- GEOTECHNICAL ENGINEERING
- CONSTRUCTION MATERIALS ENGINEERING & TESTING
- SOILS • ASPHALT • CONCRETE

January 27, 2014

Vickrey & Associates, Inc.
12940 Country Parkway
San Antonio, Texas 78216

Attention: Susan D. Landreth, P.E.

SUBJECT: **FINAL REPORT**
SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM, AND GEOTECHNICAL RECOMMENDATIONS
FOR THE PROPOSED
UTSA BLVD.
BABCOCK ROAD TO EDWARD XIMENES
SAN ANTONIO, BEXAR COUNTY, TEXAS
RETL Project Number: G213313

Dear Ms. Landreth,

In accordance with our agreement, Rock Engineering and Testing Laboratory, Inc. (RETL) (TXPE Firm #2101) has conducted a subsurface exploration and geotechnical evaluation for the above referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report.

Often, because of design and construction details, that occur on a project, questions arise concerning soil conditions and Rock Engineering and Testing Laboratory, Inc. (RETL), would be pleased to continue its role as the Geotechnical Engineer during project implementation.

If there are any questions, please contact our office.

Sincerely,

Kyle D. Hammock, P.E.
Vice President - San Antonio

FINAL REPORT
SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM AND GEOTECHNICAL RECOMMENDATIONS FOR THE PROPOSED UTSA BLVD. BABCOCK ROAD TO EDWARD XIMENES SAN ANTONIO, BEXAR COUNTY, TEXAS

RETL JOB NUMBER: G213313

PREPARED FOR:

VICKREY & ASSOCIATES, INC.
12940 COUNTRY PARKWAY
SAN ANTONIO, TEXAS 78216

JANUARY 27, 2014

PREPARED BY:

ROCK ENGINEERING AND TESTING LABORATORY, INC.
10856 VANDALE STREET
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TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NUMBER 2101

Kyle D. Hammock, P.E.
Vice President - San Antonio

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INTRODUCTION

This report presents the results of a subsurface exploration, laboratory testing program and geotechnical evaluation for the proposed UTSA Blvd., (Babcock Road to Edward Ximenes) project to be constructed in San Antonio, Bexar County, Texas. This study was conducted for Vickrey & Associates, Inc.

Authorization

The work for this project was performed in accordance with a Standard Agreement for Professional Services executed between Vickrey & Associates, Inc. and RETL on November 12, 2013. RETL Proposal P092013A was included as Exhibit A in the Agreement.

Purpose and Scope

The purpose of this exploration was to evaluate the soil and groundwater conditions at the site and to provide geotechnical recommendations suitable for the proposed project.

The scope of the exploration and analysis included the subsurface exploration, field and laboratory testing, engineering analysis and evaluation of the subsurface soils, developing pavement recommendations and noise wall foundation recommendations and preparation of this report.

The scope of services did not include an environmental assessment. Any statements in this report, or on the drilling logs, regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

General

The exploration and analysis of the subsurface conditions reported herein are considered sufficient in detail and scope to provide pavement recommendations for the roadway and foundation recommendations for the proposed noise walls. The recommendations submitted for the proposed project are based on the available soil information and the preliminary design details provided by Susan D. Landreth, P.E. of Vickrey & Associates, Inc. If additional soil information is needed to complete the design of the pavements and foundations, and this information can be obtained from the data obtained within the agreed upon scope of work, then RETL will provide this information in a supplemental report.

The Geotechnical Engineer states that the findings, recommendations, specifications or professional advice contained herein have been presented after being prepared in a manner consistent with that level of care and skill ordinarily exercised by reputable members of the Geotechnical Engineer's profession practicing contemporaneously under similar conditions in the locality of the project. RETL operates in general accordance with "*Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction*", (ASTM D3740). No other representations are expressed or implied, and no warranty or guarantee is included or intended.

This report has been prepared for the exclusive use of Vickrey & Associates, Inc. for the specific purpose of the proposed UTSA Blvd. Reconstruction Project to be constructed in San Antonio, Bexar County, Texas.

FIELD EXPLORATION

Scope

The field exploration completed to evaluate the engineering characteristics of the existing pavements and subsurface materials included a reconnaissance of the project site, drilling the test holes and recovering disturbed soil samples. Sixteen test holes were advanced to depths of 10 to 25-feet for the purpose of obtaining geotechnical information. RETL determined the number, depth and location of test holes and located the test holes in the field. The test holes information is included in the following table:

Test Hole No.	Station No.	Offset	Ground Elev.
TH-1	50+68	57' LT	961.6'
TH-2	49+72	20' LT	965.3'
TH-3	46+40	38' LT	973.2'
TH-4	40+54	11' LT	984.6'
TH-5	34+97	43' LT	980.5'
TH-6	30+65	12' LT	977.3'
TH-7	25+52	16' LT	973'
TH-8	20+18	34' LT	968.8'
TH-9	13+97	16' LT	967.5'
TH-10	10+64	31' LT	965.8'
TH-11	50+99	35' LT	966'
TH-12	47+57	88' LT	969.9'
TH-13	39+95	82' LT	983.3'
TH-14	33+63	88' LT	992.9'
TH-15	16+85	41' RT	966'
TH-16	23+19	43' RT	971'

Upon completion of the drilling operations and obtaining the groundwater observations, the test holes were backfilled with concrete, and the pavements and lawn areas were cleaned as required. Test Hole Location Plans, which are reproductions of the Plan and Profile drawings provided to RETL by Vickrey & Associates, Inc., are provided in the Appendix of this report.

Drilling and Sampling Procedures

The test holes were performed using a drilling rig equipped with a rotary head turning solid stem augers to advance the test holes to the desired test hole termination depths. Disturbed soil samples for visual examination and lab testing were obtained employing split-barrel sampling procedures in general accordance with the procedures for "*Penetration Test and Split-Barrel Sampling of Soils*" (ASTM D1586). All of the soil samples were classified in the field, placed in plastic bags, marked according to test hole number, depth and any other pertinent field data, stored in special containers and delivered to the laboratory for testing.

Field Tests and Measurements

Texas Cone Penetrometer (TCP) Tests - During the sampling procedures, TxDOT Texas Cone Penetrometer Tests (TCP) were performed to obtain the relative density or consistency of the soil. The TCP test is performed by attaching a 3-inch diameter cone to the end of the drill stem and lowering it to the bottom of the drill hole. The anvil at the top of the drill stem is attached to a 170-pound hammer which dropped a regulated 2-feet distance. The cone is initially driven 12 blows to seat the cone. The number of blows is recorded for each of two successive 6-inch penetrations. In hard or dense materials, the penetrometer is driven with the resulting penetration in inches recorded for the first and second 50 blows. In either case, the cone is driven 6-inches or 50 blows for each increment.

Dynamic Cone Penetrometer (DCP) Tests - Dynamic Cone Penetrometer (DCP) tests were performed at the project site. The Kessler Dynamic Cone Penetrometer is a device used to estimate the strength characteristics of fine grained soils, granular construction material, and weak stabilized or modified material. The device is driven into the soil by dropping a sliding 17.6-pound hammer from a height of 22.6-inches.

The depth of cone penetration is measured at selected penetration or hammer drop intervals and the soil shear strength is reported in terms of DCP index. The DCP index is based on the average penetration depth resulting from one blow of the 17.6-pound hammer.

The California Bearing Ratio (CBR) can be estimated using the DCP index. The penetration per blow, or penetration rate (PR), is then used to estimate the in-situ CBR, or shear strength, using the appropriate correlation depending on the soil type. The following correlations were provided by the DCP manufacturer, Kessler Soils Engineering Products, Inc., and have been recommended by the US Army Corps of Engineers:

1. CBR= 292 / PR $^{1.12}$ (All soils except those listed in #2 and #3)

2. CBR= 1 / (0.017019*PR) ^{2} (CL soils w/ CBR less than 10)

3. CBR= 1 / (0.002871*PR) (CH Soils)

PR= DCP Penetration Rate, mm per blow

It should be noted that a field DCP measurement results in a field, or in-situ, CBR and will not normally correlate with the laboratory, or soaked, CBR of the same material. The test is thus intended to evaluate the in-situ strength of a material under existing field conditions compared to controlled conditions in a lab.

Water Level Observations - Water level observations were obtained during the test hole operations. Water level observations are noted on the drilling logs provided in the Appendix. In relatively pervious soils, such as sandy soils, the indicated depths are usually reliable groundwater levels. In relatively impervious soils, a suitable estimate of the groundwater depth may not be possible, even after several days of observation. Drilling techniques, seasonal variations, temperature, land-use, proximity to a creek, river or body of water and recent rainfall conditions may influence the depth to groundwater. The amount of water in open test holes largely depends on the permeability of the soils encountered at the test whole locations.

Ground Surface Elevations - Ground surface elevations at the test hole locations were provided by Vickery & Associates, Inc. All depths referred to in this report are from the ground surface elevations at the test hole locations during the time of our field investigation.

LABORATORY TESTING PROGRAM

In addition to the field investigation, a laboratory testing program was conducted to determine additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the pavement systems and noise wall foundations.

The laboratory testing program included supplementary visual classification, water content tests, Atterberg limits tests and percent material finer than the #200 sieve tests. Analytical testing for sulfates and pH was also performed. All phases of the laboratory testing program were conducted in general accordance with applicable TxDOT and ASTM Specifications. The results of these tests are to be found on the accompanying drilling logs and test reports provided in the Appendix.

SUBSURFACE CONDITIONS

General

The types of subsurface materials encountered in the test holes have been visually classified and are described on the TxDOT WINCORE drilling logs. The results of the TCP, water level observations and other laboratory tests are presented on the drilling logs. Representative samples of the soils and rock were placed in polyethylene bags and are now stored in the laboratory for further analysis, if desired. All of the soil samples will be retained in our office until final design is complete.

The stratification of the soil and rock, as shown on the drilling logs, represents the conditions at the actual test hole locations. Variations may occur between, or beyond, the test hole locations. Lines of demarcation represent the approximate boundary between different soil types, but the transition may be gradual, or not clearly defined.

It should be noted that, whereas the test holes were drilled and sampled by experienced drillers, it is sometimes difficult to record changes in stratification within narrow limits. In the absence of foreign substances, it is also difficult to distinguish between discolored soils and clean soil fill.

Generalized Soil Conditions

The soil conditions at the project site generally consist of lean and fat clay soils over weathered to competent limestone materials which extend to the deepest test hole termination depths of 25-feet.

The upper clay soils generally extend to depths of 2 to 7-feet below the existing pavement or ground surfaces. The clays are classified as lean clays (CL) and fat clays (CH) in accordance with the Unified Soil Classification System (USCS), and are moderate to high in plasticity. The clays were not encountered in test holes TH-1, TH-3 and TH-7 to TH-10.

Below the upper clays, weathered to competent limestone materials were encountered and extended to the maximum test hole depths of 25-feet below the existing pavement or ground surfaces. The limestone materials are non-plastic to low in plasticity. The limestone materials were not encountered in test holes TH-4 and TH-11.

Existing Pavement Materials Summary

The test hole number and the thickness of the existing pavement materials are provided in the following table:

EXISTING PAVEMENTS		
Boring No.	**Asphalt Thickness (in.)**	**Base Thickness (in.)**
TH-1	4	12
TH-2	3	12
TH-3	3	8
TH-4	2 ½	14
TH-5	2	9
TH-6	2	12
TH-7	2 ½	11
TH-8	2	12
TH-9	2	17
TH-10	2 ½	15
Average	2 ½	12

The asphalt surface layers appeared to be a TxDOT item 340, Type C or D mix. The base material appeared to be crushed limestone.

Sulfate Test Results

The sulfate test results on representative subgrade samples are provided in the following table:

SULFATE TEST RESULTS		
Boring No.	**Depth (ft)**	**Sulfate (ppm)**
B-1	2 ½ - 4	256
B-3	2 ½ - 4	188
B-4	5 - 6 ½	< 100
B-5	2 ½ - 4	218
B-6	2 ½ - 4	< 100
B-10	2 ½ - 4	< 100

The TxDOT Technical Memorandum for stabilization of soils containing sulfates with lime indicates the following risk levels:

SULFATE RISK LEVELS	
Sulfate (ppm)	**Risk**
<3000	Low
3000-5000	Moderate
5000-8000	Moderate to High
>8000	High and Unacceptable

The sulfate concentrations indicate the subgrade soils at the site are generally low in sulfates with a **low risk** of using lime as a treatment method.

Lime Series and pH Test Results

The lime series and pH test results on the bulk subgrade samples are provided in the following tables:

BORING B-4 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	49 / 34	---
2	41 / 12	11.7
4	40 / 11	11.8
6	40 / 11	12.0

BORING B-8 BULK SUBGRADE SAMPLE LIME SERIES AND pH TEST RESULTS		
% Lime	**LL / PI**	**pH**
0	62 / 41	---
2	44 / 14	11.3
4	43 / 11	11.5
6	42 / 7	11.7

Where: LL = Liquid Limit (%)
PI = Plasticity Index

PAVEMENT AND FOUNDATION RECOMMENDATIONS

Project Description

Based on the information provided to RETL, it is understood that the project will consist of the re-construction of approximately 4,100 LF of flexible pavement for UTSA Blvd. from slightly west of Edward Ximenes to Babcock Rd. It is understood that UTSA Blvd. will be classified as an Arterial. The minimum 18-kip Equivalent Single Axle Load (ESAL) value for this street designation, based on the COSA Design Guidance Manual Appendix 10A, is 3,000,000. Based on recent COSA Bond project involvement by RETL, pavements using geogrid products were not evaluated for this project. In addition to the pavement reconstruction, concrete sidewalks, curbs, driveway approaches and noise walls will be constructed. TXDOT design guidelines will be utilized for the project.

PVR Discussion

The upper lean and fat clay soils at this site are generally moderate to high in plasticity. **The maximum calculated total potential vertical rise (PVR) for slab-on-grade and flatwork construction at this site ranges from less than 1-inch to approximately 2-inches.** The PVR was calculated using the Texas Department of Transportation Method TEX-124E and into account the depth of active zone, and the Atterberg limits test results of the soils encountered within the active zone.

The estimated PVR value provided is based on a slab or flatwork system applying a sustained surcharge load of approximately 1.0 pound per square inch on the subgrade soils. The value represents the vertical rise that can be experienced by dry subsoils if they are subjected to conditions that allow them to become saturated, such as poor drainage. Using dry soil conditions to calculate the PVR is generally considered the worst-case scenario. The actual movement of the subsoils is dependent upon their change in moisture content. Differential vertical movements can potentially be equal to the expected total movements.

Pavement Design Discussion

In designing the proposed flexible pavement, the existing subgrade conditions must be considered together with the expected traffic use and loading conditions. The conditions that influence pavement design are the bearing values (CBR) of the subgrade, number and frequency of vehicles and their range of axle loads, desired pavement life in years, probable increase in vehicular use over the life of the pavement and the availability of suitable materials to be used in the construction of the pavement and their relative costs and engineering properties.

Specific laboratory testing to define the subgrade strength was performed for this analysis. Bulk samples of the clay subgrade soil were obtained from borings B-4 and B-8. The samples were subjected to standard proctor tests and California Bearing Ratio (CBR) tests. The maximum dry density values ranged from approximately 98 to 99 pcf and the optimum moisture contents ranged from approximately 21 to 23-percent. The tested laboratory CBR values ranged from approximately 6 to 12. In addition, Dynamic Cone Penetrometer (DCP) tests were performed in the field to measure the in-place CBR values of the clay subgrade soils. The average DCP values ranged from 12 to 17.

Based on the results of the lab and field CBR testing, Atterberg limits testing, grain size testing and subgrade soil classification, the selected design CBR for the natural lean and fat clay subgrade soil at this site is 6 and the estimated design CBR for the natural weathered limestone materials is 10. RETL used the following pavement design parameters for the flexible pavement design.

AASHTO FLEXIBLE PAVEMENT DESIGN PARAMETER (COLLECTOR)	COSA VALUE
Reliability (R)	95%
Overall Deviation	0.45
Initial / Terminal Serviceability	4.2 / 2.5
Clay Subgrade Design CBR	6
Weathered Limestone Subgrade Design CBR	10
Clay Subgrade Resilient Modulus (Mr)	9,000
Weathered Limestone Subgrade Resilient Modulus (Mr)	15,000
Design Life	20 years

The following treated subgrade, crushed limestone base and asphaltic concrete layer coefficients were selected for the design.

PAVEMENT CONSTITUENT	COSA LAYER COEFFICIENT (α)
Lime Treated Subgrade	0.08
Crushed Limestone Base	0.14
Type B HMAC (Dense Graded Base)	0.38
Type C or D HMAC (Dense Graded Surface)	0.44

Flexible Pavement Recommendations

The recommended flexible pavement sections were calculated using the American Association of State Highway and Transportation Officials, *"GUIDE FOR DESIGN OF PAVEMENT STRUCTURES"*. The results are provided in the following table:

ARTERIAL STREET COSA MINIMUM 18-kip ESAL VALUE = 3,000,000 COSA AASHTO STRUCTURAL NUMBER RANGE = 3.80 to 5.76				
Pavement Constituent	Clay Subgrade Option 1	Clay Subgrade Option 2	Weathered Limestone Subgrade Option 1	Weathered Limestone Subgrade Option 2
HMAC Type C or D	2"	2"	2"	2"
HMAC Type B	4"	7 ½"	4"	8"
Crushed Limestone Base	9"	---	10"	---
Lime Treated Subgrade	6"	6"	---	---
AASHTO Structural No.	4.14	4.21	3.80	3.92
Calculated 18-kip ESAL	3,133,000	3,491,000	5,960,000	7,242,000

All TxDOT specifications are reference from the Texas Department of Transportation, *"STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS, STREETS AND BRIDGES"*.

Subgrade – After the desired subgrade elevation has been achieved, the exposed raw subgrade shall be proof rolled with a heavily loaded dump truck or similar rubber tired vehicle with a minimum weight of 20-tons. Any soft areas identified should be removed to expose firm soils and the excavation backfilled with crushed limestone base material.

The upper 6-inches of exposed subgrade soils should be compacted to a minimum density of 95-percent of the maximum dry unit weight of the subgrade soils as determined by a standard Proctor test (ASTM D698) and at or above the optimum moisture content prior to lime treating or placing the HMAC materials.

Lime Treated Subgrade – Lime treatment of the clay subgrade soils is recommended to reduce the effect of soil heave on the pavements. Lime placement and mixing operations should be performed in accordance with TxDOT Item 260, *"LIME TREATMENT FOR MATERIALS USED AS SUBGRADE (ROAD MIXED)."* Lime shall be properly mixed at a minimum rate of 6-percent of the maximum dry unit weight of the raw subgrade soils as determined by the standard Proctor (ASTM D698). After proper curing time, usually 48 to 72 hours, the lime stabilized soils should be remixed and compacted to a minimum density of 95-percent of the maximum dry unit weight of the lime stabilized subgrade soils as determined by a standard Proctor test (ASTM D698) and at, or above, the optimum moisture content.

Hot Mix Asphaltic Concrete – Surface course asphalt concrete should meet the requirements set forth in TxDOT Item 340 or 341; Type C or D. Base course mix asphaltic concrete should meet the requirements set forth in TxDOT Item 340; Type B. The asphaltic concrete should be compacted to 92 to 96-percent of the maximum theoretical specific gravity of the mixture determined according to test method TEX 227-F. Pavement cores should be tested for density according to test method TEX 207-F.

Noise Wall Drilled Shaft Design

The noise walls will be supported on 30-inch diameter drilled shafts. The structural engineer can utilize the TxDOT WINCORE "Foundation Capacity" curves provided in the Appendix to estimate the design capacity of the noise wall drilled shafts. The capacity curves include a safety factor of 2.0. Five (5) feet of the natural soils have been neglected when calculating shaft capacities. The drilled shafts should be spaced no closer than three diameters apart measured center to center. A minimum shaft depth of 10-feet is also recommended.

The manual Drilled Shafts: Construction Procedures and Design Methods suggests that drilled shafts be reinforced throughout their length with a minimum of 1-percent longitudinal reinforcing steel by cross sectional area of the shaft. The referenced document states that some reduction in the percentage of longitudinal reinforcing steel may be acceptable if the cross sectional area of the shaft is larger than required due to loading conditions. However, a minimum ¾-percent reinforcing steel by cross sectional area is suggested in the manual even if the cross sectional area of the shaft is more than twice that required due to loading conditions.

Based on observations made in the field, temporary steel casing or drilling mud slurry should not be required to successfully install the drilled shafts at this site.

Concrete should be placed as soon as possible after all loose material has been removed, the shaft excavation inspected and reinforcing steel installed. A relatively high slump concrete mix (6 to 8-inches) is suggested to minimize aggregate segregation caused by the reinforcing steel. The concrete should be placed with a tremie.

The successful placement of a drilled shaft foundation system is dependent on the expertise of the drilled shaft foundation contractor. The drilled shaft contractor should expect hard weathered limestone and competent limestone materials at this site and rock augers and high powered drilling equipment will be required.

CONSTRUCTION CONSIDERATIONS

Excavations

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. We are providing this information solely as a service to our client.

Under no circumstances should the information provided herein be interpreted to mean that RETL is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

In no case should slope height, slope inclination or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Specifically, the current OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926 should be followed. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor's "competent person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. For excavations, including a trench extending to a depth of more than 20-feet, it will be necessary to have the side slopes designed by a Professional Engineer licensed in the State of Texas. The contractor's "competent person" should establish a minimum lateral distance from the crest of the slope for all vehicles and spoil piles. Likewise, the contractor's "responsible person" should establish protective measures for exposed slope faces.

Earthwork Acceptance

Exposure to the environment may weaken the soils at the subgrade level if excavations remain open for long periods of time. Therefore, it is recommended that the excavations be extended to final grade and the pavements be constructed as soon as possible to minimize potential damage to the bearing soils.

Concrete for curbs, gutters, and sidewalks should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion, or by desiccation, the unsuitable soils must be removed from the excavation and be replaced with properly compacted base prior to placement of concrete.

The Geotechnical Engineer, or his designated representative, should approve the condition of the subgrade and monitor the placement of all pavement materials. Compaction testing should be performed in accordance with the COSA Standard Specifications. Any areas not meeting the required compaction should be recompacted and retested until compliance is met.

Drainage

Proper drainage is very important to achieve the desired performance from flexible asphaltic concrete pavements. RETL has assumed that good drainage will be incorporated into the pavement reconstruction project and the pavements will be fast draining and puddle free. Low or flat areas in asphalt pavements allow standing water and quick deterioration of the pavement primarily due to saturation of the underlying pavement materials and subgrade soils.

It should be noted that groundwater and/or saturated soils with free water may be encountered during construction. These areas will have to be remediated on a case by case basis with the installation of drain systems and piping to collect and remove the water from the pavement areas.

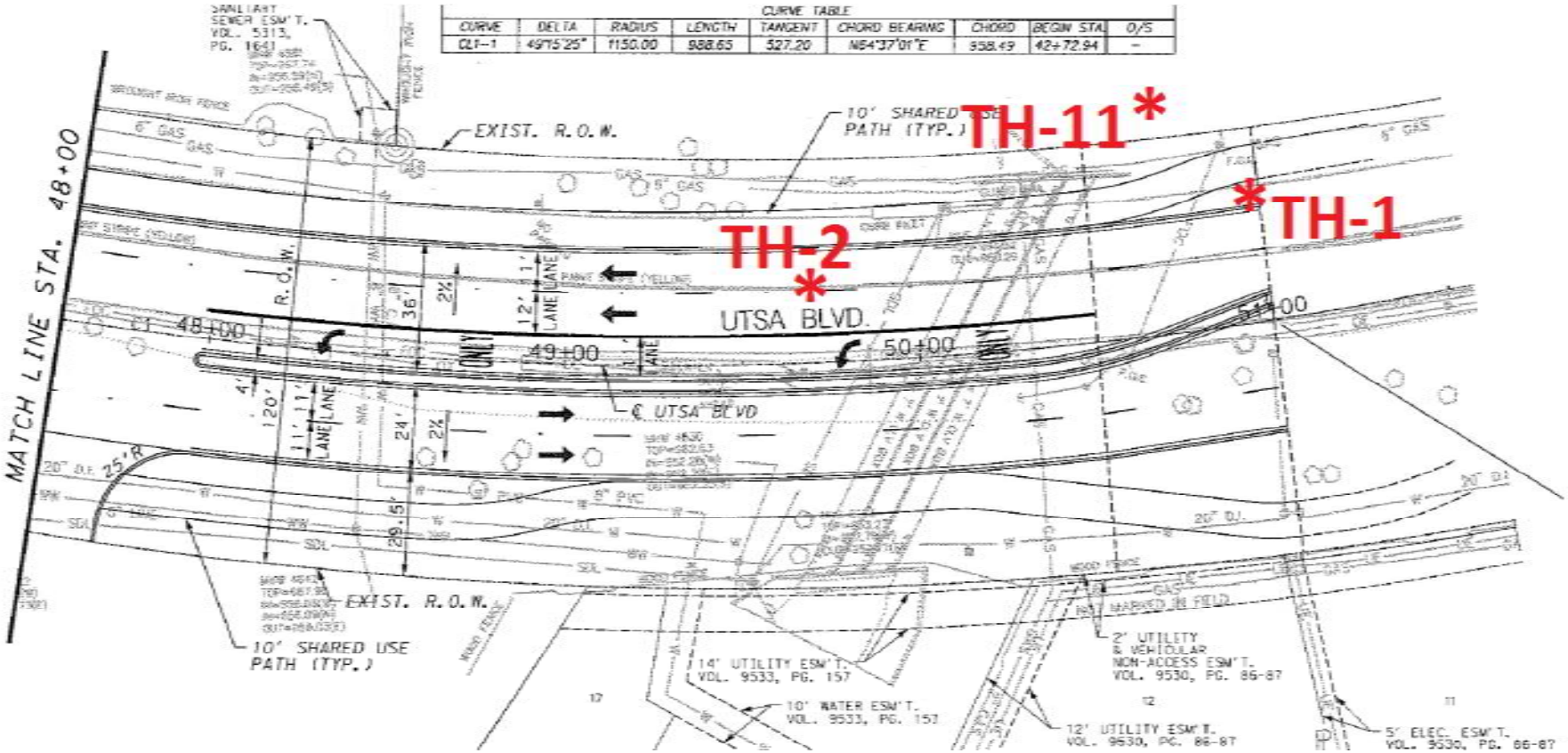
GENERAL COMMENTS

If there are any revisions to the plans for the proposed project, or if deviations from the subsurface conditions noted in this report are encountered during construction, RETL should be retained to determine if changes in the recommendations are required. If RETL is not retained to perform these functions, RETL will not be responsible for the impact of those conditions on the performance of the project.

It is recommended that the services of RETL be retained to provide observation and testing during the construction of the project in order to verify that the soils are consistent with those encountered by the test holes. RETL cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the project if not engaged to also provide construction observation and testing. If it is required for RETL to accept any liability, then RETL must agree with the plans and perform such observation during construction as we recommend.

All sheeting, shoring, and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration.

APPENDIX



TEST HOLE LOCATION PLAN

NO SCALE

January 27, 2014
Vickrey & Associates, Inc.
RETL Project No.: G213313

PROPOSED UTSA BLVD.
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San Antonio, Texas

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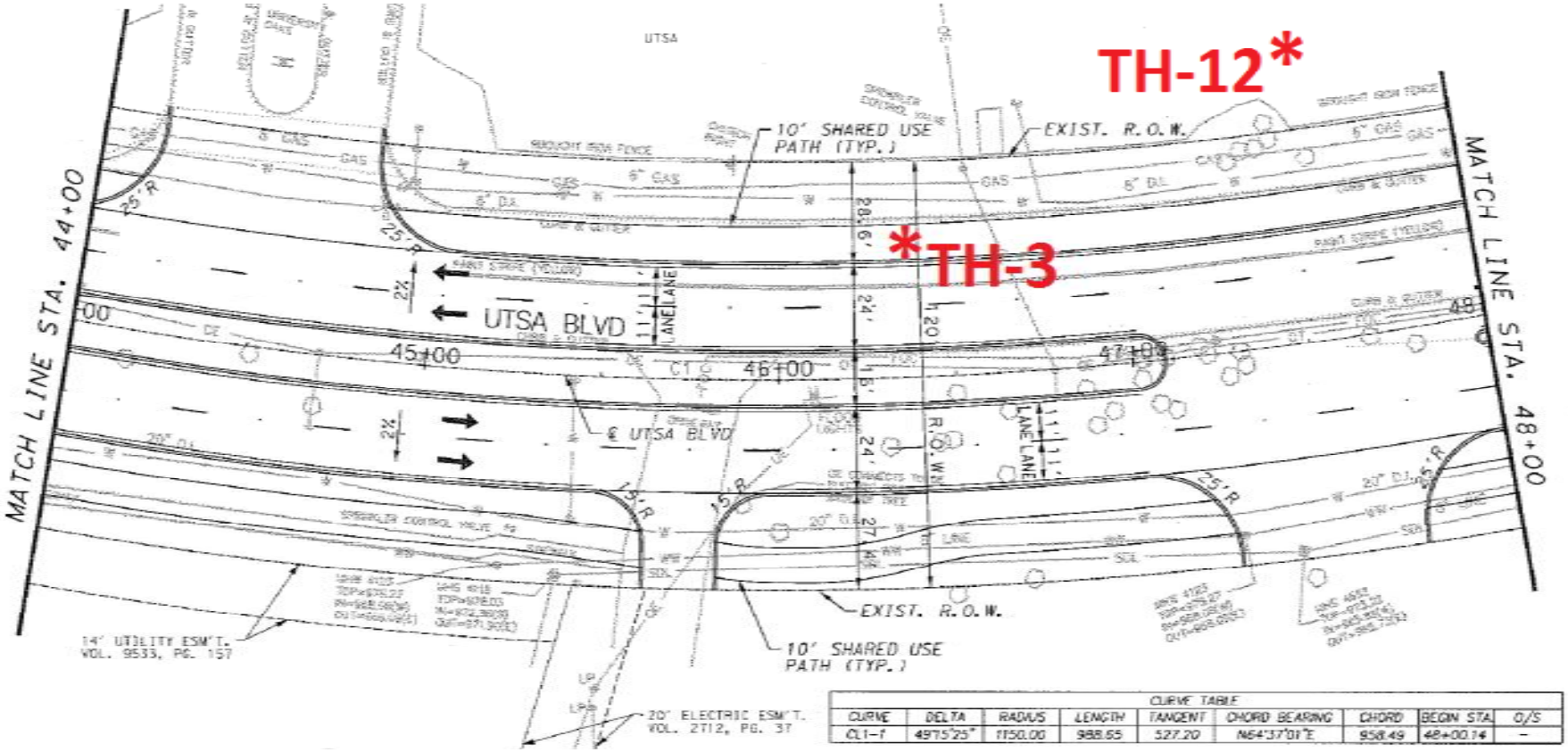

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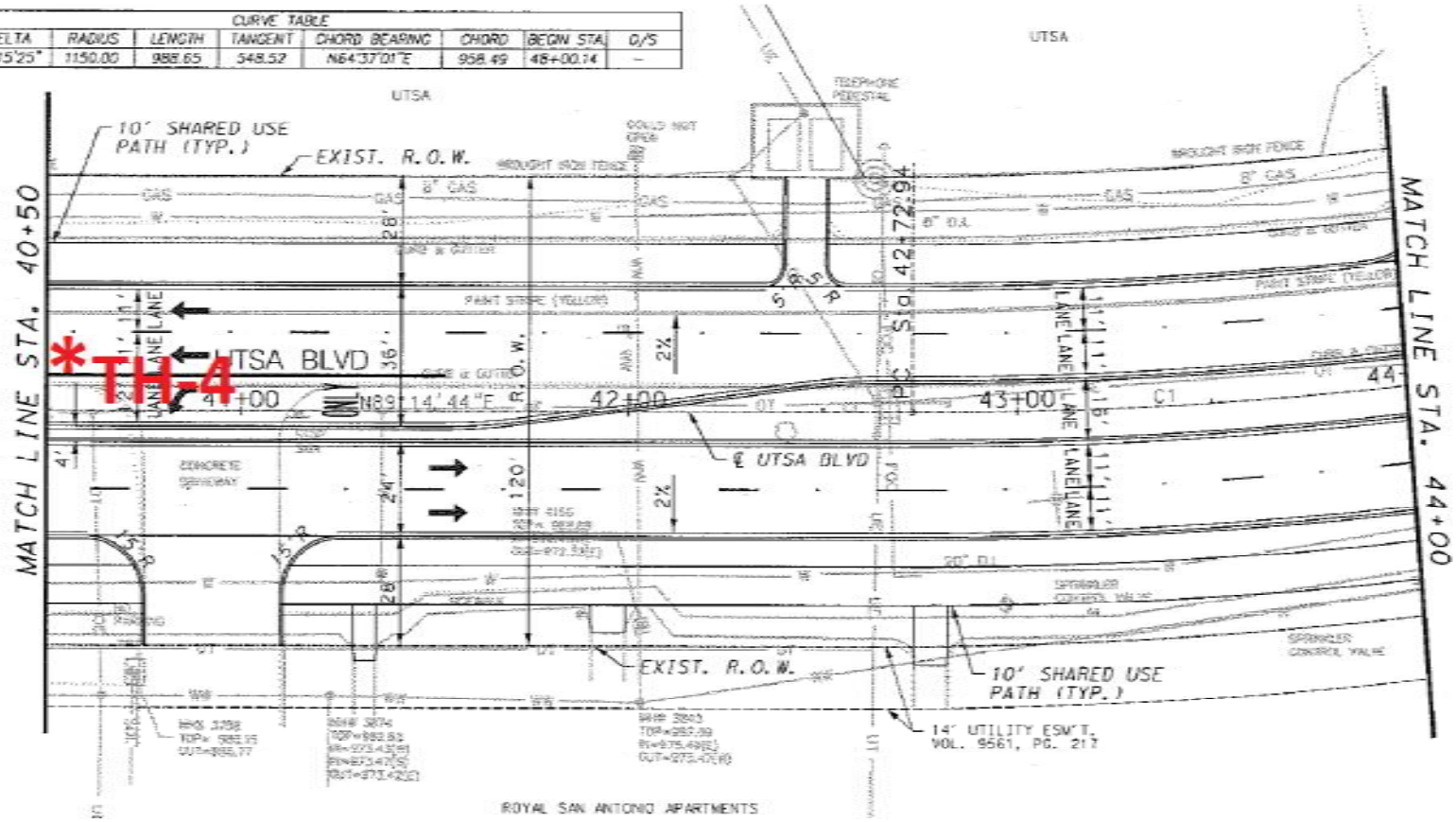
CURVE TABLE								
CURVE	DELTA	RADIUS	LENGTH	TANGENT	CHORD BEARING	CHORD	BEGIN STA.	O/S
C1-1	49°15'25"	1150.00	988.65	548.52	N64°37'01"E	958.49	48+00.14	-



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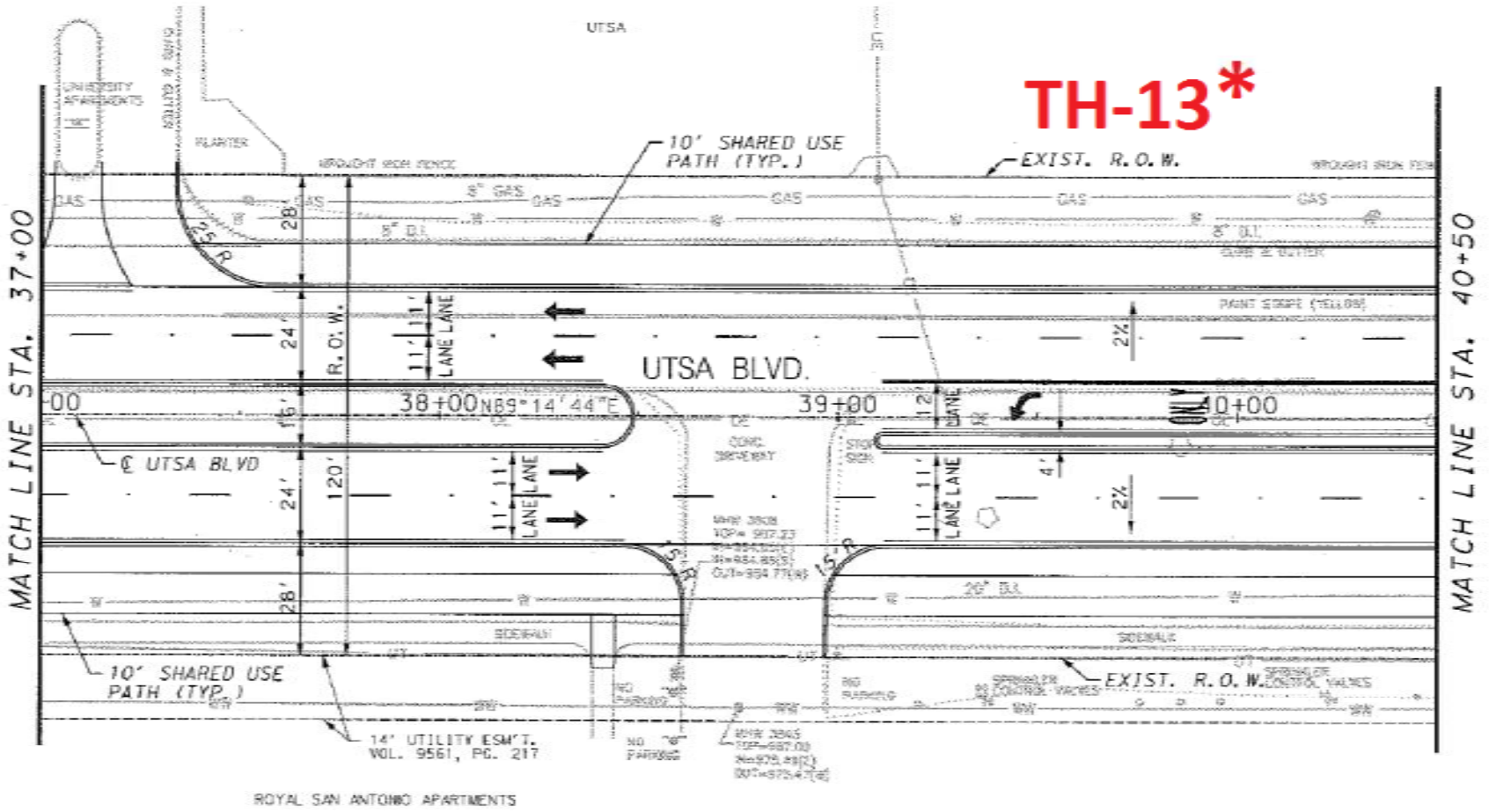

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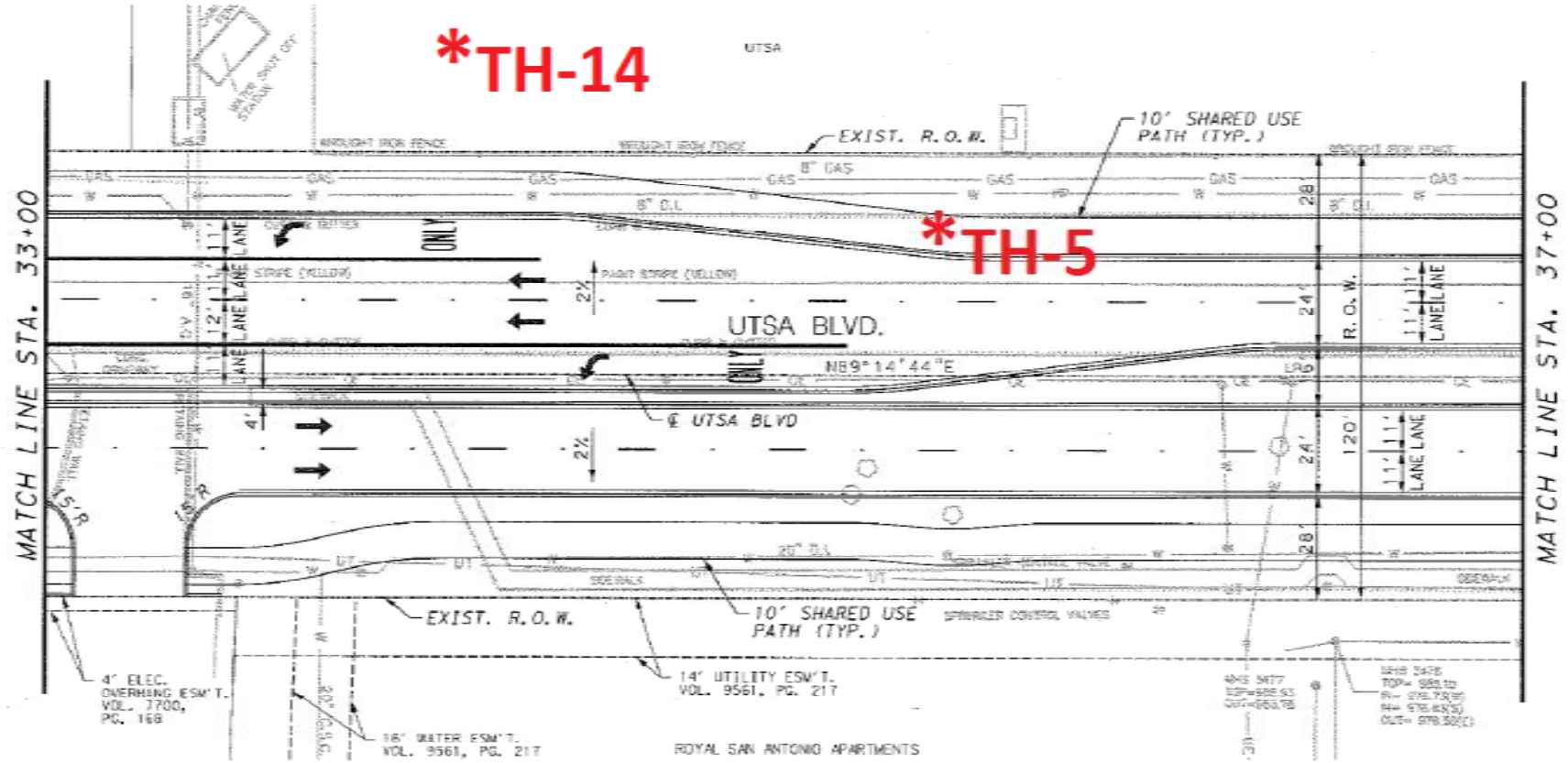

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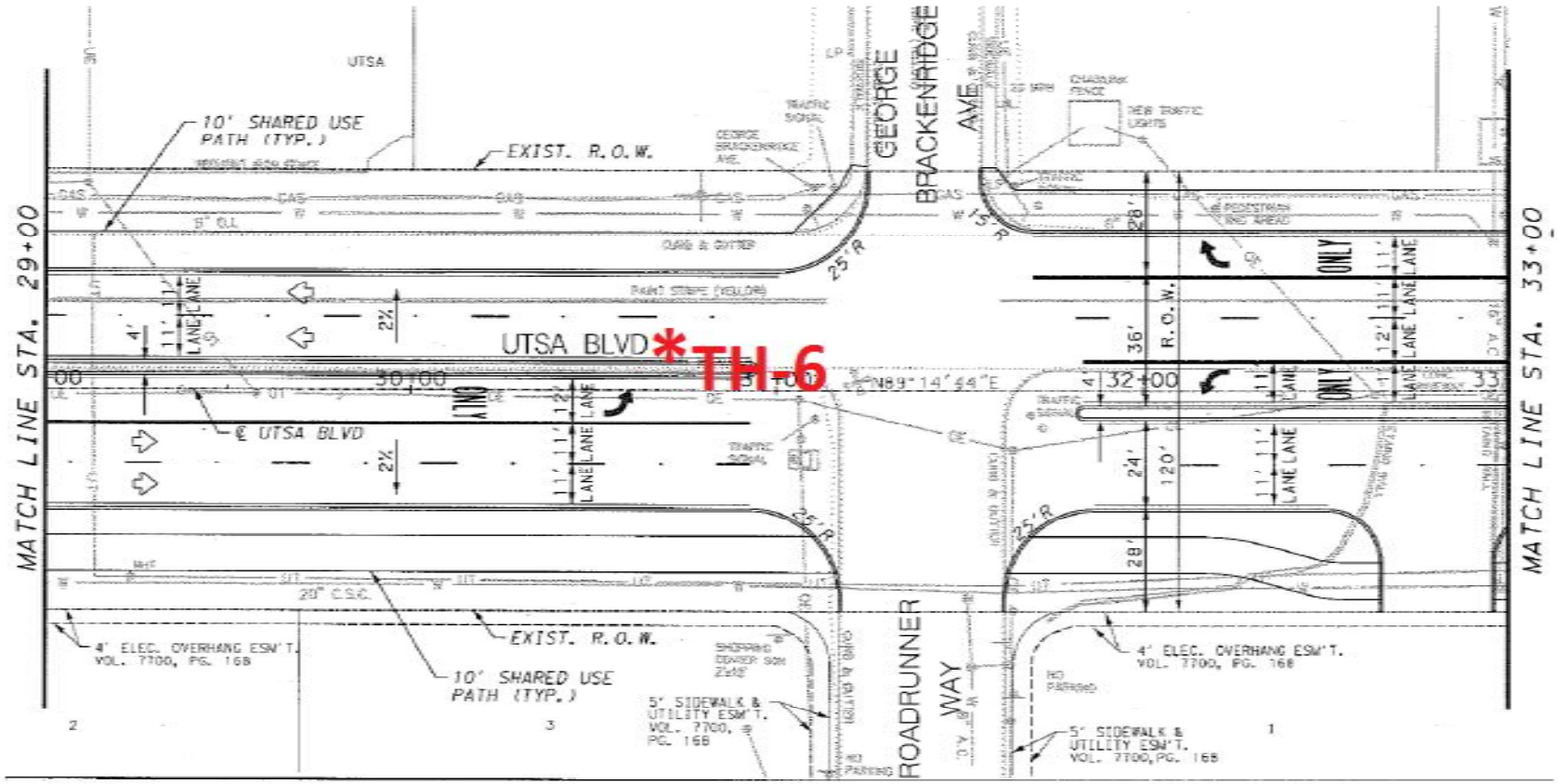
(210) 495-8000



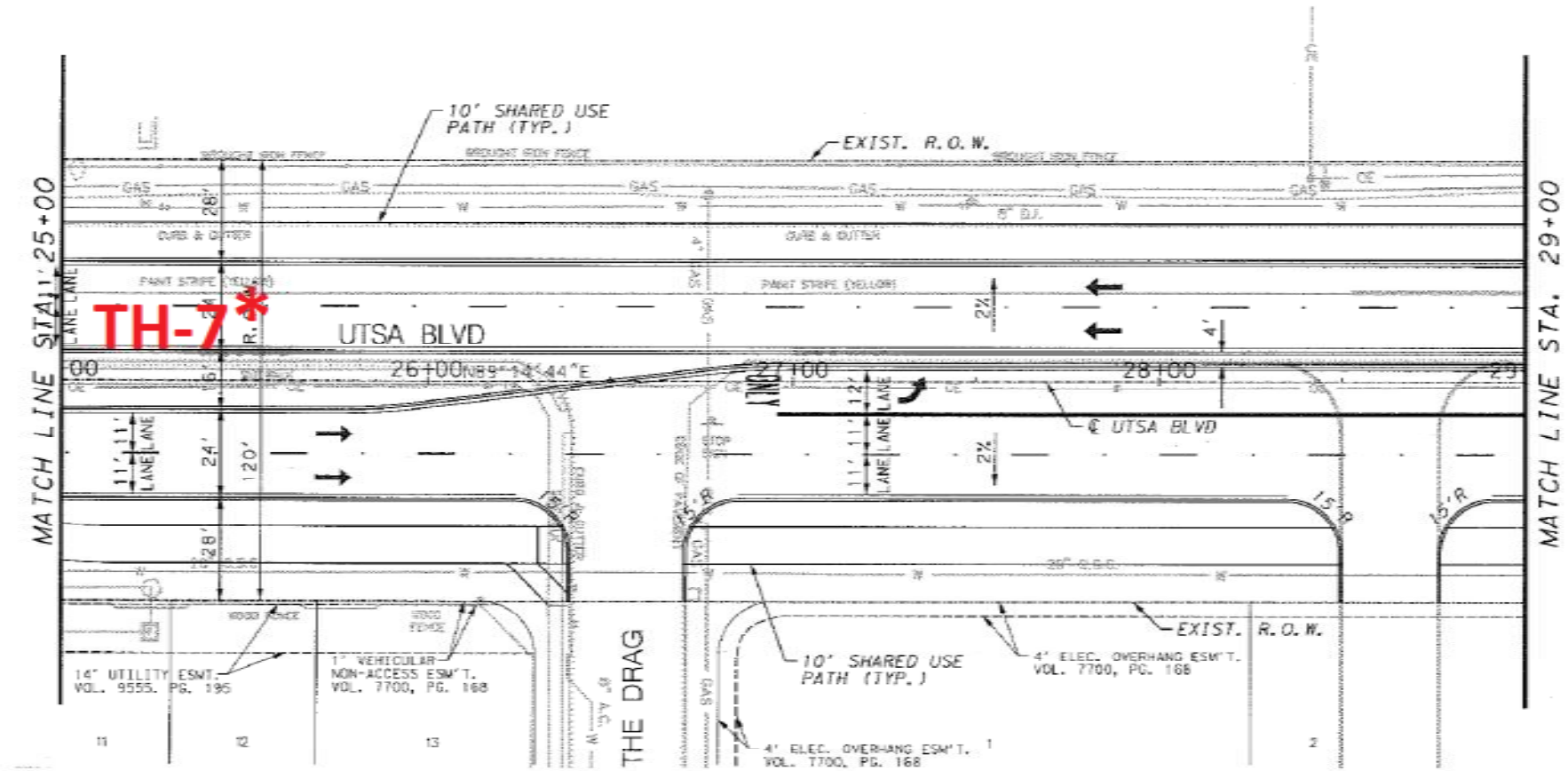
TEST HOLE LOCATION PLAN

NO SCALE

January 27, 2014
Vickrey & Associates, Inc.
RETL Project No.: G213313

PROPOSED UTSA BLVD.
Babcock Road to Edward Ximenes
San Antonio, Texas

ROCK ENGINEERING AND TESTING LABORATORY, INC.
10856 VANDALE STREET
SAN ANTONIO, TX 78216
(210) 495-8000



TEST HOLE LOCATION PLAN

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January 27, 2014
Vickrey & Associates, Inc.
RETL Project No.: G213313

PROPOSED UTSA BLVD.
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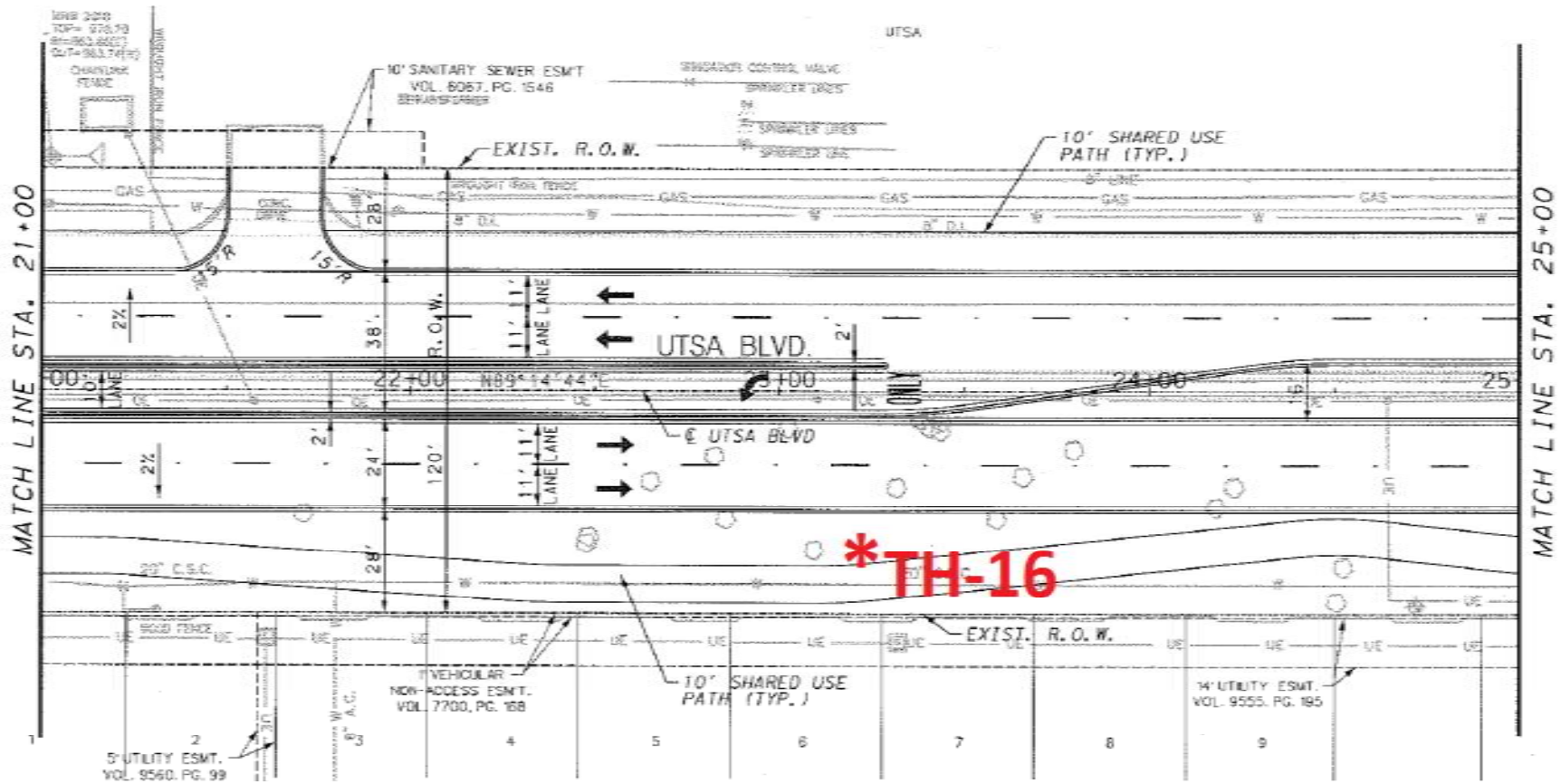

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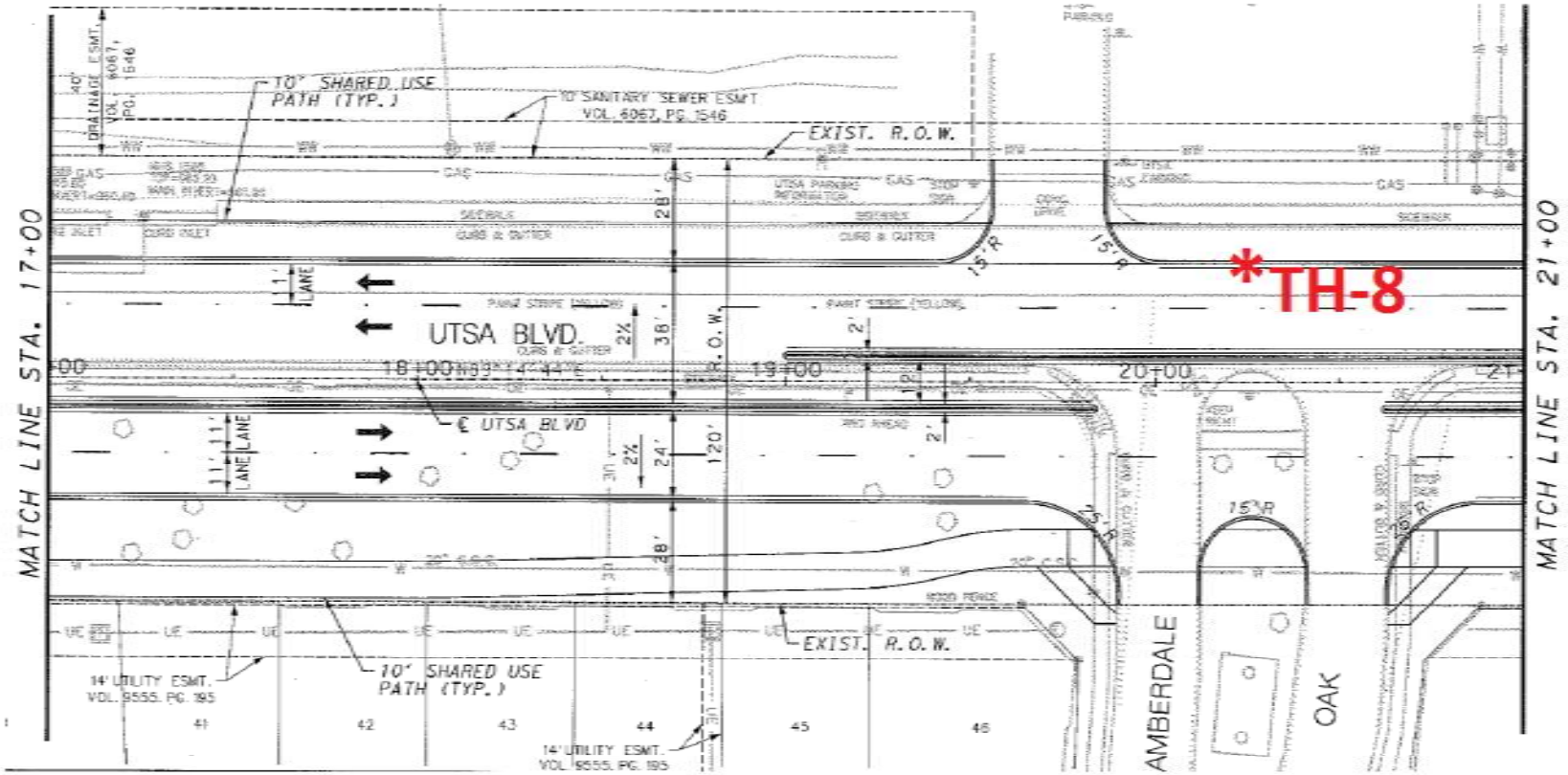

TEST HOLE LOCATION PLAN

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January 27, 2014
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RETL Project No.: G213313

PROPOSED UTSA BLVD.
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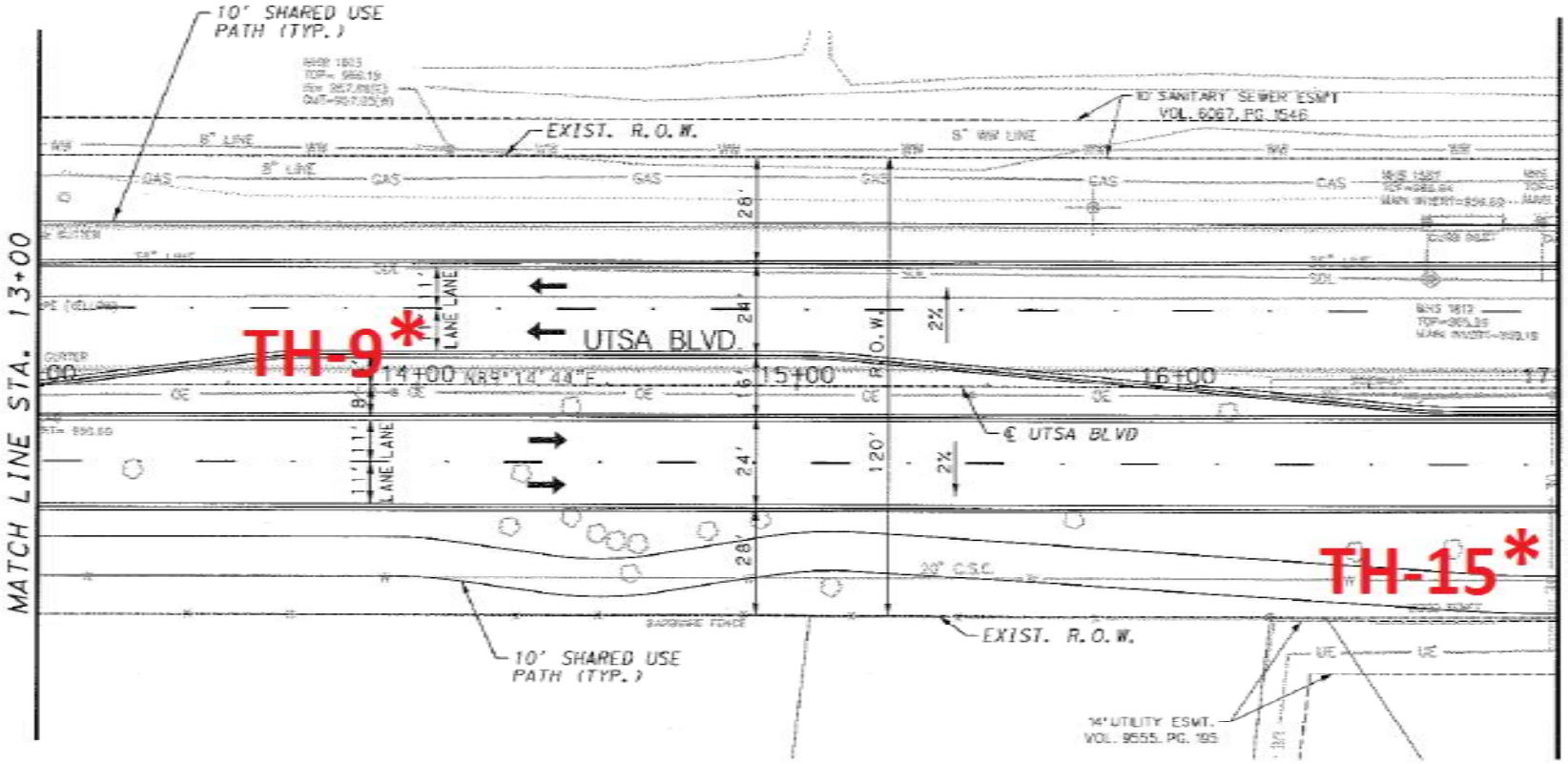

TEST HOLE LOCATION PLAN

NO SCALE

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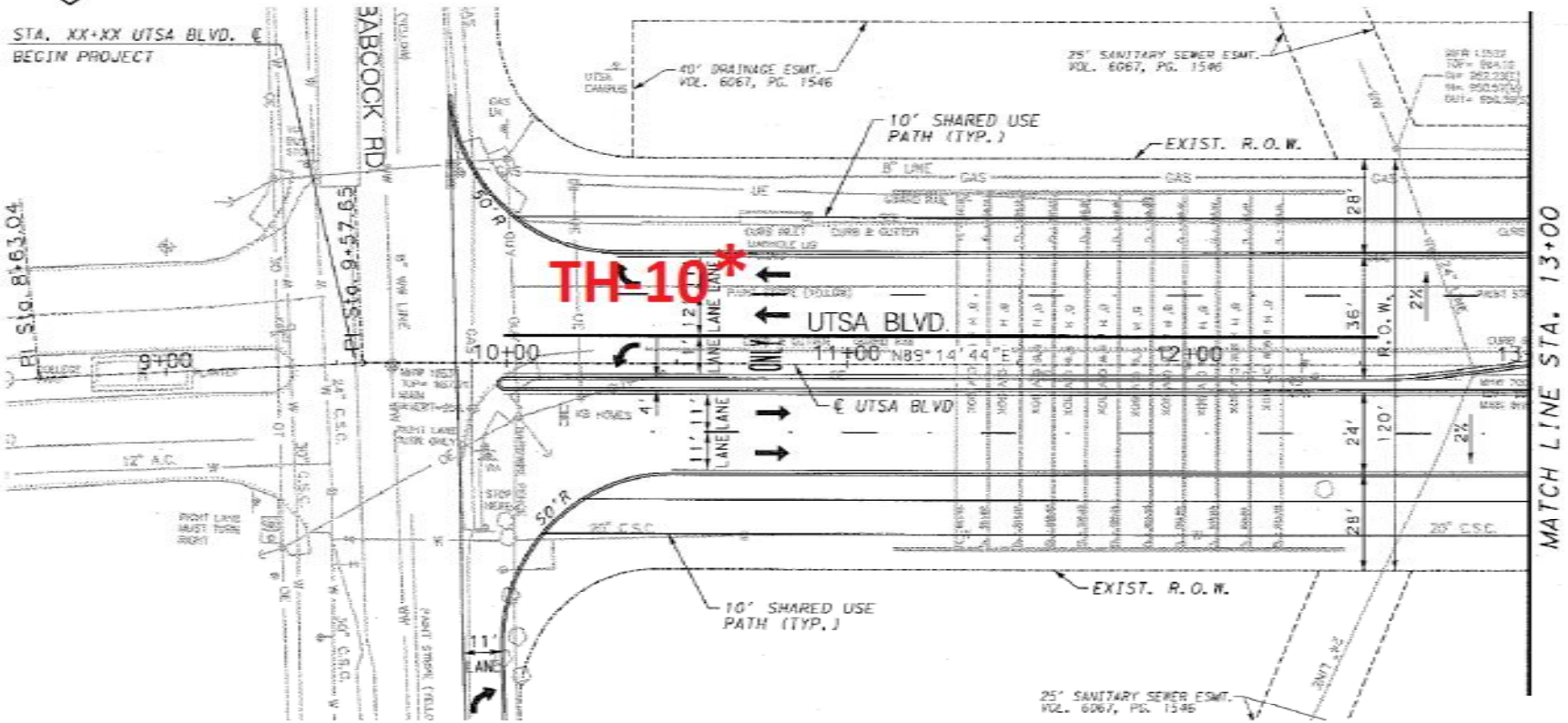

TEST HOLE LOCATION PLAN

NO SCALE

January 27, 2014
Vickrey & Associates, Inc.
RETL Project No.: G213313

PROPOSED UTSA BLVD.
Babcock Road to Edward Ximenes
San Antonio, Texas

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10856 VANDALE STREET
SAN ANTONIO, TX 78216
(210) 495-8000

DRILLING LOG

	County Bexar	Hole 1		District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-18-13
Version 3.1	CSJ	Station	50+68	Grnd. Elev.	961.60 ft
		Offset	57' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			GRAVEL, HMAC = 4 inches / BASE = 12 inches			9	20	6		-#200 = 23%
960.1		50 (2) 50 (2)	LIMESTONE, tan, weathered							
						3	21	1		-#200 = 50%
		28 (6) 30 (6)								
5						8				
		27 (6) 28 (6)								
						9				
		20 (6) 25 (6)								
951.6										
10										
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

	County Bexar	Hole	2	District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-18-13
Version 3.1	CSJ	Station	49+72	Grnd. Elev.	965.30 ft
		Offset	20' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
963.8		8 (6) 27 (6)	GRAVEL, HMAC = 3 inches / BASE = 12 inches			8				
			CLAY, lean, sandy, gray (CL)			14	34	16		-#200 = 53%
961.3		17 (6) 21 (6)								
5			LIMESTONE, tan, competent			11				
		50 (2) 50 (2)				9	17	1		-#200 = 54%
		50 (3) 50 (3)								
955.3										
10										
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger:** A. Ray **Organization:** RETL

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DRILLING LOG

WinCore Version 3.1	County Bexar	Hole 3		District San Antonio	
	Highway	Structure Roadway and Noise Walls		Date 12-18-13	
	CSJ	Station 46+40		Grnd. Elev. 973.20 ft	
		Offset 38' LT		GW Elev. N/A	

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	Properties: LL	Properties: PI	Properties: Wet Den. (pcf)	Additional Remarks
971.7		11 (6) 14 (6)	GRAVEL, HMAC = 3 inches / BASE = 8 inches			9	14	3		#200 = 16
			LIMESTONE, tan, weathered to competent			6				
		50 (5) 50 (4)								
5						5	21	6		#200 = 60%
		50 (1) 50 (1)								
966.2										
10										
15										
20										
25										
30										

Remarks: auger refusal at 7 feet

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

WinCore Version 3.1	County Bexar	Hole	4	District	San Antonio
	Highway	Structure	Roadway and Noise Walls	Date	12-18-13
	CSJ	Station	40+54	Grnd. Elev.	984.60 ft
		Offset	11' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			GRAVEL, HMAC = 2.5 inches / BASE = 14 inches			10				
983.1			CLAY, lean, light brown, with limestone layer ay 6' (CL)							
		12 (6) 35 (6)								
5						9	40	25		#200 = 41%
		50 (3) 50 (1)								
978.1			CLAY, fat, light brown (CH)							
						15	52	36		#200 = 88%
		19 (6) 27 (6)								
974.6										
10										
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger:** A. Ray **Organization:** RETL

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DRILLING LOG

	County Bexar	Hole 5		District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-17-13
Version 3.1	CSJ	Station	34+97	Grnd. Elev.	980.50 ft
		Offset	43' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			GRAVEL, HMAC = 2 inches / BASE = 9 inches			6	17	2		#200 = 25%
979.		4 (6) 4 (6)								
			CLAY, fat, with gravel, gray (CH)			24	64	46		#200 = 78%
976.5		50 (3) 50 (1)								
5			LIMESTONE, light brown, weathered to competent			5				
						8				
		43 (4) 50 (4)								
970.5										
10										
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

WinCore Version 3.1	County	Bexar	Hole	6	District	San Antonio
	Highway		Structure	Roadway and Noise Walls	Date	12-17-13
	CSJ		Station	30+65	Grnd. Elev.	977.30 ft
			Offset	12' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Properties: Wet Den. (pcf)	Additional Remarks
975.8		4 (6) 6 (6)	GRAVEL, HMAC = 2 inches / BASE = 12 inches			6				
			CLAY, fat, gray (CH)			24	59	42		-#200 = 89%
973.3		17 (6) 50 (4)								
5			CLAY, lean, light brown (CL)			15	25	14		-#200 = 70%
		50 (1) 50 (1)								
970.3										
10										
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

	County Bexar	Hole	7	District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-17-13
Version 3.1	CSJ	Station	25+52	Grnd. Elev.	973.00 ft
		Offset	16' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
971.5		6 (6) 13 (6)	GRAVEL, HMAC = 2.5 inches / BASE = 11 inches			7	22	9		-#200 = 24%
			LIMESTONE, light brown, competent			12				
		50 (1) 50 (1)								
5						5	23	11		-#200 = 45%
		50 (1) 50 (1)								
966.										
10										
15										
20										
25										
30										

Remarks: auger refusal at 7 feet

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

WinCore Version 3.1	County Bexar	Hole	8	District	San Antonio
	Highway	Structure	Roadway and Noise Walls	Date	12-17-13
	CSJ	Station	20+18	Grnd. Elev.	968.80 ft
		Offset	34' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
967.3			GRAVEL, HMAC = 2 inches / BASE = 12 inches			7	18	4		-#200 = 23%
			LIMESTONE, tan, weathered to competent			7				
		50 (5) 50 (5)								
5						4	18	6		-#200 = 50%
		50 (1) 50 (1)								
961.8										
10										
15										
20										
25										
30										

Remarks: auger refusal at 7 feet

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger: A. Ray** **Organization: RETL**

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DRILLING LOG

	County Bexar	Hole	9	District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-17-13
Version 3.1	CSJ	Station	13+97	Grnd. Elev.	967.50 ft
		Offset	16' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Properties: Wet Den. (pcf)	Additional Remarks
			GRAVEL, HMAC = 2 inches / BASE = 17 inches			8				
966.		25 (6) 50 (1)	LIMESTONE, tan, weathered to competent							
						3	18	5		#200 = 24%
		50 (5) 50 (4)								
5						2	18	6		#200 = 29%
		50 (1) 50 (1)								
						2				
958.5										
10										
15										
20										
25										
30										

Remarks: auger refusal at 9 feet

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger: A. Ray** **Organization: RETL**

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DRILLING LOG

WinCore Version 3.1	County Bexar	Hole 10		District	San Antonio
	Highway	Structure	Roadway and Noise Walls	Date	12-17-13
	CSJ	Station	10+64	Grnd. Elev.	965.80 ft
		Offset	31' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			GRAVEL, HMAC = 2.5 inches / BASE = 15 inches			10				
964.3		8 (6) 8 (6)	LIMESTONE, tan, weathered							
						9				
		19 (6) 50 (5)								
5						7	19	5		#200 = 33%
		31 (6) 50 (1)								
						5	15	3		#200 = 18%
		15 (6) 31 (6)								
955.8		10								
15										
20										
25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger:** A. Ray **Organization:** RETL

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DRILLING LOG

WinCore Version 3.1	County	Bexar	Hole	11	District	San Antonio
	Highway	-	Structure	Roadway and Noise Walls	Date	12-10-13
	CSJ		Station	50+99	Grnd. Elev.	966.00 ft
			Offset	35' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, fat, dark gray (CH)			18	52	31		#200 = 59%
963.5		4 (6) 7 (6)								
			CLAY, lean, light brown (CL)			17				
5		8 (6) 13 (6)				17	35	22		#200 = 69%
958.5		6 (6) 9 (6)								
			CLAY, fat, gray and brown (CL)			13				
10		5 (6) 5 (6)				19	112	68		#200 = 90%
15		9 (6) 13 (6)				20				#200 = 10%
20		12 (6) 12 (6)				17				#200 = 88%
941.	25									
	30									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

WinCore Version 3.1	County	Bexar	Hole	12	District	San Antonio
	Highway	^	Structure	Roadway and Noise Walls	Date	12-4-13
	CSJ		Station	47+57	Grnd. Elev.	969.90 ft
			Offset	88' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, lean, brown (CL)			9				
967.4		43 (6) 50 (4)								
			LIMESTONE, tan, competent			11	20	5		#200 = 56%
5		50 (2) 50 (2)				3				
		50 (1) 50 (1)				3	14	1		#200 = 37%
10										
		50 (1) 50 (1)				4				
15										
		50 (1) 50 (1)				3				#200 = 38%
20										
		50 (1) 50 (1)				6				
944.9	25									
	30									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

	County Bexar	Hole	13	District	San Antonio
WinCore	Highway	Structure	Roadway and Noise Walls	Date	12-4-13
Version 3.1	CSJ	Station	39+95	Grnd. Elev.	983.30 ft
		Offset	82' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
			CLAY, fat, brown to light brown (CL)			23	55	34		#200 = 92%
		5 (6) 5 (6)								
						22				
5		3 (6) 3 (6)								
						23				
975.8		34 (6) 50 (1)	LIMESTONE, tan, competent			7	23	11		#200 = 50%
10		50 (1) 50 (1)								
						5				#200 = 10%
15		50 (1) 50 (1)								
						3				
20		50 (1) 50 (1)								
						5				
958.3	25									
	30									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

	County	Bexar	Hole	14	District	San Antonio
WinCore	Highway		Structure	Roadway and Noise Walls	Date	12-4-13
Version 3.1	CSJ		Station	33+63	Grnd. Elev.	982.90 ft
			Offset	88' LT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Properties: Wet Den. (pcf)	Additional Remarks
			CLAY, fat, brown to light brown (CH)			17				
		4 (6) 6 (6)								
						22	65	42		#200 = 87%
5		6 (6) 6 (6)								
						21				
975.4		19 (6) 50 (1)	LIMESTONE, tan, competent			7				
10										
		50 (1) 50 (1)								
						3				
15										
		50 (1) 50 (1)								
						1				
20										
		50 (1) 50 (0)								
						1				
957.9 25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling Logger: A. Ray Organization: RETL

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DRILLING LOG

	County	Bexar	Hole	15	District	San Antonio
WinCore	Highway		Structure	Roadway and Noise Walls	Date	12-3-13
Version 3.1	CSJ		Station	16+85	Grnd. Elev.	966.00 ft
			Offset	41' RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test Lateral Press. (psi)	Triaxial Test Deviator Stress (psi)	Properties MC	Properties LL	Properties PI	Properties Wet Den. (pcf)	Additional Remarks
			CLAY, fat, dark brown to brown (CH)			20	61	38		#200 = 51%
		6 (6) 9 (6)				7				
5		14 (6) 27 (6)				11				
958.5		5 (2) 25 (1)	LIMESTONE, tan, competent to weathered			4	14	2		#200 = 16%
10		50 (3) 50 (1)				6				
15		50 (1) 50 (1)				6				
20		12 (6) 20 (6)				7	19	6		#200 = 61%
941.	25									
	30									

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling **Logger:** A. Ray **Organization:** RETL

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DRILLING LOG

WinCore Version 3.1

County	Bexar	Hole	16	District	San Antonio
Highway		Structure	Roadway and Noise Walls	Date	12-3-13
CSJ		Station	23+19	Grnd. Elev.	971.00 ft
		Offset	43' RT	GW Elev.	N/A

Elev. (ft)	LOG	Texas Cone Penetrometer	Strata Description	Triaxial Test: Lateral Press. (psi)	Triaxial Test: Deviator Stress (psi)	Properties: MC	LL	PI	Wet Den. (pcf)	Additional Remarks
		50 (1) 50 (1)	CLAY, lean, with gravel, dark gray to brown (CL)			27				
						25				
5		50 (3) 50 (2)				12	44	29		#200 = 50%
963.5		50 (1) 50 (1)	LIMESTONE, tan, competent			1	14	1		#200 = 21%
10		50 (1) 50 (1)				1				
15		50 (1) 50 (1)				1				
20		50 (1) 50 (0)				1				
946. 25										
30										

Remarks:

The ground water elevation was not determined during the course of this boring.

Driller: 1J2S Drilling

Logger: A. Ray

Organization: RETL

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FOUNDATION CAPACITY

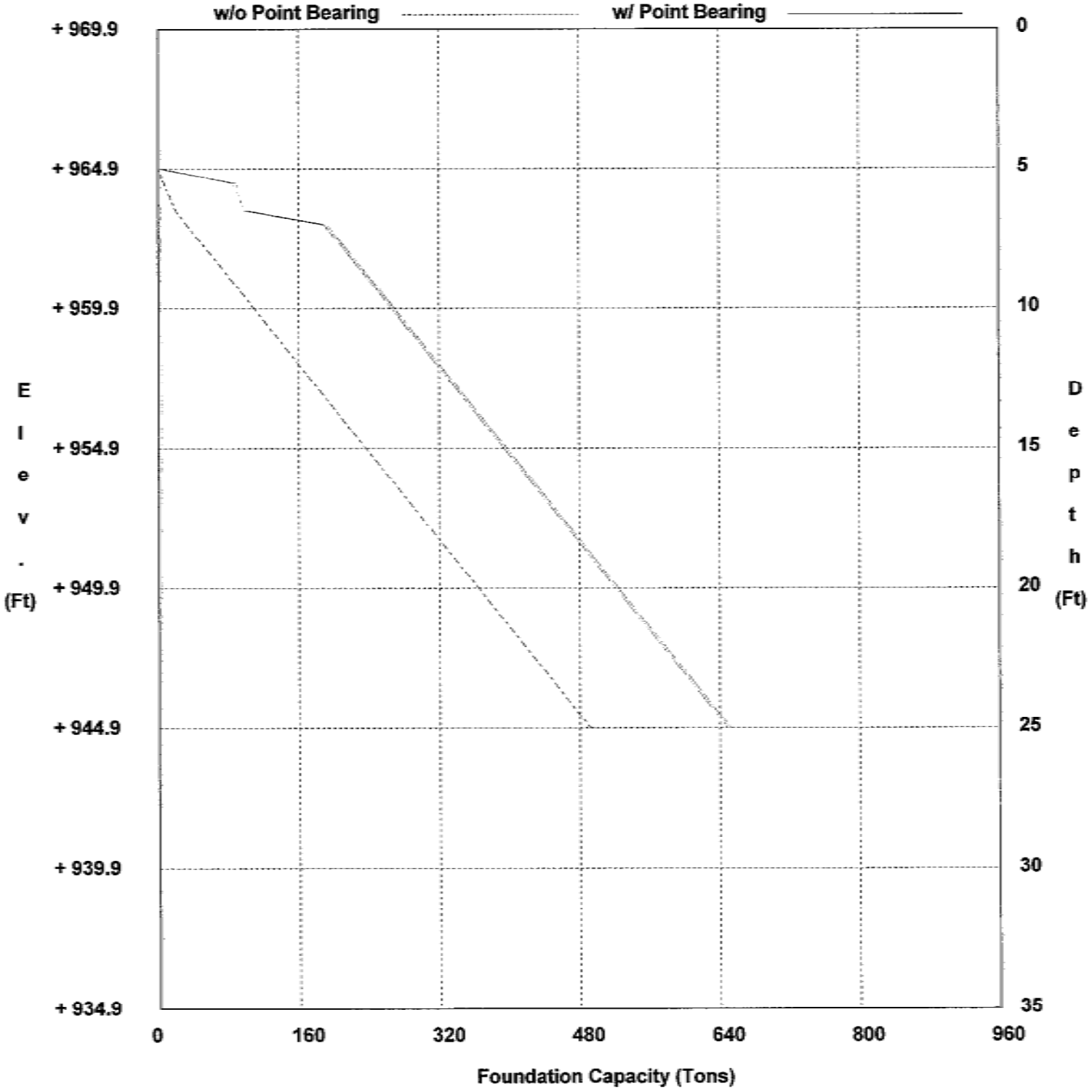
WinCore
Version 3.1

County	Bexar	Hole	12	District	San Antonio
Highway		Structure	Roadway and Noise Walls	Date	12-4-13
Control		Station	47+57	Grnd. Elev.	969.90 ft
		Offset	88' LT	GW Elev.	N/A

30 inch Drilled Shaft
20 ton Design Load
Tip Elevation = + 962.4

+969.9 Top Hole Elevation
+964.9 Disregard Elevation

Disregard above hard strata disabled
Pb: 2 Diameters Below Tip Checked
TCP Capacity Values Used
0.7 Soil Reduction Factor Used



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FOUNDATION CAPACITY

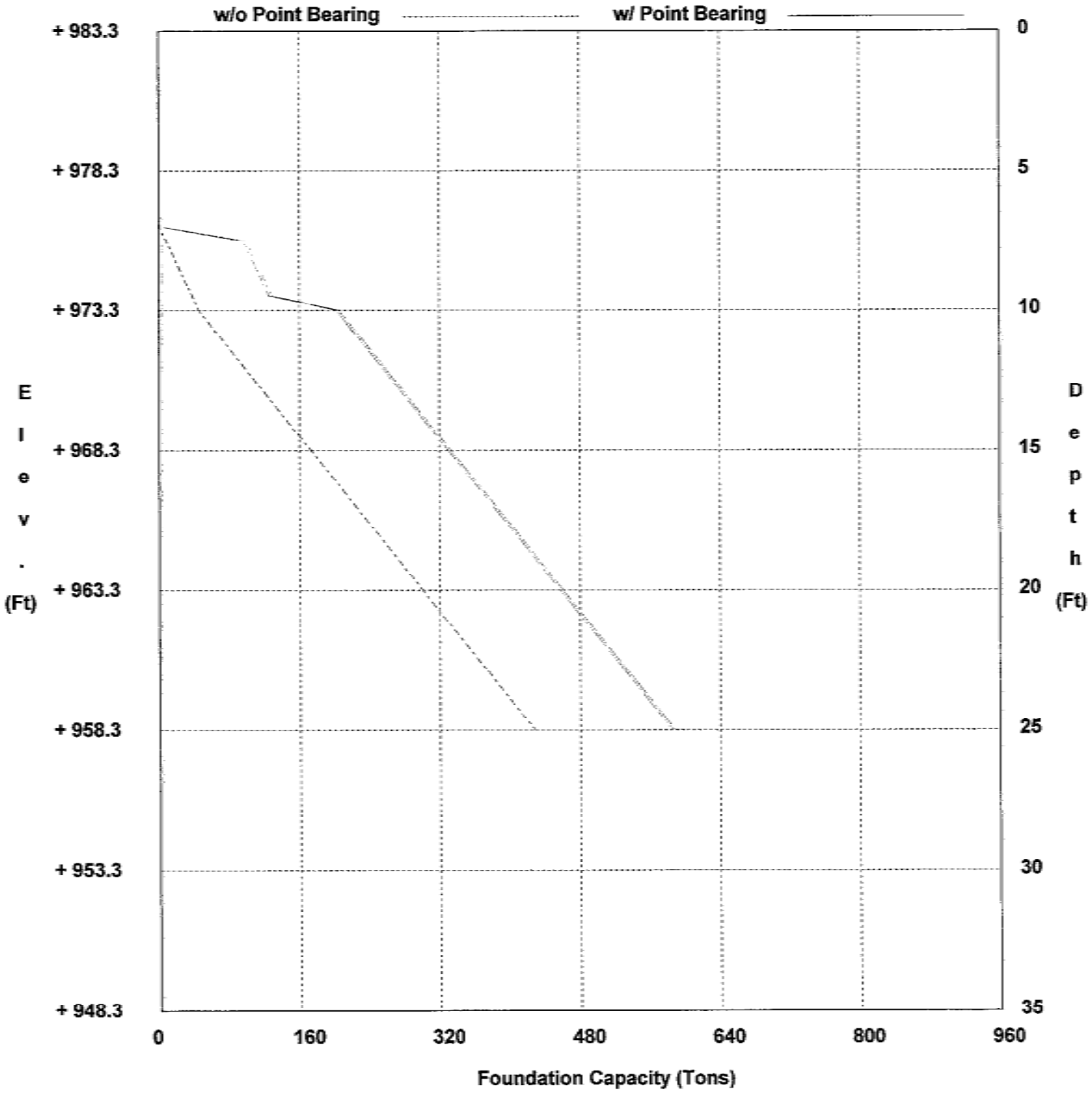
WinCore
Version 3.1

County	Bexar	Hole	13	District	San Antonio
Highway		Structure	Roadway and Noise Walls	Date	12-4-13
Control		Station	39+95	Grnd. Elev.	983.30 ft
		Offset	82' LT	GW Elev.	N/A

30 inch Drilled Shaft
20 ton Design Load
Tip Elevation = + 975.8

+983.3 Top Hole Elevation
+978.3 Disregard Elevation

Disregard above hard strata disabled
Pb: 2 Diameters Below Tip Checked
TCP Capacity Values Used
0.7 Soil Reduction Factor Used



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FOUNDATION CAPACITY

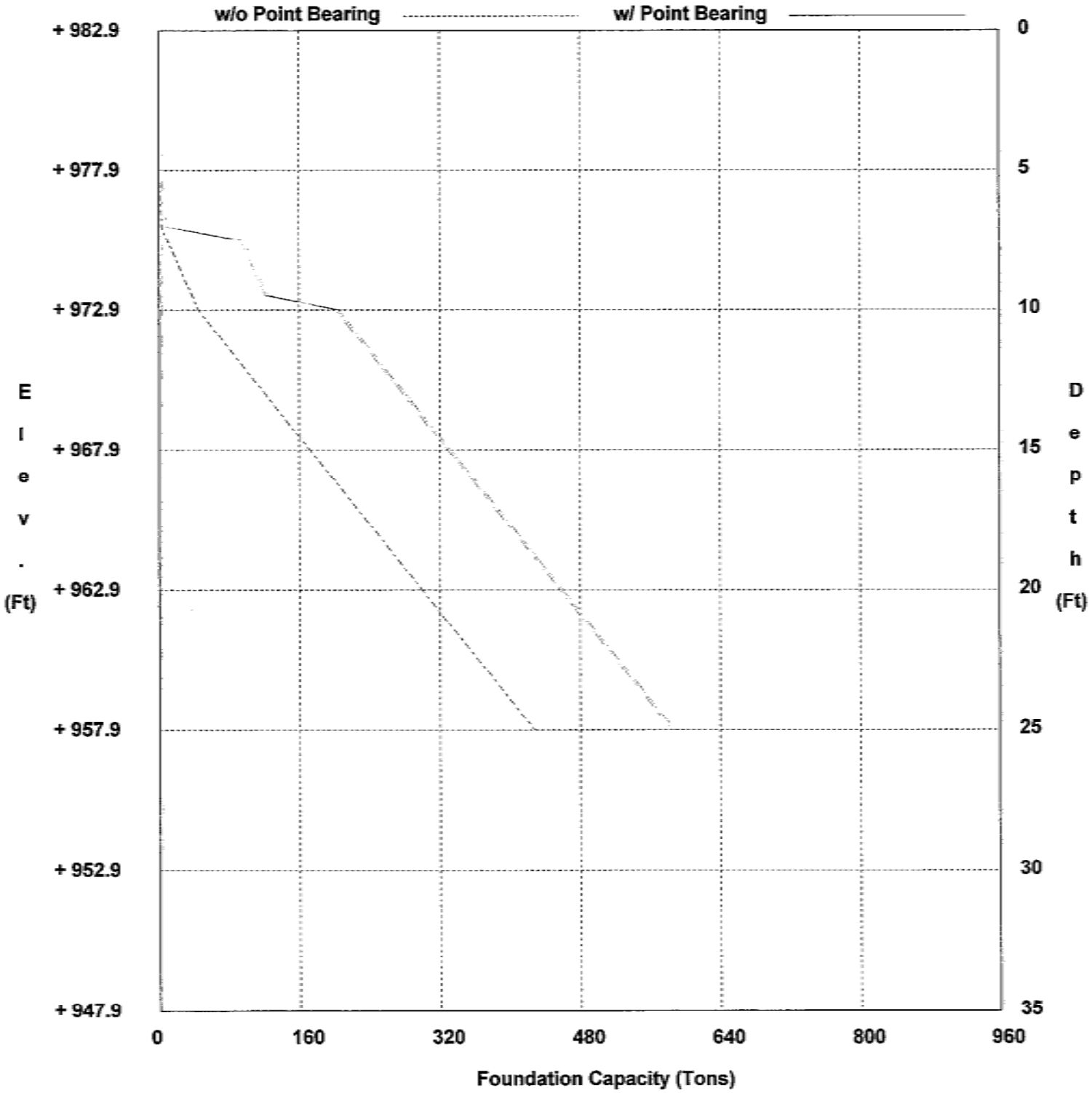
WinCore
Version 3.1

County	Bexar	Hole	14	District	San Antonio
Highway		Structure	Roadway and Noise Walls	Date	12-4-13
Control		Station	33+63	Grnd. Elev.	982.90 ft
		Offset	88' LT	GW Elev.	N/A

30 inch Drilled Shaft
20 ton Design Load
Tip Elevation = + 975.4

+982.9 Top Hole Elevation
+977.9 Disregard Elevation

Disregard above hard strata disabled
Pb: 2 Diameters Below Tip Checked
TCP Capacity Values Used
0.7 Soil Reduction Factor Used



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FOUNDATION CAPACITY

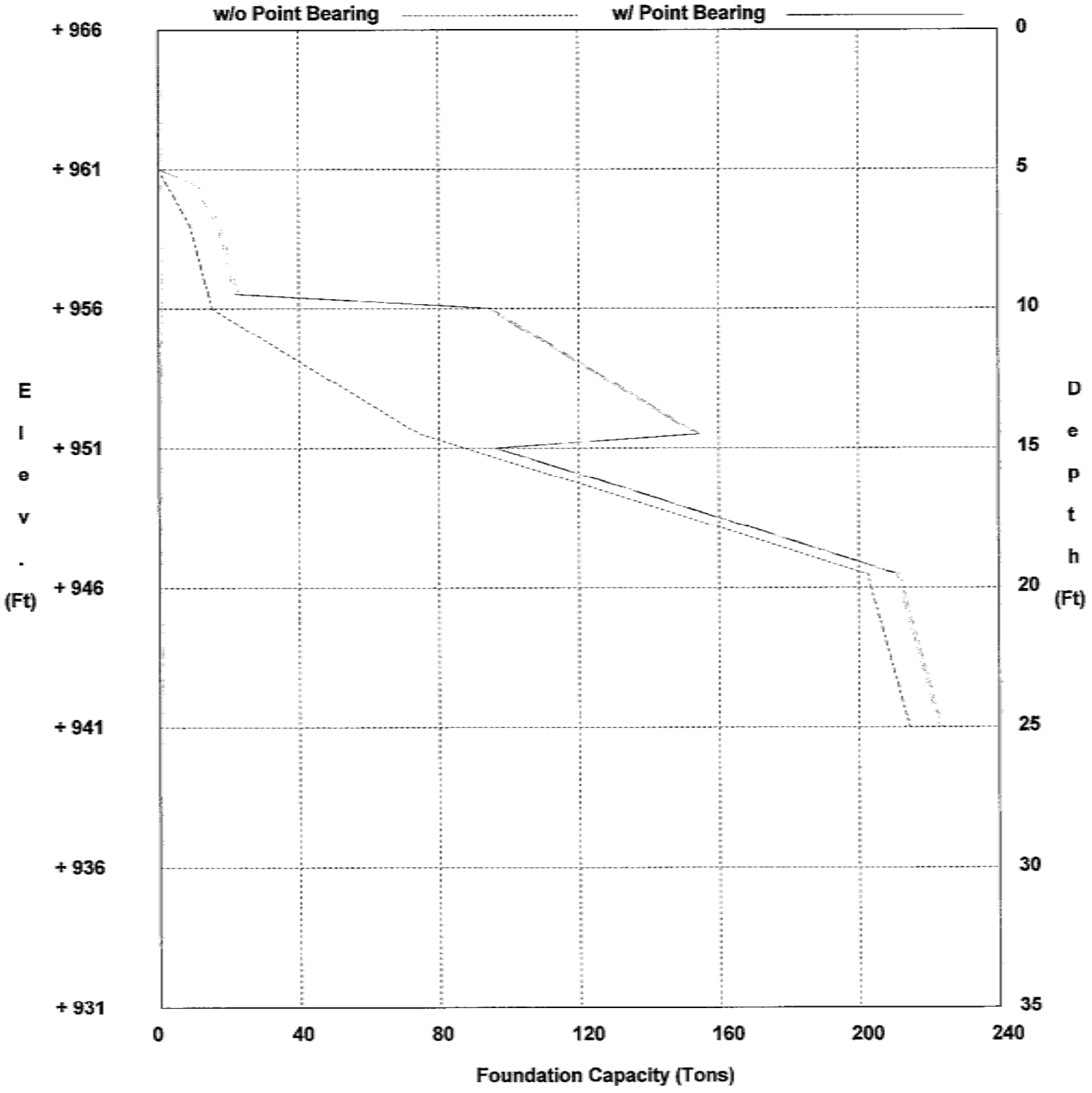
WinCore
Version 3.1

County	Bexar	Hole	15	District	San Antonio
Highway		Structure	Roadway and Noise Walls	Date	12-3-13
Control		Station	16+85	Grnd. Elev.	966.00 ft
		Offset	41' RT	GW Elev.	N/A

30 inch Drilled Shaft
20 ton Design Load
Tip Elevation = + 957.5

+966 Top Hole Elevation
+961 Disregard Elevation

Disregard above hard strata disabled
Pb: 2 Diameters Below Tip Checked
TCP Capacity Values Used
0.7 Soil Reduction Factor Used



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FOUNDATION CAPACITY

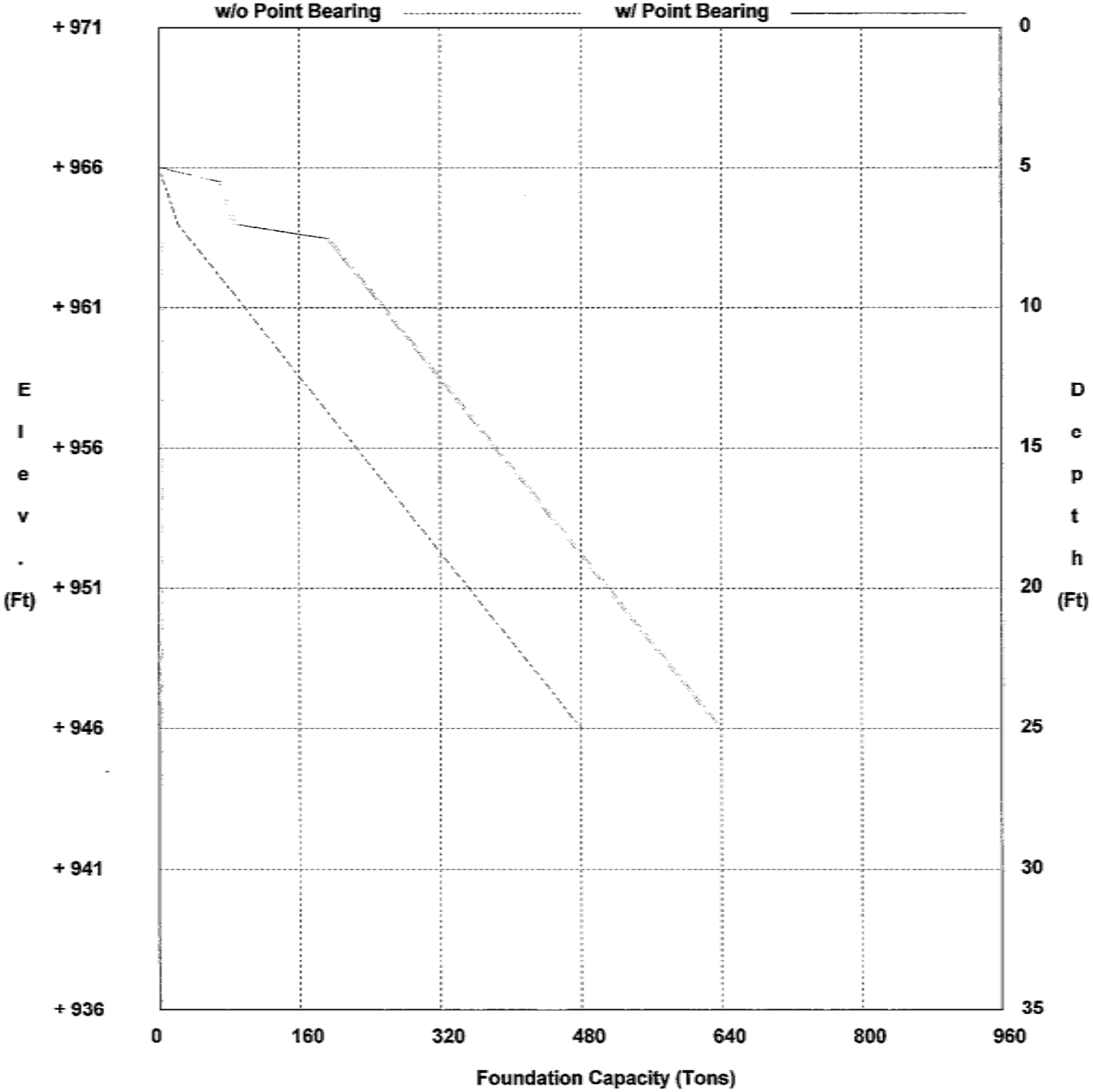
WinCore
Version 3.1

County	Bexar	Hole	16	District	San Antonio
Highway	-	Structure	Roadway and Noise Walls	Date	12-3-13
Control		Station	23+19	Grnd. Elev.	971.00 ft
		Offset	43' RT	GW Elev.	N/A

30 inch Drilled Shaft
20 ton Design Load
Tip Elevation = + 963.5

+971 Top Hole Elevation
+966 Disregard Elevation

Disregard above hard strata disabled
Pb: 2 Diameters Below Tip Checked
TCP Capacity Values Used
0.7 Soil Reduction Factor Used



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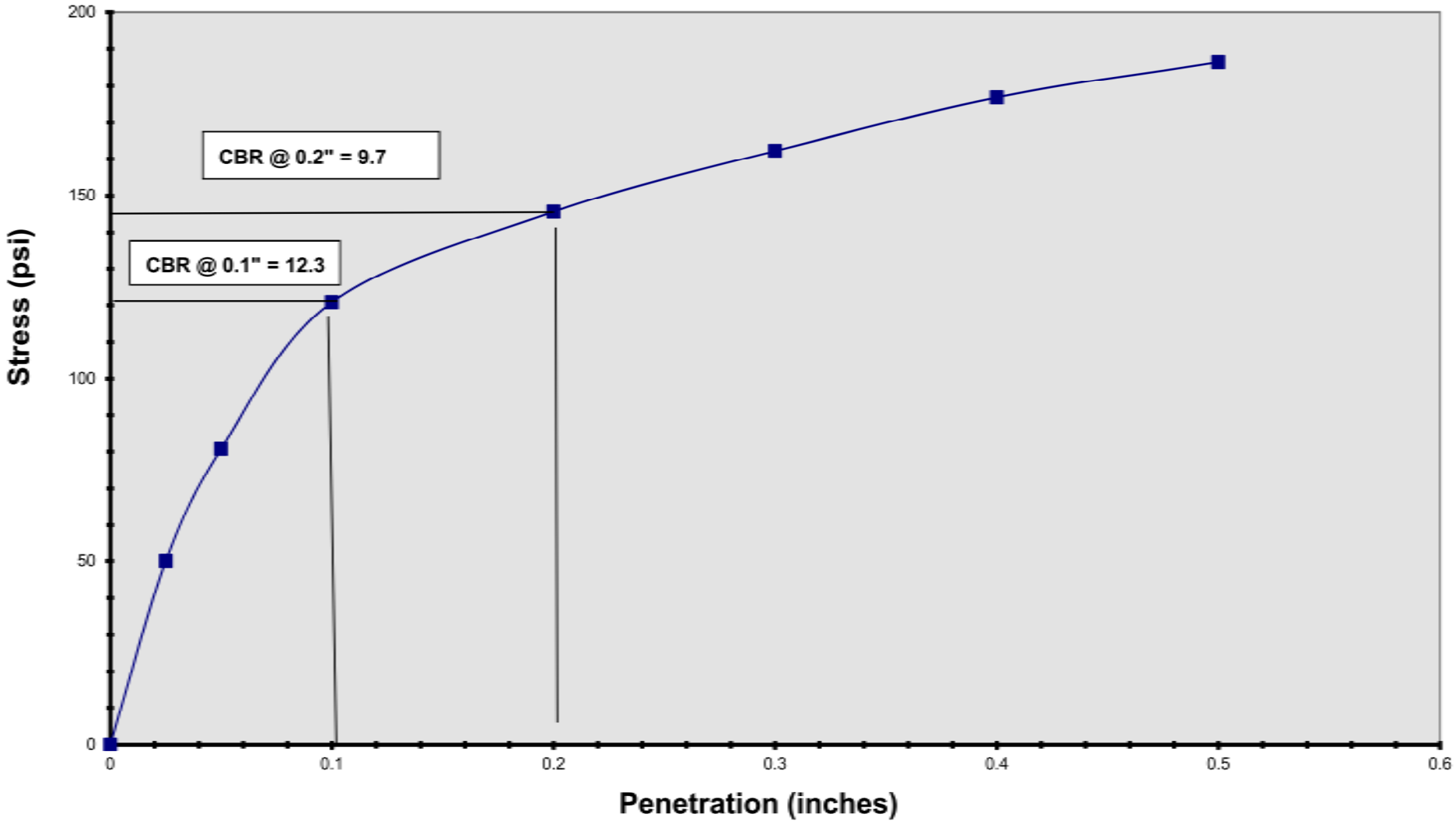
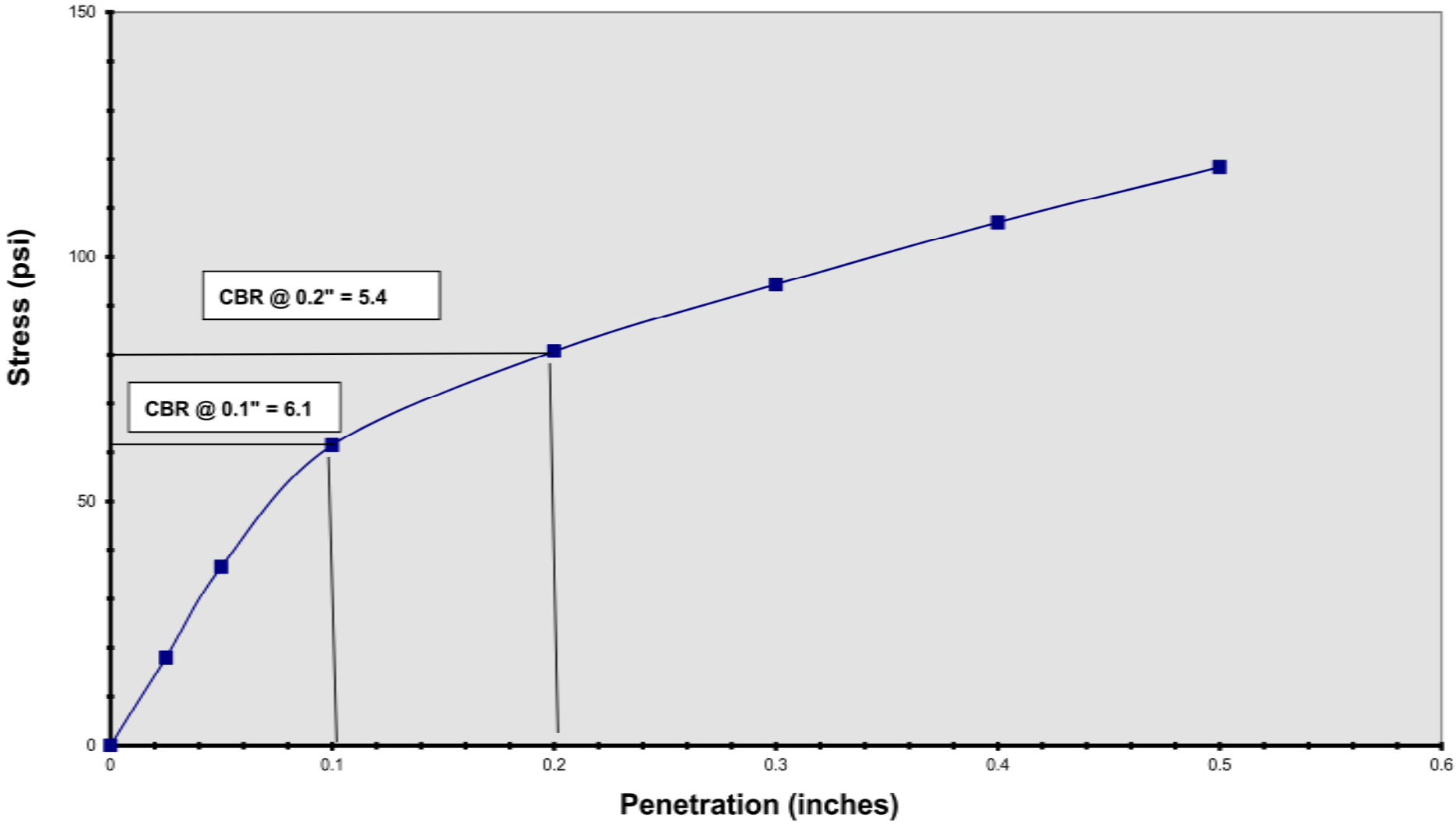
CBR - Stress versus Penetration Curve



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
UTSA Blvd. Reconstruction San Antonio, Bexar County, Texas	98.2 pcf (99% of max density)	12.30	January 2014
SAMPLE DESCRIPTION	MOLDED MOISTURE	CBR @ 0.2 INCHES PENETRATION	RETL PROJ. NO.
Subgrade Bulk Sample B-4 Lean Clay (CL)	19.6%	9.70	G213313

ROCK ENGINEERING AND TESTING LABORATORY, INC.

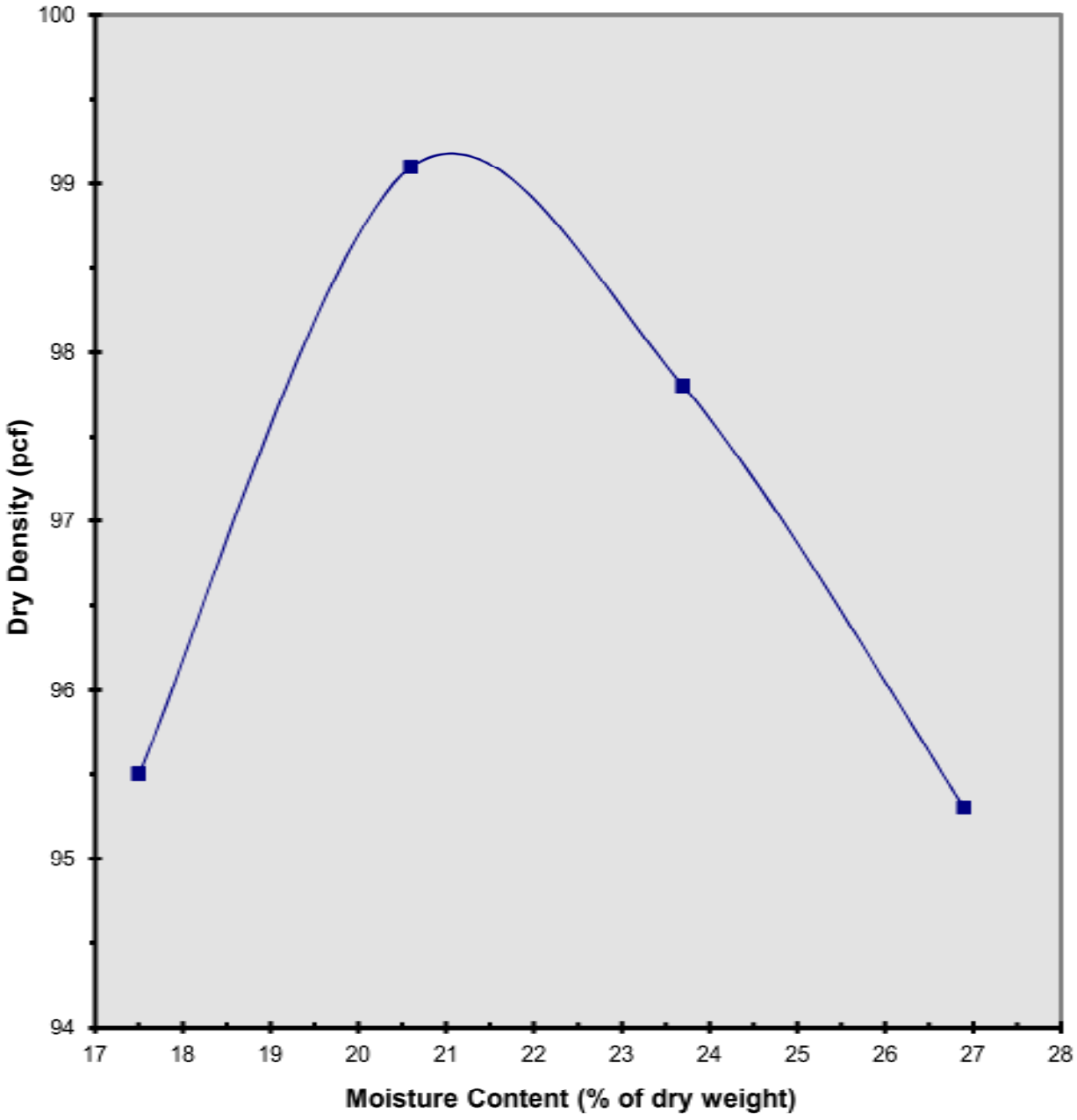
CBR - Stress versus Penetration Curve



PROJECT DESCRIPTION	MOLDED DRY DENSITY	CBR @ 0.1 INCH PENETRATION	TEST DATE
UTSA Blvd. Reconstruction San Antonio, Bexar County, Texas	93.8 pcf (95% of max density)	6.40	January 2014
SAMPLE DESCRIPTION	MOLDED MOISTURE	CBR @ 0.2 INCHES PENETRATION	RETL PROJ. NO.
Subgrade Bulk Sample B-8 Fat Clay (CH)	21.8%	5.10	G213313

ROCK ENGINEERING AND TESTING LABORATORY, INC.

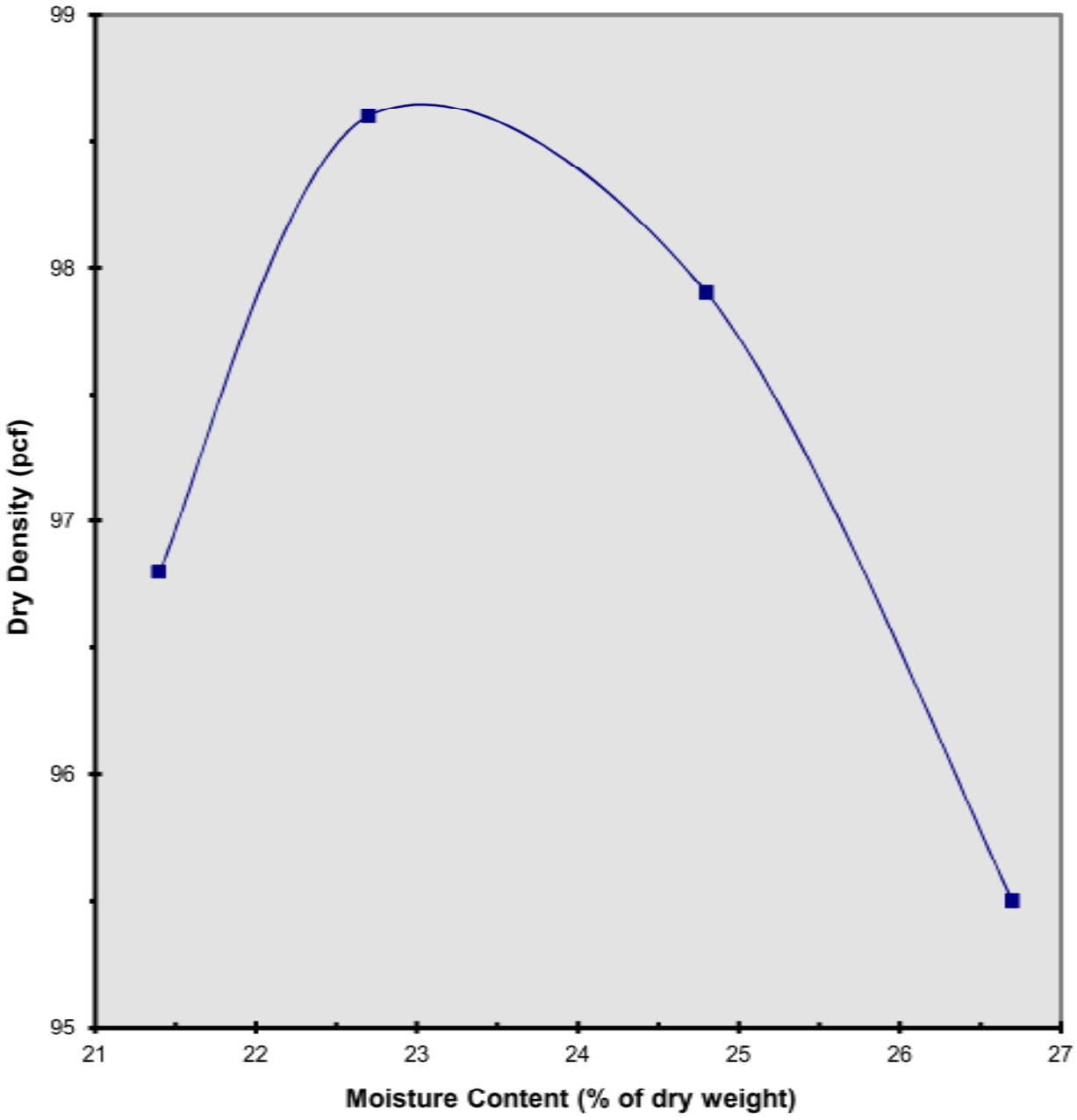
DENSITY VERSUS MOISTURE CURVE



PROJECT DESCRIPTION	MAXIMUM LAB DENSITY	TEST DATE
UTSA Blvd. Reconstruction San Antonio, Texas	99.2 pcf ASTM D698A	January 2014
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Subgrade Bulk Sample Boring B-4 Lean Clay (CL)	21.0%	G213313

ROCK ENGINEERING AND TESTING LABORATORY, INC.

DENSITY VERSUS MOISTURE CURVE



PROJECT DESCRIPTION	MAXIMUM LAB DENSITY	TEST DATE
UTSA Blvd. Reconstruction San Antonio, Texas	98.5 pcf ASTM D698A	January 2014
SAMPLE DESCRIPTION	**OPTIMUM MOISTURE**	**RETL PROJ. NO.**
Subgrade Bulk Sample Boring B-8 Fat Clay (CH)	23.0%	G213313

ROCK ENGINEERING AND TESTING LABORATORY, INC.

Project: UTSA Blvd. Reconstruction Project (RETL Project No. G213313)
Location: B-4

Date: 12/18/2013
Personnel: LV/AR
Hammer Wt.: 17.6 lbs.
Weather: Clear
Water Table: Deeper Than 10-feet

Depth of Zero Point Below Surface: **17**-inches
Material Classification: Lean Clay (CL)
Starting Heighth (mm): 650
Starting Heighth (in): 25.6
Number of Blows: 15

Blow # (N)	Gauge Reading (mm)	Penetration (mm)	Cummulative Penetration (mm)	Penetration (in)	Cummulative Penetration (in)	Hammer Factor	DCP Index (mm/blow)	CBR (%)	Ultimate Bearing Capacity (psf)
0	650	0	0	0	0				
1	670	20	20	0.79	0.79	1	20	10.19	2552.25
2	690	20	40	0.79	1.57	1	20	10.19	2552.25
3	720	30	70	1.18	2.76	1	30	6.47	1887.85
4	740	20	90	0.79	3.54	1	20	10.19	2552.25
5	760	20	110	0.79	4.33	1	20	10.19	2552.25
6	780	20	130	0.79	5.12	1	20	10.19	2552.25
7	800	20	150	0.79	5.91	1	20	10.19	2552.25
8	820	20	170	0.79	6.69	1	20	10.19	2552.25
9	840	20	190	0.79	7.48	1	20	10.19	2552.25
10	860	20	210	0.79	8.27	1	20	10.19	2552.25
11	870	10	220	0.39	8.66	1	10	22.15	4273.60
12	890	20	240	0.79	9.45	1	20	10.19	2552.25
13	900	10	250	0.39	9.84	1	10	22.15	4273.60
14	920	20	270	0.79	10.63	1	20	10.19	2552.25
15	930	10	280	0.39	11.02	1	10	22.15	4273.60

Average CBR (%)	Average Bearing Capacity (psf)
12.34	2852.23

Project: UTSA Blvd. Reconstruction Project (RETL Project No. G213313)
Location: B-8

Date: 12/17/2013
Personnel: LV/AR
Hammer Wt.: 17.6 lbs.
Weather: Clear
Water Table: Deeper Than 10-feet

Depth of Zero Point Below Surface: 14-inches
Material Classification: Fat Clay (CH)
Starting Heighth (mm): 670
Starting Heighth (in): 26.4
Number of Blows: 15

Blow # (N)	Gauge Reading (mm)	Penetration (mm)	Cummulative Penetration (mm)	Penetration (in)	Cummulative Penetration (in)	Hammer Factor	DCP Index (mm/blow)	CBR (%)	Ultimate Bearing Capacity (psf)
0	670	0	0	0	0				
1	710	40	40	1.57	1.57	1	40	4.69	1524.24
2	750	40	80	1.57	3.15	1	40	4.69	1524.24
3	790	40	120	1.57	4.72	1	40	4.69	1524.24
4	820	30	150	1.18	5.91	1	30	6.47	1887.85
5	830	10	160	0.39	6.30	1	10	22.15	4273.60
6	840	10	170	0.39	6.69	1	10	22.15	4273.60
7	850	10	180	0.39	7.09	1	10	22.15	4273.60
8	860	10	190	0.39	7.48	1	10	22.15	4273.60
9	870	10	200	0.39	7.87	1	10	22.15	4273.60
10	890	20	220	0.79	8.66	1	20	10.19	2552.25
11	900	10	230	0.39	9.06	1	10	22.15	4273.60
12	910	10	240	0.39	9.45	1	10	22.15	4273.60
13	920	10	250	0.39	9.84	1	10	22.15	4273.60
14	930	10	260	0.39	10.24	1	10	22.15	4273.60
15	940	10	270	0.39	10.63	1	10	22.15	4273.60

Average CBR (%)	Average Bearing Capacity (psf)
16.82	3449.92

CLIENT: Rock Engineering & Testing Laboratory, I **Project:** G213313 UTSA Blvd
Lab Order: 1312097

Alamo Lab ID	Client ID	Collection Date	Analyses	Matrix	Result	Rpt Limit	Units	DF
TestName: TEX-620-J		**TestNo:** TX620J	**Date Analyzed** 12/27/2013 10:00:00 AM		Initials: SS			
1312097-01A	B-1 2.5' - 4'	12/18/2013 1:00:00 PM	Sulfate	Solid	256	100	mg/Kg	10
1312097-02A	B-3 2.5' - 4'	12/18/2013 1:00:00 PM	Sulfate	Solid	188	100	mg/Kg	10
1312097-03A	B-4 5' - 6.5'	12/18/2013 1:00:00 PM	Sulfate	Solid	< 100	100	mg/Kg	10
1312097-04A	B-5 2.5' - 4'	12/18/2013 1:00:00 PM	Sulfate	Solid	218	100	mg/Kg	10
1312097-05A	B-6 2.5' - 4'	12/18/2013 1:00:00 PM	Sulfate	Solid	< 100	100	mg/Kg	10
1312097-06A	B-10 2.5' - 4'	12/18/2013 1:00:00 PM	Sulfate	Solid	< 100	100	mg/Kg	10

Approved by:

Report of Laboratory Analysis

CLIENT: Rock Engineering & Testing Laboratory, I **Project:** G213313
Lab Order: 1401025

Alamo Lab ID	Client ID	Collection Date	Analyses	Matrix	Result	Rpt Limit	Units	DF
TestName: CORROSIVITY by pH		**TestNo:** SW9045B	**Date Analyzed** 1/8/2014 1:30:00 PM		Initials: SS			
1401025-01A	B-4 2% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	11.70	1	pH Units	1
1401025-02A	B-4 4% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	11.80	1	pH Units	1
1401025-03A	B-4 6% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	12.00	1	pH Units	1
1401025-04A	B-8 2% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	11.30	1	pH Units	1
1401025-05A	B-8 4% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	11.50	1	pH Units	1
1401025-06A	B-8 6% Lime	1/7/2014 3:30:00 PM	pH at 25 o C	Soil	11.70	1	pH Units	1

Approved by: 

Report of Laboratory Analysis

Engineering & Testing
Laboratory, Inc.

6817 Leopard Street
Corpus Christi, Texas 78409
Office: (361) 883-4555 Fax: (361) 883-4711

KEY TO SOIL CLASSIFICATIONS AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Letter	Symbol: Hatching	Symbol: Color	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		RED	Well – graded gravels or gravel – sand mixtures, little or no fines
		GP			Poorly-graded gravels or gravel – sand mixtures, little or no fines
		GM		YELLOW	Silty gravels, gravel – sand – silt mixtures
		GC			Clayey gravels, gravel - sand – clay mixtures
	SAND AND SANDY SOILS	SW		RED	Well - graded sands or gravelly sands, little or no fines
		SP			Poorly – graded sands or gravelly sands, little or no fines
		SM		YELLOW	Silty sands, sand – silt mixtures
		SC			Clayey sands, sand – clay mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML		GREEN	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL			Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL			Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS LL > 50	MH		BLUE	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH			Inorganic clays of high plasticity, fat clays
		OH			Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		Pt		ORANGE	Peat and other highly organic soils

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 (VARVED) – composed of thin layers of varying color and texture, usually grading from sand or silt at the bottom to clay at the top.

CRUMBLY – cohesive soils which break into small blocks or crumbs on drying

CALCAREOUS – containing appreciable quantities of calcium carbonate, generally nodular.

WELL GRADED – having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

POORLY GRADED - predominantly of one grain size (uniformly graded) or having a range of sizes with some intermediate size missing (gap or skip graded)

SYMBOLS FOR TEST DATA

M/C = 15 – Natural moisture content in percent.

γ = 95 – Dry unit weight in lbs/cu ft.

Qu = 1.23 – Unconfined compression strength in tons/ sq ft.

51 – 21 – 30 – Liquid limit, Plastic limit, and Plasticity index.

30% FINER – Percent finer than No. 200 mesh sieve

30 B/F – Blows per foot, standard penetration test.

▼ – Ground water table.

TERMS DESCRIBING CONSISTENCY OF SOIL (2)

COARSE GRAINED SOILS		FINE GRAINED SOILS		
DESCRIPTIVE TERM	NO. BLOWS / FT. STANDARD PEN. TEST	DESCRIPTIVE TERM	NO. BLOWS / FT. STANDARD PEN. TEST	UNCONFINED COMPRESSION TONS PER SQ. FT.
Very loose	0 – 4	Very Soft	< 2	< 0.25
Loose	4 – 10	Soft	2 – 4	0.25 – 0.50
Firm (medium)	10 – 30	Plastic (med. Stiff)	4 – 8	0.50- 1.00
Dense	30 – 50	Stiff	8 – 15	1.0 – 2.00
Very Dense	over 50	Very Stiff	15 – 30	2.00 – 4.00
		Hard	over 30	over 4.00

Field classification for "Consistency" is determined with a 0.25" diameter penetrometer.