Geotechnical Engineering Report

Three Span Bridge
Interstate 35 Over Waterloo Road
Oklahoma and Logan Counties, Oklahoma
Engineering Contract No. EC-1500N
Job Piece No. 29843(04)

July 6, 2020
Terracon Project No. 03205039 Revision No. 1

Prepared for:
Garver, LLC
Tulsa, Oklahoma

Prepared by:
Terracon Consultants, Inc.
Oklahoma City, Oklahoma

July 6, 2020

Garver, LLC
6450 South Lewis, Suite 300
Tulsa, Oklahoma 74136

Attn: Mr. Jenny Sallee
P: [918] 858 4166
E: jesallee@garverusa.com

Re: Geotechnical Engineering Report
Three Span Bridge
Interstate 35 over Waterloo Road
Oklahoma and Logan Counties, Oklahoma
Job Piece No. 29843(04)
Engineering Contract No. EC-1500N
Terracon Project No. 03205029 Revision No. 1

Dear Ms. Sallee:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. The scope of our services was outlined in Engineering Contract No. EC-1500N. We were given authorization to proceed on February 12, 2020.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
Cert. Of Auth. #CA-4531 exp. 6/30/21

REGISTERED PROFESSIONAL ENGINEER
JEFFERY LYNN DEAN
16998
OKLAHOMA

Jeff Dean, P.E.
Oklahoma No. 16998

Norman Tan, P.E.
Department Manager

JD:NT\kld\n:\projects\2020\03205039\project documents\july2020

Copies to: Addressee (1 via email)

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July 6, 2020

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed Interstate 35 Bridge over Waterloo Road at the Oklahoma and Logan County line in Oklahoma. Terracon's geotechnical scope of work for this report included the advancement of eight test borings ranging in depth from approximately 52 feet to 126 feet below existing site grades.

This report describes the subsurface conditions encountered in the borings, reports test results, and provides boring logs with Standard Penetration Test and Texas Cone Penetrometer results, and photographic core logs

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site Layout	See Appendix A, Exhibits A-1 and A-2.
Structures	We understand the project will include the construction of a two three-span bridge to replace the existing bridges. The new bridges will be approximately 62.58 feet wide and 207 feet long.

2.2 Site Location and Description

Item	Description
Location	The bridge replaces the existing northbound and southbound Interstate 35 bridges over Waterloo Road in Oklahoma and Logan Counties, Oklahoma.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

The geology of this site consists of the red, clay shales, red, sandy shales and red, massive, commonly cross-bedded, lenticular, sandstones of the Garber Unit. The sandstones are more prominent in the southern portion of ODOT's Division 4 which would include this project site. Northward, the sandstones become thinner and shales become more prominent. The Garber unit outcrops in a 12 to 24 mile band across Grant, Garfield, Kingfisher, Logan, Noble, and Oklahoma Counties. Topographically, the unit generally forms rolling to gently rolling hills capped with sandstones and covered with thick growths of blackjack oak and post oak trees.

3.2 Typical Subsurface Profile

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil and rock types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1	20 to 91.5	Sand with varying amounts of silt and clay	Very loose to dense
		Moderate to high plasticity clay with varying amounts of silt, sand and gravel	Very soft to hard
Stratum 2[1]	Boring termination depths	Weathered shale, sandstone and siltstone	---

1. Highly weathered silty sandstone layer was encountered in boring A-3 at depth of about 90 to 95 feet.

Laboratory tests were conducted on selected soil samples and the test results are presented on the borings logs in Appendix A and on the report form in Appendix B.

The following table indicates the ground surface elevations and the approximate elevations of stratification changes at the respective boring locations.

Strata	Approximate Stratification Boundary Elevations (feet)							
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4
Overburden soils (ground elevation)	1110.7	1110.7	1109.3	1109.1	1110.9	1110.0	1109.5	1108.9
Weathered shale	1070.5	---	---	---	1091.0	1050.0	---	---
Weathered sandstone	1059.0	1050.5	1019.5*	1024.0	1090.5	---	1033.5	1017.5
Weathered shale interbedded with sandstone	---	1035.0	1014.5	---	---	1049.0	1024.5	---
Weathered sandstone		1025.0	1014.0	---	---	1044.0	1024.0	---
Weathered siltstone interbedded with shale	---	---	---	---	---	1034.0	1013.5	---
Weathered Shale	---	---	---	---	---	1029.0	---	---
Weathered sandstone						1024.0	1008.5	---
Boring termination elevation	1038.5	1019.5	983.5	993.0	1059.0	1019.0	993.5	987.0

***** Highly weathered sandstone

The following table indicates the ground surface elevations, approximate top of bedrock and the approximate top of competent bedrock depth and elevation at the respective boring locations. The depth to the top of bedrock encountered in the borings is presented in the following table and corresponds to the depths at which the penetration from a Standard Penetration test (SPT), conducted in accordance to ASTM D-1586, was less than or equal to 6 inches with 50 blows.

Based on current "State of Oklahoma Department of Transportation Specifications for the Geotechnical Investigations of Bridges and Related Structures", we understand that the required rock penetration does not begin until competent bedrock is encountered. The rock penetration consists of seven continuous passing Texas Cone Penetrometer (TCP) tests spaced at 5-foot intervals for a total of 30 feet of bedrock penetration in accordance with the ODOT Specifications for Geotechnical Investigations. Thus, the depth to the top of competent bedrock encountered in the borings is presented in the following table and corresponds to the depths at which the penetration from a Standard Penetration test (SPT), conducted in accordance to ASTM D-1586, was less than or equal to 6 inches with 50 blows followed by seven continuous passing Texas Cone Penetrometer (TCP) tests. Passing TCP test is define as having a penetration resistance of two consecutive 50 blows per 6 inch or less. Thus, depths to top of competent rock and the corresponding elevations shown in table do not necessarily coincide with the depths to top of weathered rock and the corresponding elevations shown on the boring logs.

Approximate Competent Bedrock Depth and Elevation						
Boring No.	**Ground Elevation (feet)**	**Bedrock Material**	**Depth to Top Rock (feet)**	**Elevation of Top of Rock (feet)**	**Depth to Top of Competent Rock (feet)**	**Elevation of Top of Competent Rock (feet)**
A-1	1110.7	Weathered shale	40	1070.5	41.5	1069.0
A-2	1110.7	Weathered sandstone	60	1050.5	60.5	1050.0
A-3	1109.3	Weathered sandstone	90	1019.5	95.0	1014.5
A-4	1109.1	Weathered sandstone	85	1024.0	85.0	1024.0
B-1	1110.9	Weathered sandstone	20	1091.0	20.5	1090.5
B-2	1110.0	Weathered shale	60	1050.0	60.5	1049.5
B-3	1109.5	Weathered sandstone	76	1033.5	85.0	1024.5
B-4	1108.9	Weathered sandstone	91.5	1017.5	91.5	1017.5

3.3 Groundwater

The borings were advanced using wash boring techniques. The water levels were measured when first encountered while drilling, WD. After completion of the borings, water was bailed from the boreholes. Water levels were then measured in the boreholes after drilling, AD, and again at least 24 hours after boring completion. At these times, groundwater was observed at the following depths:

Boring No.	Water Level (WD/AD) Depth (ft.), Elevation (ft.)	Water Level (After 24 Hours)* Depth (ft.), Elevation (ft.)
A-1	Dry to 10 (WD)	33.5, 1077.0
A-2	Dry to 10 (WD) / 32.5, 1078.0 (AD)	---
A-3	Dry to 1.5 (WD) / 35.0, 1074.0 (AD)	31.0, 1078.0
A-4	Dry to 1.5 (WD)	---
B-1	Dry to 1.5 (WD) / 15.0, 1096.0 (AD)	---
B-2	Dry to 10 (WD) / 31.0, 1079.0 (AD)	90, 1020.0
B-3	Dry to 10 (WD)	30, 1179.5
B-4	Dry to 10 (WD) / 32.0, 1077.0(AD)	---

***** 24-hour water levels were not available for all borings that were drilled in the pavement areas due to traffic conditions.

Long-term monitoring with observation wells, sealed from the influence of surface water, would be required to accurately define the potential range of groundwater conditions at this site.

Fluctuations in the groundwater level should be expected due to seasonal variations in the amount of rainfall, runoff, and other factors not apparent at the time the borings were drilled. The possibility of groundwater level fluctuations and the presence of perched and artesian water should be considered when designing and developing the construction plans for the project.

4.0 BRIDGE FOUNDATION CONSIDERATIONS

Driven pile foundations can be used to support the bridge abutments. Drilled piers can be used to support the interior bridge elements. The top of bedrock generally varied from weathered shale overlying sandstone at borings A-1 and B-2 to sandstone at borings A-2, A-3, A-4, and B-1, B-3 and B-4. The weathered sandstone and shale will adequately support the bridge structure. Specific recommendations regarding the design and construction of driven pile and drilled pier foundations are presented in the following sections.

4.1 Driven Piles

Driven steel HP piles driven to practical refusal in the bedrock can be used to support the bridge abutments. Driven piles will develop their capacity from end bearing and side resistance in the weathered sandstone and shale. We recommend discounting any side resistance from the upper 10 feet of the overburden soils. Pile capacity will depend on the cross-section and the steel grade. The piles could be designed using a maximum working stress in the pile of 25 percent of the steel's yield strength. We also understand that a bridge engineer will design pile foundations based on the THD cone penetrometer values that are provided on the attached boring logs.

Pile driving through the native overburden soils is not expected to be difficult based on the results of the borings. However, variations can occur in the density and strength of the soil and the depth and quality of the bedrock with distance away from the boring. The pile locations will most likely need to be pre-bored to penetrate though the sandstone layers. Competent weathered shale was first encountered at an elevation of 1069.0 feet at boring A-1 and 1049.0 feet at boring B-2. This transitioned to sandstone at the approximate elevations of 1059.0 feet and 1044 feet respectively. Competent weathered sandstone was encountered at elevations ranging from 1014.5 to 1090.5 feet in borings A-2 to A-4 and B-1, B-3, and B-4. Once encountered, sandstone extended the to the termination depth at borings A-1, A-3, A-4, B-1, B-3, and B-4. Because of the high driving resistance anticipated in the bedrock materials, we recommend that the piles be equipped with driving tips that can endure high driving stresses. Bedrock at borings A-2 and B-2 generally consisted of alternating layers of weathered shale and sandstone/siltstone.

Piles should be installed in accordance with Section 514 of ODOT's Standard Specifications for Highway Construction. All piles should be driven until satisfactory driving resistance is developed for the design load bearing capacity using an appropriate pile driving formula approved by

ODOT. In the event sufficient driving resistance is encountered before reaching the anticipated tip elevations, pile driving could be terminated provided it appears the pile has penetrated approximately 1 to 2 feet into the bedrock. Piles should be spaced at minimum center-to-center distances equal to 3 times the maximum pile cross-section dimension. Long-term settlement of driven pile foundations designed and constructed as recommended above, should be less than 1 inch.

4.2 Drilled Piers

We recommend drilled pier foundations extend through the overburden soils, and bear in competent weathered bedrock. The competent weathered shale or sandstone formation was encountered at elevations ranging from 1014.5 to 109.5 in our borings. The bridge engineer should note that the upper 0.5 to 9 feet of the weathered bedrock encountered in the boring is somewhat softer than the weathered bedrock encountered at greater depths. We understand that a bridge engineer will design drilled pier foundations based on the THD cone penetrometer values that are provided on the attached boring logs.

Our drilling rig used a rock-bit to penetrate the overburden soils and the weathered bedrock. We anticipate a rock bit may be required to extend the drilled pier excavations into the weathered bedrock. We anticipate that temporary casing will be needed to prevent caving of excavation sides; however, the final determination should be made at the time of construction

Based on the soil and groundwater conditions observed in the borings, we anticipate that temporary protective casing will be needed to construct the drilled piers. A sufficient head of concrete having a slump of about 6 inches should be maintained in the casing as it is being pulled to prevent an influx of soil and any water into the excavation. We recommend using a shaft diameter of at least 24 inches for drilled pier foundations. If the pier drilling equipment used is not capable of thoroughly cleaning the bearing surface, a larger shaft diameter may be required to permit sufficient cleaning.

4.3 Lateral Load Analysis

We understand that lateral load analysis and design of the pier supported foundations will be performed using the LPILE computer program. The tables included the Appendix C, present the parameters required for the LPILE computer program.

4.4 Seismic Considerations

Description	Value
2009 International Building Code Site Classification (IBC)	**D**

Note: In general accordance with the *2009 International Building Code,* Table 1613.5.2. The 2009 International Building Code (IBC) uses a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the 100 foot soil profile determination. Borings extended to a maximum depth of 126 feet. This seismic site class definition considers that weathered shale and sandstone continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be necessary to confirm the conditions below the current depth of exploration.

5.0 GENERAL COMMENTS

Terracon Consultants, Inc. should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon Consultants, Inc. also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services of this project does not include either specifically or by implication any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential of such contamination, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon Consultants, Inc. reviews the changes, and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

AERIAL FROM GOOGLE MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.

Project Mngr:	JLD
Drawn By:	CAN
Checked By:	JLD
Approved By:	NKT

Project No.	03205039
Scale:	NTS
File No.	03205039 (A1-A2)
Date:	APR 2020

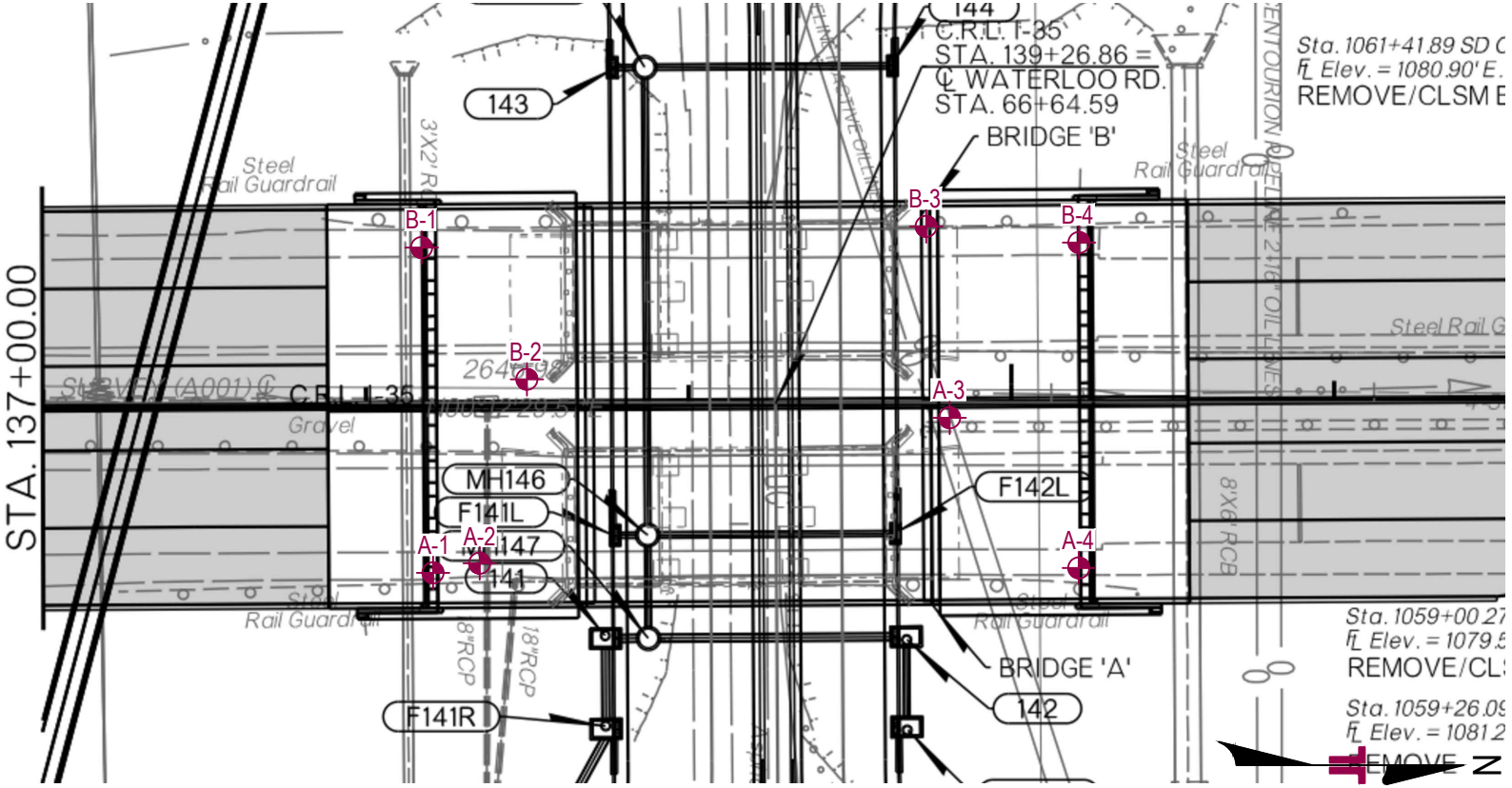
Terracon
Consulting Engineers and Scientists
4701 N STILES AVE OKLAHOMA CITY, OKLAHOMA 73105
PH. (405) 525-0453 FAX. (405) 557-0549

SITE LOCATION PLAN

THREE-SPAN BRIDGE
INTERSTATE 35 AND WATERLOO ROAD
OKLAHOMA AND LOGAN COUNTIES, OKLAHOMA

EXHIBIT

A1



BORING ID	STATION NO.	OFFSET	ELEV (FT.)
A-1	138+20.89	51.50' RT	1110.7
A-2	138+35.46	48.54' RT	1110.7
A-3	139+81.08	4.08' RT	1109.3
A-4	140+21.10	51.58' RT	1109.1
B-1	138.17.30	49.42' LT	1110.9
B-2	138+50.04	7.85' LT	1110.0
B-3	139+73.82	55.29' LT	1109.5
B-4	140+21.14	49.34' LT	1108.9

LEGEND

BORING LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES.

Project Mngr:	JLD
Drawn By:	CAN
Checked By:	JLD
Approved By:	NKT
Project No.	03205039
Scale:	NTS
File No.	03205039 (A1-A2)
Date:	APR 2020

Terracon
Consulting Engineers and Scientists
4701 N STILES AVE OKLAHOMA CITY, OKLAHOMA 73105
PH. (405) 525-0453 FAX. (405) 557-0549

EXPLORATION PLAN

THREE-SPAN BRIDGE
INTERSTATE 35 AND WATERLOO ROAD
OKLAHOMA AND LOGAN COUNTIES, OKLAHOMA

EXHIBIT

A2

Field Exploration Description

Terracon personnel located the borings in the field by use of a hand held GPS device using the latitude and longitude coordinates provided by the Client. The boring locations were offset from the original coordinates a maximum of 25 feet for site access purposes. The locations of the borings should be considered accurate only to the degree implied by the methods used to define them. The stations, offsets, and elevations for each boring were provided by Garver based upon the boring GPS coordinates. These coordinates were correlated to the stationing and elevation data developed by the project surveyor.

Based on this survey data provided to us, the ground surface elevations at the boring locations ranged from 1108.9 to 1110.9 feet. The elevations shown on the logs have been rounded to the nearest 0.1 foot. The boring locations and elevations should be considered accurate only to the degree implied by the methods used to define them.

The borings were advanced with all-terrain mounted rotary drill rigs. The borings were advanced using wash boring techniques. Temporary casing was used to support the side walls of the upper portion of the bore holes. Representative soil samples were obtained using the split-barrel sampling procedure. The bedrock at borings A-2, A-3, B-2 and B-3 was cored with a NX-size diamond bit core barrel.

Disturbed samples of the overburden soils were obtained by the split-barrel sampling procedure by driving a 2-inch O.D. split-barrel sampling spoon into the ground using a 140-pound, automatic hammer falling 30 inches. The number of blows required to advance the sampling spoon were recorded in the field and are shown on the boring logs as the standard penetration resistance (N) value. The number of blows required to advance the sampling spoon the final 12 inches or less of a standard 18-inch sampling interval indicate the in-place relative density of granular soils and, to a lesser degree of accuracy, the consistency of cohesive soils and hardness of weathered rock. The sampling depths, penetration distances, and the N values are reported on the boring logs. The percent recovery and Rock Quality Designation (RQD) for each core run was determined. The samples were tagged for identification, sealed to reduce moisture loss and returned to the laboratory for further examination and classification.

The Texas Highway Department (THD) cone penetrometer test was used to evaluate the proposed bearing strata (bedrock). The THD cone penetrometer test is a standard test developed by the Texas Highway Department to determine the strength and hardness of foundation materials in bridge foundation exploration work. The test is performed by attaching a 3-inch diameter penetrometer cone to the drill stem and lowering it to the bottom of the borehole. The cone is seated, and then driven 12 inches with a 140-pound drive hammer falling 30 inches. The number of blows required for each 6-inch increment is recorded. If more than 100 blows are

required for 12 inches of penetration, the penetration per 50 blows are recorded to the nearest 1/16 inch. The results of this test are shown on the boring logs.

An automatic drive hammer was used to advance the split-barrel and THD cone penetrometer. A greater efficiency is achieved with the automatic drive hammer compared to the conventional safety drive hammer operated with a cathead and rope.

The drilling operation was supervised by engineer who prepared field logs. The boring logs include visual classifications of the materials encountered during drilling and the engineer's interpretation of subsurface conditions between samples. Based on the material's texture, the soil samples were described according to the attached General Notes and classified in accordance with the Unified Soil Classification System. A brief description of the Unified System is included in the appendix. Rock descriptions are in general accordance with the General Notes for Sedimentary Rock. Petrographic analysis of the rock cores may reveal other rock types.

As required by the Oklahoma Water Resources Board, any borings deeper than 20 feet, or borings which encounter groundwater or contaminated materials must be grouted or plugged in accordance with Oklahoma State statutes. One boring log must also be submitted to the Oklahoma Water Resources Board for each 10 acres of project site area. Terracon grouted the borings and submitted a log in order to comply with the Oklahoma Water Resources Board requirements.

APPENDIX B
LABORATORY TESTING

BORING LOG NO. A-1

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+20.89 Offset: 51.50' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.6	1110+/-	**APPROX. 7" OF ASPHALT PAVEMENT**												
		CLAYEY SAND (SC), red (2.5YR 4/8) and dark red (2.5YR 3/6), loose				13	7-6-3 N=9				18		26-13-13	21
5.0	1105.5+/-	**LEAN CLAY WITH SAND (CL)**, red (2.5YR 4/6), medium stiff	5			8	2-2-4 N=6				18		33-15-18	74
10.0	1100.5+/-	**CLAYEY SAND (SC)**, red (2.5YR 4/8), medium dense	10			16	6-6-8 N=14				17		21-13-8	47
15.0	1095.5+/-	**SILTY SAND (SM)**, reddish brown (2.5YR 4/3), dense	15			7	19-25-11 N=36				21			19
20.0	1090.5+/-	**CLAYEY SAND (SC)**, weak red (2.5YR 4/2), red (2.5YR 5/6) and reddish brown (2.5YR 4/3), dense	20			12	11-12-19 N=31				24		23-13-10	24
		-weak red (2.5YR 4/2) and reddish brown (7.5YR 4/4), medium dense below 25'	25			15	7-8-12 N=20				17		25-15-10	29
30.0	1080.5+/-	**SILTY SAND (SM)**, red (2.5YR 4/6) and dusky red (7.5R 3/3), dense	30			18	5-12-26 N=38				14		NP	42
32.0	1078.5+/-	**SHALEY LEAN CLAY (CL)**, red (2.5YR 4/6), hard		▼										

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 72' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

▼ *33.5' on 4/14/2020*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 | Boring Completed: 03-24-2020
Drill Rig: 880 | Driller: R. Smalley
Project No.: 03205039 | Exhibit: A-4

BORING LOG NO. A-1

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+20.89 Offset: 51.50' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
35							
			18	15-21-30 N=51	22		
			17	29-40-46 N=86	13		
40.0	1070.5+/-						
40			15	21-43-50/4"	15	39-16-23	97
				50/2 1/2" 50/2 5/8"			
45				50/2 1/4" 50/1 3/4"			
50							
51.5	1059+/-						
				50/1/2" 50/5/8"			
55							
				50/3/4" 50/1/2"			
60							
				50/3/8" 50/1/8"			
65							

SHALEY LEAN CLAY (CL), red (2.5YR 4/6), hard *(continued)*

WEATHERED SHALE, red (2.5YR 4/6), soft
-moderately hard to hard below 41.4'

WEATHERED SANDSTONE, red (2.5YR 4/6), well cemented

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 72' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

33.5' on 4/14/2020

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 | Boring Completed: 03-24-2020
Drill Rig: 880 | Driller: R. Smalley
Project No.: 03205039 | Exhibit: A-4

BORING LOG NO. A-1

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+20.89 Offset: 51.50' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
							50/5/16" 50/3/16"							
			70											
	72.0	1038.5+/-					50/1/4" 50/1/8"							

WEATHERED SANDSTONE, red (2.5YR 4/6), well cemented *(continued)*

Boring Terminated at 72 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 72' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

33.5' on 4/14/2020

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 | Boring Completed: 03-24-2020
Drill Rig: 880 | Driller: R. Smalley
Project No.: 03205039 | Exhibit: A-4

BORING LOG NO. A-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+35.46 Offset: 48.54' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7	1110+/-	**APPROX. 8" OF ASPHALT PAVEMENT**												
		SILTY SAND (SM), dark reddish brown (2.5YR 3/3), light reddish brown (2.5YR 7/3) and dark red (2.5YR 3/6), medium dense				15	4-8-5 N=13				14		NP	37
5.0	1105.5+/-	**LEAN CLAY (CL)**, red (10R 4/6), medium stiff	5			4	4-4-4 N=8				22			91
10.0	1100.5+/-	**SILTY SAND (SM)**, reddish brown (2.5YR 4/4), medium dense	10			9	7-12-15 N=27				17		NP	38
		-red (2.5YR 5/6) and reddish yellow (7.5YR 6/6) below 15'	15			13	12-13-16 N=29				20		NP	22
		-reddish brown (5YR 4/4), dense below 20'	20			10	14-15-16 N=31				20		NP	32
25.0	1085.5+/-	**CLAYEY SAND (SC)**, reddish brown (2.5YR 4/4), medium dense	25			10	8-6-7 N=13				16		26-13-13	48
		-very loose below 30'	30	▽		9	5-2-1 N=3				19			

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

▽ *32.5' After boring*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 04-07-2020 | Boring Completed: 04-09-2020

Drill Rig: 880 | Driller: R. Smalley

Project No.: 03205039 | Exhibit: A-5

BORING LOG NO. A-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+35.46 Offset: 48.54' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CLAYEY SAND (SC), reddish brown (2.5YR 4/4), medium dense *(continued)*					
35		-loose below 35'	13	3-2-2 N=4	20	21-13-8	30
40		-very loose below 40'	14	2-1-1 N=2	21		
45.0	1065.5+/-	**FAT CLAY (CH)**, red (2.5YR 4/6), stiff	10	4-5-4 N=9	24	55-18-37	93
50.0	1060.5+/-	**LEAN CLAY (CL)**, red (2.5YR 4/6) and greenish gray (GLEY1 6/5/GY), medium stiff	9	5-4-4 N=8	17	39-15-24	96
55.0	1055.5+/-	**LEAN CLAY WITH SAND (CL)**, dark red (7.5R 3/6), medium stiff	14	0-0-7 N=7	29	30-13-17	84
60.0	1050.5+/-	**INTERBEDDED WEATHERED SILTSTONE AND WEATHERED SANDSTONE**, red (10R 4/6), well cemented	2	50/4"	14		80
60			57	50/5/8" 50/1/4"			
65				50/1/2" 50/3/4"			

ROCK RECOVERY (%): 95
RQD (%): 87

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

32.5' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 04-07-2020
Boring Completed: 04-09-2020
Drill Rig: 880
Driller: R. Smalley
Project No.: 03205039
Exhibit: A-5

BORING LOG NO. A-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7248° Longitude: -97.4161°

Station: 138+35.46 Offset: 48.54' RT
Approximate Surface Elev.: 1110.7 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		INTERBEDDED WEATHERED SILTSTONE AND WEATHERED SANDSTONE, red (10R 4/6), well cemented *(continued)*	39		65	27	8210	2	160		
70		-red (10R 4/6) with light brown (7.5 YR 6/3) below 70.5'		50/3/8" 50/1/4"							
			46		77	17	870	17	113		
75.5	1035+/-										
75		**WEATHERED SHALE WITH WEATHERED SANDSTONE SEAMS**, red (10R 4/6) and light gray (GLEY1 7/N), hard		50/3/4" 50/1/2"			150	12	129		
			60		100	80					
80.5	1030+/-										
80		**WEATHERED SHALE WITH WEATHERED SANDSTONE**, red (10R 4/6) and light brown (7.5YR 6/4), hard, with a 6" reddish gray (2.5YR 6/1) siltstone seam between 75.5' and 80.5'		50/3/8" 50/3/16"			6700	2	155		
			59		98	63					
85.5	1025+/-										
85		**WEATHERED SANDSTONE**, light brown (7.5YR 6/4) and red (10R 4/6), well cemented, with red (10R 4/6) siltstone		50/5/8" 50/1/4"							
			54		90	33					
90				50/1/2" 50/1/4"							
91.0	1019.5+/-	***Boring Terminated at 91 Feet***									

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

32.5' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 04-07-2020 Boring Completed: 04-09-2020

Drill Rig: 880 Driller: R. Smalley

Project No.: 03205039 Exhibit: A-5

BORING LOG NO. A-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4163°

Station: 139+81.08 Offset: 4.08' RT
Approximate Surface Elev.: 1109.3 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0	1109.3+/-	**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)**, dark reddish brown (2.5YR 3/3), loose	8	2-3-4 N=7	16	24-17-7	25
5.0	1104.5+/-	**SILTY CLAYEY SAND (SC-SM)**, dark reddish brown (2.5YR 3/3) and red (2.5YR 4/6), loose	8	6-6-3 N=9	19	20-13-7	33
10.0	1099.5+/-	**SANDY LEAN CLAY (CL)**, red (2.5YR 4/6), medium stiff	7	2-1-5 N=6	18	26-15-11	70
		-very stiff below 15'	10	10-14-11 N=25	20		
20.0	1089.5+/-	**SILTY SAND (SM)**, reddish brown (2.5YR 4/3), very dense	12	15-25-38 N=63	17	NP	20
25.0	1084.5+/-	**CLAYEY SAND (SC)**, red (2.5YR 4/3), medium dense	6	11-9-10 N=19	21	21-13-8	36
30.0	1079.5+/-	**SANDY LEAN CLAY (CL)**, dusky red (2.5YR 3/2), soft	15	1-1-1 N=2	23	21-13-8	52

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 126' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:
Vegetation at surface

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling
35' After boring
31' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 Boring Completed: 03-27-2020
Drill Rig: 578 Driller: P. Hacker
Project No.: 03205039 Exhibit: A-6

BORING LOG NO. A-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4163°

Station: 139+81.08 Offset: 4.08' RT
Approximate Surface Elev.: 1109.3 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
35.0	1074.5+/-	35					
SANDY LEAN CLAY (CL), dusky red (2.5YR 3/2), soft *(continued)*							
CLAYEY SAND (SC), red (2.5YR 4/3), loose			17	2-2-2 N=4	19	25-13-12	40
-very loose below 40'		40	17	2-1-1 N=2	22		
45.0	1064.5+/-	45					
SANDY LEAN CLAY (CL), reddish brown (2.5YR 4/4), medium stiff			2	2-2-2 N=4	23		63
50.0	1059.5+/-	50					
CLAYEY SAND (SC), reddish brown (2.5YR 4/4), very loose			17	2-2-1 N=3	25	28-12-16	42
55.0	1054.5+/-	55					
SANDY LEAN CLAY (CL), reddish brown (2.5YR 4/4), soft			17	2-2-2 N=4	29	22-12-10	62
60.0	1049.5+/-	60					
CLAYEY SAND (SC), reddish brown (2.5YR 4/4), very loose			17	1-0-0 N=0	25	22-14-8	50
65.0	1044.5+/-	65					
SILTY SAND (SM), reddish brown (2.5YR 4/4), very loose			17	1-1-0 N=1	22	NP	24

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 126' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

35' After boring

31' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 Boring Completed: 03-27-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-6

BORING LOG NO. A-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4163°

Station: 139+81.08 Offset: 4.08' RT
Approximate Surface Elev.: 1109.3 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), reddish brown (2.5YR 4/4), very loose *(continued)*								
	-reddish brown (2.5YR 4/3), loose below 70'	70	17	2-2-3 N=5			19	NP	22
		75	17	1-2-2 N=4			23		
		80	17	2-2-3 N=5			21		
		85	17	4-4-4 N=8			19		
90.0	1019.5+/-	90	17	8-18-32 N=50			17	NP	28
95.0	1014.5+/-	95	2	50/3"			13	27-14-13	86
95.5	1014+/- **WEATHERED SHALE**, reddish brown (2.5YR 4/4) and light reddish brown (2.5YR 6/4), moderately hard			50/7/16" 50/3/8"					
	WEATHERED SANDSTONE, reddish brown (2.5YR 4/4) and light reddish brown (2.5YR 6/4), well cemented		42		70	56			
		100							

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 126' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

35' After boring

31' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 Boring Completed: 03-27-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-6

BORING LOG NO. A-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4163°

Station: 139+81.08 Offset: 4.08' RT
Approximate Surface Elev.: 1109.3 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
WEATHERED SANDSTONE, reddish brown (2.5YR 4/4) and light reddish brown (2.5YR 6/4), well cemented *(continued)* -light reddish brown (2.5YR 6/4) and reddish yellow (7.5YR 7/8) below 105.5'		46	50/7/8" 50/1/4"	77	75	730	12	124		
-reddish brown (2.5YR 4/4) and pinkish white (7.5 YR 8/2), with a 6" reddish yellow (7.5YR 7/6) shale lens from 105.5' to 110.5'		44	50/3/8" 50/1/8"	73	33					
-reddish yellow (7.5YR 7/8), with a 10" reddish brown (2.5YR 4/4) shale lense from 110.5' to 115.5'		50	50/1/4" 50/1/16"	83	55	510	19	108		
-light reddish brown (2.5YR 6/3), reddish brown (2.5YR 5/4), and reddish yellow, (7.5YR 7/6) below 115.5'		51	50/3/8" 50/1/16"	85	23					
-reddish brown (2.5YR 5/4), reddish yellow (7.5YR 7/6), and pinkish white (7.5YR 8/2) below 115.5'		60	50/3/8" 50/1/16"	100	86	160	10	132		
126.0	983.5+/-		50/3/8" 50/1/8"							
Boring Terminated at 126 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 126' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

35' After boring

31' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 Boring Completed: 03-27-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-6

BORING LOG NO. A-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4161°

Station: 140+21.10 Offset: 51.58' RT
Approximate Surface Elev.: 1109.1 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.8	1108.5+/-	**APPROX. 10" OF CONCRETE PAVEMENT**						
		SILTY SAND (SM), dark reddish brown (5YR 3/3) to dusky red (10R 3/3), medium dense		13	12-10-10 N=20	14	NP	33
5.0	1104+/-	**SANDY LEAN CLAY (CL)**, red (10R 4/6) with weak red (10R 5/4), medium stiff	5	6	15-4-2 N=6	17	25-12-13	64
		-red (2.5YR 4/8) below 10'	10	8	2-2-3 N=5	18		
15.0	1094+/-	**CLAYEY SAND (SC)**, red (2.5YR 4/6), medium dense	15	11	10-18-10 N=28	18	24-14-10	25
		-brown (7.5YR 4/3) with red (2.5YR 4/6), dense below 20'	20	17	12-18-22 N=40	17	22-14-8	29
25.0	1084+/-	**SILTY SAND (SM)**, red (2.5YR 4/8), dense	25	14	10-15-17 N=32	15	NP	30
30.0	1079+/-	**SANDY LEAN CLAY (CL)**, dark brown (7.5YR 3/4), soft	30	17	1-1-1 N=2	22	23-15-8	57

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 Boring Completed: 03-24-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-7

BORING LOG NO. A-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4161°

Station: 140+21.10 Offset: 51.58' RT
Approximate Surface Elev.: 1109.1 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
35.0	1074+/-	35											
	SANDY LEAN CLAY (CL), dark brown (7.5YR 3/4), soft *(continued)*												
	CLAYEY SAND (SC), dark brown (7.5YR 3/2) and reddish brown (5YR 4/4), loose			X	17	2-3-4 N=7				18		27-15-12	48
40.0	1069+/-	40											
	SILTY CLAYEY SAND (SC-SM), reddish brown (5YR 4/4), loose			X	17	2-2-2 N=4				21		20-13-7	24
45.0	1064+/-	45											
	SILTY SAND (SM), yellowish red (5YR 5/6), loose			X	17	3-3-4 N=7				19		NP	29
		50		X	17	3-2-3 N=5				21			
	-very loose below 55'	55		X	17	2-1-1 N=2				22			
	-loose below 60'	60		X	17	3-3-3 N=6				21			
	-very loose below 65'	65		X	17	2-1-1 N=2				23			

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 | Boring Completed: 03-24-2020
Drill Rig: 578 | Driller: P. Hacker
Project No.: 03205039 | Exhibit: A-7

BORING LOG NO. A-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4161°

Station: 140+21.10 Offset: 51.58' RT
Approximate Surface Elev.: 1109.1 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND (SM), yellowish red (5YR 5/6), loose *(continued)*													
70.0	1039+/-	70											
CLAYEY SAND (SC), reddish brown (5YR 4/4), very loose					17	2-1-1 N=2				20		23-13-10	41
-yellowish red (5YR 4/6) below 75'		75			17	1-1-1 N=2				26			
80.0	1029+/-	80											
LEAN CLAY (CL), red (10R 4/6), hard					17	3-12-20 N=32				14		36-15-21	98
85.0	1024+/-	85			0	50/1" 50/9/16" 50/3/16"							
WEATHERED SANDSTONE, red (10R 4/6) with light gray (5YR 7/1), well cemented		90				50/7/8" 50/1/2"							
		95				50/3/8" 50/3/16"							
		100											

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 | Boring Completed: 03-24-2020
Drill Rig: 578 | Driller: P. Hacker
Project No.: 03205039 | Exhibit: A-7

BORING LOG NO. A-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4161°

Station: 140+21.10 Offset: 51.58' RT
Approximate Surface Elev.: 1109.1 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	WEATHERED SANDSTONE, red (10R 4/6) with light gray (5YR 7/1), well cemented *(continued)*			50/5/16" 50/3/16"							
105				50/3/8" 50/1/4"							
110				50/5/16" 50/1/8"							
115				50/3/8" 50/1/8"							
116.0	993+/-										
	Boring Terminated at 116 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-24-2020 Boring Completed: 03-24-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-7

BORING LOG NO. B-1

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7247° Longitude: -97.4164°

Station: 138+17.30 Offset: 49.42' LT
Approximate Surface Elev.: 1110.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.4	1110.5+/-	**APPROX. 5" OF ASPHALT PAVEMENT**
		CLAYEY SAND (SC), dusky red (2.5YR 3/2) and red (2.5YR 4/8), loose
5.0	1106+/-	**LEAN CLAY WITH SAND (CL)**, red (2.5YR 4/6), stiff
10.0	1101+/-	**CLAYEY SAND (SC)**, reddish brown (2.5YR 4/4), medium dense
20.0	1091+/-	
20.6	1090.5+/-	**WEATHERED SHALE**, red (2.5YR 4/8), hard
		WEATHERED SANDSTONE, red (2.5YR 4/6), well cemented

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			13	5-4-4 N=8				16		26-12-14	47
5			8	4-4-5 N=9				20		33-14-19	82
10			10	4-10-15 N=25				20		23-15-8	38
15	▽		10	7-7-6 N=13				18		22-14-8	35
20			7	35-50/1"				13		30-14-16	84
				50/7/8" 50/3/8"							
25				50/1/8" 50/1/8"							
30				50/1/16" 50/3/16"							

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 52' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

▽ *15' After boring*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 | Boring Completed: 03-23-2020

Drill Rig: 578 | Driller: P. Hacker

Project No.: 03205039 | Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/21/20

BORING LOG NO. B-1

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7247° Longitude: -97.4164°

Station: 138+17.30 Offset: 49.42' LT
Approximate Surface Elev.: 1110.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	WEATHERED SANDSTONE, red (2.5YR 4/6), well cemented *(continued)*	35			50/1/4" 50/3/16"							
		40			50/1 1/4" 50/1 3/8"							
		45			50/3/4" 50/1/2"							
52.0	1059+/-	50			50/5/8" 50/3/16"							
	Boring Terminated at 52 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 1.5' Power Auger
1.5' - 52' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 1.5' while drilling

15' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 Boring Completed: 03-23-2020

Drill Rig: 578 Driller: P. Hacker

Project No.: 03205039 Exhibit: A-8

BORING LOG NO. B-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7249° Longitude: -97.4163°

Station: 138+50.04 Offset: 7.85' LT
Approximate Surface Elev.: 1110.0 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0	1110+/-												
CLAYEY SAND (SC), red (2.5YR 5/6), loose				X	16	1-4-3 N=7				16		23-15-8	30
5.0	1105+/-	5											
LEAN CLAY (CL), red (2.5YR 4/6) and red (2.5YR 5/6), stiff				X	12	6-7-6 N=13				19		29-15-14	88
10.0	1100+/-	10											
CLAYEY SAND (SC), reddish brown (2.5YR 4/4), medium dense				X	15	4-4-8 N=12				16		24-15-9	26
		15		X	8	10-14-13 N=27				16			38
20.0	1090+/-	20											
SANDY LEAN CLAY (CL), strong brown (7.5YR 4/6), very stiff				X	12	6-6-15 N=21				19		27-15-12	52
25.0	1085+/-	25											
CLAYEY SAND (SC), strong brown (7.5YR 4/6), loose				X	11	3-4-3 N=7				16		25-14-11	44
30.0	1080+/-	30											
SILTY SAND (SM), strong brown (7.5YR 4/6), loose			▽	X	12	4-4-4 N=8				18		NP	41

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:
Vegetation at surface

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

▽ *31' After boring*

▼ *90' on 3/27/2020*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 | Boring Completed: 03-25-2020

Drill Rig: 880 | Driller: R. Smalley

Project No.: 03205039 | Exhibit: A-9

BORING LOG NO. B-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7249° Longitude: -97.4163°

Station: 138+50.04 Offset: 7.85' LT
Approximate Surface Elev.: 1110.0 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
35.0	1075+/-	**SILTY SAND (SM)**, strong brown (7.5YR 4/6), loose *(continued)*	35											
		FAT CLAY (CH), dark red (10R 3/6), very stiff				11	4-7-9 N=16				23		51-21-30	94
38.5	1071.5+/-													
		LEAN CLAY (CL), dark red (10R 3/6), very stiff to hard	40			18	11-14-14 N=28				19		43-20-23	94
						16	12-20-24 N=44				14			
45.0	1065+/-		45											
		LEAN CLAY WITH SAND (CL), dark red (10R 3/6) and red (10R 5/6), hard				17	12-17-21 N=38				15		27-15-12	80
			50			18	11-21-38 N=59				14		26-14-12	78
55.0	1055+/-		55											
		LEAN CLAY (CL), red (10R 4/8), hard				17	14-23-30 N=53				15		31-15-16	89
60.0	1050+/-		60											
61.0	1049+/-	**WEATHERED SHALE**, red (10R 5/6) and light gray (GLEY1 7/5GY), soft				5	50/5"				11			82
		WEATHERED SHALE, red (10R 5/6), soft, with 13" of weak red (10R 4/4) weathered sandstone	65			40	50/3/8" 50/1/8"	67	32	7450	3	159		
66.0	1044+/-						50/3/8" 50/1/8"			900	17	111		

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

31' After boring

90' on 3/27/2020

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 | Boring Completed: 03-25-2020

Drill Rig: 880 | Driller: R. Smalley

Project No.: 03205039 | Exhibit: A-9

BORING LOG NO. B-2

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7249° Longitude: -97.4163°

Station: 138+50.04 Offset: 7.85' LT
Approximate Surface Elev.: 1110.0 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
		WEATHERED SANDSTONE, weak red (10R 4/4), well cemented, with red (10R 5/8) siltstone seams *(continued)*
		-pale brown (2.5Y 7/4), red (10R 4/6), weak red (10R 4/3), and reddish black (2.5YR 2.5/1) below 71'
76.0	1034+/-	
		WEATHERED SILTSTONE WITH INTERBEDDED WEATHERED SHALE, red (10R 4/6), well cemented
81.0	1029+/-	
		WEATHERED SHALE, red (10R 4/6), hard, with 11" of dusky red (10R 3/4) sandstone
86.0	1024+/-	
		WEATHERED SANDSTONE, pale red (10R 3/2), weak red (10R 5/2), and dusky red (10R 6/2), well cemented, with 16" of red (10R 4/6) weathered shale
91.0	1019+/-	
		Boring Terminated at 91 Feet

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
70	60	50/1/16" 50/1/16"	100	68					
75	46	50/3/8" 50/3/16"	77	33	1500	18	111		
80	54	50/1/4" 50/1/8"	90	78	230	10	131		
85	52	50/3/16" 50/3/16"	87	60	70	12	128		
90	57	50/5/16" 50/3/16"	95	65	1090	21	105		

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 91' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling
31' After boring
90' on 3/27/2020

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-25-2020 | Boring Completed: 03-25-2020
Drill Rig: 880 | Driller: R. Smalley
Project No.: 03205039 | Exhibit: A-9

BORING LOG NO. B-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4165°

Station: 139+73.82 Offset: 55.29' LT
Approximate Surface Elev.: 1109.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1	1109.5+/-	**APPROX. 1" OF ASPHALT PAVEMENT**												
0.8	1108.5+/-	**APPROX. 9" OF PORTLAND CEMENT CONCRETE**												
		SILTY SAND (SM), dusky red (5R 3/4) and reddish black (5R 2.5/1), medium dense				12	6-10-8 N=18				14		NP	41
5.0	1104.5+/-	**SANDY LEAN CLAY (CL)**, red (10R 4/6), stiff	5			16	5-5-8 N=13				20		26-13-13	57
		-weak red (7.5R 5/4), very stiff below 10'	10			14	6-8-8 N=16				18			
15.0	1094.5+/-	**SILTY SAND (SM)**, weak red (7.5R 5/4), medium dense	15			12	6-12-16 N=28				21		NP	39
		-reddish brown (2.5YR 4/3), dense below 20'	20			16	10-16-20 N=36				24		NP	34
25.0	1084.5+/-	**SILTY CLAYEY SAND (SC-SM)**, yellowish brown (10YR 5/6), medium dense	25			18	8-8-10 N=18				20		23-16-7	44
		-brown (7.5YR 4/3), very loose below 30'	30	▼		18	1-1-1 N=2				23		20-14-6	48

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

▼ *30' After 24 hours*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-31-2020	Boring Completed: 04-01-2020
Drill Rig: 578	Driller: P. Hacker
Project No.: 03205039	Exhibit: A-10

BORING LOG NO. B-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4165°

Station: 139+73.82 Offset: 55.29' LT
Approximate Surface Elev.: 1109.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY CLAYEY SAND (SC-SM), yellowish brown (10YR 5/6), medium dense *(continued)*	35						
			X	18	2-1-1 N=2	20		
40.0	1069.5+/-	40						
	SILTY SAND (SM), reddish brown (2.5YR 4/4), loose		X	18	2-5-1 N=6	21	NP	28
	-red (2.5YR 4/8) below 45'	45	X	18	1-2-3 N=5	23	NP	39
		50	X	18	2-3-2 N=5	25	NP	36
		55	X	16	2-3-3 N=6	25		
		60	X	18	2-2-3 N=5	22	NP	15
	-dusky red (10R 3/2) below 65'	65	X	18	3-3-2 N=5	23	NP	15

ROCK RECOVERY (%) | RQD (%) | UNCONFINED COMPRESSIVE STRENGTH (psi) | DRY UNIT WEIGHT (pcf)

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

30' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-31-2020 | Boring Completed: 04-01-2020
Drill Rig: 578 | Driller: P. Hacker
Project No.: 03205039 | Exhibit: A-10

BORING LOG NO. B-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4165°

Station: 139+73.82 Offset: 55.29' LT
Approximate Surface Elev.: 1109.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
70.0	1039.5+/-	**SILTY SAND (SM)**, reddish brown (2.5YR 4/4), loose *(continued)*									
		POORLY GRADED SAND WITH SILT (SP-SM), reddish black (5R 2.5/1), loose	18	4-5-4 N=9				21		NP	11
75.0	1034.5+/-										
76.0	1033.5+/-	**CLAYEY SAND (SC)**, very dusky red (5R 2.5/3), very dense	16	10-20-50/4"				20		22-14-8	31
		WEATHERED SANDSTONE, very dusky red (5R 2.5/3), cemented									
		-red (2.5YR 4/8), well cemented to poorly cemented below 80'		50/1" 39/6"				24			31
85.0	1024.5+/-										
85.5	1024+/-	**WEATHERED SHALE**, very dusky red (5R 2.5/3), hard		50/2"				25		35-14-21	73
		WEATHERED SANDSTONE, red (10R 5/8) and dusky red (10R 3/3), well cemented	32	50/5/16" 50/3/8"	53	17					
		-red (10R 5/8) and weak red (10R 4/4), with traces of red (2.5YR 4/6) shale below 91'	47	50/3/8" 50/1/4"	78	53					
96.0	1013.5+/-										
		WEATHERED SILTSTONE WITH INTERBEDDED SANDSTONE, red (10R 4/8) with red (10R 5/6), well cemented	52	50/5/8" 50/3/8"	87	78	740 540	12 11	124 129		

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

30' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-31-2020 | Boring Completed: 04-01-2020
Drill Rig: 578 | Driller: P. Hacker
Project No.: 03205039 | Exhibit: A-10

BORING LOG NO. B-3

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7252° Longitude: -97.4165°

Station: 139+73.82 Offset: 55.29' LT
Approximate Surface Elev.: 1109.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)
101.0	1008.5+/-
116.0	993.5+/-

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		50/9/16" 50/3/8"							
	51		85	57					
105		50/3/4" 50/1/4"							
	33.5		56	10	710	10	130		
110		50/1/2" 50/1/4"							
	37		62	28					
115		50/1 1/8" 50/1/8"							

WEATHERED SANDSTONE, red (2.5YR 5/8) and reddish yellow (5YR 6/5), well cemented

-red (10R 4/8), with strong brown (7.5YR 4/6) siltstone seams

Boring Terminated at 116 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification estimated from disturbed or core samples. Petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 116' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

30' After 24 hours

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-31-2020 | Boring Completed: 04-01-2020
Drill Rig: 578 | Driller: P. Hacker
Project No.: 03205039 | Exhibit: A-10

BORING LOG NO. B-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4164°

Station: 140+21.14 Offset: 49.34' LT
Approximate Surface Elev.: 1108.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	LITHOLOGY	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	ROCK RECOVERY (%)	RQD (%)	UNCONFINED COMPRESSIVE STRENGTH (psi)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.0	1108+/-	**APPROX 12" OF PORTLAND CEMENT CONCRETE**												
		SILTY SAND (SM), weak red (10R 5/4), medium dense				10	7-13-7 N=20				14		NP	42
5.0	1104+/-	**CLAYEY SAND (SC)**, weak red (10R 5/4) and red (10R 4/6), medium dense	5			15	9-10-12 N=22				12		21-12-9	47
10.0	1099+/-	**SILTY SAND (SM)**, weak red (10R 5/4), dense	10			17	11-19-19 N=38				10		NP	29
15.0	1094+/-	**SANDY SILTY CLAY (CL-ML)**, red (2.5YR 4/6), very stiff	15			17	9-11-14 N=25				16		21-14-7	54
20.0	1089+/-	**SILTY CLAYEY SAND (SC-SM)**, yellowish red (5YR 5/6), medium dense	20			12	11-11-12 N=23				19		22-15-7	33
		-brown (7.5YR 4/4) below 25'	25			13	8-8-9 N=17				17		20-13-7	38
30.0	1079+/-	**SANDY SILTY CLAY (CL-ML)**, dark brown (7.5YR 3/3), soft	30	▽		15	1-1-1 N=2				22		23-16-7	60

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 122' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

▽ *32' After boring*

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 Boring Completed: 03-23-2020

Drill Rig: 880 Driller: R. Smalley

Project No.: 03205039 Exhibit: A-11

BORING LOG NO. B-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4164°

Station: 140+21.14 Offset: 49.34' LT
Approximate Surface Elev.: 1108.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
35.0	1074+/-						
SANDY SILTY CLAY (CL-ML), dark brown (7.5YR 3/3), soft *(continued)*		35					
SANDY LEAN CLAY (CL), reddish brown (5YR 5/4), medium stiff			16	2-2-3 N=5	17	28-13-15	59
		40	16	3-2-3 N=5	20	26-13-13	61
-soft below 45'		45	16	0-1-2 N=3	22		
		50	14	1-1-2 N=3	26	25-13-12	59
		55	17	1-1-1 N=2	23		
60.0	1049+/-	60					
POORLY GRADED SAND WITH SILT (SP-SM), reddish brown (5YR 4/4), medium dense			11	4-5-8 N=13	21	NP	10
		65	6	4-7-6 N=13	22		

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 122' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

32' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 Boring Completed: 03-23-2020

Drill Rig: 880 Driller: R. Smalley

Project No.: 03205039 Exhibit: A-11

BORING LOG NO. B-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4164°

Station: 140+21.14 Offset: 49.34' LT
Approximate Surface Elev.: 1108.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
POORLY GRADED SAND WITH SILT (SP-SM), reddish brown (5YR 4/4), medium dense *(continued)*							
70.0	1039+/-	70					
SILTY SAND (SM), reddish brown (5YR 4/4), loose			11	1-2-3 N=5	22	NP	18
-reddish brown (5YR 4/3), very loose below 75'		75	18	1-1-2 N=3	24	NP	17
80.0	1029+/-	80					
CLAYEY SAND (SC), reddish brown (5YR 4/4), medium dense			12	5-5-6 N=11	21	36-15-21	
85.0	1024+/-	85					
SILTY SAND (SM), reddish brown (5YR 4/4), very loose			18	2-1-1 N=2	23	NP	33
90.0	1019+/-	90					
CLAYEY SAND WITH GRAVEL (SC), reddish brown (5YR 4/4), very dense			12	10-23-50/2"	11	21-11-10	24
91.5	1017.5+/-						
WEATHERED SANDSTONE, red (10R 5/8), well cemented				50/1" 50/7/16"			
		95					
				50/3/8" 50/5/16"			
		100					

ROCK RECOVERY (%) | RQD (%) | UNCONFINED COMPRESSIVE STRENGTH (psi) | DRY UNIT WEIGHT (pcf)

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 122' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

32' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 | Boring Completed: 03-23-2020

Drill Rig: 880 | Driller: R. Smalley

Project No.: 03205039 | Exhibit: A-11

BORING LOG NO. B-4

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

CLIENT: Garver LLC
Tulsa, Oklahoma

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

LOCATION See Exhibit A-2

Latitude: 35.7253° Longitude: -97.4164°

Station: 140+21.14 Offset: 49.34' LT
Approximate Surface Elev.: 1108.9 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	FIELD TEST RESULTS
		WEATHERED SANDSTONE, red (10R 5/8), well cemented *(continued)*
		50/7/16" 50/1/8"
105		
		50/3/8" 50/1/4"
110		
		50/7/16" 50/3/16"
115		
		50/1/4" 50/3/16"
120		
122.0	987+/-	50/5/8" 50/1/4"
		Boring Terminated at 122 Feet

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | ROCK RECOVERY (%) | RQD (%) | UNCONFINED COMPRESSIVE STRENGTH (psi) | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.
Classification of rock materials has been estimated based on observation of disturbed samples.
Core samples and/or petrographic analysis may reveal other rock types.

Hammer Type: Automatic

Advancement Method:
0' - 10' Power Auger
10' - 122' Wash Boring

Abandonment Method:
Boring backfilled with cuttings above 4'; grouted 4' to 14'; backfilled with cuttings from 14' to termination depth.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix D for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Dry to 10' while drilling

32' After boring

Terracon
4701 N Stiles Ave
Oklahoma City, OK

Boring Started: 03-23-2020 | Boring Completed: 03-23-2020

Drill Rig: 880 | Driller: R. Smalley

Project No.: 03205039 | Exhibit: A-11

REVISIONS		
REV. NO.	DESCRIPTION	DATE

Boring No. A-1

STATION 138+20.89 51.50' RT
(3/24/2020)

Surface Elev. (Ft.): 1110.7

1,110	**APPROX. 7" OF ASPHALT PAVEMENT**	1110.5 / 1110	1109.5+/-	SPT-1; N=9; SOIL REC=13 (In.); MC=18%; P200=21%; LL= 26; PL= 13; PI= 13
	CLAYEY SAND (SC) red (2.5YR 4/8) and dark red (2.5YR 3/6), loose	1105.5	1105.5+/-	SPT-2; N=6; SOIL REC=8 (In.); MC=18%; P200=74%; LL= 33; PL= 15; PI= 18
	LEAN CLAY WITH SAND (CL) red (2.5YR 4/6), medium stiff			
1,100	**CLAYEY SAND (SC)** red (2.5YR 4/8), medium dense	1100.5	1100.5+/-	SPT-3; N=14; SOIL REC=16 (In.); MC=17%; P200=47%; LL= 21; PL= 13; PI= 8
	SILTY SAND (SM) reddish brown (2.5YR 4/3), dense	1095.5	1095.5+/-	SPT-4; N=36; SOIL REC=7 (In.); MC=21%; P200=19%
1,090	**CLAYEY SAND (SC)** weak red (2.5YR 4/2), red (2.5YR 5/6) and reddish brown (2.5YR 4/3), dense	1090.5	1090.5+/-	SPT-5; N=31; SOIL REC=12 (In.); MC=24%; P200=24%; LL= 23; PL= 13; PI= 10
	-weak red (2.5YR 4/2) and reddish brown (7.5YR 4/4), medium dense below 25'	1085.5	1085.5+/-	SPT-6; N=20; SOIL REC=15 (In.); MC=17%; P200=29%; LL= 25; PL= 15; PI= 10
1,080	**SILTY SAND (SM)** red (2.5YR 4/6) and dusky red (7.5R 3/3), dense	1080.5 / 1078.5	1080.5+/-	SPT-7; N=38; SOIL REC=18 (In.); MC=14%; P200=42%; LL= NP; PL= NP; PI= NP
	SHALEY LEAN CLAY (CL) red (2.5YR 4/6), hard		1075.5+/-	SPT-8; N=51; SOIL REC=18 (In.); MC=22%
			1072+/-	SPT-9; N=86; SOIL REC=17 (In.); MC=13%
1,070	**WEATHERED SHALE** red (2.5YR 4/6), soft -moderately hard to hard below 414	1070.5 / 1069.5	1070.5+/- / 1069+/-	SPT-10; N=50/4"; SOIL REC=15 (In.); MC=15%; P200=97%; LL= 39; PL= 16; PI= 23 TCP 50/2 1/2" 50/2 5/8" TCP 50/2 1/4" 50/13/4"
			Top of Rock = 1070.5 Ft.	
			1064+/-	
1,060	**WEATHERED SANDSTONE** red (2.5YR 4/6), well cemented	1059	1059+/-	TCP 50/1/2" 50/5/8"
			1054+/-	TCP 50/3/4" 50/1/2"
1,050			1049+/-	TCP 50/3/8" 50/1/8"
			1044+/-	TCP 50/5/16" 50/3/16"
1,040			1039+/-	TCP 50/1/4" 50/1/8"
1,030				
1,020				
1,010				

BT-72.00
Elevation: 1038.5+/-

Boring No. A-2

STATION 138+35.46 48.54' RT
(4/9/2020)

Surface Elev. (Ft.): 1110.7

1,120	**APPROX. 8" OF ASPHALT PAVEMENT**	1110.5 / 1110	1109.5+/-	SPT-1; N=13; SOIL REC=15 (In.); MC=14%; P200=37%; LL= NP; PL= NP; PI= NP
	SILTY SAND (SM) dark reddish brown (2.5YR 3/3), light reddish brown (2.5YR 7/3) and dark red (2.5YR 3/6), medium dense	1105.5	1105.5+/-	SPT-2; N=8; SOIL REC=4 (In.); MC=22%; P200=91%
	LEAN CLAY (CL) red (10R 4/6), medium stiff			
1,100	**SILTY SAND (SM)** reddish brown (2.5YR 4/4), medium dense	1100.5	1100.5+/-	SPT-3; N=27; SOIL REC=9 (In.); MC=17%; P200=38%; LL= NP; PL= NP; PI= NP
	-red (2.5YR 5/6) and reddish yellow (7.5YR 6/6) below 15'	1095.5	1095.5+/-	SPT-4; N=29; SOIL REC=13 (In.); MC=20%; P200=22%; LL= NP; PL= NP; PI= NP
1,090	-reddish brown (5YR 4/4), dense below 20'	1090.5	1090.5+/-	SPT-5; N=31; SOIL REC=10 (In.); MC=20%; P200=32%; LL= NP; PL= NP; PI= NP
	CLAYEY SAND (SC) reddish brown (2.5YR 4/4), medium dense	1085.5	1085.5+/-	SPT-6; N=13; SOIL REC=10 (In.); MC=16%; P200=48%; LL= 26; PL= 13; PI= 13
1,080	-very loose below 30'	1080.5	1080.5+/-	SPT-7; N=3; SOIL REC=9 (In.); MC=19%
	-loose below 35'	1075.5	1075.5+/-	SPT-8; N=4; SOIL REC=13 (In.); MC=20%; P200=30%; LL= 21; PL= 13; PI= 8
1,070	-very loose below 40'	1070.5	1070.5+/-	SPT-9; N=2; SOIL REC=14 (In.); MC=21%
	FAT CLAY (CH) red (2.5YR 4/6), stiff	1065.5	1065.5+/-	SPT-10; N=9; SOIL REC=10 (In.); MC=24%; P200=93%; LL= 55; PL= 18; PI= 37
1,060	**LEAN CLAY (CL)** red (2.5YR 4/6) and greenish gray (GLEY16/5/GY), medium stiff	1060.5	1060.5+/-	SPT-11; N=8; SOIL REC=9 (In.); MC=17%; P200=96%; LL= 39; PL= 15; PI= 24
	LEAN CLAY WITH SAND (CL) dark red (7.5R 3/6), medium stiff	1055.5	1055.5+/-	SPT-12; N=7; SOIL REC=14 (In.); MC=29%; P200=84%; LL= 30; PL= 13; PI= 17
1,050	**INTERBEDDED WEATHERED SILTSTONE AND WEATHERED SANDSTONE** red (10R 4/6), well cemented	1050.5	1050.5+/- / 1050+/- / 1049.5+/-	SPT-13; N=50/4"; SOIL REC=2 (In.); MC=14%; P200=80% TCP 50/5/8"; 50/1/4"
			Top of Rock = 1050.5 Ft.	DB-15; SOIL REC=57 (In.) ROCK REC=95 (%); RQD=87(%)
			1045+/- / 1044.5+/-	TCP 50/1/2"; 50/3/4" DB-17;SOIL REC=39 (In.) ROCK REC= 65 (%); RQD=27 (%) UCS=8210 psi
1,040	-red (10R 4/6) with light brown (7.5 YR 6/3) below 70.5'	1040	1040+/- / 1039.5+/-	TCP 50/3/8"; 50/1/4" DB-19; SOIL REC=46 (In.) ROCK REC=77 (%); RQD=17 (%) UCS=870 psi
	WEATHERED SHALE WITH WEATHERED SANDSTONE SEAMS red (10R 4/6) and light gray (GLEY1 7/N), hard	1035	1035+/- / 1034.5+/-	TCP 50/3/4"; 50/1/2" DB-21; ROCK REC=100 (%); RQD=80 (%); UCS=150 psi
1,030	**WEATHERED SHALE WITH WEATHERED SANDSTONE** red (10R 4/6) and light brown (7.5YR 6/4), hard, with a 6" reddish gray (2.5YR 6/1) siltstone seam between 75.5' and 80.5'	1030	1030+/- / 1029.5+/-	TCP 50/3/8"; 50/3/16" DB-23; SOIL REC=59 (In.) ROCK REC=98 (%); RQD=63 (%) UCS=6700 psi
	WEATHERED SANDSTONE light brown (7.5YR 6/4) and red (10R 4/6), well cemented, with red (10R 4/6) siltstone	1025	1025+/- / 1024.5+/-	TCP 50/5/8"; 50/1/4" DB-25; SOIL REC=54 (In.) ROCK REC=90 (%); RQD=33 (%)
1,020			1020+/-	TCP 50/1/2"; 50/1/4"
1,010				

BT-91.00
Elevation: 1019.5+/-

LEGEND

DCD = DIAMOND CORE DRILLING, ASTM D2113-83
SPT = STANDARD PENETRATION TEST, ASTM D1586
SS = SPLIT SPOON SAMPLER
N = NUMBER OF BLOWS PER 12 INCHES
MC = MOISTURE CONTENT
LL = LIQUID LIMIT (NV=NO VALUE)
PI = PLASTICITY INDEX (NP=NO PLASTICITY)
#200 = PERCENT PASSING #200 SIEVE
UCS = UNCONFINED COMPRESSIVE STRENGTH
TCP = TEXAS CONE PENETROMETER
WCI = WET CAVE IN
= WATER LEVEL WHILE DRILLING OR SAMPLING
= WATER LEVEL AFTER DRILLING
= WATER LEVEL 24 HOURS AFTER DRILLING
= TOP OF ROCK

NOTE: WATER LEVEL ELEVATIONS SHOWN WERE OBTAINED AT THE TIME THE BORINGS WERE DRILLED AND MAY FLUCTUATE THROUGHOUT THE YEAR.

NOTE: "SS" DENOTES STANDARD PENETRATION TEST, AASHTO D1586-84. "TCP" DENOTES TEXAS CONE PENETRATION TEST.

* NOTE: TOP OF ROCK LINE SHOWN FOR ESTIMATING PURPOSES ONLY.

** NOTE: WATER LEVEL ELEVATION SHOWN WERE OBTAINED AT THE TIME THE BORINGS WERE DRILLED AND MAY FLUCTUATE THROUGHOUT THE YEAR.

*** NOTE: ROCK CLASSIFICATION IS BASED ON DRILLING CHARACTERISTICS AND VISUAL OBSERVATION OF ROCK CORE SAMPLES. PETROGRAPHIC ANALYSIS OF THIN SECTIONS OF THE ROCK CORE SAMPLES MAY REVEAL OTHER TYPES.

SITE GEOLOGY

The geology of this site consists of the red, clay shales, red, sandy shales and red, massive, commonly cross-bedded, lenticular, sandstones of the Garber Unit. The sandstones are more prominent in the southern portion of ODOT's Division 4 which would include this project site. Northward, the sandstones become thinner and shales become more prominent. The Garber unit outcrops in a 12 to 24 mile band across Grant, Garfield, Kingfisher, Logan, Noble, and Oklahoma Counties. Topographically, the unit generally forms rolling to gently rolling hills capped with sandstones and covered with thick growths of blackjack oak and post oak trees.

GEOTECHNICAL REPORT

ALL GEOTECHNICAL INFORMATION CONTAINED ON THIS SHEET IS COVERED BY THE ENGINEERING SEAL AFFIXED TO AN ORIGINAL GEOTECHNICAL ENGINEERING REPORT THAT HAS BEEN STAMPED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN OKLAHOMA. TO OBTAIN A COPY OF THE COMPLETE REPORT, CONTACT THE ODOT OFFICE ENGINEER AT (405) 521-2625. THE CONTRACTOR SHOULD BE FULLY AWARE OF THE SITE CONDITIONS PRIOR TO BEGINNING WORK. ANY ADDITIONAL GEOTECNICAL INFORMATION WHICH MAY BE DESIRED IS THE RESPONSIBILITY OF THE CONTRACTOR.

Terracon

Oklahoma & Logan Counties

SUBSURFACE PROFILE
(SHEET 1of 4)

Design	XX	X/XX
Detail	XX	X/XX
Check	XX	X/XX
Squad:	XXXXXXX	
Engr.:	XXXXXXXX	

STATE OF OKLAHOMA | DEPARTMENT OF TRANSPORTATION | JOB PIECE NO. 29843(04) | SHEET NOXXX

Exhibit A-12

Boring No. A-3

STATION 139+81.08 4.08' RT
(3/27/2020)

Surface Elev. (Ft.): 1109.3

1,110	**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)** dark reddish brown (2.5YR 3/3), loose	1109.5	1109.5+/-	SPT-1; N=7; SOIL REC=8 (In.); MC=16%; P200=25%; LL= 24; PL= 17; PI= 7	
	SILTY CLAYEY SAND (SC-SM) dark reddish brown (2.5YR 3/3) and red (2.5YR 4/6), loose	1104.5	1104.5+/-	SPT-2; N=9; SOIL REC=8 (In.); MC=19%; P200=33%; LL= 20; PL= 13; PI= 7	
1,100	**SANDY LEAN CLAY (CL)** red (2.5YR 4/6), medium stiff	1099.5	1099.5+/-	SPT-3; N=6; SOIL REC=7 (In.); MC=18%; P200=70%; LL= 26; PL= 15; PI= 11	
	-very stiff below 15'	1094.5	1094.5+/-	SPT-4; N=25; SOIL REC=10 (In.); MC=20%	
1,090	**SILTY SAND (SM)** reddish brown (2.5YR 4/3), very dense	1089.5	1089.5+/-	SPT-5; N=63; SOIL REC=12 (In.); MC=17%; P200=20%; LL= NP; PL= NP; PI= NP	
	CLAYEY SAND (SC) red (2.5YR 4/3), medium dense	1084.5	1084.5+/-	SPT-6; N=19; SOIL REC=6 (In.); MC=21%; P200=36%; LL= 21; PL= 13; PI= 8	
1,080	**SANDY LEAN CLAY (CL)** dusky red (2.5YR 3/2), soft	1079.5	1079.5+/-	SPT-7; N=2; SOIL REC=15 (In.); MC=23%; P200=52%; LL= 21; PL= 13; PI= 8	▼
	CLAYEY SAND (SC) red (2.5YR 4/3), loose	1074.5	1074.5+/-	SPT-8; N=4; SOIL REC=17 (In.); MC=19%; P200=40%; LL= 25; PL= 13; PI= 12	
1,070	-very loose below 40'	1069.5	1069.5+/-	SPT-9; N=2; SOIL REC=17 (In.); MC=22%	
	SANDY LEAN CLAY (CL) reddish brown (2.5YR 4/4), medium stiff	1064.5	1064.5+/-	SPT-10; N=4; SOIL REC=2 (In.); MC=23%; P200=63%	
1,060	**CLAYEY SAND (SC)** reddish brown (2.5YR 4/4), very loose	1059.5	1059.5+/-	SPT-11; N=3; SOIL REC=17 (In.); MC=25%; P200=42%; LL= 28; PL= 12; PI= 16	
	SANDY LEAN CLAY (CL) reddish brown (2.5YR 4/4), soft	1054.5	1054.5+/-	SPT-12; N=4; SOIL REC=17 (In.); MC=29%; P200=62%; LL= 22; PL= 12; PI= 10	
1,050	**CLAYEY SAND (SC)** reddish brown (2.5YR 4/4), very loose	1049.5	1049.5+/-	SPT-13; N=0; SOIL REC=17 (In.); MC=25%; P200=50%; LL= 22; PL= 14; PI= 8	
	SILTY SAND (SM) reddish brown (2.5YR 4/4), very loose	1044.5	1044.5+/-	SPT-14; N=1; SOIL REC=17 (In.); MC=22%; P200=24%; LL= NP; PL= NP; PI= NP	
1,040	-reddish brown (2.5YR 4/3), loose below 70'	1039.5	1039.5+/-	SPT-15; N=5; SOIL REC=17 (In.); MC=19%; P200=22%; LL= NP; PL= NP; PI= NP	
			1034.5+/-	SPT-16; N=4; SOIL REC=17 (In.); MC=23%	
1,030			1029.5+/-	SPT-17; N=5; SOIL REC=17 (In.); MC=21%	
			1024.5+/-	SPT-18; N=8; SOIL REC=17 (In.); MC=19%	
1,020	**HIGHLY WEATHERED SILTY SANDSTONE** reddish brown (2.5YR 4/3), poorly cemented	1019.5	1019.5+/-	SPT-19; N=50; SOIL REC=17 (In.); MC=17%; P200=28%; LL= NP; PL= NP; PI= NP	
				Top of Rock = 1019.5 Ft.	
	WEATHERED SHALE reddish brown (2.5YR 4/4) and light reddish brown (2.5YR 6/4), moderately hard	1014.5 1014	1014.5+/- 1014+/- 1013.5+/-	SPT-20; N=50/3"; SOIL REC=2 (In.); MC=13%; P200=86%; LL= 27; PL= 14; PI= 13 TCP 50/7/16"; 50/3/8"	
1,010	**WEATHERED SANDSTONE** reddish brown (2.5YR 4/4) and light reddish brown (2.5YR 6/4), well cemented	1009	1009+/- 1008.5+/-	DB-21;SOIL REC=42 (In.) ROCK REC=70(%); RQD=56 (%) TCP 50/7/8"; 50/1/4"	
	-light reddish brown (2.5YR 6/4) and reddish yellow (7.5YR 7/8) below 105.5'	1004	1004+/- 1003.5+/-	DB-22; SOIL REC=46 (In.) ROCK REC=77 (%); RQD=75 (%) UCS=730 psi TCP 50/3/8"; 50/1/8"	
1,000	-reddish brown (2.5YR 4/4) and pinkish white (7.5 YR 8/2), with a 6" reddish yellow (7.5YR 7/6) shale lens from 105.5' to 110.5'	999	999+/- 998.5+/-	DB-23;SOIL REC=44 (In.) ROCK REC=73 (%); RQD=33 (%) TCP 50/1/4"; 50/1/16"	
	-reddish yellow (7.5YR 7/8), with a 10" reddish brown (2.5YR 4/4) shale lense from 110.5' to 115.5'	994	994+/- 993.5+/-	DB-24;SOIL REC=50 (In.) ROCK REC=83(%); RQD=23 (%); UCS=510 psi TCP 50/3/8"; 50/1/16"	
990	-light reddish brown (2.5YR 6/3), reddish brown (2.5YR 5/4), and reddish yellow, (7.5YR 7/6) below 115.5'	989	989+/- 988.5+/-	DB-25; SOIL REC=51(In.) ROCK REC=85 (%); RQD=23 (%) TCP 50/3/8"; 50/1/16"	
	-reddish brown (2.5YR 5/4), reddish yellow (7.5YR 7/6), and pinkish white (7.5YR 8/2) below 115.5'		984+/-	DB-26; SOIL REC=60 (In.) ROCK REC=100 (%); RQD=86(%); UCS=160 psi TCP 50/3/8"; 50/1/8"	
980					

BT-126.00
Elevation: 983.5+/-

Boring No. A-4

STATION 140+21.10 51.58' RT
(3/24/2020)

Surface Elev. (Ft.): 1109.1

	APPROX. 10" OF CONCRETE PAVEMENT	1109 1108.5	1109+/-	SPT-1; N=20; SOIL REC=13 (In.); MC=14%; P200=33%; LL= NP; PL= NP; PI= NP	1,110
	SILTY SAND (SM) dark reddish brown (5YR 3/3) to dusky red (10R 3/3), medium dense	1104	1104+/-	SPT-2; N=6; SOIL REC=6 (In.); MC=17%; P200=64%; LL= 25; PL= 12; PI= 13	
	SANDY LEAN CLAY (CL) red (10R 4/6) with weak red (10R 5/4), medium stiff -red (2.5YR 4/8) below 10'	1099	1099+/-	SPT-3; N=5; SOIL REC=8 (In.); MC=18%	1,100
	CLAYEY SAND (SC) red (2.5YR 4/6), medium dense	1094	1094+/-	SPT-4; N=28; SOIL REC=11 (In.); MC=18%; P200=25%; LL= 24; PL= 14; PI= 10	
	-brown (7.5YR 4/3) with red (2.5YR 4/6), dense below 20'	1089	1089+/-	SPT-5; N=40; SOIL REC=17 (In.); MC=17%; P200=29%; LL= 22; PL= 14; PI= 8	1,090
	SILTY SAND (SM) red (2.5YR 4/8), dense	1084	1084+/-	SPT-6; N=32; SOIL REC=14 (In.); MC=15%; P200=30%; LL= NP; PL= NP; PI= NP	
	SANDY LEAN CLAY (CL) dark brown (7.5YR 3/4), soft	1079	1079+/-	SPT-7; N=2; SOIL REC=17 (In.); MC=22%; P200=57%; LL= 23; PL= 15; PI= 8	1,080
	CLAYEY SAND (SC) dark brown (7.5YR 3/2) and reddish brown (5YR 4/4), loose	1074	1074+/-	SPT-8; N=7; SOIL REC=17 (In.); MC=18%; P200=48%; LL= 27; PL= 15; PI= 12	
	SILTY CLAYEY SAND (SC-SM) reddish brown (5YR 4/4), loose	1069	1069+/-	SPT-9; N=4; SOIL REC=17 (In.); MC=21%; P200=24%; LL= 20; PL= 13; PI= 7	1,070
	SILTY SAND (SM) yellowish red (5YR 5/6), loose	1064	1064+/-	SPT-10; N=7; SOIL REC=17 (In.); MC=19%; P200=29%; LL= NP; PL= NP; PI= NP	
			1059+/-	SPT-11; N=5; SOIL REC=17 (In.); MC=21%	1,060
	-very loose below 55'	1054	1054+/-	SPT-12; N=2; SOIL REC=17 (In.); MC=22%	
	-loose below 60'	1049	1049+/-	SPT-13; N=6; SOIL REC=17 (In.); MC=21%	1,050
	-very loose below 65'	1044	1044+/-	SPT-14; N=2; SOIL REC=17 (In.); MC=23%	
	CLAYEY SAND (SC) reddish brown (5YR 4/4), very loose	1039	1039+/-	SPT-15; N=2; SOIL REC=17 (In.); MC=20%; P200=41%; LL= 23; PL= 13; PI= 10	1,040
	-yellowish red (5YR 4/6) below 75'	1034	1034+/-	SPT-16; N=2; SOIL REC=17 (In.); MC=26%	
	LEAN CLAY (CL) red (10R 4/6), hard	1029	1029+/-	SPT-17; N=32; SOIL REC=17 (In.); MC=14%; P200=98%; LL= 36; PL= 15; PI= 21	1,030
	WEATHERED SANDSTONE red (10R 4/6) with light gray (5YR 7/1), well cemented	1024	1024+/- 1023.5+/-	SPT-18; N=50/1"; SOIL REC=0 (In.) TCP 50/9/16"; 50/3/16"	
				Top of Rock = 1024 Ft.	
			1018.5+/-	TCP 50/7/8"; 50/1/2"	1,020
			1013.5+/-	TCP 50/3/8"; 50/3/16"	
			1008.5+/-	TCP 50/5/16"; 50/3/16"	1,010
			1003.5+/-	TCP 50/3/8"; 50/1/4"	
			998.5+/-	TCP 50/5/16"; 50/1/8"	1,000
			993.5+/-	TCP 50/3/8"; 50/1/8"	
					990
					980

BT-116.00
Elevation: 993+/-

REVISIONS

REV. NO.	DESCRIPTION	DATE

LEGEND

DCD = DIAMOND CORE DRILLING, ASTM D2113-83
SPT = STANDARD PENETRATION TEST, ASTM D1586
SS = SPLIT SPOON SAMPLER
N = NUMBER OF BLOWS PER 12 INCHES
MC = MOISTURE CONTENT
LL = LIQUID LIMIT (NV=NO VALUE)
PI = PLASTICITY INDEX (NP=NO PLASTICITY)
#200 = PERCENT PASSING #200 SIEVE
UCS = UNCONFINED COMPRESSIVE STRENGTH
TCP = TEXAS CONE PENETROMETER
WCI = WET CAVE IN
▽ = WATER LEVEL WHILE DRILLING OR SAMPLING
▼ = WATER LEVEL AFTER DRILLING
▼ = WATER LEVEL 24 HOURS AFTER DRILLING
▨ = TOP OF ROCK

NOTE: WATER LEVEL ELEVATIONS SHOWN WERE OBTAINED AT THE TIME THE BORINGS WERE DRILLED AND MAY FLUCTUATE THROUGHOUT THE YEAR.

NOTE: "SS" DENOTES STANDARD PENETRATION TEST, AASHTO D1586-84. "TCP" DENOTES TEXAS CONE PENETRATION TEST.

* NOTE: TOP OF ROCK LINE SHOWN FOR ESTIMATING PURPOSES ONLY.

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SITE GEOLOGY

The geology of this site consists of the red, clay shales, red, sandy shales and red, massive, commonly cross-bedded, lenticular, sandstones of the Garber Unit. The sandstones are more prominent in the southern portion of ODOT's Division 4 which would include this project site. Northward, the sandstones become thinner and shales become more prominent. The Garber unit outcrops in a 12 to 24 mile band across Grant, Garfield, Kingfisher, Logan, Noble, and Oklahoma Counties. Topographically, the unit generally forms rolling to gently rolling hills capped with sandstones and covered with thick growths of blackjack oak and post oak trees.

GEOTECHNICAL REPORT

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Terracon

OKLAHOMA AND LOGAN COUNTIES

SUBSURFACE PROFILE
(SHEET 2 of 4)

Design	XX	X/XX
Detail	XX	X/XX
Check	XX	X/XX
Squad:	XXXXXXX	
Engr.:	XXXXXXXX	

STATE OF OKLAHOMA | DEPARTMENT OF TRANSPORTATION | JOB PIECE NO. 29843(04) | SHEET NOXXX

Exhibit A-13

REVISIONS		
REV. NO.	DESCRIPTION	DATE

Boring No. B-1

STATION 138+17.30 49.42' LT
(3/23/2020)

Surface Elev. (Ft.): 1110.9

APPROX. 5" OF ASPHALT PAVEMENT	1111 / 1110.5	1111+/-	SPT-1; N=8; SOIL REC=13 (In.); MC=16%; P200=47%; LL= 26; PL= 12; PI= 14
CLAYEY SAND (SC) dusky red (2.5YR 3/2) and red (2.5YR 4/8), loose	1106	1106+/-	SPT-2; N=9; SOIL REC=8 (In.); MC=20%; P200=82%; LL= 33; PL= 14; PI= 19
LEAN CLAY WITH SAND (CL) red (2.5YR 4/6), stiff			
CLAYEY SAND (SC) reddish brown (2.5YR 4/4), medium dense	1101	1101+/-	SPT-3; N=25; SOIL REC=10 (In.); MC=20%; P200=38%; LL= 23; PL= 15; PI= 8
		1096+/-	SPT-4; N=13; SOIL REC=10 (In.); MC=18%; P200=35%; LL= 22; PL= 14; PI= 8
WEATHERED SHALE red (2.5YR 4/8), hard / **WEATHERED SANDSTONE** red (2.5YR 4/6), well cemented	1091 / 1090.5	1091+/- / 1090+/-	SPT-5; N=50/1"; SOIL REC=7 (In.); MC=13%; P200=84%; LL= 30; PL= 14; PI= 16
Top of Rock = 1091Ft.			TCP 50/7/8"; 50/3/8"
		1085+/-	TCP 50/1/8"; 50/1/8"
		1080+/-	TCP 50/1/16"; 50/3/16"
		1075+/-	TCP 50/1/4"; 50/3/16"
		1070+/-	TCP 50/1 1/4"; 50/1 3/8"
		1065+/-	TCP 50/3/4"; 50/1/2"
		1060+/-	TCP 50/5/8"; 50/3/16"

BT-52.00
Elevation: 1059+/-

Boring No. B-2

STATION 138+50.04 7.85' LT
(3/25/2020)

Surface Elev. (Ft.): 1110.0

CLAYEY SAND (SC) red (2.5YR 5/6), loose	1110	1110+/-	SPT-1; N=7; SOIL REC=16 (In.); MC=16%; P200=30%; LL= 23; PL= 15; PI= 8
LEAN CLAY (CL) red (2.5YR 4/6) and red (2.5YR 5/6), stiff	1105	1105+/-	SPT-2; N=13; SOIL REC=12 (In.); MC=19%; P200=88%; LL= 29; PL= 15; PI= 14
CLAYEY SAND (SC) reddish brown (2.5YR 4/4), medium dense	1100	1100+/-	SPT-3; N=12; SOIL REC=15 (In.); MC=16%; P200=26%; LL= 24; PL= 15; PI= 9
		1095+/-	SPT-4; N=27; SOIL REC=8 (In.); MC=16%; P200=38%
SANDY LEAN CLAY (CL) strong brown (7.5YR 4/6), very stiff	1090	1090+/-	SPT-5; N=21; SOIL REC=12 (In.); MC=19%; P200=52%; LL= 27; PL= 15; PI= 12
CLAYEY SAND (SC) strong brown (7.5YR 4/6), loose	1085	1085+/-	SPT-6; N=7; SOIL REC=11 (In.); MC=16%; P200=44%; LL= 25; PL= 14; PI= 11
SILTY SAND (SM) strong brown (7.5YR 4/6), loose	1080	1080+/-	SPT-7; N=8; SOIL REC=12 (In.); MC=18%; P200=41%; LL= NP; PL= NP; PI= NP
FAT CLAY (CH) dark red (10R 3/6), very stiff	1075	1075+/-	SPT-8; N=16; SOIL REC=11 (In.); MC=23%; P200=94%; LL= 51; PL= 21; PI= 30
LEAN CLAY (CL) dark red (10R 3/6), very stiff to hard	1071.5	1071.5+/-	SPT-9; N=28; SOIL REC=18 (In.); MC=19%; P200=94%; LL= 43; PL= 20; PI= 23
		1070+/-	SPT-10; N=44; SOIL REC=16 (In.); MC=14%
LEAN CLAY WITH SAND (CL) dark red (10R 3/6) and red (10R 5/6), hard	1065	1065+/-	SPT-11; N=38; SOIL REC=17 (In.); MC=15%; P200=80%; LL= 27; PL= 15; PI= 12
		1060+/-	SPT-12; N=59; SOIL REC=18 (In.); MC=14%; P200=78%; LL= 26; PL= 14; PI= 12
LEAN CLAY (CL) red (10R 4/8), hard	1055	1055+/-	SPT-13; N=53; SOIL REC=17 (In.); MC=15%; P200=89%; LL= 31; PL= 15; PI= 16
WEATHERED SHALE red (10R 5/6) and light gray (GLEY1 7/5GY), soft	1050 / 1049	1050+/- / 1049.5+/- / 1049+/-	SPT-14; N=50/5"; SOIL REC=5 (In.); MC=11%; P200=82% / TCP 50/3/8"; 50/1/8" / DB-15; SOIL REC=40 (In.) ROCK REC=67 (%); RQD= 32 (%) UCS=7450 psi
WEATHERED SHALE red (10R 5/6), soft, with 13" of weak red (10R 4/4) weathered sandstone		Top of Rock = 1050 Ft.	
WEATHERED SANDSTONE weak red (10R 4/4), well cemented, with red (10R 5/8) siltstone seams - pale brown (2.5Y 7/4), red (10R 4/6), weak red (10R 4/3), and reddish black (2.5YR 2.5/1) below 71'	1044 / 1039	1044.5+/- / 1044+/- / 1039.5+/- / 1039+/-	TCP 50/3/8"; 50/1/8" / DB-16; SOIL REC=60 (In.) ROCK REC=100 (%); RQD=68 (%) UCS=800 psi / TCP 50/1/8"; 50/1/16"
WEATHERED SILTSTONE WITH INTERBEDDED WEATHERED SHALE red (10R 4/6), well cemented	1034	1034.5+/- / 1034+/-	DB-17;SOIL REC=46 (In.) ROCK REC=77 (%); RQD=33 (%) UCS=1500 psi / TCP 50/3/8"; 50/3/16"
WEATHERED SHALE red (10R 4/6), hard, with 11" of dusky red (10R 3/4) sandstone	1029	1029.5+/- / 1029+/-	DB-18;SOIL REC=54 (In.) ROCK REC=90 (%); RQD=78 (%) UCS=230 psi / TCP 50/1/4"; 50/1/8"
	1024	1024.5+/- / 1024+/-	DB-19;SOIL REC=52 (In.) ROCK REC=87 (%); RQD=60 (%) UCS=70 psi / TCP 50/3/16"; 50/3/16"
WEATHERED SANDSTONE pale red (10R 3/2), weak red (10R 5/2), and dusky red (10R 6/2), well cemented, with 16" of red (10R 4/6) weathered shale		1019.5+/-	DB-20; SOIL REC=57 (In.) ROCK REC=95 (%); RQD=65 (%) UCS=1090 psi / TCP 50/5/16"; 50/3/16"

BT-91.00
Elevation: 1019+/-

LEGEND

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PI = PLASTICITY INDEX (NP=NO PLASTICITY)
#200 = PERCENT PASSING #200 SIEVE
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= TOP OF ROCK

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Terracon

Oklahoma and Logan Counties

SUBSURFACE PROFILE
(SHEET 3 of 4)

Design	XX	X/XX
Detail	XX	X/XX
Check	XX	X/XX
Squad:	XXXXXXX	
Engr.:	XXXXXXXX	

STATE OF OKLAHOMA | DEPARTMENT OF TRANSPORTATION | JOB PIECE NO. 29843(04) | SHEET NO XXX

Exhibit A-14

Boring No. B-3

STATION 139+73.82 55.29' LT
(4/1/2020)

Surface Elev. (Ft.): 1109.5

1,110	**APPROX. 1" OF ASPHALT PAVEMENT**	1109.5	1109.5+/-	SPT-1; N=18; SOIL REC=12 (In.); MC=14%; P200=41%; LL= NP; PL= NP; PI= NP
	APPROX. 9" OF PORTLAND CEMENT CONCRETE	1109.5 1108.5		
	SILTY SAND (SM) dusky red (5R 3/4) and reddish black (5R 2.5/1), medium dense	1104.5	1104.5+/-	SPT-2; N=13; SOIL REC=16 (In.); MC=20%; P200=57%; LL= 26; PL= 13; PI= 13
1,100	**SANDY LEAN CLAY (CL)** red (10R 4/6), stiff	1099.5	1099.5+/-	SPT-3; N=16; SOIL REC=14 (In.); MC=18%
	-weak red (7.5R 5/4), very stiff below 10'	1094.5	1094.5+/-	SPT-4; N=28; SOIL REC=12 (In.); MC=21%; P200=39%; LL= NP; PL= NP; PI= NP
	SILTY SAND (SM) weak red (7.5R 5/4), medium dense			
1,090	-reddish brown (2.5YR 4/3), dense below 20'	1089.5	1089.5+/-	SPT-5; N=36; SOIL REC=16 (In.); MC=24%; P200=34%; LL= NP; PL= NP; PI= NP
	SILTY CLAYEY SAND (SC-SM) yellowish brown (10YR 5/6), medium dense	1084.5	1084.5+/-	SPT-6; N=18; SOIL REC=18 (In.); MC=20%; P200=44%; LL= 23; PL= 16; PI= 7
1,080	-brown (7.5YR 4/3), very loose below 30'	1079.5	1079.5+/-	SPT-7; N=2; SOIL REC=18 (In.); MC=23%; P200=48%; LL= 20; PL= 14; PI= 6
			1074.5+/-	SPT-8;N=2; SOIL REC=18 (In.); MC=20%
1,070	**SILTY SAND (SM)** reddish brown (2.5YR 4/4), loose	1069.5	1069.5+/-	SPT-9; N=6; SOIL REC=18 (In.); MC=21%; P200=28%; LL= NP; PL= NP; PI= NP
	-red (2.5YR 4/8) below 45'	1064.5	1064.5+/-	SPT-10; N=5; SOIL REC=18 (In.); MC=23%; P200=39%; LL= NP; PL= NP; PI= NP
1,060			1059.5+/-	SPT-11; N=5; SOIL REC=18 (In.); MC=25%; P200=36%; LL= NP; PL= NP; PI= NP
			1054.5+/-	SPT-12; N=6; SOIL REC=16 (In.); MC=25%
1,050			1049.5+/-	SPT-13; N=5; SOIL REC=18 (In.); MC=22%; P200=15%; LL= NP; PL= NP; PI= NP
	-dusky red (10R 3/2) below 65'	1044.5	1044.5+/-	SPT-14; N=5; SOIL REC=18 (In.); MC=23%; P200=15%; LL= NP; PL= NP; PI= NP
1,040	**POORLY GRADED SAND WITH SILT (SP-SM)** reddish black (5R 2.5/1), loose	1039.5	1039.5+/-	SPT-15; N=9; SOIL REC=18 (In.); MC=21%; P200=11%; LL= NP; PL= NP; PI= NP
	CLAYEY SAND (SC) very dusky red (5R 2.5/3), very dense	1034.5 1033.5	1034.5+/-	SPT-16; N=50/4"; SOIL REC=16 (In.); MC=20%; P200=31%; LL= 22; PL= 14; PI= 8
1,030	**WEATHERED SANDSTONE** very dusky red (5R 2.5/3), cemented -red (2.5YR 4/8), well cemented to poorly cemented below 80'	1029.5	Top of Rock = 1033.5 Ft. 1029.5+/- 1029+/-	SPT-17; N=50/1"; MC=24% P200=31% TCP 39/6"
	WEATHERED SHALE very dusky red (5R 2.5/3), hard	1024.5 1024	1024.5+/- 1024+/-	SPT-18; N=50/2"; MC=25%; P200=73%; LL= 35; PL= 14; PI= 21 TCP 50/5/16"; 50/3/8"
1,020	**WEATHERED SANDSTONE** red (10R 5/8) and dusky red (10R 3/3), well cemented -red (10R 5/8) and weak red (10R 4/4), with traces of red (2.5YR 4/6) shale below 91'	1018.5 1013.5	1023.5+/- 1019+/- 1018.5+/- 1014+/- 1013.5+/-	DB-19; SOIL REC=32 (In.) ROCK REC=53 (%); RQD=17 (%) TCP 50/3/8"; 50/1/4" DB-20;SOIL REC=47 (In.) ROCK REC=78 (%); RQD=53 (%) TCP 50/5/8"; 50/3/8"
1,010	**WEATHERED SILTSTONE WITH INTERBEDDED SANDSTONE** red (10R 4/8) with red (10R 5/6), well cemented	1008.5	1009+/- 1008.5+/-	DB-21; SOIL REC=52 (In.) ROCK REC=87 (%); RQD=78 (%) UCS=740 psi; UCS=540 psi TCP 50/9/16"; 50/3/8"
	WEATHERED SANDSTONE red (2.5YR 5/8) and reddish yellow (5YR 6/5), well cemented		1004+/- 1003.5+/-	DB-22;SOIL REC=51(In.) ROCK REC=85 (%); RQD=57 (%) TCP 50/3/4"; 50/1/4"
1,000				DB-23; SOIL REC=33.5 (In.) ROCK REC=23 (%); RQD=10 (%)
	-red (10R 4/8), with strong brown (7.5YR 4/6) siltstone seams	998.5	999+/- 998.5+/-	UCS-710 psi TCP 50/1/2"; 50/1/4"
			994+/-	DB-24; SOIL REC=37 (In.) ROCK REC=62 (%); RQD= 28 (%)
990				TCP 50/1 1/8"; 50/1/8"
980				

BT-116.00
Elevation: 993.5+/-

Boring No. B-4

STATION 140+21.14 49.34' LT
(3/23/2020)

Surface Elev. (Ft.): 1108.9

	APPROX 12" OF PORTLAND CEMENT CONCRETE	1109 1108	1109+/-	SPT-1; N=20; SOIL REC=10 (In.); MC=14%; P200=42%; LL= NP; PL= NP; PI= NP
	SILTY SAND (SM) weak red (10R 5/4), medium dense	1104	1104+/-	SPT-2; N=22; SOIL REC=15 (In.); MC=12%; P200=47%; LL= 21; PL= 12; PI= 9
	CLAYEY SAND (SC) weak red (10R 5/4) and red (10R 4/6), medium dense	1099	1099+/-	SPT-3; N=38; SOIL REC=17 (In.); MC=10%; P200=29%; LL= NP; PL= NP; PI= NP
	SILTY SAND (SM) weak red (10R 5/4), dense		1094+/-	SPT-4; N=25; SOIL REC=17 (In.); MC=16%; P200=54%; LL= 21; PL= 14; PI= 7
	SANDY SILTY CLAY (CL-ML) red (2.5YR 4/6), very stiff	1094		
	SILTY CLAYEY SAND (SC-SM) yellowish red (5YR 5/6), medium dense	1089	1089+/-	SPT-5; N=23; SOIL REC=12 (In.); MC=19%; P200=33%; LL= 22; PL= 15; PI= 7
	-brown (7.5YR 4/4) below 25'	1084	1084+/-	SPT-6; N=17; SOIL REC=13 (In.); MC=17%; P200=38%; LL= 20; PL= 13; PI= 7
	SANDY SILTY CLAY (CL-ML) dark brown (7.5YR 3/3), soft	1079	1079+/-	SPT-7; N=2; SOIL REC=15 (In.); MC=22%; P200=60%; LL= 23; PL= 16; PI= 7
	SANDY LEAN CLAY (CL) reddish brown (5YR 5/4), medium stiff	1074	1074+/-	SPT-8; N=5; SOIL REC=16 (In.); MC=17%; P200=59%; LL= 28; PL= 13; PI= 15
			1069+/-	SPT-9; N=5; SOIL REC=16 (In.); MC=20%; P200=61%; LL= 26; PL= 13; PI= 13
	-soft below 45'	1064	1064+/-	SPT-10; N=3; SOIL REC=16 (In.); MC=22%
			1059+/-	SPT-11; N=3; SOIL REC=14 (In.); MC=26%; P200=59%; LL= 25; PL= 13; PI= 12
			1054+/-	SPT-12; N=2; SOIL REC=17 (In.); MC=23%
	POORLY GRADED SAND WITH SILT (SP-SM) reddish brown (5YR 4/4), medium dense	1049	1049+/-	SPT-13; N=13; SOIL REC=11 (In.); MC=21%; P200=10%; LL= NP; PL= NP; PI= NP
			1044+/-	SPT-14; N=13; SOIL REC=6 (In.); MC=22%
	SILTY SAND (SM) reddish brown (5YR 4/4), loose	1039	1039+/-	SPT-15; N=5; SOIL REC=11 (In.); MC=22%; P200=18%; LL= NP; PL= NP; PI= NP
	-reddish brown (5YR 4/3), very loose below 75'	1034	1034+/-	SPT-16; N=3; SOIL REC=18 (In.); MC=24%; P200=17%; LL= NP; PL= NP; PI= NP
	CLAYEY SAND (SC) reddish brown (5YR 4/4), medium dense	1029	1029+/-	SPT-17; N=11; SOIL REC=12 (In.); MC=21%; LL= 36; PL= 15; PI= 21
	SILTY SAND (SM) reddish brown (5YR 4/4), very loose	1024	1024+/-	SPT-18; N=2; SOIL REC=18 (In.); MC=23%; P200=33%; LL= NP; PL= NP; PI= NP
	CLAYEY SAND WITH GRAVEL (SC) reddish brown (5YR 4/4), very dense	1019 1017.5	1019+/- 1017.5+/-	SPT-19; N=50/2"; SOIL REC=12 (In.); MC=11%; P200=24%; LL= 21; PL= 11; PI= 10
	WEATHERED SANDSTONE red (10R 5/8), well cemented		Top of Rock = 1017.5 Ft.	TCP 50/1"; 50/7/16"
			1012.5+/-	TCP 50/3/8"; 50/5/16"
			1007.5+/-	TCP 50/7/16"; 50/1/8"
			1002.5+/-	TCP 50/3/8"; 50/1/4"
			997.5+/-	TCP 50/7/16"; 50/3/16"
			992.5+/-	TCP 50/1/4"; 50/3/16"
			987.5+/-	TCP 50/5/8"; 50/1/4"

BT-122.00
Elevation: 987+/-

REVISIONS		
REV. NO.	DESCRIPTION	DATE

LEGEND

DCD = DIAMOND CORE DRILLING, ASTM D2113-83
SPT = STANDARD PENETRATION TEST, ASTM D1586
SS = SPLIT SPOON SAMPLER
N = NUMBER OF BLOWS PER 12 INCHES
MC = MOISTURE CONTENT
LL = LIQUID LIMIT (NV=NO VALUE)
PI = PLASTICITY INDEX (NP=NO PLASTICITY)
#200 = PERCENT PASSING #200 SIEVE
UCS = UNCONFINED COMPRESSIVE STRENGTH
TCP = TEXAS CONE PENETROMETER
WCI = WET CAVE IN
▽ = WATER LEVEL WHILE DRILLING OR SAMPLING
▼ = WATER LEVEL AFTER DRILLING
▼ = WATER LEVEL 24 HOURS AFTER DRILLING
▨ = TOP OF ROCK

NOTE: WATER LEVEL ELEVATIONS SHOWN WERE OBTAINED AT THE TIME THE BORINGS WERE DRILLED AND MAY FLUCTUATE THROUGHOUT THE YEAR.

NOTE: "SS" DENOTES STANDARD PENETRATION TEST, AASHTO D1586-84. "TCP" DENOTES TEXAS CONE PENETRATION TEST.

* NOTE: TOP OF ROCK LINE SHOWN FOR ESTIMATING PURPOSES ONLY.

** NOTE: WATER LEVEL ELEVATION SHOWN WERE OBTAINED AT THE TIME THE BORINGS WERE DRILLED AND MAY FLUCTUATE THROUGHOUT THE YEAR.

*** NOTE: ROCK CLASSIFICATION IS BASED ON DRILLING CHARACTERISTICS AND VISUAL OBSERVATION OF ROCK CORE SAMPLES. PETROGRAPHIC ANALYSIS OF THIN SECTIONS OF THE ROCK CORE SAMPLES MAY REVEAL OTHER TYPES.

SITE GEOLOGY

The geology of this site consists of the red, clay shales, red, sandy shales and red, massive, commonly cross-bedded, lenticular, sandstones of the Garber Unit. The sandstones are more prominent in the southern portion of ODOT's Division 4 which would include this project site. Northward, the sandstones become thinner and shales become more prominent. The Garber unit outcrops in a 12 to 24 mile band across Grant, Garfield, Kingfisher, Logan, Noble, and Oklahoma Counties. Topographically, the unit generally forms rolling to gently rolling hills capped with sandstones and covered with thick growths of blackjack oak and post oak trees.

GEOTECHNICAL REPORT

ALL GEOTECHNICAL INFORMATION CONTAINED ON THIS SHEET IS COVERED BY THE ENGINEERING SEAL AFFIXED TO AN ORIGINAL GEOTECHNICAL ENGINEERING REPORT THAT HAS BEEN STAMPED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN OKLAHOMA. TO OBTAIN A COPY OF THE COMPLETE REPORT, CONTACT THE ODOT OFFICE ENGINEER AT (405) 521-2625. THE CONTRACTOR SHOULD BE FULLY AWARE OF THE SITE CONDITIONS PRIOR TO BEGINNING WORK. ANY ADDITIONAL GEOTECNICAL INFORMATION WHICH MAY BE DESIRED IS THE RESPONSIBILITY OF THE CONTRACTOR.

Terracon

Oklahoma and Logan Counties

SUBSURFACE PROFILE
(SHEET 4 of 4)

Design	XX	X/XX
Detail	XX	X/XX
Check	XX	X/XX
Squad:	XXXXXXX	
Engr.:	XXXXXXXX	

STATE OF OKLAHOMA | DEPARTMENT OF TRANSPORTATION | JOB PIECE NO. 29843(04) | SHEET NOXXX

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer. Soil samples were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix C. Samples of bedrock were classified in accordance with the general notes for Sedimentary Rock Classification. In the laboratory, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Selected soil and bedrock samples obtained from the site were tested for the following engineering properties:

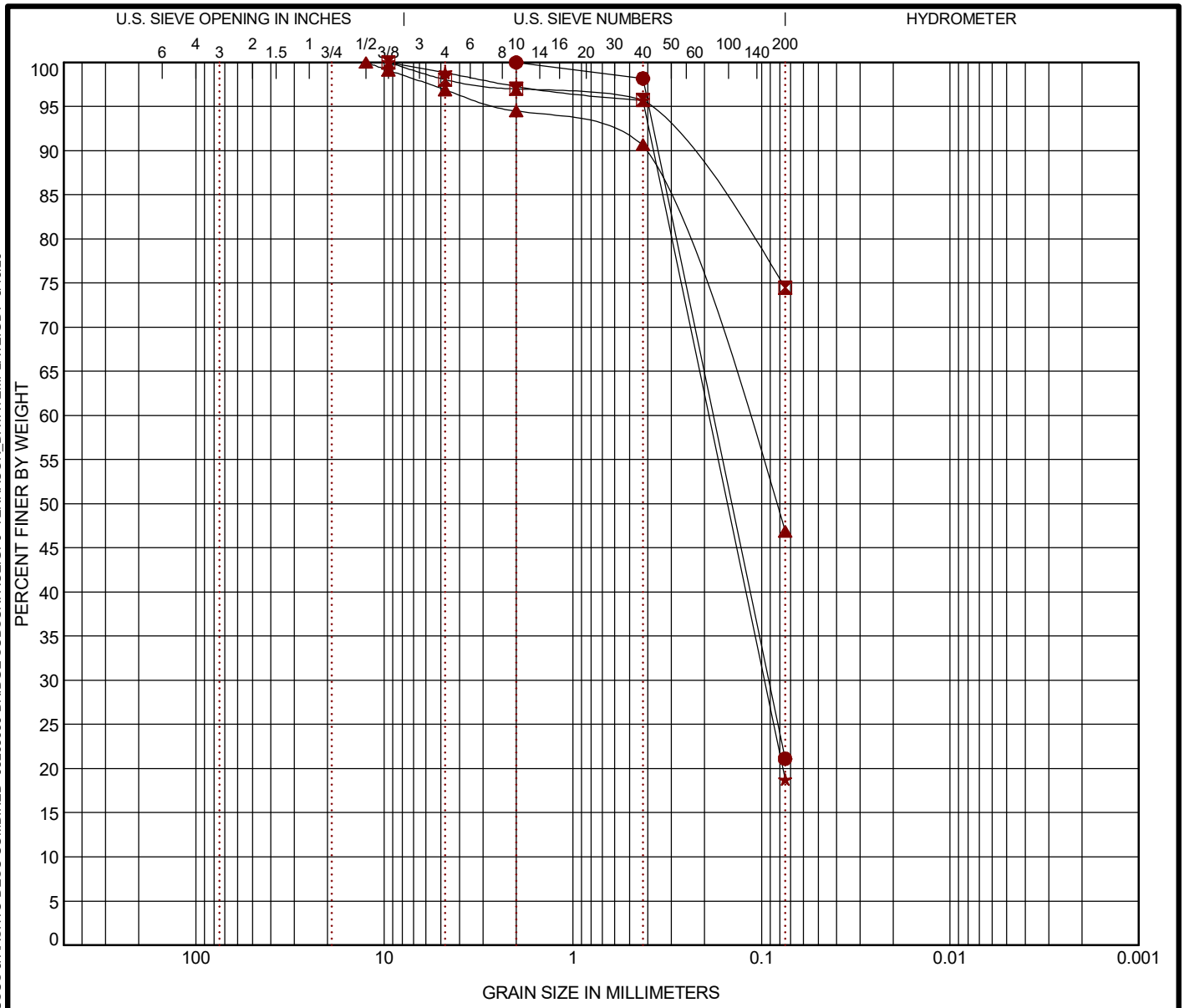
- In-situ Water Content (ASTM D-2216)
- Atterberg Limits (ASTM D-4318)
- Sieve Analysis (ASTM D-422)
- Unconfined Compression

The laboratory test results are reported on the boring logs in Appendix A. Sieve analysis grain size distribution curves are provided in Appendix B.

Procedural standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-1	1 - 2.5	CLAYEY SAND (SC)	A-2-6 (0)	18	26	13	13		
⊠	A-1	5 - 6.5	LEAN CLAY with SAND (CL)	A-6 (11)	18	33	15	18		
▲	A-1	10 - 11.5	CLAYEY SAND (SC)	A-4 (1)	17	21	13	8		
★	A-1	15 - 16.5			21					

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-1	1 - 2.5	2	0.18	0.092		0.0	78.9		21.1	
⊠	A-1	5 - 6.5	9.5				1.9	23.6		74.5	
▲	A-1	10 - 11.5	12.5	0.126			3.1	50.0		46.9	
★	A-1	15 - 16.5	9.5	0.19	0.097		1.2	80.1		18.8	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

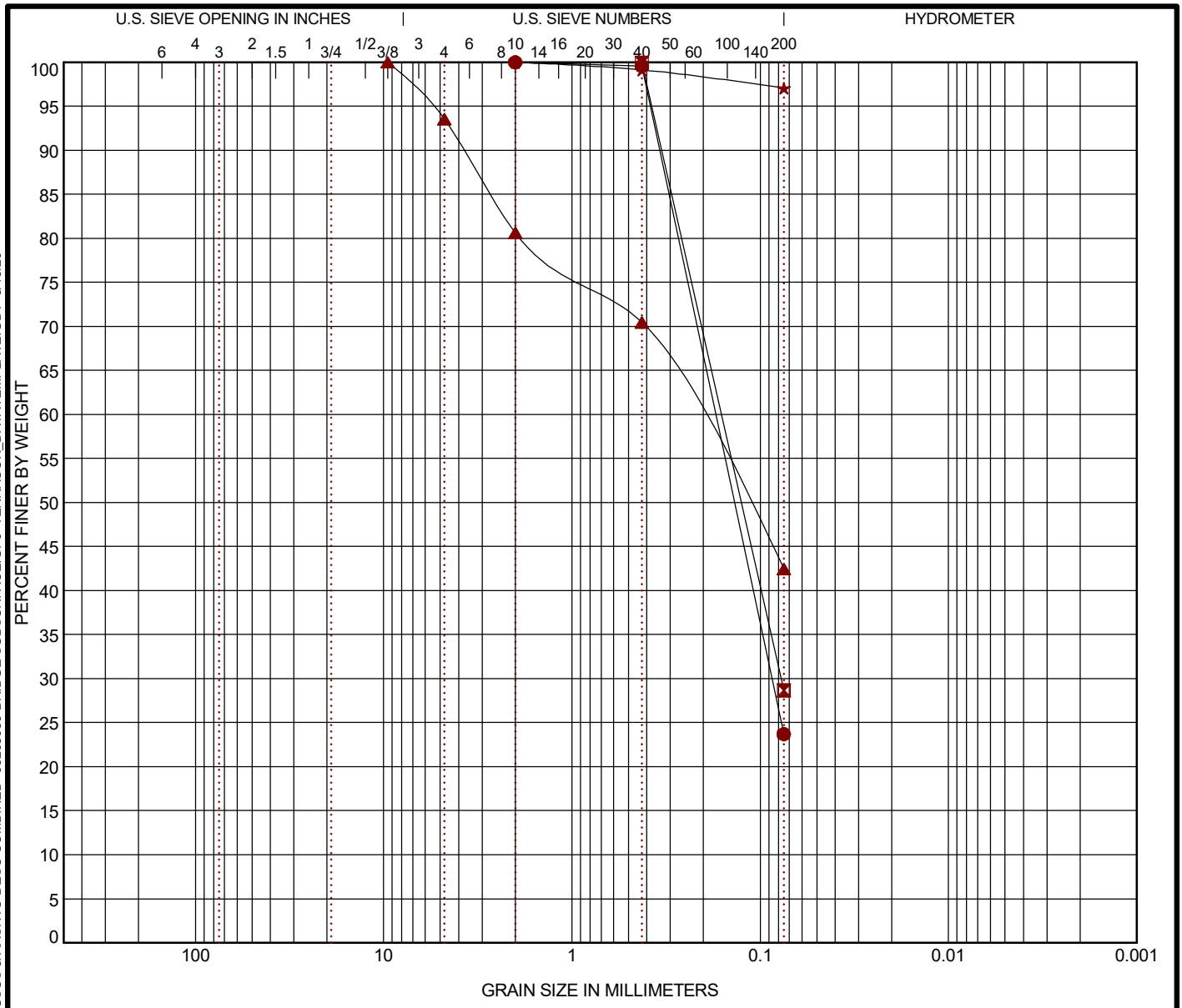
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-1	20 - 21.5	CLAYEY SAND (SC)	A-2-4 (0)	24	23	13	10		
⊠	A-1	25 - 26.5	CLAYEY SAND (SC)	A-2-4 (0)	17	25	15	10		
▲	A-1	30 - 31.5	SILTY SAND (SM)	A-4 (0)	14	NP	NP	NP		
★	A-1	40 - 41.3	WEATHERED SHALE	A-6 (23)	15	39	16	23		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-1	20 - 21.5	2	0.172	0.087		0.0	76.3		23.7	
⊠	A-1	25 - 26.5	0.425	0.161	0.077			71.3		28.7	
▲	A-1	30 - 31.5	9.5	0.222			6.4	51.1		42.5	
★	A-1	40 - 41.3	2				0.0	2.9		97.1	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

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Oklahoma & Logan Counties, Oklahoma

Terracon
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Oklahoma City, OK

PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-3

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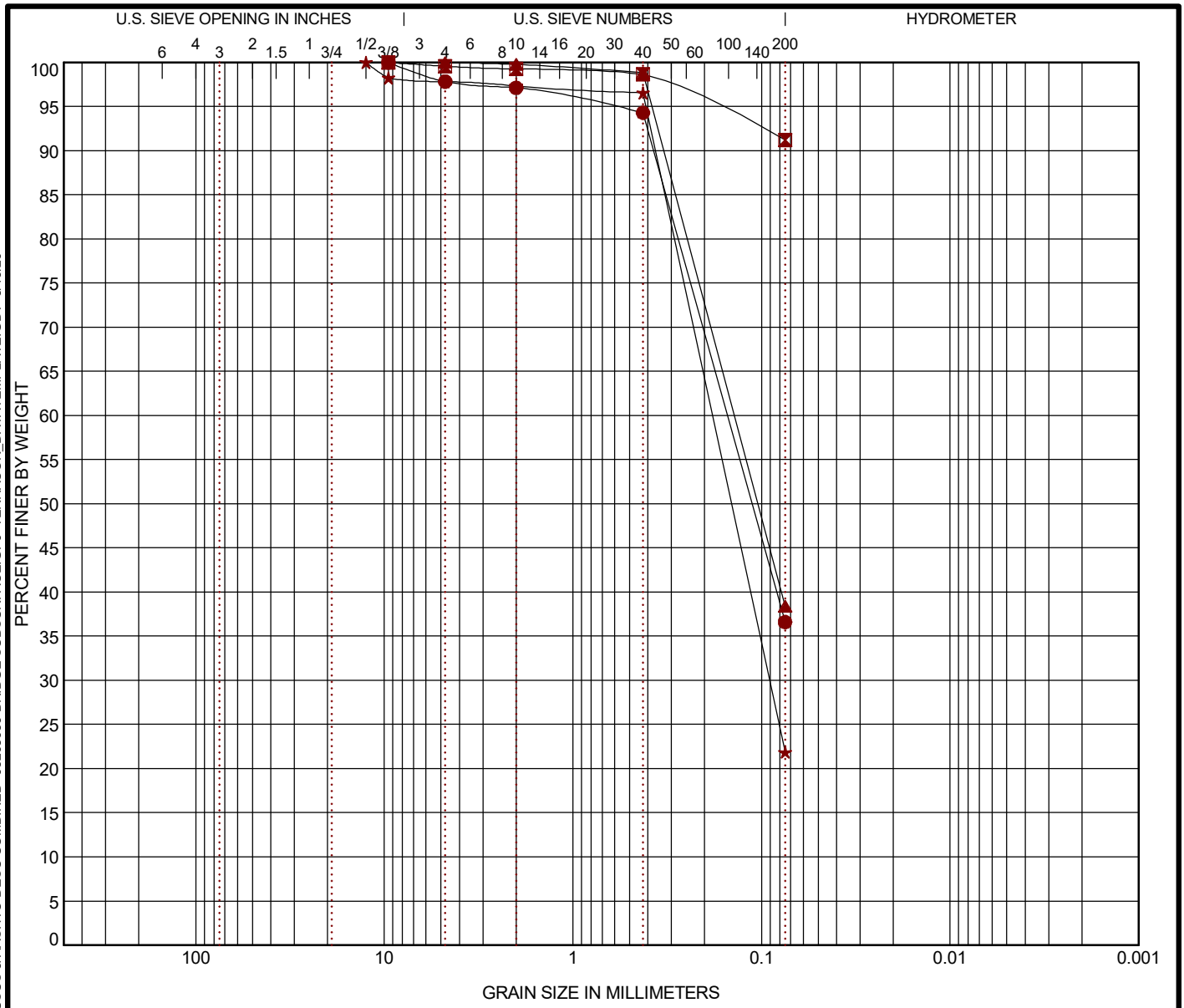
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-2	1 - 2.5	SILTY SAND (SM)	A-4 (0)	14	NP	NP	NP		
⊠	A-2	5 - 6.5			22					
▲	A-2	10 - 11.5	SILTY SAND (SM)	A-4 (0)	17	NP	NP	NP		
★	A-2	15 - 16.5	SILTY SAND (SM)	A-2-4 (0)	20	NP	NP	NP		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-2	1 - 2.5	9.5	0.152			2.2	61.2		36.6	
⊠	A-2	5 - 6.5	9.5				0.4	8.4		91.2	
▲	A-2	10 - 11.5	4.75	0.139			0.0	61.6		38.4	
★	A-2	15 - 16.5	12.5	0.182	0.091		2.2	75.9		21.9	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-4

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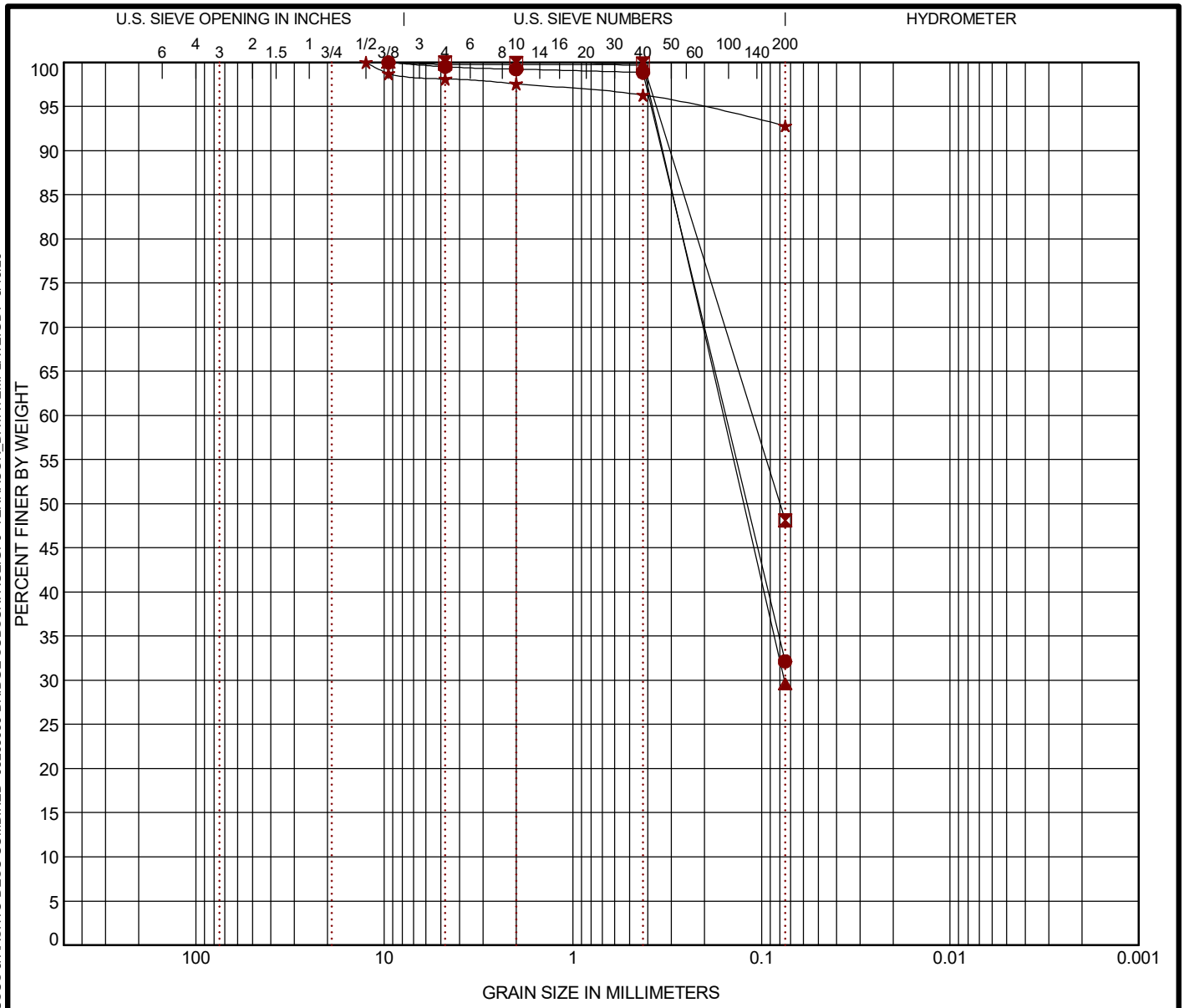
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-2	20 - 21.5	SILTY SAND (SM)	A-2-4 (0)	20	NP	NP	NP		
⊠	A-2	25 - 26.5	CLAYEY SAND (SC)	A-6 (3)	16	26	13	13		
▲	A-2	35 - 36.5	CLAYEY SAND (SC)	A-2-4 (0)	20	21	13	8		
★	A-2	45 - 46.5	FAT CLAY (CH)	A-7-6 (37)	24	55	18	37		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-2	20 - 21.5	9.5	0.155			0.5	67.4		32.1	
⊠	A-2	25 - 26.5	4.75	0.112			0.0	51.9		48.1	
▲	A-2	35 - 36.5	9.5	0.159	0.076		0.2	70.2		29.6	
★	A-2	45 - 46.5	12.5				1.9	5.3		92.8	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-5

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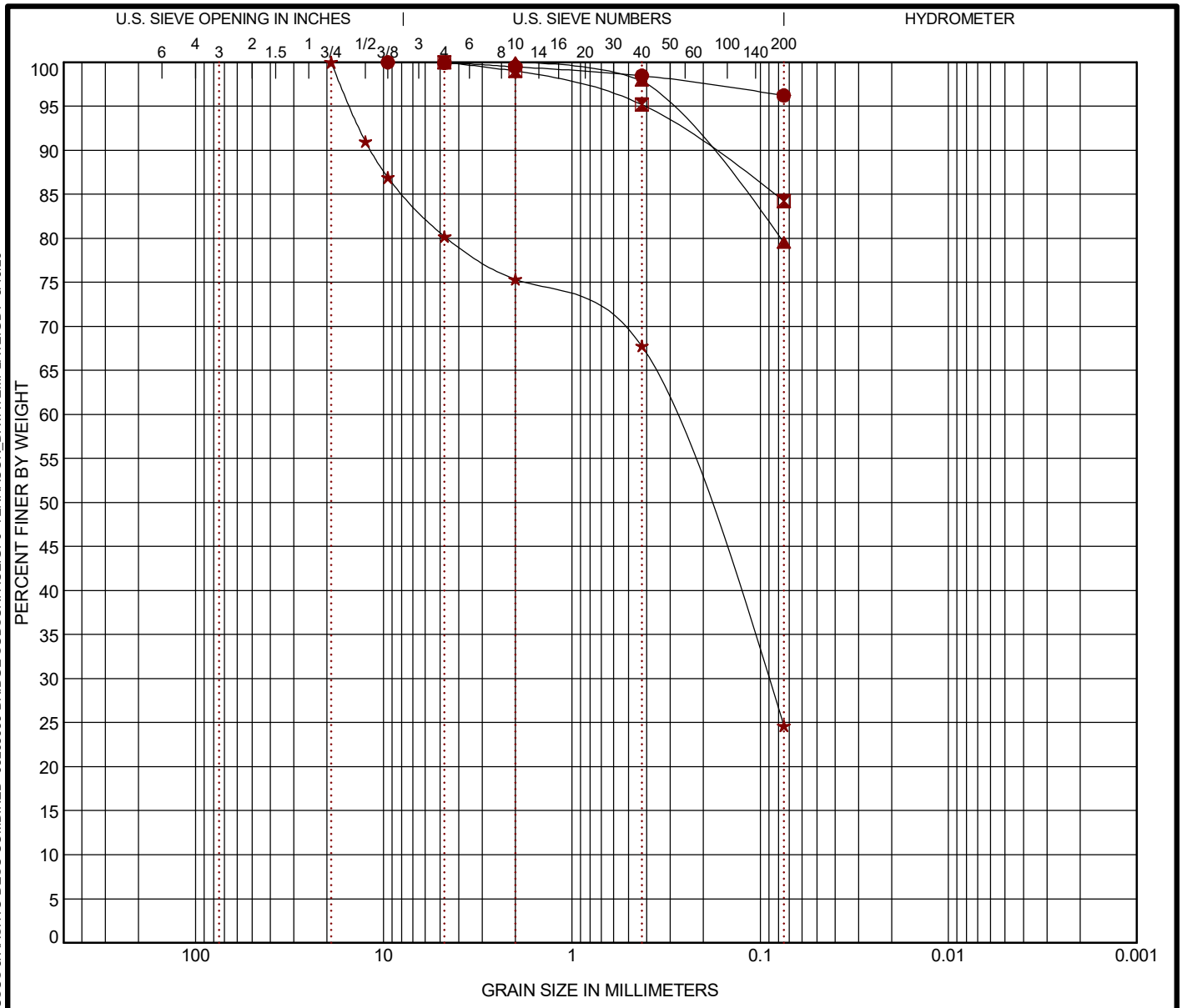
GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-2	50 - 51.5	LEAN CLAY (CL)	A-6 (23)	17	39	15	24		
⊠	A-2	55 - 56.5	LEAN CLAY with SAND (CL)	A-6 (12)	29	30	13	17		
▲	A-2	60 - 60.3			14					
★	A-3	0 - 1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	A-2-4 (0)	16	24	17	7		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-2	50 - 51.5	9.5				0.1	3.7		96.2	
⊠	A-2	55 - 56.5	4.75				0.0	15.7		84.3	
▲	A-2	60 - 60.3	2				0.0	20.5		79.5	
★	A-3	0 - 1.5	19	0.311	0.093		19.8	55.6		24.6	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

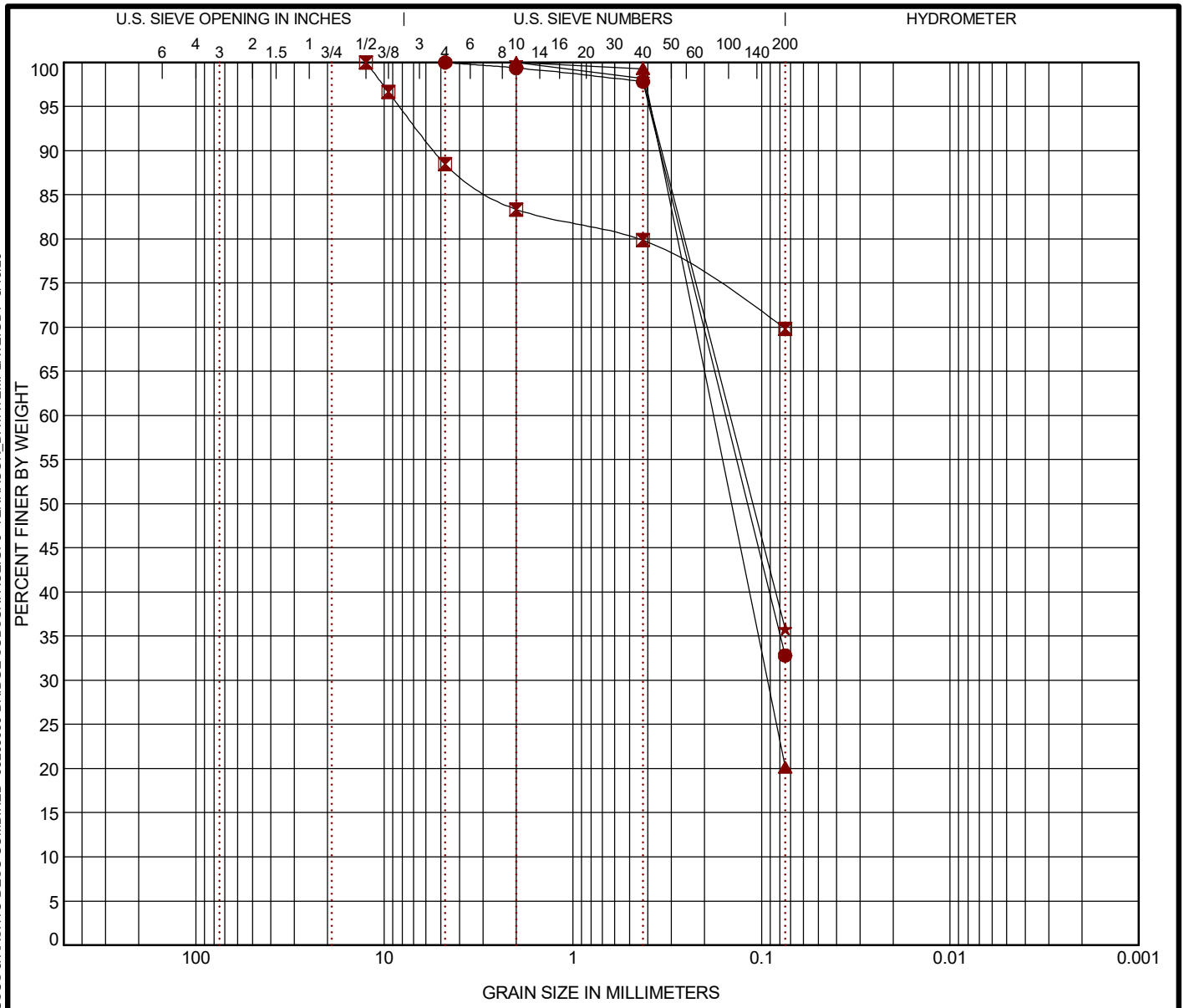
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-6

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-3	5 - 6.5	SILTY, CLAYEY SAND (SC-SM)	A-2-4 (0)	19	20	13	7		
⊠	A-3	10 - 11.5	SANDY LEAN CLAY (CL)	A-6 (5)	18	26	15	11		
▲	A-3	20 - 21.5	SILTY SAND (SM)	A-2-4 (0)	17	NP	NP	NP		
★	A-3	25 - 26.5	CLAYEY SAND (SC)	A-4 (0)	21	21	13	8		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-3	5 - 6.5	4.75	0.155			0.0	67.2		32.8	
⊠	A-3	10 - 11.5	12.5				11.5	18.7		69.8	
▲	A-3	20 - 21.5	2	0.18	0.093		0.0	79.8		20.2	
★	A-3	25 - 26.5	2	0.147			0.0	64.2		35.8	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

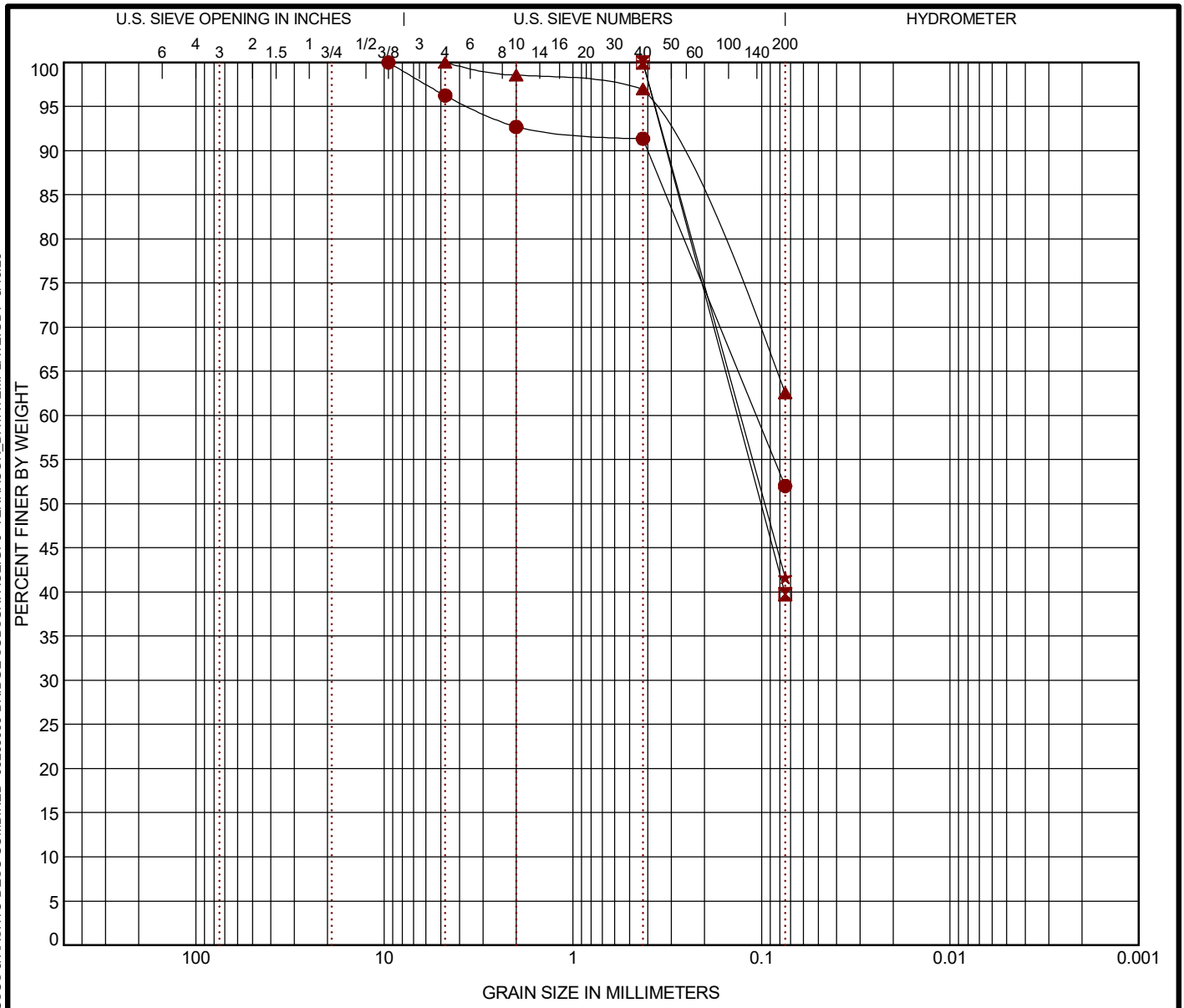
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-7

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-3	30 - 31.5	SANDY LEAN CLAY (CL)	A-4 (1)	23	21	13	8		
⊠	A-3	35 - 36.5	CLAYEY SAND (SC)	A-6 (1)	19	25	13	12		
▲	A-3	45 - 46.5			23					
★	A-3	50 - 51.5	CLAYEY SAND (SC)	A-6 (3)	25	28	12	16		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-3	30 - 31.5	9.5	0.107			3.7	44.2		52.0	
⊠	A-3	35 - 36.5	0.425	0.134			0.0	60.2		39.8	
▲	A-3	45 - 46.5	4.75				0.0	37.4		62.6	
★	A-3	50 - 51.5	0.425	0.129			0.0	58.4		41.6	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

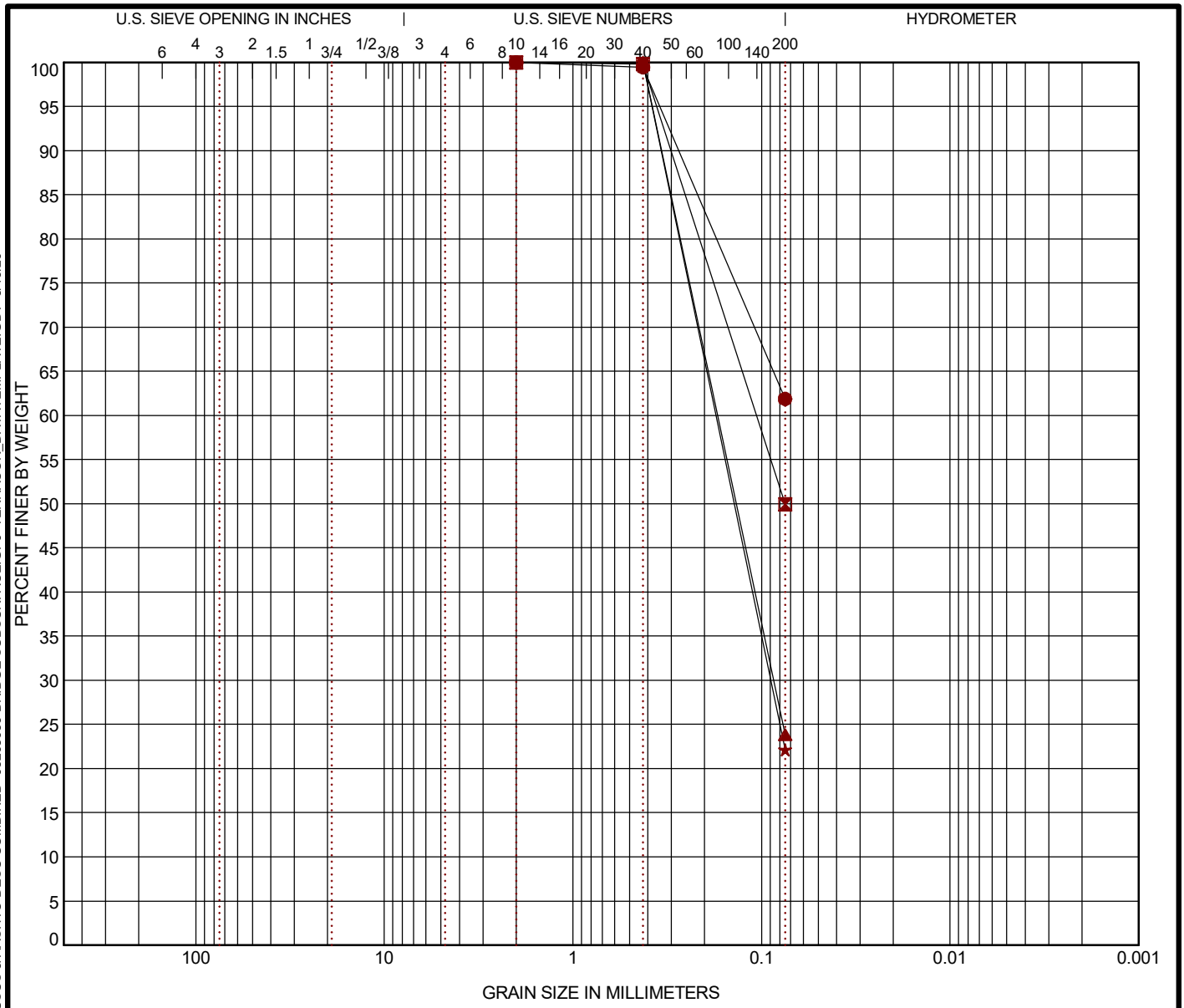
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-8

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-3	55 - 56.5	SANDY LEAN CLAY (CL)	A-4 (3)	29	22	12	10		
⊠	A-3	60 - 61.5	CLAYEY SAND (SC)	A-4 (1)	25	22	14	8		
▲	A-3	65 - 66.5	SILTY SAND (SM)	A-2-4 (0)	22	NP	NP	NP		
★	A-3	70 - 71.5	SILTY SAND (SM)	A-2-4 (0)	19	NP	NP	NP		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-3	55 - 56.5	2				0.0	38.1		61.9	
⊠	A-3	60 - 61.5	2	0.106			0.0	50.1		49.9	
▲	A-3	65 - 66.5	0.425	0.171	0.086		0.0	76.2		23.8	
★	A-3	70 - 71.5	0.425	0.174	0.089		0.0	77.9		22.1	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

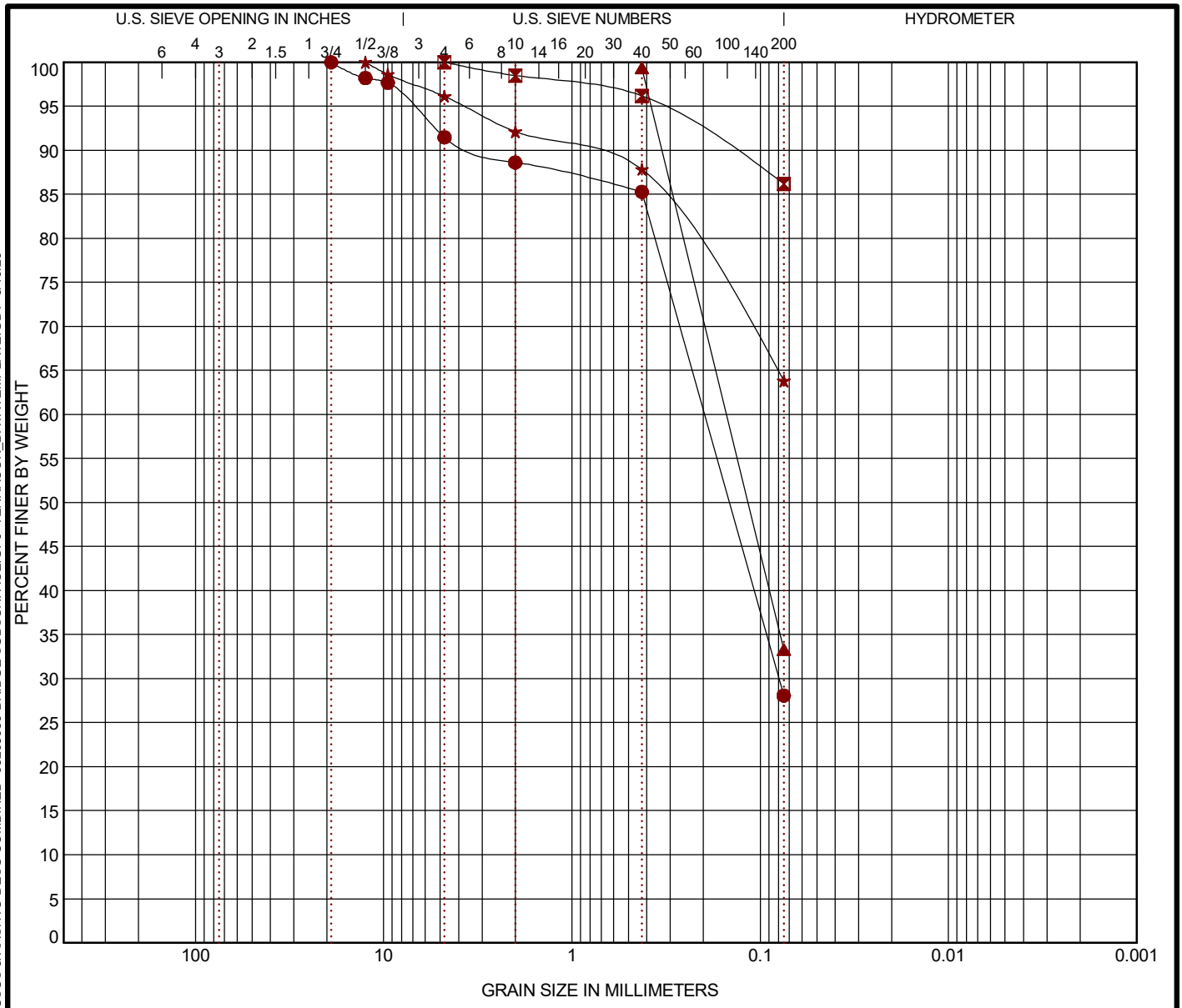
PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-9

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-3	90 - 91.5	HIGHLY WEATHERED SILTY SANDSTONE	A-2-4 (0)	17	NP	NP	NP		
⊠	A-3	95 - 95.3	WEATHERED SHALE	A-6 (9)	13	27	14	13		
▲	A-4	0 - 1.5	SILTY SAND (SM)	A-2-4 (0)	14	NP	NP	NP		
★	A-4	5 - 6.5	SANDY LEAN CLAY (CL)	A-6 (5)	17	25	12	13		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-3	90 - 91.5	19	0.197	0.08		8.5	63.4		28.1	
⊠	A-3	95 - 95.3	4.75				0.0	13.8		86.2	
▲	A-4	0 - 1.5	0.425	0.151				66.1		33.3	
★	A-4	5 - 6.5	12.5				3.8	32.3		63.8	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

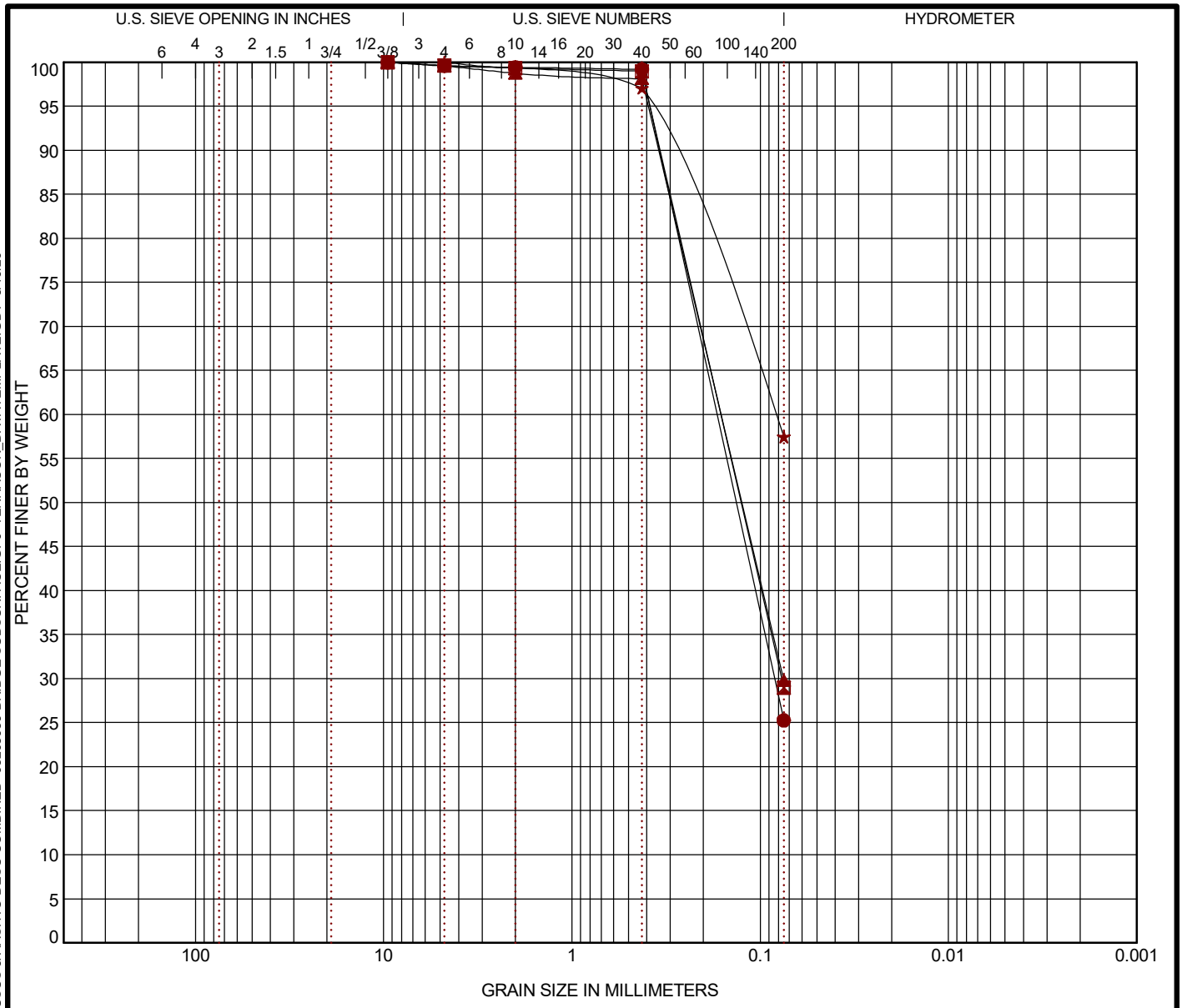
PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-10

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-4	15 - 16.5	CLAYEY SAND (SC)	A-2-4 (0)	18	24	14	10		
⊠	A-4	20 - 21.5	CLAYEY SAND (SC)	A-2-4 (0)	17	22	14	8		
▲	A-4	25 - 26.5	SILTY SAND (SM)	A-2-4 (0)	15	NP	NP	NP		
★	A-4	30 - 31.5	SANDY LEAN CLAY (CL)	A-4 (2)	22	23	15	8		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-4	15 - 16.5	9.5	0.169	0.084		0.4	74.3		25.3	
⊠	A-4	20 - 21.5	9.5	0.162	0.077		0.4	70.7		28.9	
▲	A-4	25 - 26.5	9.5	0.162	0.075		0.4	69.8		29.8	
★	A-4	30 - 31.5	4.75	0.084			0.0	42.5		57.5	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

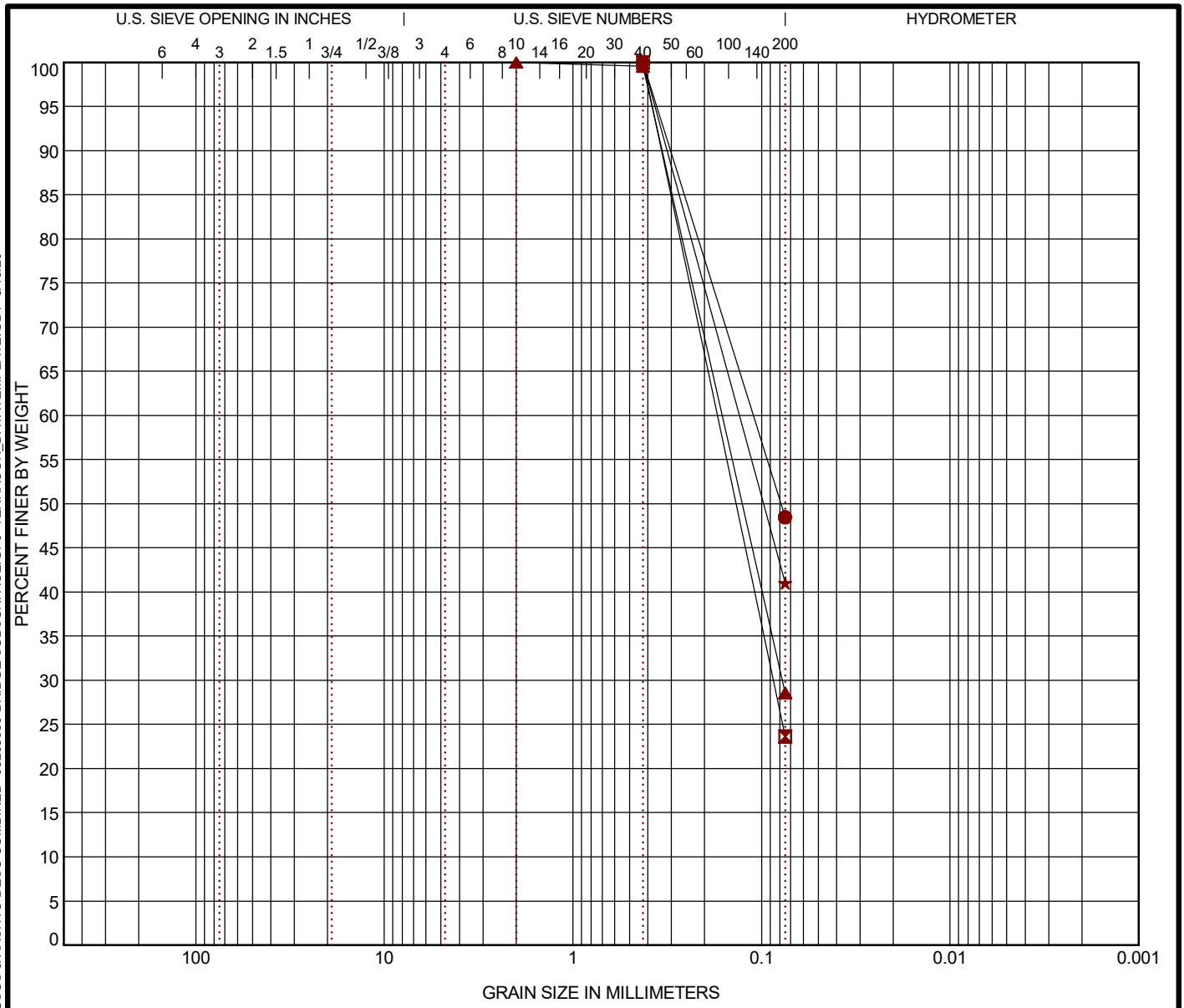
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-11

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-4	35 - 36.5	CLAYEY SAND (SC)	A-6 (2)	18	27	15	12		
⊠	A-4	40 - 41.5	SILTY, CLAYEY SAND (SC-SM)	A-2-4 (0)	21	20	13	7		
▲	A-4	45 - 46.5	SILTY SAND (SM)	A-2-4 (0)	19	NP	NP	NP		
★	A-4	70 - 71.5	CLAYEY SAND (SC)	A-4 (1)	20	23	13	10		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-4	35 - 36.5	0.425	0.111			0.0	51.5		48.5	
⊠	A-4	40 - 41.5	0.425	0.171	0.087		0.0	76.4		23.6	
▲	A-4	45 - 46.5	2	0.162	0.078		0.0	71.4		28.6	
★	A-4	70 - 71.5	0.425	0.131			0.0	59.0		41.0	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

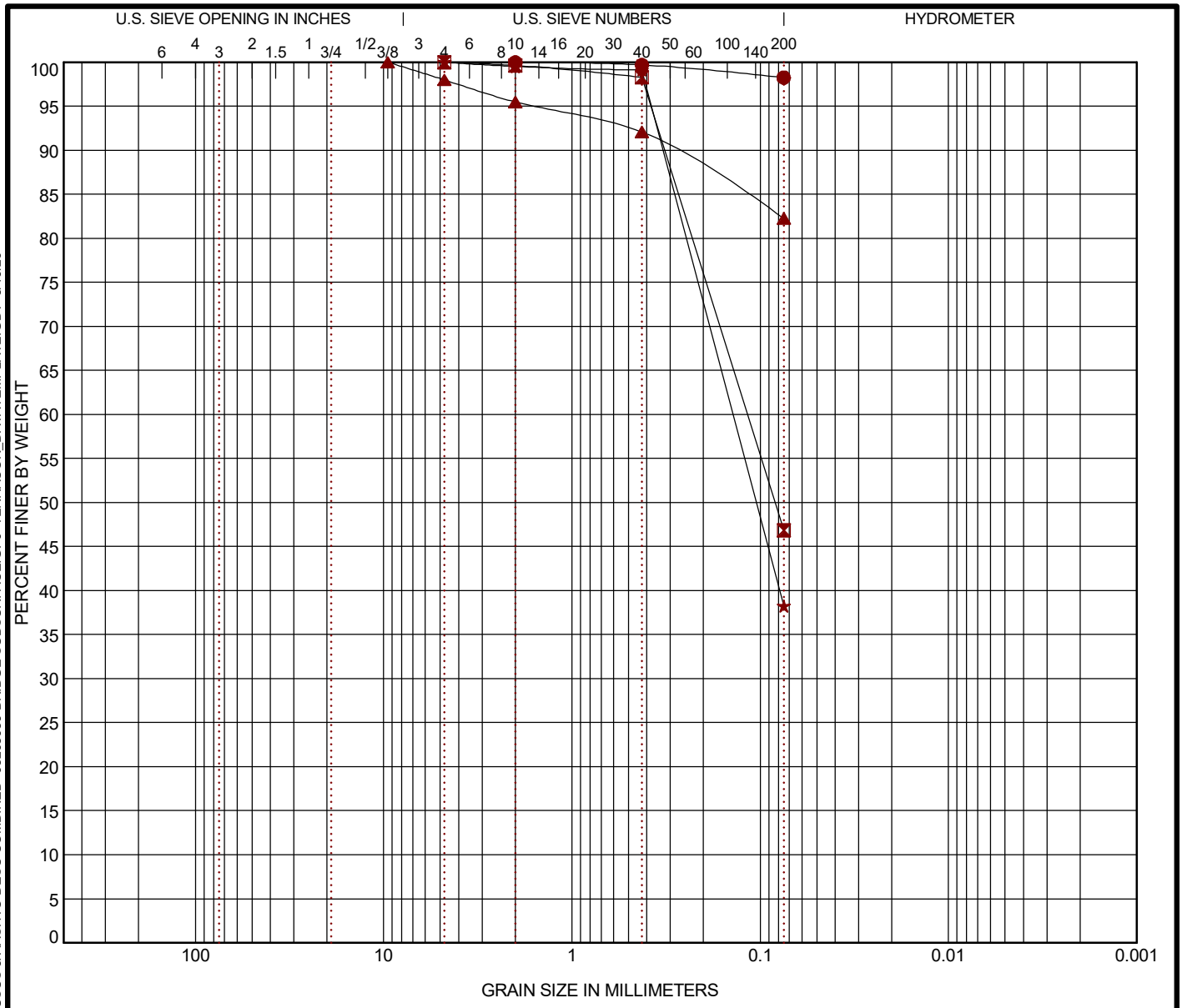
PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-12

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	A-4	80 - 81.5	LEAN CLAY (CL)	A-6 (20)	14	36	15	21		
⊠	B-1	0 - 1.5	CLAYEY SAND (SC)	A-6 (3)	16	26	12	14		
▲	B-1	5 - 6.5	LEAN CLAY with SAND (CL)	A-6 (14)	20	33	14	19		
★	B-1	10 - 11.5	CLAYEY SAND (SC)	A-4 (0)	20	23	15	8		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	A-4	80 - 81.5	2				0.0	1.7		98.3	
⊠	B-1	0 - 1.5	4.75	0.117			0.0	53.1		46.9	
▲	B-1	5 - 6.5	9.5				2.0	15.7		82.3	
★	B-1	10 - 11.5	4.75	0.139			0.0	61.8		38.2	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

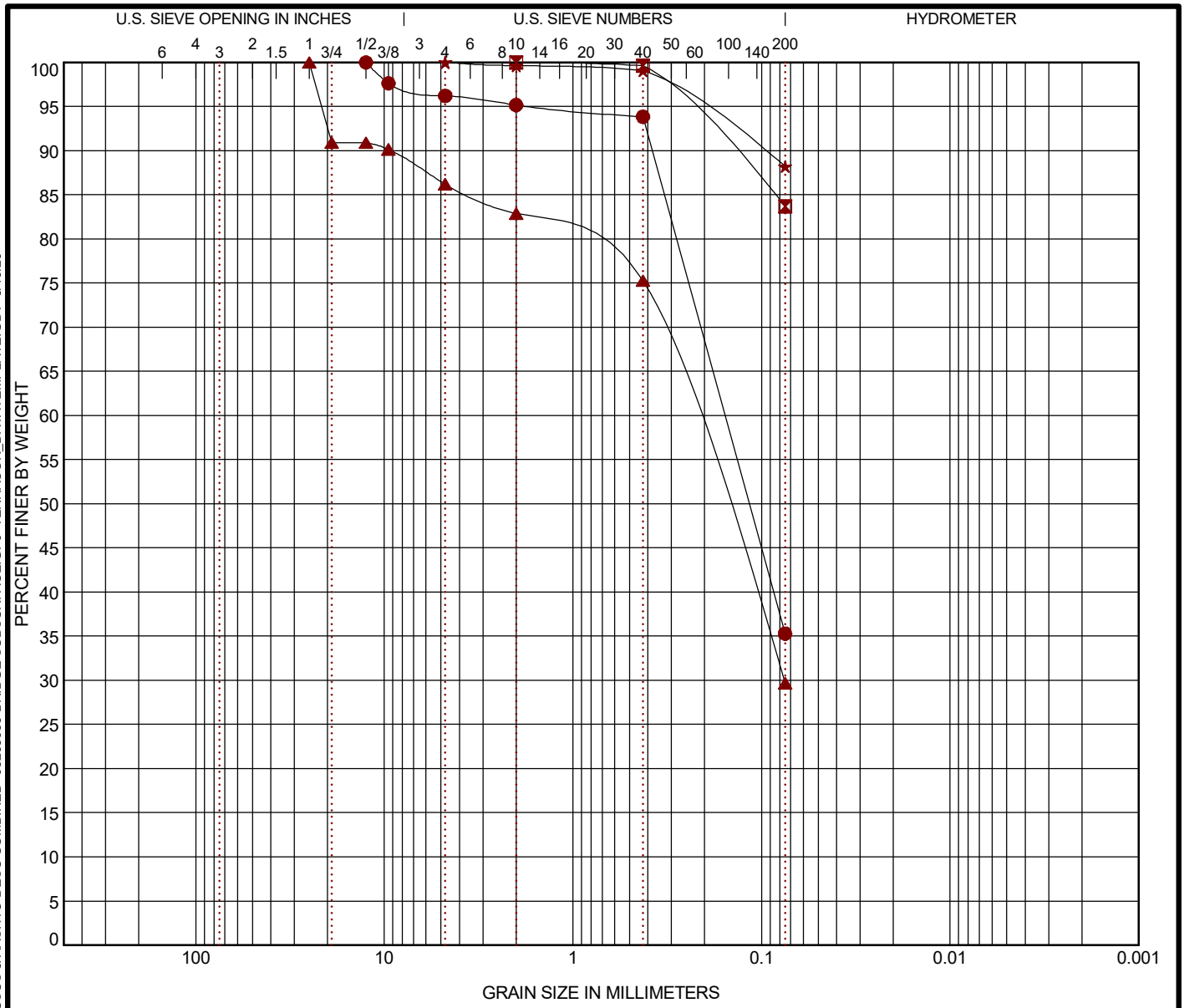
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-13

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-1	15 - 16.5	CLAYEY SAND (SC)	A-2-4 (0)	18	22	14	8		
⊠	B-1	20 - 20.6	WEATHERED SHALE	A-6 (11)	13	30	14	16		
▲	B-2	0 - 1.5	CLAYEY SAND (SC)	A-2-4 (0)	16	23	15	8		
★	B-2	5 - 6.5	LEAN CLAY (CL)	A-6 (11)	19	29	15	14		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	15 - 16.5	12.5	0.156			3.8	60.9		35.3	
⊠	B-1	20 - 20.6	2				0.0	16.3		83.7	
▲	B-2	0 - 1.5	25	0.238	0.076		13.8	56.5		29.7	
★	B-2	5 - 6.5	4.75				0.0	11.8		88.2	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

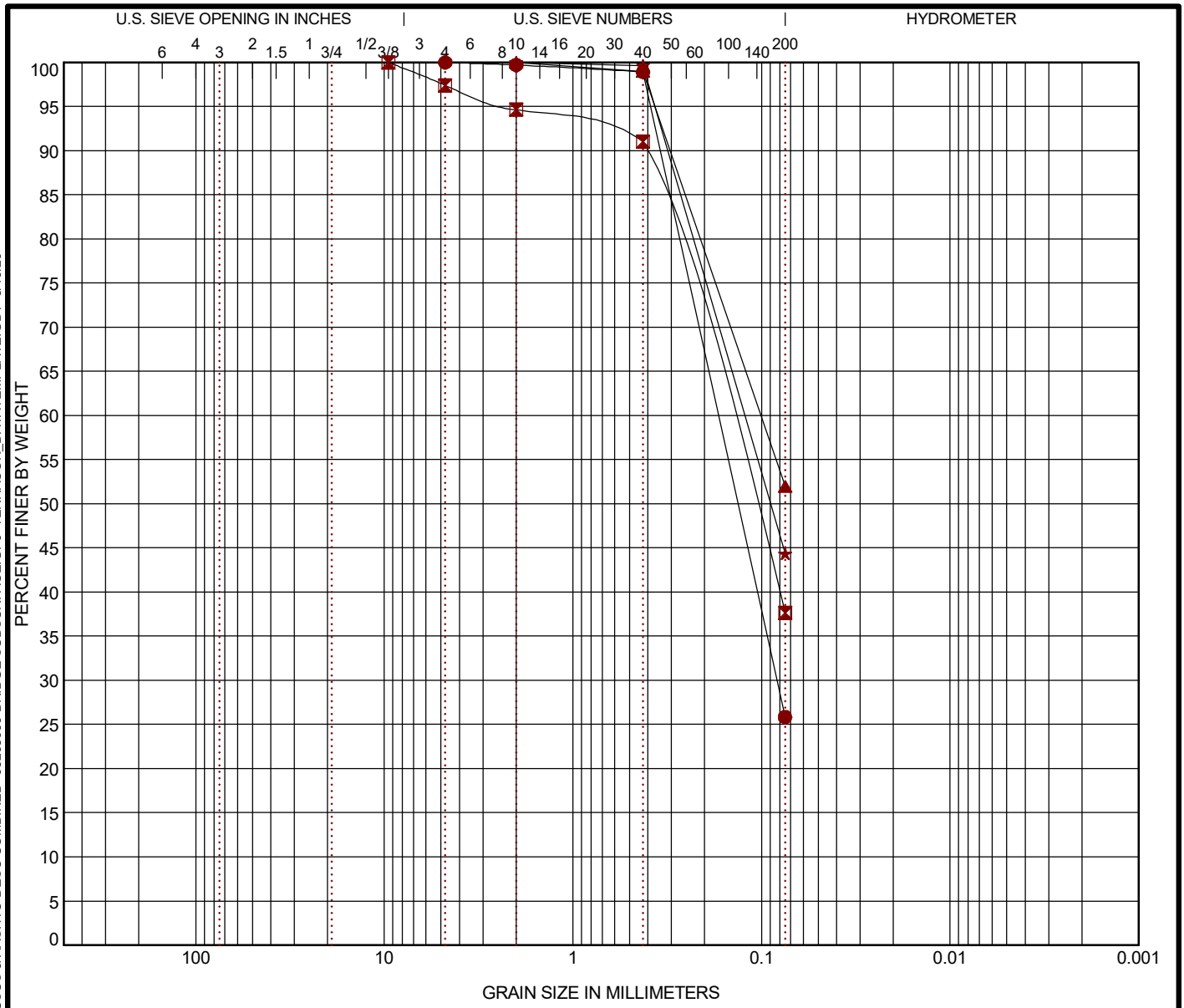
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-14

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-2	10 - 11.5	CLAYEY SAND (SC)	A-2-4 (0)	16	24	15	9		
⊠	B-2	15 - 16.5			16					
▲	B-2	20 - 21.5	SANDY LEAN CLAY (CL)	A-6 (3)	19	27	15	12		
★	B-2	25 - 26.5	CLAYEY SAND (SC)	A-6 (1)	16	25	14	11		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-2	10 - 11.5	4.75	0.169	0.083		0.0	74.2		25.8	
⊠	B-2	15 - 16.5	9.5	0.155			2.6	59.7		37.7	
▲	B-2	20 - 21.5	2	0.101			0.0	48.0		52.0	
★	B-2	25 - 26.5	2	0.123			0.0	55.6		44.4	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

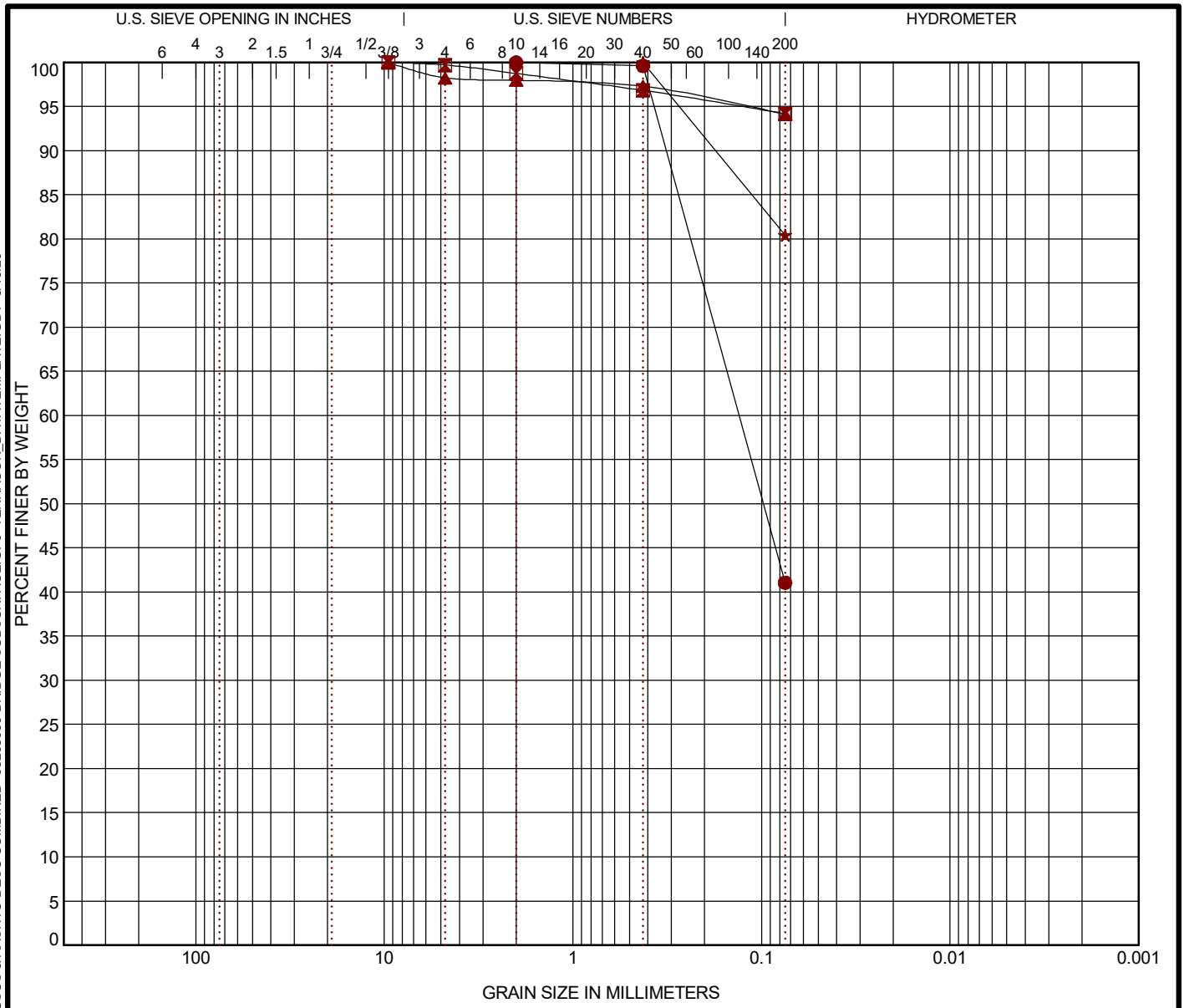
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-15

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-2	30 - 31.5	SILTY SAND (SM)	A-4 (0)	18	NP	NP	NP		
⊠	B-2	35 - 36.5	FAT CLAY (CH)	A-7-6 (31)	23	51	21	30		
▲	B-2	38.5 - 40	LEAN CLAY (CL)	A-7-6 (23)	19	43	20	23		
★	B-2	45 - 46.5	LEAN CLAY with SAND (CL)	A-6 (7)	15	27	15	12		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-2	30 - 31.5	2	0.131			0.0	58.9		41.1	
⊠	B-2	35 - 36.5	9.5				0.3	5.5		94.2	
▲	B-2	38.5 - 40	9.5				1.8	4.1		94.1	
★	B-2	45 - 46.5	0.425				0.0	19.6		80.4	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
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PROJECT NUMBER: 03205039

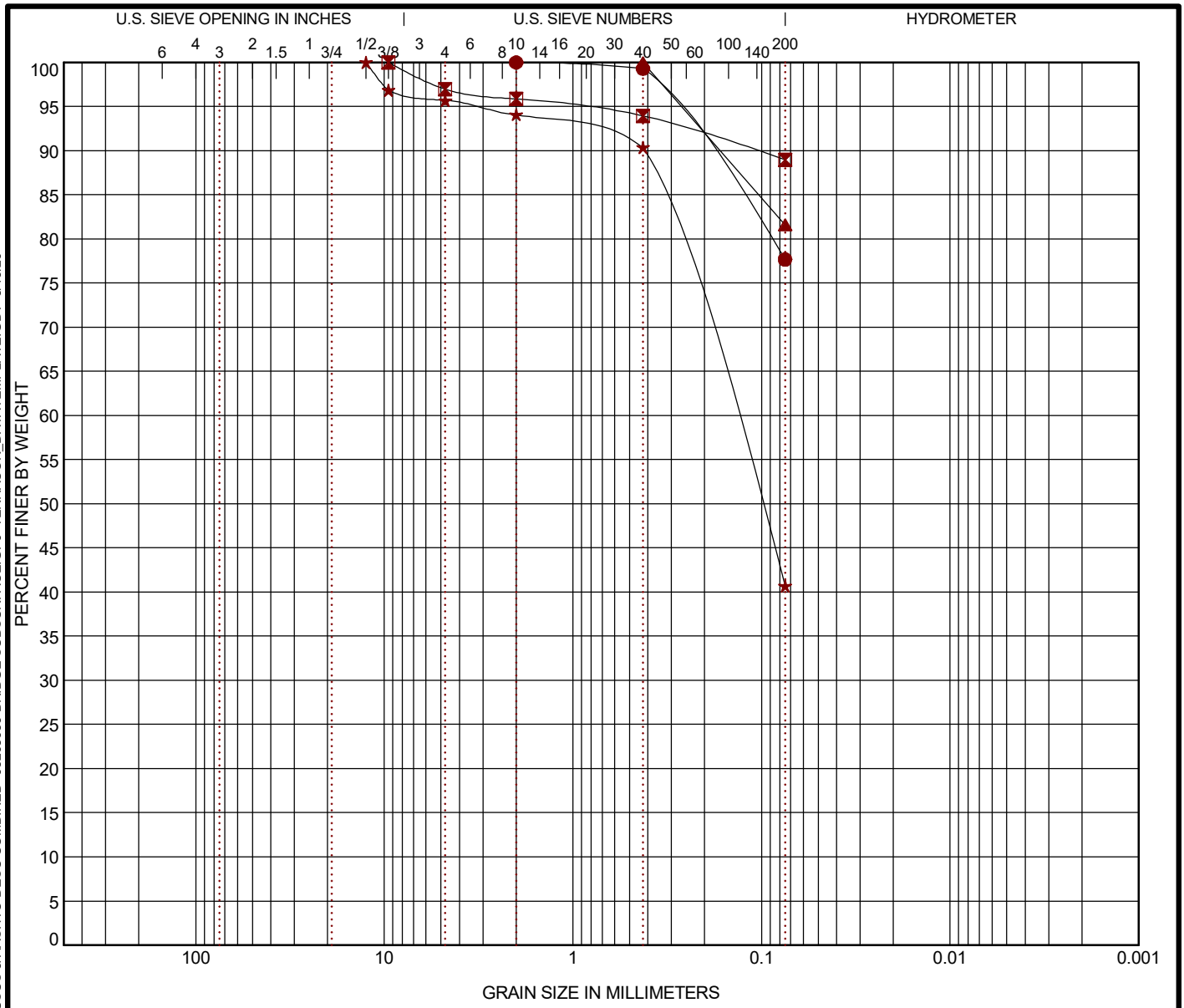
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-16

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-2	50 - 51.5	LEAN CLAY with SAND (CL)	A-6 (7)	14	26	14	12		
⊠	B-2	55 - 56.5	LEAN CLAY (CL)	A-6 (13)	15	31	15	16		
▲	B-2	60 - 60.4			11					
★	B-3	0 - 1.5	SILTY SAND (SM)	A-4 (0)	14	NP	NP	NP		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-2	50 - 51.5	2				0.0	22.3		77.7	
⊠	B-2	55 - 56.5	9.5				3.0	8.0		89.0	
▲	B-2	60 - 60.4	0.425				0.0	18.4		81.6	
★	B-3	0 - 1.5	12.5	0.147			4.3	55.0		40.7	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

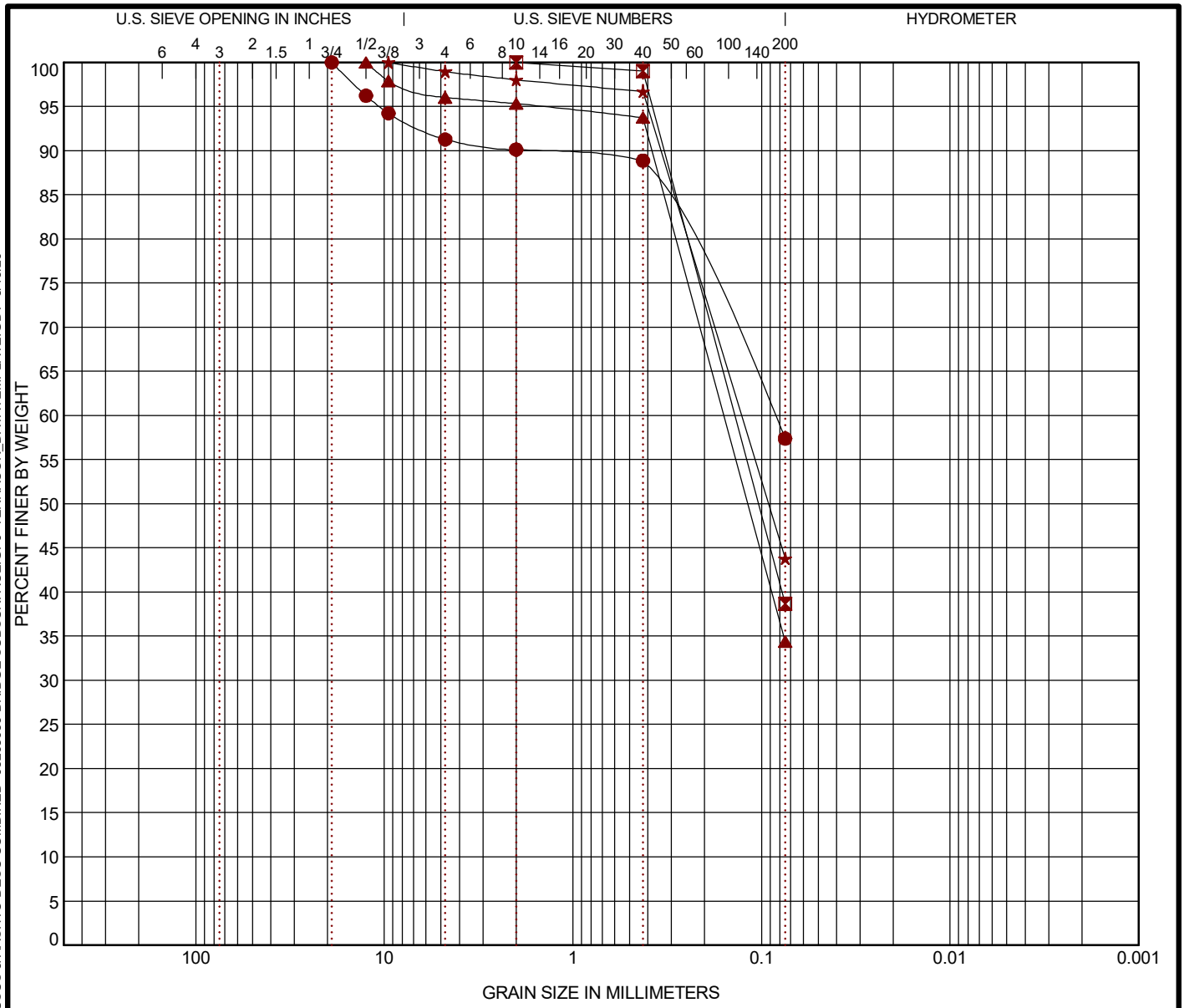
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-17

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	5 - 6.5	SANDY LEAN CLAY (CL)	A-6 (4)	20	26	13	13		
⊠	B-3	15 - 16.5	SILTY SAND (SM)	A-4 (0)	21	NP	NP	NP		
▲	B-3	20 - 21.5	SILTY SAND (SM)	A-2-4 (0)	24	NP	NP	NP		
★	B-3	25 - 26.5	SILTY, CLAYEY SAND (SC-SM)	A-4 (0)	20	23	16	7		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	5 - 6.5	19	0.087			8.7	33.9		57.4	
⊠	B-3	15 - 16.5	2	0.138			0.0	61.3		38.7	
▲	B-3	20 - 21.5	12.5	0.159			4.0	61.6		34.4	
★	B-3	25 - 26.5	9.5	0.128			1.0	55.2		43.8	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

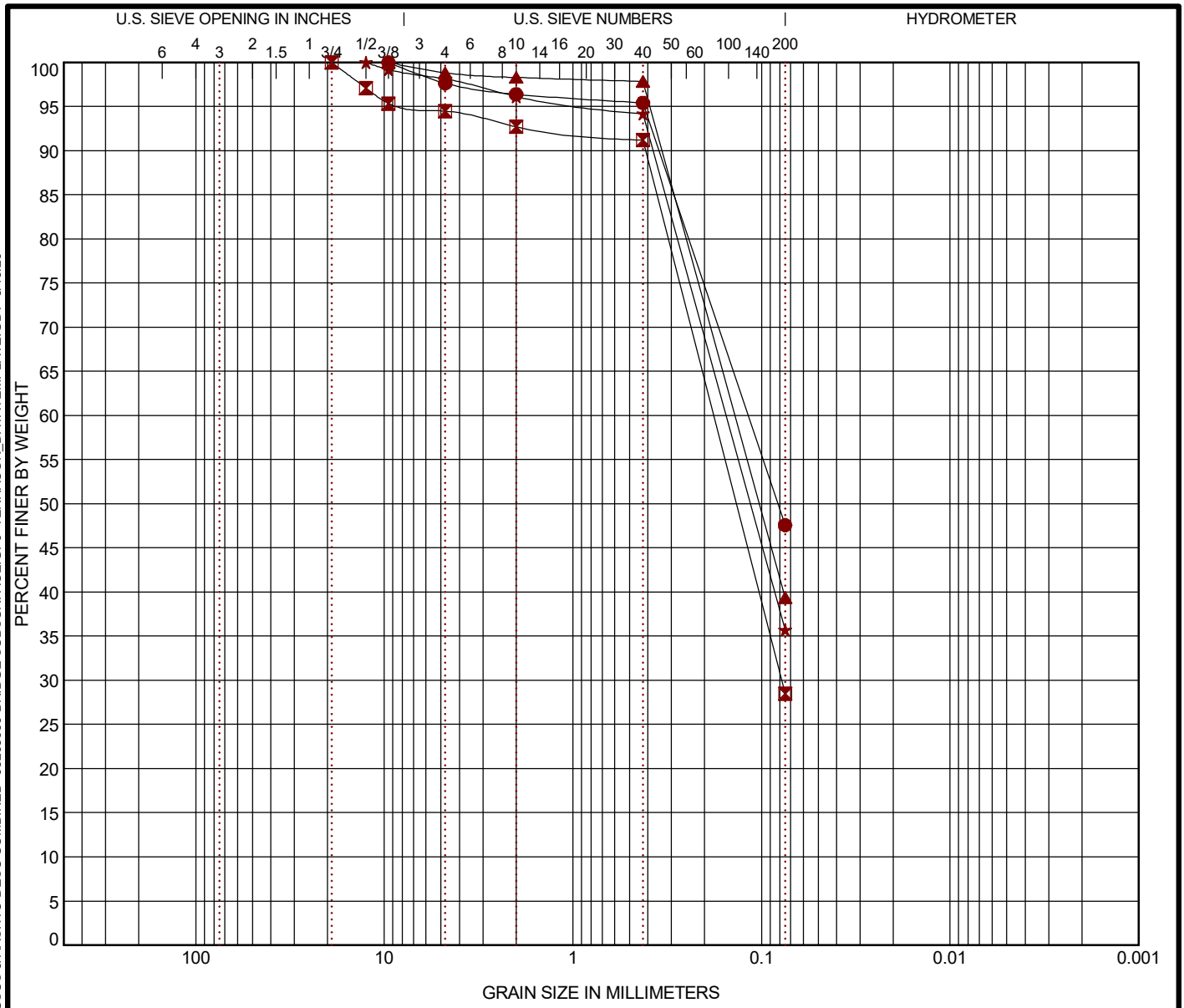
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-18

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	30 - 31.5	SILTY, CLAYEY SAND (SC-SM)	A-4 (0)	23	20	14	6		
⊠	B-3	40 - 41.5	SILTY SAND (SM)	A-2-4 (0)	21	NP	NP	NP		
▲	B-3	45 - 46.5	SILTY SAND (SM)	A-4 (0)	23	NP	NP	NP		
★	B-3	50 - 51.5	SILTY SAND (SM)	A-4 (0)	25	NP	NP	NP		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	30 - 31.5	9.5	0.118			2.4	50.1		47.6	
⊠	B-3	40 - 41.5	19	0.179	0.078		5.5	66.0		28.5	
▲	B-3	45 - 46.5	9.5	0.138			1.2	59.5		39.4	
★	B-3	50 - 51.5	12.5	0.154			1.9	62.4		35.7	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

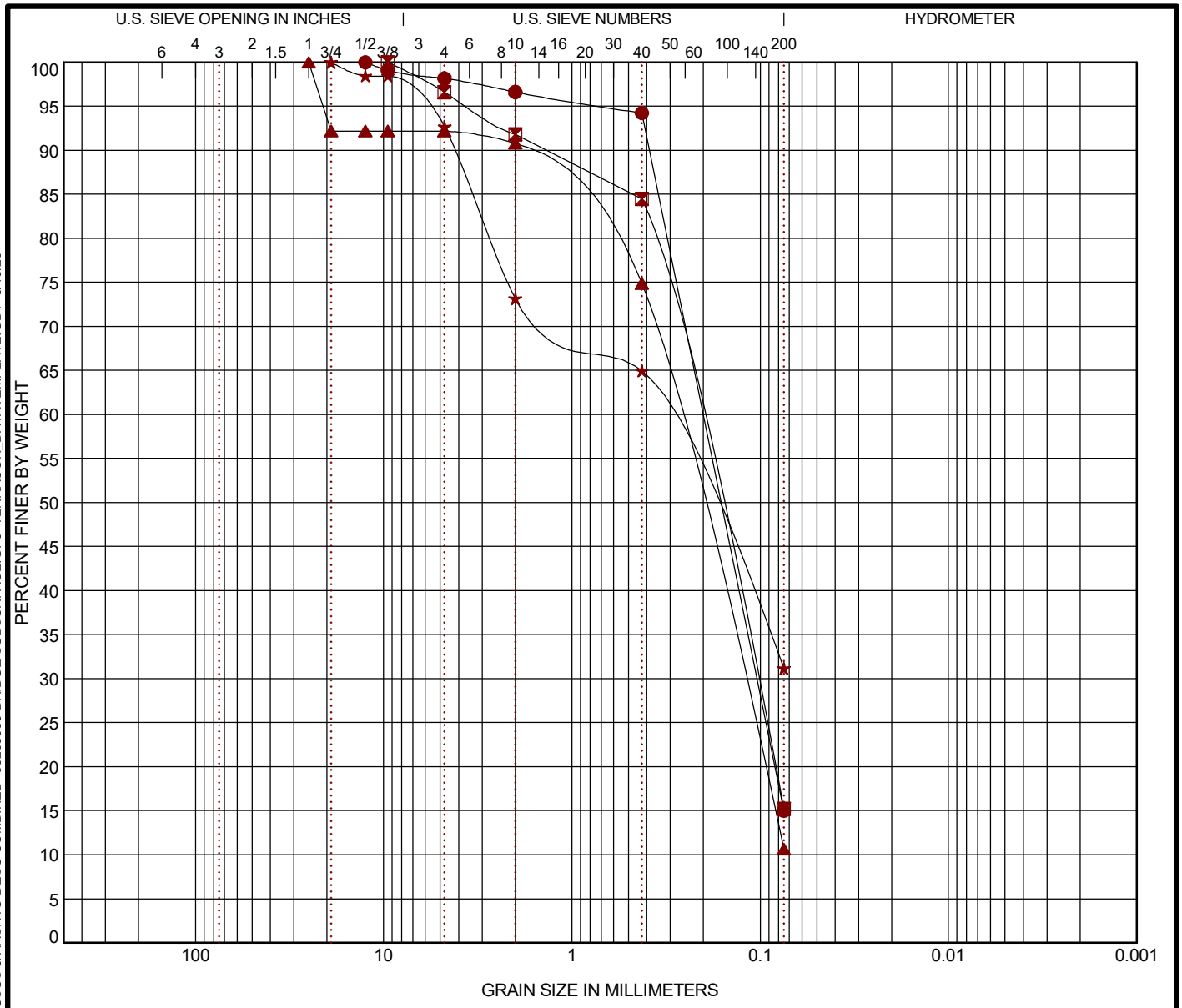
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-19

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	60 - 61.5	SILTY SAND (SM)	A-2-4 (0)	22	NP	NP	NP		
⊠	B-3	65 - 66.5	SILTY SAND (SM)	A-2-4 (0)	23	NP	NP	NP		
▲	B-3	70 - 71.5	POORLY GRADED SAND with SILT (SP-SM)	A-2-4 (0)	21	NP	NP	NP	0.76	3.86
★	B-3	75 - 76.3	CLAYEY SAND (SC)	A-2-4 (0)	20	22	14	8		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	60 - 61.5	12.5	0.201	0.104		1.8	83.2		15.0	
⊠	B-3	65 - 66.5	9.5	0.23	0.109		3.4	81.4		15.2	
▲	B-3	70 - 71.5	25	0.284	0.126		7.8	81.6		10.6	
★	B-3	75 - 76.3	19	0.329			7.3	61.5		31.2	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

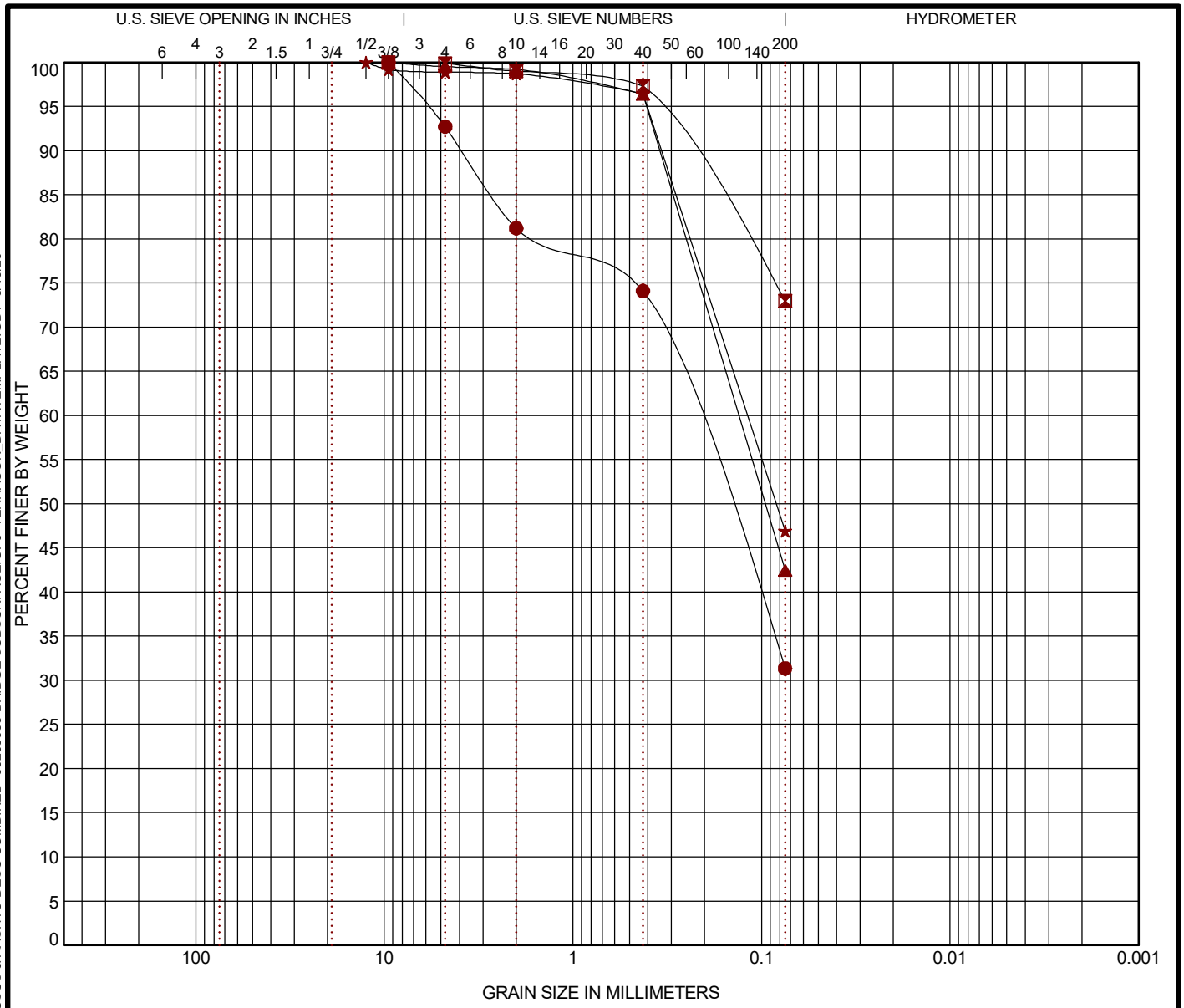
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-20

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	80 - 80.1	WEATHERED SANDSTONE		24					
⊠	B-3	85 - 85.2	WEATHERED SHALE	A-6 (13)	25	35	14	21		
▲	B-4	0 - 1.5	SILTY SAND (SM)	A-4 (0)	14	NP	NP	NP		
★	B-4	5 - 6.5	CLAYEY SAND (SC)	A-4 (1)	12	21	12	9		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	80 - 80.1	9.5	0.24			7.3	61.4		31.3	
⊠	B-3	85 - 85.2	9.5				0.1	27.0		72.9	
▲	B-4	0 - 1.5	9.5	0.132			0.5	57.1		42.5	
★	B-4	5 - 6.5	12.5	0.119			1.1	52.0		46.9	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

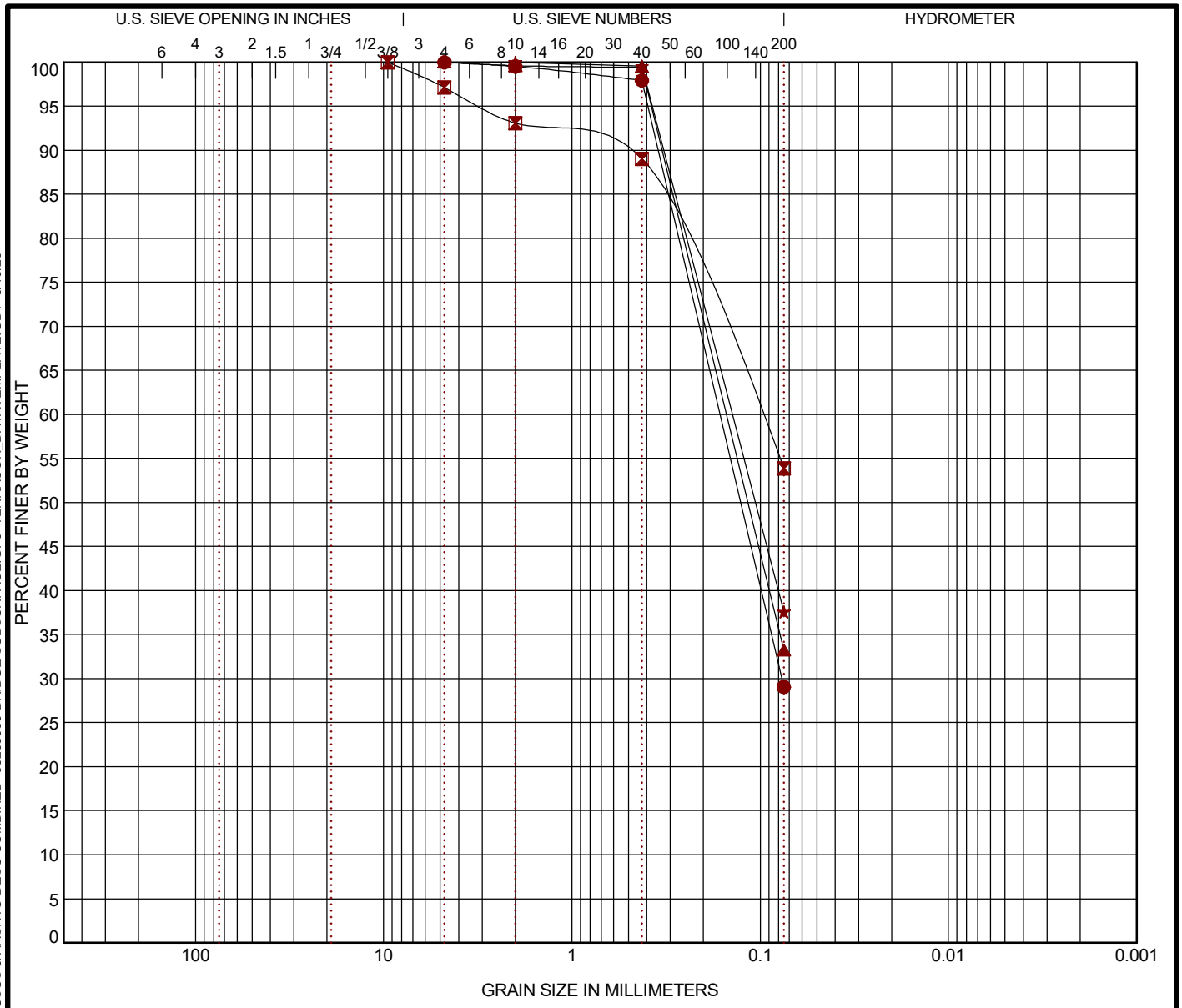
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-21

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-4	10 - 11.5	SILTY SAND (SM)	A-2-4 (0)	10	NP	NP	NP		
⊠	B-4	15 - 16.5	SANDY SILTY CLAY (CL-ML)	A-4 (1)	16	21	14	7		
▲	B-4	20 - 21.5	SILTY, CLAYEY SAND (SC-SM)	A-2-4 (0)	19	22	15	7		
★	B-4	25 - 26.5	SILTY, CLAYEY SAND (SC-SM)	A-4 (0)	17	20	13	7		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-4	10 - 11.5	4.75	0.163	0.077		0.0	70.9		29.1	
⊠	B-4	15 - 16.5	9.5	0.101			2.9	43.3		53.9	
▲	B-4	20 - 21.5	4.75	0.151			0.0	66.8		33.2	
★	B-4	25 - 26.5	2	0.14			0.0	62.4		37.6	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

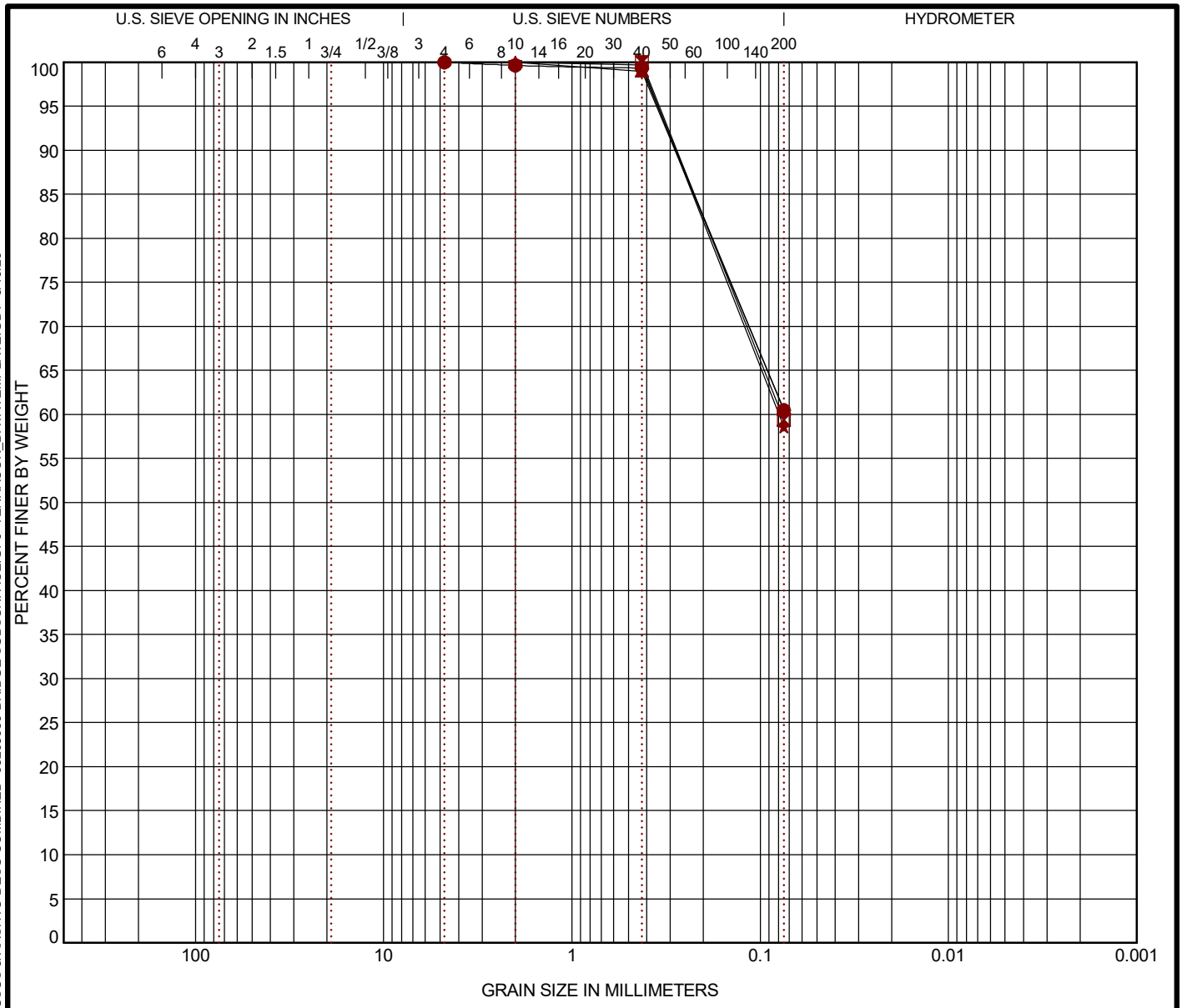
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-22

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-4	30 - 31.5	SANDY SILTY CLAY (CL-ML)	A-4 (2)	22	23	16	7		
⊠	B-4	35 - 36.5	SANDY LEAN CLAY (CL)	A-6 (6)	17	28	13	15		
▲	B-4	40 - 41.5	SANDY LEAN CLAY (CL)	A-6 (5)	20	26	13	13		
★	B-4	50 - 51.5	SANDY LEAN CLAY (CL)	A-6 (4)	26	25	13	12		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-4	30 - 31.5	4.75				0.0	39.5		60.5	
⊠	B-4	35 - 36.5	0.425	0.077			0.0	40.6		59.4	
▲	B-4	40 - 41.5	2				0.0	39.4		60.6	
★	B-4	50 - 51.5	2	0.08			0.0	41.4		58.6	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

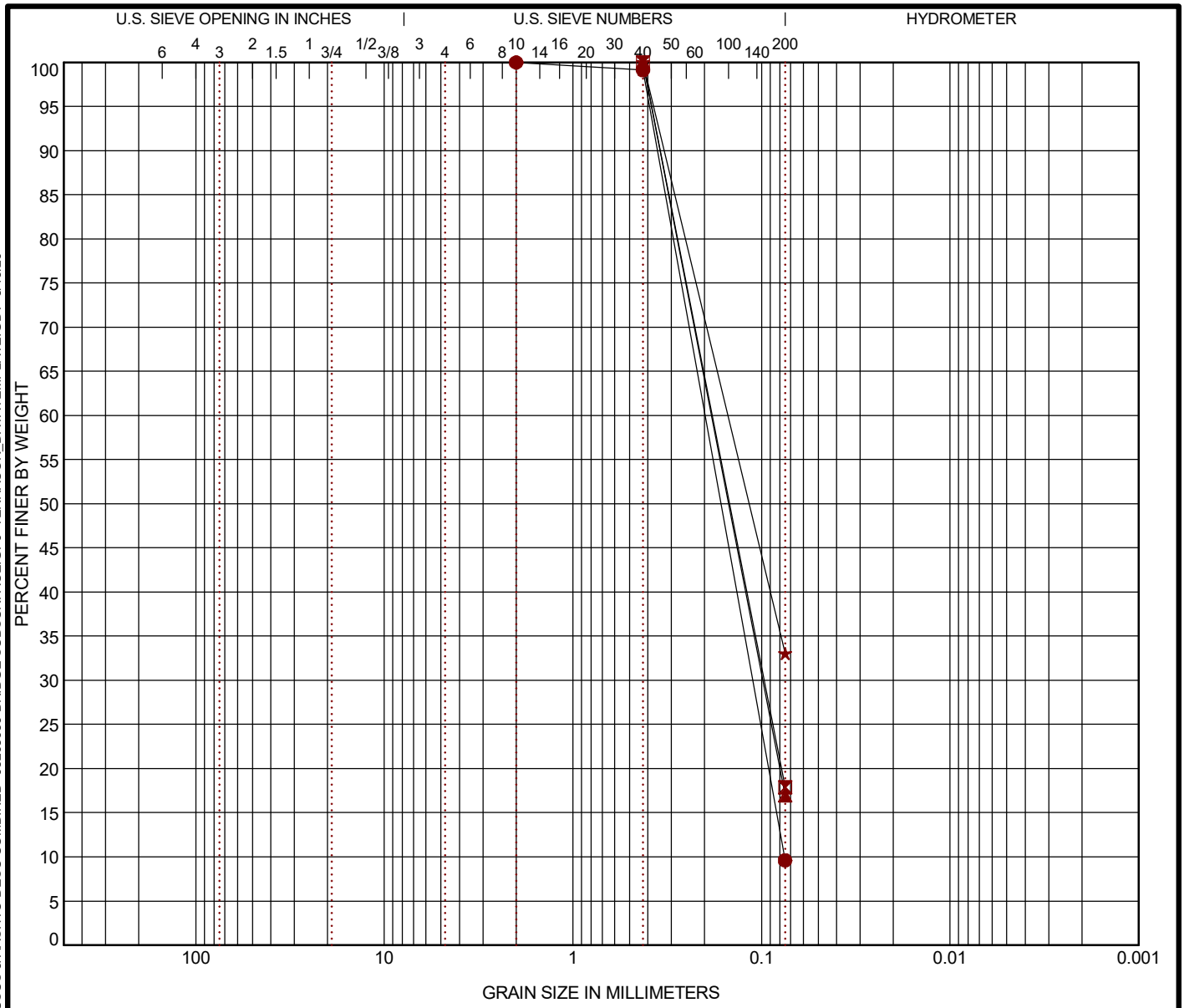
CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-23

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-4	60 - 61.5	POORLY GRADED SAND with SILT (SP-SM)	A-3 (0)	21	NP	NP	NP	0.82	2.63
⊠	B-4	70 - 71.5	SILTY SAND (SM)	A-2-4 (0)	22	NP	NP	NP		
▲	B-4	75 - 76.5	SILTY SAND (SM)	A-2-4 (0)	24	NP	NP	NP		
★	B-4	85 - 86.5	SILTY SAND (SM)	A-2-4 (0)	23	NP	NP	NP		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-4	60 - 61.5	2	0.199	0.111	0.076	0.0	90.4		9.6	
⊠	B-4	70 - 71.5	0.425	0.183	0.097		0.0	82.1		17.9	
▲	B-4	75 - 76.5	0.425	0.184	0.099		0.0	83.1		16.9	
★	B-4	85 - 86.5	0.425	0.151			0.0	67.0		33.0	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

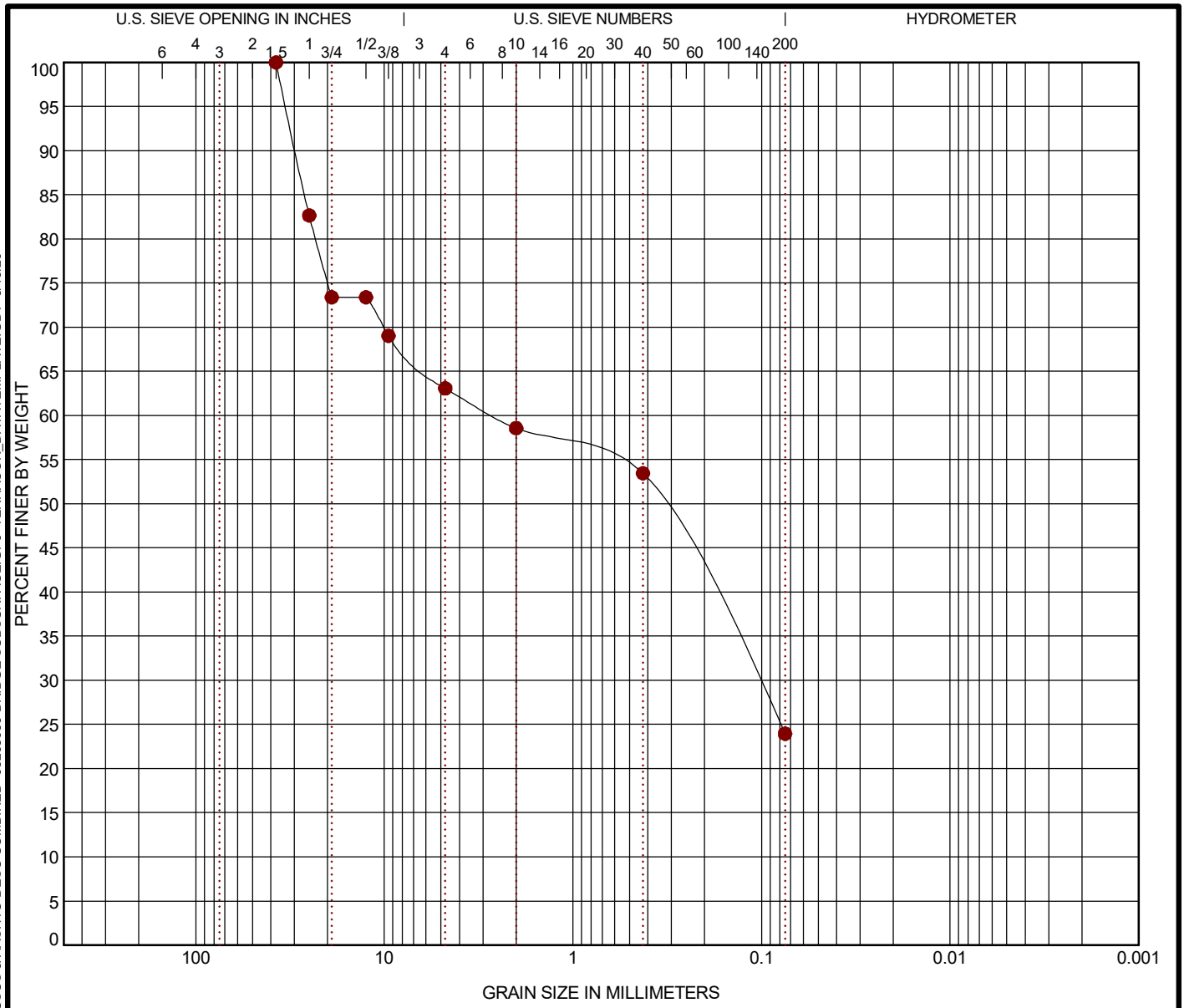
PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-24

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	AASHTO Classification	WC (%)	LL	PL	PI	Cc	Cu
B-4	90 - 91.2	CLAYEY SAND with GRAVEL (SC)	A-2-4 (0)	11	21	11	10		

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
B-4	90 - 91.2	37.5	2.633	0.107		36.9	39.1		23.9	

PROJECT: Three Span Bridge - Interstate 35 over Waterloo Road

SITE: Interstate 35 & Waterloo Road
Oklahoma & Logan Counties, Oklahoma

Terracon
4701 N Stiles Ave
Oklahoma City, OK

PROJECT NUMBER: 03205039

CLIENT: Garver LLC
Tulsa, Oklahoma

EXHIBIT: B-25

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS & AASHTO DESC COMBINED 03205039 BRIDGE SUBSURFACE.GPJ TERRACON_DATATEMPLATE.GDT 5/19/20

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-2 (69.3-69.7)	
Moisture Content =	2.2	%
Diameter =	1.983	in
Length =	3.987	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.867	kN / sec
Time to Failure	130	seconds
Compressive Strength =	56.6	MPa
Compressive Strength =	8210	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine Z-14494

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-2 (73.1-73.4)	
Moisture Content =	16.7	%
Diameter =	1.961	in
Length =	4.024	in
L/D Ratio =	2.1	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.107	kN / sec
Time to Failure	108	seconds
Sample failed before 2 minute minimum requirement		
Compressive Strength =	5.9	MPa
Compressive Strength =	870	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-2 (76.1-76.4)	
Moisture Content =	11.5	%
Diameter =	1.965	in
Length =	4.025	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.014	kN / sec
Time to Failure	148	seconds
Compressive Strength =	1.0	MPa
Compressive Strength =	150	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Failed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-2 (82.3-82.6)	
Moisture Content =	2.1	%
Diameter =	1.982	in
Length =	4.048	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.718	kN / sec
Time to Failure	128	seconds
Compressive Strength =	46.2	MPa
Compressive Strength =	6700	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine Z-14494

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-3 (104.1-104.4)	
Moisture Content =	12.9	%
Diameter =	1.928	in
Length =	4.039	in
L/D Ratio =	2.1	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.126	kN / sec
Time to Failure	75	seconds
Sample failed before 2 minute minimum requirement		
Compressive Strength =	5.0	MPa
Compressive Strength =	730	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983,
Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-3 (114.1-114.4)	
Moisture Content =	18.8	%
Diameter =	1.958	in
Length =	4.014	in
L/D Ratio =	2.1	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.099	kN / sec
Time to Failure	68	seconds
Sample failed before 2 minute minimum requirement		
Compressive Strength =	3.5	MPa
Compressive Strength =	510	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	A-3 (123.8-124.1)	
Moisture Content =	9.7	%
Diameter =	1.971	in
Length =	4.024	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.012	kN / sec
Time to Failure	172	seconds
Compressive Strength =	1.1	MPa
Compressive Strength =	160	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	B-2 (63.6-63.9)	
Moisture Content =	3.0	%
Diameter =	1.987	in
Length =	4.047	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.604	kN / sec
Time to Failure	170	seconds
Compressive Strength =	51.3	MPa
Compressive Strength =	7450	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Failed	
Procedure FP2 – Flatness*	Failed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine Z-14494

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250º
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25º

Description:	B-2 (66.5-66.8)	
Moisture Content =	16.8	%
Diameter =	1.973	in
Length =	4.039	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.157	kN / sec
Time to Failure	78	seconds
Sample failed before 2 minute minimum requirement		
Compressive Strength =	6.2	MPa
Compressive Strength =	900	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Description: B-2 (72.8-73.1)

Photo Before Compression Test

Photo After Compression Test

Moisture Content =	17.8	%
Diameter =	1.960	in
Length =	4.046	in
L/D Ratio =	2.1	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.282	kN / sec
Time to Failure	71	seconds

Sample failed before 2 minute minimum requirement

Compressive Strength =	10.3	MPa
Compressive Strength =	1500	psi
Temperature at Testing =	23	°C

Procedure S1- Side Straightness*	Passed
Procedure FP2 – Flatness*	Passed
Procedure P2 – Perpendicularity*	Failed

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983,
Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Description: B-2 (78.5-78.8)

Moisture Content = 10.3 %

Diameter = 1.983 in
Length = 4.032 in
L/D Ratio = 2.0

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction = Vertical
Load Deformation Rate = 0.018 kN / sec
Time to Failure = 171 seconds

Compressive Strength = 1.6 MPa
Compressive Strength = 230 psi

Temperature at Testing = 23 °C

Procedure S1- Side Straightness* = Failed
Procedure FP2 – Flatness* = Passed
Procedure P2 – Perpendicularity* = Passed

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Description: B-2 (82.6-82.9)

Photo Before Compression Test

Photo After Compression Test

Moisture Content =	12.1	%
Diameter =	1.978	in
Length =	4.031	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.004	kN / sec
Time to Failure	195	seconds
Compressive Strength =	0.4	MPa
Compressive Strength =	70	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Passed	
Procedure P2 – Perpendicularity*	Passed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Description: B-2 (85.9-86.2)

Photo Before Compression Test

Photo After Compression Test

Moisture Content =	20.5	%
Diameter =	1.977	in
Length =	4.025	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.232	kN / sec
Time to Failure	64	seconds

Sample failed before 2 minute minimum requirement

Compressive Strength =	7.5	MPa
Compressive Strength =	1090	psi
Temperature at Testing =	23	°C

Procedure S1- Side Straightness*	Passed
Procedure FP2 – Flatness*	Passed
Procedure P2 – Perpendicularity*	Passed

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983,
Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Description: B-3 (95.7-96.0)

Photo Before Compression Test

Photo After Compression Test

Moisture Content =	12.4	%
Diameter =	1.979	in
Length =	4.004	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.087	kN / sec
Time to Failure	116	seconds

Sample failed before 2 minute minimum requirement

Compressive Strength =	5.1	MPa
Compressive Strength =	740	psi
Temperature at Testing =	23	°C

Procedure S1- Side Straightness*	Passed
Procedure FP2 – Flatness*	Passed
Procedure P2 – Perpendicularity*	Passed

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983,
Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Description: B-3 (97.1-97.4)

Photo Before Compression Test

Photo After Compression Test

Moisture Content =	11.0	%
Diameter =	1.975	in
Length =	4.021	in
L/D Ratio =	2.0	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.057	kN / sec
Time to Failure	128	seconds
Compressive Strength =	3.7	MPa
Compressive Strength =	540	psi
Temperature at Testing =	23	°C
Procedure S1- Side Straightness*	Passed	
Procedure FP2 – Flatness*	Failed	
Procedure P2 – Perpendicularity*	Failed	

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983,
Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

Terracon

Description: B-3 (107.6-107.9)

Photo Before Compression Test

Photo After Compression Test

*ASTM D-4553 Tolerance Limits:
Procedures: S1, FP2, P2
Side Tolerance (Straightness): Not to exceed 0.020 inch
Perpendicularity Deviation: Not to exceed 0.250°
Deviation from Flatness: Not to exceed 0.001 inch
Parallelism Deviation: Not to exceed 0.25°

Moisture Content =	9.6	%
Diameter =	1.959	in
Length =	4.026	in
L/D Ratio =	2.1	

Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. Laboratory specimen length to diameter ratios must be employed with proper judgment in engineering applications.

Load Direction	Vertical	
Load Deformation Rate =	0.120	kN / sec
Time to Failure	79	seconds

Sample failed before 2 minute minimum requirement

Compressive Strength =	4.9	MPa
Compressive Strength =	710	psi
Temperature at Testing =	23	°C

Procedure S1- Side Straightness*	Passed
Procedure FP2 – Flatness*	Passed
Procedure P2 – Perpendicularity*	Passed

If specimen does not meet requirement of Practice D4543, the results reported may differ from results obtained from a test specimen that meets the requirements of Practice D4543.

Equipment Used:

Compression Machine C-2708

Kobalt Feeler gauge (270877) Z-45770

Dial Displacement Gage Z-42983, Calipers W-33369

Saw Cut Z-2821, Grinder Z-45769

APPENDIX C
DESIGN TABLES

BORING A-1
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	25	120	---	---	31	---	---
3	StC	3	5.0	10.0	---	120	750	---	0	---	0.01
4	Snd	5	10.0	32.0	90	120	---	---	35	---	---
5	StC	3	32.0	40.0	---	60	6,500	---	0	---	0.004
6	WR	8	40.0	72.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 33.5 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

BORING A-2
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	90	120	---	---	31	---	---
3	StC	3	5.0	10.0	---	120	1,000	---	0	---	0.01
4	Snd	5	10.0	25.0	225	120	---	---	35	---	---
5	Snd	5	25.0	45.0	20	60	---	---	28	---	---
6	StC	3	45.0	60.0	---	60	1,000	---	0	---	0.01
7	WR	8	60.0	91.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 32.5 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

Terracon

BORING A-3
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	10.0	25	120	---	---	30	---	---
3	StC	3	10.0	15.0	---	120	750	---	0	---	0.01
4	StC	3	15.0	20.0	---	120	4,000	---	0	---	0.004
5	Snd	5	20.0	25.0	225	120	---	---	38	---	---
6	Snd	5	25.0	30.0	90	120	---	---	33	---	---
7	Snd	5	30.0	90.0	20	60	---	---	28	---	---
8	WR	8	90.0	126	7000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 30 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

Terracon

BORING A-4
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	90	120	---	---	33	---	---
3	StC	3	5.0	15.0	---	120	750	---	0	---	0.01
4	Snd	5	15.0	30.0	225	120	---	---	36	---	---
5	Snd	5	30.0	80.0	20	60	---	---	28	---	---
6	StC	3	80.0	85.0	---	60	4,500	---	0	---	0.004
7	WR	8	85.0	116.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 30 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

BORING B-1
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	25	120	---	---	30	---	---
3	StC	3	5.0	10.0	---	120	1,000	---	0	---	0.01
4	Snd	5	10.0	20.0	60	60	---	---	33	---	---
5	WR	8	20.0	52.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 15 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

BORING B-2
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	25	120	---	---	29	---	---
3	StC	3	5.0	10.0	---	120	1,500	---	0	---	0.007
4	Snd	5	10.0	25.0	90	120	---	---	33	---	---
5	Snd	5	25.0	35.0	20	60	---	---	29	---	---
6	StC	3	35.0	60.0	---	60	5,500	---	0	---	0.004
7	WR	8	60.0	91.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 30 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

BORING B-3
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	90	120	---	---	33	---	---
3	StC	3	5.0	15.0	---	120	1,500	---	0	---	0.007
4	Snd	5	15.0	30.0	225	120	---	---	35	---	---
5	Snd	5	30.0	76.0	20	60	---	---	28	---	---
6	WR	8	76.0	116.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 30 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

BORING B-4
LPILE 6.0 LATERAL CAPACITY ANALYSIS
SOIL / ROCK PARAMETERS

Layer Number	LPILE Soil/Rock Type #	LPILE Soil/Rock Type Abbr.	Depth to Top of Layer (feet)	Depth to Bottom of Layer (feet)	LPILE Soil/Rock Modulus k or E_r (pci or psi)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Uniaxial Compressive Strength (psi)	Internal Friction Angle (degrees)	RQD (percent)	LPILE Soil/Rock Strain Factor ε_{50} or k_{rm}
1	Snd	5	0.0	3.0	25	120	---	---	28	---	---
2	Snd	5	3.0	5.0	90	120	---	---	33	---	---
3	Snd	5	5.0	27.0	90	120	---	---	34	---	---
4	SoC	1	27.0	60.0	---	60	250	---	0	---	0.02
5	Snd	5	60.0	70.0	60	60	---	---	31	---	---
6	Snd	5	70.0	91.5	20	60	---	---	28	---	---
7	WR	8	91.5	122.0	7,000	60	---	125	0	0	0.0005

Notes:

1. The design depth to groundwater is 31 feet
2. Snd ≡ Sand (Reese); SoC ≡ Soft Clay (Matlock); Stc ≡ Stiff Clay without Free Water (Reese); and WR ≡ Weak Rock (Reese)

APPENDIX D

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING


Auger


Split Spoon


Shelby Tube


Pressure Meter


Texas Cone


Rock Core


Grab Sample


No Recovery

WATER LEVEL


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer
(TCP)	Texas Cone Penetrometer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

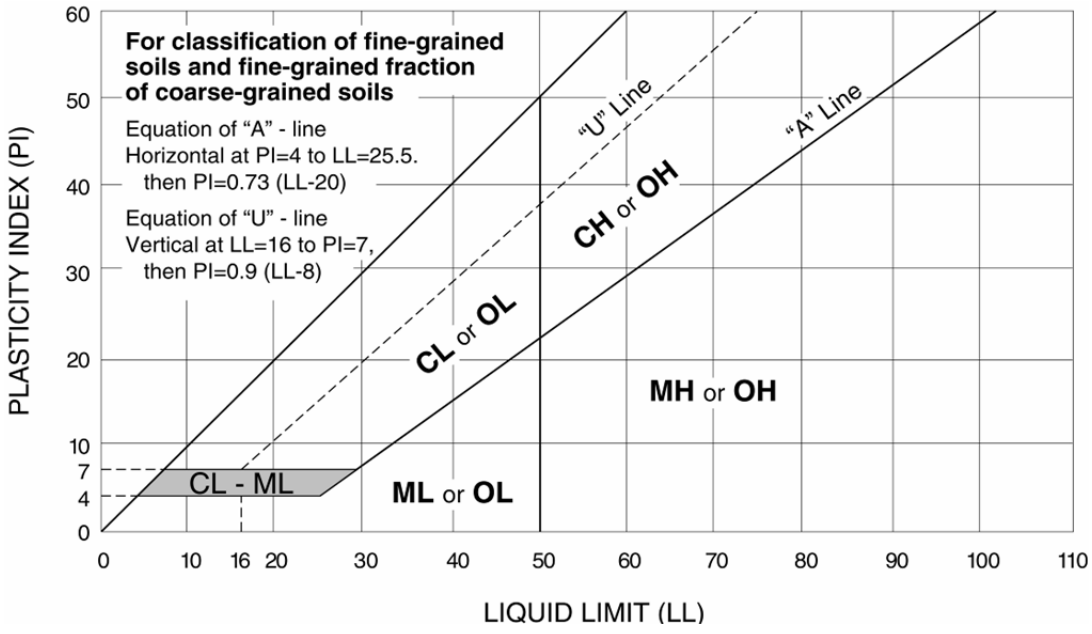
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

GENERAL NOTES

Sedimentary Rock Classification

DESCRIPTIVE ROCK CLASSIFICATION:

Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, and rock of clay and silt size grains is called mudstone or claystone, siltstone, or shale. Modifiers such as shaly, sandy, dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.

LIMESTONE	Light to dark colored, crystalline to fine-grained texture, composed of $CaCo_3$, reacts readily with HCl.
DOLOMITE	Light to dark colored, crystalline to fine-grained texture, composed of $CaMg(CO_3)_2$, harder than limestone, reacts with HCl when powdered.
CHERT	Light to dark colored, very fine-grained texture, composed of micro-crystalline quartz ($Si0_2$), brittle, breaks into angular fragments, will scratch glass.
SHALE	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.
SANDSTONE	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.
CONGLOMERATE	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size (½ inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.

PHYSICAL PROPERTIES:

DEGREE OF WEATHERING

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.

Shale, Siltstone and Claystone

Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

BEDDING AND JOINT CHARACTERISTICS

Bed Thickness	Joint Spacing	Dimensions
Very Thick	Very Wide	> 10′
Thick	Wide	3′ - 10′
Medium	Moderately Close	1′ - 3′
Thin	Close	2″ - 1′
Very Thin	Very Close	.4″ - 2″
Laminated	—	.1″ - .4″

Bedding Plane	A plane dividing sedimentary rocks of the same or different lithology.
Joint	Fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.
Seam	Generally applies to bedding plane with an unspecified degree of weathering.

SOLUTION AND VOID CONDITIONS

Solid	Contains no voids.
Vuggy (Pitted)	Rock having small solution pits or cavities up to ½ inch diameter, frequently with a mineral lining.
Porous	Containing numerous voids, pores, or other openings, which may or may not interconnect.
Cavernous	Containing cavities or caverns, sometimes quite large.