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ADDENDUM NO. 10

CITY OF SAN ANTONIO
CAPITAL IMPROVEMENTS MANAGEMENT SERVICES DEPARTMENT

PROJECT NAME: **CULEBRA 58F PHASE IIB**

DATE: JUNE 17, 2011

This addendum shall be included in and be considered part of the plans and specifications for the above named project. The contractor shall be required to sign an acknowledgement of the receipt of this addendum at the time he receives it and returns signed form with the bid package.

CIMS PROJECT NO.: **40-00050**

This addendum is to answer more Bidder's questions that have been presented since the recent Bid Date Change to June 21st. Please see the accompanying Exhibit 10.1 for questions and responses.

Also, notice the Additive Alternate to the 025 Bid Form, that being possible addition of HPTRM, as Item No. 554. 3, down in the Phase IIA area of earlier completed channel.

CIMS Environment Office has made some changes to their Special Specification No. 110 Find immediately following the Q&A pages edited Environmental Specification with edited items/language "shaded".

Also, we are attaching here-to a copy of the only geotech information we have in the area of this Project.

6/17/11

STATE OF TEXAS
ROBERT A. LIESMAN
44131
LICENSED PROFESSIONAL ENGINEER

EXHIBIT 10.1
TO ADDENDUM NO. 10
CULEBRA 58F, PHASE IIB

Question: Is the excavation for the large rock rip-rap and graded granular filler in pilot channel included in Pay Item 105, channel excavation?

Answer: *YES; it is intended to be.*

Question: Is the graded granular filler under the large rock rip-rap subsidiary to the large rock rip-rap pay item?

Answer: *CORRECT; not a separate pay item.*

Question: For Soil Erosion Control Pay Items 554.1 and 554.2, should the following Items be included Under 554.1 and 554.2:
a. 8" topsoil under HPTRM
b. ½" of topsoil over HPTRM
c. Lightweight erosion control blanket over ½" of topsoil

Answer: *CORRECT*

Question: Can you provide a location of where the 6,110 CY of topsoil is located?

Answer: *Between Stations 56+38 and 69+80, left of the Jurisdictional Waters*

Question: On the unit pricing form the SWPPP Activities pay item, there is no quantity, are we to assume a 1 is the quantity.

Answer: *YES*

Question: Upon the alignment change from the SAWS sewer main did anyone take into consideration the existing guide wires from the CPS poles that will be in conflict with the installation of the sewer main?

Answer: *See the NOTE TO CONTACTOR concerning existing utility lines on Sheet No. 50 of the Addendum No. 4 set of Sewer Plans.*

Question: Can you clarify what type of material composes the "Construction and Demolition Material"?

Answer: *It may be, but is not limited to, tires, roofing, concrete, and other such common solid materials.*

Question: Can the Construction and Demolition Material be hauled to a Type 4 Landfill?

Answer: *It may be hauled to any TCEQ-licensed landfill site.*

Question: If broken concrete is encountered, can it be stockpiled in the proposed fill area?

Answer: *Pieces of concrete larger than typical specifications for rock "Embankment" (12") may not be placed or permanently stockpiled in the Fill Area.*

Question: Is there a construction method the City of San Antonio has proposed for sorting the Construction and Demolition Material from the contaminated soil?

Answer: *NO. Sorting process is a "means & methods" item that the Contractor shall soil propose to the CIMS Inspector for approval.*

Question: Item 110 states "The City's preference is to use all lead impacted soil within the affected areas to minimize waste volume during construction". We interpret this to mean the lead impacted soil will be placed on the fill site. Is this correct?

Answer: *The City Specification provided to Bidders states that lead-impacted shall, as a preference, be utilized between Channel Statement 58+00 to 68+75.*

Question: If the lead impacted soils are placed in the fill area what containments will determine if the remaining soil in the Area of Concern requires hauling to a Class B landfill?

Answer: *"Construction Debris" is to be hauled to Landfill.*

Question: Has the City of San Antonio established a procedure or method of construction for separating the impacting soils?

Answer: *NO. Sorting process is a "means & methods" item that the Contractor shall propose to the CIMS Inspector for approval.*

Question: For the purpose of obtaining new fill material (topsoil) can we use topsoil from the proposed fill site or will we be required to purchase it from a certified clean source?

Answer: *Topsoil cannot be borrowed from the Fill Site.*

Question: Addendum No. 6 states that the Class 2 Non Hazardous Waste will be hauled to either Covel Gardens or Tessman Road landfill as directed by CIMS Environmental Management Division. As there are different haul rates and disposal fees for each site, can the contractor choose which they prefer to use prior to the bid?

Answer: *The Bidder may base his (combined) haul & disposal bid on the least of the Landfill disposal fee rates, but he should presume haul costs as profitability might dictate.*

Question: Addendum No. 9 added Item 553.1 but the quantity was blank. Was this intended to have a quantity of 1 LS like the other LS bid items?

Answer: *Item No. 553.1, and all "Lump Sum" bid items, have a quantity of "1".*

Clarification: *Concerning material disposal from "Area of Environmental Concern".*

For bid quantity for Item No. 110.2.2. Plan Sheet 2C includes a Note to the Bidder identifying for his edification only the source of the bid quantity (of 36,850 CY). The exact quantity (in "in-place" volume) cannot be known prior to excavation and analysis. We attempted to identify a bid quantity which would allow a fair bidder to develop a rational unit cost.

ENVIRONMENTAL SPECIFICATIONS (EDITED (6/17/2011)

Introduction

As part of the 2007-2012 Bond Program, Proposition II, the City of San Antonio and San Antonio Water System (SAWS) are in the process of constructing the drainage channel and related drainage structures along Zarzamora Creek at Culebra Road to contain the 100-year storm event. This project includes channel construction, bank stabilization, road culvert crossings, and a new sewer system. The mentioned project is listed in the Bond Program as "Culebra 58f, Phase IIB (Laven to Upstream of Culebra). (See Figures 1 and 3).

This project includes the installation of sanitary sewer, water and gas utilities. Construction of the channel will require environmental monitoring and management of metal and waste debris impacted soils. Environmental site investigations were performed by a private consultant for the City of San Antonio to determine the presence or absence of impacted media from historical releases in the vicinity associated with unpermitted landfill in December 2010 and March 2010.

A review of the subsurface investigations and 95% design plans dated February 8, 2011, revealed one impacted area identified as Area of Concern (AOC) 1, located along the proposed drainage improvements between STA 58+00 and 68+75 and along the proposed channel (L5) between STA 2+50 and 4+00 along Zarzamora Creek. There is potential to encounter waste debris and lead impacted soils at this AOC southeast of Culebra Road (see figure 1).

The results of the investigation identified minor lead impacts in the subsurface soils in the proximity of the proposed drainage improvement. Depths of waste material range from surface to 11.5 feet below ground surface. These soils are classified as Class 2 non-hazardous based on the laboratory analyses. Approximately 73,700 in-place cubic yards of Class 2 non-Hazardous is estimated to be removed in AOC 1.

Groundwater was not encountered in any of the test trenches.

Soils excavated from areas not addressed in this document and that do not exhibit signs of contamination (i.e., odor, discoloration, visual observation of fuel, etc.) shall be handled as non-impacted material and staged separately from suspect impacted soils. Soils from the suspected impacted areas identified in this document will require management in accordance with a Waste Management Plan (WMP). However, it is recommended and highly encouraged that impacted and non-impacted impacted soils be reused on site, if possible.

Construction practices must comply with all applicable regulations concerning the prevention of stormwater pollution, as detailed in COSA's Storm Water Pollution Prevention Plan (SWP3) Manual. New fill materials, such as topsoil, to be placed in COSA right-of-way (ROW) shall be obtained from a certified clean source outside the project limits. The Contractor shall provide documentation to the City's inspector to support this requirement.

Decontamination of equipment must be conducted prior to moving from a suspected impacted area to a non-impacted area. It is highly recommended to start first with the non-impacted areas and to move to the potentially impacted areas. The Contractor shall be required to document decontamination procedures and waste generated as part of decontaminating of heavy equipment and trucks. Soils from potentially impacted areas shall not be tracked on roadways. Any soils tracked onto roadways shall be immediately removed.

Appropriate decontamination shall be conducted within a designated area where it is possible to contain and collect decontamination-generated fluids and solids. These decontamination wastes shall be placed into appropriate containers for characterization and profiling prior to final disposal. The Contractor may, at their discretion, place the decontamination waste with the suspect lead impacted soil.

Copies of the subsurface investigation report titled "Phase II Environmental Site Assessment (Subsurface Investigation) for Culebra 58f, Phase IIB (Laven to Upstream of Culebra)," dated September, 2010, are available for review and may be obtained from the CIMS Environmental Project Manager, Michael Ortiz at (210) 207-1454 or by email at: Michael.Ortiz@sanantonio.gov.

ITEM 110
ENVIRONMENTAL AND SAFETY CONCERNS
HANDLING OF IMPACTED MEDIA

110.1 DESCRIPTION

This item consists of the evaluation and disposal of excavated petroleum hydrocarbon impacted soils, site safety and hazardous materials training, and development and implementation of a Site Specific Health and Safety Plan in accordance with the specification requirements outlined below.

ITEM 110.2
MANAGEMENT, TRANSPORTATION AND DISPOSAL OF IMPACTED SOILS

Soils at locations identified in Tables 1 and 2 may contain or have the potential to contain lead contamination. Table 2 provides the maximum detected contaminant concentrations associated with the impacted locations. Management of the affected soil shall be governed at a minimum by the following management procedures and guidelines.

The Contractor's environmental consultant will be responsible for providing environmental oversight and air monitoring activities for their construction workers in the affected areas. The environmental consultant will be on-site to perform air monitoring activities for workers working along Zarzamora Creek between STA 58+00 to 68+75 and between STA 2+50 and 4+00 for airborne contaminants. The purpose of the monitoring is to assess the potential contaminants arising from construction activities and potential exposure to construction workers in the affected areas. Additionally, the City or its representative will provide environmental oversight to ensure the Contractor complies with the waste management plan in accordance with Federal, State, and Local regulations.

The specific area, station numbers, cross-sections, and locations of the impacted area are identified in Figures 1 and 6A-6D. Specific procedures required for AOC 1 are listed below:

AOC 1

The City's preference is to reuse all lead impacted soil within the affected areas to minimize waste volume during construction. Therefore the City strongly recommends the Contractor manage affected soils by removing the waste debris where encountered and reusing the potentially lead impacted soils in AOC 1. The proposed improvements are located in this affected area. Therefore, air monitoring during excavation of soils underneath the top soils and sub-base material will have to be performed in AOC 1.

The lead impacted media generated during construction in AOC 1 shall be managed by reusing as much of the impacted material as possible along Zarzamora Creek between STA 58+00 to 68+75 and between STA 2+50 and 4+00. The waste debris should be removed from the excavated soils and disposed at a licensed TCEQ landfill. Should there be excess soils from the excavation that cannot be used within the project area; these soils must be disposed of at a licensed TCEQ landfill. It is anticipated that soils from surface to a maximum depth of 11.5 feet bgs or proposed drainage excavation depth are to be considered suspect soils and would require management and/or disposal at a licensed landfill. The Contractor will be required to coordinate and notify the City's representative 48 hours in advance prior to beginning work in AOC 1.

The total estimated quantity of impacted soils in the area of concern is approximately 73,700 in-place cubic yards. Of the 73,700 in-place cubic yards, an approximate 50% will contain construction debris (C&D) materials requiring disposal at a permitted disposal facility. The City or City's representative will obtain a preliminary waste disposal authorization from local disposal facilities for disposal of approximate 50% of the 73,700 in-place cubic yards of C & D materials. However, the disposal facility may require additional sampling of the excavated soils/debris for waste characterization purposes. It will be the Contractor's responsibility to conduct additional soil sampling and analyses, if necessary, for waste characterization and disposal purposes. The selected disposal facility shall be approved by the City, prior to beginning work in affected areas.

When transporting any soils/debris, it is the Contractor's responsibility to ensure all dump trucks used to transport this waste are equipped with operating tarps. If the tarps are not effective, the City's inspector or City's representative will remove trucks from this project. The City inspector or City's representative will also determine if trucks need to be lined with polyethylene sheeting or not.

The Contractor will be required to obtain all necessary permits and utilize waste manifest to transport and dispose of affected media at a licensed landfill. Specifically, the trucks transporting the affected material will be required to have a solid waste haulers permit. This permit is a local

requirement and will be verified prior to beginning work in the affected area. In the event the permit is not obtained or available, the inspector will immediately remove the truck from the construction project. Additionally, trucks hauling affected media to a licensed landfill without this permit are subject to fine by the City of San Antonio, Code Compliance Department. The Contractor will be required to provide documentation of truck information, such as company, truck numbers, permit numbers, etc.

If necessary, the Contractor shall notify the City's Inspector or City's representative at least 48 hours in advance of hauling impacted soil to the approved landfill. Waste manifests shall be used to transport impacted materials from the impacted areas to the final disposal site(s). The City's Inspector or City's representative will obtain and sign the manifests as the generator for the impacted soils. Copies of the disposal records for the soils shall be submitted to the City's Inspector. The inspector will forward this documentation to the Capital Improvements Management Services (CIMS), Environmental Management Division (EMD).

The City shall be notified immediately when other potentially impacted soils and/or groundwater are encountered at locations not identified in this document. The notification should be made to the City's Inspector and include the station numbers, specific points, exact locations, type of impacted media, evidence of impact, and measures taken to contain the impacted media and prevent public access. The contaminated soil and/or groundwater shall not be removed from the location without prior City's approval.

The work will be paid under Item 110.2 "Transportation and Disposal of Impacted Soils," and includes all equipment, time, materials, and labor required to complete the work. The bid proposal estimated quantity is based on the best information available as a result of the environmental investigation and in no way correlates to actual payment made for Bid Item 110.2. Final payment for Bid Item 110.2 will be based entirely on actual quantities of materials accepted by the TCEQ certified landfill facility and approved by the City. Five percent of the total amounts of pay Items 110.2 will be withheld until all disposal documentation is received by the City.

110.2 Contractors Bid Item –Transportation and Disposal of Impacted Soils

ITEM 110.3
SITE SAFETY AND HAZARDOUS MATERIALS TRAINING

Because of the potential for exposure to hazardous materials, all contractors, employees, and subcontractors working in or near the areas of known impacted media shall be required to have successfully completed a 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course in accordance with the Occupational Safety and Health Administration (OSHA) guidelines contained in 29 Code of Federal Regulations 1910.120 and retain current certification in such. The site health and safety supervisor shall have completed the 8-hour HAZWOPER Supervisory Training course.

The Contractor shall be responsible for providing this training to their employees and subcontractors' employees. The Contractor shall make current completion certifications available for inspection at any time during the project.

ITEM 110.4
GROUNDWATER OR RUNOFF WATER

During the course of the project, water, either stormwater or groundwater, may accumulate in the excavations in AOC 1. It is in the best interest of the Contractor to provide soil berms or other protective measures around the excavated trench to prevent water intrusion. A figure depicting protective measures for stormwater intrusion is shown on Figure 3, Open Excavation Run-on Prevention. In the event that removal of water from the excavation is necessary, proper characterization and disposal is required by the Contractor's environmental consultant. Specifically, the consultant shall collect at a minimum one water sample from each identified impacted area. This water sample shall be analyzed for lead. Laboratory analyses of sample(s) collected must be conducted in accordance with standards of the Environmental Protection Agency (EPA) methods. Upon approval by the Environmental Management Division of CIMS, non-impacted water may be discharged into the storm sewer system per the Texas Pollutant Discharge Elimination System (TPDES) permit. Impacted water must be removed and disposed of in accordance with all Federal, State, and Local regulations at the Contractor's expense. The Contractor's consultant shall be responsible for submitting analytical data and disposal documentation to the City of San Antonio, Capital Improvement Management Services

Department\Environmental Management Division. Upon approval, the Contractor will be directed on the appropriate disposal methods.

Payment for item 110.4, "Groundwater or Runoff Water," will be incidental to item 110.2, "Transportation and Disposal of Impacted Soils."

ITEM 110.5
WASTE MANAGEMENT PLAN, SITE SPECIFIC HEALTH AND SAFETY PLAN, AND FINAL REPORT WITH THE FINDINGS OF THE REMEDIAL ACTIVITIES

The Contractor is responsible for preparing a Waste Management Plan (WMP) addressing their plan to excavate, remove, reuse/dispose of the impacted media. The Health and Safety Plan is a component of the Waste Management Plan.

The Contractor shall prepare and implement a Site Specific Health and Safety (H&S) Plan. The Contractor shall also provide a competent Health and Safety Officer/Supervisor or environmental consultant who will comply and implement the Site Specific H&S Plan. The Project Health and Safety Officer/Supervisor or environmental consultant shall also be responsible for providing environmental oversight, air monitoring and aiding the Contractor, City Inspector(s), and/or City's representative to coordinate handling and disposition of impacted soils at the construction site. The Construction Superintendent may also be considered as the Health and Safety Officer/Supervisor.

The Contractor's H&S Plan must comply with applicable regulations contained in 29 CFR 1910.120. The Contractor should review and apply the standards found in Section 1910.120 (hazardous waste operations), Subsection M (personal protective equipment), and Subsection Z (toxic and hazardous substances). Additionally, the Contractor should review and incorporate into the H&S Plan all relevant construction procedures which are regulated by Section 1926. The H&S Plan shall be submitted to the City of San Antonio, Environmental Management Division to the attention of the Environmental Project Manager for review prior to beginning construction activities in the impacted areas. Once the Contractor H&S Plan meets the requirements below, the Contractor may begin construction activities in the affected areas.

Where the various sections of the Occupational Safety and Health Administration (OSHA) regulations require specific subplans/programs, such as Confined Space, Lockout/Tagout, Hazard Communication, Excavation and

Trenching, etc., written documentation shall be developed by the Contractor that is specific for the potential hazards associated with this construction effort. This is in addition to standard OSHA requirements for this type of construction project. Appropriate traffic control devices and location access limitation devices shall be utilized according to applicable regulations and the approved H&S Plan.

The H&S Plan shall include at a minimum the following information:

1) A health and safety risk analysis for each location, task, or operation to be performed by the Contractor.

2) A description of the training to be provided to location workers to comply with 29 CFR 1910.120(f).

3) List of engineering controls, work practices, and personal protective equipment to be provided by the Contractor to the Contractor's employees for each task or operation to be performed. These must comply with 29 CFR 1910.120(g).

4) A description of the frequency and type of air monitoring to be provided to comply with 29 CFR 1910.120(h), including the concentrations of contaminants or air constituents that will cause the Contractor to take actions to increase or decrease protective measures.

5) A description of location control measures to be used to comply with 29 CFR 1910.120(d).

6) A decontamination plan to comply with requirements of 29 CFR 1910.120(k). This plan must address both personnel and equipment decontamination and disposal of decontamination-generated fluids and materials.

7) An emergency response and spill containment plan to comply with 29 CFR 1910.120(i and j).

8) A confined space entry program to comply with 29 CFR 1910.146.

9) An excavation safety program to comply with 29 CFR 1926, Subpart P.

10) A location map, with a route and phone number, to the nearest emergency medical facility.

11)Personal Protective Equipment (PPE) levels shall be defined as appropriate to location contaminant concentrations in order to maintain worker safety.

12)A route map showing the closest medical facility to the site.

13)A truck route map showing the designated route from the project site to the proposed disposal facility.

The Contractor shall add additional elements to the H&S Plan, as required, for the safe execution of the project. The Contractor must include a written statement that they are committed to employing/enforcing the H&S Plan and will be implemented for all project operations. All workers and visitors to the site shall be informed of the H&S Plan and shall sign a statement acknowledging their commitment to following the procedures of the H&S Plan. The Contractor will be required to submit a finalized copy of the H&S Plan, a copy of the 40-hour HAZWOPER training certifications, and a copy of the 8 hour supervisory training certificates of all employees qualified to work within the impacted area to the City of San Antonio, Environmental Management Division (EMD), prior to beginning construction. CIMS EMD will review the submittals and determine weather the contractor meet the requirements or not.

The following tables should be used by the Contractor to develop the H&S Plan. Table 1 provides a summary of contaminated soils locations identified by specific points within the project limits in AOC 1. Table 2 presents the maximum detected level of contaminants concentrations (metals) identified at the sampled locations within the project limits in AOC 1.

There is the possibility that other contaminants could be encountered within the project limits. If the Contractor suspects additional contamination or impacted media outside the designated areas, the Contractor shall notify the construction inspector, City's inspector, and/or City's representative immediately.

Upon completion, the Contractor is required to submit a final report for this project. The environmental report shall include but not be limited to: number of environmental oversight days, air monitoring frequency and results, total cubic yards of impacted media removed and disposed waste manifest, and a summary of environmental activities.

This work will be paid under Item 110.5, "Waste Management Plan, Site Specific Health and Safety Plan, and Final Report with the Findings of the Remedial Activities" and includes all equipment, time, materials, and labor required to complete the work.

110.5 Contractors Bid Item – Development and Implementation of Waste Management Plan, Site Specific Health and Safety Plan, and Final Report with the Findings of the Remedial Activities.

November 27, 1989

GEOTECHNICAL STUDY
CULEBRA 58F DRAINAGE PROJECT
SAN ANTONIO, TEXAS

Prepared for:
MACINA, BOSE, COPELAND & ASSOCIATES, INC.
San Antonio, Texas

Prepared by:
Southwestern Laboratories, Inc.
Geotechnical Engineering Division
San Antonio, Texas

Project No. 24-89210

SwL **SOUTHWESTERN LABORATORIES**

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

2435 Boardwalk • P.O. Box 17965, San Antonio, Texas 78217 • 512/822-2116

November 27, 1989

Re: Geotechnical Study
Culebra 58F Drainage Project
San Antonio, Texas
SwL Project No. 24-89210

Macina, Bose, Copeland, & Associates, Inc.
415 Breesport Drive
San Antonio, Texas 78216

Attention: Mr. Samuel B. Bledsoe, P.E., R.P.S.

Gentlemen:

We are pleased to submit our report covering the geotechnical study for the Culebra 58F Drainage Project.

If you have any questions regarding the report, or if we can be of further assistance, please do not hesitate to contact us. We appreciate the opportunity to work with you on this project.

Yours very truly,

SOUTHWESTERN LABORATORIES, INC.

STATE OF TEXAS
JAMES G. BIERSCHWALE
64001
REGISTERED
PROFESSIONAL ENGINEER

James G. Bierschwale, P.E.
Project Manager
Geotechnical Engineering Division

Chester J. Drash, Jr., P.E.
Manager
San Antonio Office

JGB/CJD/caj
Copies submitted:
Macina, Bose, Copeland, & Assoc., Inc. (3)
City of San Antonio (1)
Structural Engineering Associates (1)

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INTRODUCTION

This report presents the results of our geotechnical study for the proposed Culebra 58F drainage project, located in San Antonio, Texas. This project was verbally authorized by Mr. Samuel B. Bledsoe, P.E., R.P.S. of Macina, Bose, Copeland & Associates, Inc. The project scope was carried out in general accordance with our proposal 89GP-305, Revision No. 1, dated September 12, 1989.

PROJECT DESCRIPTION

The project is to involve various roadway construction, utilities replacement, and bridge construction as part of the Culebra 58F drainage project in San Antonio. More specifically, the project is to include roadway construction and utilities placements along North Acme/Benrus Boulevard between West Commerce and Fig Avenue (about 3200 feet) and along Laven Drive south of Culebra Road (about 1000 feet). In addition, multi-span bridges are planned where Acme and Laven cross Zarzamora Creek. The project layout is shown in Appendix A on Page A-1.

SCOPE OF SERVICES

The scope of services for the project consisted of:

1. Drilling test borings at selected locations along the proposed reconstruction route to evaluate subsurface stratigraphy and groundwater conditions.

2. Performing geotechnical laboratory tests on recovered samples to evaluate the physical and engineering properties of the strata encountered.

3. Presenting the results of our field and laboratory programs, along with comments concerning soil classifications, properties, and various geotechnical conditions likely to be encountered during utility construction.

4. Presenting geotechnical engineering recommendations regarding design of foundations for the bridge structures.

SITE CONDITIONS

Surface and subsurface conditions along the proposed sewer alignment were evaluated based on the results of our field and laboratory programs, review of available geologic literature, and our experience with similar projects. Our field program consisted of drilling five borings to depths of 6 to 10 feet along the planned alignment route, as directed by Mr. Al Bridges with the City of San Antonio. In addition, two borings to 60 feet and one boring to 50 feet was performed at each of the proposed bridge locations. Details of our field and laboratory programs are located in Appendices B and C, respectively. The logs of borings, which summarize the information obtained during our field and laboratory programs, are located on Pages B-3 through B-19 of Appendix B.

Pavement Condition and Thicknesses

The condition of the existing pavements along the project route, as observed during a recent site visit, are as follows:

Acme Road (between Azar and Commerce): The pavement surface has received surface treatments in the past; the pavement is generally undulated (due to moisture changes in the underlying clays). A few potholes and cracks in the pavement were present.

Laven Drive: The pavement surface is in generally poor condition, with numerous potholes, patches, edge failures, and areas of undulated pavement surface.

Benrus Boulevard (between Fig and Groff): The pavement surface is in generally good condition, having apparently received a recent surface treatment. Some edge failure areas were noted. In addition, at one spot, a utility trench had settled.

Thickness measurements were taken of the asphalt and base at several locations along the roadways. (Please note that in many of the boring locations, there is no existing pavements in the right-of-way of the proposed roadways). The approximate thicknesses of the pavement components which were observed at these locations is tabulated below.

Boring Location	Street	Approximate Asphalt Thickness (inches)	Approximate Base Thickness (inches)
B-2	Laven	2.0	8.0
B-4	Laven	2.0	7.0
B-5	Acme	0.75	7.0
B-10	Benrus	0.75	6.0

Subsurface Conditions

The generalized subsurface stratigraphy at the site, as interpreted from our field and laboratory programs, is tabulated below.

Stratum	Range in Depth (ft)[1]	Soil Description and Classification
I[2,3]	0 - 6	Very stiff to hard dark gray to dark brown clay (CH) and gravelly clay (CL)
II[4]	1 - 12	Dense to very dense tan to dark gray clayey gravel (GC) and hard gravelly clay (CL)
III	6 - 29	Hard tan and gray silty clay (CL) and clay (CH)
IV	16 - 60	Gray claystone (Navarro Group)

[1] Approximate depth below ground surface.

[2] Not observed in borings B-2, B-6 and B-7.

[3] Fill observed to depths of about 5 feet at B-6 and 12 feet at B-7.

[4] Not observed in boring B-7.

The surficial Stratum I clays encountered generally exhibit a high potential for volumetric change during moisture variation, as indicated by measured Plasticity Indices of 38 to 55 percent. Measured in-situ moisture contents ranged from about 13 percent dry of the corresponding Plastic Limits. These soils generally exhibit a very stiff to hard consistency, as indicated by measured unconfined compressive strengths of 2.27 to 8.49 tons per square foot (tsf). Increased percentages of gravel were noted in borings B-3 and B-9, with measured percentages of fines of 51 to 64 percent.

In borings B-6 and B-7, fill soils were observed. At B-6, about five feet of dark brown clay fill with gravel and glass fragments was observed; at B-7, about four feet of brown clay fill were observed, underlain by clayey gravel fill with significant debris and a foul odor to a depth of about 12 feet. A void was observed between about four and seven feet at this location. Subsequent field auger borings were performed to more accurately define the limits of the fill in the pavement subgrade area south of boring B-6; a boring drilled about 30 feet south of B-6 measured the fill thickness at about two feet; no fill was observed in a boring drilled about 100 feet south of B-6.

The Stratum II gravelly soils exhibited measured Standard Penetration Test N values ranging from 22 blows per foot to 50 blows for two inches of penetration. Measured percentages of fines of these soils vary between 21 and 62 percent.

The Stratum III silty clay and clay soils observed exhibited measured unconfined compressive strengths of 5.56 to 8.76 tsf, indicative of a hard consistency. Measured Plasticity Indices range from 12 to 38 percent.

The Stratum IV claystone (which is a clay-shale type of material) exhibited measured N values between 53 blows per foot and 50 blows for one inch of penetration. Although classified as very low strength, this Stratum is quite competent (rock with uniaxial compressive strengths lower than about 288 tsf are considered to be very low strength). At the Laven Street bridge (Borings B-1 through B-3), the claystone was encountered at

elevations between about 709 and 711 feet (depths of about 16 to 22 feet). At the Acme Street bridge (borings B-6 through B-8), the claystone was initially observed at elevations of 683 to 687 feet (depths of about 23 to 29 feet).

All of the clayey soils encountered along the utility route have a tendency to exhibit tension cracks in an exposed surface (as previously stated, some of the clays are already jointed). In addition, backfill soils from other existing utilities may be encountered during excavation. Although some fill soils were encountered during our drilling program, many other backfill zones are likely along the utility route. Backfill soils will most likely be less competent and more variable than the natural soils described in this subsection, and may vary substantially from the fill soils observed in the borings.

Based on the conditions observed, the soils encountered at the boring locations would generally be considered as Type B soils according to OSHA soil classification guidelines. (An exception to this would be the fill soils containing debris, which we feel should be considered as type C soils due to the inconsistent nature of the fill).

Groundwater Conditions

Many of the borings were drilled without the use of water to full depths in an attempt to observe groundwater conditions. Groundwater was observed in borings B-6 and B-7 at depths of about 5 to 8 feet; groundwater was not observed in any of the other project borings during drilling. Groundwater

at the site should primarily consist of "perched water" travelling in the Stratum II gravelly soils or the fill soils along the alignment routes. However, seepage in fissures of the clays at the site is also possible.

Seasonal and climatic variations may cause changes in groundwater conditions. Groundwater conditions should be established just prior to construction.

ROADWAY RECONSTRUCTION CONSIDERATIONS

Laboratory Test Results On Soil Samples

As indicated in the previous section and as shown on the boring logs on Pages B-3 through B-10 of Appendix B, the near-surface subgrade soils at the boring locations generally consist of dark gray clays. Samples of these soils were taken from boring location B-10 for the purpose of performing laboratory moisture-density and California Bearing Ratio (CBR) tests. These test results are presented and discussed in the following paragraphs.

A standard Proctor moisture-density relationship (ASTM D 698) was established for the dark brown clay subgrade soils. The results of this determination is shown in Appendix C on Page C-3. The clays exhibited a maximum dry density of 84.9 pounds per cubic foot at a moisture content of 28.0 percent.

California Bearing Ratio (CBR) tests were performed on the subgrade soils in accordance with ASTM D 1883. The CBR tests were performed at

approximate moisture contents and compactive efforts as specified by the City of San Antonio for laboratory soil testing for reconstruction of streets. Results of these tests are presented below and are illustrated on Pages C-4 through C-6 of the Appendix. A graphical illustration depicting the variation in CBR with compactive effort is shown on Page C-7 of Appendix C. A surcharge of about 11.9 to 12.6 pounds was placed on the CBR samples during saturation and testing.

Material	Percent Compaction Relative to ASTM D 698	Percent Moisture Relative to Optimum	Swell (Percent)	CBR (Percent)
Dark gray clay	96.2	+0.6	4.8	2.1
Dark gray clay	91.5	+2.1	3.6	2.0
Dark gray clay	85.7	+5.0	1.5	0.9

Based on the above test results, it is recommended that a CBR of about 1.9 percent be used for pavement design. This value assumes that the subgrade soils are scarified to a depth of six inches, moisture conditioned to between optimum and +4 percent of optimum moisture content, and compacted to at least 90 percent of standard Proctor (ASTM D 698) maximum dry density, as specified by the City of San Antonio. The soils should not be allowed to dry out prior to placement of base material.

Determination of the optimal percentage of lime for lime treatment purposes was requested. To estimate this, a series of Plasticity Index determinations were performed as a function of percentage of added lime by weight. The pH of the soil was also determined relative to the percent of added lime by weight, in accordance with ASTM C 977. The results of these tests are shown in the Appendix on Page C-8 and C-9, respectively. The

Plasticity Index test results tend to indicate an optimal percentage of lime of about six percent. Per ASTM C 977, the optimal percentage of lime based on pH is estimated at about four to six percent. Based on these results, we feel that a lime percentage of at least six percent by dry weight of soil be utilized for lime treatment purposes.

Site Preparation for Pavement Reconstruction

Pavement sections to be replaced should be stripped of all existing pavement layers to expose a competent subgrade. The exposed subgrade should be proof-rolled with a 20 ton roller or equivalent equipment to detect weak areas. Weak areas should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

In the area south of boring B-6 (extending between about 50 to 100 feet south of this location), fill soils which may potentially contain debris were observed. In the roadway areas, we recommend that these fill soils be removed to natural subgrade and the exposed soils proofrolled as indicated above. The fill soils, once cleaned of all debris and organics, may then be replaced in compacted lifts not to exceed six inches at the moisture and density requirements stated on Page 8.

It is important that proper perimeter drainage be provided after the roadway is constructed so that infiltration of surface water from unpaved

areas surrounding the pavement is minimized. Curbs should extend through the base and into the subgrade.

UTILITY INSTALLATION

The following sections present our comments pertaining to the subsurface conditions encountered in the test borings drilled along the proposed utility route and the effects these conditions may have upon utility line design and construction. Our comments are based on the data obtained from the field drilling program, laboratory test results, geologic conditions, and our experience with similar projects.

General

Occupational Safety and Health Administration (OSHA) Safety and Health Standards (29 CFR 1926/1910 Revised, 1987 Subpart P) require that all trenches in excess of five feet deep be shored or appropriately sloped unless the trench sidewalls are comprised of "solid" rock. The following sections provide general geotechnical information regarding site and subsurface conditions along the sewer route for use in evaluating the OSHA standards. In addition to excavation retention, possible health effects of the debris-containing fill soils should be considered.

Groundwater Control

As mentioned previously, groundwater seepage should be expected in the gravelly soils, fill, or in fissures of the clayey soils observed at the site, especially during periods of wet weather. It is anticipated that

the use of sumps or sump pumps would generally be an effective means of dewatering the excavation during construction in cases where groundwater is present.

Trench Construction

As stated previously, OSHA requires all trenches in excess of five feet be shored or appropriately sloped. Available methods for achieving slope and/or trench wall stability are sloping, benching, combinations of sloping and benching, and installation of shoring systems (hydraulic, timber, etc.). Trench shields may also be considered for use. However, these shields only provide protection to workers; they are not means for providing slope or trench wall stability.

Sloping and Benching. If right-of-way is available, sloping, benching, or a combination thereof could be considered. The slope angle and/or vertical height of the bench section, (generally less than 4 feet) will be dependent on the soil type. The section "SITE CONDITIONS" and subsection "Groundwater Control" provide information that can be used to evaluate the OSHA soil classification for determining the slope or bench configuration.

During excavation, slopes or benches should be observed for possible signs of failure such as bulging of the vertical face of the bench, tension cracks at the slope crest and/or raveling of material down the slope. Observations should also be made for surcharge loadings from soil spoil piles, traffic, or equipment loading which might alter the stability of

the slope. If such conditions are observed, workmen should not be permitted in the trench until the conditions noted are corrected by the contractor. If such conditions occur, further flattening of the slope may be required.

Surface water runoff should not be permitted to flow down the benched slope or slopes or pond at the toe or crest. The trench slopes should be thoroughly evaluated by competent personnel following a rainfall prior to workmen entering the excavations.

Trench Shoring. If space limitations do not permit sloping or benching the excavations, shoring may be considered for protection against trench instability. Due to the variations in types of shoring systems which are available, lateral earth pressures will vary depending on which type of system will be utilized.

Trench Shields. If sloping, benching or shoring is not selected, a trench shield may be considered to protect the workers from slope instability. We should be note that trench shields only serve as a means for worker protection; they are not a means of excavation retention. Potential effects of sidewall caving and corresponding damage to adjacent property and personnel should be taken into account when considering the use of trench shields.

Backfill Operations

Spoil material from the excavation operations may generally be used as backfill, provided no stones larger than three inches in their maximum

dimension exist in the soil. Backfill in pavement areas and areas requiring structural support should be compacted to at least 100 percent of the standard Proctor (ASTM D698 or TEX 113E) maximum dry density at -2 to +3 percent of optimum moisture content, in loose lifts not to exceed eight inches in thickness. The backfilling operations should extend no higher than the bottom of the original pavement section. In general areas, compaction to 90 percent of standard Proctor should be sufficient. Backfill operations should be in accordance with City of San Antonio Standard Specifications.

BRIDGE FOUNDATIONS

Based on the results of our field and laboratory programs, we feel that drilled and underreamed piers bearing into the Stratum IV claystone would be the most desirable foundation type to support the proposed bridge foundations. Recommendations are provided in the following subsections regarding design and construction of drilled pier foundations.

Drilled Pier Foundation Design

Principal column loads for the proposed Laven Drive and Acme Road bridges should be founded in the Stratum IV claystone, bearing at an elevation of about 700 and 673 feet, respectively. However, in no case should the piers be embedded less than seven feet into the claystone. The piers may be designed for a net allowable bearing pressure of 40,000 psf based on total loads or 27,000 psf based on dead loads plus long-term live loads, whichever results in a larger bearing surface. These bearing pressures

include a factor of safety against a bearing capacity failure of at least two and three, respectively.

With the indicated bearing pressures, total settlements should be less than one inch for properly constructed drilled piers. Differential settlements across bays may approach 0.5 to 0.75 percent of the total settlements. The settlements will be primarily elastic with a portion of settlement occurring during construction. Settlement response of drilled piers is impacted more by the quality of construction than the response of the intact rock to the foundation loads.

The shafts of the drilled piers should be reinforced with sufficient vertical reinforcing steel to resist the potential tension forces which may be induced by expansion of the high plasticity soils observed at the site. The magnitude of this potential uplift force can be estimated by the following equation:

$$U = 95D$$

Where: U = Uplift force induced on shaft as a result of swelling clays (kips)

D = Shaft diameter (feet)

The amount of reinforcing steel required can be computed by assuming that the dead load of the structure surcharges the footing, that the above estimated tensile force acts vertically on the shaft, and that the underream of the pier acts as a rigid anchor.

In addition to having an adequate bearing area to support compressive loads, the diameter of the underream should be large enough to overcome uplift forces on the pier without causing a local soil failure to the overlying soils. We recommend that the ratio of underream diameter to shaft diameter be larger than 1.5:1 to withstand uplift forces due to soil expansion. However, in no case should this ratio exceed 3:1.

Drilled Pier Foundation Construction

Drilled pier foundations should be augered and constructed in a continuous manner. Concrete should be placed in the pier excavations immediately following drilling, underreaming, and evaluation for proper embedment, diameter, and cleanliness. Surface runoff or groundwater seepage accumulating in the excavation in excess of two inches should be pumped out and the condition of the bearing surface should be evaluated prior to placing concrete. High torque drilling equipment will most likely be necessary to properly underream the claystone.

Groundwater and/or sidewall sloughing may be encountered in the Stratum II gravelly soils and/or fill soils during pier excavation. Thus, we recommend that provisions be incorporated into the plans and specifications to utilize casing to control sloughing during pier construction should it occur. Backfilling outside the casing with soil cuttings or pea gravel is not recommended.

The American Concrete Institute (ACI) Committee Report "Suggested Design and Construction Procedures for Pier Foundations", dated August, 1982, can be referenced for pier design guidelines and construction specifications.

Pier construction should be carefully monitored to assure compliance of construction activities with the appropriate specifications. Items of concern include the following:

a. Pier location
b. Vertical alignment
c. Penetration into bearing stratum
d. Competent bearing
e. Proper casing seal for groundwater control
f. Steel placement
g. Concrete properties and placement
h. Casing removal

Foundation Construction Monitoring

The performance of the foundation systems will be highly dependent upon the quality of construction. Thus, we recommend that the foundation construction be monitored by SwL to identify the proper bearing strata and depths and to help evaluate foundation construction. We would be pleased to develop a plan for foundation monitoring to be incorporated in the overall quality control program.

LIMITATIONS

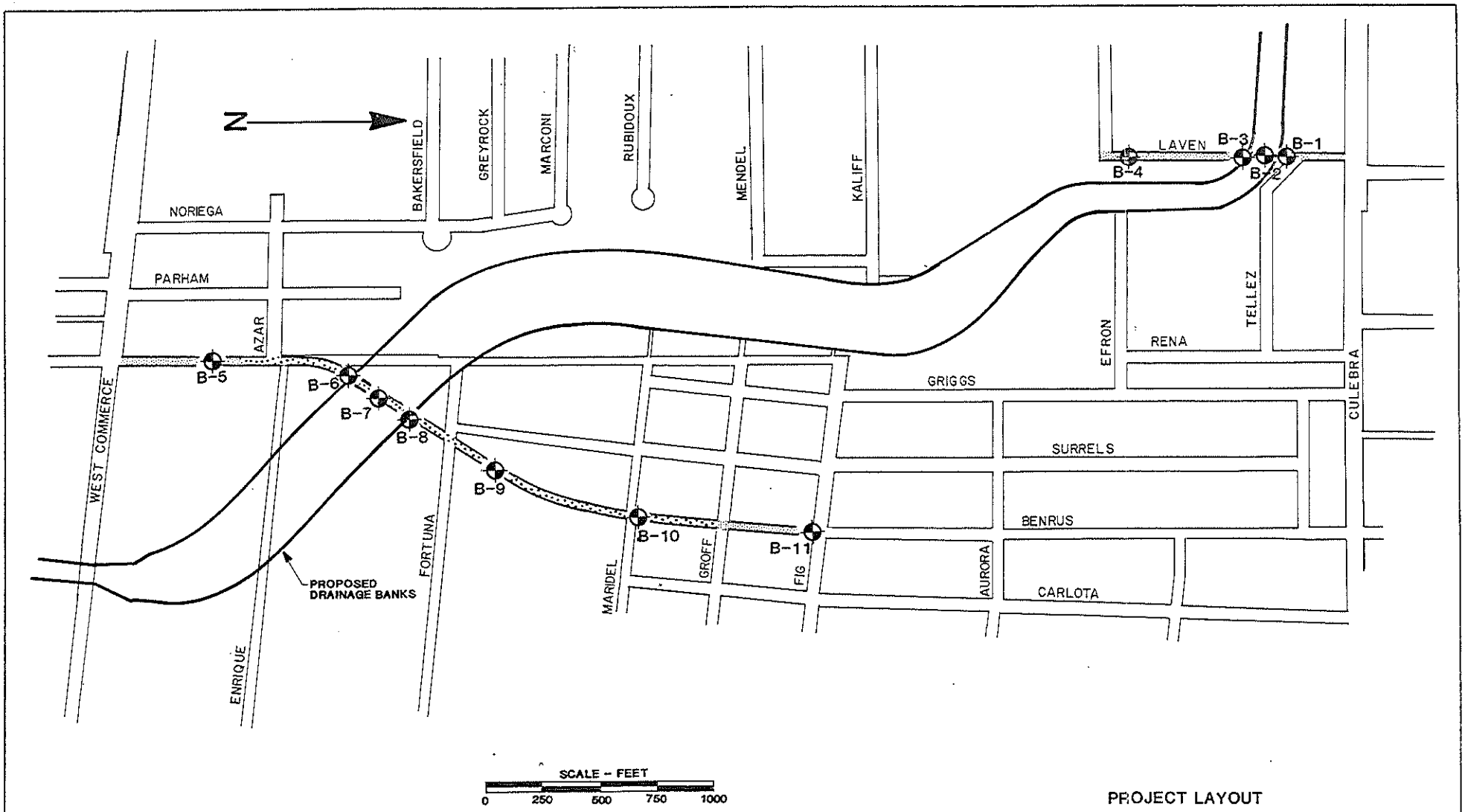
The information contained in this report is based upon a limited number of small diameter boreholes performed at widely spaced intervals. Variations in the subsurface conditions along the project route are possible. Should any unusual subsurface conditions be encountered, Southwestern Laboratories, Inc. (SwL) should be immediately notified so

that any necessary evaluation can be performed. The subsurface information in regards to the proposed utility construction is available for review without expressed or implied representation, assurance, warranty, or guarantee that it is complete or correct or that it represents a true, or approximately true picture of the subsurface conditions to be encountered at the proposed jobsite. This information is not part of the contract documents.

This study was performed in accordance with accepted geotechnical engineering practice for informational purposes only. This report is no substitute for design, but may be used to develop information for adherence to OSHA standards during construction. Determination of excavation, dewatering, trench safety, and trafficability requirements is the responsibility of others specializing in those areas. In the event of any changes in the nature, design or location of the proposed improvements, the data and comments in this report should not be considered valid until the changes are reviewed and the data and comments modified or verified in writing.

APPENDIX A

ILLUSTRATIONS



PROJECT LAYOUT

CULEBRA 58F DRAINAGE PROJECT
SAN ANTONIO, TEXAS

SWL PROJECT NO. 24-89210

SOUTHWESTERN LABORATORIES

APPENDIX B

FIELD PROGRAM

APPENDIX B

FIELD PROGRAM

Subsurface conditions were determined by drilling five borings to depths of 6 to 10 feet along the proposed reconstruction route, along with two borings to 60 feet and one boring to 50 feet at each of the proposed bridge locations. The three inch nominal diameter borings were drilled with rotary drilling equipment at the approximate locations shown on Page A-1. Boring depths were measured from existing ground surface at the time of our field activities.

The Logs of Borings, presenting the material descriptions, types of sampling used, surface elevations, and other pertinent field data, are presented in this Appendix on Pages B-3 through B-19. The Symbol Key Sheet, which defines the terms and descriptive symbols used on the logs, is presented on Page B-20.

When possible, soil samples were recovered using thin-walled, open-tube samplers (Shelby tubes) in accordance with the procedures outlined in ASTM D 1587. All samples were removed from samplers in the field, classified, and placed in sample containers. Pocket penetrometer tests were performed on cohesive samples in the field to serve as a general measure of consistency.

Soils for which good quality Shelby tube samples could not be recovered were sampled by means of the Standard Penetration Test (SPT) in accordance with ASTM D 1586. This test consists of determining the number of blows required for a 140 pound hammer free falling 30 inches to drive a standard split-spoon sampler 12 inches into the subsurface material after being seated 6 inches. This blow count or SPT N-value is used to evaluate the engineering properties of the soil layer.

Additional soil from the upper 18 inches of subgrade was collected for the purpose of performing laboratory compaction and California Bearing Ratio (CBR) tests.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-1
DATE 10/18/89
SURFACE ELEVATION Appr. 732

DRILLING METHOD(S):
Dry Augered 0 - 15'; Wet Rotary 15' - 60'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													8" gravel and base material
			P = 4.5+										Hard dark gray to gray clay (CH) with gravel and calcareous pockets
			P = 4.5+	20	66	27	39	107	4.99	9			Stratum I
	5		N = 42										Dense light gray clayey gravel (GC) with calcareous pockets
			N = 31	17								33	
	10		N = 32	13									Stratum II
	15		N = 50/2"	13	29	15	14						Hard tan and gray silty clay (CL) with marl seams
	20		N = 50/2"	16									Stratum III
	25		N = 50/1"	23	69	26	43						Gray claystone (Navarro Group), very low strength
	30		N = 70										-with ferrous stains 28.5' - 32'
	35		N = 50/1"										-slightly sandy below 32'
	40		N = 50/1"										Stratum IV

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-1
DATE 10/18/89
SURFACE ELEVATION Appr. 732

FIELD DATA				LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	ATTERBERG LIMITS (%) PLASTIC LIMIT PL	ATTERBERG LIMITS (%) PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	45		N = 50/1"										Gray claystone (Navarro Group), very low strength, slightly sandy
	50		N = 50/1"										
	55		N = 50/1"										
	60		N = 87/9"	16									Stratum IV
													Boring Terminated at 60'

DRILLING METHOD(S):
Dry Augered 0 - 15'; Wet Rotary 15' - 60'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-2
DATE 10/19/89
SURFACE ELEVATION Appr. 727

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA: N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													2" asphalt; 8" gravel base material
	5		N = 23	15	64	26	38						Very stiff gray gravelly clay (CL)
			N = 22									21	-clayey gravel 3.5' - 5'
			N = 30										Stratum II
	10		N = 50/3"	10	30	15	15						Hard tan and gray silty clay (CL) with ferrous stains and marl seams
			N = 50/3"	10									
	15		N = 50/2"	16									Stratum III
	20		N = 50/1"	43									Gray claystone (Navarro Group), very low strength
	25		N = 53	23	74	27	47						-with ferrous stains and slickensided planes at 23.5' - 25'
	30		N = 50/1"										-slightly sandy below 28.5'
	35		N = 50/1"										
	40		N = 50/6"	16									-with clay seams 38.5' - 40'
													Stratum IV

DRILLING METHOD(S):
Dry Augered 0 - 10'; Wet Rotary 10' - 50'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-2
DATE 10/19/89
SURFACE ELEVATION Appr. 727

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	45		N = 50/1"										Gray claystone (Navarro Group), very low strength, slightly sandy
	50		N = 50/1"										Stratum IV
													Boring Terminated at 50'

DRILLING METHOD(S):
Dry Augered 0 - 10'; Wet Rotary 10' - 50'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-3
DATE 10/19/89
SURFACE ELEVATION Appr. 729

FIELD DATA					LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT		MOISTURE CONTENT (%)	ATTERBERG LIMITS (%)			DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
						LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX						
						LL	PL	PI						
			N = 16		16	69	29	40					51	Very stiff dark gray gravelly clay (CL) with cobbles Stratum I
	5		N = 32											Hard gray gravelly clay (CL) with cobbles
			N = 76										60	Stratum II
			N = 50/2"		9	27	15	12						Hard tan silty clay (CL) with ferrous stains and marl seams
	10													
			N = 50/2"		42									
	15													
			N = 50/5"		16									Stratum III
	20													
			N = 50/2"		18	38	19	19						Gray claystone (Navarro Group), very low strength
	25													
			N = 50/1"											-with ferrous stains 26' - 28.5'
	30													-slightly sandy below 28.5'
			N = 50/1"											
	35													
			N = 50/1"											Stratum IV
	40													

DRILLING METHOD(S):
Dry Augered 0 - 10'; Wet Rotary 10' - 60'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-3
DATE 10/19/89
SURFACE ELEVATION Appr. 729

FIELD DATA				LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	
	45		N = 50/1"										
	50		N = 50/1"										
	55		N = 50/1"										
	60		N = 50/1"	13									

DRILLING METHOD(S):
Dry Augered 0 - 10'; Wet Rotary 10' - 60'

GROUNDWATER INFORMATION:
No groundwater observed during dry augering.

DESCRIPTION OF STRATUM

Gray claystone (Navarro Group), very low strength, slightly sandy

Stratum IV

Boring Terminated at 60'

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-4
DATE 10/18/89
SURFACE ELEVATION Appr. 730

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													2" asphalt; 7" gravelly base material
			P = 4.5+	18	63	25	38	105					Hard dark gray clay (CH) with gravel and brown clay pockets
			P = 4.5+	17				112					Stratum I
	5		P = 4.5+										Dense to very dense gray clayey gravel (GC) -gravelly clay 4' - 6'
			N = 46	9								39	
			N = 52										Stratum II
	10												Boring Terminated at 10'

DRILLING METHOD(S):
Dry Augered 0 - 10'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-5
DATE 10/20/89
SURFACE ELEVATION Appr. 715

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA: N: BLOWS/FT, P: TONS/SQ FT, T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													0.75" asphalt; 7" crushed limestone base
			P = 3.0	31 33	86	31	55						Very stiff dark gray clay (CH) with gravel Stratum I
	5			24				103	4.33	11			Hard gray clay (CH) Stratum I
													Boring Terminated at 6'
	10												

DRILLING METHOD(S):
Dry Augered 0 - 6'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-6
DATE 10/12/89
SURFACE ELEVATION Appr. 712
Page 1 of 2

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			P = 4.5+	14									Fill - Hard dark brown clay (CH) with gravel -with glass fragments 0 - 2'
			N = 44										
	5		N = 50/4"										Very stiff to hard dark brown gravelly clay (CL)
			N = 26	26								62	
			N = 27										Stratum II
	10												Hard tan and gray clay (CH), slightly sandy
			P = 4.5+	20	54	23	31	107	5.56	7			
	15												
			P = 4.5+	21									-damp seam at 19'
	20												
			P = 4.5	19	62	24	38	108	7.32	8			-gray below 23'
	25												Stratum III
			P = 4.5+	14									Gray claystone (Navarro Group), very low strength, slightly sandy
	30												
			N = 50/5"	16	54	24	30						
	35												
			N = 50/5"										
	40												

DRILLING METHOD(S):
Dry Augered 0 - 60'

GROUNDWATER INFORMATION:
Groundwater seepage observed at about 19' during drilling. Water level rose to about 8' after a 12-hour monitoring period.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-6
DATE 10/12/89
SURFACE ELEVATION Appr. 712

SOIL SYMBOL	FIELD DATA: DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	LABORATORY DATA: MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	45		N = 50/5"										Gray claystone, very low strength, slightly sandy
	50		N = 50/4"	22									
	55		N = 50/5"										
	60		N = 50/5"	21									Stratum IV
													Boring Terminated at 60'

DRILLING METHOD(S):
Dry Augered 0 - 60'

GROUNDWATER INFORMATION:
Groundwater seepage observed at about 19' during drilling. Water level rose to about 8' after a 12-hour monitoring period.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-7
DATE 10/16/89
SURFACE ELEVATION Appr. 710

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA: N: BLOWS/FT, P: TONS/SQ FT, T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			P = 4.5+	16				90					Fill - brown clay (CH) with gravle
			N = 5										
	5												Fill - Dark brown clayey gravel with debris (wire, glass, oilly residue, etc.), foul odor -void from 4' - 7'
			N = 50/4"										
	10												
			N = 73	25	58	24	34						Hard tan and gray clay (CH), slightly sandy
	15												
			P = 4.5+	21				96					-with gypsum seams below 18'
	20												Stratum III
			P = 4.5+	19	54	23	31	105					Gray claystone (Navarro Group), very low strength, slightly sandy
	25												
			N = 50/5"	20									
	30												
			N = 50/3"										
	35												
			N = 50/5"	19									
	40												Stratum IV

DRILLING METHOD(S):
Dry Augered 0 - 50'

GROUNDWATER INFORMATION:
Groundwater observed at about 5' during drilling. Water level remained relatively constant during a 15-minute observation period.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-7
DATE 10/16/89
SURFACE ELEVATION Appr. 710

FIELD DATA				LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	 PLASTIC LIMIT PL	 PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	
	45		N = 50/5"	20	56	24	32						
	50		N = 50/3"										

DRILLING METHOD(S):
Dry Augered 0 - 50'

GROUNDWATER INFORMATION:
Groundwater observed at about 5' during drilling. Water level remained relatively constant during a 15-minute observation period.

DESCRIPTION OF STRATUM

Gray claystone (Navarro Group), very low strength, slightly sandy

Stratum IV

Boring Terminated at 50'

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-8
DATE 10/13/89
SURFACE ELEVATION Appr. 712

DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		P = 4.5+	17	70	26	44	108					Hard dark gray clay (CH) with gravel
		P = 4.5+										Stratum I
5		P = 4.5+	17									Hard tan gravelly clay (CL)
		N = 50/2"	16								53	-very gravelly 6' - 8'
												Stratum II
		P = 4.5+	15	53	22	31	114	8.76	5			Hard tan and gray clay (CH), slightly sandy
10												
		N = 80/11"	15									
15												
		N = 70/10"										-with ferrous stains below 18.5'
20												
		N = 84/10"	17	62	25	37						-with gypsum seams below 23.5'
25												
		N = 50/3"										Stratum III
30												Gray claystone (Navarro Group), very low strength, slightly sandy
		N = 50/3"	16									
35												
		N = 50/4"										Stratum IV
40												

DRILLING METHOD(S):
Dry Augered 0 - 60'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-8
DATE 10/13/89
SURFACE ELEVATION Appr. 712

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)
	45		N = 50/4"	16								
	50		N = 50/3"									
	55		N = 50/1"	14								
	60		N = 50/3"									

DRILLING METHOD(S):
Dry Augered 0 - 60'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

DESCRIPTION OF STRATUM

Gray claystone (Navarro Group), very low strength, slightly sandy

Stratum IV

Boring Terminated at 60'

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas
CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-9
DATE 10/16/89
SURFACE ELEVATION Appr. 727

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			$N = \frac{50}{5"}$	14								64	Hard dark brown gravelly clay (CL) Stratum I
	5		$N = \frac{50}{6"}$										Very dense tan clayey gravel (GC)
			N = 59	12									Stratum II
			N = 16										Very stiff tan clay (CH), slightly sandy Stratum III
	10												Boring Terminated at 8'

DRILLING METHOD(S):
Dry Augered 0 - 8'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-10
DATE 10/18/89
SURFACE ELEVATION Appr. 736

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA: N: BLOWS/FT, P: TONS/SQ FT, T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			P = 4.5+	27	86	34	52	96					Hard dark gray clay (CH) with gravel
			P = 4.5+	22				99	8.49	5			Stratum I
	5		N = 83										Very dense gray clayey gravel (GC) Stratum II
													Boring Terminated at 6'
	10												

DRILLING METHOD(S):
Dry Augered 0 - 6'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

LOG OF BORING

PROJECT: Culebra 58F Drainage Project
San Antonio, Texas

CLIENT: Macina, Bose, Copeland & Associates, Inc.
San Antonio, Texas

PROJECT NO. 24-89210
BORING NO. B-11
DATE 10/18/89
SURFACE ELEVATION Appr. 745

DRILLING METHOD(S):
Dry Augered 0 - 6'

GROUNDWATER INFORMATION:
No groundwater observed during drilling.

SOIL SYMBOL	DEPTH (FT)	SAMPLES	FIELD DATA: N: BLOWS/FT; P: TONS/SQ FT; T: TONS/SQ FT	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%): LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY (POUNDS/CU FT)	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN.)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													0.75" asphalt; 6" crushed limestone base
			P = 3.0	31	75	29	46	88	2.27	6			Very stiff dark gray clay (CH) with gravel
			P = 2.75	27									-gray 4' - 6'
	5			23				98					Stratum I
													Boring Terminated at 6'
	10												

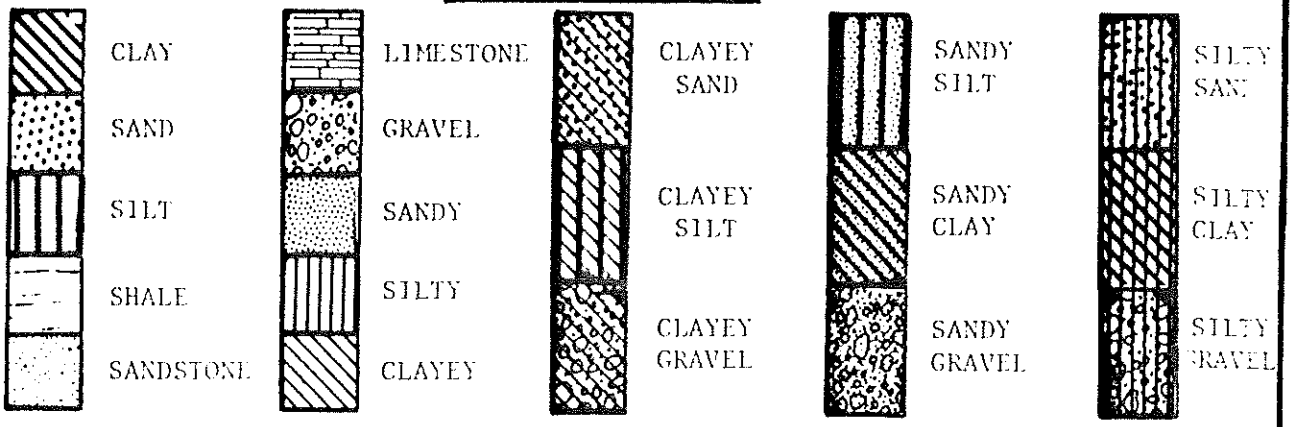
N-STANDARD PENETRATION TEST RESISTANCE
P-POCKET PENETROMETER RESISTANCE
T-POCKET TORVANE SHEAR STRENGTH

REMARKS:

SOUTHWESTERN LABORATORIES, INC.

KEY TO SOIL CLASSIFICATION AND SYMBOLS

SOIL OR ROCK TYPES



CONSISTENCY OF COHESIVE SOILS

Penetration Resistance, blows per foot	Consistency	Cohesion, TSF	Plasticity Index	Degree of Plasticity
0-2	Very Soft	0-0.125	0-5	None
2-4	Soft	0.125-0.25	5-10	Low
4-8	Firm	0.25-0.5	10-20	Moderate
8-15	Stiff	0.5-1.0	20-40	Plastic
15-30	Very Stiff	1.0-2.0	> 40	Highly Plastic
> 30	Hard	> 2.0		

RELATIVE DENSITY OF COHESIONLESS SOILS

Penetration Resistance, blows per foot	Relative Density
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
> 50	Very Dense

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.

Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

Laminated - composed of thin layers of varying color and texture.

Interbedded - composed of alternate layers of different soil types.

Calcareous - containing appreciable quantities of calcium carbonate.

SAMPLER TYPES

SOUTHWESTERN LABORATORIES

APPENDIX C

LABORATORY TESTING

APPENDIX C

LABORATORY TESTING

All samples obtained during the field program were visually classified in the laboratory by a geotechnical engineer according to procedures outlined in ASTM D 2488. A testing program was conducted on selected samples to aid in classification and evaluation of engineering properties required for analyses. Laboratory tests were performed in accordance with the procedures indicated below.

Laboratory Test	Applicable Test Standard
Liquid Limit, Plastic Limit, & Plasticity Index of Soil	ASTM D 4318
Moisture Content	ASTM D 2216
Unconfined Compressive Strength of Cohesive Soils	ASTM D 2166
Percent Finer than No. 200 Sieve	ASTM D 1140
Standard Proctor Moisture-Density Relation	ASTM D 698
California Bearing Ratio Determination	ASTM D 1883
Method for Determining Stabilization Ability of Lime	ASTM C 977

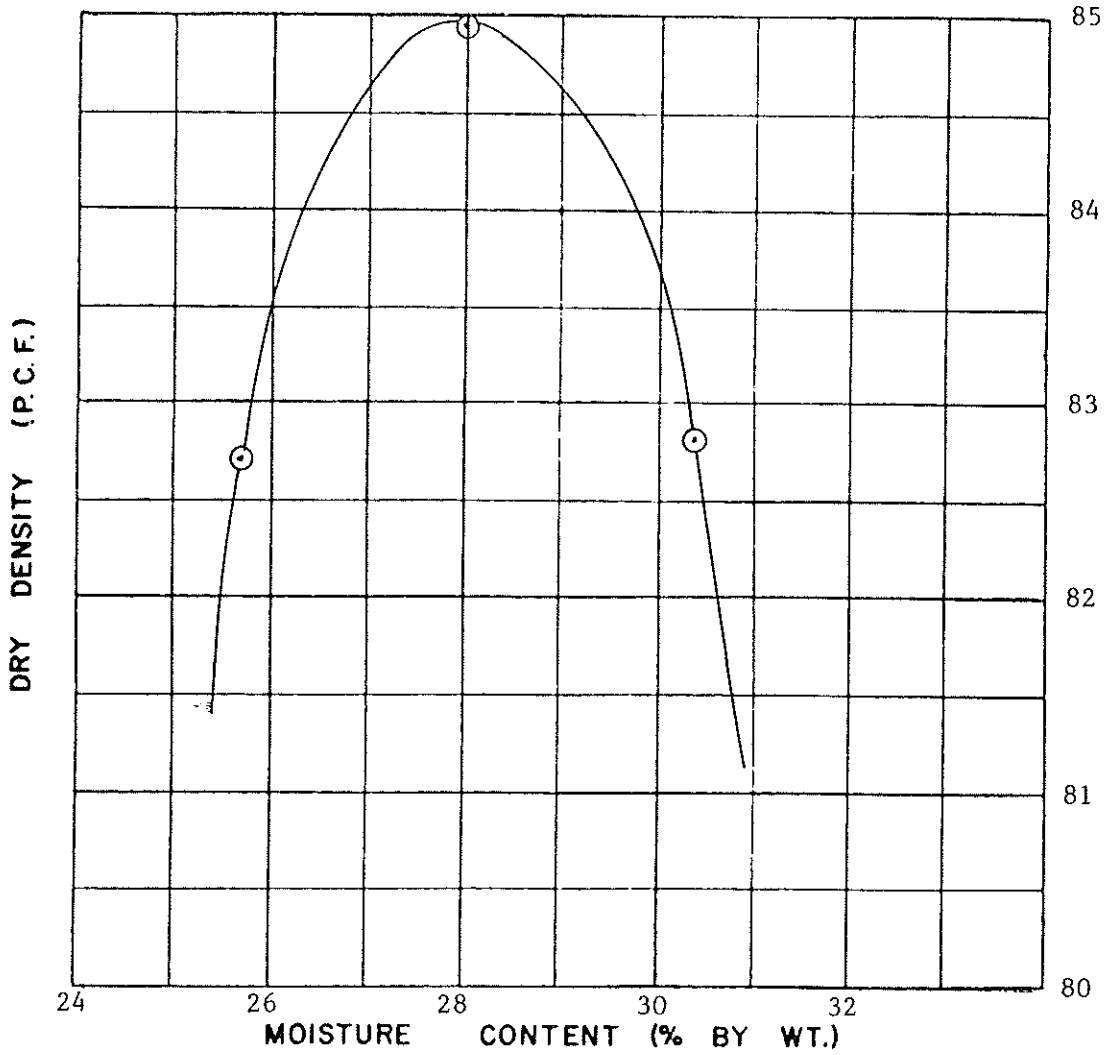
Results of the tests performed on samples taken from the borings are presented on the Logs of Borings, located on Pages B-3 through B-10 of Appendix B. Results of the compaction and CBR tests are located on Pages C-3 and C-4 through C-7, respectively, and the subsection "Laboratory Test Results of Soil Samples". Results of the optimal lime percentage determination as a function of Plasticity Index and pH is located on Pages C-8 and C-9, respectively. Laboratory test results were used to classify soils encountered according to the Unified Soil Classification System (ASTM D 2487).

Soil samples taken during our field program which remained after completion of our laboratory testing will be stored for a period of 60 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

TYPE MATERIAL Dark gray clay (CH) with gravel (PI = 52)

MAX. DRY DENSITY 84.9 P.C.F. OPTIMUM MOISTURE 28.0 %

METHOD OF COMPACTION ASTM D 698



PROJECT Culebra 58F Drainage Project

FOR SwL Project No. 24-89210

CONTRACTOR N/A

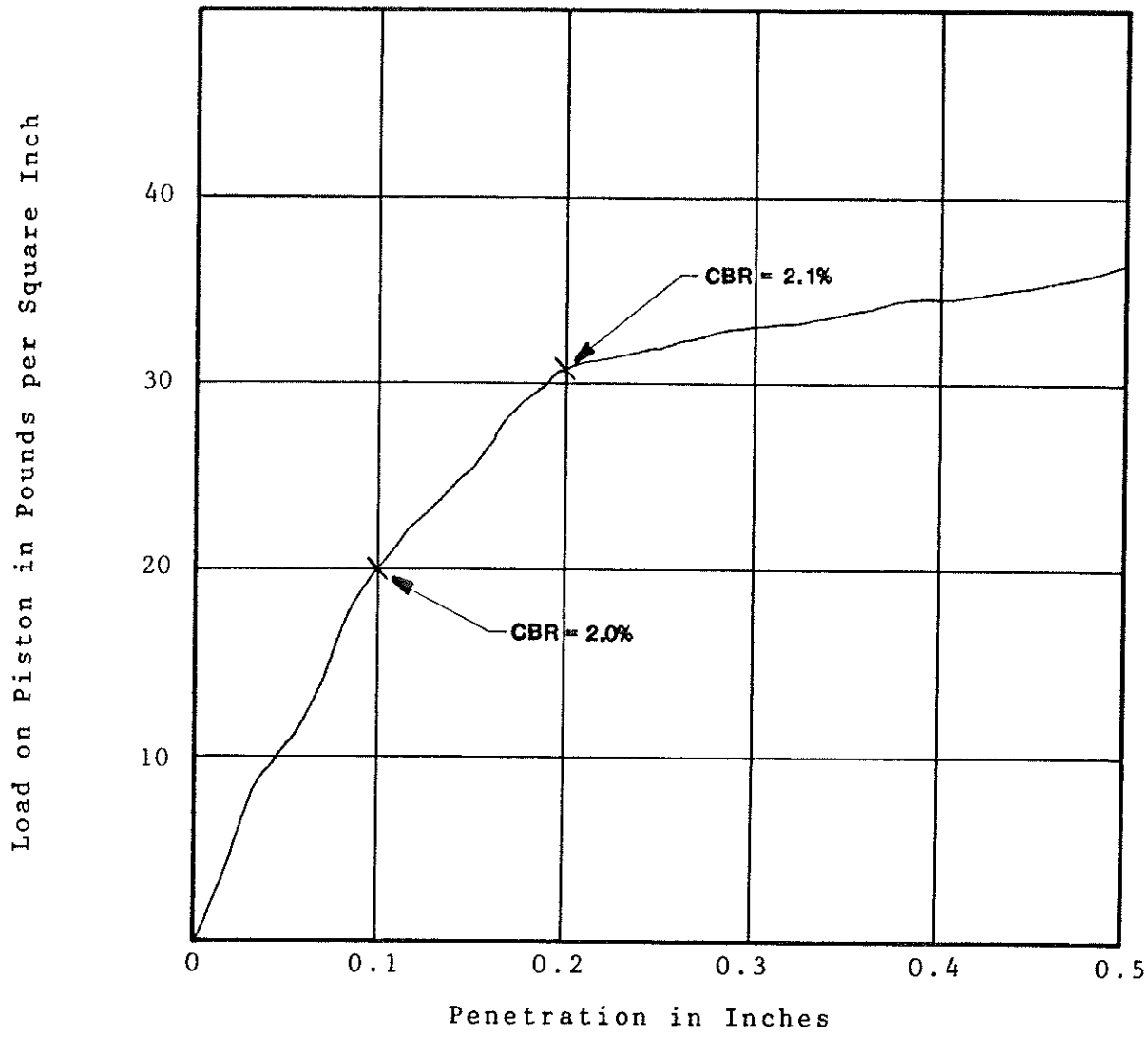
DATE 11/19/89

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P. O. Box 17865 • 2435 Boardwalk • San Antonio, Texas 78217 • 512/822-2116

CBR TEST RESULTS (ASTM D 1883)



Type of Material Dark gray clay with gravel

Compacted Moisture Content (Percent) 28.6 **Compacted Dry Density (pcf)** 81.7

Compaction Method ASTM D 698 **Percent of Maximum Density** 96.2

Moisture Relative to Optimum (Percent) + 0.6 **Surcharge (lbs)** 12.6

Swell (inches) 0.218 (4.8%) **Soaking Period (hours)** 96

CBR Value (percent): **At 0.1" deflection** 2.0%; **At 0.2" deflection** 2.1%

Client Macina, Bose, Copeland & Associates, Inc **Client No.** --

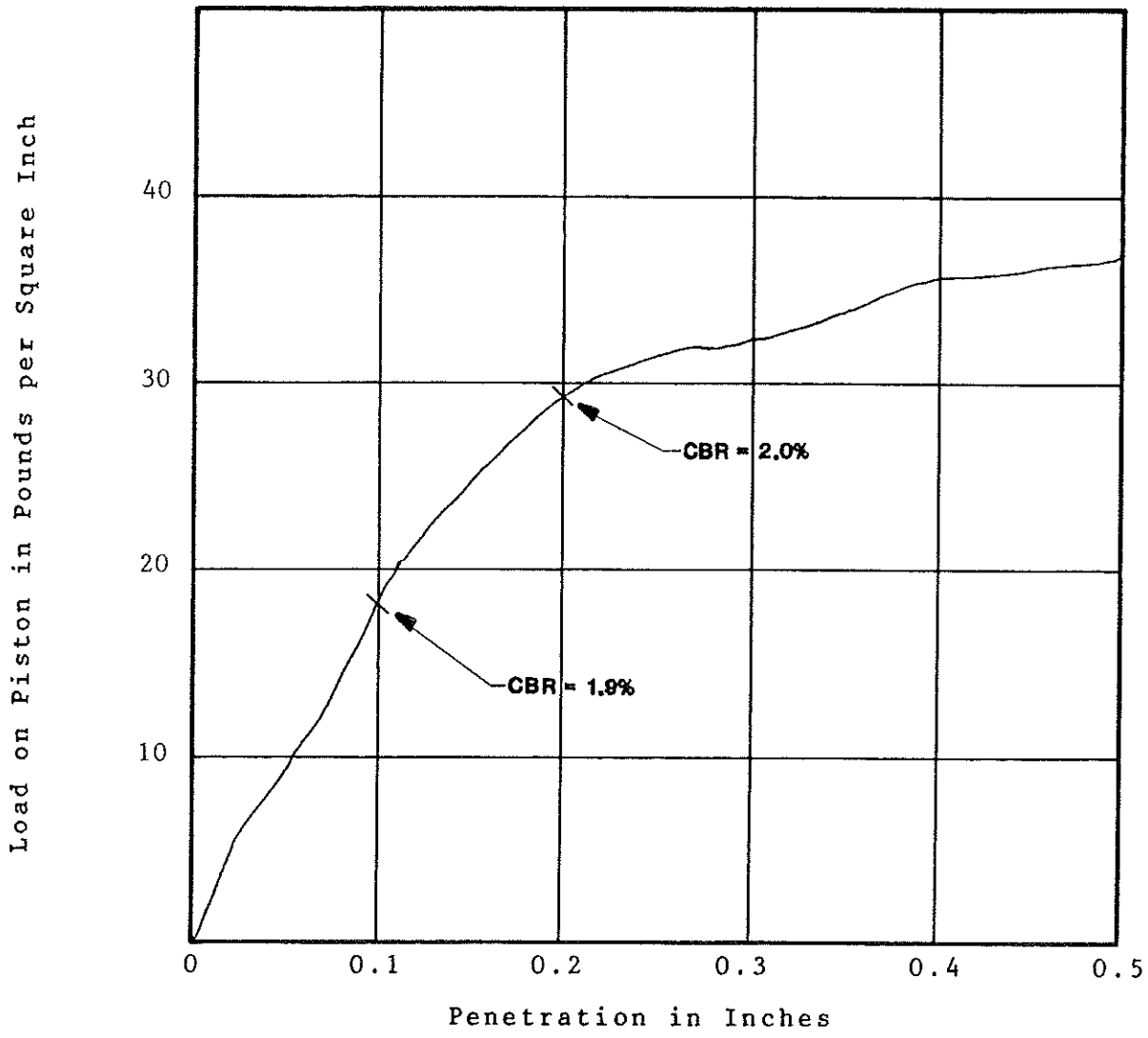
Project/Lab No. 24-89210 **Date** 11/20/89

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P. O. Box 17985 • 2435 Boardwalk • San Antonio, Texas 78217 • 512/822-2116

CBR TEST RESULTS (ASTM D 1883)



Type of Material Dark gray clay with gravel

Compacted Moisture Content (Percent) 30.1 **Compacted Dry Density (pcf)** 77.7

Compaction Method ASTM D 698 **Percent of Maximum Density** 91.5

Moisture Relative to Optimum (Percent) + 2.1 **Surcharge (lbs)** 12.6

Swell (inches) 0.165 (3.6%) **Soaking Period (hours)** 96

CBR Value (percent): **At 0.1" deflection** 1.9 ; **At 0.2" deflection** 2.0

Client Macina, Bose, Copeland & Associates, Inc. **Client No.** --

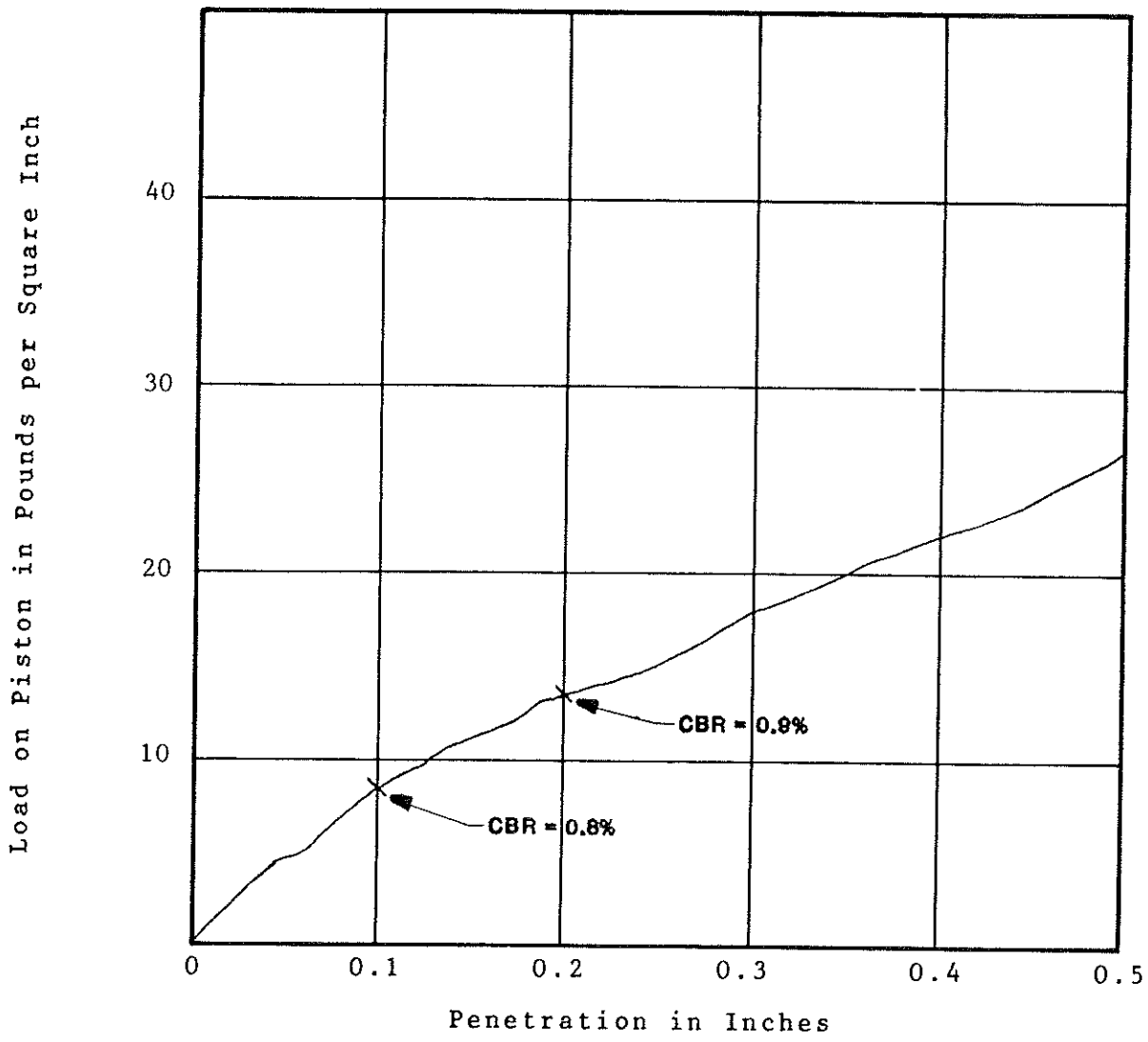
Project/Lab No. 24-89210 **Date** 11/20/89

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

P. O. Box 17885 • 2435 Boardwalk • San Antonio, Texas 78217 • 512/822-2116

CBR TEST RESULTS (ASTM D 1883)



Type of Material Dark gray clay with gravel

Compacted Moisture Content (Percent) 33.0 **Compacted Dry Density (pcf)** 72.8

Compaction Method ASTM D 698 **Percent of Maximum Density** 85.7

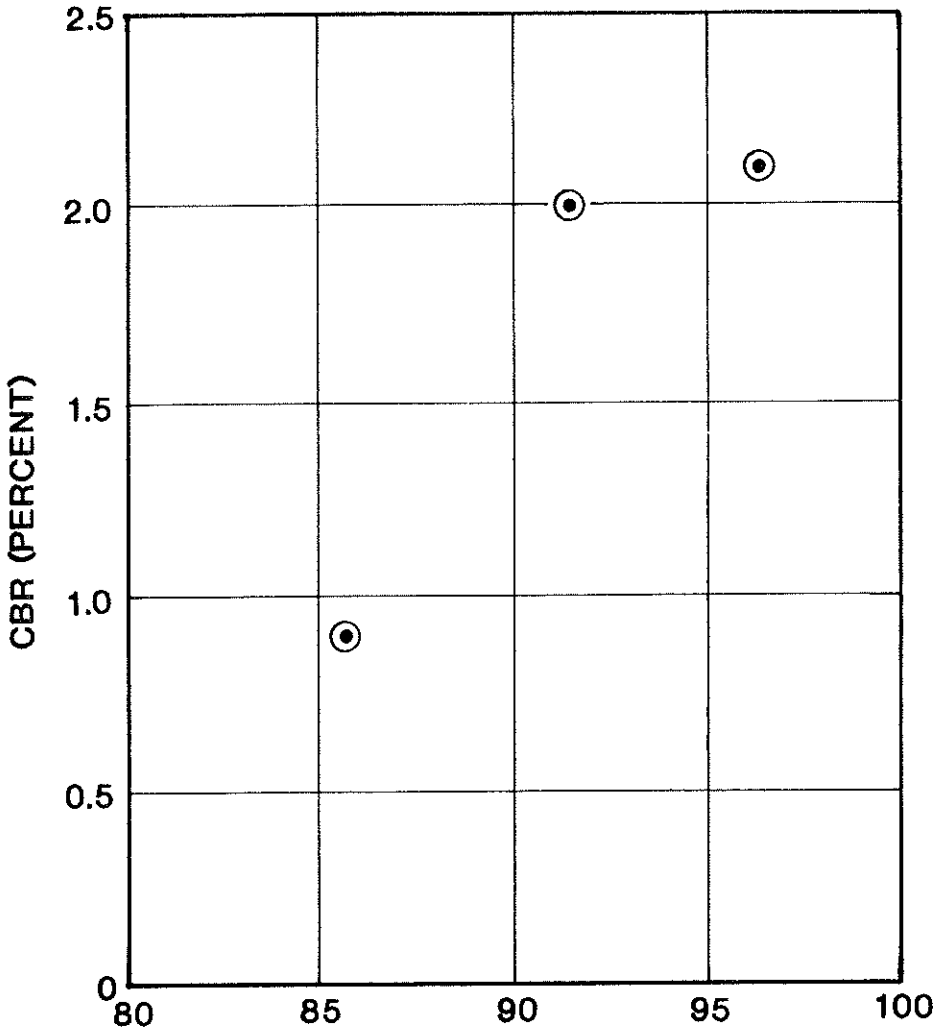
Moisture Relative to Optimum (Percent) + 5.0 **Surcharge (lbs)** 11.9

Swell (inches) 0.070 (1.5%) **Soaking Period (hours)** 96

CBR Value (percent): **At 0.1" deflection** 0.8 ; **At 0.2" deflection** 0.9

Client Macina, Bose, Copeland & Associates, Inc **Client No.** --

Project/Lab No. 24-89210 **Date** 11/20/89

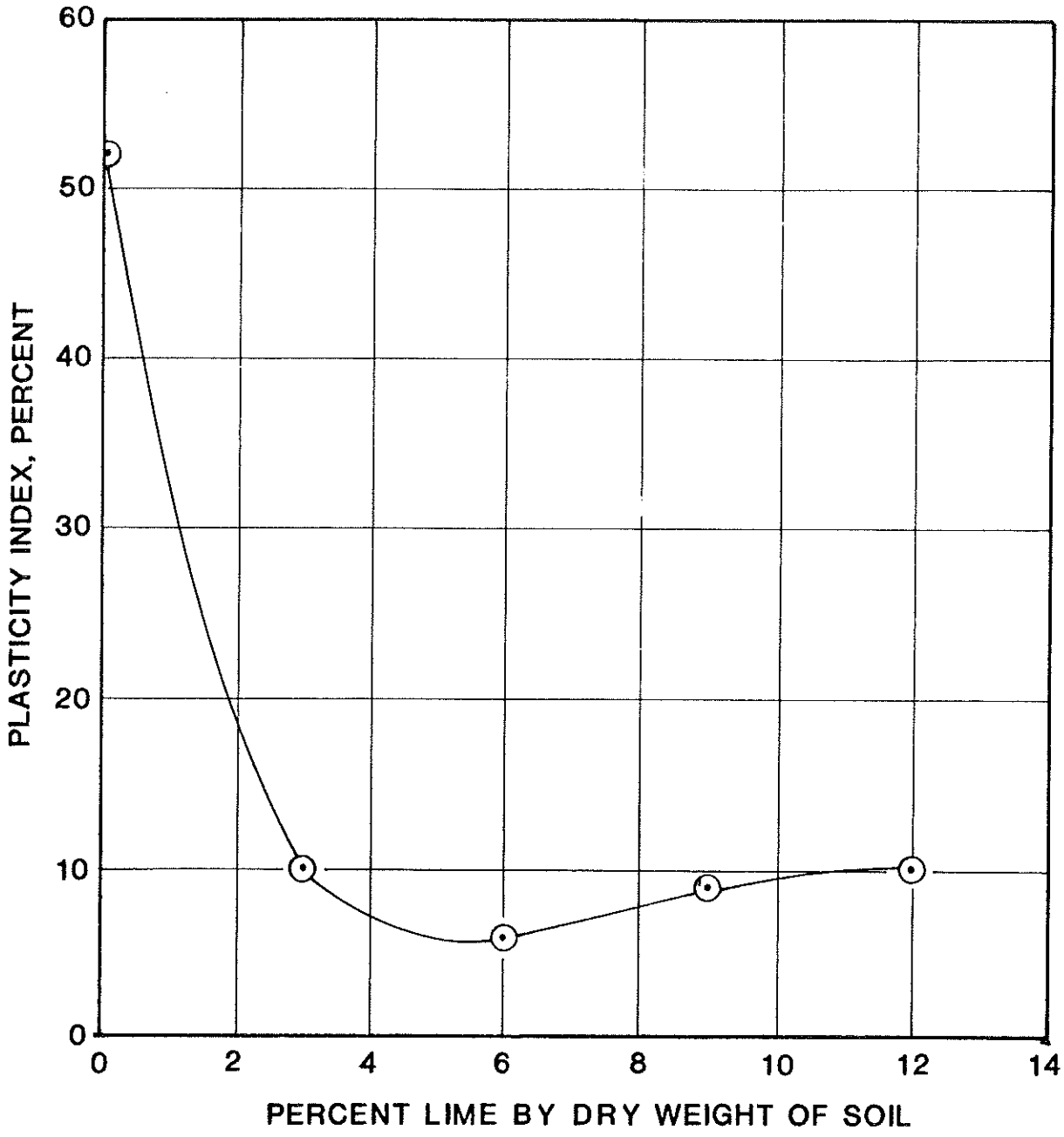


CBR RESULTS AS A FUNCTION OF DENSITY

CULEBRA 58F DRAINAGE PROJECT
SAN ANTONIO, TEXAS

SWL PROJECT NO. 24-89210

SOUTHWESTERN LABORATORIES

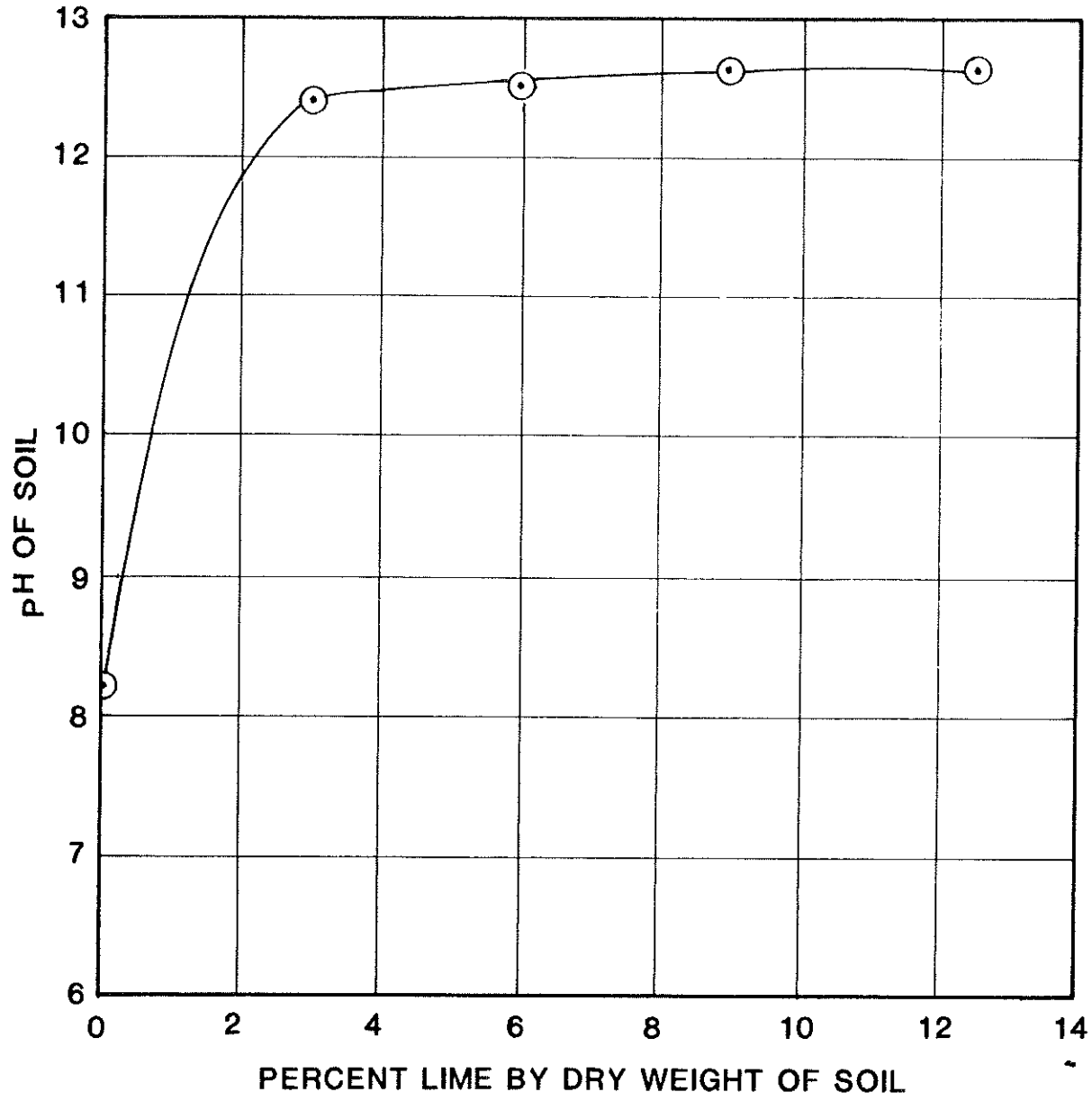


PLASTICITY INDEX VS. PERCENT OF ADDED LIME

CULEBRA 58F DRAINAGE PROJECT
SAN ANTONIO, TEXAS

SWL PROJECT NO. 24-89210

SOUTHWESTERN LABORATORIES



pH OF SOIL VS. PERCENT OF ADDED LIME

CULEBRA 58F DRAINAGE PROJECT
SAN ANTONIO, TEXAS

SWL PROJECT NO. 24-89210

SOUTHWESTERN LABORATORIES

CITY OF SAN ANTONIO
025 UNIT PRICING FORM

PROJECT NAME: CULEBRA #58F PHASE IIB
PROJECT NO. 40-00050

	ITEM NO.			BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	
	100			Mobilization	LS	1			
	101.1			Insurance and Bond	LS	1			
	101			Preparation of Right-of-Way	LS	1			
	102			Obliterating Abandoned Street	SY	7,435			
	103.2			Remove Concrete Rip-Rap and Pipe (includes retards and slabs)	SF	26,275			
	105			Channel Excavation	CY	183,900			
	107.1			Embankment in Phase 2B Area	CY	2,260			
**	110.2.2			Transportation & Disposal at Soil to Disposal Facility	CY	36,850			
**	110.5			Preparation/Implementation of Site Specific H & S Plan	LS	1			
	300.1			Concrete Class "A" (flow blocks & structure)	CY	271			
	301			Reinforcing Steel	LB	8,275			
	401.1			24" Storm Drainage Pipe, R.C.P., 6'-8' Cut	LF	20			
*	410.2			Gravel Subgrade Filler	CY	3,793			
	500			Concrete Curbing	LF	80			
	503.1			Laven Access Driveway	SY	580			
	505			Concrete Rip-Rap (5")	SY	51,460			
	505.2			(b) Large-Rock Rip-Rap (in pilot channel)	SY	7,460			
	514.1			Anti-graffiti Coating System (for concrete rip-rap)	SF	83,600			
	515			Top Soil	CY	6,110			
	520.1			Hydromulching (Phase 2B Area)	SY	42,760			
**	520.2			Hydromulching (Phase 2A Restoration Area)	SY	10,500			
	520			Irrigation of Planted Areas	LS	1			
	526			Field Office	Not Pay Item				
	530			Barricades, Signs and Traffic Handling	LS	1			
**	553.1			SWPPP Activities (Unspecified)	LS	1			
	553.2			Rock Filter Berms	LF	825			

Updated: 6/03/11
* Updated: 6/14/11
** Updated: 6/17/11

** All special provisions that apply to Project Bid Items.*

CITY OF SAN ANTONIO
025 UNIT PRICING FORM

PROJECT NAME: CULEBRA #58F PHASE IIB
PROJECT NO. 40-00050

	ITEM NO.			BID ITEM DESCRIPTION	UNIT OF MEASURE	APPROX. QUANTITIES	UNIT BID PRICE	AMOUNT	
	553.3			Standard Silt Fence	LF	3,530			
	554.1			Soil Erosion Control Matting (Phase 2B Area)	SY	42,760			
				(Landlock 300 or Equal HPTRM)					
	554.2			Erosion Control Matting (Phase 2A Channel)	SY	4,670			
				(Landlock 300 or Equal HPTRM)					
	555			3' Pipe Railing, installed	LF	56			
	556			Steel Plate Channel Cover installed	SF	280			
	700.0			Project Schedule (Cost Loaded)	Not Pay Item				
				Permit Mitigation Items:					
	554.3			Erosion Control Matting	SY	4,200			
				SRB Class II, Type G					
	999.1			Tree Plantings	EA	165			
				(See Schedule on Plans)					
	999.2			Creekbank Stabilization	LF	2,130			
				(of natural, low-flow channel; ref. specs)					
	999.3			Relocation Allowance for 36" Oak Trees	LS	1		$ 95,000.00	
							TOTAL BID AMOUNT:		

ADDITIVE ALTERNATE:

**	554.3			Deferred Phase IIA HPTRM	SY	23,000			

_____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.

_____Acknowledged 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: _____

Updated: 6/03/11
* Updated: 6/14/11
** Updated: 6/17/11

** All special provisions that apply to Project Bid Items.*

CITY OF SAN ANTONIO
DEPARTMENT OF CAPITAL IMPROVEMENTS MANAGEMENT SERVICES
CONTRACT SERVICES DIVISION

RECEIPT OF ADDENDUM NUMBER(S) **10** IS HEREBY ACKNOWLEDGED FOR PLANS AND

SPECIFICATIONS FOR CONSTRUCTION OF **CULEBRA 58F PHASE IIB**

FOR WHICH BIDS WILL BE OPENED ON **TUESDAY, JUNE 21, 2011 AT 2:00 PM**

THIS ACKNOWLEDGEMENT MUST BE SIGNED AND RETURNED WITH THE BID PACKAGE.

Company Name: _____

Address: _____

City/State/Zip Code: _____

Date: _____

_____
Signature

_____
Print Name/Title