for additional set-ups required or delays due to repairs or removal of obstructions.

3. **By-Pass Pumping.** The Contractor shall perform bypass pumping operations in accordance with Specification.

   The Contractor shall furnish all labor, supervision, tools, equipment, appliances, and materials to perform all operations in connection with bypass pumping of sewage flow for the purpose of preventing interference with the televising of the sanitary sewer manholes and mainlines as well as providing reliable sewer service to the occupants of the buildings being served.

   The Contractor will be required to provide adequate pumping equipment and force mains in order to maintain reliable sanitary sewer service in all sanitary sewer lines involved in this project. The Contractor shall notify the Inspector should a surcharge occur during the televising process which results in overflows of sewage. In case of bypass equipment failure, the Contractor shall discontinue work and release sewer flows until such time as equipment failure is corrected. The location of the pump(s), force main(s), and discharge points shall be approved by SAWS. Under no circumstances shall the flow be interrupted or stopped, such that damage is done to either private or public property, or sewage flows or overflows into a storm sewer or natural waterway

   The Contractor shall provide bypass pumping of sewage around each segment(s) of pipe that is to be televised and shall be responsible for all required bulkheads, pumps, equipment, piping, and other related appurtenances to accomplish the sequence of pumping. A qualified person shall man the pumps, on-site, at all times during the bypassing procedure

   All piping, joints, and accessories shall be designed to withstand the maximum bypass system pressure, or a minimum of 50 psi, whichever is greater. During bypass pumping, no sewage shall be leaked, dumped, or spilled into or onto any area outside of the existing sanitary sewer system. When bypass pumping operations are complete, all piping shall be drained into the sanitary sewer prior to disassembly. The Contractor shall demonstrate that the pumping system is in good working order and can successfully handle flows during cleaning and televising operations, prior to commencing with the cleaning and televising of the system.

4 **Video Equipment Operations.** The Contractor is to be responsible for the TV inspection equipment having an accurate footage counter which displays on the monitor the distance of the camera from the centerline of the starting manhole. The camera height is to be adjusted such that the camera lens is always centered (1/2 ID or higher) in

the pipe being televised. In no case will the television camera be pulled or propelled through the line at a speed greater than 40-ft. per minute.

5. **Post Repair TV Inspection**. Upon completion of any repairs required by the Inspector Engineer, the Contractor will re-televise the sewer and submit these DVDs to the Inspector. These DVDs are to be permanently labeled as described in Section 2.K. and are to be used as a portion of the acceptance criteria. This post repair-TV inspection is to be done to the satisfaction of the Engineer, and is subject to the same acceptance criteria as the post construction-TV inspection DVDs. Post repair-TV inspection is to be provided at the Contractor's expense.

6. **Negotiability of Sewers.** The Engineer makes no guarantee that all of the sanitary sewer mains proposed to be TV inspected are clear for the passage of a camera.

No separate or additional payment will be made for any excavation, man entry or any other method, which may be required to retrieve video equipment that has been hung up, destroyed or lost during the televising operation.

Q. Reconstruct Manholes. The reconstruction of existing manholes, all types and sizes, will include the replacement of manhole ring and covers, the replacing of existing cone, manhole section or sections required, regardless of the type shown on the plans, and as specified herein.

Manholes will be raised or lowered by replacing the existing cone and manhole sections, as required for installation, to the finished surface. All openings will be protected by hatch covers or steel plates, as needed. Flowable fill shall be used from the base of the manhole to 1 foot below the cone section.

Reconstructed manholes will be cleaned of any debris as accepted by the San Antonio water System's Inspector. If a new manhole cover, ring, or reconstructed manhole is damaged by the Contractor, it will be replaced, as directed by the San Antonio Water System Inspector, by the Contractor, at his expense.

Material excavation from around the manholes will be replaced with concrete in accordance with details shown on the plans, and select materials from the excavation. All excess materials of any type will be disposed of by the Contractor at his own expense and at an approved location.

Existing monolithic manholes will not be reconstructed but replaced.

R. Air Release Assembly. Air release valves and appurtenant items will be installed at the locations shown on the plans unless otherwise directed.

S . Anchorage and Blocking. Suitable reaction blocking or anchorage will be provided at all locations specified on the plans. Anchor blocks will be constructed solidly behind the fitting and symmetrical with the axis of resultant thrust except where this is not possible as in the case of gravity anchorage for vertical bends. Special ties and anchor fittings may be utilized in conjunction with blocking when shown on the plans or as directed.

Concrete blocking for mains will be a minimum of 3000 psi placed between solid ground and the fitting except as otherwise shown on the plans. The area of bearing in contact with solid ground will be that shown on the plans or as directed.

All thrust blocking placed in conjunction with mains and appurtenances constructed in Pressure Zones (formally known as Service Levels) 9 through 15 shall be in accordance with Standard Drawings DD-839 Series. In all cases, the design of thrust blocking shall be of sufficient size to withstand a soil pressure of 3000 psf, unless specified otherwise in the job plans or specifications. The maximum soil pressure value that will be allowed for the design of thrust blocking shall be 5000 psf. When soil pressure bearing values of 4000 psf or 5000 psf are recorded for design of thrust blocks, copies of soil tests made for determining the bearing value of the soil in question shall be submitted to the Engineering for verification.

The blocking shall be placed so that pipe and fitting joints will be accessible. Pipe polywrap shall be placed between the pipe or fitting and the concrete.

The reaction block on the unused branch of a fitting shall be poured separately from the block across the back of the fitting. If they are poured simultaneously, a rigid partition shall be placed between the blocks.

Valves 12 inches or larger in size shall be supporte4d on a concrete pad extending vertically from 12 inche3s below the bottom of the valve to the lower quarter point of the hub and laterally from face to face of hubs and transversely form wall to wall of the trench.

T. Sand Backfilling of Cross Trenches and Open Holes. Air release valves, copper tubing, meter boxes, or other specials will be backfilled with pit run sand which is free from clay lumps, organic material and other deleterious substances, and will be thoroughly consolidated by saturating with water, unless otherwise directed. The use of mechanical tamping equipment for compaction of backfill will not be permitted at such locations. Disposal of surplus excavated material and placement of sand will be considered subsidiary to trenching and backfilling and will not be paid for directly.

U. Rehabilitation of Lines.

1. Special Construction Conditions. (Rehabilitation of Lines)

a. For Work activities impacted by the size and shape of the existing pipe, the Contractor is herein informed that the pipe is not exactly circular and a normal diameter has been approximated.

b. On lines designated for a combination of repair and other specified rehabilitation work, the repair shall be accomplished before the other rehabilitation work.

c. Due to the age of the sanitary sewer lines to be rehabilitated, location of sewer lines and manholes in public right-of-ways, and soil conditions may arise which have not been anticipated by the plans and specification. In such a case, the Contractor shall submit a proposed construction method to solve specific

situations problems not covered by the plans and specifications for approval prior to proceeding with the proposed work.

d. If, the specified method of rehabilitation is not the most effective method available to obtain the desired results, the Engineer reserves the right to propose an alternate method of rehabilitation.

e. Once work has begun at a specific location, the Contractor shall diligently pursue the work to be done until the rehabilitation is complete. The Contractor shall schedule work such that sewer rehabilitation at each site is complete before moving to another location. Should the work not progress on schedule, the Engineer may direct the Contractor to dispatch additional crews or equipment to the jobsites. The time limit for completion of this work will be strictly enforced. Such direction, shall not be cause for additional payment to the Contractor and will not serve as the basis of a claim for acceleration.

2. General. All pipe to be used shall have a corrosion resistant inner surface. All pipes, joints, and fitting supplies shall conform, as a minimum, to the requirements of any and all applicable ASTM or AWWA standard specifications for such procedure. A certificate of "Compliance with Specifications" shall be furnished for all piping materials supplied.

The interior and exteriors surfaces of the pipe shall be free from pinholes, cracks, pits or delaminations detrimental to the intended use of the product. No pipe having apparent holes or openings which could permit the passage of water or gases through the pipe wall will be installed.

Any visible repairs to the pipe performed by the manufacturer prior to shipment to the job site shall be recorded on a pipe inventory log and submitted to the Engineer. The log shall reference the repaired unit as per the manufacturer's pipe numbering system.

On-site repairs will not be allowed without approval. All repairs shall be accomplished as per the manufacturer's recommended procedures, and must be done by an approved manufacturer's certified repairman.

Repairs on the outside surfaces shall be allowed if the remaining thickness of the wall laminate is greater then 80 percent on minimum wall thickness.

Pipe shall be field connected with joints meeting the performance requirements, as a minimum, of any applicable ASTM or AWWA Standard Specifications for such products so as to maintain water tightness. Joint materials shall be chemically resistant to the fluids to be conveyed and gases generated by the sewer. Joint shall provide a Leak-proof seal when deflected as per the manufacturer's recommended maximum deflection or as per the applicable ASTM or AWWA Standard Specification and shall have a rating equivalent to the pipe itself.

Stiffening ribs or rings within the lining inner diameter will not be allowed. Pipe shall have a smooth inner lining.

The Contractor shall provide sufficient data from the pipe manufacturer to demonstrate that the pipe supplied provides a 50 year service life for the various loading conditions. This data shall be submitted as required.

A higher pipe stiffness will be acceptable if recommended by the manufacturer to meet the performance specifications in a particular situation.

3. **Equipment.** The Contractor shall provide the Engineer with satisfactory evidence, upon request, that the equipment to be used on the rehabilitation work is adequate, has functioned effectively on previous similar work, and any damage to sanitary sewer lines, appurtenances and surrounding property caused by the use of the equipment will be repaired or replaced by the Contractor at the Contractor's expense and to the satisfaction of the Engineer.

4. **Sewer Flow Control.**

   a. Flow through the sewer, as measured at the manhole, shall not exceed 30 perent of pipe diameter during any construction operations.

   Flow depths above the maximum allowable requirements shall be reduced to within allowable limits by plugging or bypass pumping as required.

   b. Wastewater flow shall be blocked with a pneumatic sewer plug inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of flow can be released as required. The Contractor shall station an observer at the manhole immediately upstream of the plug during the entire period that the line is plugged to constantly watch for flooding and sewage backup of upstream lines. Full flow shall be restored by plug removal as soon as possible after work has been completed.

   c. When flow in a sewer line is plugged or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property served by the sewers involved.

   Contractor shall release flow or install a bypass pump should surcharging result in sewage bypassing into a storm sewer through indirect or direct cross connections between adjacent sanitary and storm sewer.

   d. No sewer main shall be plugged during Contractor non-working hours. A temporary tie-in shall be made between the end of the new and existing main. Plugs at manholes shall be removed to allow the flow of sewage until work is resumed.

5. **By-Pass Pumping.**

   a. Where required, the Contractor shall furnish all labor, supervision, plant equipment, appliances and materials to perform all operations in connections with by-pass pumping of sewage for the purpose of preventing interference

with the rehabilitation of the sanitary sewer system and providing reliable sewer service to the occupants of the buildings being served.

b. The Contractor shall notify the Engineer and the property owners at least 72 hours in advance of work which will affect their business or residence sewer service. The Contractor shall coordinate with all property owners to ensure that no damage will be caused to their property during any and all sewer rehabilitation work.

6. **Pre-Installations.** Prior to commencement of field operations, the Contractor shall furnish, for approval, a detailed schedule of all planned operation sequences and any other procedures that may be necessary to complete the job. Additionally, all inner diameter dimensions and distances between existing manholes shall be verified by the contractor prior to ordering and manufacturing rehabilitation materials.

7. **Pumps and Force Mains.** The Contractor shall have, on the project site, adequate pumps and force mains with backup systems, as specified in the Item "Sanitary Sewer (By-Pass Pumping)", in order to maintain reliable sanitary sewer service in case of any emergency that may arise during the rehabilitation operations.

8. **Safety.** The Contractor shall conduct all operations in strict accordance with all applicable federal, state and local safety codes and statues and shall be fully responsible and obligated to maintain procedures for the safety of all work, personnel and equipment involved in the work.

   Particular attention is drawn to those safety requirements involving work on an elevated platform or entry into a confined space.

   The Contractor is advised that sewage encountered may contain harmful viruses and bacteria any may be detrimental to the health of workers. Utmost care is urged to prevent contraction of potentially dangerous diseases. The existing line is known to contain quantities of hazardous gases and caution is advised.

   The areas occupied by workmen shall be protected by the best available devices for the detection of oxygen depletion and lethal and combustible gases. Such devices shall be frequently tested to assure functional capability.

   All safety measures, including but not limited to safety personnel, first aid equipment, ventilating equipment and safety equipment are considered the responsibility of the Contractor. No direct payment will be made for these measures.

   No sewer main trenches, manhole excavation or any other opening will be left open during non-working hours without proper protection.

9. **Pre-Rehabilitation Cleaning.** It shall be the responsibility of the Contractor to remove all loose debris which is located within the sewer pipe. Payment for this work will not be made for separately, but will be considered subsidiary to this Item.

10. **Pre-Rehabilitation Inspection.** Inspection of sewer pipe shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television inspection. The interior of the pipe shall be carefully inspected to determine the location of any conditions which may prevent proper installation of the rehabilitation materials. A videotape and suitable log shall be kept for later reference by the Engineer and the Contractor. Payment for this work will be made for under the Item "Sanitary Sewer (Television Inspection)".

11. **By-Passing Sewage.** When required for acceptable completion of a rehabilitation task, the Contractor shall provide for sewage flow maintenance around the section or sections of pipe designated for rehabilitation. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Payment for this work will be made under the Item "Sanitary Sewer – By-Pass Pumping".

12. **Line Obstructions.** If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, such as heavy solids, dropped joints, protruding service connections or collapsed pipe that will prevent completion of the rehabilitation process, a repair excavation shall be made by the Contractor to uncover and remove or repair the obstruction. Payment for this work will be made under the Item "Sanitary Sewer – Repair".

13. **Sewer Service Line Reconnections.** Service line reconnections will not be required as part of the rehabilitation of sanitary sewer lines. All existing laterals shall be connected to the new, adjacent sewer main.

14. **Utilities.** The Contractor shall contact the appropriate utility companies to locate the existing underground facilities at the job site 48 hours prior to the beginning of construction.

    The Contractor shall accommodate site specific utility locations and construction constraints. It is the responsibility of the Contractor to locate, protect and work around existing utility conditions.

15. **Contractor Mobilization Area.** The Contractor shall be solely responsible for providing all storage sites, access to the sites or temporary right-of-way which may be required for proper completion of work.

16. **Wet Out.** The Contractor shall designate a location where the tube will be impregnated ("wet out") with resin using distribution roller and vacuum to thoroughly saturate the tube felt fiber prior to installation. The Contractor shall allow the Engineer to inspect the materials and wet out procedure. A catalyst system compatible with the resin and tube shall be used.

17. **Insertion.** The wet out tube shall be inserted through an existing manhole or other approved access by means of an inversion process and the application of a water column sufficient to fully extend it to the next designated manhole or termination point. The tube end shall initially be turned out and attached to a platform ring or standpipe. The inversion water column will be adjusted to be of sufficient height to

cause the impregnated tube to invert from manhole to manhole and hold the tube tight against the existing pipe wall, produce dimples at side connections, and flared ends at the manholes. The Contractor shall not be allowed to pull the wet out in place unless the Contractor can prove that this method of installation does not result in tears or abrasion of the tube or uneven redistribution of the resin.

18. **Curing.** After the insertion is completed, the Contractor shall supply a suitable heat source and water recirculation system capable of delivering hot water uniformly throughout the section to effect a consistent cure of the resin. The curing temperature shall be that recommended by the resin or catalyst system manufacturer. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another gauge shall be place between the impregnated tube and the invert of the original pipe at the manholes to determine the temperature during the resin curing process. Initial cure shall be considered completed when the exposed portions of the CIPP appear to be hard and the remote temperature sensing device indicates the cure period to be of adequate duration as recommended by the resin or catalyst system manufacturer and modified for the inversion process.

19. **Cool Down.** The Contractor shall cool the hardened CIPP to a temperature below 100° F before relieving the water column. Cool water may be added to the water column while draining hot water from a small hole at the opposite end of the CIPP so that a constant water column height is maintained until cool down is completed. Care shall be taken in the release of the water column so that a vacuum will not be developed that could damage the newly installed CIPP.

20. **Test Period.** The finished CIPP shall be continuous over the entire length of an inversion run and be free, as commercially practical, of visual defects such as foreign inclusions, dry spots, pinholes and delamination. It shall also meet the leakage requirements and pressure tests as specified. During the test period, which is defined as 12 calendar months after acceptance of the work, any defect which will affect the integrity or strength of the CIPP shall be repaired at the Contractor's expenses in a manner approved.

21. **Sealing at Manholes.** The CIPP liner shall make a tight seal at the manhole opening with no annular gaps. Under all circumstances, a 1/2-in. diameter activated Oakum bank soaked in Scotchseal 5600, or approved equal, shall be applied all around for a seal, unless otherwise approved. All large annular space shall be sealed by using activated Oakum soaked in Scotchseal 5600, or approved equal, and later covered with a cementious mortar. This procedure shall be completed before proceeding to the next manhole section. This work shall not be paid for separately, but will be considered subsidiary to this Item.

22. **Installation.**
    - **a.** Insertion Pits. The Contractor shall provide all necessary pits to completely reline the sewers. The location of insertion pits shall be subject to approval. The number of insertion pits shall be minimized. Insertion pits and lateral reconnection pits, if required, shall be constructed to the minimum size

necessary for insertion of sliplining pipe or reconnection of service laterals. All pits shall be constructed with properly applied vertical side support.

b. Pipe Stockpiling and Handling. Pipe and fittings shall be stockpiled in a safe manner at each Contractor staging area or pit location. The stockpiling shall be arranged to cause a minimum of interference to pedestrian and vehicular traffic. When handling sliplining pipe, the Contractor shall take all precautions necessary to avoid damage to the pipe.

Pipe with deep cuts, scratches or gouges shall be rejected and replaced. If the pipe is found to have developed an irregular shape that will not allow pipe joining or insertion without the use of outside forces to bring pipe to a round shape, it shall be rejected and replaced. An irregularly shaped pipe that would necessitate the use of undue force that could cause damage to the pipe or joints shall be rejected and replaced.

23. Liner Pipe Installation.

a. The sliplining pipe installation shall be the responsibility of the Contractor. The Contractor shall adhere to the manufacturer's pipe installation procedures. Sliplining pipe grade shall be maintained parallel to the grade of the sewer being relined. As the work progresses, the interior of the pipe shall be cleared of all dirt and debris.

b. The Contractor shall make all necessary arrangements and provide all necessary equipment to maintain sewage flows at all times. A combination of flow diversion or By-Pass Pumping may be used to control the level of sewage flows during sliplining operations. It may be necessary to increase the weir height in the diversion box and discontinue flow diversion prior to sliplining operations to provide a level of flow conducive to sliplining. The Contractor will divert or reinstate flows only with approval.

c. Sliplining Pipe Insertion. Within the insertion pit, the top half of the exposed pipe is to be removed to the springline. The bottom half is to be left in place, where it shall serve as a cradle for the sliplining pipe. The sliplining pipe shall be pushed into the exiting pipe. A tapered guide may be attached to the leading pipe of each section to be installed to help pipe cleat small obstructions. A push ring shall be used to distribute load as per the manufacturer's recommendations for installation of the sliplining pipe. For each section to be lined, insertion shall be one continuous operation until the planned termination point is reached. Closure in the insertion pit after installation may be accomplished using a long bell closure kit or other methods as approved.

24. Manhole Replacement. In those places where the entrance pit is excavated at an existing manhole, the manhole shall be repaired or replaced with a new manhole conforming to the specifications on manhole construction and in accordance with

Standard Details included in the plans. This work shall be paid under the Item "Sanitary Sewer (Manhole Rehabilitation)".

25. Manholes. After insertion and grouting the sliplining pipe shall be cut out at manholes as detailed. The method of cutting shall be as to leave a smooth, clean, straight edge. Where detailed or required, mild steel ties shall be provided as needed to tie the sliplining to the manhole benching. This work will not be paid for separately, but shall be subsidiary to this Item.

26. Pipe Grade. Pipe grade shall be maintained within the limits shown on the plans. The Contractor shall be responsible for and take all necessary precautions to ensure that no adverse pipe grades result nor collapses of the sliplining pipe occur during grouting operations.

27. Annular Space Grouting. If TV Inspection shows caverns above or around the deteriorated pipe, the Contractor shall take care not to cause the ground to collapse over the deteriorated pipe.

After rehabilitation is in place, the Contractor shall fill the caverns with grout to prevent any future settling or collapse of the existing ground grout mix and grouting pressure shall be as approved prior to placement. Payment for this work will not be made separately, but shall be considered subsidiary to this Item.

28. Testing. The Contractor shall provide to the Engineer and the City of San Antonio a video tape showing the completed work. Such videotape shall be of a quality to permit close-up viewing of the restored taps and the liner. A TV camera with 360° articulating lens shall be utilized to produce such videotape. Similar videotape shall be provided, when requested, during the test period. This work shall be paid for under the Item "Sanitary Sewer (Television Inspection)".

a. Install liner pipe through the existing pipe, including line deflection and curves, and location of insertion pits,

b. Install grout in annular space between liner pipe and existing sewer pipe, including details on proposed grout to be mixed, and

c. Technical data on pipe including information on pipe materials, physical properties and dimensions.

V. Point Repairs

1. General

Locate and replace small lengths of one or more pipe sections where isolated line failure has occurred due to settlement, corrosion, crushing, or separation of joints.

The Saws Engineer may identify potential locations for point repair, but the Contractor is responsible for verifying locations.

Determine the location of service line repairs by smoke testing the manhole section in which the failed pipe is located. The Saws Engineer will authorize the Contractor to make point repairs based on results of smoke testing.

Smoke testing shall not be performed within 24 hours of a rainfall event or if ponded or standing water is present on the ground or in the drainage channels in the area planned for smoke testing.

Smoke testing shall be accomplished utilizing two minimum 1,750 CFM blowers designed specifically for smoke testing of sewers. Place blower on the upstream and downstream manhole of the line section to be tested. Place sandbags in the upstream and downstream manholes to isolate the section being tested and prevent the migration of smoke into sections not being tested. Utilize smoke bombs as necessary to ensure a continuous supply of smoke is provided for the entire duration of the test period.

Determine the location of point repairs by smoke testing or video inspection of the manhole section in which the failed pipe is located. The Saws Engineer will authorize the Contractor to make point repairs.

The Saws Engineer will authorize each point repair after failure points are located. Do not make point repairs without prior authorization of the Saws Engineer. Perform point repairs only on those portions of service lines which are located in an easement or right-of-way; perform no repairs to service lines on private property.

Replace carrier pipe for point repairs unless otherwise directed by Saws Engineer

2. Typical Sequence of Point Repair:

a. Perform pre-installation video inspection, if required, to verify location of sewer line point repairs. Perform service testing between manholes to verify location of service line point repairs.

b. After the location of a point repair, excavate the required length for the point repair.

c. Prior to replacing pipe, determine condition of the existing line on both sides of the point repair by lamping the line at least 10 feet in each direction. Determine whether additional lengths of line (beyond "minimum length" criteria) need replacement. Report need for additional replacement to Saws Engineer and obtain authorization before proceeding.

d. Remove the damaged pipe and replace with new pipe, shaping the bottom of the trench and placing the required pipe bedding so that the grade of the replaced pipe matches the grade of the existing line. Establish proper grade for the pipe being replaced using methods acceptable to the Saws Engineer.

e. Connect the new pipe to existing pipe using flexible adapters. If joints cannot be made watertight using flexible adapters, place waterstop gaskets on each joint and encase in a reinforced concrete collar. Reconnect affected service connections or stacks using full-bodied fittings. No field fabrication of fittings allowed.

f. After completion of point repair, but prior to backfill, perform a smoke test to demonstrate the integrity of the repair, in the presence of Saws Construction Inspector. Test as specified in this specification. Repair and retest sections that fail until repair passes test.

g. Encase exposed pipe in cement stabilized sand

h. Backfill the excavation in accordance with this specification.

i. Perform a post-installation video inspection as specified in, "Television Inspection", of this specification. Point repairs that show offset joints, non-uniform grade, incorrect alignment, excessive deflection or similar conditions are considered defective work. Replace pipe and bedding as required to correct defective work.

3. Abandonment of Point Repair

a. If a pipe is exposed by excavation and found to be in good condition, not requiring a point repair that point repair shall be abandoned. Notify Saws Construction Inspector.

b. If pre-installation video inspection reveals that no point repair is required in a manhole section, point repair shall be abandoned. Notify Saws Construction Inspector.

c. Backfill the excavation, replace pavement or sidewalk, and repair and seed or sod unpaved areas. No separate pay item.

4. Obstruction Removal

a. Remote Device: Remove obstructions identified on video of a sanitary sewer line segment which could cause a non-uniform liner pipe installation or obstruction of the liner during installation. Obtain authorization from the Saws Construction Inspector for obstruction removal with a remote device before proceeding.

b. Use a power-driven cutting device (robotic cutter) to remove protruding taps. Cut protruding taps so that protrusions are no greater than ¾ inch. If a protruding tap cannot be removed by the cutting device, then a point repair may be performed. Obtain authorization from the Saws Construction Inspector before proceeding.

c. To remove other obstructions, use a remote device. Pull or drive the device from manhole to manhole up to a continuous length of 500 feet using a solid steel mandrel, porcupine, root saw, bucket, robotic cutter or similar device to remove the obstruction. Select a device that is adequately sized to remove the obstruction.

d. Excavation: Use excavation as the method of obstruction removal when installation of the liner in the sanitary sewer is in progress. If during the liner insertion operation, a collapsed sewer, off-set joint or other obstruction is encountered which prevents or blocks the passage or insertion of the liner, notify the Saws Construction Inspector for authorization to excavate. To be determined by Design Engineer:

e. Excavate at the point where there is an obstruction. Use a trench safety system as required.

f. Break out the existing sanitary sewer pipe (carrier pipe) as directed by the Saws Construction Inspector. Remove only that amount of material which is causing the obstruction. Remove the minimum amount of carrier pipe.

g. Under such conditions, replacement of the carrier pipe is not required. Do not disturb the existing sewer bedding during excavation. However, if embedment is disturbed during the obstruction removal procedure, place cement-stabilized sand or crushed stone beneath the liner. No Separate pay item.

h. When the liner is completely in place, encase it with crushed stone or cement-stabilized sand.

W. By-Pass Pumping.

The Contractor shall provide bypass pumping of sewage and wet weather flows around each segment(s) of pipe that is to be replaced. The Contractor will be required to provide in writing a sequence of bypass pumping for review and approval by the Inspector. Refer to the construction plans for the construction phasing and diversion requirements. The Contractor shall also provide the Inspector a sketch showing the location of bypass pumping equipment for each line segment(s) around which flows are being bypassed. The Contractor shall be responsible for all required bulkheads, pumping, equipment, piping, etc., to accomplish the sequence of pumping. The Contractor shall cease bypass pumping operations and return flows to the new and/or existing sewer when directed by the Inspector. All piping(s), joints and accessories shall be designed to withstand at least twice the maximum system pressure, or a minimum of 50 psi whichever is greater. During bypass pumping, no sewage shall be leaked, dumped, or spilled in or unto, any area outside of the existing sanitary sewer system. When bypass pumping operations are complete, all pumping shall be drained into the sanitary sewer prior to disassembly

1. **Pump Condition.** The Contractor shall demonstrate that the pumping system is in good working order and can successfully handle flows 24 hours a day.

2. **Pump Operation.** The Contractor shall plug off and pump down the sewer manhole and line segment in the immediate work area and shall maintain the sanitary sewer system so that surcharging does not occur. Where work required the line to be locked beyond working hours, the Contractor shall operate the by-pass pump and man the operation 24 hours a day.

   The Contractor shall complete the repair, replacement, rehabilitation as quickly as possible, satisfactorily meet all test, and repair all deficiencies as specified prior to discontinuing by-pass pumping operations and returning flow to the sewer manhole or line segment.

   The Contractor shall notify the inspector, should a surcharge occur during the rehabilitation process resulting in the overflow of sewage. If the Contractor is unable to regain control of the situation, the rehabilitation operation should be suspended or terminated until such time as the overflows have been controlled. Any damage to the materials, equipment and/or adjacent properties due to such surcharge shall be repaired at the Contractor's expense.

   The Contractor shall ensure that no damage will be caused to private property as a result of by-pass pumping operations. Ingress and egress to adjacent properties shall be maintained at all times. Ramps, steel plates or other methods shall be employed by the Contractor to facilitate traffic over surface piping. High traffic commercial properties may require alternate methods.

   In the event, that sewage accidentally drains into the storm drainage system or is spilled within the project, the Contractor shall immediately stop overflow, notify the inspector, and take necessary action to clean up and disinfect the spillage using an HTH, or equal, chemical to the satisfactory of the Engineer. If sewage is spilled onto public or private property, the contractor shall wash down, clean up and disinfect the spillage to the satisfaction of the engineer.

   The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways and alleys. In cases where the suction and or discharge lines are required to be buried for vehicle/pedestrian traffic, cost for this work is incidental and includes complete restoration of any surface features disturbed. Force main piping may be laid inside of storm drainage pipes to avoid surface interference with vehicular or pedestrian traffic. Flows shall not be allowed to spill from said force mains into said drainage pipes. The use of existing storm drain systems shall be approved by the SAWS Drainage Engineer. Force mains laid in storm sewers shall be pressure pipe and fittings.

   The Contractor shall not intentionally damage or remove portions of existing storm sewer system structures or sanitary sewer structures for the purpose of installing bypass pumping system without specific approval from the Inspector. If a structure

is damaged, it shall be reconstructed or replaced to the satisfaction of the Engineer at no additional cost to the SAWS.

SAWS shall not be responsible for any damage to the bypass pumping system sustained by the Contractor directly or indirectly as a result of storm water runoff within streets, ditches and/or storm sewer systems. The Contractor shall be responsible for any and all damage that results directly or indirectly from the interference of storm water runoff to bypass pumping equipment, piping and/or appurtenances. It is the intent of these specifications to require the Contractor to establish adequate bypass pumping as required regardless of the flow conditions.

X. Pipe Bursting/Crushing Replacement.

1. Pit Location. Location and number of insertion or launching pits will be chosen by the Contractor, and will typically be located near existing or proposed manholes, P.I.'s in the line, at logical breaks in the construction phasing, or at locations to comply with access or maintenance requirements.

Pits shall be placed and located to minimize the total number of pulls and maximize the length of pipe replaced per pull, within the constraints of maintaining service and access and other requirements. Use excavations at point repair locations for insertion pits where possible.

2. Operations. The Contractor shall provide equipment, planning, and job execution necessary to accomplish the work in an efficient manner and consistent with the objectives of this specification, including preventing damage to existing infrastructure, maintaining pedestrian and vehicle access, and providing continual sewer service to customers.

Pipe shall be assembled and fused on the ground in sections equivalent to the length of the anticipated pull. During installation, all bending and loading the pipe shall be in conformance with manufacturer's recommendations and shall not damage the pipe.

Manholes shall be prepared so as to provide pipe installation at the lines and grades indicated on the plans. The invert in the manholes shall be removed as required to allow for pipe installation activities and to accommodate invert replacement. Manhole inverts shall be restored upon completion with 3,000 psi grout so as to establish a minimum 4-in. thick bottom on the manholes after shaping per drawing.

3. Equipment. The Contractor shall utilize pipe bursting/crushing equipment with adequate pulling/pushing force to complete pulls in timely manner. The Contractor shall provide equipment on the pulling mechanism to verify the pulling/pushing force exerted on the pipe does not exceed the manufacturer's recommendation for allowable pulling force to prevent damage to the pipe. The pulling force may not exceed the following: 6 tons for 8.625-in. O.D.; 10 tons for 10.75-in. O.D.; 17 tons for 14-in. O.D.; 23 tons for 16-in. O.D.; 28 tons for 18-in. O.D. Allowable pulling

force for all diameters shall be determined by the Contractor depending on the pipe size, wall thickness, manufacturer, field conditions, pull distance, manhole integrity, bearing capacity of soils, adjacent infrastructure, related equipment and cable strength, and related considerations.

4. Equipment Configured. Equipment shall be configured with adequate knives or other appropriate devices to minimize interruptions in the installation process due to obstruction removal and other problems. Pipe shall be secured to the pulling/pushing device in accordance with standard practice. The diameter of the pulling/pushing head shall be equal or slightly greater than the pipe O.D.

5. Minimize Noise Impact. Equipment used to perform the work will be located away from buildings so as not to create noise impact. Provide silencers or other devices to reduce machine noise as required to meet requirements.

6. Protection. The Contractor shall provide for the general safety of workers, pedestrians and traveling public throughout this project. Existing surface improvements and underground facilities and utilities shall also be protected. Damage caused by the Contractor shall be repaired at his own expense. Protection to be provided includes:

a. Provide barricades, warning lights and signs for excavations created by point repairs. Conform to requirements of TxDOT, City of San Antonio, and of contract documents.

b. Protection of Manholes. The Contractor will install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances will the pipes be stressed beyond their elastic limit.

c. Do not allow sand, debris, or runoff to enter the sewer system.

d. Verify location of all underground utilities and facilities potentially impacted by rehabilitation related or other project activities and take necessary precautions to provide protection from damage. Damage caused by the Contractor shall be at his cost and responsibility.

e. Protect the new pipe and components during all phases of work, including hauling, installation, entry into the entry pit and prevention of scarring or gauging of the pipe or components.

7. Sealing Liner in Manhole.

a. Allow liner pipe to normalize to ambient temperatures as well as recover from imposed stretch before cutting to fit between manholes, sealing at manholes, and manhole invert shaping. Normalization usually takes at least 12 hours for polyethylene.

b. Cut liner so that it extends 4-in. into manhole. Make a smooth, vertical cut and slope area over top of exposed liner using non-shrink grout.

c. Seal the annular space between liner and sanitary sewer main at each manhole with a chemical seal and non-shrink grout. Place strips of oakum soaked in sealer (Scotchseal 5600 as manufactured by 3M Corporation, or equal) in a band to form an effective water-tight gasket in the annular space between liner and existing opening in manhole. Make width of the sealing bank a minimum of 8-in. or the thickness of the manhole wall, whichever is greater.

d. Finish seal with a non-shrink grout place around annular space from inside manhole. Apply grout in a bank not less than 6-in wide.

e. Reshape and smooth the manhole invert. Form a smooth transition with a reshaped invert and a raised manhole bench to eliminate sharp edges of liner pipe, concrete bench, and channeled invert. Build up and smooth invert of manhole to match flow line of new liner.

Y. Sliplining.

1. Obstruction Removal and Point Repair.

a. Make point repairs and remove obstructions, such as roots, rocks and other debris, prior to installing liner pipe.

2. By-Pass Pumping.

a. Refer to this special specification Section 3.X; By-pass Pumping.

3. Insertion or Access Pits.

a. Locate pits so that the total number is minimized and footage of liner pipe installed in a single pull is maximized. Where possible, use excavations at point repair locations for insertion pits.

b. Before excavating, check with various utility providers (e.g., City Public Service, AT&T, Paragon, and SAWS), and determine locations of utilities in or neat the work area. Costs of utility repairs, temporary service and other costs arising out of damage to or interruption of utilities, resulting from operations under this Contract, shall be borne by Contractor at no additional cost to the City.

c. Perform excavation and backfill in accordance with Sections 3.A. and 3.D.

d. Perform work in accordance with OSHA standards. Comply with Item 402 “Trench Excavation Protection”.

e. Install and operate necessary dewatering and surface water control measures.

4. FRP Liner Pipe Installation. FRP Liner pipe may be pushed or pulled into existing sewers. Insert pipes, spigot end first, with bell end trailing. Apply pushing force to pipe wall end inside bell in accordance with manufacturer's instruction. Do not apply jacking loads to end of bell. Maximum allowable joint angular deflection one degree.

5. Clamp Installation.

a. Where excavations for inner pipe insertion are made between two manholes, cut ends of liner pipe smooth, square to pipe axis. Join liner pipes with appropriately sized stainless steel universal clamp couplings. Butt together gap between ends of liner pipe with space between ends not exceeding 2-in.

b. Bedding in accordance with this specification.

6. FRP Collar/Closure.

a. Install FRP collar closure pieces in accordance with manufacturer's recommendations.

7. Field Quality Control.

a. After liner installation, perform the following tests:

1. Service lateral connection test: After all service laterals have been completed for a particular sewer section, verify integrity of re-connections at points where they join liners and existing service lines by performing smoke test.

8. Sealing Liner in Manhole.

a. Allow liner pipe to normalize to ambient temperatures and recover from imposed stretch before cutting to fit between manholes, sealing at manholes and shaping manhole invert. Allow at least 12 hours for normalization of polyethylene.

b. Cut liner so it extends 4-in. into manhole. Make smooth, vertical cuts and slope areas over top of exposed liner using non-shrink grout.

c. Seal annular spaces between liner and sanitary sewer main at each manhole with chemical seal and nonshrink grout. Place strips of oakum soaked in sealer in a band to form effective water-tight gasket in annular space between liner and existing pipes in manhole. Make width of the sealing band at least 12-in., or one-half pipe diameter, whichever is greater.

d. Finish seal liner pipe to host pipe with non-shrink grout placed around annular space from inside manhole. Apply grout in a band at least 6-in. wide. Obtain the

SAWS Engineer's approval of sealing methods, including seal chemicals and materials.

e. Use cementitious grout to form smooth transitions with reshaped inverts and raised manhole benches to eliminate sharp edges of liner pipe, concrete benches, and channeled inverts. Build up and smooth manhole invert to match flow line of new liner.

9. Grouting Annular Space.

a. Provide grouting plan and obtain approval of grouting plan from SAWS Engineer before proceeding with the Work.

b. Grout annular space between the outside of liner and inside of existing pipe for sewer pipe 18-in. in diameter and larger.

10. Post Installation Videotape Recording.

a. Provide the SAWS Engineer with DVD showing completed work including condition of restored connections. Comply with requirements of "Television Inspection" of this specification.

11. Final Clean-up.

a. Upon completion of installation and testing, clean and restore project area affected by work of this Section. No separate pay item.

4. Traffic Control

A. General.

1. Procedures for traffic control safety according to Item 502 of the TxDoT Standard Specifications for Construction of Highways, Streets and Bridges. Contractors should refer to the SAWS Work Zone Traffic Control Program for guidance.

2. All streets and traffic ways shall be kept open for the passage of traffic and pedestrians during the construction period unless otherwise approved.

3. When required to cross, obstruct or temporarily close a street or traffic way, the Contractor shall provide and maintain suitable bridges, detours or other approved temporary expedients for the accommodation of traffic. Closing shall be for the shortest time practical, and passage shall be restored immediately after completion of the work.

4. The Contractor shall give the required advance notice of proposed operations to the fire and police departments.

5. The Contractor shall give reasonable notice to owners or tenants of private property who may be affected by proposed operations.

6. The Contractor shall provide signs, signals, barricades, lights and all other equipment, service and personnel required to regulate and protect all traffic and warn of hazards as approved and directed. The Contractor shall remove temporary equipment and facilities when no longer required and restore the area to its original or specified condition.

7. Provide and operate traffic control required to direct and maintain an orderly flow of traffic in all areas under the Contractor's control or affected by the Contractor's operations.

8. Provide traffic control at the following locations:

a. at each change of direction of a roadway and at each crossroad,
b. at detours and hazardous areas, and
c. at parking areas.

B. Traffic Notes and Special Conditions.

1. It is the Contractor's responsibility to insure that all traffic control devices are properly installed and maintained. All locations and distances will be determined in the field, by the Contractor, using the Texas Manual on Uniform Traffic Control Devices. If the traffic control devices do not conform to established standards, or are incorrectly placed or insufficient, the Engineer shall have the authority to stop construction operations until such time as the conditions are corrected.

2. The Contractor shall notify the Engineer then contact the City Traffic and Signalization Departments one week in advance of any street closure.

3. As work progresses, location for traffic control devices will be adjusted and modified by the Contractor, as necessary or directed.

4. Additional traffic control devices, special directional devices, or business name signs (as requested by businesses) may be required at the Contractor's expense.

5. The Contractor shall be responsible for suitable access accommodations for:

a. pedestrians, including school children,
b. delivery of mail by the U.S. Postal Service, and
c. residents and all businesses during all phases of work.

6. At no time shall the Contractor have more than 50-ft. of trench unbackfilled or unconcreted, nor more than two open excavation areas at any one time, unless previously approved.

7. The Contractor shall provide for lane closings and traffic routing such that a minimum of tow lanes on one-way streets and one lane each way on two-lane streets is maintained open to traffic at all times.

C. Parking Control.

1. Contractor related vehicular parking shall not interfere with public traffic or parking, access by emergency vehicles, other utility operations, or construction operations. Temporary parking facilities for the public will be provided by the Contractor as required due to construction operations.

2. Parking of all construction and private vehicles will be monitored by the Contractor.

3. Free vehicular access to and through parking areas will be maintained.

4. Parking will be prohibited in non-designated areas.

D. Haul Routes. The Contractor shall consult with governing authorities to establish haul routed and site access.

E. Traffic Control While By-Pass Pumping. The Contractor shall locate by-pass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways and alleys; to include the possible temporary trenching of force mains at critical intersections. Traffic control shall be approved.

F. Payment for the above traffic control operations will not be paid for separately, but will be considered subsidiary to this Item.

G. Traffic Considerations While Cleaning Manholes and Mains. The Contractor shall locate all cleaning equipment so as to not cause undue interference with the use of streets, private driveways and alleys. All street diversions or shutdowns will be in accordance with TxDOT and CoSA procedures.

5. Testing.

A. Manhole Testing. Successful passage of a vacuum test is required for acceptance of standard sanitary sewer manholes.

1. Hydrostatic testing is to be conducted by plugging with Inspector-approved plugs all influent and effluent pipes in the manhole and filling the manhole to the top of the cone with water. Additional water may be added over a 24-hour period to compensate for absorption and evaporation losses. At the conclusion of the 24-hour saturation period, the manhole is to be filled to the top of the cone and observed. A loss of water within the next 30-minute period is to be considered an unsuccessful test. The Engineer is to be notified when the 30 minute test is going to be conducted.

2. Vacuum Testing:

a. General. Manholes shall be tested after installation and prior to backfilling with all connections (existing and/or proposed) in place. Lift holes shall be plugged with an approved non-shrink grout prior to testing. Drop-connections and gas sealing connections shall be installed prior to testing.

b. Test Procedure. The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole. The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc. The test head shall be inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off. With the valve closed, the level vacuum shall be read after the required test time. If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), after two minute with all valves closed the manhole will have passed the vacuum test.

c. Acceptance. Manholes will be accepted with relation to vacuum test requirements if they meet the criteria above. Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material the manhole is constructed of. Manholes shall be repaired on the exterior surface only prior to backfilling. The manhole shall be retested as described above until a successful test is made. After a successful test, the temporary plugs will be removed.

d. Repairs to existing manholes. Any existing manhole which fails to pass the vacuum test shall be closely examined by the Owner and the Contractor to determine if the manhole can be repaired. Thereafter, the Contractor shall either repair or remove and replace the manhole as directed. The manhole shall then be retested. The Owner may elect to simply remove and replace the existing manhole with a new manhole.

e. Measurement and Payment. Vacuum testing of new manholes will not be a pay item. The cost of this work will be included in the bid price for the new manhole

B. Low Pressure Air Testing. The Contractor will conduct low pressure air tests on completed sections of sewer main. The air test results will be used to evaluate materials and construction methods on the pipe line sections. Successful air tests will be mandatory for the acceptance of the lines. Copies of test results are to be made available to the Inspector upon request.

1. Materials for Air Testing. The Contractor is to furnish all materials and equipment for air testing including the Air Compressor.

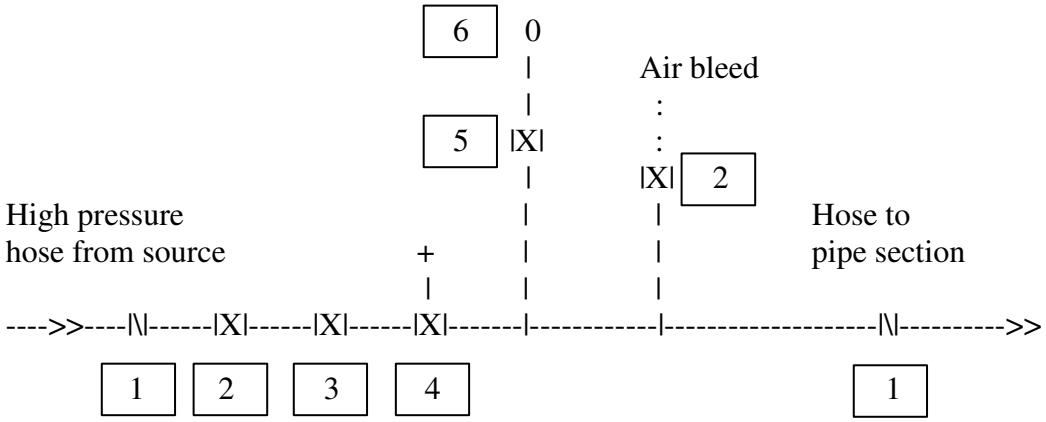
Compressor Air Supply. Any source which will provide at least 300-cu. ft. per minute at 100 pounds per square inch.

The equipment for air testing will consist of valves, plugs, and pressure gauges used to control the rate at which air flows to the test section and to monitor the air pressure inside the plugs and, for large diameter pipe, joint testers as manufactured by Cherne Industrial, Inc., of Edina, Minn., or an approved equal. Test equipment is to be assembled as follows:

- Hose connection,
- Shut off valve,
- Throttle valve,
- Pressure reduction valve,
- Gage cock, and
- Monitoring pressure gage.

Figure 1

Air Testing Equipment Assembly Order



2. Test Procedures.

The procedure for the low pressure air test shall conform to the procedures described in ASTM C-828, ASTM C-924, ASTM F-1417 or other appropriate procedures, except for testing times. The test times shall be as outlined in this section. For sections of pipe less than 36-inch average inside diameter, the following procedure shall apply unless the pipe is to be joint tested. The pipe shall be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure

to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

$$T = (0.085xDxK) \setminus Q$$

T = Time for pressure to drop 1.0 pound per square inch gauge in seconds
K = 0.000419xDxL, but not less than 1.0
D = Average inside pipe diameter in inches
L = Length of line of same pipe size being tested, in feet
Q = Rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used since a K value of less than 1.0 shall not be used.

There are minimum testing times for each pipe diameter as follows

Pipe Diameter	Minimum Time	Length for Minimum Time	Time for Longer Length
Inches	Seconds/Ft	Feet	Seconds/Ft
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1,020	133	7.693
21	1,190	114	10.471
24	1,360	100	13.676
27	1,530	88	17.309
30	1,700	80	21.369
33	1,870	72	25.856

Note: Test time starts after the required 60 seconds of stabilization time.

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined above or until failure. Lines with a 27 inch average inside diameter and larger may be air tested at each joint. Pipe greater than 36“diameter must be tested for leakage at each joint. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from

3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

C. Deflection Testing. Deflection test shall be performed on all flexible pipes.

For pipelines with inside diameters less than 27", a rigid mandrel shall be used to measure deflection. For pipelines with an inside diameter 27" and greater, a method approved by the Engineer or Inspector shall be used to test for vertical deflections. Other methods shall provide a precision of $\pm$ 0.2% deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of five percent. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices. The design engineer should recognize that this is a maximum deflection criterion for all pipes and a deflection test less than 5 % may be more appropriate for specific types and sizes of pipe. Upon completion of construction, the design engineer or other Texas Registered Professional Engineer appointed by the owner shall certify, to the Construction Manager, that the entire installation has passed the deflection test. This certification may be made in conjunction with the notice of completion required in 30 TAC 217.57.1(e) (1) of this title (relating to General Provisions). This certification shall be provided for the Commission to consider the requirements of the approval to have been met.

1. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, all dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

2. Mandrel Design: The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

3. Method Options: Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test. A deflectometer may be approved for use on a case by case basis. Mandrels with removable legs or runners may be accepted on a case by case basis.

D. Testing for Manhole Rehabilitation. Testing for manhole rehabilitation – structural and low sulfate, and structural lining and moderate sulfate shall consist of the following:

1. Visually verify the absence of leaks.

2. Perform an exfiltration test.

a. For manholes 0 to 60-ft. deep, if water loss is 1-in. or less in five minutes, manhole passes the exfiltration test.

b. For manholes over 6-ft. deep, if water loss is 1-in. or less plus 1/8-in. per additional foot of depth in five minutes, manhole passes the exfiltration test.

3. Perform a vacuum test on randomly selected manholes on every five manholes that are rehabilitated.

Testing for manhole rehabilitation – non-structural lining or high sulfate and structural lining high sulfate shall be tested as described above with the following additional requirement:

For every five manholes that are rehabilitated, one manhole shall be inspected using high-voltage holiday detection equipment. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material shall be applied to the repair area. All touch-up procedures shall follow the protective coating manufacturer's recommendations.

If a manhole fails to pass on the above test, it shall be repaired in accordance with the manufacturer's recommendations and re-tested. It shall not be accepted until it passes all tests.

All repairs and re-testing shall be at no additional cost to the Owner. If more than 20 percent of the manholes fail to pass any testing requirement, all manholes shall be vacuum tested and holiday tested as appropriate at no additional cost to the Owner.

E. T.V. Camera Testing. After the vacuum tests on the manholes and the air tests on the sewer lines are performed by the Contractor, the San Antonio Water System (SAWS) reserves the right to perform a T.V. Camera Test with their forces and equipment on the completed sewer lines. The T.V. test will be observed by State and Contractor personnel as the camera is run through the sewer lines.

Any sections in the sewer lines found by the camera such as broken pipe, misaligned pipe joints (that could result in a leak), etc. as determined to be damaged or abnormal are to be repaired or replaced by the Contractor at his expense.

F. Sewer Force Main Flushing and Testing.

1. Flushing. Immediately upon completion of pipelaying, the Contractor will flush all mains which are scheduled to be tested. This flushing will be at the direction of the Engineer and will consist of completely filling sections of main between valves and then displacing such initial volumes of water by introducing clear water from existing facilities into and through the main to the point of discharge from the main being flushed. The flow-through will continue until the Engineer

determines all dust, debris, or foreign matter that may have entered during pipe laying operations have been flushed out. The new line will then be left under system pressure for testing.

To avoid damage to pavement and inconvenience to the public, fire hoses will be used to direct flushing water from the main into suitable sewers.

2. **Operation of Valves.** No valve in the sanitary sewer force main system will be operated by the Contractor without prior permission. The Contractor will notify the Engineer when a valve is to be operated and will only operate the valve in the presence of the Engineer's representative.

3. **Hydrostatic Tests.** All new mains will be hydrostatically field tested at a maximum test pressure of 200 psi before acceptance.

   All joints which are found to leak either by observation or during any test will be made watertight by the Contractor. In case repairs are required, the hydrostatic field test will be repeated until the pipe installation conforms to the specified requirements and is acceptable. The expense for tests which meet specified requirements will be made in accordance with the unit price for the hydrostatic pressure test. No payment will be made for tests which fail to meet specified test leakage requirements.

   After the new main has been laid and backfilled as specified, but prior to replacement of pavement, it will be filled with water for a minimum of 24 hours and then subjected to a hydrostatic pressure test. The specified test pressure will be supplied by means of a pump connected to the main in a satisfactory manner. The pump, pipe connection, and all necessary apparatus including gauges and meters will be furnished by the Contractor. Unless otherwise specified, the San Antonio Water System will furnish potable water for filling lines and making tests through existing mains.

   Before applying the specified test pressure, all air will be expelled from the main. To accomplish this, taps will be made, if necessary, at the points of highest elevation and afterwards tightly plugged. At intervals during the test, the entire route of the new main will be inspected to locate any leaks or breaks. If any are found, they will be stopped or repaired. The test will be repeated until satisfactory results are obtained.

   The hydrostatic test will be made so that the maximum pressure at the lowest point does not exceed the specified test pressure. The duration of each pressure test will be a minimum of 4 hours for new mains in excess of 1,000-ft. after the main has been brought up to test pressure. The test pressure will be measured by means of a tested and properly calibrated pressure gauge acceptable. All pressure tests will be continued until the Engineer is satisfied that the new main meets the requirements of these specifications. Should any test of pipe in place disclose leakage greater than listed in the following Hydrostatic Test Leakage Allowances Table, the Contractor will, at his expense, locate and repair the defective joints until the leakage is within the specified allowance. Leakage is defined as the quantity of water supplied into the newly laid main, or any valved

section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled. The Contractor will notify the Engineer prior to beginning the test, and the San Antonio Water System's Inspector will be present during the pressure test.

Hydrostatic Test Leakage Allowances Table
(Maximum) @ 200 psi

Nom Dia-Ty Pipe	Allowable Leakage in Gallons Per Hour (GPH) Pipe Length in Feet									
	100	**200**	**400**	**600**	**800**	**1000**	**2000**	**3000**	**4000**	**5000**
16"HDPE	0.34	0.68	1.36	2.04	2.72	3.40	6.80	10.20	13.60	17.00
20"HDPE	0.43	0.85	1.70	2.55	3.40	4.25	8.50	12.75	17.00	21.25

Note: Leakage allowances may be determined for footages not specifically listed by interpolation and/or by the combination of various tabular data.

Example No. 1: The maximum leakage allowances for 6,000 LF of 20" HDPE pipe would be the sum of the values for 5,000 LF and 1,000 LF, or 21.25 GPH plus 4.25 GPH equals 25.50 GPH.

4. **Contractor's Personnel and Equipment.** The Contractor will supply labor and equipment necessary to make all excavations required for flushing, equipment connections, and placing the mains in service.

5. **Safeguarding and Backfilling Open Holes.** The Contractor will be responsible for safeguarding any open holes excavated or left open for flushing and testing purposes. Following completion of testing, the Contractor will backfill such holes in accordance with appropriate provisions of Subarticle 3.(1), "Excavation and Backfill".

G. Rehabilitation of Lines Testing.

1. The Contractor shall provide to the Engineer and the City of San Antonio a DVD showing the completed work. Such DVD shall be of a quality to permit close-up viewing of the restored taps and the liner. A TV camera with 360° articulating lens shall be utilized to produce DVD. Similar DVD shall be provided, when requested, during the test period. This work shall be paid for under the Item "Sanitary Sewer (Television Inspection)".

2. Quality Control.

a. Reference Standards. This specification references Insituform Technologies, Inc. (ITI) Standard Test Methods., which are made a part hereof by such reference, and shall be the latest editions and revisions thereof. ASTM F1216, "Standard Practice of Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube", shall govern when this specification does not address installation methods and materials.

No change or alteration during the course of the contract shall be allowed without the prior written approval of the Engineer. Physical properties of the approved resin components of the materials, as well as the cured liner, shall conform with the minimum structural values as listed below:

Flexural Strength	4,500 psi	ASTM D-790
Modulus of Elasticity	250,000 psi	ASTM D-790

Certified copies of all test reports on the properties of the selected resin and (after placement) on the cured liner coupons performed by and for the Contractor shall be submitted. Results of additional product testing, normally performed for in-house quality control and process improvement, shall also be provided to the Engineer at no additional cost. The Contractor shall inform the Engineer, in writing, of the name and designation of all in-house quality control test and the sampling frequency of the tests on the resin and liner materials. The Engineer shall also have the right to require the testing to be done at designated liner locations within the scope of the Contract. The Engineer may also run test on random samples at no additional cost to the Contractor. Whenever possible, a short section of a sewer pipe very similar to the existing pipe may be placed in the manhole to run the liner under restrained conditions, for later testing and thickness measurements, at no additional payment. All samples shall be labeled before shipment for testing; and a duplicate piece shall also be provided, if requested, for inspection and testing by an independent laboratory, if required.

b. General Corrosion Requirements. The CIPP shall be fabricated from materials which when cured, will be chemically resistant to internal exposure to domestic sewage.

c. Water Analysis (Industrial Areas Only). In industrial areas where sewers are subject to possible organic and inorganic wastes other than normal domestic sewage, the Engineer shall obtain samples of the dry weather sewage for chemical content analysis. This analysis shall be supplied to the Contractor for their information.

d. Submittals. The Contractor shall submit, along with the bid proposal, a copy of the recommended pipe installation procedures, certified by the pipe manufacturer.

H. Pipe Bursting/Crushing Replacement Testing. After the existing sewer is completely replaced, internally inspect with television camera and DVD as required. The finished tape will be continuous over the entire length of the sewer between two manholes and to be free from visual defects.

Defects which may affect the integrity or strength of the pipe in the opinion of the Engineer will be repaired or the pipe replaced at the Contractor's Expense.

The Contractor shall smoke test to verify all sewer service connections.

The following items are excerpted from TCEQ Chapter 317 requirements for gravity sewer construction testing (§317.a.4). Compliance with these requirements is required

unless the Contractor obtains and provides written authorization from the TCEQ authorizing alternative testing and compliance procedures:

1. Testing of Installed Pipe. An infiltration, exfiltration or low-pressure air test shall be specified. Copies of all test results shall be made available to the executive director (TCEQ) upon request. Test shall conform to the following requirements:

2. Infiltration or Exfiltration Tests. The total exfiltration as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2-ft. above the crown of the pipe at the upstream manhole. When pipes are installed below the groundwater level an infiltration test shall be used in lieu of the exfiltration test. The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2-ft. above the crown of the pipe at the upstream manhole, or at least 2-ft. above existing groundwater level, whichever is greater. For construction within the 25 year flood plain, the infiltration or exfiltration shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head. If the quantity of infiltration or exfiltration exceeds the maximum quantity of infiltration or exfiltration exceeds the maximum quantity specified, remedial action shall be undertaken in order to reduce the infiltration or exfiltration to an amount within the limits specified.

3. Low Pressure Air Test. Perform in accordance with requirements of this specification**.**

4. Deflection Testing. Perform in accordance with requirements of this specification**.**

5. Clean-up and Restoration. Any damage to existing utilities, structures, storm drain systems, curbs, sprinkler systems, mail boxes, driveway, etc., shall be repaired as directed. All repairs and replacements shall be made at the Contractor's expense. Upon acceptance of the installation work and testing, the Contractor shall clea-up and restores the project area affected by operations. Daily clean-up of the project site to the satisfaction of the Engineer shall also be required.

6. Cleaning Manhole and Mains

A. Cleaning Manhole and Mains.

1. Water Usage for Cleaning. Satisfactory precautions shall be taken to protect the sanitary sewer mains from damage that might be inflicted upon them by the improper use of cleaning equipment. Any damage inflicted upon the sewer, regardless of the cleaning method used, shall be repaired by the Contractor at the Contractor's expense and to the satisfaction of the Engineer. Whenever hydraulically propelled cleaning tools, those which depend upon water pressure to provide their cleaning force, or any tools which retard the flow of water in the sanitary sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved. The flow of wastewater present in the sanitary sewer main shall be utilized to prove necessary fluid for hydraulic cleaning devices whenever possible. When additional quantities of water from fire hydrants are

necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed or used when there is a fire in the area. As a general rule, the Contractor does not need prior written approval to use any particular fire hydrant located within the City of San Antonio. The Contractor shall be responsible for obtaining the water meter and all related charges for the set-up, including the water usage bills. All related expenses will not be paid for separately, but shall be considered subsidiary to the appropriate bid items.

2. Waste Disposal. The Contractor shall remove all sludge, dirt, sand, rocks, grease, or other solid or semi-solid material resulting from the cleaning operations at the downstream manhole of the section being cleaned. Passing of debris from manhole section to manhole section will not be allowed. All debris from the manholes shall also be removed either manually or mechanically prior to rehabilitation of the sewer main. When hydraulic cleaning equipment is used, a suitable sand trap, weir, or dam shall be constructed in the downstream manhole in such a manner that all the solids shall be trapped for removal.

3. Clean-up. All debris from the manholes shall be removed either manually or mechanically prior to the rehabilitation of the sewer main.

All solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed of at least once each work day. It is the responsibility of the Contractor to secure a legal dump site for the disposal of the materials. The cost for this removal and disposal will not be paid for separately, but shall be considered subsidiary to the appropriate bid items.

The Contractor's clean-up operation shall include cleaning all debris from the manhole and off the ground around the manhole. The Contractor shall not be allowed to accumulate debris on the site, except in totally enclosed containers and as approved. Watertight vehicles shall be used to transport the waste material to disposal site. Under no circumstances shall sewage or solids removed from the main or manholes be dumped onto streets or into ditches, catch basins, storm drains or sanitary sewers. If the Contractor removes or damages any portion of an existing manhole to get equipment in or out of the line, the manhole will be replace or repaired by the Contractor at the Contractor's expense and to the satisfaction of the Engineer.

7. Measurement.

A. Sewer Excavation and Non-stabilized Backfill. Sewer excavation and non-stabilized backfill will be measured in accordance with Item 400, "Excavation and Backfill for Structures" but will not be measured for payment and will be considered subsidiary to the sewer line installation.

B. Trench Excavation Protection. Trench excavation protection will be measured by the foot along the centerline of the trench where the depth exceeds 5-ft.

C. Sanitary Sewers. Longitudinal measurement of sanitary sewers will be made along the centerline of the sewer from center of manhole to center of manhole or end of main by

the foot of the various sizes and types (when a specific type is required) of sewers shown on the plans, in accordance with this specification, complete and accepted.

One way cleanouts to be installed in all laterals at the customers property line and will be measured for payment by each installed.

Plugging existing sewer lines will be considered subsidiary to the pipe installation.

D. Sanitary Sewer Laterals. The lengths of laterals will be measured from the centerline of the sewer main to the connection at or within the customer's property line or premises. Wyes, tees, and bends of any kind will not be paid for separately for laterals but will be measured for payment by the foot of lateral to be installed.

E. Jack, Boring or Tunneling. Jacking, Boring or Tunneling will be measured by the linear foot of bore or tunnel as measured from face to face of jacking pits.

Carrier pipe used in bores and tunnels or backed into place will be measured by the linear foot of pipe installed from end to end of pipe to the limits shown on the plans

Casing or liners, where required for plans of the size and material required will be measured by th linear foot actually installed in accordance with plans.

F. Vertical Stacks. Vertical Stacks will be measured by the linear feet. Footage will be measured from the finish grade elevation (centerline) minus invert elevation minus 8 feet.

G. Manhole Structures. Manholes structures will be measured by each manhole structure complete in place. Manhole structures will be installed where any pipe intercepted is larger than 24-inch in diameter. Rings and Watertight Covers, concrete ring encasement and I&I Barriers, will not be measured for payment, but will be considered subsidiary to the manhole.

H. Pre-Cast Manholes. Manholes to 6 feet deep and designated on plan will be measured by each type manhole complete in place including those exceeding 6 feet in depth from the lowest invert elevation to the top of the ring. Rings and Watertight Covers, concrete ring encasement and I&I Barriers, will not be measured for payment, but will be considered subsidiary to the manhole.

Manholes deeper than 6 feet will be measured by the number of vertical feet in excess of 6 feet

I Adjusted or Abandoned Manholes. Manholes adjusted or abandoned as prescribed herein, will be measured by each manhole. The excavation and backfill required and the I&I Barrier for Adjust Manholes will not be measured for payment, but will be considered subsidiary to this Item.

J. Select Backfill. Cement Stabilized Backfill will be measured by the cubic yard in accordance with the backfill diagram shown on the plans or as directed.

K. Flowable Backfill. Flowable Backfill will be measured by the cubic yard based on the dimensions and depths shown on the plans or as directed.

L. **Select Bedding Material**. Where directed to be used for rigid pipe installations, Select Bedding Material will be measured by the cubic yard as dimensioned on the plans. Select Bedding Material is always required for Flexible Pipe installation; therefore, it will not be measured for payment.

M. **Concrete Encasement, Cradles, Saddles and Collars**. Concrete encasement, cradles, saddles and collars for pipe will be measured by the cubic yard as dimensioned on the plans or as directed, complete in place. Reinforcing if required will not be measured.

N. **Concrete Curb, Sidewalks, Driveways, Islands and Medians**. For concrete curbs, sidewalks, driveways, islands and medians required to be removed and replaced due to placement of sewer lines, removal of the existing concrete will be measured by the foot or by the square yard as dimensioned and detailed on the plans.

O. **Cut and Restore Pavement.** The work to be done in the cutting and restoring of pavement will be measured by the square yard in accordance with the dimensions and details shown on the plans.

P . **Removing and Replacing Chain-Link and/or Wire Fence**. This work will be measured by the foot of fence removed and replaced, regardless of the type or height of the fence, complete in place. The existing fence materials may be reused unless, the existing materials were damaged during removal and should not be reused, the Contractor is to provide new material for the replacement work at his expense.

Q. **Abandon Sewer Lines**. When shown on the plans, this work will be measured by linear foot complete in place.

R. **Television Inspection.** This Item will be measured by the foot of main televised for TV inspection. The foot measurement will be determined as the distance from the center of sewer manhole to the center of sewer manhole.

S. **Reconstruct Manholes.** Manholes completely reconstructed as prescribed herein, will be measured by the unit of each manhole (any type or size), regardless of the type shown on the plans.

T. **Automatic Air Release Valve.** Automatic Air Release Valve will be measured as each assembly of the size installed.

U. **Ductile-Iron Fittings.** Ductile-Iron Fittings will be measured by the weight to the nearest one-hundredth of a ton of the various sizes installed.

V. **Hydrostatic Pressure Test.** Hydrostatic Pressure Test will be measured as each successful test conducted on sanitary sewer force mains only. Hydrostatic testing of manholes will not be measured for payment

W. **Rehabilitation of Lines.** This Item shall be measured by the foot, based on the measured distance of existing sanitary sewer line to be rehabilitated from centerline of manhole to centerline of manhole.

The Engineer shall have the right to modify or change the required liner thickness, depending upon the field conditions determined from the video tape. An analysis of

design criteria and calculations for the liner thickness shall be provided for approval. Liner thickness may vary for the same size sewer depending upon field condition of the pipes and depths. Physical characteristics and properties of the felt tube shall also be submitted if required.

The CIPP liner thickness required shall be calculated using standard resin and the Design Criteria and Values tables in the above references standards. The thickness shall be rounded to the next highest multiple of 1/16-in. after adding an allowance of 5 percent to the design thickness for resin migration. Contractor shall also verify the table for correctness and must have any modifications approved. These calculations shall be bases on the following physical condition of the existing pipe:

a. All pipes shall be considered fully deteriorated.

b. All pipes shall be subject to full soil load of 120 lb/cf, with applicable live load, and water table 5-ft. below the top of the ground.

c. All pipes should be considered to have a minimum of 2 percent ovality in the circumference.

d. The liner inside diameter shall be a minimum of 36-in. A minimum clearance of 5 percent of the liner pipe O.D. should be allowed between O.D. of the liner pipe and the I.D. of the existing pipe.

e. Any reduced clearance (less than 5 percent) between the O.D. of the liner and the I.D. of the existing pipe may be allowed if the Contractor submits, as required, a statement demonstrating that the liner pipe manufacturer recommends and certifies the sliplining installation procedures with less then 5 percent, and as approved. Such clearance shall not be less than 1-in. (all around the pipe) between the O.D. of the liner and the I.D. of the existing pipe.

f. Any flexible pipe used shall be Fiberglass Reinforced Plastic (FRP) slipliner pipe and shall have a minimum pipe stiffness (PS) requirement of 36 psi based on the short term Modulus of Elasticity, at 5 percent defection when tested in accordance with the applicable ASTM or AWWA Standard Specifications.

g. The pipe shall be furnished in a maximum of 20-ft. lengths.

h. The thickness of the pipe wall at joint shall be designed to be safely capable of withstanding all loading conditions, including, but not limited to, insertion, grouting of annular space, external hydrostatic pressure above the pipe centerline and internal pressure rating.

X. Point Repair. This Item will be measured on an each basis. The minimum length of pipe to be replaced at each repair locations shall be 9-ft. Measurement for sewer line extra length point repair is on a linear foot basis in excess of minimum replacement length.

Y. By-Pass Pumping. This Item will be measured by the "Lump Sum" as the work progresses. No additional measurement or payment will be made for conditions caused by the Contractor during construction.

Z. Rehabilitation of Manholes. This Item will be measured by the vertical foot.

AA. Cleaning Manhole and Mains. Sanitary sewer manhole and mainline cleaning will not be measured for payment.

8. Payment.

A. Sewer Excavation. Payment for sewer excavation and non-stabilized backfilling in accordance with these specifications will not be paid for directly but will be included in the unit price bid for the sanitary sewer pipe installation. Select bedding and stabilized backfill will be paid for under their own items of work.

B. **Trench Excavation Protection.** Payment will be made at the unit price bid for "Sanitary Sewer (Trench Excavation Protection)" in place. Payment will include all components of the trench protection system which can include but not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering/diversion of water to provide adequate/acceptable drainage, any additional excavation or backfill required, jacking, jack removal, removal of the trench support after completion and all other labor, materials, tools, equipment and incidentals necessary to complete the work.

C. Sanitary Sewers. Payment will be made at the unit price bid for "Sanitary Sewers" of the size, and type (when a specific type is required) specified on the plans complete in place.

Sanitary sewer force mains will be paid for at the unit price bid for "Sanitary Sewers (Force Main)" of the size and type specified on the plans, complete in place.

Sanitary sewer service connections will be paid for at the unit price bid for "Sanitary Sewers Lateral Pipe)" of the size specified per linear foot complete in place.

D. Sanitary Sewer Laterals. Payment will be made at the unit price bid for "Sanitary Sewer Lateral" of the size and type (when a specific type is required) specified on the plans per linear foot complete in place.

E. Jacking, Boring or Tunneling. Jacking, Boring or Tunneling will be paid for at the contract unit price bid per linear foot of jacking, boring or tunneling, which price shall be full compensation for furnishing all materials (except carrier pipe, casings or liners), labor, tools, equipment and incidentals necessary to complete the work, including excavation, grouting, backfilling, restoration to original ground conditions, and disposal of surplus materials.

Carrier pipe shall be paid for at the contract unit price bid for "Carrier Pipe for Jacking, Boring or Tunneling" per linear foot of pipe installed and measured as prescribed above.

Casings or liners shall be paid for at the contract unit price bid for "Casing or Liner" per linear foot of casing or liner installed and measured as prescribed above.

F. Vertical Stacks. Payment will be made at the unit price bid per vertical foot, complete in place.

G. Sanitary Sewer Cleanouts. Payment will be made at the unit bid price for "Sanitary Sewer Cleanout" of the size and type (when a specific type is required) specified on the plans complete in place.

H. Manhole Structures. Payment for Manholes structures, including the stack, rings, watertight covers, steps and concrete ring encasement, I&I Barriers, will be made at the unit price bid for "Sanitary Sewer Manhole Structure (Complete) of the type specified.

I. Pre-Cast Manholes. Payment for Pre-Cast manholes, including the stack, rings, watertight covers, steps and concrete ring encasement, I&I Barriers, will be made at the unit price bid for "Sanitary Sewer Pre-Cast Manhole (Complete)" of the type specified.

Payment for Extra depth manholes will be made at the unit price bid per vertical foot as measured.

J. Abandon or Adjust Manholes. Manholes abandoned or adjusted will be paid for at the unit price bid for "Sanitary Sewer (Abandon Manhole)" or "Sanitary Sewer (Adjust Manhole)".

K. Select Backfill.

Cement Stabilized Backfill. Payment will be made for "Cement Stabilized Backfill" at the unit price bid for "Sanitary Sewer (Cement Stabilized Backfill)".

Flowable Backfill. Payment for "Flowable Backfill" will be made at the unit price bid for "Sanitary Sewer (Flowable Backfill)".

L. Select Bedding Material. Payment for "Select Bedding Material" for rigid pipe installations will be made at the unit price bid for "Sanitary Sewer (Select Bedding)". The select bedding for flexible pipes will not be paid for directly but will be subsidiary to the flexible pipe.

M. Concrete Encasement, Cradles, Saddles and Collars. Payment will be made at the unit price bid for "Sanitary Sewers (Concrete Encasement, Concrete Cradles, Concrete Saddles and Concrete Collars)".

N. Concrete Curbs, Driveways, Sidewalks, Islands or Medians. Payment for replacement of curbs, driveways, sidewalks, islands and medians will be made at the unit price bid for "Sanitary Sewers (Concrete Sidewalk)", "Sanitary Sewers (Concrete Driveway)", "Sanitary Sewers (Concrete Islands)", "Sanitary Sewers (Concrete Medians)" and "Sanitary Sewer (Concrete Curb)".

O. Cut and Restore Pavement. Payment will be made at the unit price bid for "Sanitary Sewers (Cut and Restore Pavement)".

P. Remove and Replace Chain-Link and/or Wire Fence. Payment will be made at the unit price bid for "Sanitary Sewer (Remove and Replace Fence)".

Q. Abandon Sewer Lines. Payment will be made at the unit price bid for "Sanitary Sewer (Abandon Pipe)" of the size shown on the plans.

R. Television Inspection. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Sanitary Sewer (Television Inspection)." This price will include all labor, materials, equipment, tools, logging, and all incidentals necessary to complete the work.

Testing Sanitary Sewers for leakage, including all labor, materials, and equipment necessary to perform the tests, will not be paid for directly but will be considered incidental to the various Sanitary Sewer pay items.

S. Reconstruct Manholes. Payment for reconstructed manholes, complete in place will be made at the unit price bid for "Sanitary Sewer (Reconstruct Manhole)".

T. Automatic Air Release Valve. Payment for "Automatic Air Release Valve" will be made at the unit price bid for "Sanitary Sewer (Automatic Air Release Valve)(Complete)" and will be full compensation for each assembly of the various sizes installed in accordance with the details shown on the plans. This payment will also include selected embedment material, anti-corrosion embedment when specified, blocking and various sizes and types of meter boxes.

U. Ductile-Iron Fittings. Payment for "Ductile-Iron Fittings" will be made at the unit price bid for "Sanitary Sewer (Ductile-Iron Fittings)" and will be full compensation for each ton of fittings of all sizes and types installed and will be based upon the weights of fittings shown in the "Weights of Ductile-Iron and Cast-Iron Fittings" table.

V. Hydrostatic Pressure Test. Payment made for "Hydrostatic Pressure Test" will be made at the unit price bid for "Sanitary Sewer (Hydrostatic Pressure Test)" and will be full compensation for each successful test conducted on sanitary sewer force mains only. No direct payment will be made for hydrostatic testing manholes.

No direct payment will be made for concrete blocking of sanitary sewer force mains; furnishing and installing the joint restraint system; coating and wrapping pipe joints; polyethylene wrapping; trench excavation below specified limits; excavation and removal of unsuitable material at bottom of trench grade and restoration with approved material; supporting pipe or conduits of public utilities; and flushing sanitary sewer force mains. This work will be considered subsidiary to the various bid items.

W. Rehabilitation of Lines. The work performed and materials furnished in accordance with this Item and measured as provided under 'Measurement", will be paid for at the unit price for "Sanitary Sewer (Line Rehabilitation)". This price shall be full compensation for all labor, equipment, materials, tools, pre-rehabilitation line cleaning, water, clean-up, dump sites and hauling of debris, labor, materials and equipment used in replacing bases and pavements, access to right-of-ways and easements as necessary, removal of equipment due to bad ground or poor pipe conditions, and other incidentals necessary to complete the work for either method of sanitary sewer line rehabilitation.

X. Point Repair. The work performed and materials furnished in accordance with this Item and measured under "Measurement" will be paid for at the unit price bid for "Sanitary Sewer (Point Repair)", for sizes and types constructed (when a specific type is required), regardless of depth. This price shall include all materials, including pipe, trenching, pumping, shoring and bracing, sand cushion, concrete plugs, laying and

jointing, backfilling, tapping, water, labor, tools, equipment, pavement work and all incidentals necessary to complete the work.

Payment for sewer line extra length will be in accordance with this Item and measured under "Measurement" will be paid for at the unit price bid for "Sanitary Sewer (Point Repair sewer line extra length)", for sizes and types constructed (when a specific type is required), regardless of depth. This price shall include all materials, including pipe, trenching, pumping, shoring and bracing, sand cushion, concrete plugs, laying and jointing, backfilling, tapping, water, labor, tools, equipment, pavement work and all incidentals necessary to complete the work.

Y. By-Pass Pumping. The work performed and material furnished in accordance with this Item and measured as provided under "Measurement" will be paid for the unit price bid for "Sanitary Sewer (By-Pass Pumping)". Partial payments of this "Lump Sum" bid will be as follows:

1. When initial set-up and operation of the bypass system begins, 40% of the line item will be paid.

2. The remaining portion of the line item will be paid when the bypass pumping operations for the entire job are completed.

Z. Rehabilitation of Manholes. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement", will be paid for at the unit price bid for "Sanitary Sewer (Manhole Rehabilitation)". This price shall be full compensation for materials, labor, equipment, tools, testing and all incidentals necessary to complete the work.

AA. Cleaning Manholes and Mains. All work described by this Item shall be subsidiary to the other Sanitary Sewer Items.

BB. Pipe Bursting/Crushing Replacement.

1. Installed Pipe. The inserted pipe will be paid for per foot of pipe installed using pipe-bursting/crushing method for the pipe diameter, type, quantity, and depth specified and will include all pipe installation materials, all submittals, sealing materials at manholes and annulus (if required), launching pits, receiving pits, post testing, shoring, bedding, backfill, and all necessary, corresponding, and related work specified herein.

2. Services. Locating and reconstruction of services and all connections of services will be paid for per each connection made, including fittings and pipe. Payment for abandoned services will be on as per each connection made basis.

3. Point Repairs. Point repairs will be paid for on as per each basis, as needed. Extra length point repair will be paid based on the length of pipe replaced per repair beyond the length established for each single point repair item, as needed. Abandoned point repairs will be paid on a cubic yard basis, as needed.

4. Obstruction Removal. Obstruction removal will be paid for on as per each basis, as needed.

5. **Storm Water Pollution Prevention and Erosion Control Plan.** Payment for this item will be based on the items and quantities of control measures included in the proposal on the basis indicated in the respective specification sections.

6. **Site Restoration.** Except as associated with point repairs and obstruction removals, site restoration for all impacts to surface improvements will be on a foot basis of the rehabilitated line segment. For point repairs and obstruction removals, site repair will be on as per each basis.

7. **Television Inspection.** Payment will be made for television inspection of the sewer line prior to pipe rehabilitation in accordance with this special specification, Section 3; O. There will be no additional or separate payment for "post-TV" video inspection, documentation, required submittals, and associated or related work.

8. **By-Pass Pumping.** The cost of any necessary by-pass pumping will be considered subsidiary to the appropriate pay items for pipe installation, television inspection, repair, or related work and will not be a separate pay item.

CC. Sliplining.

1. Measurement for Sliplining is on a by foot basis for installed liner pipe, measure form center line of upstream manhole to center line of downstream manhole. Depth range for payment is based on depth measured at sewer main from natural ground level to flow line of sanitary sewer for each pipeline segment.

2. Insertion pits, access pits, clamp installation, embedment (bedding, haunching and initial backfill), field quality control (testing), sealing liner at manholes, grouting annular space, building up, shaping and reworking manhole inverts and benches, and pre-installation and post-installation cleaning and television inspection of completed work are included in sliplining unit price and not paid for separately.

3. Excavations initially begun as obstruction removals or point repairs which the Contractor later decides to use as insertion pits are considered as insertion pits and not paid for separately.

4. Trench safety systems, well pointing and other applicable bid items associated with insertion pits will be paid for at their respective contract unit prices.

SPECIAL SPECIFICATION

9502

Adjustments to Recycled Water Facilities

1. **Description**. This Item shall govern for the relocation and/or reconstruction of recycled water main appurtenances as shown on the plans.

2. **Materials**. Materials shall be as called for on the plans. Concrete vaults, ductile iron pipe, cast iron meter box, and manhole rings and covers shall comply with the material requirements manholes listed in the Special Specifications for Water and Sanitary Sewer for this project. Vaults and manhole rings/covers shall accomodate H-20 traffic loading.

3. **Construction Methods**. Concrete vaults, ductile iron pipe, and manhole rings and covers shall be constructed and/or placed in accordance with the construction requirements of the Special Specifications for Water and Sanitary Sewer for this project for the respective items.

   (1) Concrete vaults shall be reconstructed to support access and maintenance of the valve units and shall be set to match the proposed finished grade of the roadway at the installation location. Existing vent risers shall be relocated outside of the pavement section as shown in the plans by installing additional ductile iron pipe as required by the plans. Vent piping shall be sloped such that any water within the piping will drain back to the vault. 24" minimum cover shall be maintained above the vent piping between the riser and the vault.

   (2) Existing blowoff hydrant will be relocated outside of the pavement section by installing additional pipe as indicated on the plans. A new cast iron meter box will be provided to enclose the hydrant in its new location.

4. **Measurement**.

   (1) Recycled water vault reconstruction will be measured by each unit. Vault reconstruction shall include the following: reconstruction of concrete vault (including base, riser, slab top, and manhole ring and cover) and relocation of existing vent riser (including additional cast iron pipe in the size specified by the plans), demolition of portions of the existing vault and removal and disposal of the demolished materials. Damage to existing facilities to remain in service shall be repaired by the Contractor at no additional cost to the Owner (NSPI).

   (2) Recycled water hydrant relocation will be measured by the unit. Each unit shall include the following: relocation of existing hydrant riser, installation of additional 3" ductile iron pipe as required by the plan, installation of new cast-iron meter box.

5. Payment.

(1) Recycled water vault reconstruction will be paid for at the unit price bid for "Recycled Water Vault Reconstruction". This price shall be full compensation for the reconstruction of concrete vault (including base, riser, slab top, and manhole ring and cover), relocation of existing vent riser (including additional cast iron pipe in the size specified by the plans), and for furnishing/installing all additional materials and/or fittings which may be required to complete the work.

(2) Recycled water hydrant relocation will be paid for at the unit price bid for "Recycled Water Hydrant Relocation". This price shall be full compensation for the relocation of existing hydrant riser, installation of additional 3" ductile iron pipe, installation of new cast-iron meter box, and for furnishing/installing all additional materials and/or fittings which may be required to complete the work.

SPECIAL SPECIFICATION

9503

Handling Asbestos Cement Pipe

This item shall govern for the removal, handling, disturbance, and disposal of asbestos cement (AC) pipe and other asbestos containing materials (ACM) related to the AC pipe work. AC pipe is also known as transite pipe. Since buried AC pipe typically contains approximately 15% to 20% chrysotile and crocidolite asbestos, it is considered to be an asbestos-containing material. The material is classified as non-friable, unless broken at which time its classification changes to friable ACM. The removal and/or disturbance of this material is governed by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the Occupational Safety and Health Administration (OSHA).

1. Description

This item shall consist of the handling, disturbance, removal and disposal of AC water pipe, joints, wrappings and other ACM. In order to comply with NESHAP and OSHA regulations, this project will require workers with specialized training using wet work procedures to cut and remove AC pipe, AC pipe joints, valves (any type) containing ACM and surrounding soils containing ACM. A Texas Department of Health (TDH) licensed Asbestos Consultant shall develop the asbestos work practices and monitoring in the Contractor's Health & Safety Plan to be reviewed by SAWS Environmental Division and City of San Antonio (COSA) Environmental representatives. It is the contractor's responsibility to obtain the services of a licensed Asbestos Consultant authorized in the State of Texas and this work shall be considered subsidiary to this item. Any other ACM encountered that has not been identified by the SAWS inspector or not shown on SAWS plans will be not be authorized for payment. Any other disturbance, handling, or disposal of AC water pipe that is necessary due to Authorized work by any other agency will be paid for by that agency under a different special specification and a different bid item number.

To meet and/or exceed NESHAP and OSHA guidelines, the contractor will subcontract the AC water pipe handling to an Environmental Protection Agency (EPA) accredited and TDH licensed Asbestos Abatement Contractor and TDH Licensed Asbestos Consultants.

An alternative method would entail the disturbance, handling, repair, and disposal of the AC pipe by an authorized TDH licensed worker with the required course of an asbestos worker awareness class or a TDH required asbestos training course preparing workers to handle disturbed ACM. Review of the asbestos work practices and monitoring in the Contractor's Health & Safety Plan will still need to be performed by a licensed TDH Asbestos Consultant.

NESHAP guidelines apply to projects with at least 260 linear feet or 35 cubic feet or 160 square feet. NESHAPS also applies when AC pipe becomes or will become "regulated

asbestos containing material" or RACM. This means that if at least 260 linear feet of the AC pipe has become crushed, crumbled, or pulverized, then the project is subject to the NESHAP. If the Texas Department of Health (TDH) limit of 260 LF is exceeded, it will be the responsibility of the contractor will be responsible for the TDH administrative fee. The asbestos consultant shall be responsible for submitting the TDH notification with copies also submitted to SAWS Environmental Division and the City of San Antonio Environmental Division, if the quantity of 260 LF is exceeded.

During the disjoining operation of AC pipe removal, only the portion that has become RACM would be counted toward the threshold amount if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated AC pipe debris is not properly cleaned up. Then the AC pipe must be considered contaminated, and the whole length is treated as asbestos-containing waste material. If the scope of this project may involve the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

All AC pipe projects will require that NESHAP and OSHA guidelines are met and/or exceeded in areas where AC pipe is to be disturbed. This means that all AC pipe disturbance will require a third party TDH licensed asbestos consultant and asbestos contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to SAWS Environmental Division and City of San Antonio Environmental Division representatives by both the licensed asbestos consultant and asbestos contractor. Upon completion of the AC pipe project an air monitoring abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to SAWS Environmental Division and COSA Environmental representatives by the contractor's consultant. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

2. Definitions

The following terms are defined for the nature of this work.

(1) Air Monitoring - The process of measuring the fiber concentration of a known volume of air collected during a specific period of time. The analysis procedure utilized for asbestos is the NIOSH Standard Analytical Method for Asbestos in Air, Method 7400. Transmission electron microscopy (TEM) may be utilized for lower detection limits and/or specific fiber identification.

(2) Air Monitoring Technician - The person licensed by the Texas Department of Health to conduct air monitoring for an asbestos abatement project or related activity. The Air Monitoring Technician may only obtain air samples, and may only perform analysis of air samples with an upgraded Air Monitoring Technician License, which includes completion of the NIOSH-582 equivalent course. The air-monitoring technician shall be an employee of a licensed asbestos laboratory or a licensed Asbestos Consultant agency.

(3) Amended Water - Water to which a surfactant has been added.

(4) Asbestos - The asbestiform varieties of serpentines and amphiboles. Specifically, chrysotile, crocidolite, grunerite, amosite, anthophyllite, actinolite, and tremolite.

(5) Asbestos Containing Material (ACM) - Material or products that contain more than 1.0% of any kind of asbestos.

(6) Asbestos Containing Waste Material - asbestos containing material or asbestos contaminated objects requiring disposal

(7) Authorized Personnel - Any person authorized by the Contractor and required by work duties to be present in the work area or other regulated areas.

(8) Authorized Visitor – SAWS representatives, and any representative of a regulatory or other agency having jurisdiction over the project.

(9) Asbestos Consultant - That person licensed by the Texas Department of Health to perform the following asbestos related functions: (1) Project design; (2) Asbestos surveys and condition assessment of ACM; (3) Asbestos Management Planning; (4) The collection of bulk material samples, airborne substance samples and the planning of sampling strategies; (5) Owner-representative services for asbestos abatement projects or O&M programs, including air monitoring and project management; (6) Consultation regarding regulatory compliance and all aspects of technical specifications and contract documents; and (7) The selection, fit testing, and appropriate use of personal protection equipment and the development of asbestos related engineering controls.

(10) Abatement Contractor - The company, agency, or entity licensed by the Texas Department of Health that has been retained by SAWS or the Contractor to perform asbestos abatement and other associated functions.

(11) Class II Asbestos Work (OSHA Standard) – Activities involving the removal of ACM, which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestoscontaining wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

(12) Competent Person – One who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them.

(13) Encapsulant - A specific adhesive designed to lock down and minimize the fiber release of asbestos containing materials and asbestos contaminated materials.

(14) Friable Asbestos - Asbestos-containing material, which can be crumbled to dust, when dry, under hand pressure, and includes previously nonfriable material after such previously non-friable material becomes damaged to the extent that, when dry, it may be crumbled, pulverized, or reduced to powder by hand pressure.

(15) HEPA Filter - A high efficiency particulate air filter capable of removing particles > 0.3 microns in diameter with 99.97% efficiency.

(16) NESHAP - The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).

(17) NIOSH - The National Institute for Occupational Safety and Health.

(18) OSHA - The Occupational Safety and Health Administration.

(19) Regulated Area – An area established by the Contractor to demarcate areas where asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

(20) Regulated Asbestos-containing Material (RACM) – (1) Friable asbestos material; (2) Category I non-friable ACM that has become friable; (3) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or, (4) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of the demolition or renovation operations regulated by 40 CFR Part 61, Subpart M.

(21) Staging area – A pre-selected area where containerized asbestos containing waste material will be placed prior to removal from the project site.

(22) Surfactant - A chemical wetting agent added to water to improve penetration.

3. Applicable Standards and Guidelines:

All work under these specifications shall be done in strict accordance with all applicable Federal, State, and local Regulations, standards, and codes governing asbestos abatement and any other trade work done in conjunction with the asbestos abatement. Work activities must also comply with these and other SAWS and City of San Antonio Specifications related to health and safety.

The most recent edition of any relevant regulation, standard, or code shall be in effect. Where there exists conflict between the regulations, standards, codes, or these specifications, the most stringent requirements shall be utilized.

The Contractor shall comply with, at minimum, the following specific regulations:

(1) Occupational Safety and Health Administration (OSHA) including but not limited to:

- Title 29 Code of Federal Regulations Section 1910.1001 – General Industry Standard for Asbestos.
- Title 29 Code of Federal Regulations Section 1910.134 – General Industry Standard for Respiratory Protection.
- Title 29 Code of Federal Regulations Section 1926 – Construction Industry.

- Title 29 Code of Federal Regulations Section 1910.2 - Access to Employee Exposure and Medical Records.

- Title 29 Code of Federal Regulations Section 1910.1200 – Hazard Communication.

(2) Environmental Protection Agency (EPA) including but not limited to:

- Title 40 Code of Federal Regulations Part 61 Subpart M – National Emission Standard for Asbestos.

(3) Texas Department of Health including but not limited to:

- Texas Department of Health - Texas Administrative Code, Title 25, Chapter 295, Subchapter C - Texas Asbestos Health Protection.

- Texas Department of Health - Texas Administrative Code, Title 25, Chapter 325 - Texas Solid Waste Regulations.

- Texas Department of Health - Texas Civil Statutes, Article 4477- A, Section 12, General Provisions 295.31 to 295.73.

(4) American National Standards Institute (ANSI)

(5) American Society for Testing and Materials (ASTM)

(6) Department of Transportation - HM 181

4. Submittals and Notices

(1) At the Pre-construction Conference/Meeting, all training records, certifications, medical records, and laboratory qualifications will be submitted for review to SAWS Environmental Division and COSA Environmental representatives as well as the following:

(a) In order to comply with the SAWS Project Construction Health and Safety Program requirements for any project with the potential to involve friable ACM, the Contractor will be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, SAWS Special Specifications, Item Number 3000, and state requirements. As such, Contractors submitting bids for the project must have a Texas Department of Health (TDH) licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Plans submitted by the Asbestos Consultant must include the person or firms name, address, phone number and TDH certification. Health and Safety plans for working with ACM must address the guidance provided in these special specifications. The guidance provided in this special specification is not intended and does not constitute asbestos abatement project design as described under TAC 25, Chapter 295.47 (TDH asbestos regulations).

(b) Submit documentation satisfactory to SAWS Environmental Division and COSA Environmental representatives that an Initial and/or Negative Exposure Assessment in accordance with OSHA Standard 29 CFR 1911 has or will be performed (as applicable).

(c) Submit documentation satisfactory to SAWS Environmental Division and COSA Environmental representatives that the Contractor's employees, including foremen, supervisors and any other company personnel or agents who may be exposed to airborne asbestos fibers or who may be responsible for any aspects of asbestos disturbance activities, have received adequate training in compliance with applicable rules and regulations.

(d) Submit documentation to SAWS Environmental Division and COSA Environmental representatives of a respiratory protection program for affected employees as per OSHA Standard 29 CFR 1910.134.

(e) Submit documentation to SAWS Environmental Division and COSA Environmental representatives from a physician that all personnel who may be required to wear a respirator are medically monitored to determine whether they are physically capable of working while wearing the required respiratory protection without suffering adverse health effects. In addition, document that personnel have received medical monitoring as is required in compliance with applicable rules and regulations.

(f) Submit to SAWS Environmental Division and COSA Environmental representative's documentation of respirator fit testing for all Contractor employees and agents who must enter the work area. This fit testing shall be in accordance with qualitative procedures as detailed in the OSHA Standard 29 CFR 1910.134. Optionally, the fit testing may be quantitative in nature.

(g) Name of OSHA monitoring Consultant/Lab. The Contractor will be responsible for air monitoring as required to meet OSHA Requirements.

(h) Submit proof satisfactory to SAWS Environmental Division and COSA Environmental representatives that required permits, site location and arrangements for transport and disposal of asbestos containing waste materials have been made.

(2) During Asbestos Disturbance Activities:

(a) Submit copies to SAWS Environmental Division and COSA Environmental representatives of all transport manifests, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area during the project. The Contractor will sign manifests as the SAWS's representative (generator) for the AC pipe and provide copies to SAWS Construction Inspections for final payment.

(b) Upon completion of the AC pipe project an abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to SAWS Environmental Division and COSA Environmental representatives by the contractor's consultant.

5. Construction Requirements

(1) The Work includes all Work specified herein, to include mobilization and demobilization, labor, materials, overhead, profit, taxes, transportation, disposal fees, administrative fees incidental cost, etc. Estimating areas, quantities, weight, etc., are the sole responsibility of the Contractor.

(2) The Contractor shall remove, seal, transport and dispose of all impacted asbestos-containing materials in compliance with all current Federal, State and local regulations, laws, ordinances, rules, standards and regulatory agency recommended requirements. Asbestos disturbance and/or removal activities shall be conducted by properly trained, accredited, and licensed personnel using proper personal protective equipment.

(3) The Contractor shall notify SAWS and City representatives, if applicable, at least 72 hours in advance prior to beginning removal and/or disturbance of the AC pipe. AC pipe disturbance shall be conducted during regular business hours, Monday-Friday. No weekend work of AC pipe disturbance is allowed, unless special circumstances require the contractor to do so.

(4) Time is of the essence in removing the asbestos-containing materials from the project area. All work must be completed within the time period specified. SAWS and the COSA representative will be responsible for coordinating this work in high-density areas, such as schools, church facilities, and residential areas.

(5) All required notifications required to state regulatory agencies will be made by the Contractor with a copies provided to SAWS and City representatives, including but not limited to the TDH Demolition/Renovation Notification Form. If 260 linear feet or greater of AC pipe will become crushed, crumbled or pulverized, then the project is subject to NESHAP regulations and a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

(6) The Contractor shall have an on-site supervisor, who is an OSHA Competent Person, present on the job site at all times that the work is in progress. This supervisor shall be thoroughly familiar with and experienced at asbestos disturbance and other related work and shall be familiar with and shall enforce the use of all safety procedures and equipment. He shall be knowledgeable of all applicable EPA, OSHA, NIOSH and TDH requirements and guidelines.

(7) Prior to commencing any preparation of the work areas for asbestos disturbance, the Contractor shall post all required documents, warning signs and, as necessary, erect physical barriers in order that the work area may be secured.

(8) The Contractor has sole and primary responsibility for the "means and/or methods" of the work and obligation to SAWS to make inspections of the work at all stages and has sole responsibility to supervise the performance of the work. Certain work practices for AC pipe disturbance are prohibited as per Section 3000.10.B.1.

(9) The Contractor shall be responsible for site safety and for taking all necessary precautions to protect the Contractor's personnel, SAWS and COSA personnel and the

public from asbestos exposure and/or injury. The Contractor shall be responsible for maintaining the integrity of the work area.

(10) The Contractor shall confine operations at the site to the area requiring disturbance of AC pipe and the general site area associated with the proximity of the project. Portions of the site beyond areas on which the indicated work is required are not to be disturbed. The Contractor will not unreasonably encumber the site with materials or equipment. If asbestos containing waste materials are required to be stored overnight, it will be properly labeled, secured, and containerized to preclude unauthorized disturbance of the waste materials.

(11) The Contractor shall be responsible for the transport and disposal of asbestos containing waste materials to a duly licensed landfill facility permitted to accept asbestos waste. The Contractor shall be responsible for obtaining and coordinating waste disposal authorization from a TCEQ licensed landfill. Waste manifests shall be used to transport the AC pipe from the project site to the final landfill disposal site. The Contractor will sign manifests as the SAWS's representative (generator) for the AC pipe and provide copies to SAWS Construction Inspections for final payment.

6. Site Security

(1) The Contractor shall demarcate the area of AC pipe disturbance ("regulated area") with barrier tape and warning signs, as per OSHA regulation 29 CFR 1926.1101. Access to the regulated area will be limited to only authorized personnel. Authorized personnel will have to have asbestos awareness training, respiratory training, etc. including SAWS and COSA personnel.

(2) Entry into the work area by unauthorized individuals shall be reported immediately to SAWS and COSA representatives by the Contractor.

(3) A logbook shall be maintained immediately outside of the regulated area. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry

7. Personal Protective Equipment

(1) All work which will or may disturb asbestos-containing materials as specified shall be accomplished utilizing, as a minimum disposal suits with protective head cover, gloves, boots, eye protection, proper respiratory protection, decontamination by HEPA vacuuming and/or wet methods and wet wiping all equipment. The Contractor shall provide hard hats and/or other protection as required for job conditions or by applicable safety regulations. Disposal suits consisting of material impenetrable by asbestos fibers shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing. Workers will be provided protective clothing from the time of first disturbance of asbestos-containing or contaminated materials until final cleanup is completed.

(2) Respiratory Protection: The Contractor shall use removal techniques, methods and equipment which will not permit the fiber count to exceed the OSHA Permissible Exposure Level (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as detected by

personal air sampling methods. Any remedial measures taken by the Contractor to meet this requirement will be at the Contractor's expense.

(a) The Contractor's Competent Person shall ensure use of the appropriate respiratory protection for the work being performed. For minimum legal respiratory requirements, see OSHA Standards 29 CFR 1910.134, 29 CFR 1910.1001, and 29 CFR 1926.1101. All respiratory equipment, such as respirators, filters, etc. shall be certified by the National Institute of Occupational Safety and Health (NIOSH) for use in asbestos contaminated atmospheres.

(b) The Contractor's Competent Person shall perform an Initial and/or Negative Exposure Assessment, which shall be performed on employees who have been trained in compliance with the OSHA regulations. Employees' exposures shall be collected using objective data that is to demonstrate whether the materials specified for removal can release airborne fibers in concentration levels exceeding 0.1 fibers per cubic centimeters (f/cc) during an eight-(8) hour time weighted average (TWA) and the excursion limit of 1.0 f/cc. For the purpose of the assessment, the work conditions should be those having the greatest potential for releasing asbestos fibers. Removal methods using conventional hand tools shall be performed in an area that requires a minimum of a seven-(7) hour work shift with employees performing functions normally required for a total project. Removal, for the purposes of the assessment, should be performed with methods most likely to release fibers and that do not render the asbestoscontaining materials friable. Properly trained employees shall wear proper protective clothing and respirators during the assessment. Initial and/or Negative Exposure Assessments shall be performed in accordance with OSHA Standard 29 CFR 1926.1101.

The development of the Health & Safety Plan by the Contractor's TDH licensed Asbestos Consultant shall include determining the adequacy of the Contractor's air monitoring data (which must performed within the previous 12 months of the project start date) for the Initial and/or Negative Exposure Assessment, based in part on site-specific factors such as changes in personnel or work methods used during AC pipe removal. If this type of air monitoring data needs to be reviewed during the course of a project, the Contractor's Asbestos Consultant shall review the data in order to determine if it is adequate. Any downgrade in personal protective equipment related to asbestos exposure shall be requested in writing to SAWS Health & Safety Department, the COSA Environmental Services Department, and approved by a TDH licensed Asbestos Consultant. This request may be granted only when all regulations and pertinent sections of this special specification for respiratory protection are met.

(c) The Contractor shall begin AC pipe removal operations (i.e., breaking, sawing, cutting, or repairing the pipe) in powered air purifying respirators (PAPRs) equipped with dual HEPA filters. PAPRs will be utilized until such time that air monitoring results indicate that half-face respirators may be used. Any changes (downgrade or upgrade) in respiratory protection will be based upon an 8-hour time weighted average (TWA) of fiber concentrations in the regulated area. Eight hour TWA's will be calculated daily by the Contractor's OSHA monitoring firm, for personal samples. The highest calculated 8 hour TWA shall be used to determine

the type of respirator to be worn. The type of respirators worn will be selected in accordance with 29 CFR 1926.1101 (h) (3).

The Contractor may request a respiratory protection downgrade, approved by a TDH licensed Asbestos Consultant, in writing to SAWS Health & Safety Department and COSA Environmental Services Department when all regulations and pertinent sections of this special specification for respiratory protection are met.

(d) Workers shall be provided with personally issued, individually identified respirators.

(e) No one wearing a beard shall be permitted to wear a respirator.

8. Air Monitoring

(1) Personal Air Monitoring: The Contractor shall provide personal air sampling as required by OSHA regulations. The OSHA TWA permissible exposure limit (PEL) for asbestos (0.1 f/cc) shall not be exceeded. Personal air samples shall be obtained by a TDH licensed Asbestos Air Monitoring Technician and analyzed by an accredited, independent TDH licensed Phase Contrast Microscopy (PCM) laboratory. OSHA monitoring results shall be posted at the project site and made available to all affected Contractor personnel on a daily basis.

(2) The Contractor shall provide, as a minimum, personal air monitoring on each worker who is cutting, (wet) sawing, breaking, or repairing the AC pipe.

(3) Area Air Monitoring: At any time that visible airborne fibers are generated or that wet work procedures are not used, all work will immediately cease until air monitoring by a TDH-licensed Asbestos Consultant Agency has started. The Contractor's on-site Competent Person shall be responsible for making this determination; however, periodic, random site visits by SAWS and COSA Inspectors will field-verify the objectivity of the Competent Person in these matters. Once initiated, the sampling and frequency of the area air monitoring will be dependent upon on the specific work practices being used by the workers at that time. However, the area air monitoring shall include, as a minimum, samples collected inside the regulated area, and upwind and downwind of the regulated area. The TDH licensed Asbestos Consultant Agency hired by the Contractor shall determine the need for additional samples and shall amend the Health & Safety Plan (with a copy to SAWS and COSA) to include sampling protocols.

(4) Area air monitoring shall be conducted in accordance with applicable Federal, State, and local requirements. The cost of area air monitoring due to failure to use adequate wet work procedures will be borne by the Contractor. Copies of all results will be provided to SAWS Environmental Division and COSA Environmental representatives.

(5) Area air sampling shall be mandatory in high density areas such as schools, residential areas, and certain other locations as determined by SAWS Environmental Division and COSA Environmental representatives and made clear in individual SAWS bid documents/plans.

9. Employee Training

(1) Training shall be provided by the Contractor to all employees or agents who may be required to disturb asbestos containing or asbestos contaminated materials for AC pipe handling and auxiliary purposes and to all supervisory personnel who may be involved in planning, execution or inspection of such projects. The training shall be in accordance with OSHA Standard 29 CFR 1926.1101 for "Class II asbestos work".

(2) At a minimum, Contractor employees who will be potentially exposed to asbestos shall have completed within the last 12 months, an 8-hour Asbestos Awareness training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos and work practices related to the handling of AC pipe.

(3) The Contractor's Competent Person shall have completed within the last 12 months, a 40-hour Asbestos Contractor Supervisor training course taught by a TDH licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos, employee personal protective equipment, medical monitoring requirements for workers, air monitoring procedures and requirements for workers, work practices for asbestos abatement, personal hygiene procedures, special safety hazards that may be encountered, and other topics as required.

10. AC Pipe Handling:

(1) General: The Contractor shall properly remove, handle, transport and dispose of all AC pipe specified in the SAWS bid documents/plans for this project. All work involving AC pipe and other ACM products must be addressed in Health and Safety Program documents submitted to SAWS and COSA representatives. To comply with the SAWS and COSA Project Construction Health and Safety Program, Contractors submitting bids for the project must have a TDH licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Program plans are to include provisions for the discipline of any worker failing to use wet work procedures or failing to use designated personnel protective equipment.

The Contractor shall remove ACM with wet methods or by other controlled techniques approved by the TDH, EPA, and OSHA and in accordance with these specifications and the Contractor-provided Health & Safety Plan. Alternative removal methods must be approved at time of the Contractor's submittals. The Contractor shall take special care to prevent damage to the adjacent structures, materials and finished materials not required for demolition to access ACM.

The Contractor shall limit his use of the premises to the work area indicated. Access to the work area shall be controlled by the Contractor. All electrical equipment, etc., shall have ground fault circuit interrupter (GFCI) protection. The Contractor shall properly demarcate, barricade and contain the work and/or regulated areas.

The work consists of providing GFCI protection, the use of approved equipment with engineering controls, sufficiently wetting the asbestoscontaining materials using a

surfactant or lock-down encapsulant, removing the asbestos-containing materials, HEPA vacuuming the work area, wet wiping the work area, double-bagging/double-wrapping the waste and removing carefully as indicated herein and in accordance with the Contractor-provided Health & Safety Plan.

(2) Equipment: Equipment used to cut, break, or otherwise disturb AC pipe and associated asbestos-containing materials may include, but are not limited to: wet-cutting saws, saws equipped with point of cut ventilator (saw equipped with a water mister) or enclosures with HEPA filtered exhaust air, snap cutters, manual field lathes, pressure and non-pressure tapping devices. Equipment used to either control visible emissions of fibers, contain the work area, or facilitate the clean-up of debris may include, but are not limited to: airless spray equipment, pump-up sprayers, surfactant, lockdown encapsulant, HEPA vacuums, brushes, brooms, shovels, disposable rags, polyethylene sheeting of 6-mil thickness, moisture resistant duct tape, asbestos warning signs, notices and barrier tape.

Alternative dismantling equipment may be substituted for the materials indicated herein, but must be approved by the SAWS Health & Safety Office and/or COSA Environmental Service Department.

(a) Prohibited Work Practices and Engineering Controls: the following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of asbestos exposure or the results of Initial Exposure Assessments:

- High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- Other high-speed abrasive tools, such as disk sanders.
- Carbide-tipped cutting blades.
- Electrical drills, chisels, and rasps used to make field connections in AC pipe.
- Shell cutters used to cut entry holes in AC pipe.
- A hammer and chisel used to remove couplings or collars on AC pipe.
- Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud generated by the compressed air.
- Dry sweeping, dry shoveling or other dry clean-up of dust and debris containing ACM.
- Employee rotation as a means of reducing employee exposure to asbestos.

(3) General Removal Work Practices: AC pipe has been identified as a nonfriable ACM with the potential to become friable ACM. The material is classified as non-friable, unless broken at which time its classification changes to friable. NESHAP guidelines apply to projects with at least 260 linear feet or 35 cubic feet or 160 square feet.

NESHAPS also applies when AC pipe becomes or will become "regulated asbestos containing material" or RACM. This means that if at least 260 linear feet of the AC pipe has become crushed, crumbled, or pulverized, then the project is subject to the NESHAP. During the disjoining operation of AC pipe removal, only the portion that has become RACM would be counted toward the threshold amount if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated AC pipe debris is not properly cleaned up. Then the AC pipe must be considered contaminated, and the whole length is treated as asbestos-containing waste material. If the scope of this project may involve the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form will need to be sent to TDH by the Contractor. This form will need to be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

All AC pipe projects will require that NESHAP and OSHA guidelines are met and/or exceeded in areas where AC pipe is to be disturbed. This means that all AC pipe disturbance will require a third party TDH licensed asbestos consultant and asbestos contractor on-site during AC pipe disturbance. An asbestos abatement work plan shall be provided to *SAWS a*nd City representatives by both the licensed asbestos consultant and asbestos contractor. Upon completion of the AC pipe project an air monitoring abatement report shall be required by the contractor's asbestos consultant. Copies of the final abatement report shall be prepared and submitted to SAWS and COSA representatives by the contractor's consultant. OSHA requires that during any ACM disturbance, regardless of amount, the asbestos worker(s) shall be properly protected during potential asbestos exposure, 29 CFR, Subpart Z, 1910.1101.

In order to comply with SAWS Project Construction Health and Safety Program requirements for any project with the potential to involve friable ACM, the Contractor will be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, and state requirements. As such, Contractors submitting bids for the project must have a TDH licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety plans for working with ACM must address the guidance provided in these special specifications.

(4) A sufficient supply of disposable rags for work area decontamination shall be available.

(5) Disposal bags for RACM shall be of true 6-mil polyethylene, pre-printed with labels as required by EPA regulation 40 CFR 61.152 (b)(i)(iv) or OSHA requirement 29 CFR 1926.1101(k)(8).

(6) Stick-on labels identifying the Generator's name (SAWS) and address and the project site location shall be applied to any asbestos waste bags that contain RACM, as per EPA or OSHA and Department of Transportation HM 181 requirements.

(7) Work Area Preparation: Post warning signs and barrier tape meeting the specification of OSHA 29 CFR 1910.1001 and 40 CFR 61 at any location and approaches to a location where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough away from the work area to permit an employee to read the sign and take the necessary protective measures to avoid exposure. Maintain

constant security against unauthorized entry past warning signs and barrier tape. Signs will be in both English and Spanish.

(8) Personnel exit procedures

(a) Before leaving the work area all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing and/or wet wiping procedures. (Small HEPA vacuums with brush attachments may be utilized for this purpose.) Adequate washing facilities shall be provided and utilized on-site.

(b) Upon completion of the work, contaminated gloves shall be disposed of as asbestos contaminated waste. Disposable cloth gloves may be substituted for leather gloves, at the Contractor's discretion. (Rubber boots may be decontaminated at the completion of the project.)

(9) Specific Removal Work Practice Requirements

(a) The Contractor has sole and primary responsibility for the "means and/or methods" of the work and obligation to SAWS and COSA to make inspections of the work at all stages and has sole responsibility to supervise the performance of the work.

(b) The Contractor shall isolate the regulated area with barrier tape and asbestos warning signs.

(c) The Contractor shall lay and secure 6-mil polyethylene sheeting on the ground on both sides of the AC pipe for the length of the work area.

(d) Working within the regulated area, using wet removal methods, the Contractor shall thoroughly soak each section of AC pipe to be disturbed, prior to any removal activity, with a surfactant or lock down encapsulant. The Contractor shall use equipment capable of producing a "mist" application to reduce the potential for release of fibers. The Contractor shall take care to use as much encapsulant or surfactant as needed in order to lockdown possible fallout debris from edges and joints during removal. Provide continuous wetting of the materials throughout the entire removal process. The Contractor shall take care to limit the breakage of asbestos containing materials and remove these materials as intact as possible.

(e) Any AC pipe debris on adjacent surfaces shall be removed. The Contractor shall promptly clean up asbestos wastes and debris following AC pipe disturbance. Remove and containerize all visible accumulations of asbestos containing material and asbestoscontaminated debris by hand. Asbestos debris mixed with soil may be picked up with shovels, with the contaminated soil being containerized as a regulated ACM waste. Clean-up activities may also involve vacuum cleaners equipped with HEPA filtration or wet-wiping surfaces with disposable rags. contaminated rags shall be containerized as a regulated ACM waste.

(f) After disturbance and clean-up activities and prior to removal of the AC pipe from the regulated area, the Contractor shall encapsulate damaged and exposed areas and ends of the AC pipe with a lock-down encapsulant.

(g) The Contractor may now remove the Category II non-friable asbestos-containing material "that is not in poor condition and is not friable" as defined in NESHAP regulations. The Contractor shall remove all AC pipe "intact" and in whole complete sections by carefully lifting the AC pipe to the disposal container using approved equipment. The Category II non-friable AC pipe must not become "friable" (crumbled, pulverized, or reduced to a powder). The Contractor shall not drop, break and/or otherwise make the AC pipe susceptible to release asbestos fibers. If these procedures are followed and debris is cleaned up properly, then the Category II non-friable AC pipe may be disposed of as nonregulated asbestos-containing waste material.

(h) Pieces of AC pipe debris shall be considered RACM and handled as regulated ACM waste. The debris shall be placed in two 6-mil asbestos bags or double wrapped, with proper labeling.

(10) Abandonment of AC water mains/pipes: The Contractor is responsible for isolating the existing mains to remain in service by capping, plugging and blocking as necessary. The opening of an abandoned ac water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete into and around the openings in sufficient quantity to provide a permanent watertight seal. Abandonment of old, existing AC water mains will be considered subsidiary to the work required, an no direct payment will be made.

(11) Abandonment of Valves that contain ACM: Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within eight (8") inches of the street surface. The remaining eight (8") shall be filled with 2,500 psi concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valves covers shall be salvaged and return to SAWS. The abandonment of valves containing ACM will be considered subsidiary to the work required, and no direct payment will be made.

(12) Verification of Removal & Clean-up Procedures: The Contractor's on-site Competent Person shall inspect the work area and ensure that all surfaces are free of AC pipe dust and debris.

(13) Disposal Procedures

(a) If a dumpster/trailer is used for temporary storage it will be secured and closed at all times except when loading. It will be properly marked and critical barrier tape will be in place.

(b) AC pipe debris and asbestos-contaminated items shall be properly double bagged, labeled and loaded in a fully enclosed, lined, locked and placard transport container and transported and disposed of in compliance with all regulatory requirements as RACM.

(c) After being removed from the regulated area, Category II nonfriable AC pipe shall be transferred to a polyethylene-lined container. Remove all containers as soon as practical, but no later than the end of the work shift.

(d) When the dumpsters/trailers are full, they will be hauled away to the closest EPA approved landfill for proper disposal. The Contractor may dispose of the Category II non-friable AC pipe waste material as non-regulated waste in a municipal solid waste landfill as defined in the NESHAP and TCEQ Rule (Type I Landfill). Written approval to transport and accept the Category II non-friable material shall be obtained from a pre-approved transporter and landfill and submitted to SAWS Environmental Division and COSA Environmental representatives prior to disposal.

(e) Submit copies to SAWS Environmental Division and COSA Environmental representatives of all transport manifests, trip tickets, and disposal receipts for all asbestos waste materials removed from the work area during the project. The Contractor will sign manifests as the SAWS's representative (generator) for the AC pipe and provide copies to SAWS Construction Inspections for final payment.

11. Measurement

Measurement of the items "Asbestos Abatement Work Plan" and "Removal, Transportation, and Disposal" as specified herein shall be by the "lump sum."

12. Payment

The work performed as prescribed by these items shall be paid for at the contract lump sum price bid for "Asbestos Abatement Work Plan" and "Removal, Transportation, and Disposal," which prices shall be full compensation for the work herein specified including the furnishing of all materials, equipment, tools and for the material disposal, submittals, labor and air monitoring necessary to complete the work.

CPS ENERGY
REQUIREMENTS AND SPECIFICATIONS
FOR CONSTRUCTION OF
NATURAL GAS DISTRIBUTION FACILITIES
ON THE
FORT SAM HOUSTON TRANSPORTATION PROJECT

CPS Energy

TABLE OF CONTENTS

CPS ENERGY (CPS)
EXHIBIT GAS-1

ADDITIONS TO THE PROJECT BID DOCUMENTS

I. MINIMUM REQUIREMENTS FOR BIDDING ON CPS WORK

A. Contractor used for the gas pipeline work must have performed utility gas pipeline work within the past (3) three years of similar technical scope and magnitude as the services to be performed under this contract. With their bid, Contractor shall provide evidence of qualifications in this regard and of any licenses, permits or registrations possessed that pertain to the services or are required in the specifications. Contractor may contact CPS Energy (CPS) prior to the letting of this project to determine if their previous experience meets this requirement.

B. The Contractor shall have a program complying with 49 CFR Part 199, "Control of Drug Use in Natural Gas, Liquified Natural Gas, and Hazardous Liquid Pipeline Operations" and 49 CFR Part 40, "Procedures for Transportation Workplace Drug and Alcohol Testing Programs" to test employees for the presence of prohibited drugs as prescribed and to provide an employee assistance program. The Contractor agrees to provide CPS with an affidavit prior to the date of execution of the Contract which states that Contractor and its employees have complied with all applicable laws, statutes, and regulations pertaining to ensuring a drug free workplace including, but not limited to, the requirements of Part 199 and Part 40. Furthermore, the Contractor agrees to allow CPS Human Resources personnel periodic on-site access to Contractor's records documenting compliance with Part 199 and Part 40. Contractor will provide the name and contact person for the agency or consortium used by the Contractor to comply with this requirement prior to the date of execution of the Contract.

C. The Contractor agrees to provide CPS with an affidavit prior to the date of execution of the Contract which states that Contractor and its employees have complied with all applicable laws, statutes, and regulations pertaining to ensuring a drug free workplace including, but not limited to, the requirements of 49 CFR as amended by the Research and Special Programs Administration (RSPA).

D. City Public Service requires the following to verify Contractor and Sub Contractor compliance with all applicable laws, statutes and regulations pertaining to the qualification of pipeline personnel including, but not limited to the applicable requirements of 49 CFR Part 192 — Subpart N -"Qualification of Pipeline Personnel" as adopted by the Railroad Commission of Texas (RCC) within the Pipeline Safety Rules.

1. ***A Notarized Affidavit*** **that states the company placing the bid and its sub-contractors are in compliance with 49 CFR 192 and RRC Pipeline Safety Rules pertaining to the qualification of pipeline personnel.**

2. A current copy of its Operator Qualification Plan, unless currently on file, and approval of its plan by a City Public Service Gas Operation's Representative. A copy of City Public Service Covered Tasks is shown in Exhibit Gas-7 - City Public Service Covered Tasks Regulated by 49 CFR Part 192.

3. Current listing of employees and qualifications.

E. The Contractor shall submit a copy of SMWBA Form 101 to CPS prior to date of execution of the contract.

F. Prospective Contractors bidding on the Project shall submit to CPS through the City of San Antonio a properly executed Certificate of Insurance from its insurance agent or carrier of such insurance coverages as required and set forth in the Project Contract Documents prior to award of the Contract. Failure to provide proof of insurance will result in City's Contractor not being approved for award of the CPS utility work on the Project.

ADDITIONS TO THE PROJECT CONTRACT DOCUMENTS

1. DEFINITION OF TERMS

Add to the City of San Antonio Article I. Contract Definitions:
49. CPS – CPS Energy Board, a municipal agency of the City of San Antonio.

2. LAWS TO BE OBSERVED

The Contractor shall make himself familiar with and at all times shall observe and comply with all Federal, State, and local laws, ordinances, and regulations which in any manner affect the conduct of the work and shall indemnify and save harmless CPS and its representatives against any claim arising from the violation of any such law, ordinance, or regulation, whether by himself or by his employees.

3. PERMITS, LICENSES AND TAXES

The Contractor and his subcontractors shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incident to the due and lawful prosecution of the work and upon request by the City Engineer give evidence of the same.

4. RESPONSIBILITY FOR DAMAGE CLAIMS

The Contractor agrees to indemnify and save harmless CPS, its agents, and employees from all suits, action or claims and from all liability and damages for any and all injuries or damages sustained by any person or property of any character in consequence of any neglect in the performance of the contract by the Contractor and from any claims or amounts arising or recovered under the "Workers' Compensation Laws"; Chapter 101, Texas Civil Practice and Remedies Code (Texas Tort Claims Act), or any other laws. He shall further so indemnify and be responsible for all damages or injury to property of any character occurring during the prosecution of the work to the extent resulting in whole or in part from any act, omission, neglect or misconduct on his part in the manner or method of executing the work; or from failure to properly execute the work; or from defective work or materials purchased by Contractor, except those claims for damages caused solely by the negligence of CPS. Contractor shall not be released from these responsibilities until all claims have been settled and suitable evidence to the effect furnished to CPS. The indemnification provided herein shall survive the termination of this Contract.

5. CONTRACTOR REQUIREMENT

A. The Contractor shall abide by the regulations promulgated in 49 Code of Federal Regulations Part 40 and 49 Code of Federal Regulations Part 199 and any modifications thereto listed below in this Article. CPS will require such compliance to be a part of this Contract and will immediately terminate this Contract if Contractor is found to not be in compliance with said regulations. Contractor shall indemnify CPS against any fines, penalties, damages, costs or attorney fees based upon any violation by Contractor of the same.

B. The Contractor shall abide by the regulations promulgated by the Federal Highway Administration (FHWA) which states that contractors subject to FHWA mandates shall be in compliance with those parts of 49 Code of Federal Regulations (CFR) which relate to the illegal use of alcohol and controlled substances.

6. PROSECUTION AND PROGRESS

All workers or subcontractors employed by the Contractor shall have such skill and experience as will enable them to properly perform the duties assigned them.

7. WARRANTY

The Contractor shall warrant all components, materials and workmanship for a period of at the least one (1) year from the date of final completion of gas pipeline work by Contractor. The Contractor warrants the title and guarantees the equipment, materials and workmanship furnished under this Contract to be specified and to be free from defects in design, workmanship and materials. If within the warranty period the work fails to meet the provisions of this guarantee, CPS shall notify the Contractor thereof immediately and the Contractor shall promptly correct any defects, including nonconformance with the Contract Documents, by adjustment, repair or replacement F.O.B. the Project site of all defective work at its sole costs.

8. INSURANCE

The Contractor agrees to keep in full force during the performance of services hereunder insurance sufficient to fully protect CPS from all damages, claims, suits and/or judgements, caused or claimed to have been caused by or in connection with the performance or failure to perform any services undertaken by Contractor, his subcontractor, or their agents, or employees.

9. COORDINATION

All questions about the gas construction shall be addressed to Brad Carr, CPS Gas Construction, at (210) 353-4251. Design and engineering questions may be addressed to the CPS Gas Engineering Division, Civic Improvements Section, at (210) 353-2430.

CPS ENERGY (CPS)
EXHIBIT GAS-2
SPECIFICATIONS FOR CONSTRUCTION OF NATURAL GAS DISTRIBUTION FACILITIES

1. GENERAL

The work to be done includes clearing right-of-way where necessary; receiving, transporting and unloading all materials from a designated CPS Energy (CPS) center; stringing pipe, welding steel pipe and pipe fittings, and fusing high density polyethylene gas pipe and pipe fittings; excavating trenches and ditching for the burial of the gas piping facilities; installation of gas piping into the excavation along with required appurtenances such as anodes, anodes lead wires, and tracer wires; backfilling of ditches, repair of damage to any street, road, highway, sidewalk, drainage structures, driveways, signs, other utilities, fencing, or other existing structures; clean-up of right-of-way and any other item enumerated in these specifications.

The work shall conform with Title 49 of the Code of Federal Regulations, Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards" and to the CPS design standards attached to this document as Exhibits GAS-3 and GAS-4, as applicable.

2. ROUTE OF THE GAS LINE

Construction of the gas line will, in general, follow the route shown on Exhibit GAS-6 (CPS Job Sketch). Gas services to be installed, relocated or adjusted are also indicated on Exhibit GAS-6, as applicable.

CPS reserves the right to make any changes in the routing which may be deemed necessary and such changes shall in no manner alter the terms or compensations payable under this contract except as they are affected by linear measurements of work completed.

All gas lines shall be installed in a separate trench apart from any other utility lines unless joint trenching with other utilities is specifically required on the CPS Job Sketch or prior written approval is obtained from the CPS Representative allowing joint trench construction.

3. RIGHT-OF-WAY

The CPS Job Sketch will indicate the planned route of the gas lines to be installed. The construction plans will show as much information as can be reasonably obtained by CPS regarding the location of other existing buried utilities and structures in/or crossing the rights-of-way, but CPS assumes no responsibility for the correctness or completeness of this information. Contractor will be held responsible for locating all such utilities and structures and for avoiding damage to them and for making repairs or paying for any damage thereto. CPS will provide and furnish all necessary right-of-way, federal, state, county and city roadway crossing permits, which shall be necessary for the construction.

Most of CPS' gas facilities are constructed within public rights-of-way, however, CPS may acquire easements on private property for construction of gas distribution facilities when public rights-of-way are not available or unusable. When gas facilities are planned for construction within easements on private property, the exact boundaries of such easements will be shown on the CPS Job Sketch, and CPS will survey and stake the easement boundaries in the field. Contractor shall preserve such field staking of easement boundaries. If the Contractor's construction activities disturb the field survey stakes, then the Contractor shall be responsible for resurveying the easement boundary when necessary. Contractor shall comply with all reasonable requirements of landowners, tenants or lessees which are designed to reduce interference of construction. It will be the Contractor's responsibility to limit traffic on the right-of-way to only such vehicles as may be necessary for construction. Contractor will be held liable for damage claims arising from grass and brush fires that may be set during his operations.

In addition, the term "right-of-way" shall also apply to those portions of public streets, roads or highways in which sections of the utility lines will be constructed. The Contractor working in any public right-of-way is responsible for the safe movement of traffic (pedestrian and/or vehicular) through the construction area. The Contractor shall meet all requirements for barricading and traffic control as specified in the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

4. MATERIALS TO BE FURNISHED BY CPS

CPS agrees to furnish all steel pipe, polyethylene (plastic) gas pipe, casing pipe, valves, valve boxes, stop cocks, service risers, couplings, casing insulators, casing end seals, steel pipe insulating joints, miscellaneous pipe fittings, anodes, cathodic protection test lead boxes, pipeline warning signs, gas pipe tracer wire, tracer wire clamps, pipe coating primer, and pipe coating tape and/or shrink sleeves necessary to complete the job except when these materials are to be specifically provided by the Contractor in accordance with written requirements of the Compensation Schedule (Exhibit GAS-5) or CPS Job Sketch (Exhibit GAS-6).

5. CLEARING AND GRADING OF RIGHT-OF-WAY

The Contractor shall clear and grade right-of-way sufficiently for his need and for hauling and stringing pipe and other material but not to exceed the width of right-of-way. Contractor shall be responsible for any damages outside of right-of-way limits. Contractor shall perform all necessary grading and compaction at road, stream, and gully crossings and at other locations where needed to permit the passage of equipment, cars, and trucks. Before any brush or timber is cut to clear right-of-way, approval from CPS in writing must be obtained. All brush and timber cut to clear right-of-way must be removed from the right-of-way and disposed of to the satisfaction of the CPS Representative. Any trimming of an Oak Tree will require the contractor to follow **Oak wilt suppression procedures:**

- Avoid pruning or wounding any oaks unless absolutely necessary.
- If pruning is required, request assistance as soon as possible from the CPS Tree & ROW Maintenance Section or one of the Inspectors listed below.
- Any pruning wounds or damage caused by equipment (trucks, diggers, trenchers, backhoes, etc.) must be painted immediately, within a minimum of one hour. This includes any cracked

or ripped limbs and wounds to trunks, limbs or root flares which may have been damaged by passing equipment.

- Within a known infection center, all tools must be disinfected with a 10% clorox and water solution or Lysol spray before using these tools on any other oak tree.

Requests for Assistance From the Tree & ROW Maintenance Section
When assistance is required, please provide as much notice as possible or call as soon as damage occurs. Contact names and numbers are listed below:

	Office	Radio#	Cellular	Pager#
Section Office	353-3593	2400		
James F. Koenig	353-3798	2401	844-5457	1336
Terri Minnia	353-5218	2405	394-3580	2241
Margie Regalado	353-5243	2403	394-3579	2428
Clyde Stroud	353-5218	2404	394-3578	2301
Ed Scott	353-5243	2402	275-6935	2852

The Contractor shall promptly repair all bridges, private roads, fences, buildings or other property damaged by him in the progress of the work. Permission must be secured from owner before private roads or bridges are used or blocked.

The Contractor will be notified prior to construction of all known requirements or restrictions of right-of-way by CPS.

6. UNLOADING, HAULING, AND STRINGING MATERIALS

The Contractor shall unload from trucks and string on the right-of-way, as needed, all gas pipe and other materials in such manner as to prevent damage to same. Pipe shall be unloaded with proper equipment, and not dropped from trucks.

When materials in storage are issued to the Contractor, such materials shall become the responsibility of the Contractor, and adequate methods of inventory and material transfer will be set up by the Contractor. The Contractor and CPS shall jointly inspect materials, which have been stockpiled by CPS prior to hauling. After this inspection, the Contractor shall pay CPS delivered cost of any materials lost or damaged beyond use during the construction operation.

Under no circumstances shall pipe be strung in advance of right-of-way clearing operations.

Stringing of pipe on right-of-way shall be done in such a manner as to cause minimum interference with the normal use of driveways, streets, roads, highways, and land crossed. The Contractor shall prevent entrance of dirt or debris into pipe during stringing.

7. LOCATING EXISTING CPS GAS FACILITIES

The Contractor shall be required to locate all existing gas facilities as needed for the construction and installation of new gas facilities. Upon request by the Contractor, the CPS Inspector will provide copies of the appropriate gas maps to facilitate locating activities for the existing gas facilities at the job site, however, CPS does not guarantee the accuracy of such gas facilities map information. The Contractor shall use conventional pipe locating equipment and techniques in conjunction with information from the gas facilities maps to determine the actual location of existing gas facilities. The Contractor shall be solely liable for any damages to existing gas facilities and any damages to other infrastructure such as the street, drainage structures or other utilities, that are incurred by the Contractor.

8. TRENCHING (CONVENTIONAL OPEN EXCAVATION)

A. **Equipment and General Methods** - Contractor shall use such equipment and methods that may be required to excavate the trench or ditch along the route specified on the CPS Job Sketch, regardless of the type of soil or rock encountered and regardless of the depth of excavation necessary. Contractor shall furnish all equipment, materials and supplies that may be necessary for the completion and maintenance of the trench or ditch, including water control, shoring, coffer dams and sheet piling.

B. **Survey Stakes** - Contractor shall carefully preserve all survey stakes set by CPS, CPS representatives or consulting engineers and shall be liable for any extra expense due to Contractor's failure to maintain such stakes.

C. **Trench Specifications** - The trench or ditch shall have sufficient width and be of such depth to allow installation of piping and valves at depths specified on the CPS Job Sketch and/or the CPS Design Standards. When surfaced streets are cut, the paving shall be cut in neat lines defining the width of the trench to be excavated. The cut shall extend entirely through the asphaltic surfacing and shall break the base material to a sufficient depth to assure the removal of the surfacing and base without breaking beyond the lines of the trench. Concrete saws, pneumatic paving chisels, or mechanically operated drop blades may be used for asphalt surface cutting as approved by the governmental authority exercising jurisdiction. A concrete saw must be used to cut concrete driveways, streets, or other concrete surfaces.

D. **Blasting** - No blasting will be permitted by CPS.

E. **Hand Ditch Requirement** - In all cases where shrubbery, trees, or valuable growing timber is encountered in the right-of-way, and in any location where, in the opinion of the CPS Representative, the use of ditching equipment may result in unnecessary damage or injury to property crossed by the right-of-way, CPS may require the Contractor to excavate the trench or ditch by hand or other approved method.

F. **Temporary Bridges** - When the trench or ditch is excavated where it is desirable for a property owner, tenant or other pedestrians to have a passageway across the excavation, the Contractor shall provide safe, temporary bridges or provide other safe means of crossing the ditch.

No streets or driveways shall be blocked at night, except with owner's permission, and any street or driveway opened shall be provided with a strong temporary bridge to allow traffic to move safely. Open trenches and test holes shall be properly marked by means of barricades and warning lights.

G. **Additional Depth of Trench** - Where trenching across or adjacent to, or within the right-of-way of roads or highways, railroads, drainage ditches, creeks, ravines, and other water courses and also at points where the contour of the earth may require extra depth, Contractor shall excavate to such additional depth as may be necessary to meet the requirements of CPS and any public or private authority having jurisdiction over same.

H. **Dust Suppression** - **Whenever trenching activities create significant amounts of dust or other undesirable emissions into the atmosphere, then the Contractor may be required, at the sole discretion of the CPS Inspector, to take necessary action to reduce such emissions.**

I. **Trench Excavation Safety** - The Contractor must comply with 29 CFR Part 1926, Occupational Safety and Health Standards; Subpart P - Excavations. Contractor and/or Contractor's independently retained employee or safety consultant, if any, shall review the construction plans and any available geotechnical information and the anticipated installation sites within the project work area in order to develop the Contractor's trench excavation safety plan and procedures. The plans and procedures shall, at a minimum, comply with OSHA's standards for trench excavations. Specifically, the Contractor and/or the Contractor's independently retained employee or safety consultant shall develop and implement a trench safety program in accordance with OSHA's standards governing the presence and activities of individuals working in and around trench excavation.

9. TRENCHLESS CONSTRUCTION METHODS

The use of guided or directional boring equipment to install new gas distribution facilities is acceptable to CPS provided that the Contractor demonstrates to the satisfaction of the CPS Representative that such equipment is capable of installing the gas pipe along a controlled and relatively constant horizontal and vertical alignment for the specific soil conditions that are encountered at each job site. Special provisions must be made to insure that the gas pipe is not damaged as it is pulled or otherwise inserted into the bored hole. The bored hole must be at least one nominal pipe size larger than the gas pipe that is to be installed (i.e. a 4-inch gas pipe requires at least a 6-inch bored hole). When the bored hole is known to have significant deflections, the bored hole must then be at least two nominal pipe sizes larger than the gas pipe.

When such equipment is used to install polyethylene gas pipe, a fusible link shall be used between the pull head and the gas pipe at all times to prevent damage to the gas pipe during the pull-back operation. The fusible link shall be at least 2 feet in length and it shall be a section of CPS polyethylene pipe that is one nominal pipe size smaller than the gas main being installed. The CPS Representative shall inspect the fusible link and the leading edge of the installed gas pipe for any significant gouges or scrapes in the outside wall of the pipe or excessive change in length of the fusible link. If such damages to the fusible link or pipe are found to exist, then the

Contractor shall remove and replace all of the damaged pipe at the Contractor's expense, and the Contractor shall reimburse CPS for the cost of the damaged pipe (including CPS inventory and handling expenses).

When such equipment is used to install steel gas pipe, the CPS Representative shall inspect the installed gas pipe for any significant gouges or scrapes in the protective coating on the outside wall of the steel pipe. If such damages to the coating are found to exist, then the Contractor shall repair all of the damaged coating at the Contractor's sole expense.

Whenever gas service lines are planned for installation along a section of gas main that is being installed with guided or directional boring equipment, the Contractor shall excavate at least one service tap location prior to pulling the gas main into the bored hole. The purpose of this excavation is to provide the CPS Representative with an intermediate inspection hole where the gas pipe can be inspected during the pipe insertion process. Preferably, the intermediate inspection hole shall be located near the middle of the directionally bored section. If several gas service connections are planned along the insertion route, then the CPS Representative shall select the location of the service tap that the Contractor must excavate for the intermediate inspection hole before the gas pipe insertion process.

Gas mains and services that are installed by guided or directional boring equipment shall not be routinely installed at depths greater than seven (7) feet unless one of the following conditions apply:

1) The CPS Job Sketch (Exhibit Gas - 6) specifically requires installation depths in excess of seven (7) feet.
2) Installation depths in excess of seven (7) feet are the shallowest depths necessary to achieve acceptable clearance between the gas pipe and another buried utility or structure while maintaining the minimum burial depth requirements for the gas pipe.
3) The CPS Representative approves such installations even though conditions described in Items 1) and 2) above are not applicable.

When guided or directional boring equipment is used to install gas distribution facilities special provisions (if any) in the Compensation Schedule (Exhibit Gas-5) for additional compensation due to extra depth of cover shall not apply.

The method of gas service replacement by Insertion involves sliding a new polyethylene service pipe of smaller diameter into the existing steel service pipe. This is an acceptable method of installation provided that the ends of the existing steel pipe are reamed and fitted with bushings for the pipe to be inserted without damage, and a shrink sleeve is applied to keep components in place and prevent damage thereafter. In order to reduce stress on the service line being inserted from the main, the horizontal distance between the end point of the new service alignment and the point of insertion should be, at least, twice the perpendicular distance between the lines (See Insertion Detail, page 19 of 20, exhibit Gas-3). Tracer wires will be inserted through the existing service along with the new pipe. An electrical continuity test will be conducted on each installed tracer wire to verify that the tracer wire has not been "shorted" against the existing steel service during the installation procedure.

10. STORM WATER POLLUTION PREVENTION PLAN

The gas utility construction work shall be performed in accordance with the City of San Antonio Storm Water Pollution Prevention Plan (SWPPP).

11. PROTECTION OF GAS PIPE ENDS

During the course of construction, diligent care shall be exercised to keep the gas pipelines clean. At the end of each day's work and at the other times that the ends of the installed pipe are left unattended, the pipe ends shall be securely closed to prevent the entrance of water, animals, trash or any other obstructions, and shall not be opened until work is resumed.

If there is reasonable cause to believe that water, trash or other obstruction is in a portion of the lines, the Contractor shall take whatever steps are necessary to assure CPS that there is no water, trash or other obstruction in the line or to remove the water or other foreign matter if it is in the lines. Any and all work required to assure CPS that the gas pipes are clear of debris and other such matter or to remove such obstructions shall be at the Contractor's expense.

12. WELDING

Welding shall be in accordance with API Standard 1104, 17th Edition, dated September, 1994.

Welds shall be made the "shielded metal-arc" process. All equipment and welding rods will be furnished by the Contractor. Brand of welding rods proposed to be used by the Contractor shall be approved by CPS prior to use.

Where determined by the CPS Representative to be necessary, back-welding or inside-welding of all tube turns, ells, etc., in the pipe lines shall be required by the Contractor as part of the work covered by the Contract. Back-welding shall be performed at the sole expense of the Contractor.

All welds shall be made with not less than three (3) beads. The second or "Hot Pass Bead", should be run on the full circumference of the pipe as soon as practical. The intent of the above is that the Hot Pass or second bead shall be run before the Stringer Bead has cooled.

Prior to being permitted to weld on the line, each welder shall qualify in accordance with Section 3.0 of API Standard 1104 referred to previously and shall pass the tests listed in paragraph 3.4 of the API Standard. The Contractor will conduct, or make arrangements for, and stand the expense of the qualification tests of the welders. The qualifying tests will be conducted in the presence of the CPS representative.

Each welder will be assigned a specific number and it shall be his duty to personally affix such number in crayon on each weld for future identification. Steel die stamping shall not be used.

CPS rights of welding inspection, shall be as given in Section 5.1 of API Standard 1104. Unless otherwise directed, the Contractor will test all welds with soapsuds while subjected to an internal air pressure of 90 psig prior to field coating the joints.

Pin holes, leaks, cold laps, rivers, undercutting or any defects whatsoever occurring in any weld shall, at the discretion of the CPS Representative, be repaired by cutting out the entire weld and completely rewelding at no additional expense to CPS. Whenever it thus becomes necessary to remove a weld from the completed line, replacement shall be made, at the sole expense of the Contractor, by welding into the line a pup joint having a minimum length of ten (10) feet.

13. RADIOGRAPHIC INSPECTION

This Section applies when radiographic inspection is specified in the contract documents.

A. Standards and Codes - The latest available edition of the following referenced documents shall be applied when required:

1. Department of Transportation, Title 49, Part 192 - "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards."

2. Recommended Practice No. SNT-TC-1A, Supplement A - "Radiographic Testing Method."

3. ANSI B31.8, "Gas Transmission and Distribution Piping Systems."

4. ASME Code Section V, "Nondestructive Examination."

5. United States Nuclear Regulatory Commission, Title 10, Chapter 1, CFR - Energy and other federal, state and local regulations for protection against radiation hazards.

B. Radiographic Procedure - All radiographic inspections shall be performed in accordance with written procedures per Section 8.2 of API Standard 1104. Contractor shall provide a copy of the written procedure to the CPS Representative who shall determine the acceptance of the procedure.

C. Personnel Qualifications - Radiographic certification shall be the result of a qualification and certification program that incorporates the requirements of Recommended Practice SNT-TC-1A, Supplement A in accordance with Section 8.7 of API Standard 1104.

D. Equipment and Material - Contractor shall furnish all equipment and materials necessary for the performance of the radiographic inspection. Such materials and equipment include all film and supplies for the processing, film identification, recording, filing and storage of same. Also, Contractor shall provide all barriers, warning systems, film badges, documentation and records as is necessary for the protection and personnel monitoring of every person near a radiation source.

E. **Production Radiography Procedures** - Contractor will notify the CPS Representative if any welds fail to meet the specification. All repaired welds or welded joints, which have been completely replaced, shall be radiographed.

F. **Film Identification Procedure** - Film identification shall be in accordance with Section 8.6 of API Standard 1104. The exact method of identification will be approved by the CPS Representative prior to the start of radiographic inspection.

G. **Radiographic Reports and File** - Contractor shall be responsible for furnishing the CPS Representative with a report for each calendar day the unit is on the project. All radiographs made by Contractor shall be delivered to the CPS Representative and shall become the property of CPS.

14. PRESSURE TESTING

A. **General** - The Contractor shall demonstrate to the satisfaction of the CPS Representative, by performing a pressure test, that the mains and/or services installed do not leak and that they will operate safely at the desired maximum allowable operating pressure. Pressure tests are performed to verify satisfactory workmanship and the strength of materials. To the extent practical, the test shall be conducted to the entire pipeline so as to minimize the number of untested tie-in connections. All joints used to tie-in a test segment of pipeline after the test shall be soap bubble tested at not less than its operating pressure. The Contractor shall be responsible for locating and repairing any leaks or failures, which are revealed by the test.

The Contractor shall furnish all supervision, labor, materials and equipment to perform the pressure test required, including but not limited to, pumps, compressors, pigs, test instrumentation and water. Pressure test specifications will be indicated on the CPS Job Sketch (Exhibit GAS-6). The specifications will indicate the minimum and maximum test pressure, test fluid and test duration, as appropriate. The Contractor shall conduct the test in accordance with the applicable requirements of Title 49 CFR 192 and shall take all necessary safety precautions to protect construction personnel and the general public during the course of the test. The Contractor shall be responsible for obtaining all permits necessary to conduct the test except for the Railroad Commission of Texas test water discharge permit that is required for hydrostatic pressure tests.

B. **Standard Air Test** - A standard air test will generally be specified for gas mains and services to be operated at pressures of 60 psig or less. This test will be indicated on the CPS Job Sketch without a test duration period. The minimum test pressure shall be 90 psig and shall not exceed 120 psig. The test duration shall be a time sufficient to insure discovery of all potentially hazardous leaks. At the minimum, each weld, butt fusion and any other fitting and connection shall be soap bubble tested at the specified test pressure. The test pressure shall be measured with a dial type gauge and shall be monitored during the course of the test to detect leakage. Upon completion of the test(s), the Contractor shall sign and date, in the appropriate location, the "as built" job sketch to indicate successful completion of the test. Pending acceptance by the CPS Representative, the CPS Representative shall also sign the "as built" job sketch at the appropriate location.

C. **High Pressure Test** - When the CPS Job Sketch specifies a test pressure greater than 90 psig or if a specific test duration period is specified, then the following requirements for a High Pressure Test shall also apply.

Prior to initiating any work required for a High Pressure Test, the Contractor must hold a pre-test meeting with the CPS Representative and a CPS Engineer from the Gas Engineering Division. At this meeting, the Contractor will be required to discuss all aspects of plans for conducting the High Pressure Test. The key points of discussion for hydrostatic pressure tests will include the following: 1) optimum direction and injection rate for filling the pipe section with water while minimizing air entrapment; 2) optimum direction and discharge location for safely and completely draining the pipe section; 3) the type, quantity and condition of pipeline pigs; 4) installation and use of temporary pig launchers and/or receivers; 5) capacities of water pumping equipment; 6) pressurization procedures; 7) written test documentation; 8) limitations on refilling and/or discharging test water during the pressure test without invalidating the test and causing the test to be restarted; 9) test water stabilization period after filling the pipe section; 10) appropriate procedure for dewatering the pipe section to minimize the amount of water that remains in the pipe; 11) any other critical aspects of the High Pressure Test.

The test medium may be either air or water and will be specified on the CPS Job Sketch. A hydrostatic test shall be conducted in general conformance with API Recommended Practice 1110. Air tests shall also be conducted in conformance with API RP 1110 with regard to safety and instrumentation.

All filling and pressurization procedures are subject to the approval of the CPS Representative. When a hydrostatic test is to be performed, the Contractor shall fill the pipeline in such a manner that no air is entrapped, making use of pipeline pigs as necessary. The Contractor shall be required to furnish all pipeline pigging equipment, including appropriate styles and types of pipeline pigs and temporary pig traps and launchers. The CPS Representative must inspect all pigging equipment, and such equipment must be acceptable to the CPS Representative prior to use by the Contractor.

The Contractor shall allow a suitable time for temperature stabilization of the test fluid. The stabilization period shall be a minimum of twenty-four (24) hours after the filling operation is complete for a hydrostatic test, and the stabilization period shall be a minimum of eight (8) hours after the pipeline is pressurized to the minimum test pressure for all High Pressure Tests performed with air or other compressed gases. At the sole discretion of the CPS Representative, the stabilization period may be reduced for short sections of pipe such as offsets and valve complexes.

The Contractor shall note each significant step or event during the filling, pressurization and testing operation and comments shall be added for any incidents which may affect the results of the tests. Where the specified test duration is two hours or less, deadweight pressure, pipe temperature and ambient temperature measurements shall be recorded at 15 minute intervals. Where the specified test duration is greater than two hours, these measurements shall be recorded at 30 minute intervals.

Upon completion of the test, the Contractor shall obtain the approval of the CPS Representative prior to depressurizing the pipeline. The Contractor shall then depressurize, dewater, clean and dry the pipeline to the satisfaction of the CPS Representative. Water shall be disposed of in the manner required by any permits and to the satisfaction of the CPS Representative.

D. Test Records - The Contractor shall submit to the CPS Representative all documentation associated with the test, including a completed Form I, "Hydrostatic Test Record and Certification" of Appendix I, API RP 1110, (or substantially similar documentation), testing logs and all recorder charts. All documentation shall be labeled to identify the pipeline section that was tested, and it must be signed and dated by the Contractor and approved by the CPS Representative.

15. COATING OF PIPE

The Contractor will be furnished coated and wrapped pipe in accordance with such specifications as CPS may in its sole discretion determine. The Contractor will be responsible for coating all field joints and repairing damaged and defective coating on the pipe regardless of the nature, extent or cause of such damage or defect in the coating. However, if the damaged or defective coating is of such magnitude as requires an extra or additional charge by the Contractor, then the Contractor shall first refer such matter to the CPS Representative and not proceed until the Contractor has obtained prior written authorization from CPS to do so, in which event the provisions of the Contract relating to extra or additional work shall be applicable.

Coating materials for coating field joints and repairing damaged or defective coating will be furnished by CPS.

For coating field joints, the coating on the pipe must be cut back a distance of 8" to 12" from the joint. The edge of the enamel and felt wrapping shall be feathered at these points to assure a firm bond between the original coating and the field coating. After the joints are welded and tested, and the welds cleaned and brushed, the bare ends of the pipe shall be thoroughly cleaned, then immediately given a hand-brushed coat of primer to dry surfaces. Care shall be exercised to prevent primer from being applied too heavily, especially at the base of the welds; any runs or sags which have dried or dead primer shall be scraped off and the pipe reprimed. After the tape primer has dried to a tacky consistency, apply cold wrap tape with a 30 percent overlap taking care not to create any voids between the pipe and tap coating. No primer or coating will be applied to wet or damp pipe.

After the field joints have been coated and immediately before the pipe is lowered into the ditch, the entire coating will be tested to locate breaks or pinholes and other flaws in the enamel with an approved "holiday" detector in good working condition capable of producing the testing voltage in pulsating cycles at very low amperage. The voltage used shall not exceed 14,000 volts for pipe coatings of 3/32. All defective places will be plainly marked immediately after they are detected. The Contractor will furnish the holiday detector, and will check the coating for holidays in the presence of the CPS Representative.

All repairs to damaged coating which exceeds 2 square inches will be made by breaking out the old coating, scraping the pipe to bare metal, feathering the edges to assure a firm bond

and reprimming. After the primer has dried to a tacky consistency, apply cold wrap tape taking care not to create any voids between the pipe and the tape coating. For repairs less than 2 square inches, the pipe need not be scraped to bare metal and primed; however, the good enamel around the damaged portion shall be feathered before the cold wrap is applied.

Compression type couplings, valves, welded fittings, etc., will receive a cold applied mastic after the pipe is in the ditch and they have been tested for leaks. A plastic wrap supplied by CPS will be placed over the mastic to protect the coating during backfilling.

Handling of Coated Pipe - Coated pipe shall be handled only with suitable equipment in such a manner as to prevent damage to the coating. The coated pipe shall be placed on skids alongside the ditch until it is to be welded and lowered into the ditch. The skids shall be of sufficient width or padded with sandbags or resilient pads to prevent the skid edges from cutting the coating and wrapping. The skids shall be arranged to permit the coated pipe to bear on the full width of the skid.

At all times, coated and wrapped pipe shall be carefully handled with wide rubber, leather, composition, or canvas slings or belts containing no protruding rivets or belts that may injure the coating. Wire rope, tongs, chairs, hooks, and bare cables shall not be permitted to come into contact with the coating. Coated pipe shall not be handled when the temperature is low enough to cause cracking of the enamel.

16. CATHODIC PROTECTION

The Contractor shall install packaged anodes, insulating joints and insulating flange sets as provided for in the exhibits. Welding machines will not be used to test insulation or otherwise be grounded across insulating devices. Insulation will be checked by the CPS Representative and declared acceptable only after testing establishes satisfactory performance.

17. POLYETHYLENE GAS PIPE

Polyethylene pipe, which is commonly referred to as plastic, PE or HDPE pipe, shall be handled only with suitable equipment in such a manner as to prevent damage to the pipe such as fracture, kinking, deep gouges or cuts. The polyethylene pipe shall not be subjected to abuse by dropping, throwing or dragging except over smooth non-scratching terrain or surface.

An insulated copper wire shall be installed with all polyethylene pipe for the purpose of locating the pipe after backfilling. This wire shall be installed with 2 to 6 inches separation between the tracer wire and the polyethylene pipe. Under no circumstances shall the tracer wire be taped or otherwise secured against the outside wall of the polyethylene pipe or spirally wrapped around the pipe.

Fusion of polyethylene pipe joints shall be done by the Contractor in accordance with requirements of D.O.T., Title 49, Part 192 - Transportation of Natural Gas by Pipeline: Minimum Federal Safety Standards, Paragraphs 192.281, 192.283, 192.285, 192.287.

Prior to starting production fusing under this contract each Contractor employee that will be making polyethylene fusion joints shall qualify according to Paragraph 192.285 of the D.O.T.

code using a CPS approved procedure. Qualifying tests will be conducted in the presence of the CPS Representative.

The Contractor shall furnish all specialty tools and equipment that are required to handle, install, butt fuse and squeeze-off polyethylene pipe. The Contractor shall insure that all specialty tools and equipment are specifically designed for use on polyethylene piping systems and are in good working condition. The CPS Representative shall be allowed to inspect all specialty tools and equipment furnished by the Contractor. The CPS Representative may disallow the use of any specialty tools or equipment that are not specifically designed for use on high density polyethylene piping systems or are deemed to not be in good working condition. CPS routinely uses the Steve Vick 6" Mark II Coil Trailer for handling large diameter coiled pipe, McElroy equipment for making butt fusions on polyethylene pipe and Mustang squeeze-off tools for stopping the flow of gas in existing polyethylene piping systems. The Contractor shall be required to provide copies of the original manufacturer's literature for all comparable equipment from other manufacturers. At the sole discretion of CPS, comparable equipment from other manufacturers may be approved for use by the Contractor.

All polyethylene pipe joints shall be tested with soap and water with the line having an internal pressure of between 90 and 120 psig. All pressure tests on polyethylene pipe must be observed and approved by the CPS Representative. It shall be the Contractor's responsibility to coordinate pressure tests on polyethylene pipe so that such test can be performed with a CPS Representative present.

18. LOWERING IN AND BACKFILLING

The ditch shall be free of rocks and clods before the pipe is lowered into the ditch. No pipe will be lowered into the ditch until the ditch has been inspected and approved by the CPS Representative.

All stumps and roots found in the ditch line shall be cut so that they will not come in contact with the pipe. All loose rocks, stones, blocks, skids, chocks, tools, heavy clods, tree limbs, and other items, which may damage the pipe, shall be removed from the bottom of the ditch before the pipe is lowered in.

The ditch shall be excavated with sufficient depth to allow for a minimum thickness of four (4) inches of pit run sand to be placed in the ditch below the pipe. Pit run sand placed in the ditch to cushion the pipe shall be leveled and tamped so that the weight of the pipe is as evenly distributed as possible on solid ground.

Backfilling shall be so conducted that the ditch shall be neatly backfilled and compacted. Rock, gravel or like materials shall not be backfilled directly onto the pipe. The Contractor shall provide and shall haul sufficient pit run sand to be backfilled around and over the pipe to form a protective padding or cushion between the pipe and the rock, gravel and other such unexcavated materials. After the pipe has a six (6) inch minimum cover of pit run sand, the remaining backfill may contain rocks and gravel, except that large rocks in excess of four (4) inches in diameter, width or length, shall not be backfilled into the ditch. Such rocks shall be removed from the right-of-way and disposed of to the satisfaction of the landowner, tenant, and/or CPS

Representative. Care shall be exercised to prevent hand shovels and tampers from damaging the pipe.

Trenches in public roadways will be backfilled and paved in accordance with the requirements of the governmental authority having jurisdiction over the street or road.

Where paving is cut, backfilling and finishing of the top of the trench will be in accordance with the requirements of the authority having jurisdiction over the pavement. On state highways, U.S. highways, expressways and freeways and their frontage roads, and any streets or roadways that are being maintained or rebuilt by the Texas Department of Transportation (TxDOT), the TxDOT specifications and requirements for backfilling trenches will apply. On county roads, private roads, streets in incorporated townships, driveways or paved parkways the backfill will be a mixture of concrete or other material mixtures with depths as required by the authority having jurisdiction and shall be placed in trench to within one and one-half (1-1/2) inches of the surface of the existing pavement. The Contractor shall apply final and finishing topping to cuts in paving with hot mix, hot lay asphalt. Inspection and approval by the authority having jurisdiction over the pavement shall be obtained by the Contractor before the job will be accepted as completed by CPS.

Backfill in public and private thoroughfares shall be hydra-tamped with special care to prevent settlement or damage to other buried utilities.

The Contractor shall not use soil from the right-of-way except from the spoil bank. Any surplus soil shall be disposed of by the Contractor.

When crossing drainage ditches and minor streams, the Contractor shall furnish and install all materials necessary for bank reinforcement. Such backfill must be properly maintained by the Contractor until the entire job has been completed and accepted by an authorized representative of CPS. No reimbursement will be made for repairing of backfill due to floods and/or other conditions occurring before final acceptance.

The Contractor shall control the ditching and backfilling so as to have a minimum amount of open ditch commensurate with good construction practices.

As soon as backfill is completed on a section of line, Contractor shall immediately clean up the right-of-way, removing all surplus and defective materials to CPS designated locations. Disposal of all refuse such as brush, broken skids, rock, etc., shall be to the satisfaction of the CPS Representative. Insofar as possible, the earth on both sides of the line ditch which has been disturbed during the construction of the line shall be leveled, and the ditch line shall be left in a condition satisfactory to the CPS Representative. All temporary fills and bridges shall be removed and the area cleaned to the satisfaction of the CPS Representative. The Contractor shall, at his expense, furnish, haul and install black top soil on the ditch line and right-of-way area where necessary in the opinion of the CPS Representative to leave such area in the same condition as existed prior to the commencement of the work and/or to obtain the minimum required cover for the utility lines as specified.

Upon completion of all backfilling and cleaning of the right-of-way, permanent repairs shall be made to all fences by using equivalent or new fencing materials. All fence repairs must

be satisfactory to CPS Representative. These repairs are to be made by Contractor at no extra compensation.

19. FINAL PIPING CONNECTIONS AND/OR TIE-INS

The Contractor will make all connections of new gas lines to existing gas lines. This includes all necessary preparations for tie-ins and purging for all sections of gas lines installed by the Contractor. The Contractor will be required to weld short stop fittings and other necessary fittings on existing steel gas lines that will be used by CPS personnel to control the flow of gas into the new gas lines. CPS personnel will control the flow of gas on all operative gas facilities while the Contractor is making final piping connections and/or tie-ins.

The Contractor shall be responsible for insuring that all tie-ins between new and existing gas mains are performed in a safe manner. The Contractor shall furnish all necessary equipment and instrumentation that is required to insure that the final tie-in welds and/or fusions between new and existing gas facilities are performed in a safe manner. Such equipment and instrumentation may include pneumatic air movers, combustible gas indicators (CGI's), oxygen monitors, self-contained breathing apparatus and fire retardant clothing for construction personnel, and fire extinguishers.

20. REMOVAL OF EXISTING PIPE

The asphaltic wrap on pipe removed under this contract may contain asbestos. In handling the pipe (including the excavation, cutting, removal, loading and unloading of such pipe), Contractor shall observe all State and Federal worker protection regulations and standards, and all environmental and public safety standards that are applicable to such work, including the OSHA standard found at 29 CFR Section 1926.1101, and following, that relates to the occupational exposure standard to asbestos for the construction industry.

The Contractor will indicate in its bid the manner in which the pipe shall be managed after removal. For example, Contractor shall indicate whether the pipe will be disposed at a licensed landfill facility, will be recycled as pipe by Contractor, will be sold to and recycled as pipe by a third party, will be recycled by a third party as scrap metal, etc. If dealing with a third party, Contractor shall identify the various third parties Contractor will rely upon to provide the indicated services.

For all pipe removed from the ground under the terms of this contract, Contractor shall place the following notice, beginning approximately two (2), feet from each end of the pipe, in stenciled or comparable lettering, i.e. not attached labels, of not less than 3 inches in height:

PIPE WRAP MAY CONTAIN ASBESTOS

Upon removal of the pipe from the ground, ownership of the pipe is transferred to the Contractor.

21. PURGING NEW GAS FACILITIES

CPS personnel will purge the new gas mains, and the Contractor will purge all new gas service lines or existing gas service lines that have been tied-over to the new gas mains or otherwise adjusted.

22. GOODWILL OF GAS CUSTOMERS & RESIDENTS IN THE WORK AREA

The Contractor shall make reasonable efforts to create goodwill among the property owners, tenants and lessees along the right-of-way of the gas construction project.

For this reason, no gas service shall be cut-off after 2:30 p.m. each day. All gas services that have been cut-off during the day must be restored before 4:00 p.m. that same day. If the Contractor is consistantly late in restoring gas service by 4:00 p.m., the contract may, at CPS's discretion, be adjusted to reflect an earlier cut-off time.

When customer gas service is to be interrupted, the Contractor must use CPS approved door-hangers to inform the customers of the impending construction activity. The door-hangers must be placed on the front door of each residence at least 48 hours prior to construction, and the Contractor must contact each customer by telephone or in person before the gas service is cut off.

The Contractor shall provide approved sanitary facilities in sufficient quantities and at such locations as may be needed for workers on the job.

24. WORKDAYS, WORKING HOURS AND HOLIDAYS

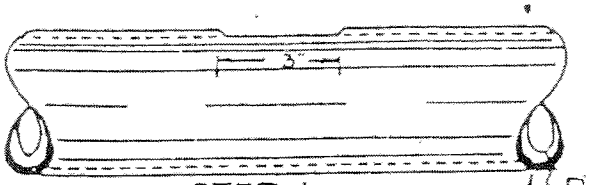
Normal working hours for this contract shall be from 7:30 a.m. to 4:00 p.m. Work days shall include Monday through Friday, except for holidays. Holidays shall include the following days: New Year's Day, San Jacinto Day (observed on Friday of Fiesta Week), Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day. If the holiday falls on a Saturday, it will be observed on the preceding Friday. If the holiday falls on a Sunday, it will be observed on the following Monday. Christmas Eve and New Year's Eve will be observed as holidays when Christmas Day and New Year's Day fall on Tuesday through Friday. Exceptions to these working hours and work days will be allowed by CPS when required by the governing entity, mutually agreed upon by both Contractor and CPS or the customer approves or requests work to be performed outside of these established times. **At the sole discretion of CPS, service renewal work can be suspended during periods of extremely cold weather.**

25. ACCEPTANCE

The CPS Representative will make all inspections and final acceptance of the work performed by the Contractor for CPS.

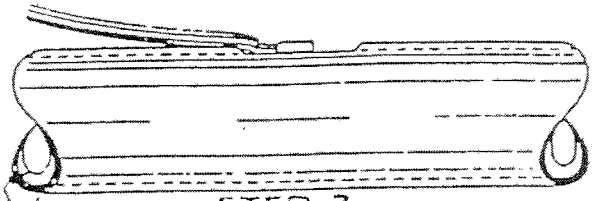
CPS Energy
Design Standards
(Steel Gas Pipe)
Exhibit GAS-3

Remove a section of coating 3" long and file pipe bright so that a space 1" wide and 2" long is clean and dry.



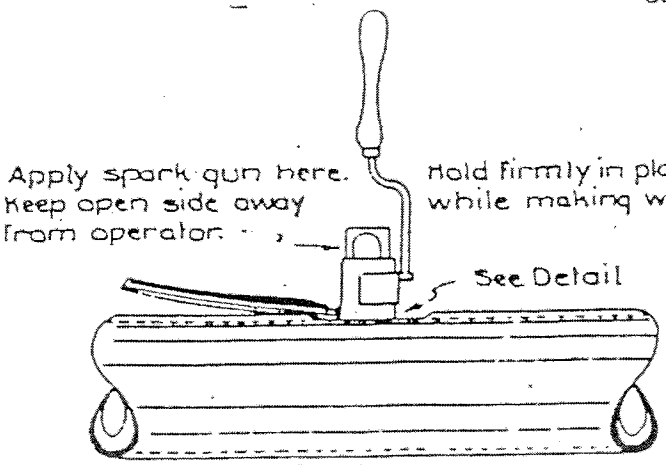
STEP 1

Strip 1½" of insulation from wire and place copper sleeve on #10 and smaller wire.



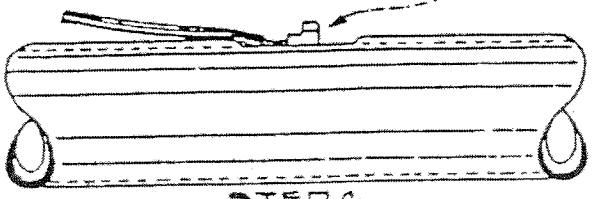
STEP 2

Pipe Coating



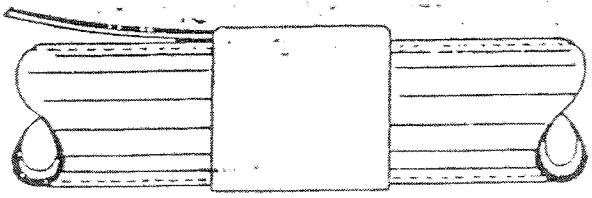
STEP 3

Remove slag with hammer and paint thoroughly with primer.

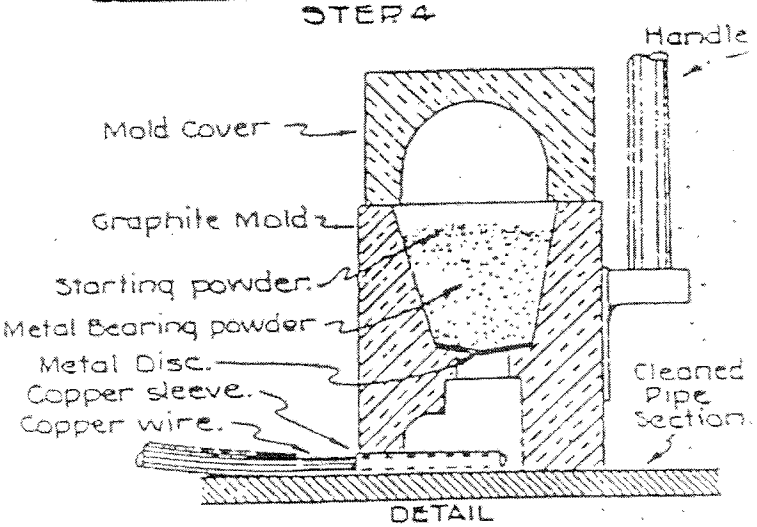


STEP 4

Repair pipe coating with care Cover entire weld.



STEP 5



DETAIL

IMPORTANT

1. REMOVE RED CAP OF CADWELL CARTRIDGE AND DUMP ALL OF CONTENTS INTO MOLD. THE CHARGE WILL NOT IGNITE WITHOUT THE FINE STARTING POWDER ON TOP.
2. THE CARTRIDGES MUST BE KEPT DRY AT ALL TIMES.

Cadweld mold with sleeve for #10 wire and smaller.

CITY PUBLIC SERVICE BOARD
SAN ANTONIO, TEXAS
GAS DEPARTMENT

COPPER WIRE CONNECTION TO PIPE USING CADWELD.

SCALE 2" = 1"	APPROVED		FIG.
DRAWN C.W.T.	BY W.D.B.		64
CHECKED	DATE 4-13-54		

EXHIBIT DST-

DRAWING DS-32

INSTRUCTION SHEET - TYPE TB-3 WELDER

PREPARATION OF SURFACE:

To obtain a good weld, surface must be bright clean and dry.

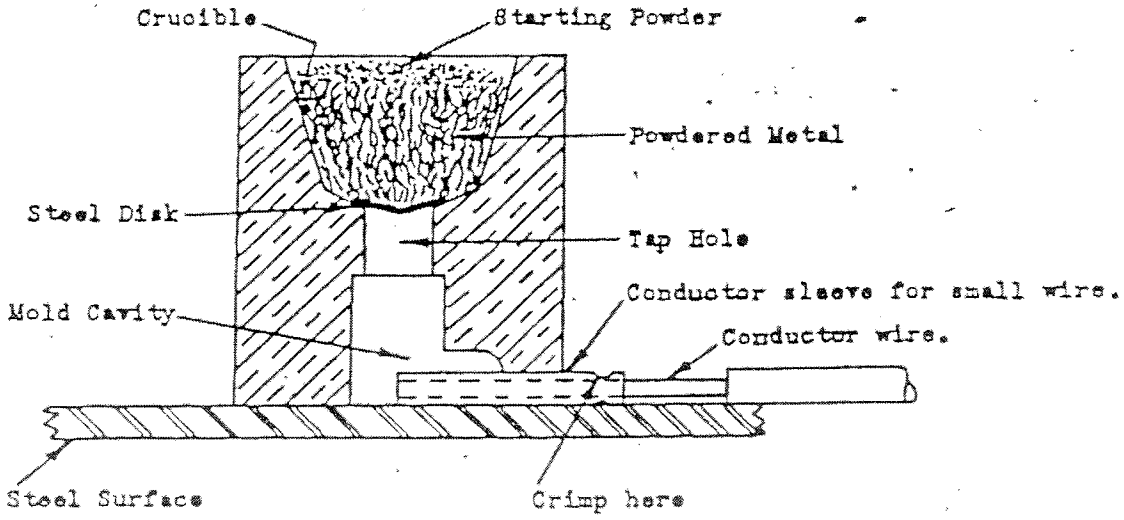
Steel surface should be ground or filed to remove all scale, rust, grease and dirt.

Galvanized steel must be cleaned with emery cloth to remove oxide.

PREPARATION OF WIRE:

Strip the insulation from the conductor and scrape until wire is bright and clean.

For #10 and smaller sizes, place the wire in a copper sleeve, ends flush, and crimp the sleeve tightly to the wire at the insulation to provide additional mechanical strength at the weld.



WELDING PROCEDURE:

(1) PLACE WELDER OVER CLEAN STEEL SURFACE and insert the wire until it is under the CENTER of the tap hole.

(2) COVER TAP HOLE WITH STEEL DISK.

(3) DUMP CARTRIDGE IN CRUCIBLE AND CLOSE COVER. (Tap bottom of cartridge to be sure starting powder is emptied). Replace empty cartridge in box to keep remaining cartridges in an upright position.

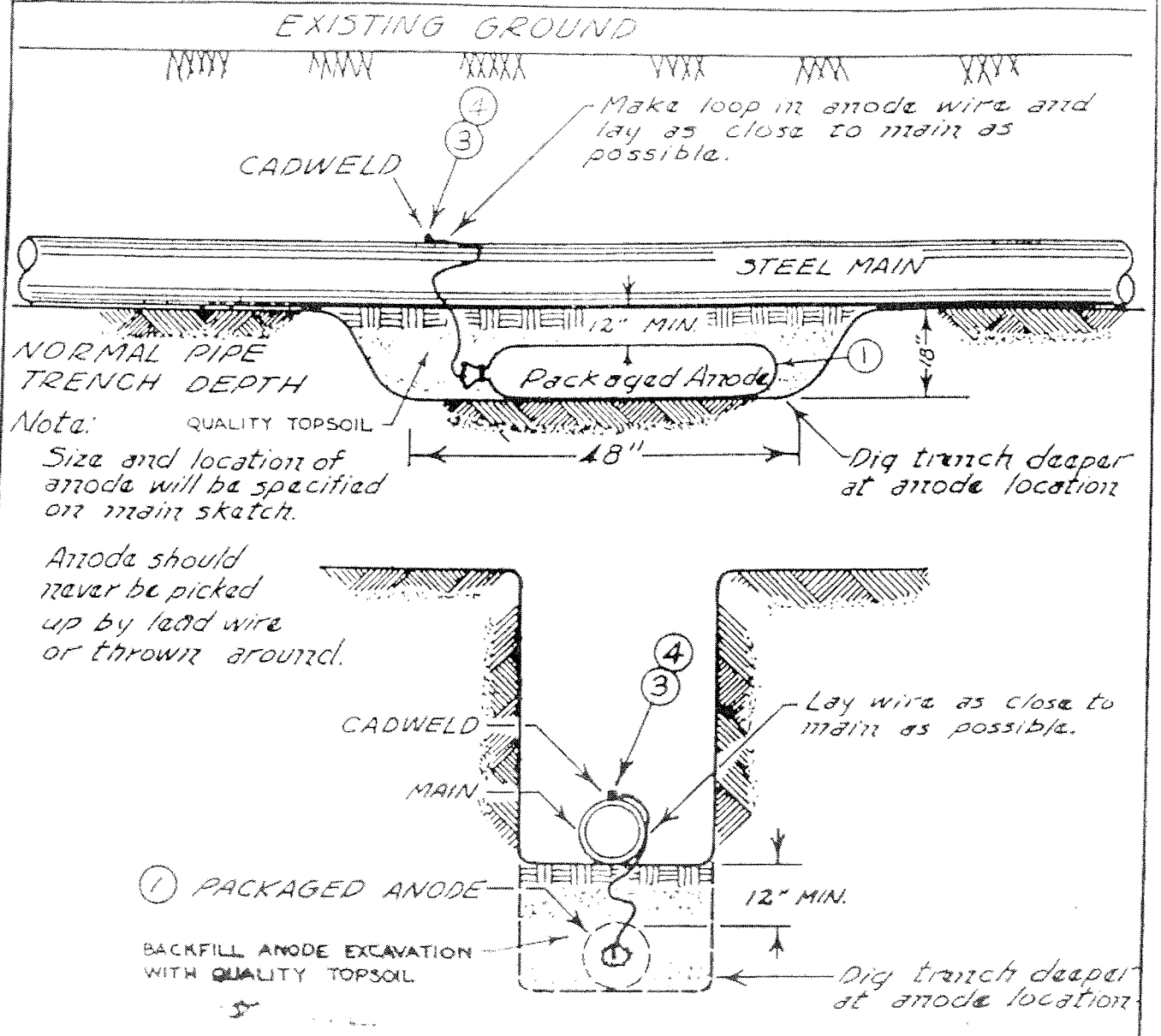
(4) HOLD DOWN ON WELDER TO PREVENT LEAKS AND IGNITE WITH FLINT GUN. Jerk gun away to prevent fouling. Should gun become fouled, soak in Spirits of Ammonia.

(5) DO NOT REMOVE WELDER UNTIL METAL HAS SOLIDIFIED.

(6) ALL SLAG MUST BE CLEANED FROM MOLD BEFORE MAKING NEXT WELD.

Note: Wet or damp molds produce porous welds. Mold can be dried out by firing a charge before making the desired weld.

4.5	PACKAGED ANODES	



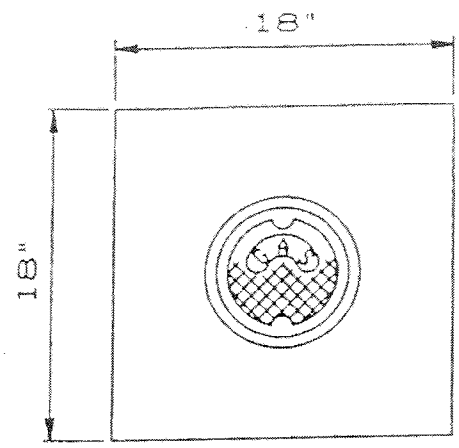
NOTES:

a. Cadweld connection to be primed and coated carefully.
b. Packaged anode should be covered with fine soil containing no rocks, clods, or sand.
c. Pour 5 gallons of water over anode location and tamp thoroughly.
d. Provide test leads when specified. (See test lead standard)
e. Anode specification sheet will be attached to main order, and is to be completed by the main construction foreman.

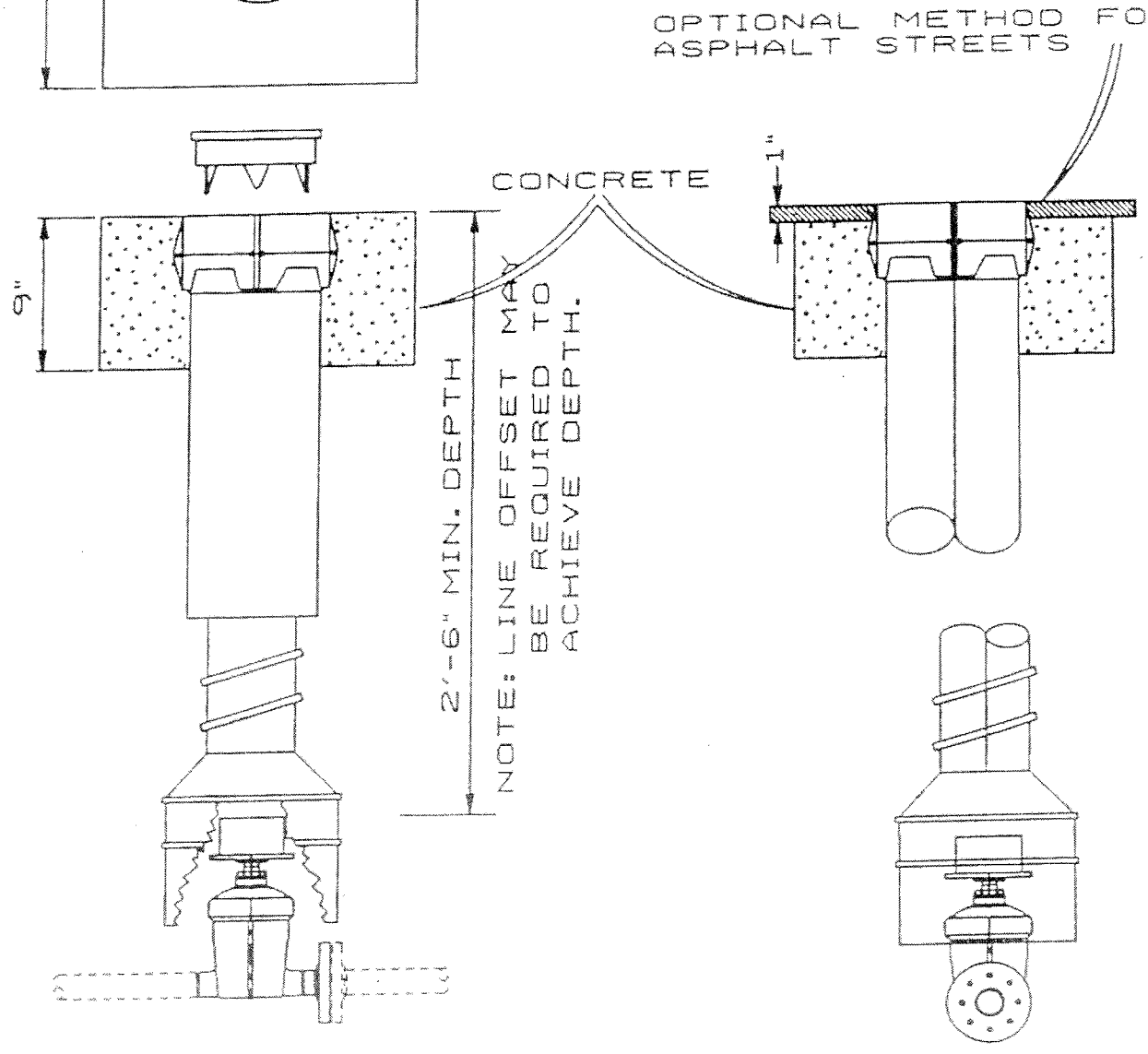
	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-33
ISSUED	9-1-70	CJH	CONSTRUCTION STANDARD (GAS)	G-S-171-1-2
REVISED				

VALVE, STEEL (WELD x FLANGE)

CAM UNITS
VGS2WXF
VGS4WXF



NOTE: TAMP & BACKFILL VALVE BOX ABOVE PIPE.



NOTE: COAT VALVE UP TO TOP OF PACKING GLAND.

AVAILABLE SIZES: 2, 4

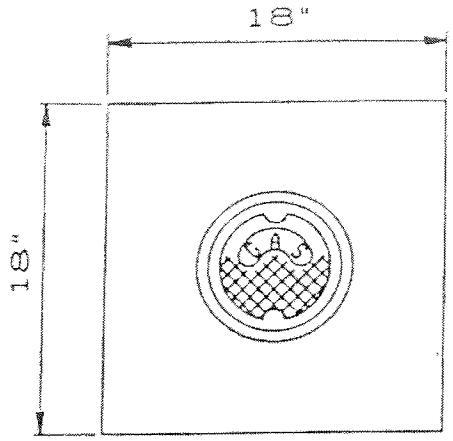
	DATE	APPROVED
ISSUED		
REVISED		

CITY PUBLIC SERVICE
CONSTRUCTION STANDARD (GAS)

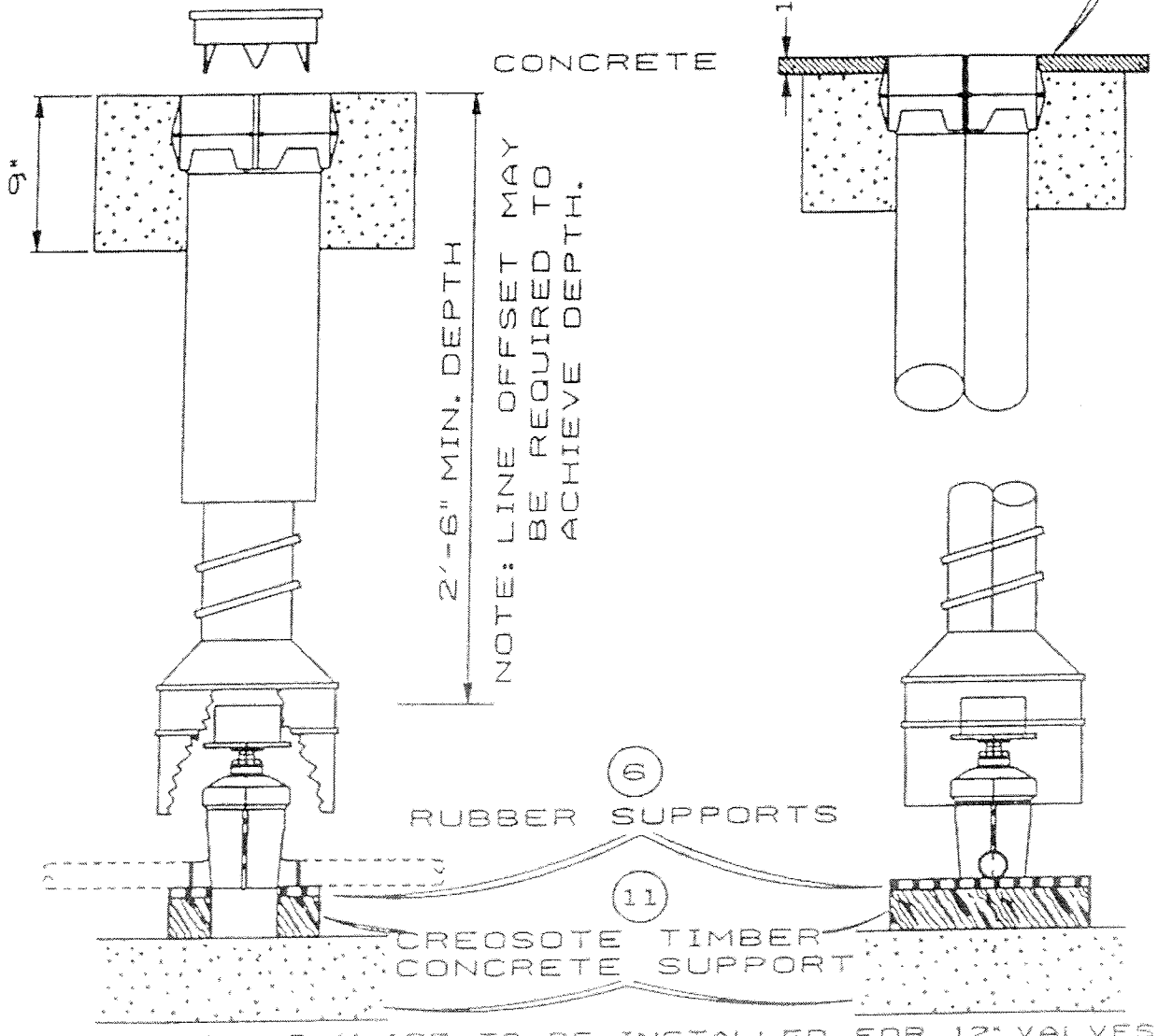
0 - 9 - 127 - 1 - 0

DRAWING DS-36

VALVE, STEEL (WELD x WELD)



CAM UNITS	
VGS2WE	VGS8WE
VGS4WE	VGS12WE
VGS6X8WE	VGS16WE



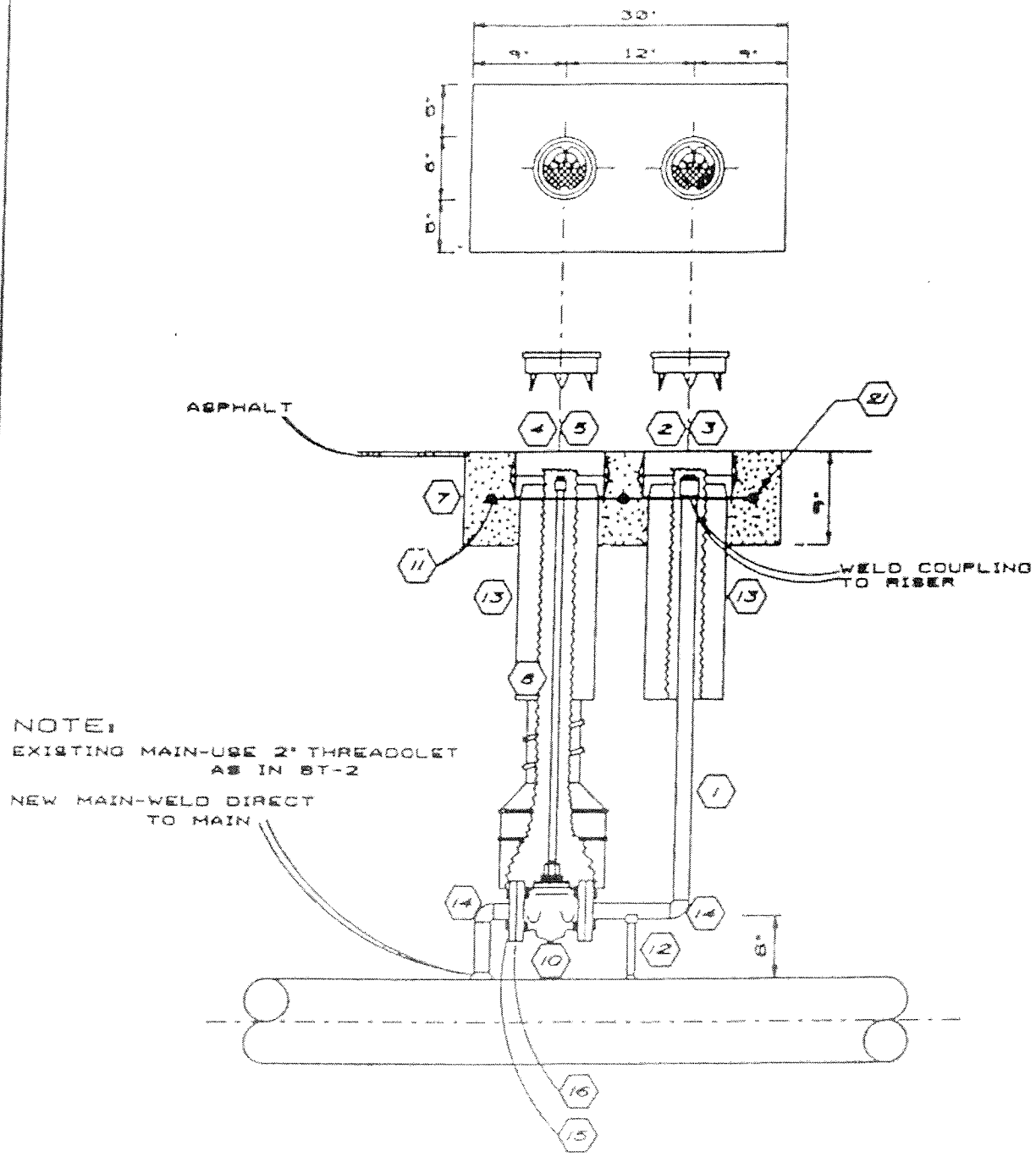
NOTE: ITEMS 6 AND 11 ARE TO BE INSTALLED FOR 12" VALVES, OR LARGER. COAT VALVE UP TO TOP OF PACKING GLAND.

AVAILABLE SIZES: 2, 4, 8x6, 8, 12

	DATE	APPROVED	CITY PUBLIC SERVICE CONSTRUCTION STANDARD (GAS)	0 - S - 127 - 2 - 0
ISSUED				DRAWING DS-37
REVISED				

TEST RISER 2 IN.

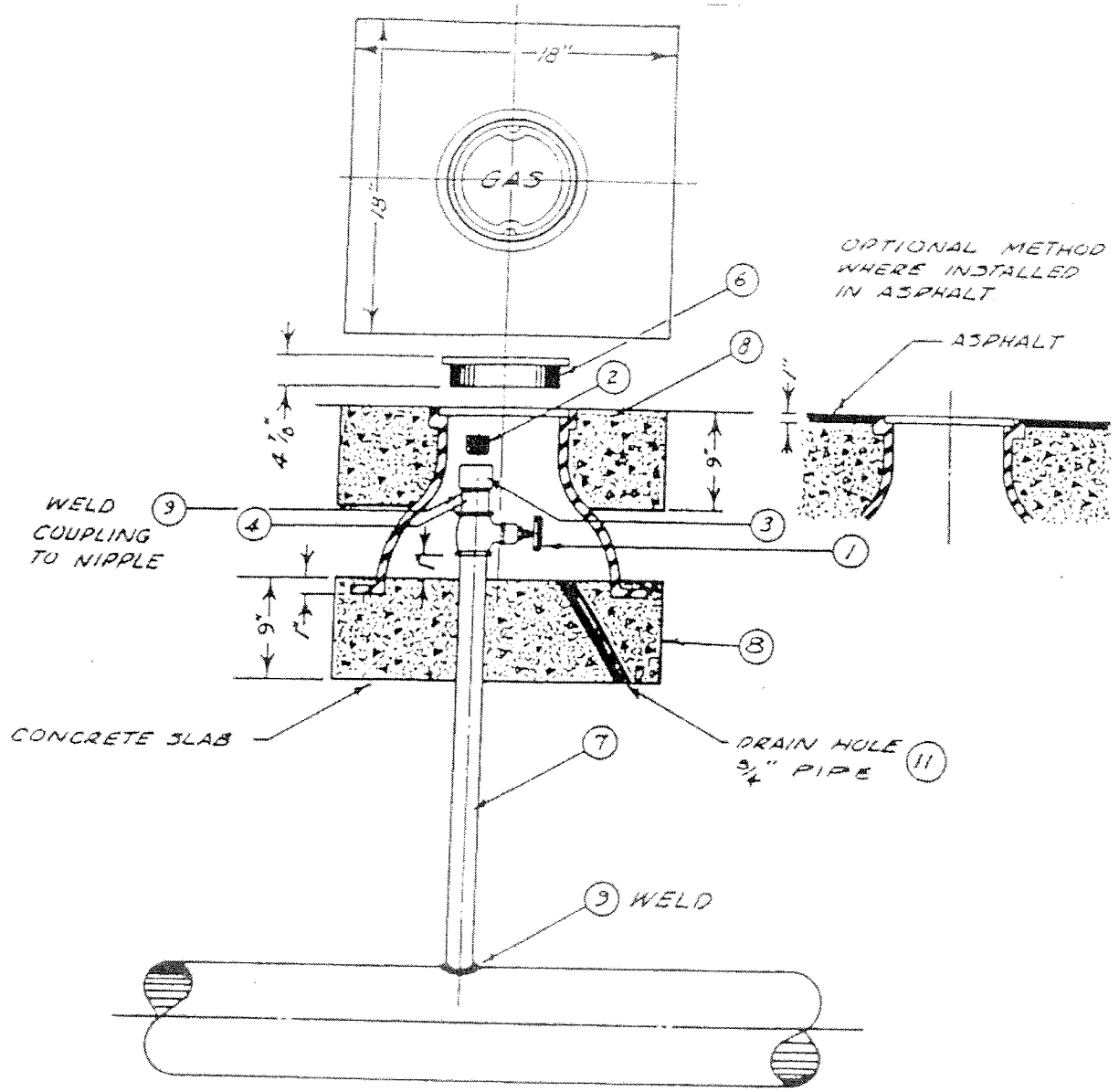
EXHIBIT DST-3



DRAWING DS-38

	DATE	APPROVED	CITY PUBLIC SERVICE	0 - 9 - 142 - 1 - 1
ISSUED	9/2/92	D. Voge	CONSTRUCTION STANDARD (GAS)	PLANNER: M. BLYTHE
REVISED				

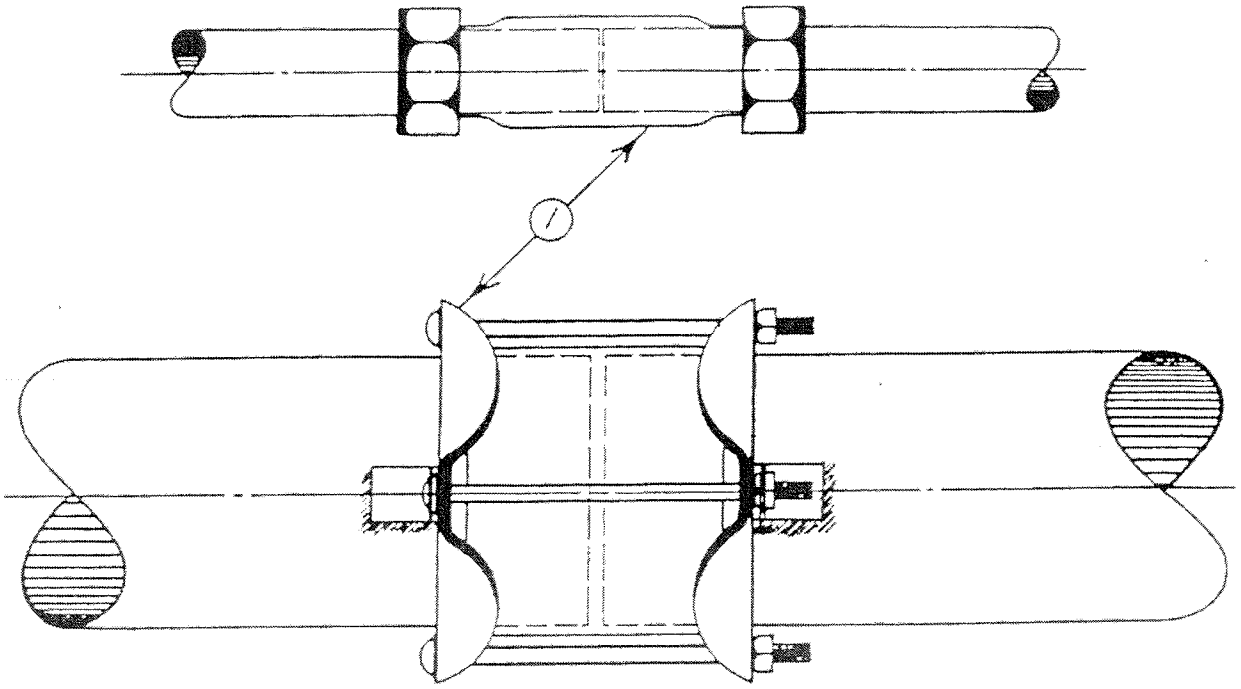
4.5	TEST RISER, 1 IN.	



	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-39
ISSUED	9-1-70	CJN	CONSTRUCTION STANDARD (GAS)	G-S-141-1-0
REVISED				

4.5	COUPLING, BONDED	

WITH WELD LUGS

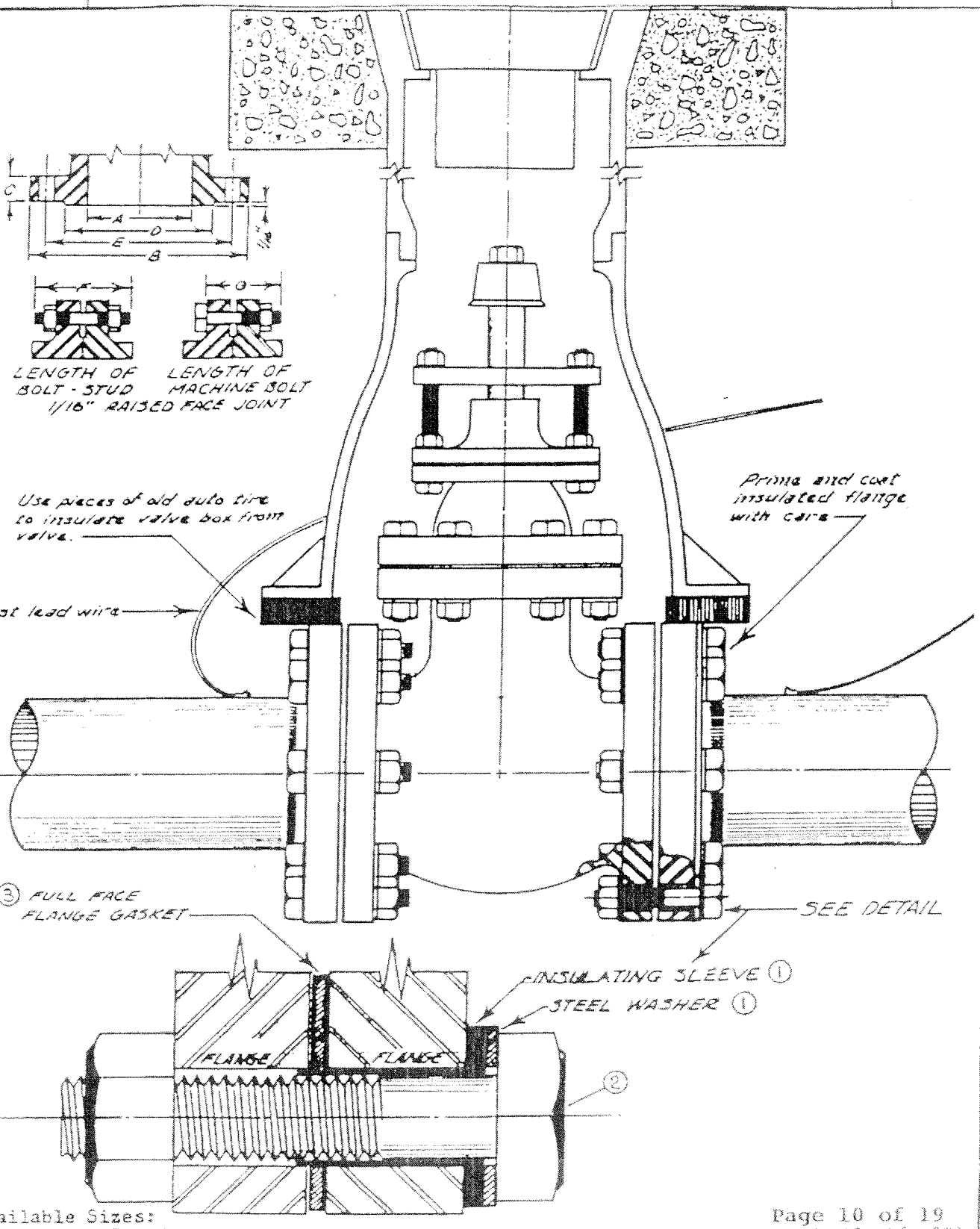


NOTE: 1 All couplings to be centered over pipe joint with minimum spacing between pipe ends. Spacing shall not exceed 1".
2 File pipe to bright finish over areas covered by bonding gaskets. Area should be a minimum of 2-1/2" wide.
3 Lubricate gaskets with soap water before installing.
4 Tighten all bolts on coupling uniformly.

AVAILABLE SIZES: 3/4" , 1" , 1-1/4" , 1-1/2"
2" , 4" , 8" , 12" , 16" , 18" , 20" , 24" , 30"

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-40
ISSUED	9-1-70	CJH	CONSTRUCTION STANDARD (GAS)	G-S-Ø51-1-1
REVISED				

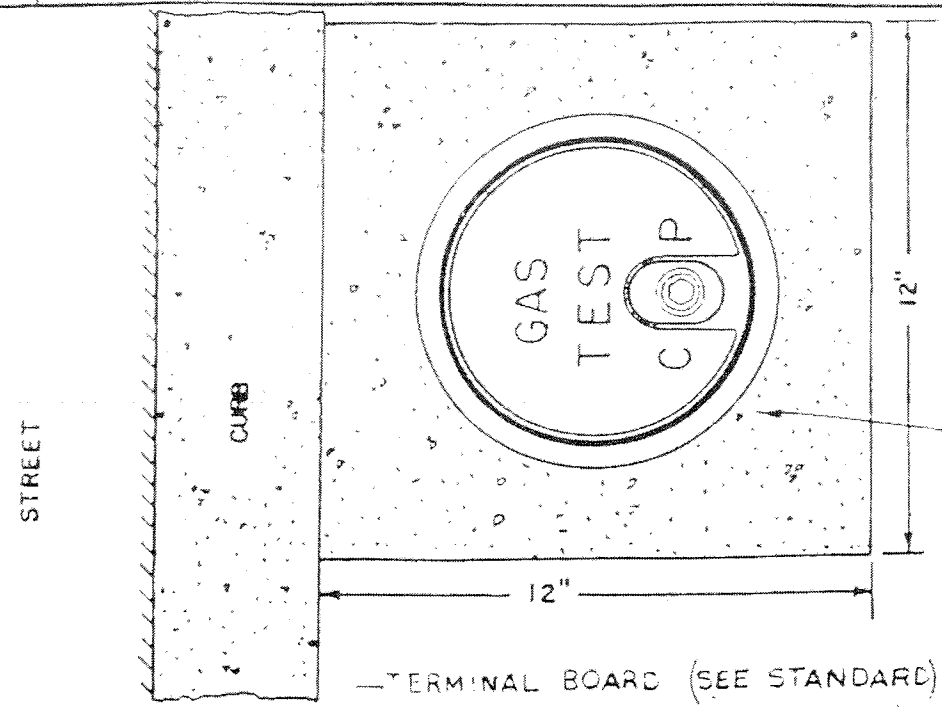
4.5 INSULATE FLANGE

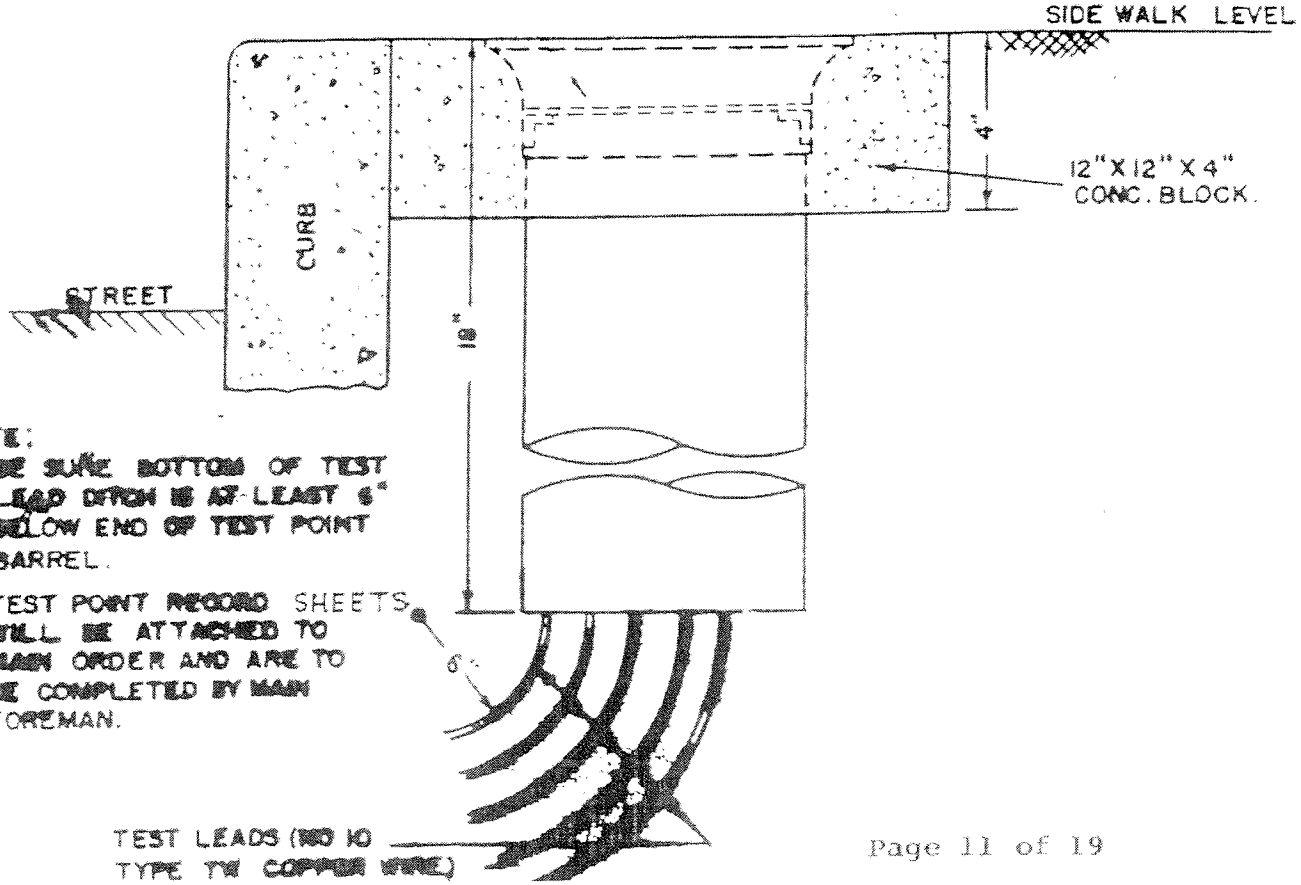


Available Sizes:
150# Flg (2, 4, 8, 12, 16); 150# Exist Flg (2, 4, 8, 12, 16); 300# Flg (8, 12, 16, 20)

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-41
ISSUED	9-1-70	CJH	CONSTRUCTION STANDARD (GAS)	G-S-118-1-1
REVISED				

4.5	CATHODIC PROTECTION TEST POINT	



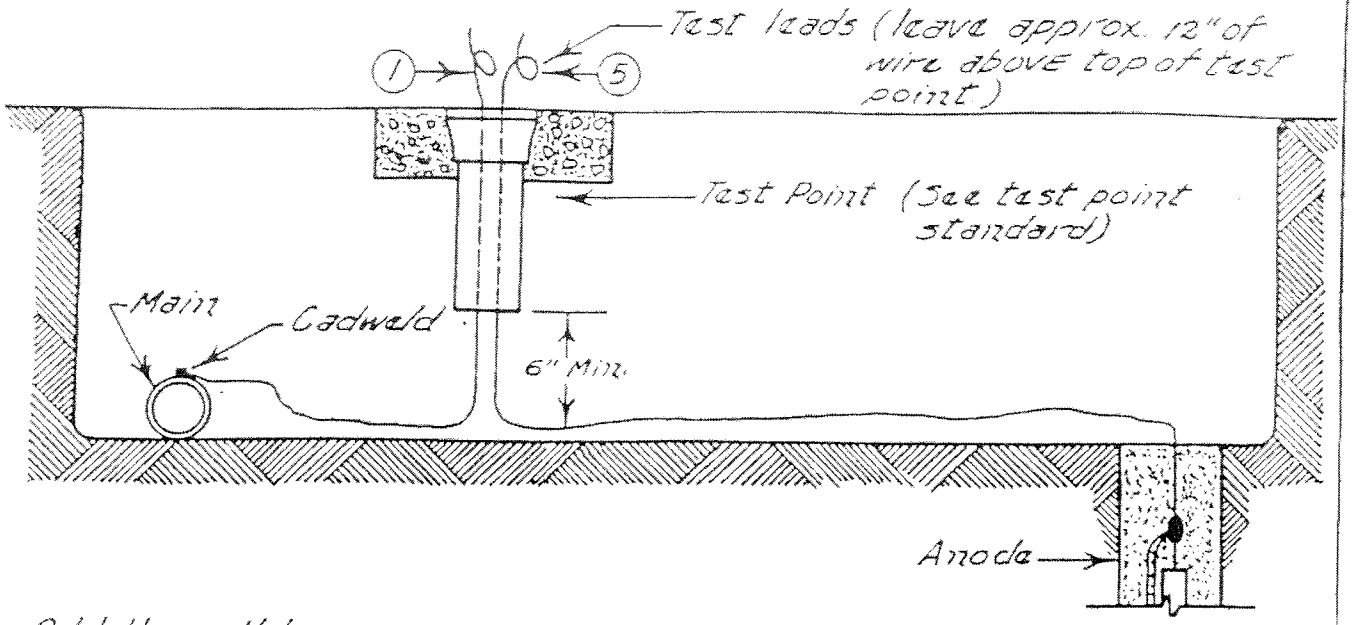


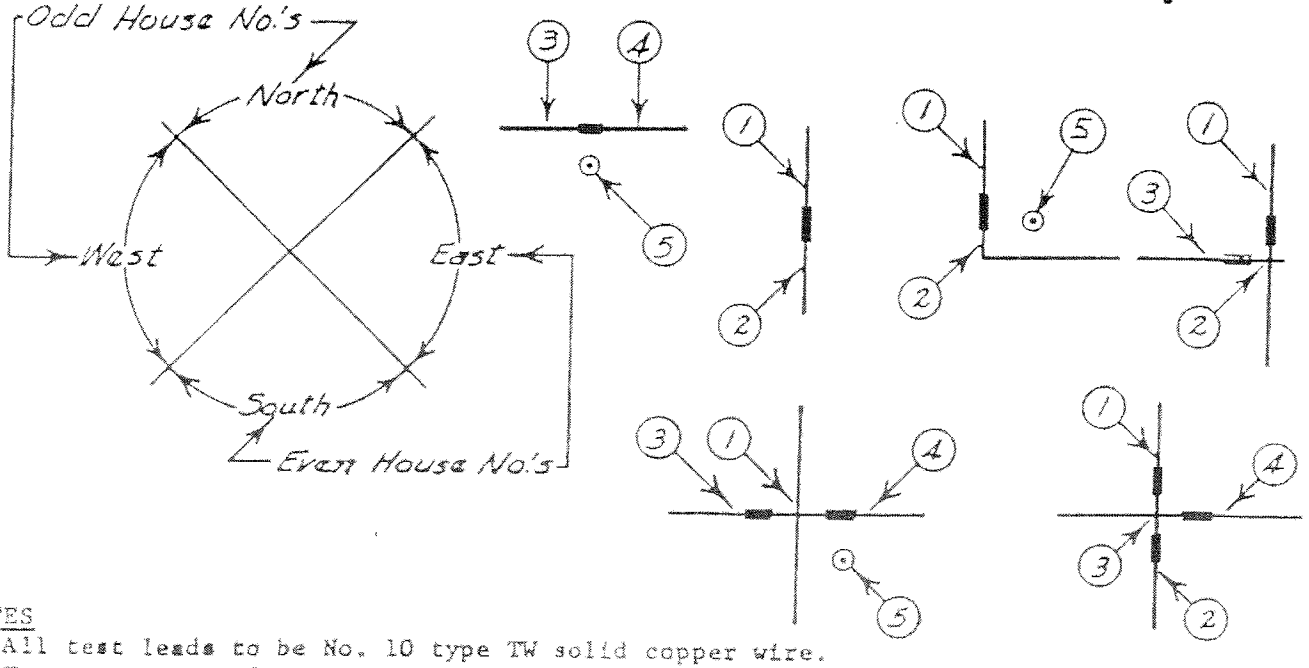
NOTE:

1. BE SURE BOTTOM OF TEST LEAD DITCH IS AT LEAST 6" BELOW END OF TEST POINT BARREL.
2. TEST POINT RECORD SHEETS WILL BE ATTACHED TO MAIN ORDER AND ARE TO BE COMPLETED BY MAIN FOREMAN.

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-42
ISSUED	9-1-70	CJH		G-S-182-2-0
REVISED				

4.5	CATHODIC PROTECTION TEST LEAD CONNECTION TO MAIN	



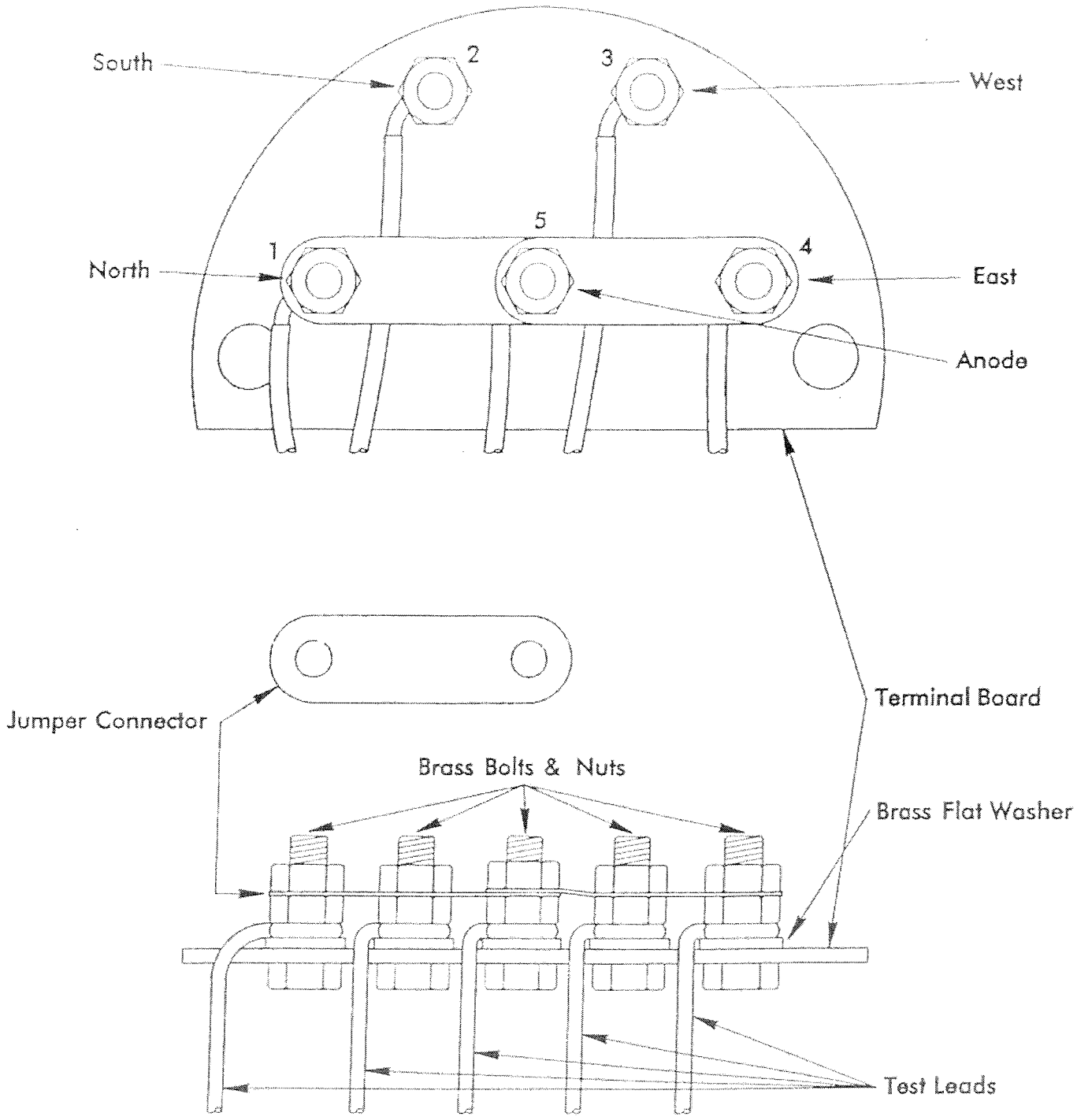


NOTES

1. All test leads to be No. 10 type TW solid copper wire.
2. Test point record cards will be attached to main order, and are to be completed by the main foreman.
3. All test leads should be tagged with a metal tag about 6" from end of lead according to the following numbering code:

   1 North
   2 South
   3 West
   4 East
   5 Anode

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-43
ISSUED	9-1-70	CJH		G-S-182-1-0
REVISED				



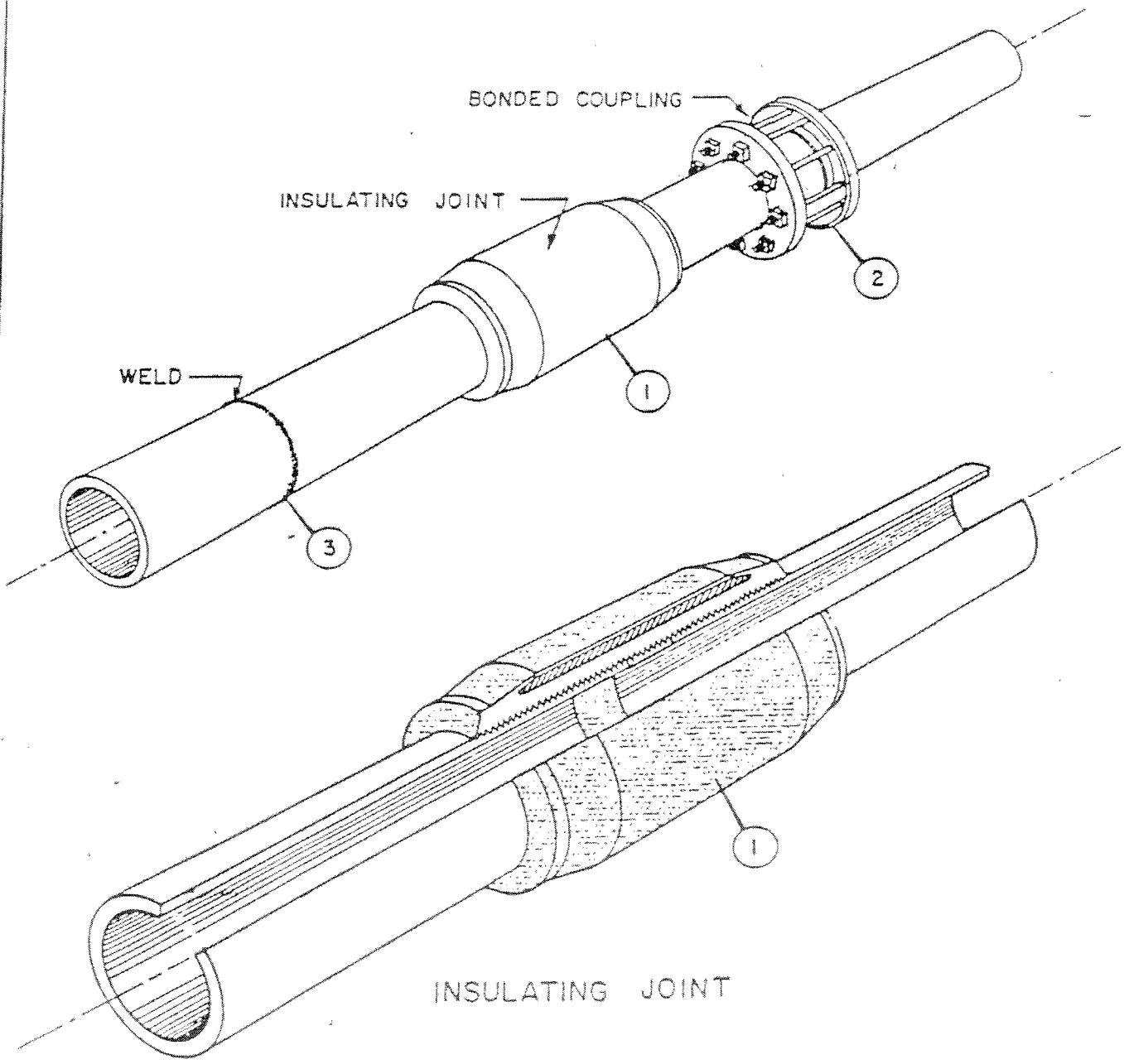
Note:
Connect test leads on top side of terminal board

	Date	Approved
Issued	11-28-94	
Revised		

City Public Service
Gas Construction Standard

DRAWING DS-44
G - S - 182 - 3 - 0

4.5	INSULATING JOINT 8" & 12"	

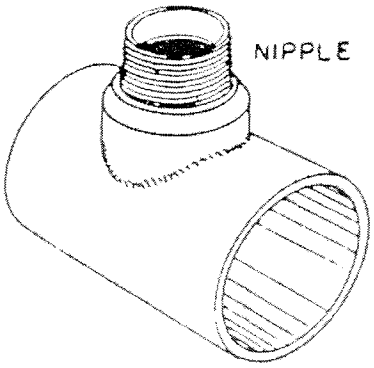


INSULATING JOINT

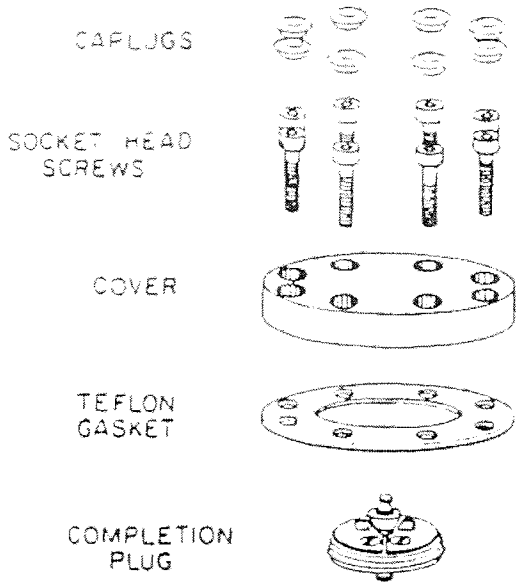
AVAILABLE SIZES: 8" & 12"

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-45
ISSUED	6/5/80	G.R.L	CONSTRUCTION DRAWING (GAS)	

PLUGGING EQUIPMENT FITTINGS



Plug 2



Plug 4, 8 & 12

NOTE:
4" YELLOW BALL MARKERS (PASSIVE ANTENNA) TO BE BURIED DIRECTLY ABOVE 8" and 12" SHORTSTOP FITTINGS AT A MAXIMUM DEPTH OF 4 FEET.

G-S-094-1-2

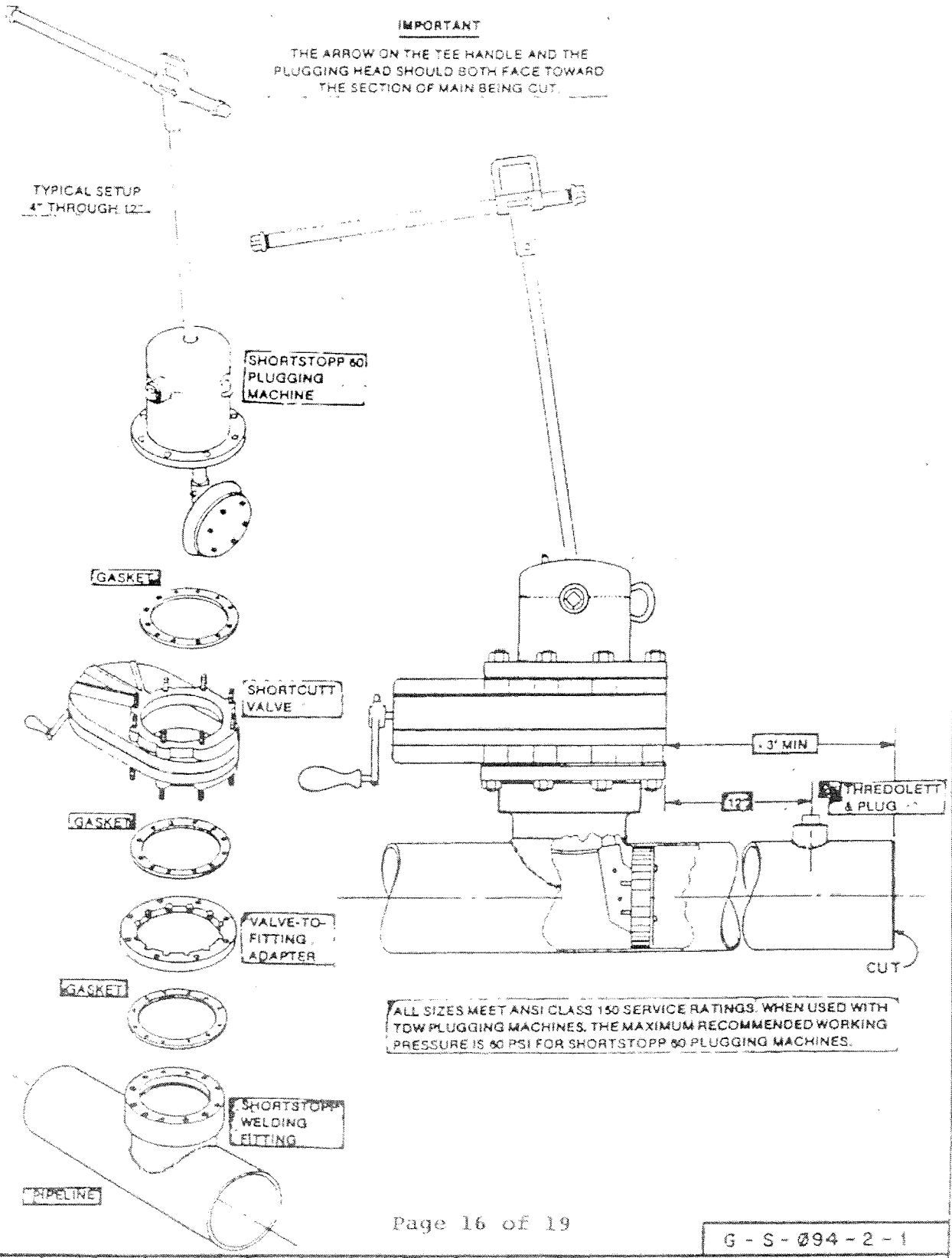
APPROVED	WJG	BRJ										CITY PUBLIC SERVICE BOARD
DATE	10/22	10/82	9/93									CONSTRUCTION STANDARD

EXHIBIT DST-3

PLUGGING EQUIPMENT INSTALLATION

IMPORTANT

THE ARROW ON THE TEE HANDLE AND THE PLUGGING HEAD SHOULD BOTH FACE TOWARD THE SECTION OF MAIN BEING CUT.



ALL SIZES MEET ANSI CLASS 150 SERVICE RATINGS. WHEN USED WITH TDW PLUGGING MACHINES, THE MAXIMUM RECOMMENDED WORKING PRESSURE IS 60 PSI FOR SHORTSTOPP 60 PLUGGING MACHINES.

G - S - 094 - 2 - 1

APPROVED	WAG	FEC										CITY PUBLIC SERVICE BOARD
DATE	10/87	10/87										CONSTRUCTION STANDARD

INSTALLATION INSTRUCTIONS TYPE II SHORTSTOPP® FITTING

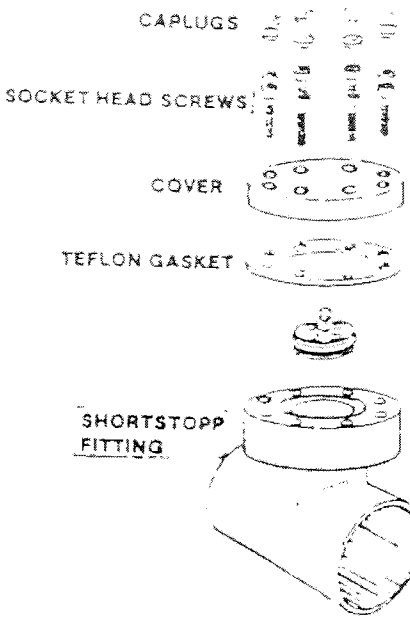
1. Remove completion plug from inside fitting before welding.
2. Clean all weld edges thoroughly — remove all paint, dirt, rust, oil, etc.
3. Apply grease to machined surface inside fitting to protect machined surface from weld spatter.
4. Center and level fitting. Flange centerline should intersect centerline of pipe, and flange gasket surface parallel to pipe.
5. Maintain 1/16" to 1/8" gap between fitting and pipe surface for proper penetration. DO NOT WELD INSIDE of fitting to avoid tapping problems.
6. Place white Teflon gasket on face of fitting.
7. Position reusable valve adapter flange on fitting so that the flow arrow stamped on flange adapter is in line with the pipe. Be sure that fitting and valve adapter flange bores are concentric.
8. Attach valve adapter flange to face of fitting; use socket head screws furnished with the fitting. A minimum torque on socket head screws assures a leak-tight joint.

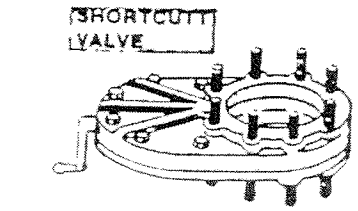
   4" fitting...40 to 60 ft. lbs.
   8" fitting...60 to 90 ft. lbs.
   12" fitting...50 to 90 ft. lbs.

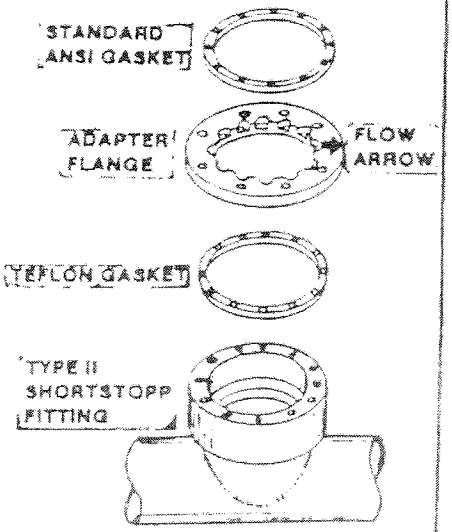
CAUTION

Excessive overtorquing can break socket head screws. Broken socket head screws can be difficult to remove and could allow gasket to leak.

9. Place a standard ANSI flange gasket on face valve adapter flange. Then install T.D.W. Shortcutt® Valve on the valve adapter flange.
10. Proceed and use standard T.D.W. Shortstopp equipment.
11. After completion plug has been set and Shortcutt Valve has been removed, remove reusable valve adapter flange.
12. Install cover (blind flange) on fitting with use of socket head screws and Teflon gasket. Use minimum torque values as shown in Item 8.
13. Insert plastic Caplugs into hex holes of socket head screws on cover. Caplugs help protect fitting from dirt and other foreign matter.

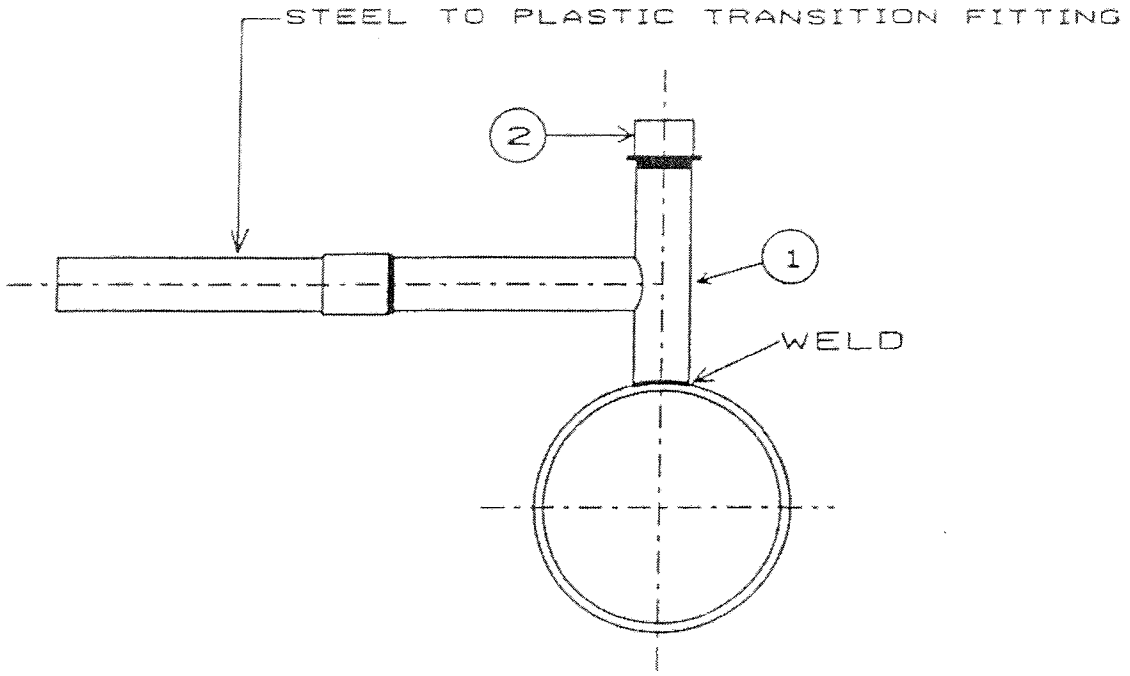






APPROVED	WRS Final									G-S-094-3-0
DATE	1/27 Nov 93									CITY PUBLIC SERVICE BOARD
										CONSTRUCTION STANDARD

TEE SERVICE WELDED TRANSITION STEEL TO PLASTIC



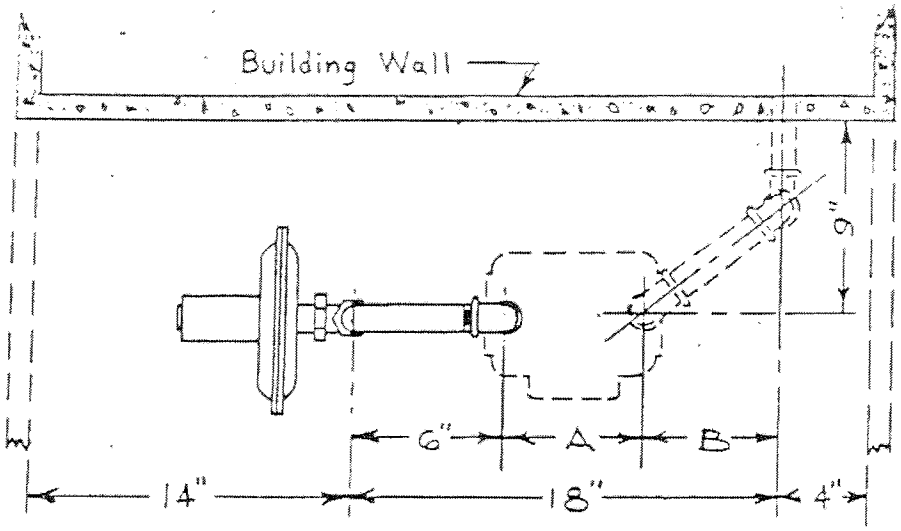
SIZE SERVICE	DRILL SIZE
1"	7/8"
1-1/4"	1-1/8"

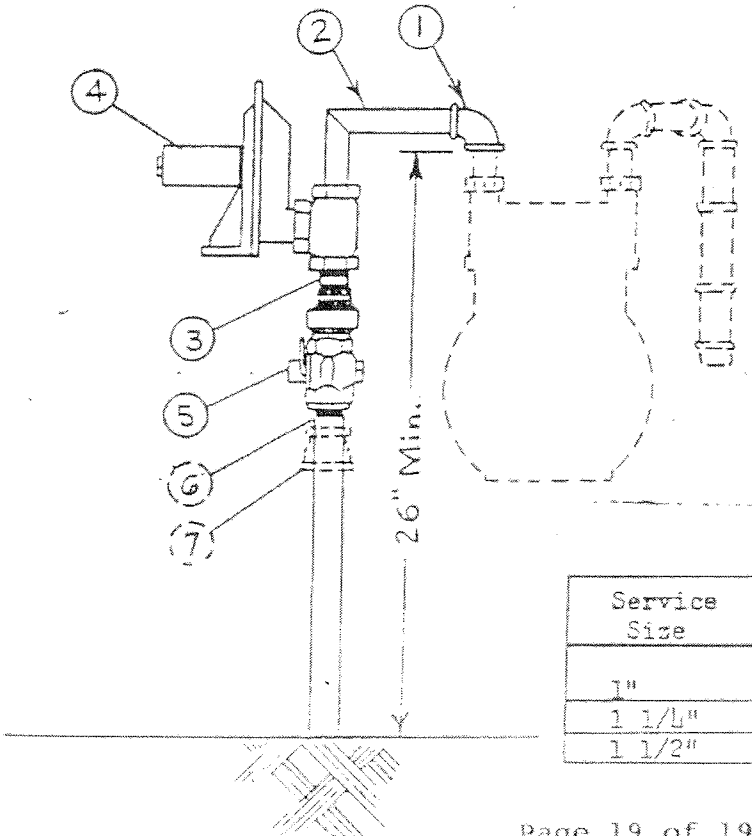
TEE SERVICE WELDED TRANSITION STEEL TO PLASTIC 1"
C.P.S. STOCK #520700204
TEE SERVICE WELDED TRANSITION STEEL TO PLASTIC 1¼"
C.P.S. STOCK #520700220

	DATE	APPROVED	CITY PUBLIC SERVICE	0 - 8 - 127 - 2 - 0
ISSUED			CONSTRUCTION STANDARD (GAS)	DRAWING DS-49
REVISED				

4.5	RISER AND REGULATOR FOR 5,10,30 & 35 LT. METERS	

NOTE: FOR DIMENSIONS OF METERS REFER TO EXHIBIT 6-1 IN THE PLANNING INSTRUCTIONS.





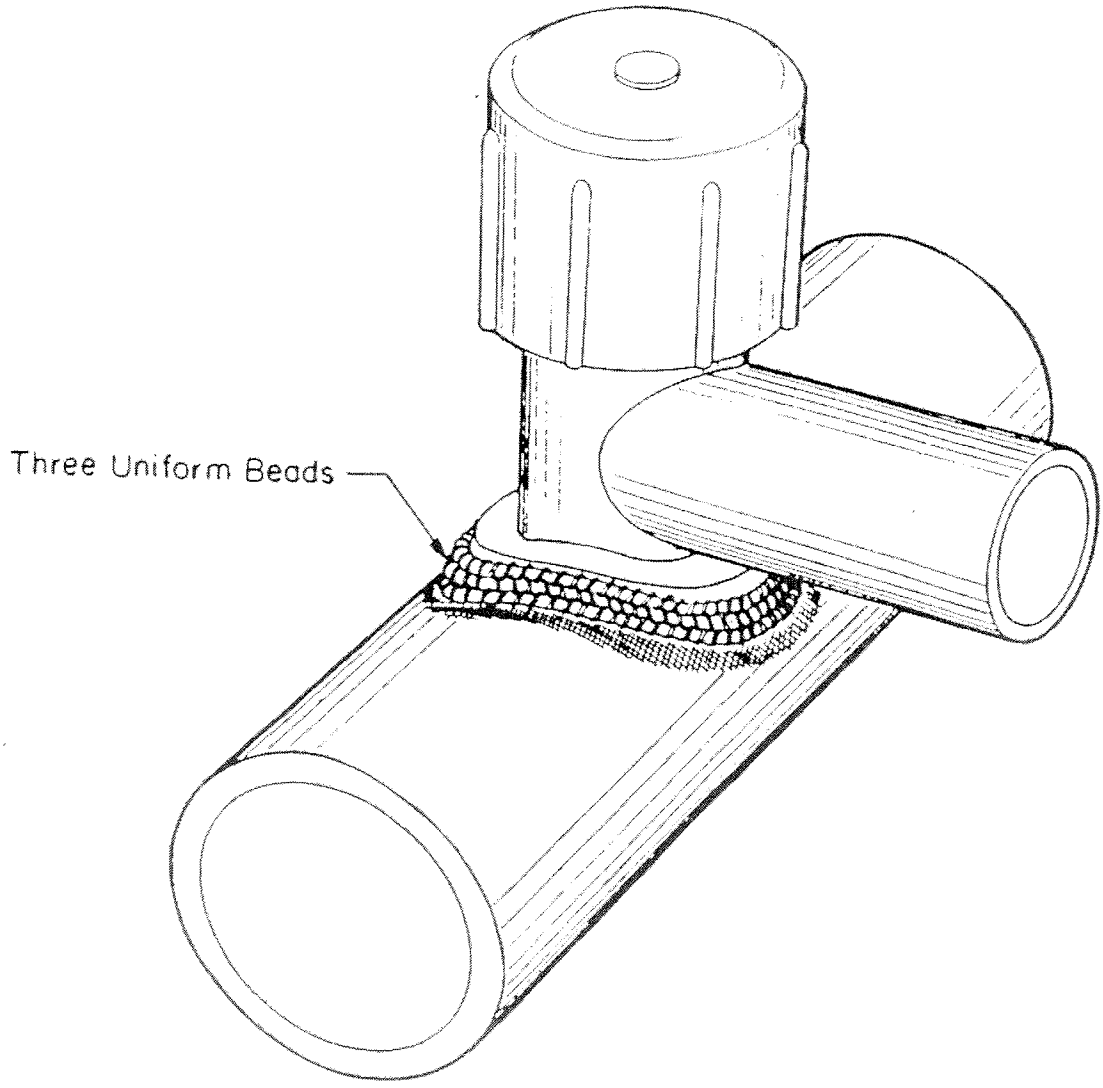
Available Sizes: ●

Service Size	Size of Meter Connection		
	1"	1 1/4"	1 1/2"
1"	●	●	●
1 1/4"	●	●	●
1 1/2"			●

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-50
ISSUED			CONSTRUCTION STANDARD (GAS)	G-S-222-1-1
REVISED				

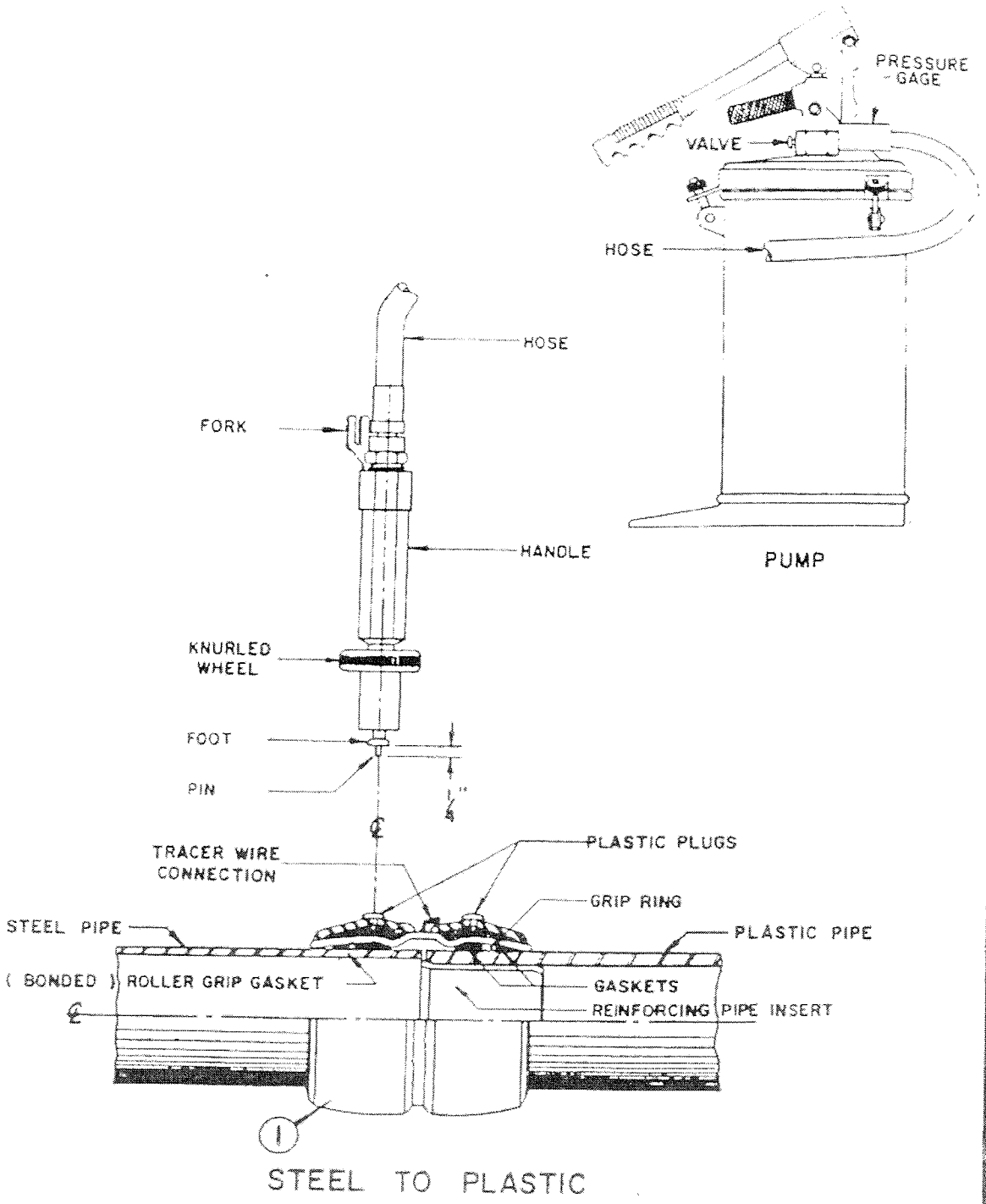
CPS Energy
Design Standards
(Plastic Gas Pipe)
Exhibit GAS-4

4.5	PLASTIC PIPE, TAPPING TEE	



	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-21
ISSUED	3/2/	[signature]	CONSTRUCTION STANDARD (GAS)	G-S-505-6-0
REVISED				

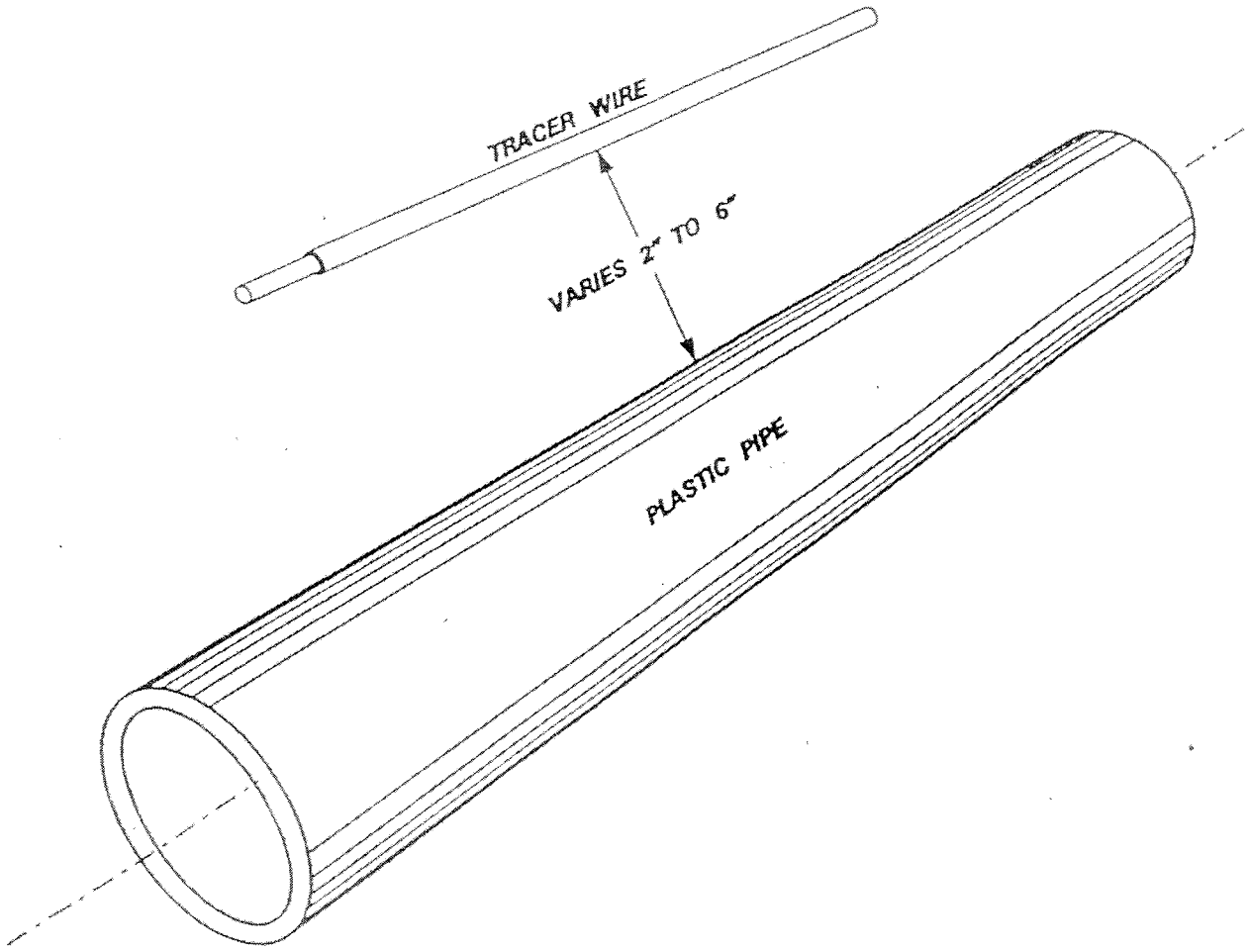
4.5	POSI-HOLD COUPLING INSTALLATION	



STEEL TO PLASTIC

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-24
ISSUED	5/80		CONSTRUCTION DRAWING (GAS)	G-S-507-8-Ø
REVISED				

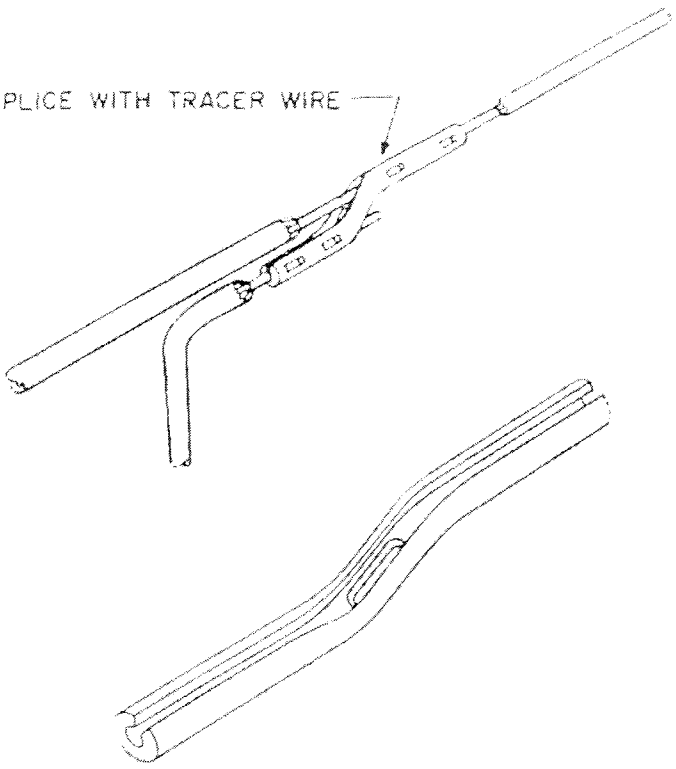
4.5	PLASTIC PIPE & TRACER WIRE	



NOTE: THERE IS TO BE 2" TO 6" OF SEPARATION BETWEEN PIPE AND TRACER WIRE.

	DATE	APPROVED	CITY PUBLIC SERVICE	G-S-501-2-1
ISSUED	8-6-80	D.R.S.	CONSTRUCTION STANDARD	
REVISED				DATE: 18-Dec-92 12:47

4.5	TEE SPLICE	



TEE SPLICE

NOTE:
1. APPLY PIPELINE TAPE WRAP PRIMER (ALLOW TO DRY UNTIL TACKY)
2. USE PIPELINE TAPE WRAP ONLY (CIGARETTE WRAP)

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-27
ISSUED	6/5/80	R.L.A.	CONSTRUCTION DRAWING (GAS)	G-S-541-1-0
REVISED				

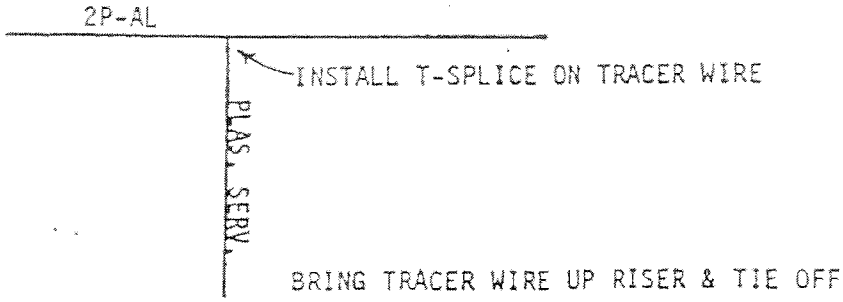
8847920005

EXHIBIT DST-2

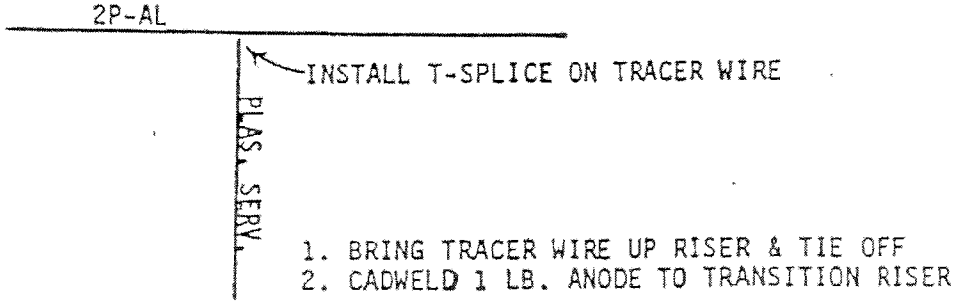
4/1/83

DRAWING DS-28
EXAMPLES FOR ANODELESS RISERS
(Page 1 of 2)

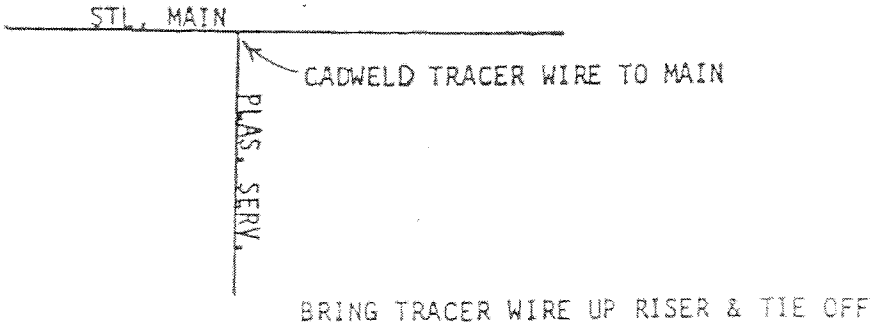
(1) ANODELESS TRACER WIRE ON PLASTIC MAIN - PLASTIC SERVICE WITH ANODELESS RISER



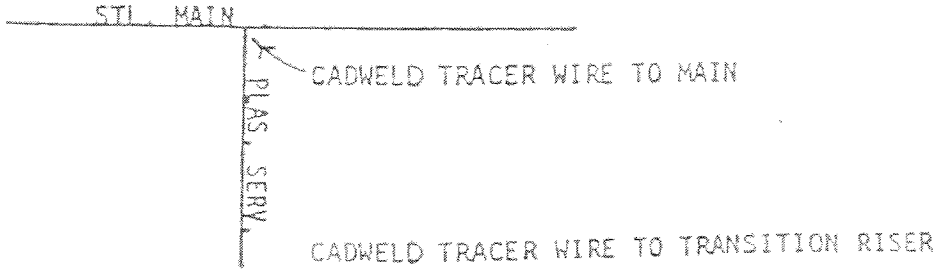
(2) ANODELESS TRACER WIRE ON PLASTIC MAIN - PLASTIC SERVICE WITH STEEL TRANSITION RISER



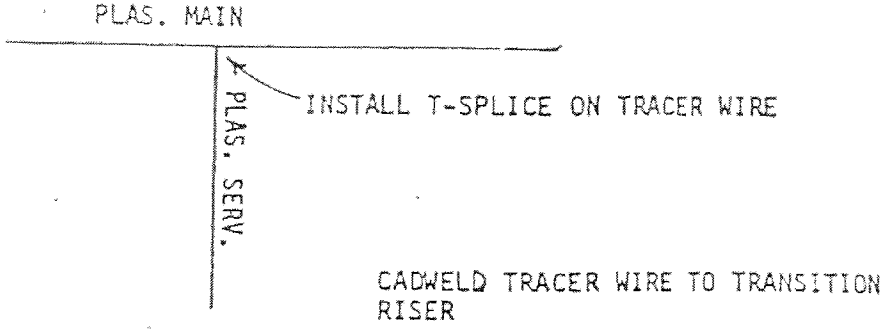
(3) STEEL MAIN - PLASTIC SERVICE WITH ANODELESS RISER - ALSO RERUNS



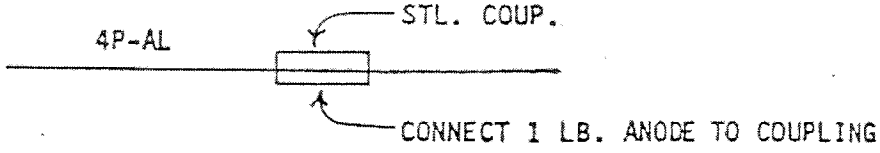
(4) STEEL MAIN - PLASTIC SERVICE WITH STEEL TRANSITION RISER



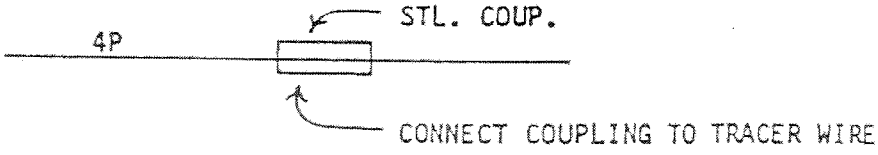
(5) PROTECTED TRACER WIRE ON PLASTIC MAIN - 2" OR 4" PLASTIC SERVICE WITH STEEL TRANSITION RISER



(6) ANODELESS TRACER WIRE ON PLASTIC MAIN OR SERVICE WITH STEEL REPAIR COUPLING

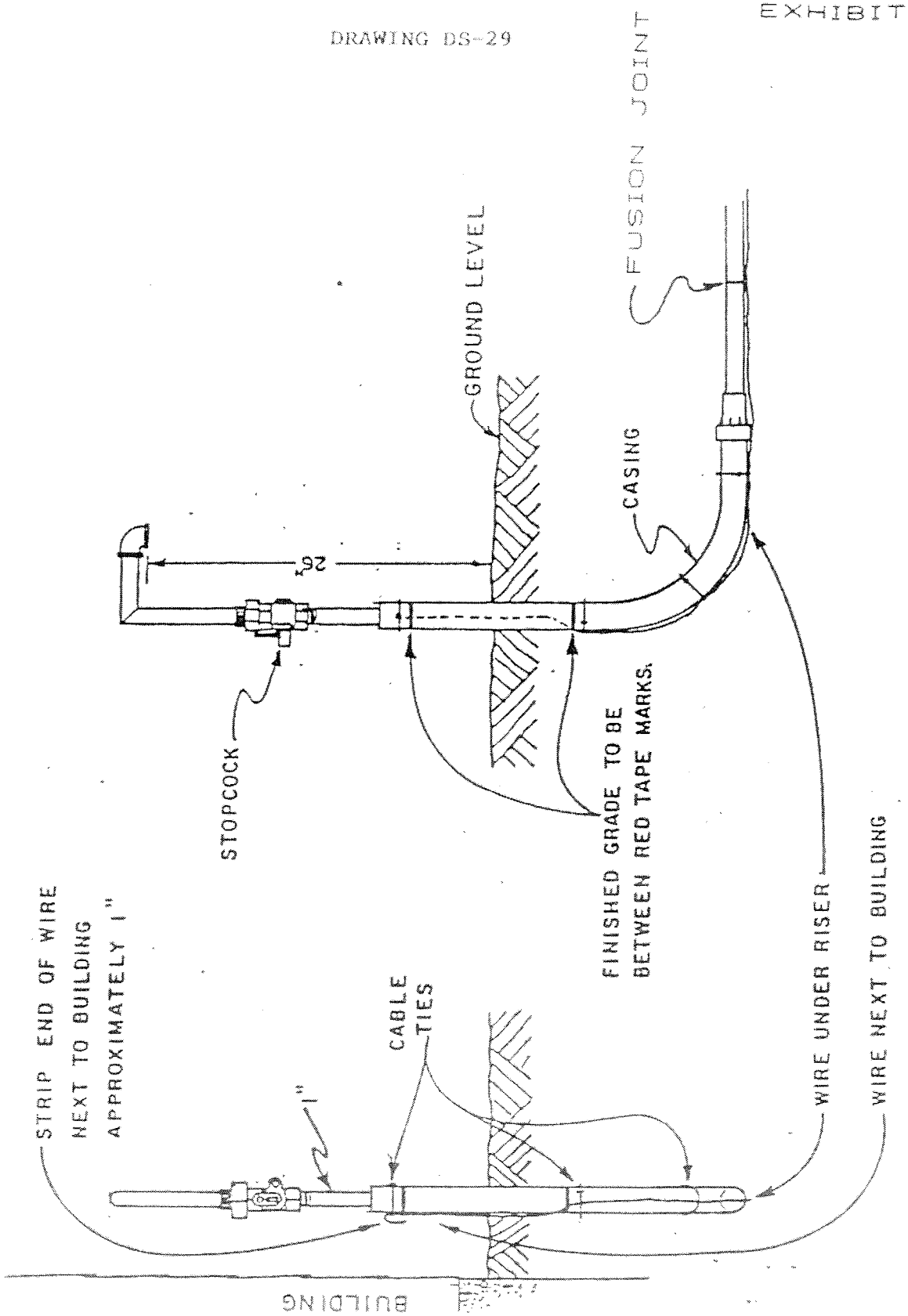


(7) PROTECTED TRACER WIRE ON PLASTIC MAIN OR SERVICE WITH STEEL REPAIR COUPLING



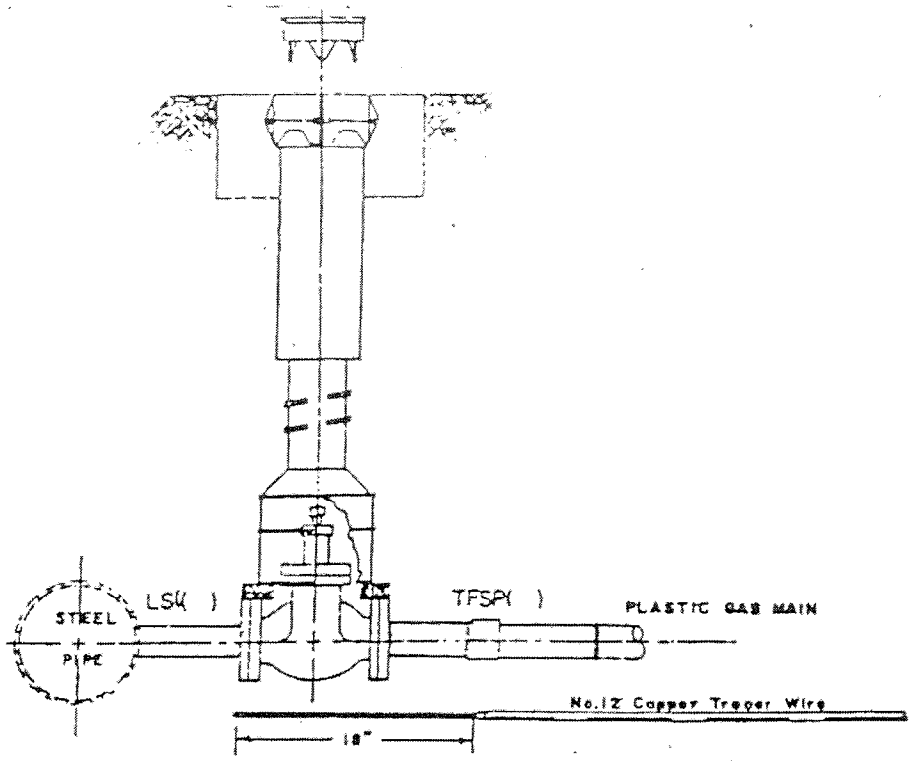
NOTE - NEVER CADWELD TRACER WIRE TO THE NEW ANODELESS SERVICE RISER

DRAWING DS-29

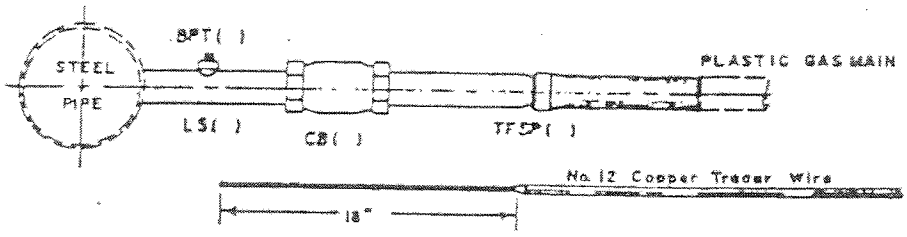


ANODELESS RISER

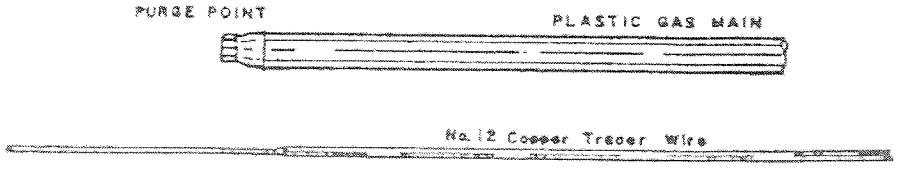
TERMINATION OF TRACER WIRE ON ANODELESS SYSTEMS



REMOVE 18" OF INSULATION AT END OF TRACER WIRE — LEAVE WIRE BARE
DO NOT LET WIRE TOUCH STEEL MAIN OR FITTINGS



REMOVE 18" OF INSULATION AT END OF TRACER WIRE — LEAVE WIRE BARE
DO NOT LET WIRE TOUCH STEEL MAIN OR FITTINGS

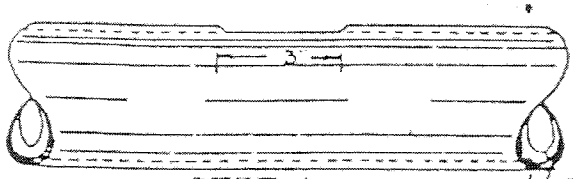


REMOVE 18" OF INSULATION AT END OF TRACER WIRE — LEAVE WIRE BARE

DRAWING DS-30

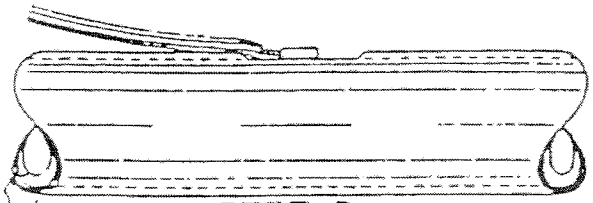
APPROVED		CITY PUBLIC SERVICE BOARD
DATE	2-83	CONSTRUCTION STANDARD

Remove a section of coating 3 long and file pipe bright so that a space 1" wide and 2" long is clean and dry.



STEP. 1

Strip 1½ of insulation from wire and place copper sleeve on #10 and smaller wire.



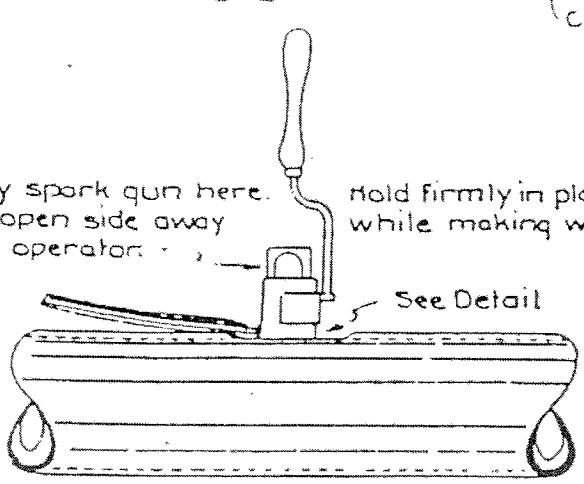
STEP 2

Pipe Coating

Apply spark gun here. Keep open side away from operator.

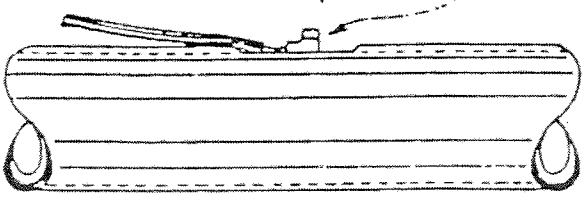
Hold firmly in place while making weld.

See Detail



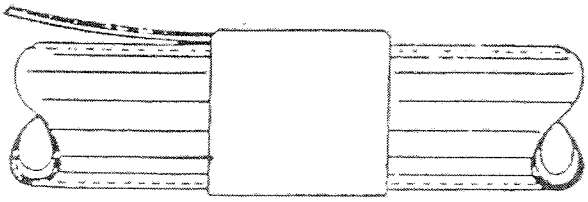
STEP 3

Remove slag with hammer and paint thoroughly with primer.

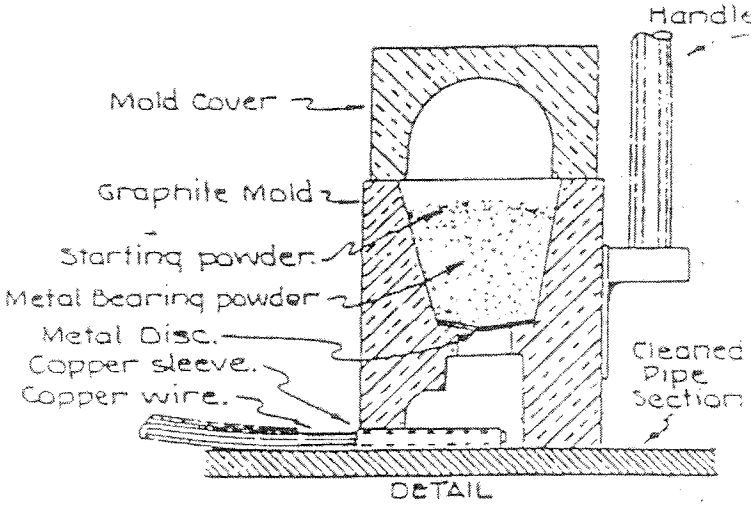


STEP 4

Repair pipe coating with care Cover entire weld.



STEP 5



DETAIL

IMPORTANT

1. REMOVE RED CAP OF CADWELL CARTRIDGE AND DUMP ALL OF CONTENTS INTO MOLD. THE CHARGE WILL NOT IGNITE WITHOUT THE FINE STARTING POWDER ON TOP.
2. THE CARTRIDGES MUST BE KEPT DRY AT ALL TIMES.

Cadweld mold with sleeve for #10 wire and smaller.

CITY PUBLIC SERVICE BOARD
SAN ANTONIO TEXAS
GAS DEPARTMENT

COPPER WIRE CONNECTION TO PIPE USING CADWELD.

SCALE 2" = 1"	APPROVED	FIG
DRAWN C.W.T.	BY W.D.B.	60

INSTRUCTION SHEET - TYPE TB-3 WELDER

PREPARATION OF SURFACE:

To obtain a good weld, surface must be bright clean and dry.

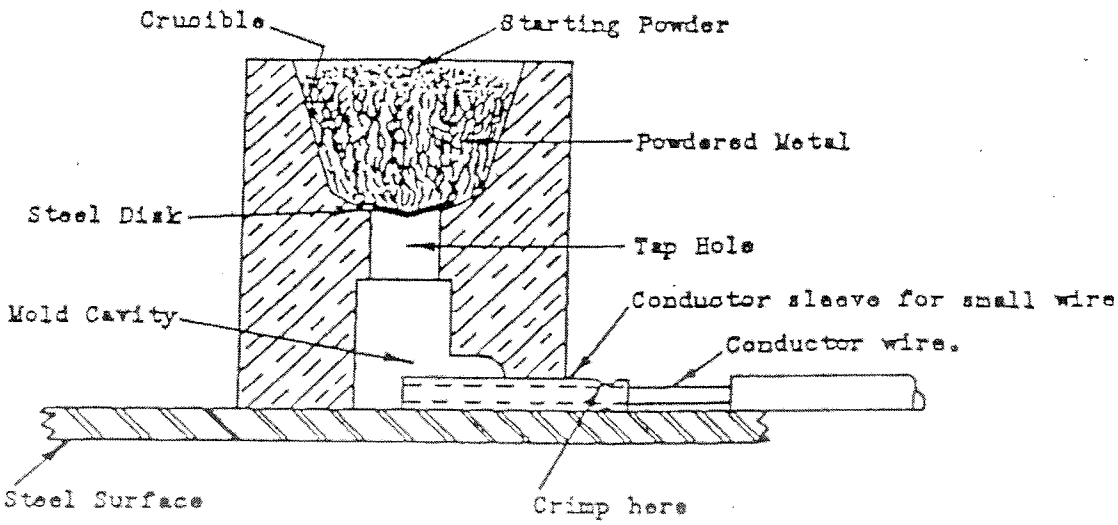
Steel surface should be ground or filed to remove all scale, rust, grease and dirt.

Galvenized steel must be cleaned with emery cloth to remove oxide.

PREPARATION OF WIRE:

Strip the insulation from the conductor and scrape until wire is bright and clean.

For #10 and smaller sizes, place the wire in a copper sleeve, ends flush, and crimp the sleeve tightly to the wire at the insulation to provide additional mechanical strength at the weld.



WELDING PROCEDURE:

(1) PLACE WELDER OVER CLEAN STEEL SURFACE and insert the wire until it is under the CENTER of the tap hole.

(2) COVER TAP HOLE WITH STEEL DISK.

(3) DUMP CARTRIDGE IN CRUCIBLE AND CLOSE COVER. (Tap bottom of cartridge to be sure starting powder is emptied). Replace empty cartridge in box to keep remaining cartridges in an upright position.

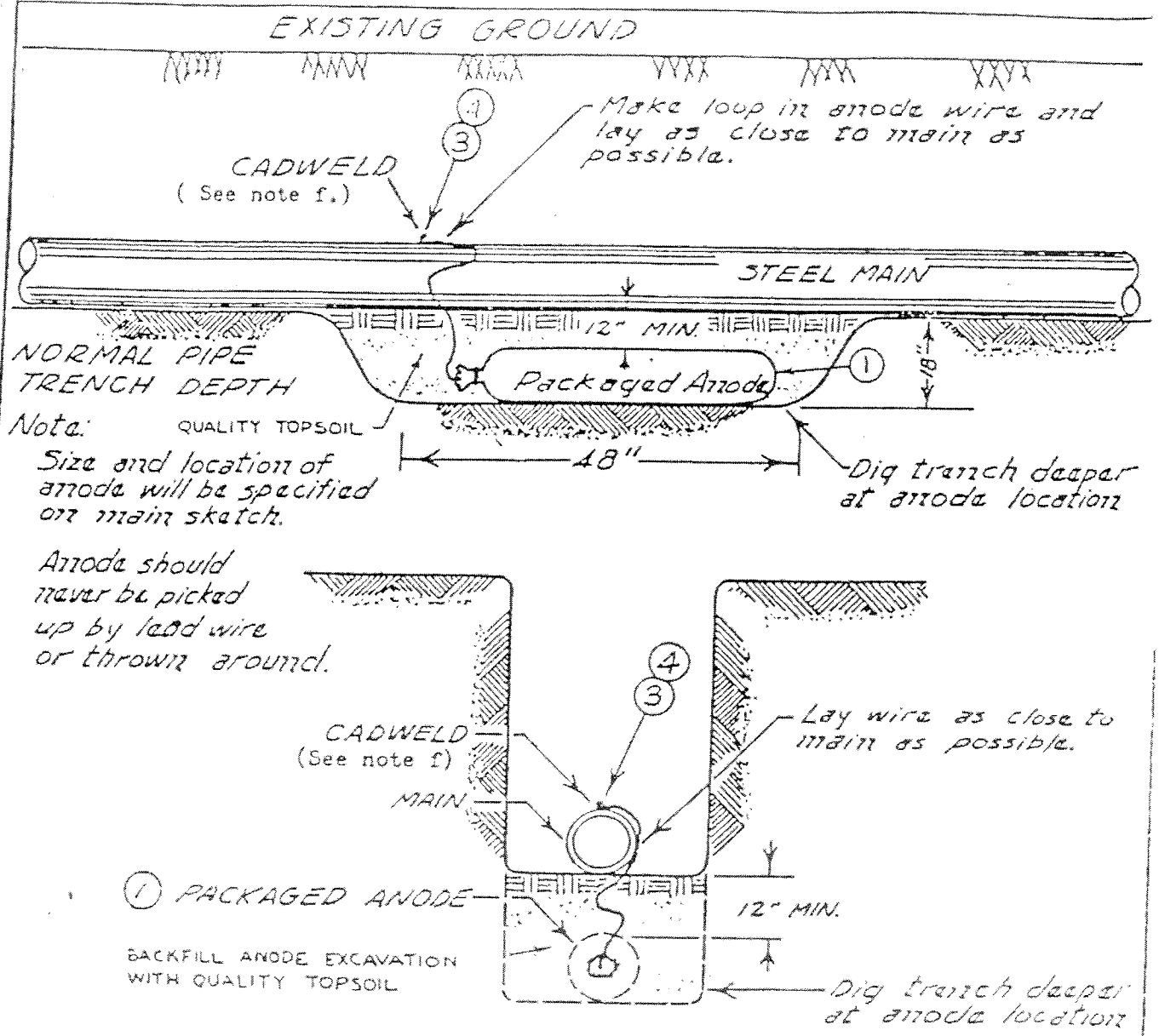
(4) HOLD DOWN ON WELDER TO PREVENT LEAKS AND IGNITE WITH FLINT GUN. Jerk gun away to prevent fouling. Should gun become fouled, soak in Spirits of Ammonia.

(5) DO NOT REMOVE WELDER UNTIL METAL HAS SOLIDIFIED.

(6) ALL SLAG MUST BE CLEANED FROM MOLD BEFORE MAKING NEXT WELD.

Note: Wet or damp molds produce porous welds. Mold can be dried out by firing a charge before making the desired weld.

4.5 PACKAGED ANODES

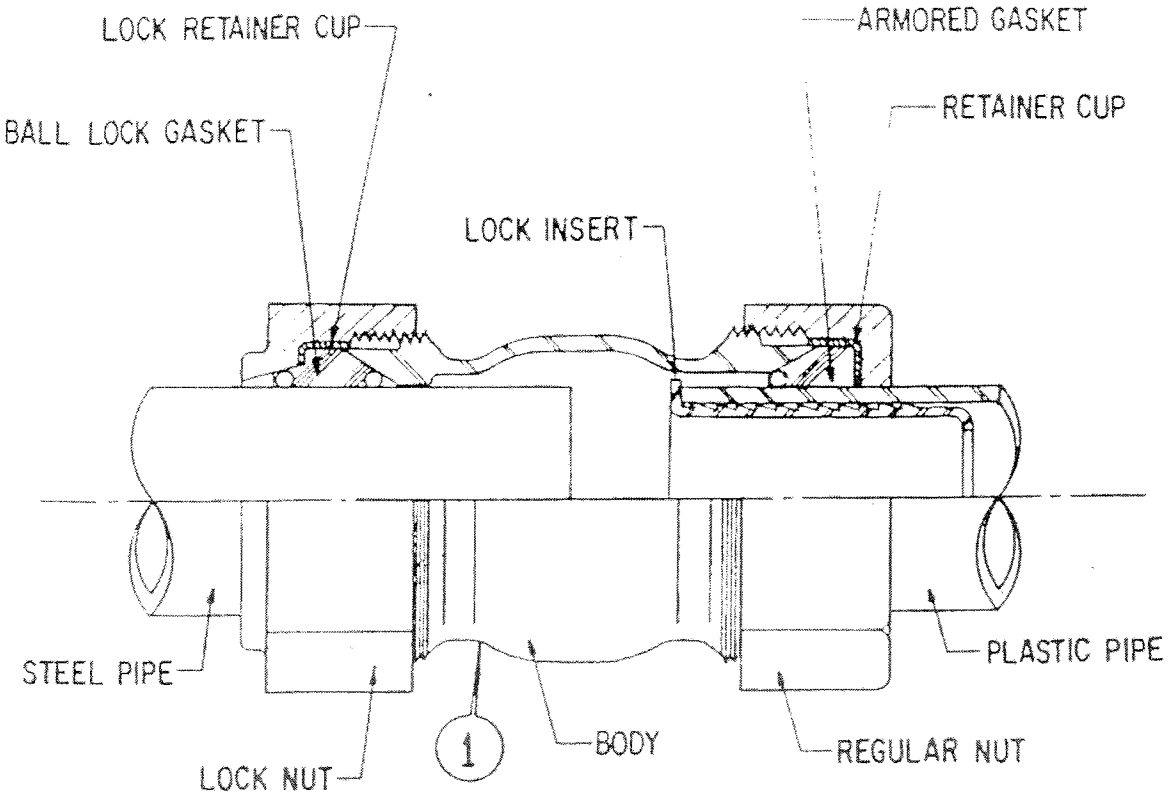


NOTES:

a. Cadweld connection to be primed and coated carefully.
b. Packaged anode should be covered with fine soil containing no rocks, clods, or sand.
c. Pour 5 gallons of water over anode location and tamp thoroughly.
d. Provide test leads when specified. (See test lead standard)
e. Anode specification sheet will be attached to main order, and is to be completed by the main construction foreman.
f. Where plastic main is installed in place of steel, use tee splice to connect anode wire to tracer wire.

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-33
ISSUED			CONSTRUCTION STANDARD (GAS)	G-S-171-1-2
REVISED				

4.5	PLASTI-LOK TRANSITION COUPLING INSTALLED	



STEEL TO PLASTIC

AVAILABLE SIZES: 1", 1¼", 2"

	DATE	APPROVED	CITY PUBLIC SERVICE BOARD	DRAWING DS-34
ISSUED	9/81	RLS	CONSTRUCTION DRAWING (GAS)	G-S-507-4-Ø
REVISED				

EXHIBIT GAS-7

City Public Service Covered Tasks Regulated by 49 CFR Part 192

Tasks Regulated By 49 CFR Part 192	CFR 192	ReQual Interval	Tasks Regulated By 49 CFR Part 192	CFR 192	ReQual Interval
Examining PE pipe for defects	192.59	3 year		192.287	3 year
Visually inspecting metallic components for defects	192.144	3 year		192.305	3 year
Welding	192.225	6 month		192.307	3 year
	192.225	-------		192.309 192.713	3 year
	192.241	3 year		192.311	3 year
	192.243	3 year	Installation of pipe in a ditch	192.319	3 year
	192.243	3 year	Inserting PE pipe into a casing	192.321	3 year
Repair or removal of weld defects	192.245 192.715	6 month	Installing customer meters and regulators	192.357	3 year
Making welded joints	192.273	6 month	Installation of service lines	192.361	3 year
Inspecting welded joints	192.273	3 year	Installation and maintenance of cathodic protection systems	192.453	3 year
Joining PE pipe by heat fusion or mechanical joint	192.281	1 year		192.457	-------
Qualifying PE pipe joining procedures	192.283	1 time		192.457	3 year
	192.285	-------	Inspecting pipe coating	192.459 192.461	3 year
	192.285	-------		192.465	3 year
Testing cathodic protection system with pipe-to-soil reads	192.465	3 year	Line locating and marking pipelines	192.614	3 year
Inspect interference bonds, diodes & reverse current switches	192.465	3 year		192.615	-------
Remedial actions to correct cathodic protection deficiencies	192.465	3 year		192.615	3 year
Connecting test lead wires to the pipeline	192.471	-------	Making safe a pipeline emergency	192.615	3 year
Taking action to minimize the effect of stray currents	192.473	3 year		192.615	-------
	192.475	3 year		192.619 192.621	3 year
Cleaning and coating pipe for control of atmospheric corrosion	192.479	3 year		192.625	3 year
	192.479	3 year		192.625	3 year
	192.479 192.463	3 year	Tapping pipelines under pressure	192.627	3 year

Covered Tasks (cont)

Pipeline pressure testing	192.503	3 year	Purging of pipelines	192.629	3 year
	192.605	3 year			
	192.605	-------			
[3]	192.605	-------	Abandoning or deactivating pipeline facilities	192.727	3 year
Starting up and shutting down any part of a pipeline	192.605	3 year			3 year
Taking precautions against hazardous atmospheres in trenches [2,3]	192.605	-------			3 year
Recognizing safety-related conditions that require reporting	192.605	3 year			3 year
	192.605	3 year			3 year
	192.605	3 year	Prevention of accidental ignition	192.751	3 year
	192.613	3 year			

[1] Not an operations or maintenance task

[2] Does not affect the operation or integrity of the pipeline

[3] Not an activity performed on the pipeline

[4] Not required by CFR Part 192

Any Contractor employed by CPS to perform a covered task will have their employees qualified by an approved consortium or training provider. CPS will require contractor to supply a list of all qualified personnel and may require the contractor to supply the qualified employee with a qualification card stating tasks that employee is qualified for, the qualification date, qualification method and the name of the qualifier.

CPS will accept qualification of contractor employees by any approved combination of the following methods:

(a) Approved qualification and training program (i.e. TEEX/TGA)

(b) Approved certifications (i.e. AWS Certified Welding Inspector, ASNT)

(c) Field evaluation

(d) Work performance history (See Note)

(e) Other forms of assessment approved by CPS

Contractor employee will be subject, at a minimum, to the same re - qualification intervals as CPS employees. CPS shall have the right to require removal of any employee of Contractor, or of Subcontractors, who in the CPS Representative's opinion, may be incompetent or unqualified to perform work.

Note: Work performance history cannot be the sole method for qualifying an employee after October 28, 2002.

CPS ENERGY (CPS)
EXHIBIT GAS-5
COMPENSATION SCHEDULE
CONSTRUCTION OF NATURAL GAS DISTRIBUTION FACILITIES

PROJECT NAME: Fort Sam Houston Transportation Projects JOB #: 1479016

NOTE A: For each of the items below, the Contractor's work is to include: trenching, joining, testing, coating steel, connecting new pipe to existing pipe and all necessary fittingsfor tie-ins such as, stopper fittings and 3-way stopper tees, sand padding, backfilling and compacting to consistency of original soil, Installing all necessary cathodic protection devices such as CPTLB's and anodes, replacing paving, curbs, and sidewalksremoved or damaged during construction, and cleanup as may be necessary in each instance.

NOTE B: Trenching is considered to be the normal method of service installation and is required on all service adjustments. A gas service can be rerun by INSERTION, when the old service is PULLED from the riser to one foot inside the property line, ONLY at the discretion of the CPS Inspector.

NOTE C: Bid quantities shown are estimates by CPS. Per foot prices shall be applied to the actual distance measured along the top of the trench or the actual length of the bore, as applicable.

NOTE D: Unit prices shall include insurance costs. CPS' insurance requirements are specified in Exhibit GAS-1.

ITEM NO.	DESCRIPTION	UNIT	UNIT PRICE	BID QUANTITY	TOTAL PRICE
1.	Install Gas Main or Casing (Distance As Measured Along the Top of Trench)				
	2" Plastic Pipe and Tracer Wire	1 ft.	$_____	X 1000	= $_____
	6" Plastic Pipe and Tracer Wire	1 ft.	$_____	X 2771	= $_____
	8" Plastic Pipe and Tracer Wire	1 ft.	$_____	X 46	= $_____
	8" Steel Pipe	1 ft.	$_____	X 142	= $_____
	16" Steel Pipe	1 ft.	$_____	X 1104	= $_____

The COST to abandon the existing main(s) is not an ADDITIONAL item and is to be included in the Unit Price(s) for this item.

2.	Install Gas Mains Joint Trench (Distance as Measured Along the Top of Trench)				
	6" Plastic Pipe with Tracer Wire & 16" Steel	1 ft.	$_____	X 340	= $_____
3.	Rerun and Lower Gas Service Off New Main (Main to 1 Ft. Inside Property Line), Sizes 1" thru 4" (including replacing riser if necessary).				
	Short Side	1 ea.	$_____	X 1	= $_____
4.	Rerun and Lower Gas Service Off New Main (Main to Meter) Sizes 1" thru 4"				
	Short Side	1 ea.	$_____	X 4	= $_____
	Long Side	1 ea.	$_____	X 1	= $_____

CPS ENERGY (CPS)
EXHIBIT GAS-5
COMPENSATION SCHEDULE
CONSTRUCTION OF NATURAL GAS DISTRIBUTION FACILITIES

ITEM NO.	DESCRIPTION	UNIT	UNIT PRICE	BID QUANTITY	TOTAL PRICE
5.	Hire TDW to Purchase,Install and Perform Stopple Operations.				
	16" Pipe	1 ea.	$_____	X 3	= $_____
6.	Cut Back, Pump Test and Tie Existing Service to New Main, Sizes 1" thru 4"	1 ea.	$_____	X 1	= $_____
7.	Install Pipe by Boring in Dirt Under Streets, Alleys, Driveways, Etc.:				
	2" Pipe	1 ft.	$_____	X 59	= $_____
	6" Pipe	1 ft.	$_____	X 385	= $_____
	16" Pipe	1 ft.	$_____	X 100	= $_____
8.	Street restoration adjustment, when required. To be used as directed by the CPS Energy Representative				
	Asphalt	1 SY.	$_____	X 460	= $_____
	Flowable Fill	1 CY.	$_____	X 390	= $_____

TOTAL COST: $_____

COMPANY: _____

PREPARED BY: _____

TITLE: _____

DATE: _____

Envelope No. 1
(To be opened only if Envelope No.2 contains all required documents.)

BID ON: **FORT SAM HOUSTON TRANSPORTATION PROJECTS**

2- Bid Proposal, Form 9-12 (Rev. 05-03)
Proposal to the City of San Antonio

PROPOSAL

TO

CITY OF SAN ANTONIO TEXAS

FOR THE CONSTRUCTION OF

FORT SAM HOUSTON TRANSPORTATION PROJECTS

IN SAN ANTONIO, TEXAS

The undersigned, as bidder, declares that the only person or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any other person, firm, corporation; that Bidder has carefully examined the form of contract, instructions to bidders, profiles, grades, specifications, and the plans therein referred to, and has carefully examined the locations, conditions and classes of materials of the proposed work; and agrees that Bidder will provide all the necessary machinery, tools, apparatus, and other means of construction, and will do all the work and furnish all the materials called for in the contract and specifications in the manner prescribed therein and according to the requirements of the Director of Public Works as therein set forth.

It is understood that the following quantities of work to be done are approximate only, and are intended principally to serve as a guide in figuring out the bids.

It is understood and agreed that the work is to be completed in full in **182** calendar days

Accompanying this Proposal is a Bid Guaranty in the amount of _____

_____ Dollars ($_____) said amount being **Five percent (5%)** of the total bid. Said Bid Guaranty, in the form of a Certified or Cashier's Check on a State or National Bank, or Bid Bond, is submitted as a guaranty of the good faith of the Bidder and that the Bidder will execute and enter into a written contract to do the work, if his bid is accepted. It is hereby agreed that the Bidder may, at any time prior to opening of the bids withdraw this Proposal without penalty; it is also agreed that if Bidder shall, at any time after opening of bids, withdraw this Proposal or if this Bid is accepted and Bidder shall fail to execute the written contract and furnish satisfactory bond, within twenty (20) calendar days after the date of transmittal of the contract documents by Owner to Contractor, the City of San Antonio shall, in any of such events, be entitled and is hereby given the right to retain said Bid Guaranty as liquidated damages. It is understood that the City of San Antonio reserves the right to reject any and all bids whenever the City Council deems it in the interest of the City to do so, and also the right to waive any informalities in a bid.

In the event of the award of a contract to the undersigned, the undersigned will execute same on Standard Form City Construction Contract and make bond for the full amount of the contract, to secure proper compliance with the terms and provisions of the contract, and to insure and guarantee the work until final completion and acceptance or the end of the guarantee period where so stipulated, and to guarantee payment of all lawful claims for labor performed and materials furnished in the fulfillment of the contract.

The work proposed to be done shall be accepted when fully completed and finished to the entire satisfaction of the Director of Public Works.

The undersigned certifies that the bid prices contained in this proposal have been carefully checked and are submitted as correct and final.

Bidder is:

[] An individual proprietorship;

[] A partnership composed of _____

_____ and _____

[] A corporation chartered under the laws of the State of _____ , acting by its officers pursuant to its by-laws or a resolution of its Board of Directors.

_____

(Name of Bidder)

By:_____

ATTEST: (Signature) Date

_____ _____

(Title)

Amount of Base Bid (Insert Amount in Words and Numbers): _____

_____

_____ $_____

Alternates (if applicable):

(1) _____ (3) _____

(2) _____ (4) _____

_____ _____

Company's Name Telephone No.

_____ _____

Address Fax No.

_____ _____

City & State Zip Code

CITY OF SAN ANTONIO

025 UNIT PRICING FORM

PROJECT NAME: FORT SAM HOUSTON TRANSPORTATION PROJECTS
PROJECT NO. 0915-12-470, ETC.

ALT. NO.	ITEM NO	DESC CODE	S.P. NO	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	ITEM SEQUENCE NO.
	100	2002	2	PREPARING ROW	STA	68.35		$	1
	104	2001	0	REMOVING CONC (PAV)	SY	5517		$	2
	104	2017	0	REMOVING CONC (DRIVEWAYS)	SY	4891		$	3
	104	2029	0	REMOVING CONC (CURB OR CURB & GUTTER)	LF	7600		$	4
	104	2031	0	REMOVING CONC (HEADWALL)	CY	789		$	5
	104	2036	0	REMOVING CONC (SIDEWALK OR RAMP)	SY	311		$	6
	105	2011	0	REMOVING STAB BASE AND ASPH PAV (2"-6")	SY	26984		$	7
	110	2001	0	EXCAVATION (ROADWAY)	CY	5751		$	8
	112	2001	0	SUBGRADE WIDENING (ORD COMP)	STA	30.35		$	9
	132	2001	0	EMBANKMENT (FINAL)(ORD COMP)(TY A)	CY	37932.9		$	10
	162	2002	0	BLOCK SODDING	SY	15367.22		$	11
	168	2001	0	VEGETATIVE WATERING	MG	251.128632		$	12
	260	2001	2	LIME (HYDRATED LIME (DRY))	TON	1619.31		$	13
	260	2006	2	LIME TRT (EXST MATL) (6")	SY	43067.78		$	14
	316	2028	16	ASPH(AC-5 OR 10,CRS/HFRS-2,RS/CRS-1P)	GAL	16195.29		$	15
	316	2582	16	AGGR (TY-PB GR-4)	CY	539.83		$	16
	340	2236	3	D-GR HMA(METH) TY-B PG64-22 (LEVEL UP)	TON	749		$	17
	341	2011	24	D-GR HMA(QCQA) TY-B PG64-22	TON	26695.31		$	18
	341	2034	24	D-GR HMA(QCQA) TY-C PG64-22	TON	5938.28		$	19
	354	2045	0	PLANE ASPH CONC PAV (2")	SY	13619		$	20
	356	2024	0	PAV JT UNDERSEAL (48")	LF	5550		$	21
	401	2001	0	FLOWABLE BACKFILL	CY	420		$	22
	402	2001	0	TRENCH EXCAVATION PROTECTION	LF	3900		$	23
	420	2120	2	CL C CONC (BUS STOP)	CY	556.49		$	24
	432	2001	0	RIPRAP (CONC)(4 IN)	CY	22.3708642		$	25
	462	2006	0	CONC BOX CULV (5 FT X 2 FT)	LF	126		$	26
	462	2019	0	CONC BOX CULV (8 FT X 4 FT)	LF	785		$	27
	464	2005	0	RC PIPE (CL III)(24 IN)	LF	398		$	28
	464	2007	0	RC PIPE (CL III)(30 IN)	LF	44		$	29
	464	2009	0	RC PIPE (CL III)(36 IN)	LF	492		$	30
	464	2011	0	RC PIPE (CL III)(48 IN)	LF	1110		$	31
	464	2013	0	RC PIPE (CL III)(60 IN)	LF	193		$	32
	465	2014	1	MANH (COMPL)(JUNCT BOX)	EA	14		$	33
	465	2020	1	INLET (COMPL)(CURB)(TY II)	EA	17		$	34
	465	2077	1	INLET (COMPL)(DROP)(TY 1)	EA	2		$	35
	465	2211	1	JUNCTION BOX (SPL)	EA	7		$	36
	465	2215	1	INLET (COMPL)(TY H)(SPL)	EA	1		$	37
	465	2405	1	INLET (COMPL)(CURB)(TY C)	EA	1		$	38
	465	2473	1	INLET EXT (TY II-E)	EA	31		$	39
	465	2474	1	INLET EXT (TY C-E)	EA	2		$	40
	465	xxxx	1	INLET (COMPL)(DROP)(TY 1A)	EA	1		$	41
	500	2001	5	MOBILIZATION	LS	1		$	42
	502	2001	3	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	10		$	43
	502	2047	3	OFF-DUTY POLICE OFFICER	HR	288		$	44
	506	2016	10	CONSTRUCTION EXITS (INSTALL) (TY 1)	SY	234		$	45
	506	2019	10	CONSTRUCTION EXITS (REMOVE)	SY	156		$	46
	506	2032	10	SANDBAGS FOR EROSION CONTROL (18")	LF	699		$	47

PROJECT NAME: FORT SAM HOUSTON TRANSPORTATION PROJECTS
PROJECT NO. 0915-12-470, ETC.

ALT. NO.	ITEM NO	DESC CODE	S.P. NO	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	ITEM SEQUENCE NO.
	506	2034	10	TEMPORARY SEDIMENT CONTROL FENCE	LF	144		$	48
	508	2002	0	CONSTRUCTING DETOURS	SY	8084		$	49
	512	2008	2	PORT CTB (FUR & INST)(LOW PROF)(TY 1)	LF	3380		$	50
	512	2009	2	PORT CTB (FUR & INST)(LOW PROF)(TY 2)	LF	240		$	51
	512	2026	2	PORT CTB (MOVE)(LOW PROF)(TY 1)	LF	5580		$	52
	512	2027	2	PORT CTB (MOVE)(LOW PROF)(TY 2)	LF	400		$	53
	512	2044	2	PORT CTB (REMOVE)(LOW PROF)(TY 1)	LF	3380		$	54
	512	2045	2	PORT CTB (REMOVE)(LOW PROF)(TY 2)	LF	240		$	55
	529	2001	0	CONC CURB (TY I)	LF	12002		$	56
	530	2010	0	DRIVEWAYS (CONC)	SY	4180		$	57
	531	2015	0	CONC SIDEWALK (4")	SY	3150.53		$	58
	531	2034	0	CONC SIDEWALK (DRAIN)	LF	14		$	59
	531	2040	0	CURB RAMPS (TY 5)	EA	16		$	60
	536	2004	0	CONC DIRECTIONAL ISLAND	SY	718		$	61
	618	2018	0	CONDT (PVC) (SCHD 40) (2")	LF	335		$	62
	618	2022	0	CONDT (PVC) (SCHD 40) (3")	LF	964		$	63
	620	2009	0	ELEC CONDR (NO. 6) BARE	LF	28		$	64
	620	2010	0	ELEC CONDR (NO. 6) INSULATED	LF	56		$	65
	620	2011	1	ELEC CONDR (NO. 8) BARE	LF	1102		$	66
	624	2014	0	GROUND BOX TY D (162922) W/APRON	EA	12		$	67
	628	2148	1	ELC SRV TY T 120/240 000 (NS)GS(N)SP(U)	EA	3		$	68
	636	2001	0	ALUMINUM SIGNS (TY A)	SF	30		$	69
	644	XXX1	0	INS SM RD SN SUP&AM COSA TY U MOUNT (POST TY 1)	EA	43		$	70
	644	XXX2	0	INS SM RD SN SUP&AM COSA TY U MOUNT (POST TY 2)	EA	2		$	71
	644	2060	0	REMOVE SM RD SN SUP & AM	EA	18		$	72
	647	2002	0	RELOCATE LRSA	EA	2		$	73
	662	2001	0	WK ZN PAV MRK NON-REMOV (W) 4" (BRK)	LF	6270		$	74
	662	2004	0	WK ZN PAV MRK NON-REMOV (W) 4" (SLD)	LF	30810		$	75
	662	2011	0	WK ZN PAV MRK NON-REMOV (W) 8" (LNDP)	LF	408		$	76
	662	2012	0	WK ZN PAV MRK NON-REMOV (W) 8" (SLD)	LF	405		$	77
	662	2016	0	WK ZN PAV MRK NON-REMOV (W) 24" (SLD)	LF	452		$	78
	662	2032	0	WK ZN PAV MRK NON-REMOV (Y) 4" (SLD)	LF	25450		$	79
	666	2003	0	REFL PAV MRK TY I (W) 4" (BRK)(100MIL)	LF	3640		$	80
	666	2012	0	REFL PAV MRK TY I (W) 4" (SLD)(100MIL)	LF	8622		$	81
	666	2015	0	REFL PAV MRK TY I (W) 6" (BRK)(100MIL)	LF	118		$	82
	666	2033	0	REFL PAV MRK TY I (W) 8" (LNDP)(100MIL)	LF	205		$	83
	666	2036	0	REFL PAV MRK TY I (W) 8" (SLD)(100MIL)	LF	9657		$	84
	666	2048	0	REFL PAV MRK TY I (W) 24"(SLD)(100MIL)	LF	1785		$	85
	666	2054	0	REFL PAV MRK TY I (W) (ARROW) (100MIL)	EA	36		$	86
	666	2057	0	REFL PAV MRK TY I (W)(BIKE ARW)(100MIL)	EA	18		$	87
	666	2063	0	REFL PAV MRK TY I(W)(BIKE SYML)(100MIL)	EA	18		$	88
	666	2072	0	REFL PAV MRK TY I(W)(ENTR GORE)(100MIL)	EA	3		$	89
	666	2075	0	REFL PAV MRK TY I(W)(EXIT GORE)(100MIL)	EA	2		$	90
	666	2096	0	REFL PAV MRK TY I (W) (WORD) (100MIL)	EA	10		$	91
	666	2099	0	REF PAV MRK TY I(W)18"(YLD TRI)(100MIL)	EA	2		$	92
	666	2111	0	REFL PAV MRK TY I (Y) 4" (SLD)(100MIL)	LF	18552		$	93

PROJECT NAME: FORT SAM HOUSTON TRANSPORTATION PROJECTS
PROJECT NO. 0915-12-470, ETC.

ALT. NO.	ITEM NO	DESC CODE	S.P. NO	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	ITEM SEQUENCE NO.
	666	2132	0	REFL PAV MRK TY I (Y) 24"(SLD)(100MIL)	LF	2539		$	94
	666	2141	0	REFL PAV MRK TY I (Y)(MED NOSE)(100MIL)	EA	12		$	95
	666	2189	0	PAVEMENT SEALER 4"	LF	30814		$	96
	666	2191	0	PAVEMENT SEALER 8"	LF	9622		$	97
	666	2195	0	PAVEMENT SEALER 24"	LF	4324		$	98
	672	2012	0	REFL PAV MRKR TY I-C	EA	565		$	99
	672	2015	0	REFL PAV MRKR TY II-A-A	EA	586		$	100
	677	2001	0	ELIM EXT PAV MRK & MRKS (4")	LF	62530		$	101
	677	2003	0	ELIM EXT PAV MRK & MRKS (8")	LF	813		$	102
	677	2007	0	ELIM EXT PAV MRK & MRKS (24")	LF	452		$	103
	680	2003	0	INSTALL HWY TRF SIG (SYSTEM)	EA	3		$	104
	681	2001	0	TEMP TRAF SIGNALS	EA	4		$	105
	682	2001	0	BACK PLATE (12 IN) (3 SEC)	EA	27		$	106
	682	2002	0	BACK PLATE (12 IN) (4 SEC)	EA	3		$	107
	682	2022	0	VEH SIG SEC (12 IN) LED (GRN ARW)	EA	11		$	108
	682	2023	0	VEH SIG SEC (12 IN) LED (GRN)	EA	20		$	109
	682	2024	0	VEH SIG SEC (12 IN) LED (YEL ARW)	EA	11		$	110
	682	2025	0	VEH SIG SEC (12 IN) LED (YEL)	EA	20		$	111
	682	2026	0	VEH SIG SEC (12 IN) LED (RED ARW)	EA	7		$	112
	682	2027	0	VEH SIG SEC (12 IN) LED (RED)	EA	22		$	113
	682	2044	0	PED SIG SEC (12IN)(2 INDICAT IN 1 SEC)	EA	8		$	114
	684	2009	0	TRF SIG CBL (TY A) (12 AWG) (4 CONDR)	LF	1640		$	115
	684	2012	0	TRF SIG CBL (TY A) (12 AWG) (7 CONDR)	LF	1575		$	116
	684	2035	0	TRF SIG CBL (TY A) (14 AWG) (9 CONDR)	LF	1084		$	117
	686	2031	0	INS TRF SIG PL AM(S) 1 ARM (32')	EA	1		$	118
	686	2035	0	INS TRF SIG PL AM(S) 1 ARM (36')	EA	2		$	119
	686	2039	0	INS TRF SIG PL AM(S) 1 ARM (40')	EA	2		$	120
	686	2047	0	INS TRF SIG PL AM(S) 1 ARM (48')	EA	3		$	121
	686	2059	0	INS TRF SIG PL AM(S) 1 ARM (60')	EA	1		$	122
	686	2063	0	INS TRF SIG PL AM(S) 1 ARM (65')	EA	1		$	123
	688	2001	0	PED DETECT (2 INCH PUSH BTN)	EA	12		$	124
	690	2071	0	INS OF TRF SIG PL FND (30" DRIL SHFT)	LF	12		$	125
	690	2072	0	INS OF TRF SIG PL FND (36" DRIL SHFT)	LF	94		$	126
	690	2074	0	INS OF TRF SIG PL FND (48" DRIL SHFT)	LF	44		$	127
	690	XXXX	0	TYPE 332 CONTROLLER FOUNDATION	EA	3		$	128
	6041	2008	0	ILSN (LED)(8 D)	EA	10		$	129
	6044	2001	0	VIVDS PROCESSOR SYSTEM	EA	6		$	130
	6044	2002	0	VIVDS CAMERA ASSEMBLY	EA	21		$	131
	6044	2003	0	VIVDS SET-UP SYSTEM	EA	3		$	132
	6044	2005	0	VIVDS COMMUNICATION CABLE (COAXIAL)	LF	2698		$	133
	8260	2001	0	LED COUNTDOWN PEDESTRIAN MODULE	EA	12		$	134
	8261	2001	0	BATTERY BACKUP SYSTEM FOR TRAFFIC SIGNAL	EA	3		$	135
	6525	XXXX	0	EMERGENCY PREEMPTION PHASE SELECTOR	EA	3		$	136
	6525	XXXX	0	EMERGENCY PREEMPTION PHASE DETECTOR	EA	10		$	137
	6525	XXXX	0	EMERGENCY PREEMPTION DETECTOR CABLE	LF	1640		$	138

PROJECT NAME: FORT SAM HOUSTON TRANSPORTATION PROJECTS
PROJECT NO. 0915-12-470, ETC.

ALT. NO.	ITEM NO	DESC CODE	S.P. NO	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	ITEM SEQUENCE NO.
	6834	2001	0	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	29		$	139
	8245	XXXX	0	MODEL 2070 CONTROLLER UNIT	EA	3		$	140
	8643	XXXX	0	TYPE 2070 CONTROLLER CABINET ASSEMBLY	EA	3		$	141
	9501	XXXX	0	MOBILIZATION (10%)	LS	1		$	142
	9501	XXXX	0	PREPARE ROW (5%)	LS	1		$	143
	9501	XXXX	0	TRENCH EXCAVATION PROTECTION	LF	5450		$	144
	9501	XXXX	0	8" PVC WATER MAIN (RESTRAINED)	LF	550		$	145
	9501	XXXX	0	12" PVC WATER MAIN	LF	3960		$	146
	9501	XXXX	0	12" DI WATER MAIN	LF	215		$	147
	9501	XXXX	0	16" PVC WATER MAIN	LF	585		$	148
	9501	XXXX	0	20" DI WATER MAIN	LF	140		$	149
	9501	XXXX	0	VALVE BOX ADJUSTMENT	EA	8		$	150
	9501	XXXX	0	8" GATE VALVE	EA	6		$	151
	9501	XXXX	0	12" GATE VALVE	EA	13		$	152
	9501	XXXX	0	16" GATE VALVE	EA	2		$	153
	9501	XXXX	0	20" BUTTERFLY VALVE	EA	1		$	154
	9501	XXXX	0	8" TIE-IN	EA	7		$	155
	9501	XXXX	0	12" TIE IN	EA	7		$	156
	9501	XXXX	0	16" TIE-IN	EA	1		$	157
	9501	XXXX	0	20" TIE-IN	EA	1		$	158
	9501	XXXX	0	FIRE HYDRANT ASSEMBLY	EA	7		$	159
	9501	XXXX	0	RELAY 3/4" SHORT SERVICE	EA	5		$	160
	9501	XXXX	0	RELAY 1" SHORT SERVICE	EA	1		$	161
	9501	XXXX	0	RELAY 1" LONG SERVICE	EA	1		$	162
	9501	XXXX	0	RELAY 2" SHORT SERVICE	EA	2		$	163
	9501	XXXX	0	PIPE FITTINGS	TON	15		$	164
	9501	XXXX	0	CASING OR LINER, 24"	LF	55		$	165
	9501	XXXX	0	HYDROSTATIC TESTING	EA	5		$	166
	9501	XXXX	0	2" BLOWOFF TEMPORARY	EA	14		$	167
	9501	XXXX	0	4" BLOWOFF TEMPORARY	EA	1		$	168
	9501	XXXX	0	2" BLOWOFF PERMANENT	EA	1		$	169
	9501	XXXX	0	TRENCH COMPLETION TYPE "A"	SY	313		$	170
	9501	XXXX	0	TRENCH COMPLETION TYPE "B"	SY	2050		$	171
	9501	XXXX	0	AC PIPE REMOVAL	LS	1		$	172
	9501	XXXX	0	AC PIPE REMOVAL PLAN	LS	1		$	173
	9501	XXXX	0	RECYCLED WATER VAULT RECONSTRUTION	EA	3		$	174
	9501	XXXX	0	RECYCLED WATER HYDRANT RELOCATION	EA	1		$	175
	9501	XXXX	0	CONCRETE ENCASEMENT, CRADLES, SADDLES & COLLARS	CY	18		$	176
	9500	XXXX	0	ADJUST EXISTING MANHOLE	EA	16		$	177

CITY OF SAN ANTONIO
025 UNIT PRICING FORM

PROJECT NAME: FORT SAM HOUSTON TRANSPORTATION PROJECTS
PROJECT NO. 0915-12-470, ETC.

ALT. NO.	ITEM NO	DESC CODE	S.P. NO	BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	ITEM SEQUENCE NO.
	9500	XXXX	0	8" PVC SANITARY SEWER LINE (14' - 18')	LF	95		$	178
	9500	XXXX	0	SEWER MAIN TELEVISION INSPECTION	LF	95		$	179
	9500	XXXX	0	SANITARY SEWER DROP MANHOLE (0' - 6')	EA	3		$	180
	9500	XXXX	0	EXTRA DEPTH MANHOLE (>6')	VF	18		$	181
	9503	9001	0	NGP (SHORT SERV)(NEW MAIN TO PROP)	FT	1		$	182
	9503	9003	0	NGP (SHORT SERV)(NEW MAIN TO METER)	FT	4		$	183
	9503	9004	0	NGP (LONG SERV)(NEW MAIN TO METER)	FT	1		$	184
	9503	9005	0	NGP (EXTEND)(PUMP TEST AND TIE TO METER)	FT	1		$	185
	9503	9006	0	NGP (MAIN)(PLASTIC W/ TRACER)(2 IN)	FT	1000		$	186
	9503	9007	0	NGP (MAIN)(PLASTIC W/ TRACER)(6 IN)	FT	2771		$	187
	9503	9008	0	NGP (MAIN)(PLASTIC W/ TRACER)(8 IN)	FT	46		$	188
	9503	9009	0	NGP (MAIN)(STEEL)(8 IN)	FT	142		$	189
	9503	9010	0	NGP (MAIN)(STEEL)(16 IN)	FT	1104		$	190
	9503	9011	0	NGP (MAIN)(STEEL)(16 IN) AND PLASTIC (6 IN)	FT	340		$	191
	9503	9012	0	NGP (MAIN)(PLASTIC W/ TRACER)(2 IN)	FT	59		$	192
	9503	9013	0	NGP (MAIN)(PLASTIC W/ TRACER)(6 IN)	FT	385		$	193
	9503	9014	0	NGP (MAIN)(STEEL)(16 IN)	FT	100		$	194
	9503	9015	0	TRENCH EXCAVATION PROTECTION	FT	5403		$	195
	9503	9016	0	NGP (STOPPLE) (16IN)(TWD SERVICE)	EA	3		$	196
	9503	9017	0	FLOWABLE BACKFILL	CY	390		$	197
	9503	9018	0	ASPHALT	CY	460		$	198
	9503	9019	0	MOBILIZATION	LS	1		$	199

_____certifies that the unit prices shown on this complete computer print-out for all of the bid items and the alternates contained in this proposal are the unit prices intended and that its bid will be tabulated using these unit prices and no other information from this print-out.

_____Acknowleged and agrees that the total bid amount shown will be read as its total bid and further agrees that the official total bid amount will be determined by multiplying the unit bid prices shown in this print-out by the respective estimated quantities shown in the proposal and then totaling all of the extended amounts. _____ agrees to the terms, conditions, and requirements of the bidder's bid proposal.

Signed: _____ Date: _____

Title: _____

Envelope No. 2
(To be opened first. This Envelope must contain all items listed below or Envelope No.1 will not be opened.)

BID ON: **FORT SAM HOUSTON TRANSPORTATION PROJECTS**

a. Bid Bond or Cashier's Check
b. Assurance of Compliance with Equal Employment Opportunity Statement.
c. Certificate of Non-Segregated Facilities.
d. Statement on President's Executive Order.
e. Addenda Acknowledgement Form.
f. Disclosure of Lobbing Activities.
g. Child Support Statement.
h. Certificate of Non-Collusion.
i. Certificate if Interest in other Bid Proposals for this Work.
j. Litigation Disclosure Form
k. Certificate of Absence of Suspension, Debarment, Voluntary Exclusion, or Determination of Ineligibility.

CITY OF SAN ANTONIO

ASSURANCE OF COMPLIANCE

EQUAL EMPLOYMENT OPPORTUNITY

CITY OF SAN ANTONIO

MAY 1994

The bidder, _____, hereafter known as "contractor," as a part of the procedure for the submission of bids on a project known as _____ agrees to the following conditions if awarded a contract by the City of San Antonio, hereafter known as City, on the above named project.

1. The Contractor will not discriminate in any personnel action including hiring, promotion, suspension, termination, sick leave, work assignments, holidays and vacation on the basis of race, color, religion, national origin, sex, age, handicap, or political belief or affiliation.
2. The contractor will maintain a copy of its Affirmative Action Plan for Equal Employment Opportunity and will provide upon request to the City of San Antonio.
3. The Contractor agrees to provide the City with whatever information may be requested by the Affirmative Action Planning Section for the purpose of monitoring compliance with Contractor's affirmative action requirements.
4. The Contractor agrees to attempt to fill newly created positions with qualified persons, so that the Sex and Ethnic ratios approximate the ratios of the Civilian Labor Force as determined by the applicable U. S. Census Data for job classifications similar to those jobs created by the proposed contract.
5. The Contractor agrees to update its Affirmative Action Plan annually or as required by the City, taking into consideration changes in the Civilian Labor Force and the Contractor's needs to insure non-discrimination and affirmative action relevant to employment.

It is understood that failure to comply with any of these conditions may constitute a violation of the contract between the Contractor and the City and may result in termination of the contract and/or the barring of the Contractor from future contracts with the City.

FOR THE CONTRACTOR

_____

NAME

_____

SIGNATURE

_____

TITLE

CITY OF SAN ANTONIO

CERTIFICATION OF NONSEGREGATED FACILITIES

_____ certifies that he does not and will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not and will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained.

_____

Signature of Bidder's Representative

_____

Typed or Printed Name and Title of
Bidder's Representative

STATEMENT ON PRESIDENT'S EXECUTIVE ORDERS

The undersigned bidder (has) (has not) previously performed work subject to the President's Executive Orders Nos. 11246 and 11375 or any preceding similar executive orders (Nos. 10925 and 11114).

_____
Name of Bidder

_____
Signature of Bidder's Representative

_____
Typed or Printed Name and Title of
Bidder's Representative

CITY OF SAN ANTONIO

Control 0915 - 12 - 470,Etc.
Project
Highway CS(HARRY WURZBACH)
County Bexar

ADDENDUM ACKNOWLEDGMENT

Each bidder is required to acknowledge receipt of an addendum issued for a specific project. This page is provided for the purpose of acknowledging an addendum.

FAILURE TO ACKNOWLEDGE RECEIPT OF AN ADDENDUM WILL RESULT IN THE BID NOT BEING READ.

In order to properly acknowledge an addendum the date which appears on the top of the addendum notification letter must be entered below.

ADDENDUM NO. 1 DATED: _____

ADDENDUM NO. 2 DATED: _____

ADDENDUM NO. 3 DATED: _____

ADDENDUM NO. 4 DATED: _____

ADDENDUM NO. 5 DATED: _____

In addition, the bidder by affixing their signature to the signature page of the proposal is acknowledging that they have taken the addendum(s) into consideration when preparing their bid and that the information contained in the addendum will be included in the contract, if awarded by the Commission or other designees.

DISCLOSURE OF LOBBYING ACTIVITIES

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352 (See reverse for public burden disclosure.)

1. Type of Federal Action: a. contract b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	2. Status of Federal Action: a. bid/offer/application b. initial award c. post-award	3. Report Type: a. initial filing b. grant For Material Change Only: year _____ quarter _____ date of last report _____

4. **Name and Address of Reporting Entity:** ❑ Prime ❑ Subawardee Tier _____, if known: **Congressional District**, if known:	5. **If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: **Congressional District**, if known:
6. **Federal Department/Agency:**	7. **Federal Program Name/Description:** CFDA Number, if applicable: _____
8. **Federal Action Number**, if known:	9. **Award Amount,** if known: $ _____
10. a. Name and Address of Lobbying Entity (if individual, last name, first name, MI):	b. Individuals Performing Services (including address if different from No. 10a) (last name, first name, MI):
(attach Continuation Sheet(s) SF-LLL-A, if necessary)	

11. Amount of Payment (check all that apply): $ _____ actual planned	13. Type of Payment (check all that apply): a. retainer b. one-time fee c. commission d. contingent fee e. deferred f. other; specify: _____
12. Form of Payment (check all that apply) a. cash b. in-kind: specify: nature _____ value _____	

14. Brief Description of Services Performed or to be Performed and Date(s) of Service, including officer(s), employee(s), or Member(s) contacted, for Payment Indicated in Item 11:

(attach Continuation Sheet(s) SF-LLL-A, if necessary)

15. **Continuation Sheet(s) SF-LLL-A attached:** ❑ Yes ❑ No

16. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities s a material representation of fact upon which reliance wasplaced by the tier above when thi transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	Signature: _____ Print Name: _____ Title: _____ Telephone No: _____ Date: _____

FEDERAL USE ONLY	Authorized for Local Reproduction Standard Form - LLL

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Use the SF-LLL-A Continuation Sheet for additional information if the space on the form is inadequate. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secure to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a follow-up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity or this covered Federal action.
4. Enter the full name, address, city, state and zip code of the reporting entity. Include Congressiona District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee", then enter the full name, address, city, state and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number, the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, state and zip code of the lobbying entity engaged by the reporting entity identified in item 4 to influence the covered Federal action.
    (b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).
11. Enter the amount of compensation paid or reasonably expected to be paid by the reporting entity (item 4) to the lobbying entity (item 10). Indicate whether the payment has been made (actual) or will be made (planned). Check all boxes that apply. If this is a material change report, enter the cumulative amount of payment made or planned to be made.
12. Check the appropriate box(es). Check all boxes that apply. If payment is made through an in-kind contribution, specify the nature and value of the in-kind payment.
13. Check the appropriate box(es). Check all boxes that apply. If other, specify nature.
14. Provide a specific and detailed description of the services that the lobbyist has performed, or will be expected to perform, and the date(s) of any services rendered. Include all preparatory and related activity, not just time spent in actual contact with Federal officials. Identify the Federal official(s) or employee(s) contacted or the officer(s), employee(s), or Member(s) of Congress that were contacted.
15. Check whether or not a SF-LLL-A continuation Sheet(s) is attached.
16. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

DISCLOSURE OF LOBBYING ACTIVITIES

Approved by OMB

0348-0046

CONTINUATION SHEET

Reporting Entity: _____ Page _____ of _____

Authorized for Local Reproduction

Standard Form - LLL-A

CITY OF SAN ANTONIO
CHILD SUPPORT STATEMENT

Under Family Code, Section 231.006, _____ *(name of individual)* certifies that _____ *(name of business)* _____ *(vendor #)* as of _____, 20___ *(date)* is eligible to receive a grant, loan, or payment and acknowledges that any contract may be terminated and payment may be withheld if this certification is inaccurate.

List below the name and social security number of the individual or sole proprietor and each partner, shareholder, or owner with an ownership interest of at least 25% of the business entity submitting the bid or application. This form must be updated whenever any party obtains a 25% ownership interest in the business entity.

Name (Please Print Legibly)	***Social Security Number***

Family Code, Section 231.006, specifies that a child support obligor who is more than thirty (30) days delinquent in paying child support and a business entity in which the obligor is a sole proprietor, partner, shareholder, or owner with an ownership interest of at least 25% percent is not eligible to receive payments from state funds under a contract to provide property, materials, or services; or receive a state-funded grant or loan.

A child support obligor or business entity ineligible to receive payments described above remains ineligible until all arrearage have been paid or the obligor is in compliance with a written repayment agreement or court order as to any existing delinquency.

Except as provided by Family Code, Section 231.302(d), a social security number is confidential and may be disclosed only for the purposes of responding to a request for information from an agency operating under the provisions of Subchapters A and D of Title IV of the federal Social Security Act (42 U.S.C. Sections 601 et seq. and 651 et seq.)

The City of San Antonio maintains the information collected through this article. With few exceptions, you are entitled on request to be informed about the information that we collect about you. Under Sections 552.021 and 552.023 of the Texas Government Code, you also are entitled to receive and review the information. Under Section 559.004 of the Government Code, you are also entitled to have us correct information about you that is incorrect.

- Please send this form to City of San Antonio, Public Works Department, Capital Improvement Programs, Fiscal Section, P.O. Box 839966, San Antonio, Texas 788283-3966.

CITY OF SAN ANTONIO

Certification of Non-Collusion

Under the penalty of perjury of the laws of the United States, the undersigned affirms that they are duly authorized to execute the proposed contract, that this company, corporation, firm, partnership or individual has not prepared this Bid in collusion with any other Bidder, and that the contents of this Bid as to prices, terms or conditions of said Bid have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this Bid.

By:_____

(Print or Type Name)

_____

(Print or Type Title/Position with Business)

_____

(Signature)

_____

(Date)

CITY OF SAN ANTONIO

CERTIFICATION OF INTEREST IN OTHER BID PROPOSALS FOR THIS WORK

By signing this proposal, the bidding firm and the signer certify that the following information, as indicated by checking "Yes" or "No" below, is true, accurate, and complete.

A. Quotation(s) have been issued in this firm's name to other firm(s) interested in this work for consideration for performing a portion of this work.

_____ YES

_____ NO

B. If this proposal is the low bid, the bidder agrees to provide the following information prior to award of the contract.

1. Identify firms which bid as a prime contractor and from which the bidder received quotations for work on this project.
2. Identify all the firms which bid as a prime contractor to which the bidder gave quotations for work on this project.

CITY OF SAN ANTONIO

Section 00440
LITGATION DISCLOSURE FORM

The attached Litigation Disclosure Form will be completed and submitted with the bid for the construction of this project.

LITIGATION DISCLOSURE

Failure to fully and truthfully disclose the information required by this Litigation Disclosure form may result in the disqualification of your bid from consideration or termination of the contract, once awarded.

1. Have you or any member of your Firm or Team to be assigned to this engagement ever been indicted or convicted of a felony or misdemeanor greater than a Class C in the last five (5) years?

   Circle One YES NO

2. Have you or any member of your Firm or Team been terminated (for cause or otherwise) from any work being performed for the City of San Antonio or any other Federal, State or Local Government, or Private Entity?

   Circle One YES NO

3. Have you or any member of your Firm or Team been involved in any claim or litigation with the City of San Antonio or any other Federal, State or Local Government, or Private Entity during the last ten (10) years?

   Circle One YES NO

If you have answered "Yes" to any of the above questions, please indicate the name(s) of the person(s), the nature, and the status and/or outcome of the information, indictment, conviction, termination, claim or litigation, as applicable. Any such information should be provided on a separate page, attached to this form and submitted with your bid.

TO THE BEST OF MY KNOWLEDGE, THE ABOVE INFORMATION IS TRUE AND CORRECT.

Company Name: _____

_____
Signature of Principal:

_____
Printed Name of Principal:

_____
Title of Principal

The State of _____
County of _____

Certification of Absence of Suspension, Debarment, Voluntary Exclusion, or Determination of Ineligibility

The undersigned bidder, under penalty of perjury under the laws of the United States or the State of Texas, certifies that, except as noted herein, the bidder's firm and all persons associated therewith in the capacity of the owner, partner, stockholder, director, officer, principal investigator, project director, manager, auditor, or any position involving the administration of any part of the firm's operations:

1. are not currently suspended, debarred, or voluntarily excluded from or determined to be ineligible for bidding by any federal agency;

2. have not been suspended, debarred, voluntarily excluded from of determined to be ineligible for bidding by any federal agency within the past 3 years;

3. do not have a proposed debarment pending with any federal agency, and

4. have not been indicted, convicted, or had a civil judgement rendered against it or any person indicated above by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

All exceptions to the above are recorded in the following space:

_____

_____

_____

_____

_____

The undersigned bidder understands that all exceptions will not necessarily preclude the issuance of a bidding proposal or result in the denial of award of the contract for a federally-funded project. It is also understood that exceptions will be carefully reviewed by the department and by the Federal Highway Administration and may result in rejection of the bid proposal and suspension and debarment of the contractor pursuant to 43 Texas Administrative Code (TAC) Section 9.6, Procedure for Debarment of a Contractor, to 43 TAC 9.7, Procedure for Suspension of a Contractor, to 43 TAC Section 9.8, Supplemental Procedures for Suspension or Debarment of a Contractor, and/or Debarment and Suspension (Non-Procurement) 49 CFR Part 29 (1987).

For any exception noted, the following information explains to whom it applies, the initiating agency, and the dates of action.

The undersigned bidder understands that providing false information mat result in criminal prosecution or administrative sanctions .

_____

_____

_____

_____

_____

_____

_____

Print Firm Name

_____

Signature/Title

Before me, the undersigned authority, a Notary Public, on this personally appeared _____

who, being by me duly sworn, upon oath says that she/he is qualified and authorized to make affidavit for and on behalf

of _____

bidder, of _____ County, and is fully cognizant of the facts herein set out

and affirms to the truth and accuracy of the certifications made herein by signing the document above.

Subscribed and sworn to before me by the said _____

Name

this _____ day of _____ , 19 _____ , to certify which witness my

hand and seal of office.

_____

Notary Public in and for

_____ County