ARKANSAS DEPARTMENT OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. 070471

FEDERAL AID PROJECT NO. NHPP-BFP-0014 (35)

CORNIE BAYOU, HARPER & LAPILE CREEKS STRS. & APPRS. (S)

STATE HIGHWAY 82 **SECTION** 4 & 6

IN COLUMBIA & UNION **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

Geotechnical Engineering Report

Job No. 070417, Cornie Bayou, Harper & Lapile Creek Structures and Approaches
Columbia and Union Counties, Arkansas
April 11, 2019
Terracon Project No. 35185110

Prepared for:
Michael Baker International, Inc.
Little Rock, Arkansas

Prepared by:
Terracon Consultants, Inc.
Little Rock, Arkansas

April 11, 2019

Terracon GeoReport

Michael Baker International, Inc.
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Attn: Mr. Scott Thornsberry
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Re: Geotechnical Engineering Report
Job No. 070417, Cornie Bayou, Harper & Lapile Creek Structures and Approaches
Highway 82
Columbia and Union Counties, Arkansas
Terracon Project No. 35185110

Dear Mr. Thornsberry:

We have completed the Geotechnical Engineering services for the above-referenced project. This study was performed in general accordance with Task Order No. 55, dated October 5, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations for designing and constructing the proposed bridge improvements for the proposed project.

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.
Certificate of Authorization #223, Expires 12/31/2019

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REPORT TOPICS

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Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Job No. 070417, Cornie Bayou, Harper & Lapile Creek Structures and Approaches

Highway 82

Columbia and Union Counties, Arkansas

Terracon Project No. 35185110

April 11, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed bridge improvements to be located on Highway 82 in Columbia and Union Counties, Arkansas. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Site preparation and earthwork
- Groundwater conditions
- Foundation design and construction
- Seismic site classification per IBC
- Lateral earth pressures

The geotechnical engineering Scope of Services for this project included the advancement of 18 test borings to depths ranging from approximately 10 to 80 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at three structures along Highway 82 in Columbia and Union Counties. Approximate Latitude and Longitude: Structure #02912 - 33.1160° N, 92.3811° W Structure #02667 - 33.2502° N, 93.0935° W Structure #02668 - 33.2499° N, 93.0775° W **See Site Location**

Item	Description
Existing Improvements	Existing bridge structures along Highway 82 in Columbia and Union Counties
Current Ground Cover	Existing bridge structure with asphalt pavement approaches and vegetated embankments
Existing Topography	The bridge structures and approaches appeared to be relatively level

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Project Description	ArDOT is proposing structures and approach improvements on three existing bridge structures
Proposed Structures	The project includes the improvement to three structures and approaches over Cornie Bayou, Harper Creek and Lapile Creek
Bridge Construction	Bridge Construction plans were not available at the time of this report. Through coordination with Michael Baker, we understand that the bridges will likely be supported on pile foundations.
Maximum Loads	Traffic and structure loads are not known at this time
Grading/Slopes	We assume that final grade will be at or near existing grade.
Below-Grade Structures	None anticipated
Free-Standing Retaining Walls	None anticipated
Pavements	Pavement section design is not included in this scope of work. Resilient modulus testing of anticipated pavement subgrades is provided at each bridge location.
Estimated Start of Construction	2019

GEOTECHNICAL CHARACTERIZATION

The three bridges are in Alluvium deposits within the Claiborne Group. The Claiborne Group includes mainly unconsolidated sand and silty clay that is interbedded with carbononaeous clay and lignite. The maximum thickness of this group is 1500 feet. Cyclic marine-nonmarine units formed in a fluvial-deltatic system. Based on the results of the borings, subsurface conditions at the boring locations can be generalized as follows:

Structure Number 02912 - Borings B-1 and B-2:

Stratum	Approximate Depth to Bottom of Stratum (feet)		Material Description	Consistency/Density
	B-1	B-2		
1	13.5		B-1: Clayey sand fill over sandy silt B-2: Silty sand	B-1: Soft B-2: Very loose
2	23.5		Poorly graded sand	Loose
3	38.5	28.5	Fat clay with sand and fat clay	Very stiff
4	43.5	48.5	Clayey sand	Medium dense to dense
5	58.5		Sandy fat clay and fat clay with sand	Very stiff to hard
6	73.5		Clayey sand	Very dense
7	80		Fat clay and fat clay with sand	Hard

Roadway (R-1 and R-2) and shoulder (S-1 and S-2) borings were performed for new pavement design at the approaches to Bridge Structure No. 02912. We encountered 10 to 12 inches of asphalt in the two roadway borings. The asphalt was underlain by 2 to 6 inches of aggregate base course. We encountered 8 inches of asphalt underlain by 2 inches of aggregate base in Shoulder Boring S-2. Asphalt pavement was not encountered in Shoulder boring S-1.

The roadway and shoulder borings encountered fill soils containing lean clay with gravel, clayey sand, sandy silt, and clayey gravel to depths of about 2.5 to 4 feet below the existing ground surface. Native sandy silty clay, silt with sand, silty sand, lean clay with sand and clayey sand soils were observed underlying the existing fill soils to the termination depths of about 10 feet. The consistency or relative density of the soils typically decreased at about 8.5 feet below the ground surface and the borings terminated in lower-strength soils at depths of 10 to 15 feet.

Structure Number 02668 - Boring B-3:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	2.5	12 inches of asphalt pavement overlying 6 inches of aggregate base Fill – Poorly graded sand with clay	N/A
2	18.5	Lean clay with sand and sandy lean clay	Medium stiff to very stiff

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
3	38.5	Fat clay and fat clay with sand	Very soft to very stiff
4	68.5	Clayey sand	Very dense
5	75	Sandy fat clay	Hard

Structure Number 02668 - Boring B-4:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	3.5	Silty clay with sand	Medium stiff to stiff
2	18.5	Sandy lean clay	Medium stiff to stiff
3	28.5	Sandy silt	Very stiff to hard
4	48.5	Silty sand	Very dense
5	80	Sandy fat clay	Hard

We encountered 8 inches of asphalt in the two roadway borings (R-3 and R-4). The asphalt was underlain by 4 inches of aggregate base. We encountered 6 inches of asphalt overlying 5 inches of aggregate base in Shoulder Boring S-3. Asphalt was not encountered in Shoulder Boring S-4. The roadway and shoulder borings performed for new pavement design at the approaches to Bridge Structure No. 02668 encountered native sandy silt, clayey sand, lean clay, lean clay with sand, gravelly lean clay, and sandy fat clay. With the exception of Roadway Boring R-4, the consistency or relative density of the soils generally decreased in strength at a depth of about 8.5 feet below the existing ground surface.

Structure Number 02667 (Borings B-5 and B-6):

Stratum	Approximate Depth to Bottom of Stratum (feet)		Material Description	Consistency/Density
	B-5	B-6		
1	8.5	--	Sandy silty clay, sandy silt	Very soft to soft
2	--	18.5	Silty sand	Loose
3	23.5		B-5: Silty sand B-6: Elastic silt with sand	B-5: Very loose to loose B-6: Stiff
4	38.5	43.5	Fat clay with sand, fat clay and sandy lean clay	Very stiff
5	63.5		Clayey sand and silty sand	Dense to very dense
6	73.5		Fat clay and sandy fat clay	Hard

Stratum	Approximate Depth to Bottom of Stratum (feet)		Material Description	Consistency/Density
	B-5	B-6		
7	80		B-5: Sandy lean clay B-6: Clayey sand	B-5:Hard B-6: Very dense

We encountered 8 inches of asphalt underlain by 0 and 3 inches of aggregate base in Roadway Borings R-5 and R-6 drilled for new pavement design for approaches at Bridge Structure Number 02912. Two borings were also drilled on the shoulder of the roadway (S-5 and S-6). The roadway and shoulder borings encountered native sandy lean clay underlying the asphalt pavement and topsoil in the borings. The consistency or relative density of the soils generally decreased in strength at a depth of about 8.5 feet below the existing ground surface.

GEOTECHNICAL OVERVIEW

Variable layers of lean and fat clay, silt, and sand were observed in the borings drilled for this project. Generalized profiles of the soil observed at each bridge location were developed. The results of our study indicate that the site can be developed for the proposed bridge replacements. During our study the following geotechnical conditions were identified:

- Existing fill
- Low-strength soils
- Expansive soils
- Moisture-sensitive soils
- Potential liquefiable soils

The following discussion addresses these items and provides the basis for design recommendations present in the subsequent sections.

Existing Fill

Fill consisting of lean clay, silt, clayey sand, clayey gravel and poorly graded sand with clay was observed to depths ranging from 2 to 4 feet below the existing surface. Many of the borings were drilled in the roadway or along the existing embankment therefore we believe the fill is associated with the previous roadway and bridge construction. Information regarding the placement of the existing fill was not available at the time of this report. There is an inherent risk that otherwise unsuitable material within or buried by the fill will not be discovered that could result in unpredictable post-construction performance of the bridge foundations or roadway supported on existing fill.

Low-Strength Soils

Low-strength soils (SPT N-values less than or equal to 5 blows per foot) were observed in most of the borings at varying depths. Bridge structure Borings B-1 through B-6 contained low-strength soils typically observed from the surface or near the existing ground surface to depths of about 13.5 to 23.5 feet. In their present conditions, the low-strength soils are not suitable for providing direct support to shallow foundations such as bridge abutments or wingwalls and are expected to be compressible under new embankment fills. The low-strength soils listed above would also provide low skin friction and lateral resistance, which were factored into the deep foundation parameters and resistances provided in the **Deep Foundations** section.

The roadway and shoulder borings, except R-4 and S-4, encountered low-strength soils, typically below a depth of about 8.5 feet below the existing surface. With the exception of R-1, these borings terminated at a depth of about 10 feet; therefore, it is possible the low-strength soils may continue beyond the termination depths of these borings.

Because the low-strength soils are deeper seated, overexcavation and replacement of the low-strength soils would be impractical and expensive. Grading information was not provided; therefore, Terracon should be notified to reevaluate recommendations if cuts greater than 5 feet are expected for bridge and roadway improvements.

The soils on-site have a high compressibility potential. We do not anticipate any additional settlement will be observed if future embankments are at or near the existing embankment heights. If large changes in grading are anticipated, we should be notified to evaluate the potential embankment settlement.

Expansive Soils

Fat clay and high PI lean clay and clayey sand soils were observed in Borings B-3, R-4, S-3 and S-4 within the zone of seasonal moisture change. These soils are expansive and have a moderate to high potential for shrinking and swelling with variations in moisture content. We recommend that expansive soils be removed or chemically stabilized to a depth of about 2 feet below the subsurface in pavement and approach areas as encountered.

Moisture-Sensitive Soils

The lean clay, clayey sand, and silt soils are moisture-sensitive and prone to further strength loss with increased moisture content. These soils could become unstable with typical earthwork and construction traffic, especially after precipitation events. Effective drainage should be completed early in the construction sequence and maintained after construction. If possible, the grading should be performed during the warmer and drier times of the year. If grading or construction is

performed during the winter months, an increased risk for possible treatment of unstable subgrade will persist.

Potential Liquefaction

Bridge structure Borings B-1 through B-6 contained low-strength soils typically observed from the surface or near the existing ground surface to depths of about 13.5 to 23.5 feet. Liquefaction analyses were performed on all the structure borings using the groundwater depths observed during the subsurface investigation. From the liquefaction analyses performed, we anticipate reductions in the lateral soil resistance and increases in lateral soil loads on pile foundations to be relatively minor for ground motions with a 7 percent probability of exceedance in 75 years.

Based on the subsurface conditions observed as well as the conversations with the client, we understand that driven piles are being considered for support of the bridge replacements. The **Deep Foundations** section addresses the support of the three bridges on driven piles. The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork should be performed as required in the ArDOT Standard Specifications for Highway Construction latest edition. The following recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project are considered general recommendations for earthwork. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, and other geotechnical conditions during construction of the project. Terracon should be retained during site preparation operations.

Fill Material Types

Fill materials should be free of organic matter and debris. Portions of the on-site soils or approved imported borrow materials may be used as fill material. Near-surface existing fill and native soils in Borings B-3, R-4, S-3 and S-4 exhibited plasticity indices greater than 20, which is typically considered unsuitable for use as engineered fill in the upper 2 feet of pavement subgrade. If it is desired to use on-site material as engineered fill for this project, we recommend thorough testing prior to reuse. Undercutting or chemical stabilization may be required.

While ArDOT has no specific requirement for borrow materials, they do require that the materials be capable of forming and maintaining a stable embankment slope when compacted. Therefore, we recommend avoiding elastic silts (MH) and organic soils (OL, OH and PT) when considering materials for use as borrow.

We suggest that approved imported borrow soils meet the following material property requirements:

Sieve Size	Percent Finer by Weight (ASTM C136)
3 inch	100
No. 4	50-100
No. 200	15-50

- Plasticity Index……..20 (max)

Fill Compaction Requirements

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should start at the toe of the slope and have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface. We recommend that fill slopes be filled beyond the planned final slopes face and then cut back to develop an adequately compacted slope face.

Earthwork Construction Considerations

We anticipate that shallow excavations can be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of pile caps or pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Any water that collects over or adjacent to, construction areas should be promptly removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or these materials should be scarified and moisture conditioned. All these procedures should be observed by Terracon.

If unstable subgrade conditions are encountered, the methods described below can be considered to improve subgrade strength. Common methods include scarification, moisture conditioning and compaction, removal of unstable materials and replacement with granular fill (with or without geosynthetics), and chemical stabilization. The appropriate method of improvement, if required, depends on factors such as schedule, weather, the size of area to be stabilized, and the nature of the instability.

If the exposed subgrade becomes unstable, methods outlines below can be considered.

- **Scarification and Compaction –** It may be feasible to scarify, dry and compact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot, if the unstable soil is at or near the groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.

- **Crushed Stone –** The use of crushed stone or crushed gravel is the most common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 6 to 30 inches below the finished subgrade elevation. The use of high modulus geosynthetics (i.e., geotextile or geogrid) can also be considered after underground work such as utility construction is completed. Prior to placing the geotextile or geogrid, we recommend that all below-grade construction, such as utility line installation, be completed to avoid damaging the geosynthetics. Equipment should not be operated above the geosynthetics until one full lift of crushed stone fill is placed above it.

Further evaluation of the need for subgrade stabilization should be provided by a qualified geotechnical engineer during construction as the subgrade conditions are exposed on a broad scale.

Temporary excavations will probably be required during grading operations. As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming any responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proof-roll to require mitigation. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the

continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

PRELIMINARY SHALLOW FOUNDATIONS

No information was provided regarding the bridge design at the time of this report. Typically bridges are designed with wingwalls or retaining wall structures located on the embankments. Based on the findings from our borings and the observed low-strength soils in all of the bridge borings, it is our opinion that any planned wingwalls or retaining walls associated with the new bridge be supported on driven pile foundations. Shallow foundation support would require significant subgrade improvement to avoid bearing on the very soft/loose soils encountered in our borings; additional structure information (such as planned grades) and consultation with our geotechnical engineer would be required to analyzed and develop recommendations for shallow foundations.

LATERAL EARTH PRESSURES

For planned wingwall or retaining walls planned at the bridge locations, the following lateral earth pressures can be utilized.

Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	**Coefficient for Backfill Type**	**Surcharge Pressure** [2, 3, 4] **p_1 (psf)**	**Effective Fluid Pressures (psf)** [4, 5]	
			Unsaturated [6]	**Submerged** [6]
Active (Ka)	Granular - 0.31	(0.31)S	(40)H	(80)H
	Fine Grained - 0.41	(0.41)S	(50)H	(85)H
At-Rest (Ko)	Granular - 0.47	0.47)S	(55)H	(90)H
	Fine Grained - 0.58	(0.58)S	(70)H	(105)H
Passive (Kp)	Granular - 3.25	---	(390)H	(250)H
	Fine Grained - 2.46	---	(295)H	(205)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance
2. Uniform surcharge, where S is surcharge pressure.
3. Loading from heavy compaction equipment is not included in surcharge or earth pressures
4. No safety factor is included in these values.
5. Uniform, horizontally graded backfill, compacted to at least 95 percent of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf
6. In order to achieve "Unsaturated" conditions, wall drainage must be provided. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

DEEP FOUNDATIONS

Soil Strength Parameters

Driven pile parameters used to determine the nominal and factored resistances of piles are shown below. The values were developed based on our interpolation of the generalized stratigraphy of the borings near each bridge and our experience with the soils in the project area.

Structure Number 02912 (Borings B-1 and B-2):

Stratum	Approximate Depth to Bottom of Stratum (feet)		Material Description	Unit weight (pcf)	Undrained Shear Strength (psf)	Friction Angle (°)
	B-1	B-2				
1	13.5		B-1: Fill and sandy silt B-2: Silty sand	110	B-1: 500 B-2: --	B-1: -- B-2: 26
2	23.5		Poorly graded sand	110	--	28
3	38.5	28.5	Fat clay with sand and fat clay	120	3,000	--
4	43.5	48.5	Clayey sand	115	--	32
5	58.5		Sandy fat clay and fat clay with sand	120	3,500	--
6	73.5		Clayey sand	120	--	36
7	80		Fat clay and fat clay with sand	120	4,000	--

Structure Number 02668:

Boring B-3

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Unit Weight (pcf)	Undrained Shear Strength (psf)	Friction Angle (°)
1	18.5	Lean clay with sand and sandy lean clay	110	1,000	--
2	28.5	Fat clay	110	500	--
3	38.5	Fat clay with sand	120	3,000	--
4	68.5	Clayey sand	120	--	36
5	75	Sandy fat clay	120	4,000	--

Boring B-4

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Unit Weight (pcf)	Undrained Shear Strength (psf)	Friction Angle (°)
1	18.5	Silty clay with sand and sandy lean clay	115	1,000	--
2	28.5	Sandy silt	115	2,000	--
3	48.5	Silty sand	120	--	36
4	80	Sandy fat clay	120	4,000	--

Structure Number 02667 (Borings B-5 and B-6):

Stratum	Approximate Depth to Bottom of Stratum (feet)		Material Description	Unit Weight (pcf)	Undrained Shear Strength (psf)	Friction Angle (°)
	B-5	B-6				
1	8.5	--	Sandy silty clay, sandy silt	110	500	--
2	23.5	18.5	Silty sand	110	--	28
3	--	23.5	Elastic silt with sand	115	1,000	--
4	38.5	43.5	Fat clay with sand, fat clay and sandy lean clay	120	3,000	--
5	63.5		Clayey sand and silty sand	120	--	36
6	73.5		Fat clay and sandy fat clay	120	4,000	--
7	80		B-5: Sandy lean clay B-6: Clayey sand	120	B-5: 4,000	B-6: 36

Driven Pile Resistances

Based on the general profiles above, the driven piles resistances for an open-ended pipe with various diameters were determined at different depths. The following tables and graphical representation of the pile resistance for each bridge improvement follows: (The tables are selected values from the presented graphs and commonly do not line up with inflections in plotted lines; interpolation should not be used)

For the tables below:

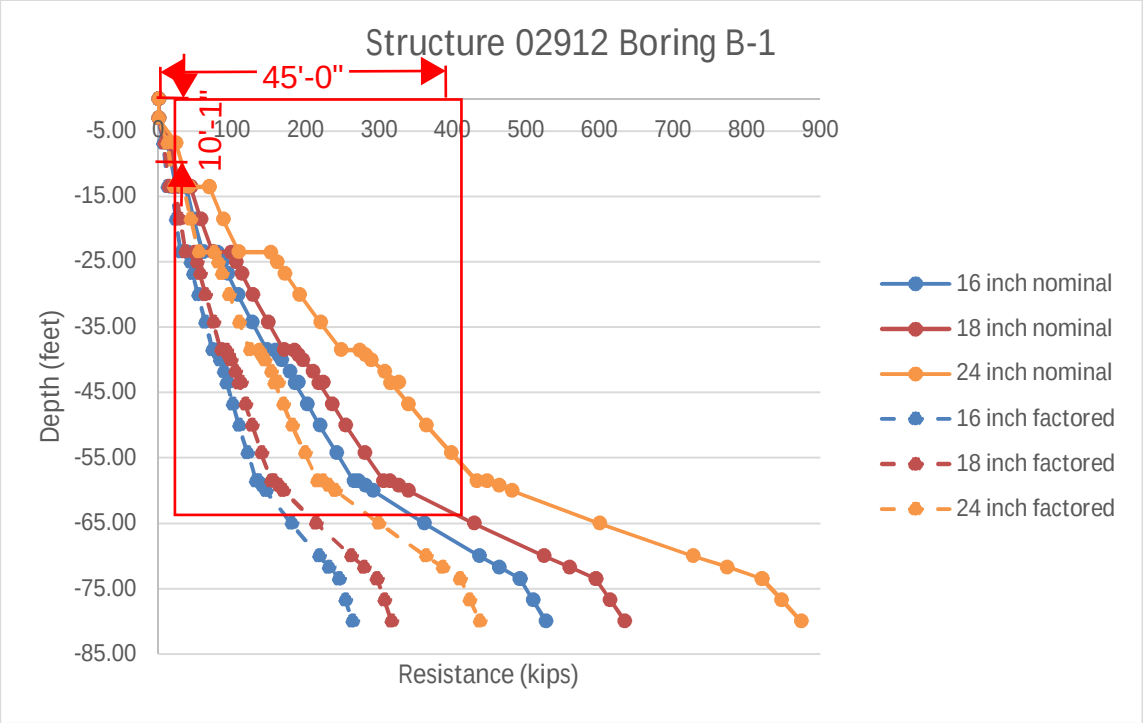
- The nominal resistances are applicable if the center-to-center spacing of the piles is equal to or greater than 3 times the maximum pile section dimension
- The factored resistance values are based on the nominal resistance multiplied by the structural resistance factor of 0.5 from **Resistance Factors for Geotechnical Resistance of Driven Piles, φ** [AASHTO 10.5.5.2.3-1]. The resistance factor can be increased if pile dynamic analysis or wave equation analyses is specified to be performed prior to construction.

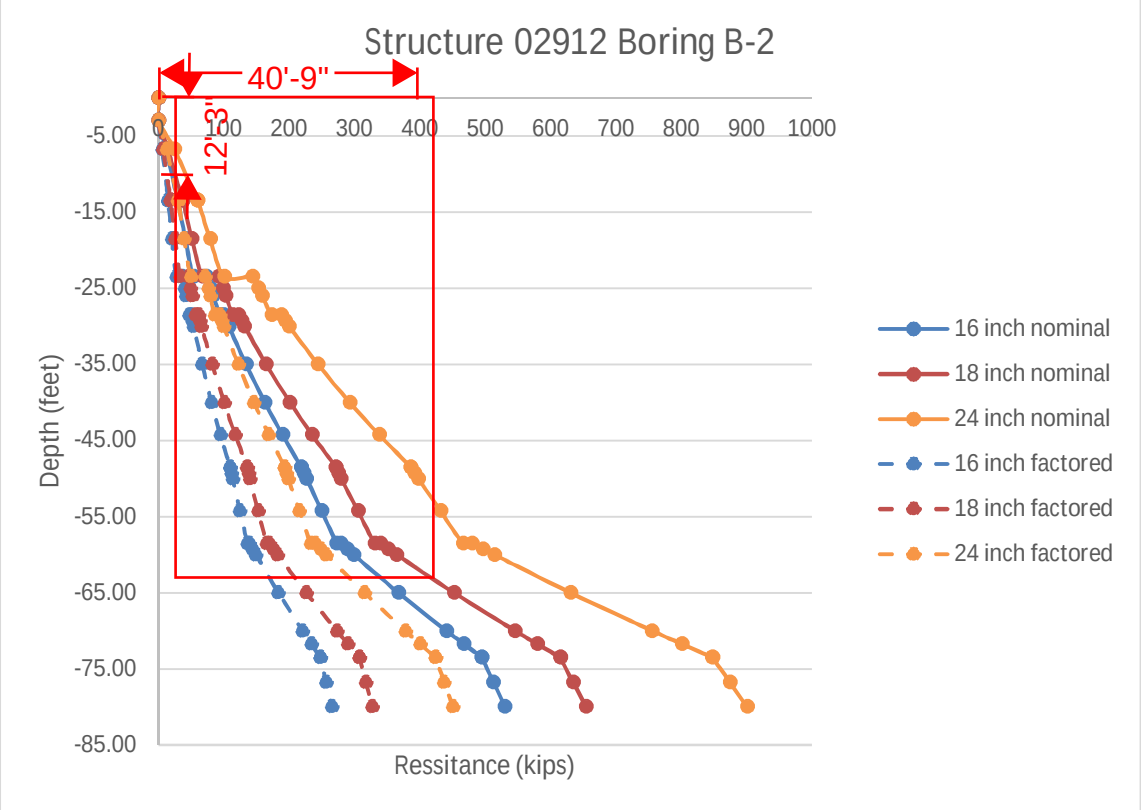
Structure 02912 (Boring B-1)

Pipe Pile Depth (feet)	Nominal Resistance (kips) Pile Diameter (inches)			Factored Compression Resistance (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	105	125	190	50	60	95
40	165	195	285	80	95	145
50	215	250	360	110	125	180
60	290	340	480	145	170	240
70	435	525	725	215	260	360

Structure 02912 (Boring B-2)

Pipe Pile Depth (feet)	Nominal Resistance (kips) Pile Diameter (inches)			Factored Compression Resistance (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	105	130	200	50	65	100
40	160	200	290	80	100	145
50	225	275	395	110	140	195
60	295	360	510	145	180	255
70	440	545	755	220	270	375


Structure 02912 Boring B-1
45'-0"
10'-1"
-5.00
-15.00
-25.00
-35.00
-45.00
-55.00
-65.00
-75.00
-85.00
0
100
200
300
400
500
600
700
800
900
Depth (feet)
Resistance (kips)
16 inch nominal
18 inch nominal
24 inch nominal
16 inch factored
18 inch factored
24 inch factored

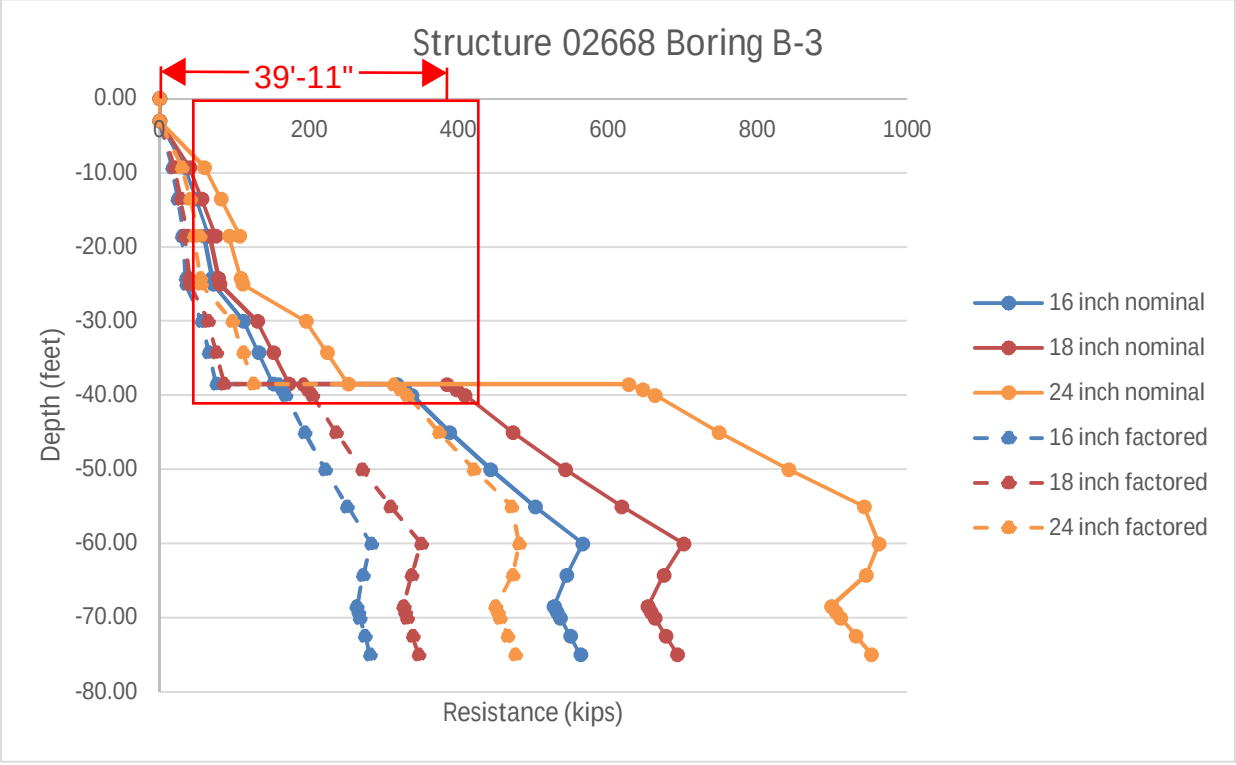

Structure 02912 Boring B-2
40'-9"
12'-3"
-5.00
-15.00
-25.00
-35.00
-45.00
-55.00
-65.00
-75.00
-85.00
0
100
200
300
400
500
600
700
800
900
1000
Depth (feet)
Ressitance (kips)
16 inch nominal
18 inch nominal
24 inch nominal
16 inch factored
18 inch factored
24 inch factored

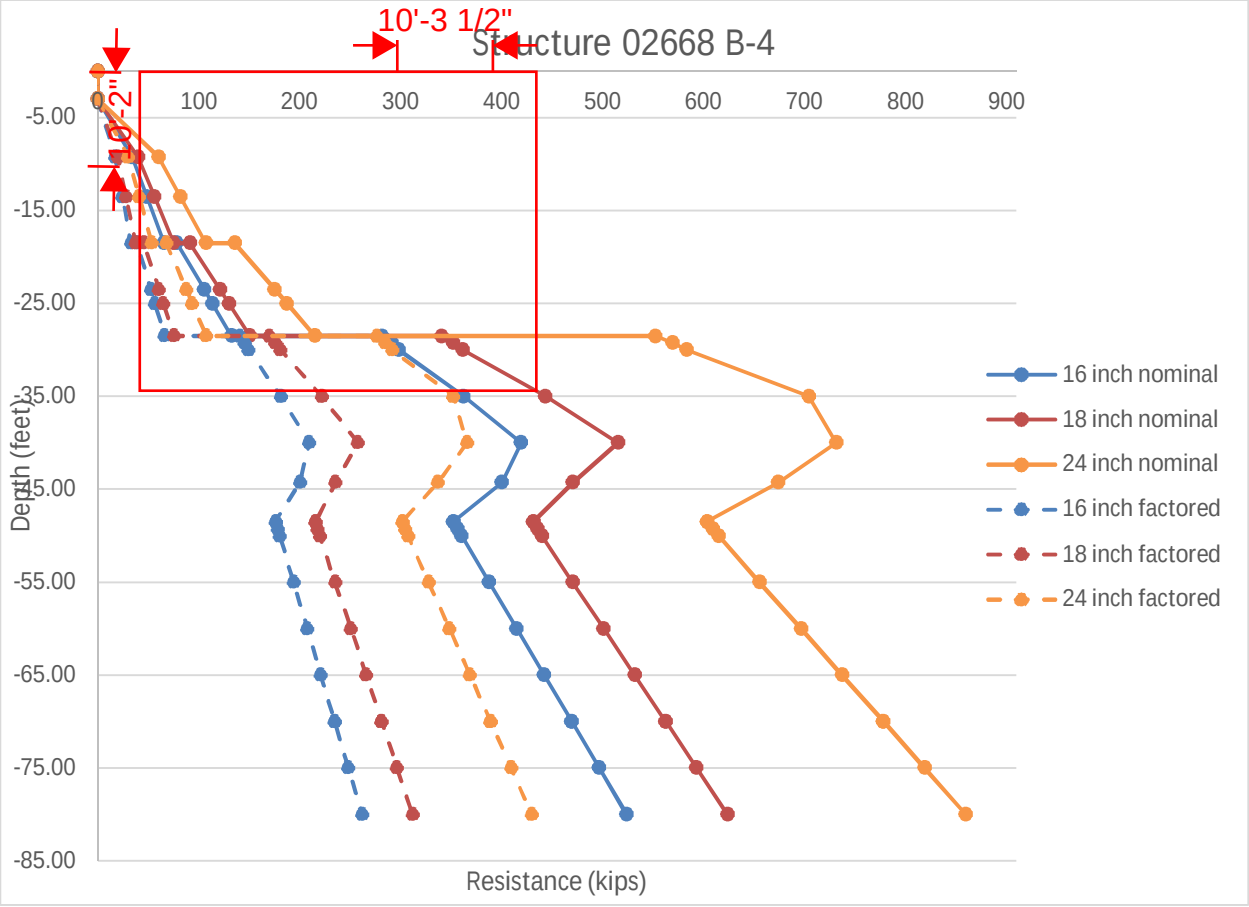
Structure 02668 (Boring B-3)

Pipe Pile Depth (feet)	Nominal Resistance (kips) Pile Diameter (inches)			Factored Compression Resistance (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	110	130	195	55	65	95
40	335	405	660	165	200	330
50	440	540	840	220	270	420
60	565	700	960	280	350	480
70	535	660	910	265	330	455

Structure 02668 (Boring B-4)

Pipe Pile Depth (feet)	Nominal Resistance[1] (kips) Pile Diameter (inches)			Factored Compression Resistance[2] (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	295	360	580	145	180	290
40	415	515	730	210	255	365
50	360	440	615	180	220	305
60	415	500	695	205	250	345
70	465	560	775	235	280	385



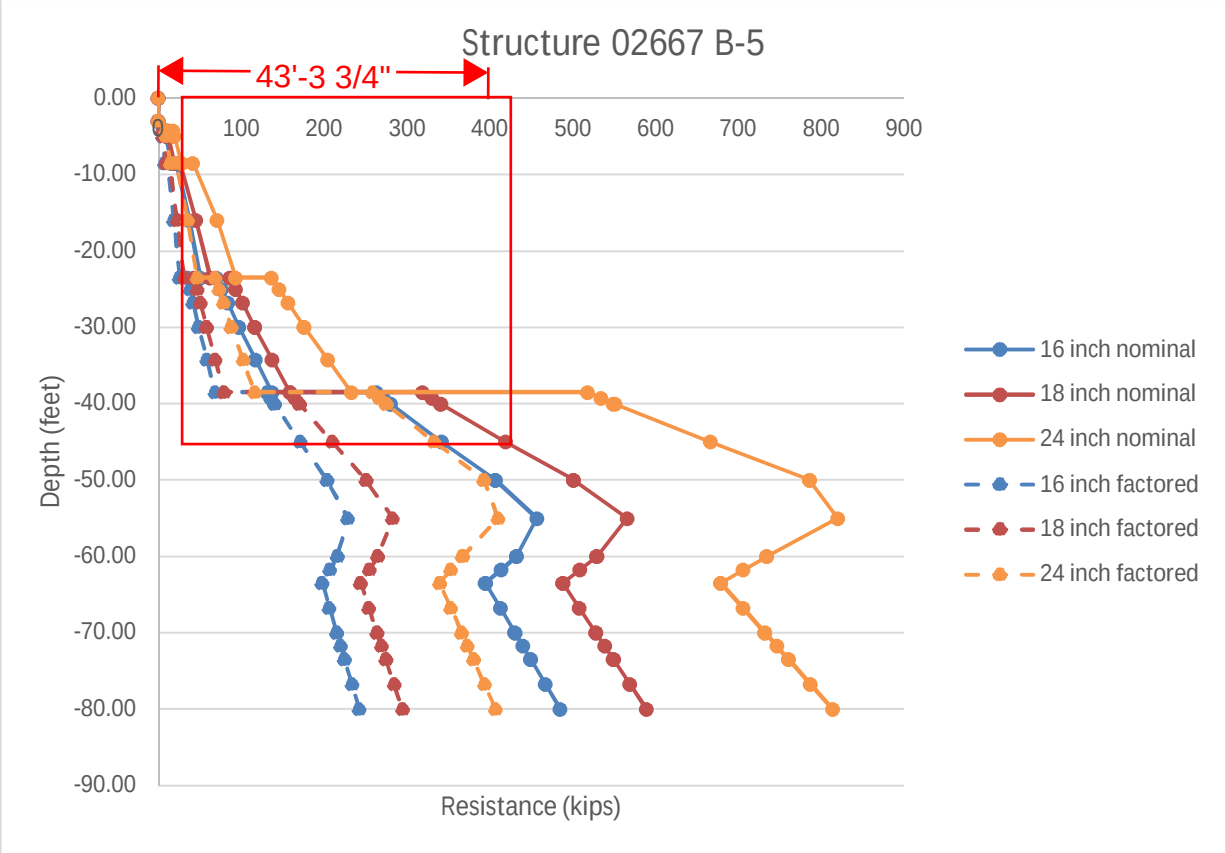


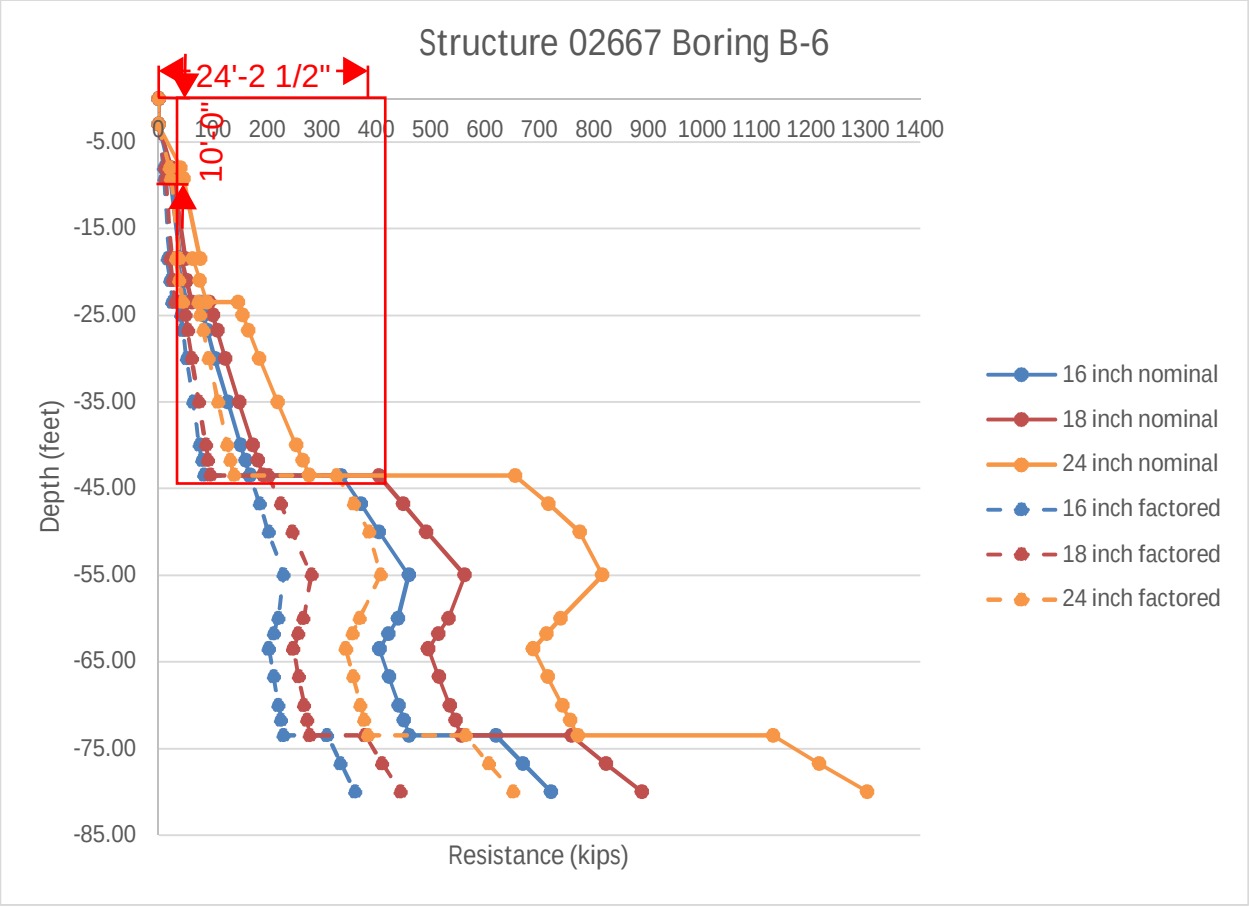
Structure 02667 (Boring B-5)

Pipe Pile Depth (feet)	Nominal Resistance[1] (kips) Pile Diameter (inches)			Factored Compression Resistance[2] (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	95	115	175	45	55	85
40	280	340	545	140	170	275
50	405	500	785	200	250	390
60	430	530	730	215	265	365
70	430	525	730	215	260	365

Structure 02667 (Boring B-6)

Pipe Pile Depth (feet)	Nominal Resistance[1] (kips) Pile Diameter (inches)			Factored Compression Resistance[2] (kips) Pile Diameter (inches)		
	16	18	24	16	18	24
30	100	120	185	50	60	90
40	150	170	250	75	85	125
50	405	490	770	200	245	385
60	440	530	735	220	265	365
70	440	535	740	220	265	370





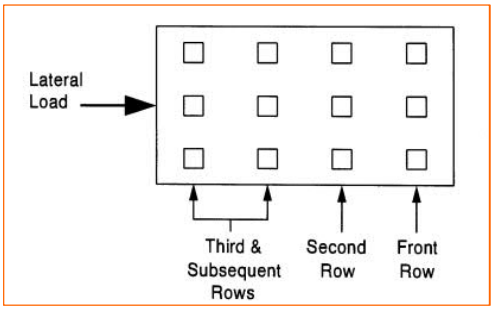
Wall thickness for pipe piles should be selected in consideration of the design nominal resistance (or conversely, the maximum nominal resistance, or structural limit state, should be established for the selected pipe pile section). The critical event occurs during driving, and pile stresses should be maintained less than $0.9F_y$ to reduce the potential for damage to the pile, where F_y = yield strength of the steel. This driving stress was often correlated to a maximum allowable design capacity of $0.25*F_y*A_{st}$ using ASD methods (where A_{st} = cross sectional steel area). For LRFD design methods, resistance factors for the strength limit state are provided in AASHTO Article 6.5.4.2 for pipe pile sections; use of a pile tip is not considered necessary on these sites.

Driven Pile Lateral Loading

The strength parameters listed in the Soil Strength Parameters can be used as input values for use in LPILE analyses. LPILE will estimate values of k_h and E_{50} based on the provided strength values. Effective unit soil weights should be used for input assuming a maximum groundwater level similar to flood stage elevation.

When piles are used in groups, the lateral resistances of the piles in the second, third, and subsequent rows of the group should be reduced as compared to the capacity of a single, independent pile. Guidance for applying p-multiplier factors to the p values in the p-y curves for each row of pile foundations within a pile group are as follows:

- Front row: $P_m = 0.8$;
- Second row: $P_m = 0.4$
- Third and subsequent row: $P_m = 0.3$.



The load resistances provided herein are based on the stresses induced in the supporting soil strata. The structural capacity of the piles should be checked to assure that they can safely accommodate the combined stresses induced by axial and lateral forces. Lateral deflections of piles should be evaluated using an appropriate analysis method, and will depend upon the pile's diameter, length, configuration, stiffness and "fixed head" or "free head" condition. We can provide additional analyses and estimates of lateral deflections for specific loading conditions upon request. The load-carrying capacity of piles may be improved by increasing the diameter of pipe piles.

Driven Pile Construction Considerations

The contractor should select a driving hammer and cushion combination which can install the selected piling without overstressing the pile material. The hammer should have a rated energy in foot-pounds at least equal to 15 percent of the design compressive load capacity in pounds. The contractor should submit the pile driving plan and the pile hammer-cushion combination to the engineer for evaluation of the driving stresses in advance of pile installation. During driving a maximum of 10 blows per inch is recommended to reduce the potential of damage to the piles.

Pile driving conditions, hammer efficiency, and stress on the pile during driving could be better evaluated during installation using a Pile Driving Analyzer (PDA). A Terracon representative should observe pile driving operations. Each pile should be observed and checked for buckling, crimping and alignment in addition to recording penetration resistance, depth of embedment, and general pile driving operations.

The pile driving process should be performed under the direction of the Geotechnical Engineer. The Geotechnical Engineer should document the pile installation process including soil/rock and groundwater conditions encountered, consistency with expected conditions, and details of the installed pile.

Excavations for pile caps should be evaluated under the direction of a Geotechnical Engineer. The base of all excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with AASHTO Guide Specification for LRFD Bridge Design (2014). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is E**. Subsurface explorations at this site were extended to a maximum depth of 80 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

PAVEMENTS

Resilient Modulus Testing

Resilient modulus testing was performed on the onsite materials at each bridge for this project. The resilient modulus is a measure of the material's stiffness and provides a mean to analyze the stiffness of the onsite material under different conditions. The resilient modulus testing was performed in accordance with AASHTO T307-99 and was performed on a combined sample at each bridge. Bulk samples were obtained from the shoulder borings.

For this project we analyzed each sample at the material's optimum and at +2.5% moisture content as determined from a standard Proctor test (ASTM D698). The following modulus values are for a chamber confining pressure of 2 psi and a nominal maximum axial stress of 4 psi. We recommend a resilient modulus value of 3,202 psi for the pavements at Structure 02912 (Borings S-1 and S-2). . We recommend a resilient modulus value of 4,408 psi for the pavements at Structure 02668 (Borings S-3 and S-4). We recommend a resilient modulus value of 4,484 psi for the pavements at Structure 02667 (Borings S-5 and S-6).

Using ArDOT's method for converting the laboratory resilient modulus values, Resilient Modulus values of about 2,700 psi was estimated for Structures 02667 and 02668. A resilient modulus value of about 2,500 psi was estimated for Structure 02912.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
6	75 to 80	Bridge borings
12	10 to 15	Roadway and shoulder borings

Boring Layout and Elevations: The locations of the field exploration points (borings) were measured in the field by Terracon's exploration team using a hand-held GPS unit to measure the latitude and longitude. The coordinates and elevations of Borings B-3, B-4, B-5, and B-6 were provided by Michael Baker from a performed field survey.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted, rotary drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion. Pavements were patched with cold-mix asphalt and/or pre-mixed concrete, as appropriate.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Representative soil samples were tested in the laboratory to measure their natural water content, gradation and Atterberg limits. Bulk samples were also collected from the embankment materials at each structure and were tested to measure its standard Proctor compaction characteristics and

resilient modulus stiffness. The test results are provided on the appended boring logs and laboratory test reports.

The soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the laboratory testing described above. The soil descriptions presented on the boring logs are in accordance with the enclosed General Notes and Unified Soil Classification System (USCS). The estimated USCS group symbols for native soils are shown on the boring logs, and a brief description of the USCS is included in this report.

Bulk samples were obtained from the shoulder borings drilled at the approaches to each bridge. Standard Proctor (AASHTO T-99) and Resilient modulus (AASHTO T307-99) testing was performed on a bulk sample from each bridge location. Resilient modulus testing was performed on remolded samples compacted to near the optimum moisture content and +2% of the optimum moisture content.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan (2 pages)
Exploration Plan (3 pages)

Note: All attachments are one page unless noted above.

SITE LOCATION PLAN - 1

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Union, AR
January 7, 2019 ■ Terracon Project No. 35185110

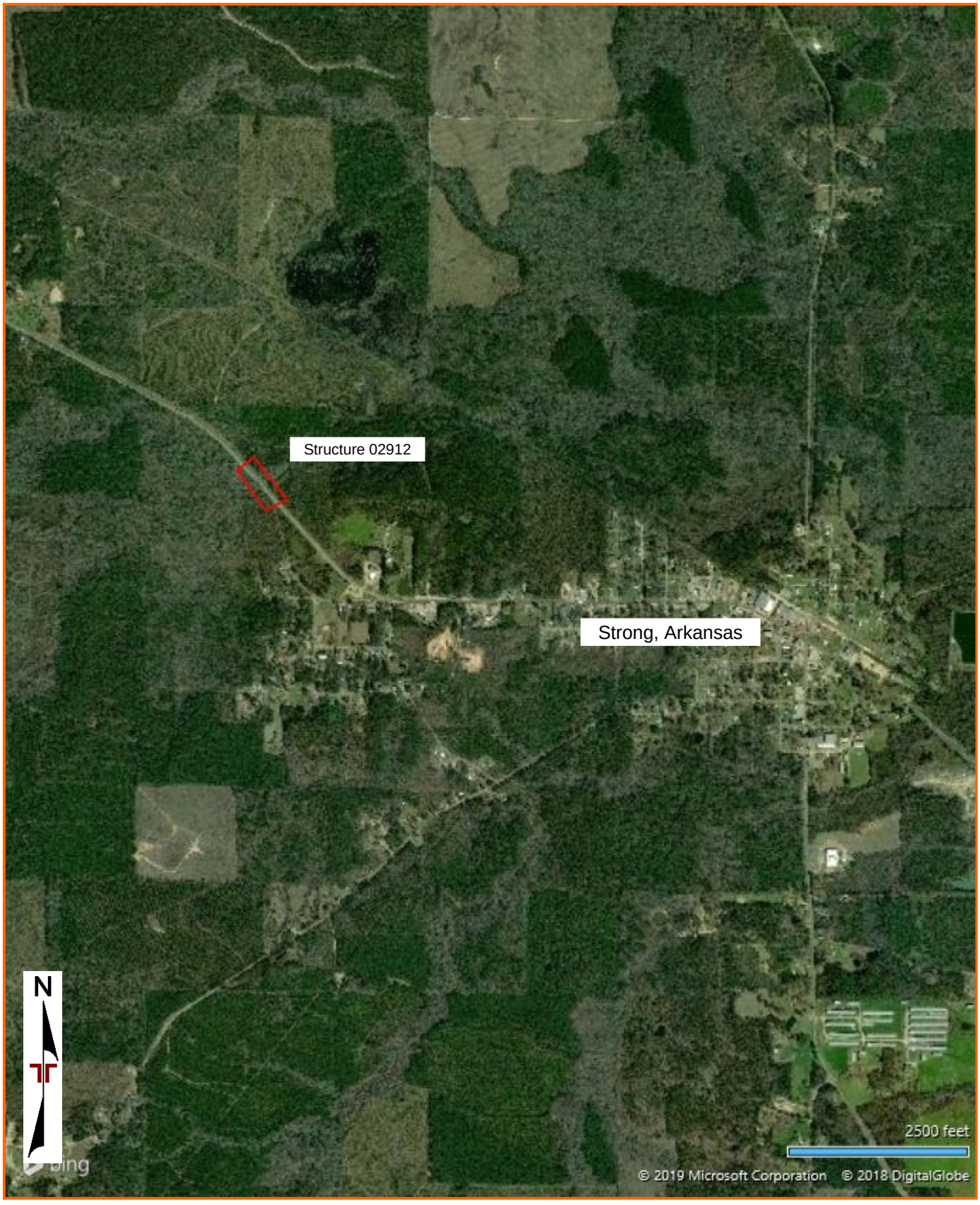


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN - 2

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Union, Arkansas
January 7, 2019 ■ Terracon Project No. 35185110

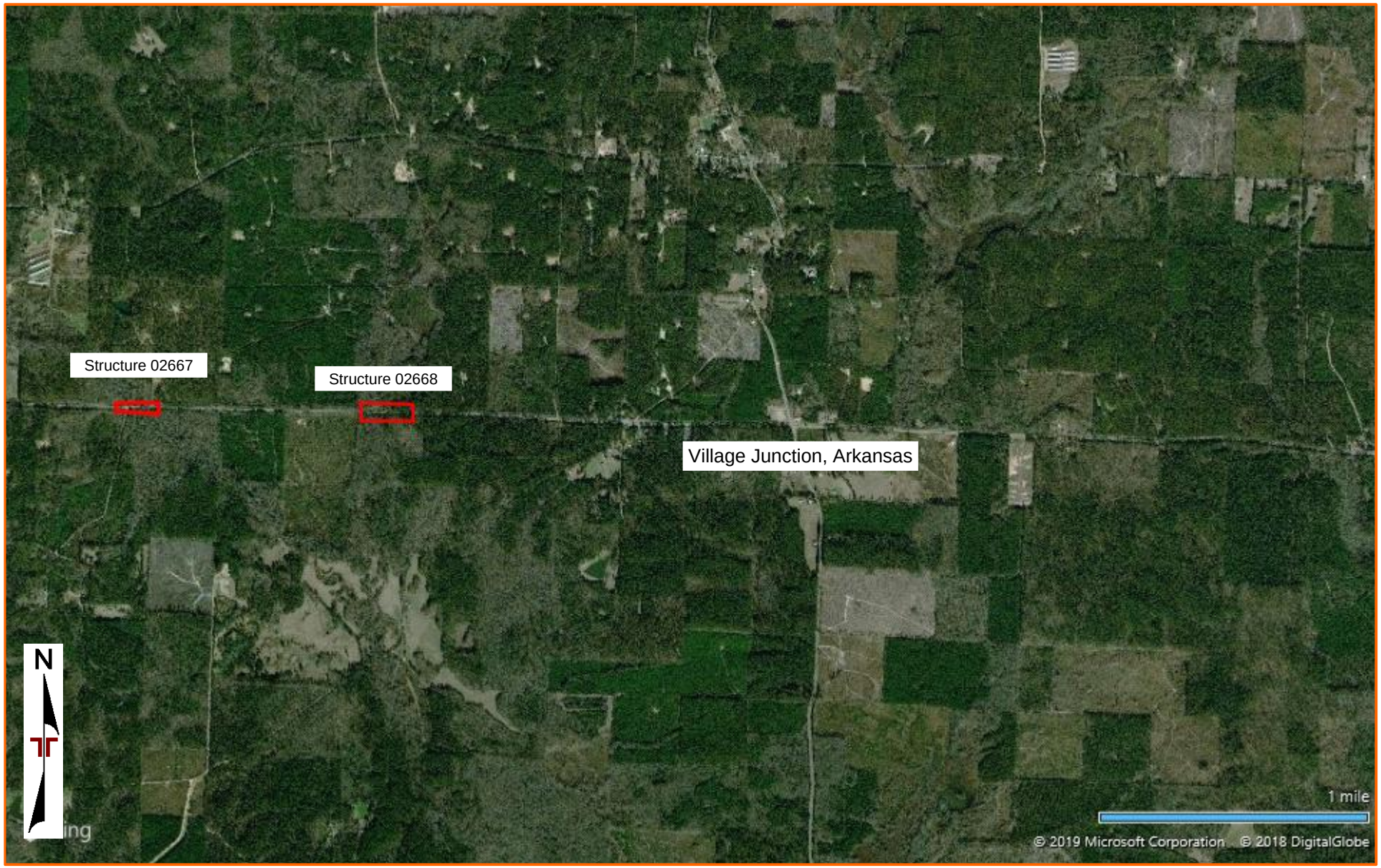


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN - 1

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Union, Arkansas
January 7, 2019 ■ Terracon Project No. 35185110

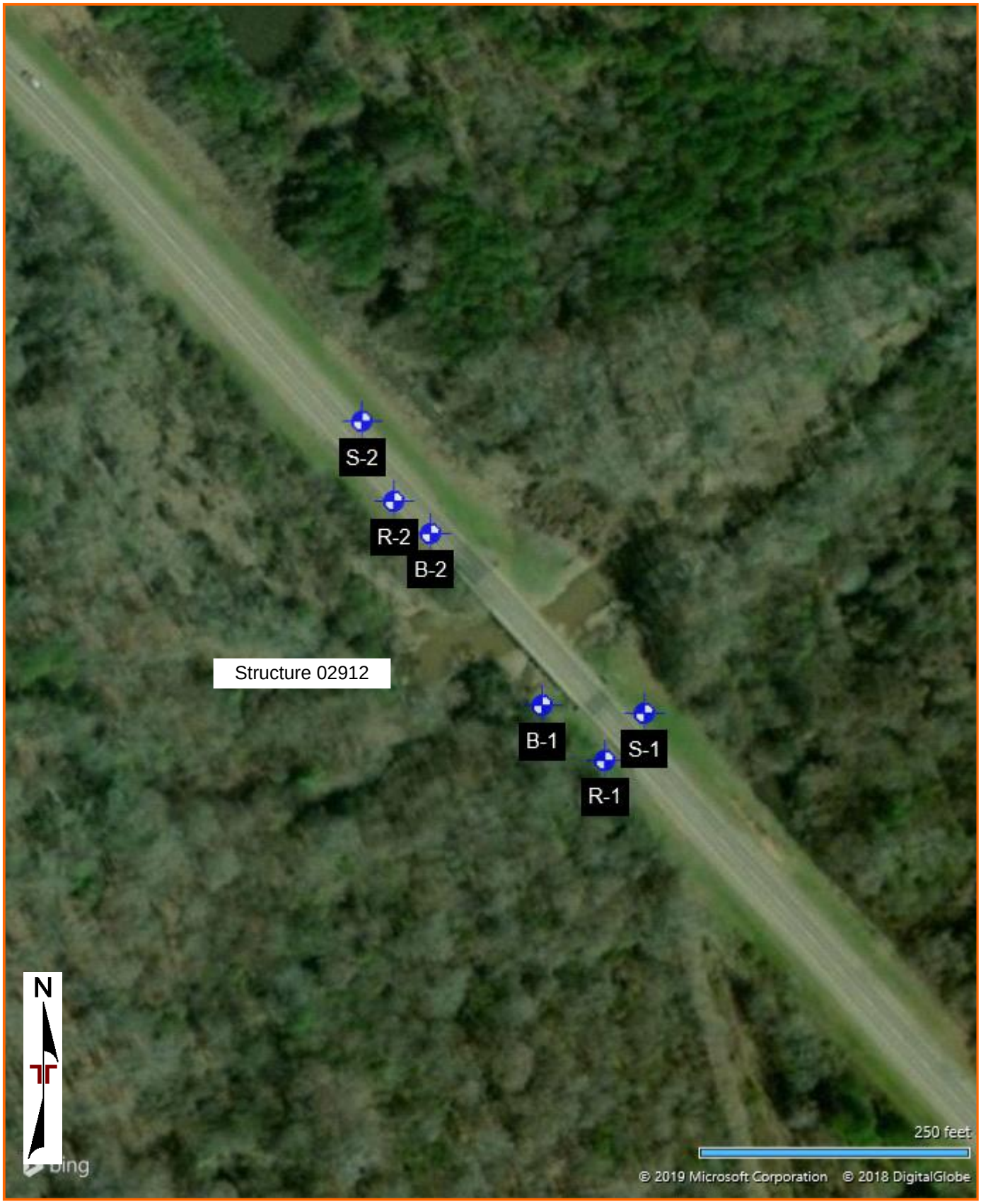


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN - 2

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Union, Arkansas
January 7, 2019 ■ Terracon Project No. 35185110

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

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN - 3

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Union, Arkansas
January 7, 2019 ■ Terracon Project No. 35185110

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

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 through S-6)
Grain Size Distribution
Resilient Modulus Testing

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.116° Longitude: -92.3811°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - CLAYEY SAND (SC), reddish-brown						2-2-2 N=4	14			
2.0						2-2-2 N=4	20			
SANDY SILT (ML), brown and gray, soft						2-1-1 N=2	20		NP	51
			5			2-1-1 N=2	18			
						1-1-1 N=2	20			
13.5			10	▽						
POORLY GRADED SAND (SP), fine grained, gray, loose						2-3-5 N=8	24			
			15							
						1-2-3 N=5	33			4
23.5			20							
FAT CLAY WITH SAND (CH), gray, very stiff						4-6-12 N=18	25			
			25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: Mud rotary drilling

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while dirlling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-29-2018 | Boring Completed: 11-29-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-1

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.116° Longitude: -92.3811°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30							
					X	5-7-8 N=15	25		54-18-36	71
			35		X	7-11-13 N=24	30			
38.5										
CLAYEY SAND (SC), gray, medium dense			40		X	8-8-11 N=19	27		41-18-23	39
43.5										
SANDY FAT CLAY (CH), gray, very stiff to hard			45		X	9-12-15 N=27	25			
			50		X	10-14-18 N=32	24			
			55		X	13-13-16 N=29	24		58-19-39	63

FAT CLAY WITH SAND (CH), gray, very stiff *(continued)*

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: Mud rotary drilling

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while dirlling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-29-2018 | Boring Completed: 11-29-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-1

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.116° Longitude: -92.3811°

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY FAT CLAY (CH), gray, very stiff to hard *(continued)*									
	58.5									
	CLAYEY SAND (SP), fine grained, gray, very dense				X	17-36-50/5"	31			21
			60							
					X	44-50/4"	23			
			65							
					X	50/6"	29			
			70							
	73.5									
	FAT CLAY (CH), with sand, gray, hard				X	12-14-19 N=33	30		58-22-36	88
			75							
					X	14-18-28 N=46	26			
	80.0		80							
	Boring Terminated at 80 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: Mud rotary drilling

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while dirlling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-29-2018 | Boring Completed: 11-29-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-2

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1164° Longitude: -92.3815°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND (SM), brown and gray, very loose						0-1-0 N=1	23			
						1-0-0 N=0	20		NP	34
						0-0-0 N=0	23			
			5			1-1-1 N=2	23			
						1-1-2 N=3	19		NP	31
			10							
	13.5			▽						
POORLY GRADED SAND (SP), fine grained, gray, loose						2-2-2 N=4	29			5
			15							
						2-1-3 N=4	32			
			20							
	23.5									
FAT CLAY (CH), brown, very stiff						5-9-12 N=21	26			
			25							
	28.5									

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem Auger
15 to 80 feet: Wash rotary with 3-7/8" drag bit

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while drilling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-16-2018 | Boring Completed: 11-16-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-2

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1164° Longitude: -92.3815°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
CLAYEY SAND (SC), gray, medium dense to dense			30			5-8-11 N=19	27			
			35			7-10-13 N=23	24		49-16-33	46
- more sand at about 38.5 feet			40			9-12-18 N=30	25			
			45			10-14-26 N=40	23			
	48.5									
FAT CLAY WITH SAND (CH), gray, very stiff to hard			50			11-16-20 N=36	21		57-19-38	75
			55			7-11-12 N=23	28			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem Auger
15 to 80 feet: Wash rotary with 3-7/8" drag bit

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while drilling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-16-2018 | Boring Completed: 11-16-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-2

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1164° Longitude: -92.3815°

GRAPHIC LOG	DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FAT CLAY WITH SAND (CH), gray, very stiff to hard *(continued)*								
	58.5								
	CLAYEY SAND (SC), fine grained, gray, very dense				14-50/4"	24			
		60							
					4-30-50/2"	31			45
		65							
					40-31-30 N=61	21			
		70							
	73.5								
	FAT CLAY WITH SAND (CH), gray, hard				12-17-21 N=38	31		70-23-47	96
		75							
					13-17-33 N=50	32			
	80.0	80							
	Boring Terminated at 80 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem Auger
15 to 80 feet: Wash rotary with 3-7/8" drag bit

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while drilling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-16-2018 | Boring Completed: 11-16-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-1

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1158° Longitude: -92.3809°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.8			**ASPHALT CONCRETE - 10 inches**								
1.0			**AGGREGATE BASE COURSE - 2 inches**								
			LEAN CLAY WITH GRAVEL (CL), gray and brown				7-7-11 N=18	10			
							11-32-14 N=46	4			
4.0			**SANDY SILTY CLAY (CL-ML)**, gray, very stiff to very soft	5			12-9-7 N=16			22-16-6	59
					▽						
				10			0-0-0 N=0	22			
							2-1-2 N=3	19			
15.0			***Boring Terminated at 15 Feet***	15							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *8.5 feet while drilling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-29-2018 | Boring Completed: 11-29-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-2

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1165° Longitude: -92.3816°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0										
		ASPHALT CONCRETE - 12 inches								
1.0										
1.5		**AGGREGATE BASE COURSE - 6 inches**								
		FILL - CLAYEY SAND (SC), with aggregate gravel from base course, gray				17-13-8 N=21	14			
2.5		**SILT WITH SAND (ML)**, trace gravel, gray, medium stiff to soft				3-2-2 N=4	20		20-17-3	73
			5			2-3-4 N=7	20			
		- petroluem odor at about 8.5 feet				1-1-1 N=2	14			
10.0		***Boring Terminated at 10 Feet***	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-15-2018 | Boring Completed: 11-15-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-1

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.116° Longitude: -92.3808°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0						6-10-7 N=17	12		NP	50
						6-7-7 N=14	14			
3.5						5-4-3 N=7	15		NP	45
			5			2-1-3 N=4	12			
10.0			10			2-1-2 N=3	18			

FILL - SANDY SILT (ML), brown and gray, stiff to very stiff

SILTY SAND (SM), fine grained, gray, very loose to loose
- wood piece at about 3.5 feet

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 10 feet: Solid stem auger

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-29-2018 | Boring Completed: 11-29-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-2

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.1167° Longitude: -92.3817°

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7		**ASPHALT CONCRETE - 8 inches**								
0.9		**AGGREGATE BASE COURSE - 2 inches**								
2.5		**FILL - CLAYEY GRAVEL (GC)**, aggregate base course gravel, gray, brown and reddish-brown				9-3-5 N=8	7			
		LEAN CLAY WITH SAND (CL), gray, very stiff				8-6-8 N=14	15			
			5			7-8-8 N=16	18		22-14-8	78
8.5										
10.0		**CLAYEY SAND (SC)**, fine grained, gray, loose				1-2-2 N=4	18			
		Boring Terminated at 10 Feet	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 11-16-2018 | Boring Completed: 11-16-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-3

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2498° Longitude: -93.077°

Surface Elev.: 236.48 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
1.0	235.5	**ASPHALT CONCRETE - 12 inches**
1.5	235	**AGGREGATE BASE COURSE - 6 inches**
2.5	234	**FILL - POORLY GRADED SAND WITH CLAY (SP)**, brown and gray
8.5	228	**LEAN CLAY WITH SAND (CL)**, brown, stiff to very stiff
18.5	218	**SANDY LEAN CLAY (CL)**, with wood pieces, gray, medium stiff to stiff
28.5	208	**FAT CLAY (CH)**, dark brown, very soft to stiff

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		10-7-6 N=13	9		
		5-7-8 N=15	18	42-14-28	73
		7-8-8 N=16	30		
		6-7-8 N=15	19		
10		4-4-3 N=7	17	37-15-22	62
15		4-5-8 N=13	21		
20		0-0-0 N=0	32		
25		4-5-5 N=10	31	69-24-45	94

WATER LEVEL OBSERVATIONS: ▽ at 13.5 feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 18.5 feet: Hollow-stem auger
18.5 to 80 feet: Rotary wash

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite
Surface Capped with Asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-10-2018 | Boring Completed: 12-10-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-3

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2498° Longitude: -93.077°

Surface Elev.: 236.48 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FAT CLAY WITH SAND (CH), gray, very stiff	30			9-10-12 N=22	23			
			35			8-12-14 N=26	26		53-20-33	80
	38.5	198								
		CLAYEY SAND (SC), dark gray, very dense	40			30-50/5"	27			
			45			32-46-50 N=96	29			17
			50			26-36-38 N=74	23			
			55			17-37-50 N=87	34			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 18.5 feet: Hollow-stem auger
18.5 to 80 feet: Rotary wash

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite
Surface Capped with Asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-10-2018 | Boring Completed: 12-10-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-3

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2498° Longitude: -93.077°

Surface Elev.: 236.48 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CLAYEY SAND (SC), dark gray, very dense *(continued)*								
					X	11-14-24 N=38	25		47-14-33	28
			60							
					X	26-15-22 N=37	21			
			65							
	68.5	168								
		SANDY FAT CLAY (CH), dark gray and brown, hard			X	12-16-19 N=35	25		76-21-55	67
			70							
	75.0	161.5			X	12-17-19 N=36	23			
		Boring Terminated at 75 Feet	75							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 18.5 feet: Hollow-stem auger
18.5 to 80 feet: Rotary wash

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite
Surface Capped with Asphalt

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-10-2018 | Boring Completed: 12-10-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-4

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.25° Longitude: -93.0781°

Surface Elev.: 228.16 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY CLAY WITH SAND (CL-ML), brown to reddish-brown, medium stiff to stiff					1-4-4 N=8	26			
	3.5	224.5				5-3-3 N=6	16		22-16-6	71
	SANDY LEAN CLAY (CL), brown, medium stiff to stiff		5			3-3-3 N=6	19			
						2-2-3 N=5	22			
			10			3-6-6 N=12	26		28-20-8	61
				▽						
						3-4-5 N=9	21			
			15							
	18.5	209.5								
	SANDY SILT (ML), dark gray, very stiff to hard					10-8-7 N=15	39		NP	54
			20							
						9-37-50 N=87	24			
			25							
	28.5	199.5								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: 27/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-11-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-4

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.25° Longitude: -93.0781°

Surface Elev.: 228.16 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), trace gravel, dark gray, very dense	30			21-36-50 N=86	25			13
						34-50/4"	24			
			35							
			40			19-34-50 N=84	36			13
			45			12-32-50 N=82	38			
	48.5	179.5								
		SANDY FAT CLAY (CH), dark gray, hard	50			19-24-47 N=71	42			
		- difficult drilling from about 50 to 54 feet								
			55			12-20-50 N=70	24		59-17-42	67

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: 27/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-11-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-4

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.25° Longitude: -93.0781°

Surface Elev.: 228.16 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
58.5	169.5	**SANDY FAT CLAY (CH)**, dark gray, hard *(continued)*						
		FAT CLAY (CH), dark gray, hard	60					
					9-14-47 N=61	24		
		- difficult drilling at about 64 feet	65		7-15-25 N=40	22	71-20-51	93
			70		7-12-24 N=36	24		
			75		3-7-19 N=26	35		
78.5	149.5							
80.0	148	**LEAN CLAY WITH SAND (CL)**, dark gray, hard	80		17-18-31 N=49	20	47-15-32	71
		Boring Terminated at 80 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 to 15 feet: Hollow-stem auger
15 to 80 feet: 27/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *13.5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-11-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-3

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2497° Longitude: -93.0766°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7										
ASPHALT CONCRETE - 8 inches										
1.0										
AGGREGATE BASE COURSE - 4 inches										
SANDY SILT (ML), gray and brown, very stiff to soft						13-8-8 N=16	14		NP	68
						11-11-7 N=18	17			
			5			7-8-8 N=16	18			
						0-1-2 N=3	20			
10.0			10							
Boring Terminated at 10 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings and capped with ashpalt patch

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-4

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.25° Longitude: -93.0784°

DEPTH	ELEVATION (Ft.)	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7		**ASPHALT CONCRETE - 8 inches**								
1.0		**AGGREGATE BASE COURSE - 4 inches**								
		CLAYEY SAND (SC), gray and brown, medium dense				9-8-9 N=17	11		49-12-37	36
2.5		**LEAN CLAY (CH)**, gray and brown, very stiff to hard				10-9-9 N=18	23			
			5			9-8-10 N=18	21			
						16-19-16 N=35				
10.0		***Boring Terminated at 10 Feet***	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings and capped with ashpalt patch

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-3

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2499° Longitude: -93.0764°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5										
ASPHALT CONCRETE - 6 inches										
1.0										
AGGREGATE BASE COURSE - 5 inches										
LEAN CLAY WITH SAND (CL), brown and reddish-brown, very stiff to soft					X	6-5-5 N=10	12			
					X	7-6-7 N=13	19		39-13-26	71
			5		X	8-7-9 N=16	19			
					X	2-1-2 N=3	18			
10.0			10							
Boring Terminated at 10 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings and capped with ashpalt patch

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-4

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.25° Longitude: -93.0786°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2										
TOPSOIL - 2 inches										
GRAVELLY LEAN CLAY (CL), brown and reddish-brown, medium stiff						4-4-4 N=8	16			
2.0										
SANDY FAT CLAY (CH), brown and gray, stiff to very stiff						5-5-7 N=12	31		59-22-37	69
			5			9-9-8 N=17	25			
						5-4-4 N=8	25			
8.5										
CLAYEY SAND (SC), fine grained, gray, loose						2-2-4 N=6	14			
10.0			10							
Boring Terminated at 10 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-5

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2502° Longitude: -93.0933°

Surface Elev.: 229.49 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SANDY SILTY CLAY (CL-ML), reddish-brown, soft				1-1-2 N=3	24			
						1-2-2 N=4	23		28-21-7	62
3.5	226	**SANDY SILT (ML)**, brown to reddish-brown, very soft to soft	5	▽		2-2-1 N=3	21			
						2-1-1 N=2	23		NP	54
8.5	221	**SILTY SAND (SM)**, brown, very loose to loose	10			1-1-1 N=2	23			
			15			3-2-3 N=5	29			31
			20			5-4-3 N=7	23			
23.5	206	**FAT CLAY WITH SAND (CH)**, grayish brown, very stiff	25			8-9-10 N=19	29			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-12-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-5

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2502° Longitude: -93.0933°

Surface Elev.: 229.49 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FAT CLAY WITH SAND (CH), grayish brown, very stiff *(continued)*	30			7-10-18 N=28	23		52-18-34	79
			35			9-12-17 N=29	25			
	38.5	191								
		CLAYEY SAND (SC), dark gray and brown, dense to very dense	40			13-28-42 N=70	27		35-15-20	48
			45			42-26-44 N=70	29			
			50			18-24-50/5"	28			
			55			10-11-27 N=38	26		43-23-20	44

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-12-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-5

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2502° Longitude: -93.0933°

Surface Elev.: 229.49 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		CLAYEY SAND (SC), dark gray and brown, dense to very dense *(continued)*								
					X	20-45-50/5"	30			
	63.5	166	60							
		FAT CLAY (CH), brown and gray, hard			X	12-18-27 N=45	20		59-19-40	85
			65							
					X	13-14-18 N=32	27			
	73.5	156	70							
		SANDY LEAN CLAY (CL), dark gray, hard			X	18-40-50/5"	35		40-19-21	55
			75							
					X	13-28-25 N=53	26			
	80.0	149.5	80							
		Boring Terminated at 80 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *5 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-12-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-6

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2504° Longitude: -93.0937°

Surface Elev.: 228.62 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	228.62	**SILTY SAND (SM)**, reddish-brown to brown, very loose to loose	3-4-3 N=7	18	NP	49
			2-3-5 N=8	17		
			3-3-2 N=5	19		
5			1-4-5 N=9	19		50
			1-1-2 N=3	24		
10						
			4-3-3 N=6	19		
15						
18.5	210					
		ELASTIC SILT WITH SAND (MH), dark gray, stiff	3-4-7 N=11	28	51-32-19	83
20						
23.5	205					
		FAT CLAY (CH), dark gray, very stiff	7-8-14 N=22	29	60-22-38	95
25						
28.5	200					

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
1 to 10 feet: Hollow-stem auger
10 to 80 feet: 37/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *8 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-6

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2504° Longitude: -93.0937°

Surface Elev.: 228.62 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			30							
					X	7-8-13 N=21	23			
			35		X	10-11-15 N=26	31		49-17-32	
			40		X	10-10-18 N=28	23			
	43.5	185								
	SILTY SAND (SM), dark gray, very dense		45		X	12-50/6"	25			
			50		X	15-20-50 N=70	26		36-25-11	42
			55		X	10-18-42 N=60	25			

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
1 to 10 feet: Hollow-stem auger
10 to 80 feet: 37/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *8 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. B-6

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2504° Longitude: -93.0937°

Surface Elev.: 228.62 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), dark gray, very dense *(continued)*								
					X	18-28-50/4"	25			50
	63.5	165	60							
		SANDY FAT CLAY (CH), dark gray, hard			X	12-18-24 N=42	22			
			65							
					X	13-14-50 N=64	26		55-19-36	69
	73.5	155	70							
		CLAYEY SAND (SC), dark gray, very dense			X	24-34-49 N=83	24			
			75							
	79.9	148.5			X	34-43-50/5"	24		60-21-39	44
		Boring Terminated at 79.9 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
1 to 10 feet: Hollow-stem auger
10 to 80 feet: 37/8" drag bit

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *8 feet while sampling*

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-11-2018 | Boring Completed: 12-12-2018

Drill Rig: Acker Renegade 679 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-5

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2501° Longitude: -93.0925°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7										
ASPHALT CONCRETE - 8 inches										
SANDY LEAN CLAY (CL), gray and brown, soft to very stiff										
						10-7-10 N=17	14			
						10-12-12 N=24	16		30-11-19	57
			5			16-10-10 N=20	12			
10.0						2-2-2 N=4	15			
Boring Terminated at 10 Feet			10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings and capped with ashpalt patch

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. R-6

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2505° Longitude: -93.0941°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.7										
ASPHALT CONCRETE - 8 inches										
0.9										
AGGREGATE BASE COURSE - 3 inches										
SANDY LEAN CLAY (CL), gray and brown, very stiff to soft						6-6-7 N=13	16		30-12-18	52
						8-8-8 N=16	15			
			5			7-8-8 N=16	19			
10.0						0-2-2 N=4	20			
Boring Terminated at 10 Feet			10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings and capped with ashpalt patch

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-5

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

SITE: Highway 82
Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2501° Longitude: -93.0923°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1									
		TOPS - 1 inch							
		SANDY LEAN CLAY (CL), gray, brown and reddish-brown, very stiff to soft			6-8-7 N=15	12			
					4-7-7 N=14	16			
					5-7-7 N=14	17		33-12-21	58
5					4-5-6 N=11	17			
					2-1-2 N=3	17			
10.0									
		Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
25809 I 30
Bryant, AR

Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

BORING LOG NO. S-6

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

CLIENT: Michael Baker International, LLC Little Rock, Arkansas

SITE: Highway 82 Columbia and Union Counties, Arkansas

LOCATION See Exploration Plan

Latitude: 33.2503° Longitude: -93.0943°

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2									
		TOPSOIL - 2 inches							
		SANDY LEAN CLAY (CL), gray and reddish-brown, medium stiff to very stiff			3-5-8 N=13	7			
					3-4-5 N=9	18			
					6-7-8 N=15	19		28-14-14	61
5					5-3-3 N=6	19			
			▽						
10.0					0-2-3 N=5	21			
		Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0 to 10 feet: Solid-stem auger

Abandonment Method:
Boring backfilled with auger cuttings

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *8.5 feet while drilling*

Terracon
25809 I 30
Bryant, AR

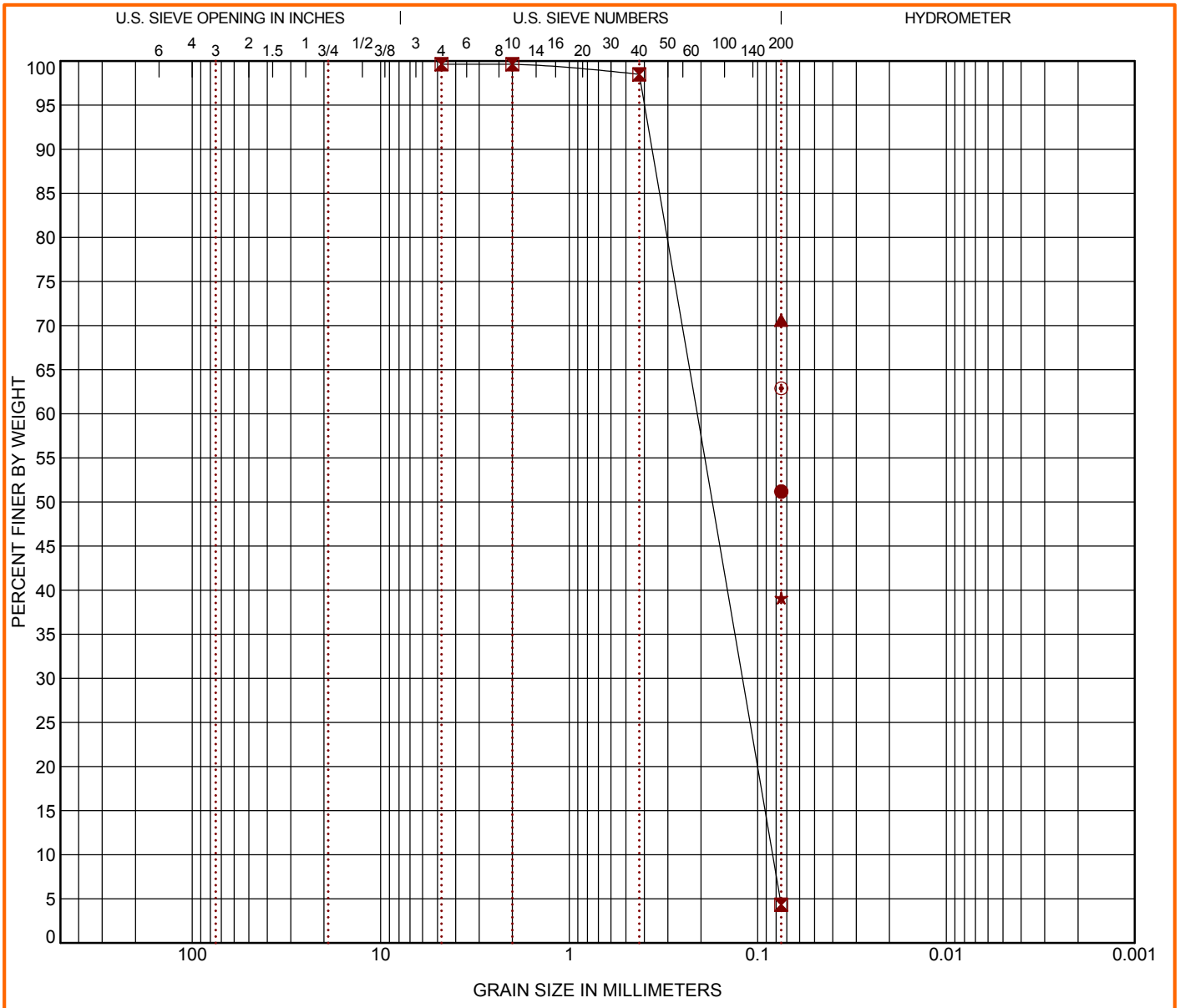
Boring Started: 12-03-2018 | Boring Completed: 12-03-2018

Drill Rig: CME 750 | Driller: TF

Project No.: 35185110

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-1	3.5 - 5	SANDY SILT (ML)	20	NP	NP	NP		
⊠	B-1	18.5 - 20	POORLY GRADED SAND (SP)	33				0.83	2.51
▲	B-1	28.5 - 30	FAT CLAY with SAND (CH)	25	54	18	36		
★	B-1	38.5 - 40	CLAYEY SAND (SC)	27	41	18	23		
⊙	B-1	53.5 - 55	SANDY FAT CLAY (CH)	24	58	19	39		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	3.5 - 5	0.075				0.0			51.2	
⊠	B-1	18.5 - 20	4.75	0.209	0.12	0.083	0.0	95.3		4.3	
▲	B-1	28.5 - 30	0.075				0.0			70.6	
★	B-1	38.5 - 40	0.075				0.0			39.1	
⊙	B-1	53.5 - 55	0.075				0.0			62.9	

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

SITE: Highway 82
Columbia and Union Counties, Arkansas

Terracon
25809 I 30
Bryant, AR

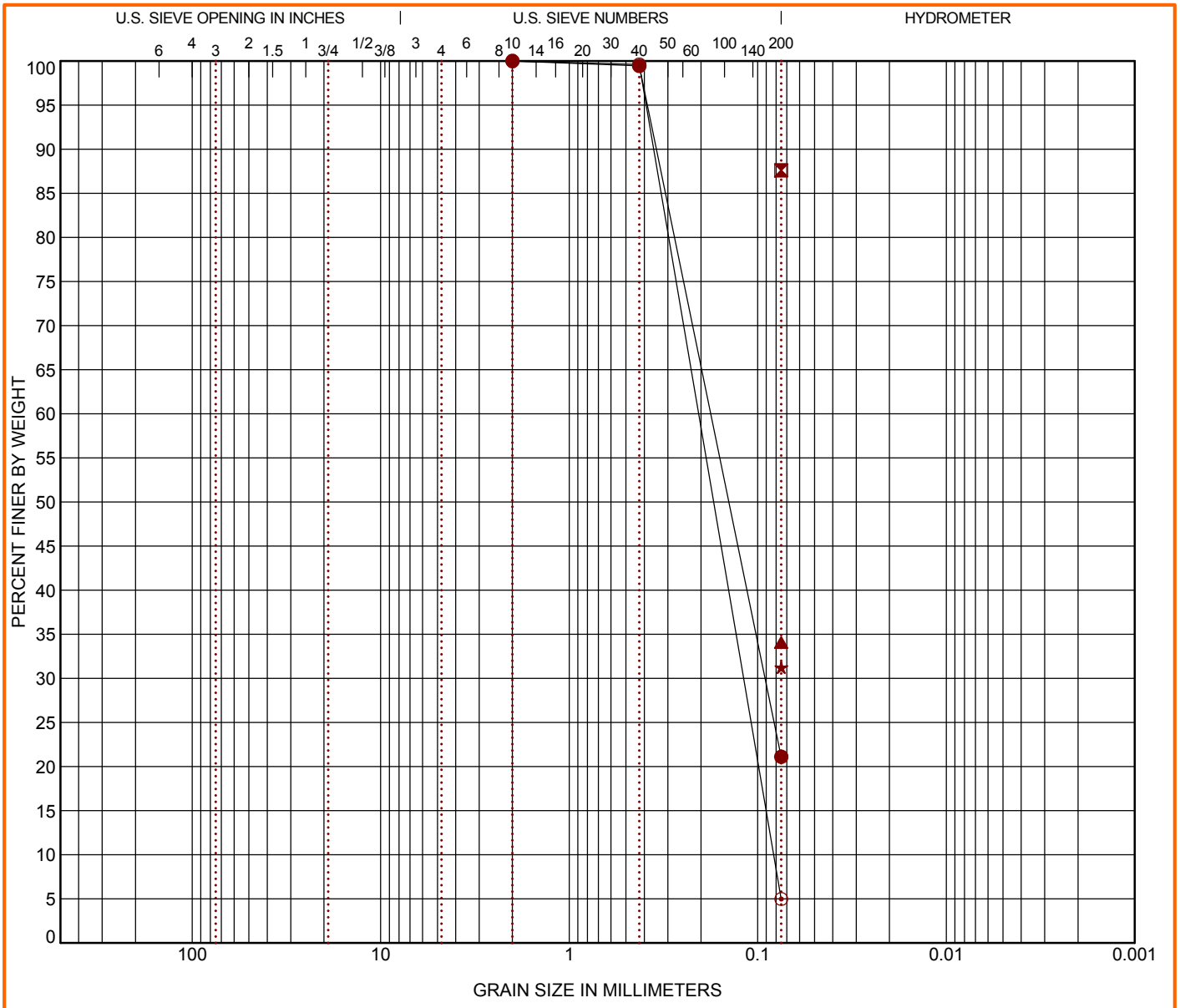
PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 35185110 JOB NO. 070471 CO.GPJ TERRACON_DATATEMPLATE.GDT 1/7/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-1	58.5 - 59.9		31					
⊠	B-1	73.5 - 75	FAT CLAY (CH)	30	58	22	36		
▲	B-2	2 - 3.5	SILTY SAND (SM)	20	NP	NP	NP		
★	B-2	8.5 - 10	SILTY SAND (SM)	19	NP	NP	NP		
⊙	B-2	13.5 - 15	POORLY GRADED SAND (SP)	29				0.83	2.50

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	58.5 - 59.9	2	0.177	0.091		0.0	78.9		21.1	
⊠	B-1	73.5 - 75	0.075				0.0			87.6	
▲	B-2	2 - 3.5	0.075				0.0			34.1	
★	B-2	8.5 - 10	0.075				0.0			31.2	
⊙	B-2	13.5 - 15	2	0.206	0.119	0.082	0.0	95.0		5.0	

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

SITE: Highway 82
Columbia and Union Counties, Arkansas

Terracon
25809 I 30
Bryant, AR

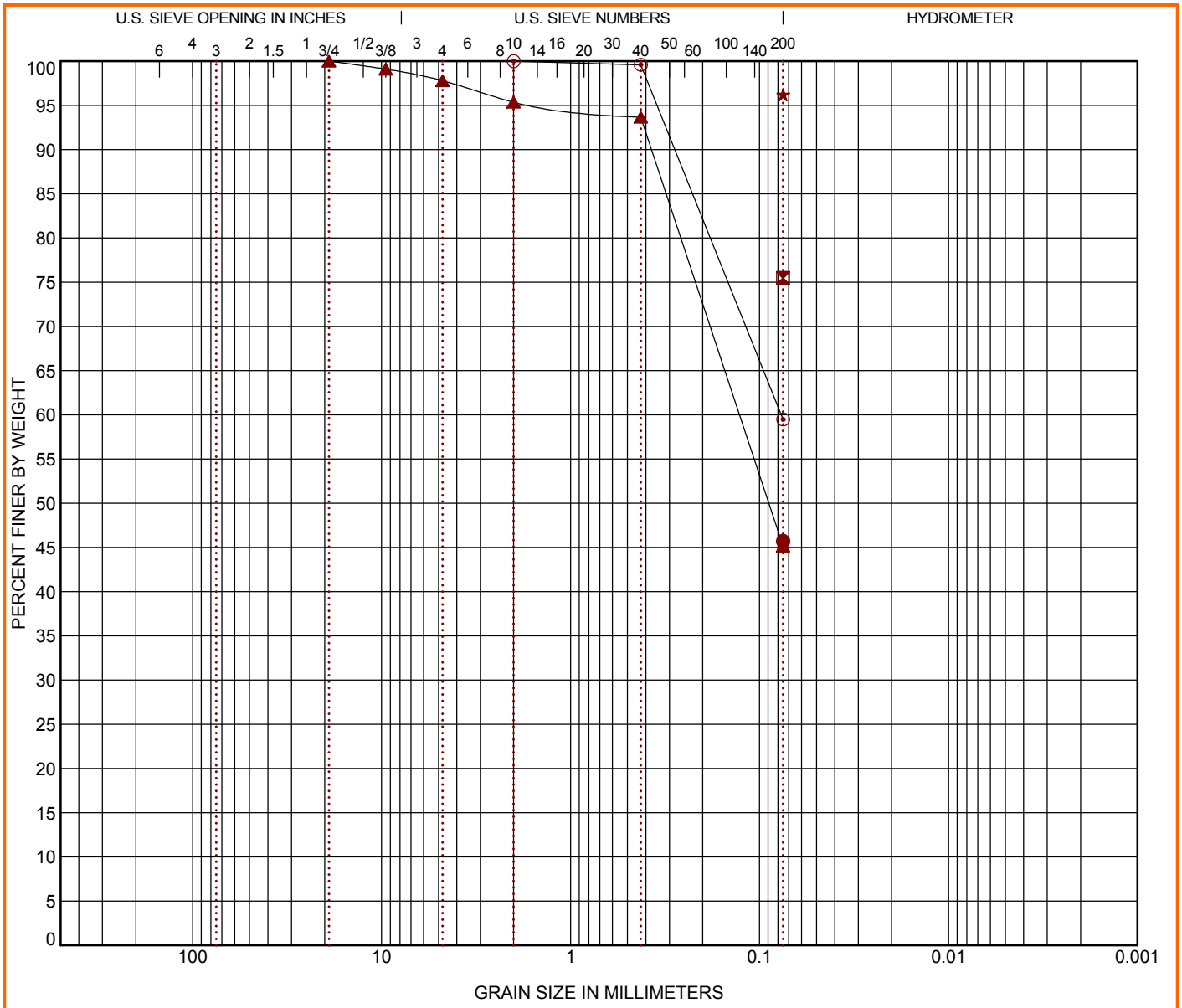
PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 35185110 JOB NO. 070471 CO.GPJ TERRACON_DATATEMPLATE.GDT 1/7/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-2	33.5 - 35	CLAYEY SAND (SC)	24	49	16	33		
⊠	B-2	48.5 - 50	FAT CLAY with SAND (CH)	21	57	19	38		
▲	B-2	63.5 - 64.7		31					
★	B-2	73.5 - 75	FAT CLAY (CH)	31	70	23	47		
⊙	R-1	4 - 5.5	SANDY SILTY CLAY (CL-ML)		22	16	6		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-2	33.5 - 35	0.075				0.0			45.7	
⊠	B-2	48.5 - 50	0.075				0.0			75.5	
▲	B-2	63.5 - 64.7	19	0.128			2.2	52.6		45.2	
★	B-2	73.5 - 75	0.075				0.0			96.2	
⊙	R-1	4 - 5.5	2	0.077			0.0	40.5		59.5	

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

SITE: Highway 82
Columbia and Union Counties, Arkansas

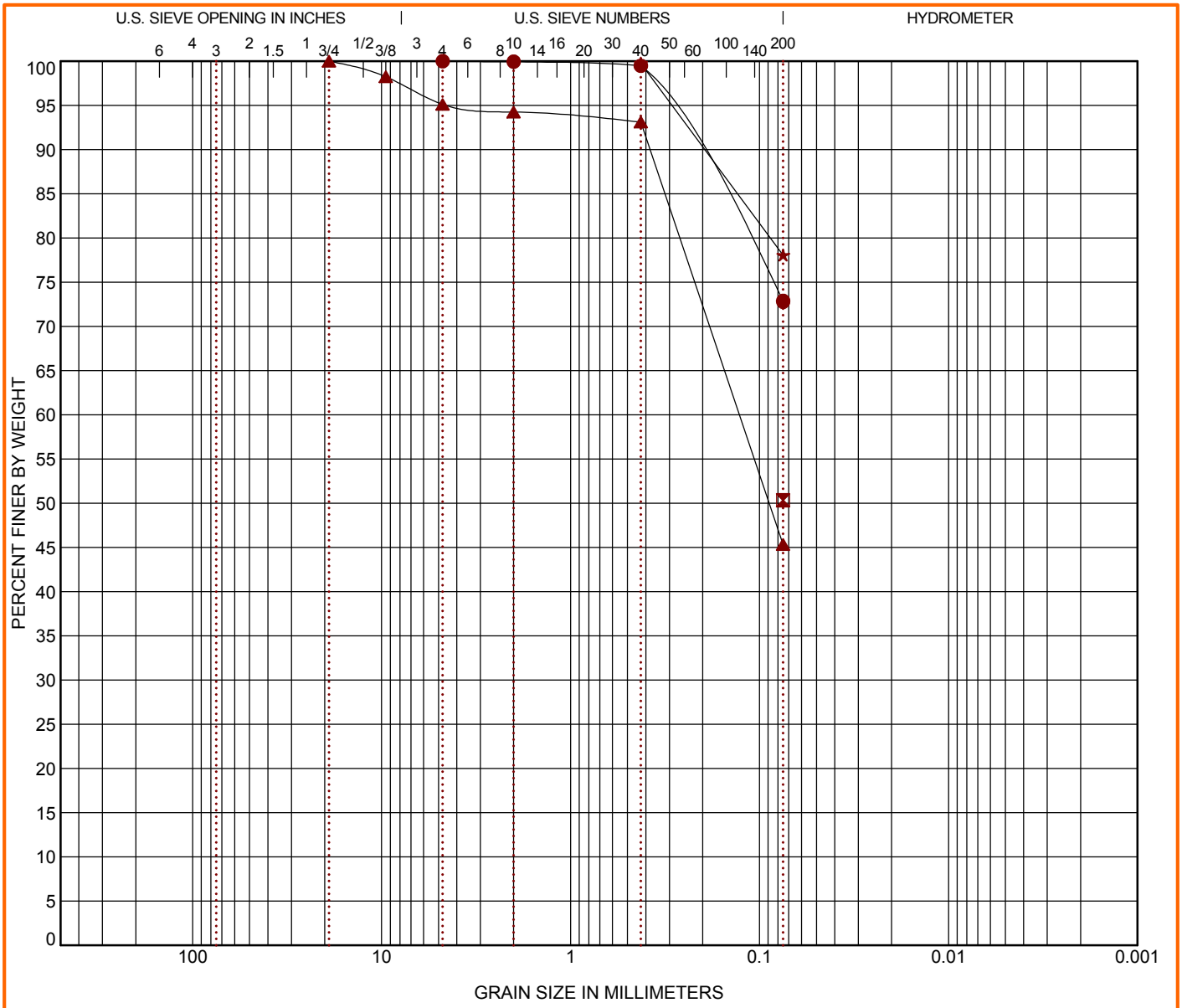
Terracon
25809 I 30
Bryant, AR

PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	R-2	2.5 - 4	SILT with SAND (ML)	20	20	17	3		
⊠	S-1	0.5 - 2	SANDY SILT (ML)	12	NP	NP	NP		
▲	S-1	3.5 - 5	SILTY SAND (SM)	15	NP	NP	NP		
★	S-2	4 - 5.5	LEAN CLAY with SAND (CL)	18	22	14	8		
⊙	B-3	2.5 - 4	LEAN CLAY with SAND (CL)	18	42	14	28		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	R-2	2.5 - 4	4.75				0.0	27.1		72.9	
⊠	S-1	0.5 - 2	0.075				0.0			50.3	
▲	S-1	3.5 - 5	19	0.128			4.9	49.8		45.3	
★	S-2	4 - 5.5	0.425				0.0	21.7		78.1	
⊙	B-3	2.5 - 4	0.075				0.0			72.8	

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

SITE: Highway 82
Columbia and Union Counties, Arkansas

Terracon
25809 I 30
Bryant, AR

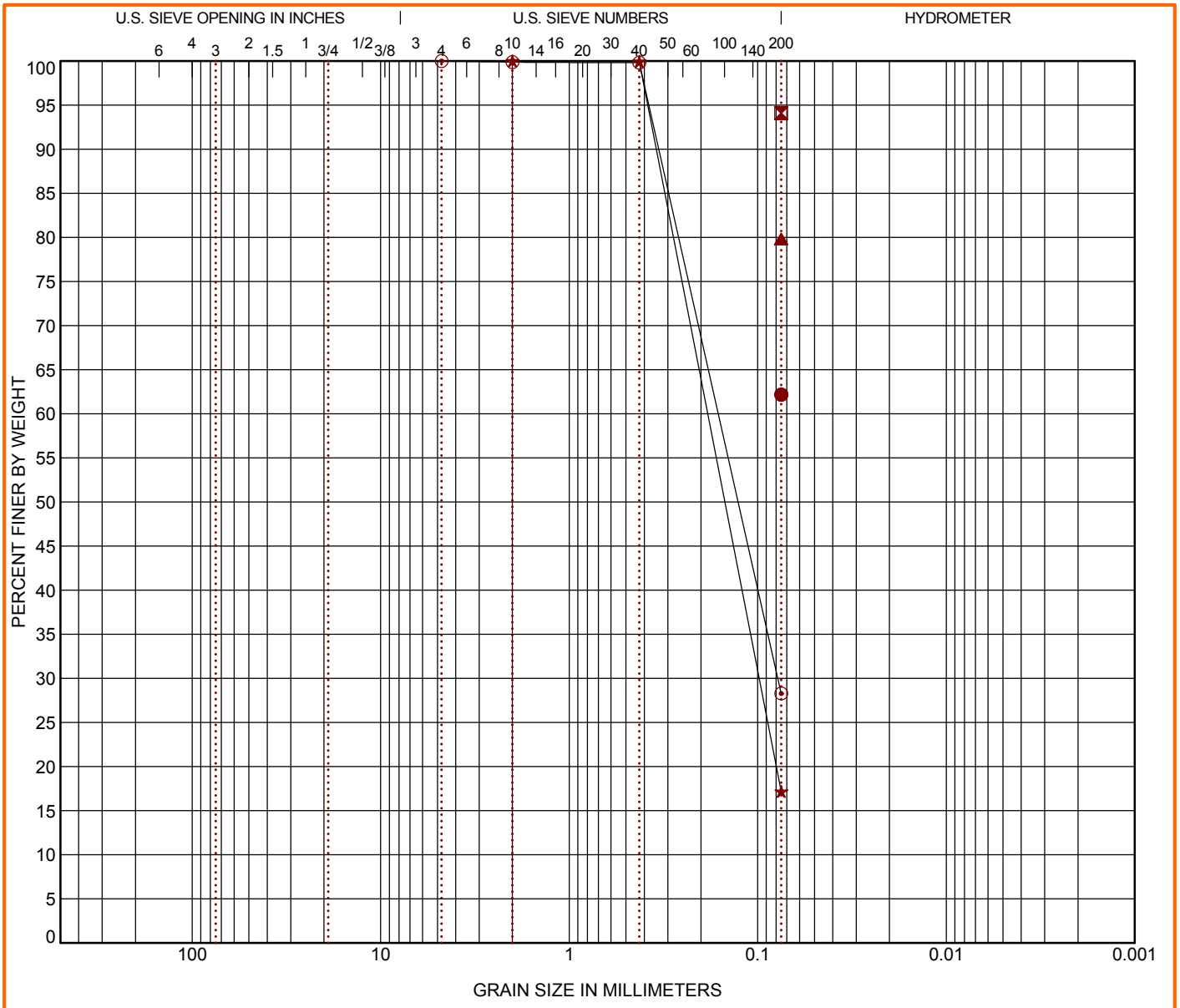
PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 35185110 JOB NO. 070471 CO.GPJ TERRACON_DATATEMPLATE.GDT 1/7/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	8.5 - 10	SANDY LEAN CLAY (CL)	17	37	15	22		
⊠	B-3	23.5 - 25	FAT CLAY (CH)	31	69	24	45		
▲	B-3	33.5 - 35	FAT CLAY with SAND (CH)	26	53	20	33		
★	B-3	43.5 - 45		29					
⊙	B-3	58.5 - 60	CLAYEY SAND (SC)	25	47	14	33		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	8.5 - 10	0.075				0.0			62.2	
⊠	B-3	23.5 - 25	0.075				0.0			94.1	
▲	B-3	33.5 - 35	0.075				0.0			79.8	
★	B-3	43.5 - 45	2	0.184	0.098		0.0	82.8		17.2	
⊙	B-3	58.5 - 60	4.75	0.162	0.078		0.0	71.7		28.3	

PROJECT: Job No. 070471 Cornie, Harper and Lapile Structures and Approaches

SITE: Highway 82
Columbia and Union Counties, Arkansas

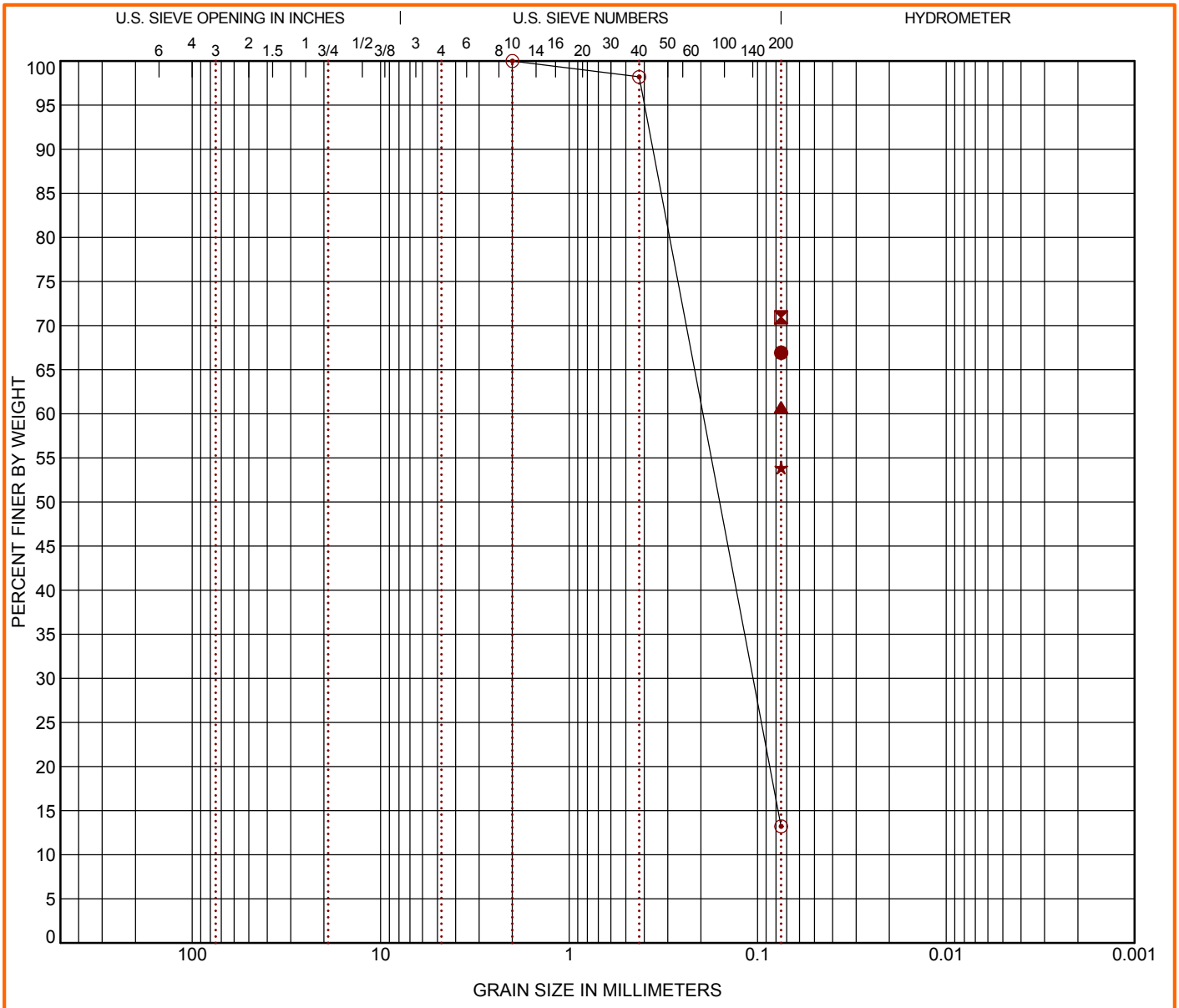
Terracon
25809 I 30
Bryant, AR

PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	68.5 - 70	SANDY FAT CLAY (CH)	25	76	21	55		
⊠	B-4	2 - 3.5	SILTY CLAY with SAND (CL-ML)	16	22	16	6		
▲	B-4	8.5 - 10	SANDY LEAN CLAY (CL)	26	28	20	8		
★	B-4	18.5 - 20	SANDY SILT (ML)	39	NP	NP	NP		
⊙	B-4	28.5 - 30		25					

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	68.5 - 70	0.075				0.0			66.9	
⊠	B-4	2 - 3.5	0.075				0.0			70.9	
▲	B-4	8.5 - 10	0.075				0.0			60.7	
★	B-4	18.5 - 20	0.075				0.0			53.9	
⊙	B-4	28.5 - 30	2	0.195	0.106		0.0	86.8		13.2	

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Little Rock, Arkansas

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 35185110 JOB NO. 070471 CO.GPJ TERRACON_DATATEMPLATE.GDT 1/7/19

GRAIN SIZE DISTRIBUTION

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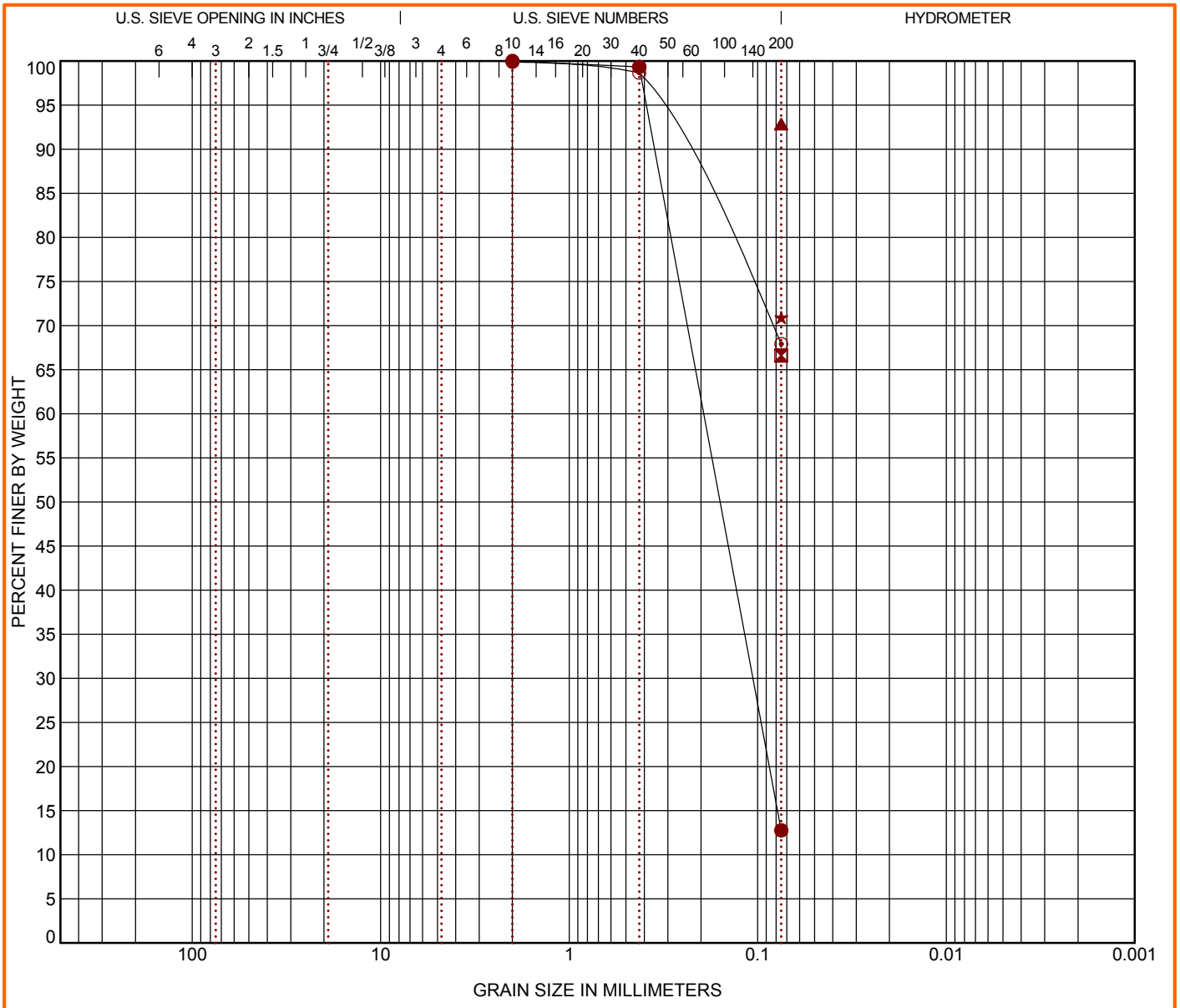

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-4	38.5 - 40		36					
⊠	B-4	53.5 - 55	SANDY FAT CLAY (CH)	24	59	17	42		
▲	B-4	63.5 - 65	FAT CLAY (CH)	22	71	20	51		
★	B-4	78.5 - 80	LEAN CLAY with SAND (CL)	20	47	15	32		
⊙	R-3	1 - 2.5	SANDY SILT (ML)	14	NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-4	38.5 - 40	2	0.193	0.106		0.0	87.2		12.8	
⊠	B-4	53.5 - 55	0.075				0.0			66.6	
▲	B-4	63.5 - 65	0.075				0.0			92.9	
★	B-4	78.5 - 80	0.075				0.0			70.9	
⊙	R-3	1 - 2.5	2				0.0	32.0		67.9	

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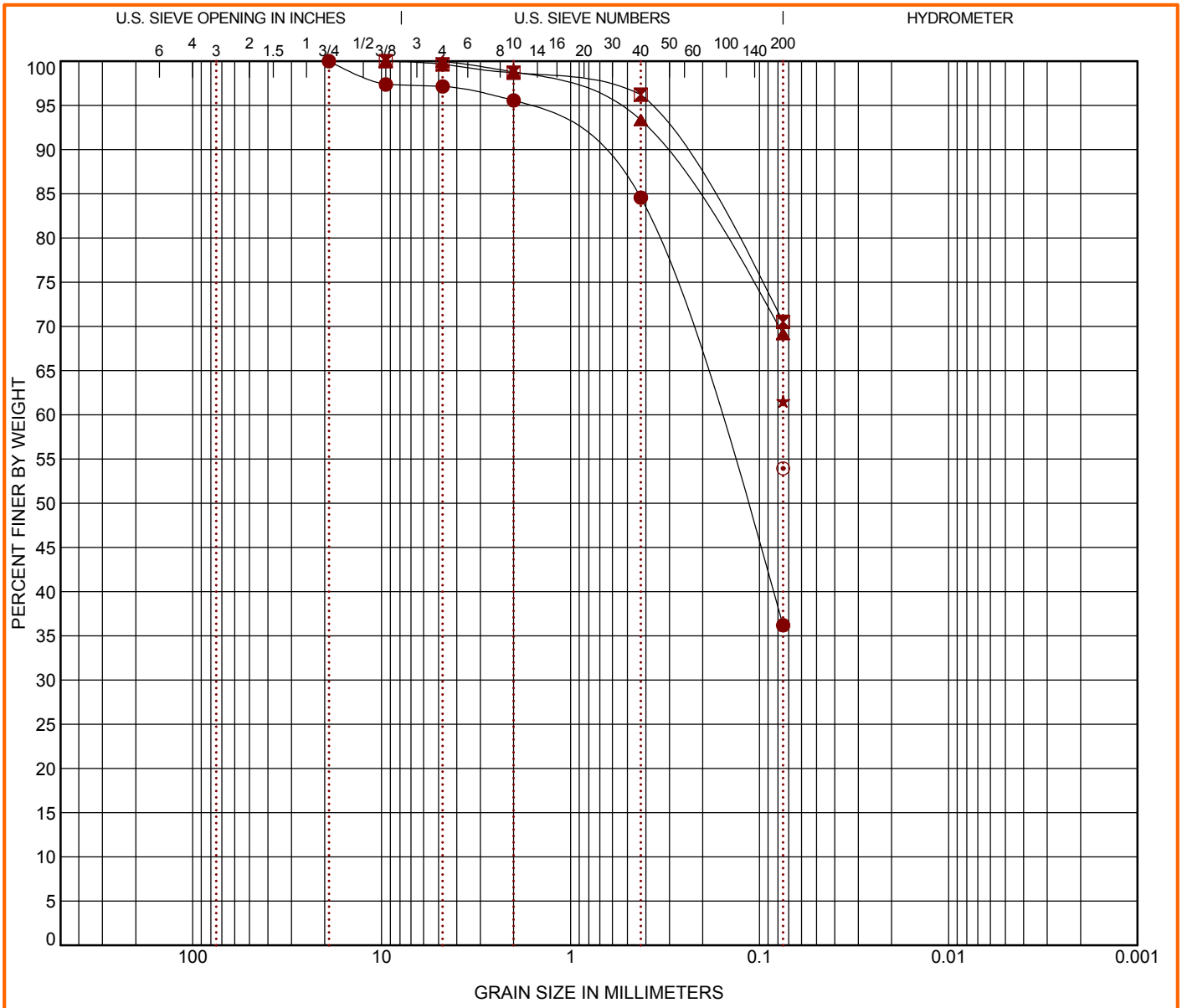

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	R-4	1 - 2.5	CLAYEY SAND (SC)	11	49	12	37		
⊠	S-3	2.5 - 4	LEAN CLAY with SAND (CL)	19	39	13	26		
▲	S-4	2 - 3.5	SANDY FAT CLAY (CH)	31	59	22	37		
★	B-5	2 - 3.5	SANDY SILTY CLAY (CL-ML)	23	28	21	7		
⊙	B-5	5 - 6.5	SANDY SILT (ML)	23	NP	NP	NP		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	R-4	1 - 2.5	19	0.176			2.9	61.0		36.2	
⊠	S-3	2.5 - 4	9.5				0.4	29.1		70.5	
▲	S-4	2 - 3.5	9.5				0.1	30.8		69.1	
★	B-5	2 - 3.5	0.075				0.0			61.5	
⊙	B-5	5 - 6.5	0.075				0.0			53.9	

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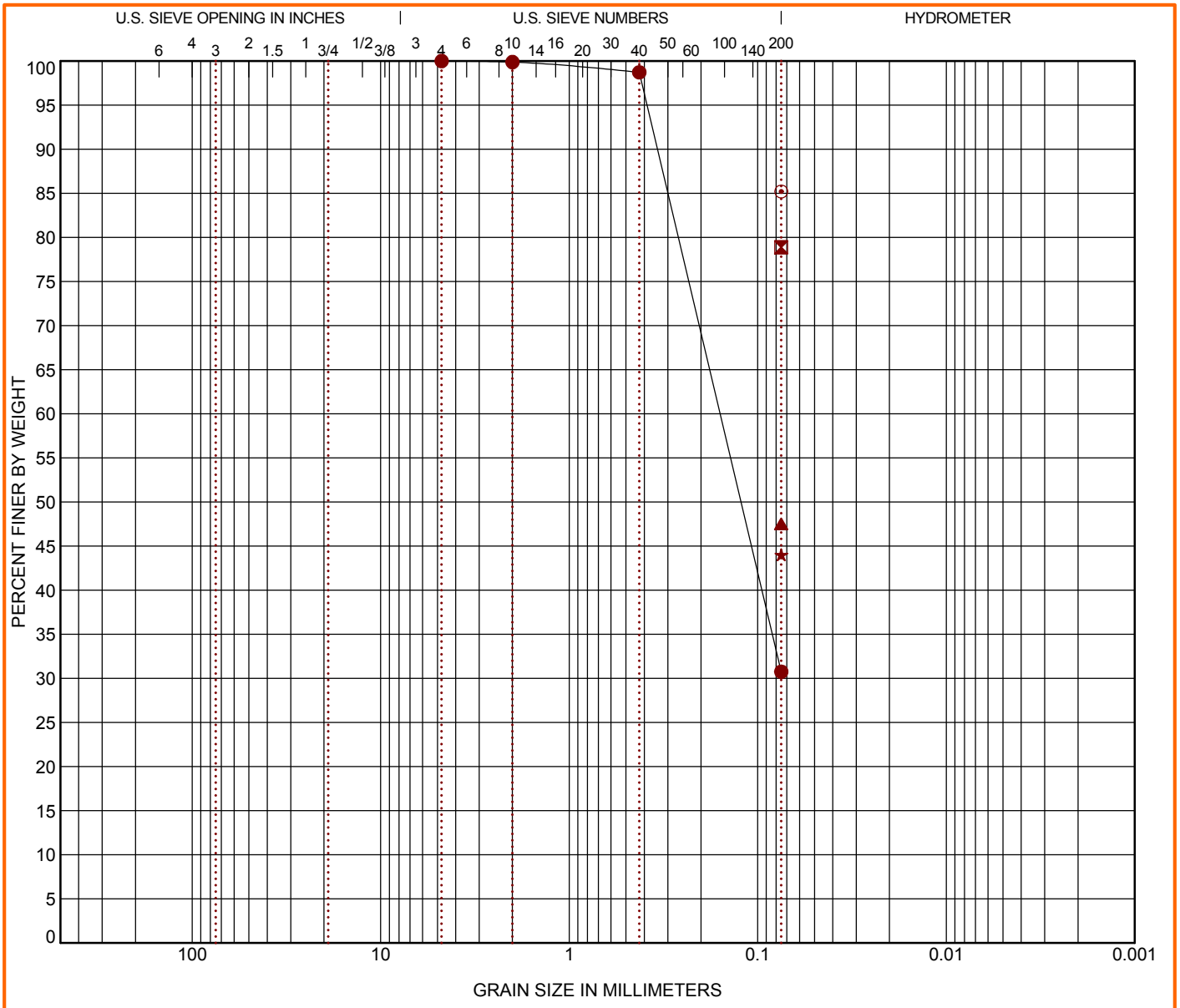

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-5	13.5 - 15		29					
⊠	B-5	28.5 - 30	FAT CLAY with SAND (CH)	23	52	18	34		
▲	B-5	38.5 - 40	CLAYEY SAND (SC)	27	35	15	20		
★	B-5	53.5 - 55	CLAYEY SAND (SC)	26	43	23	20		
⊙	B-5	63.5 - 65	FAT CLAY (CH)	20	59	19	40		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-5	13.5 - 15	4.75	0.158			0.0	69.2		30.8	
⊠	B-5	28.5 - 30	0.075				0.0			78.9	
▲	B-5	38.5 - 40	0.075				0.0			47.5	
★	B-5	53.5 - 55	0.075				0.0			44.0	
⊙	B-5	63.5 - 65	0.075				0.0			85.2	

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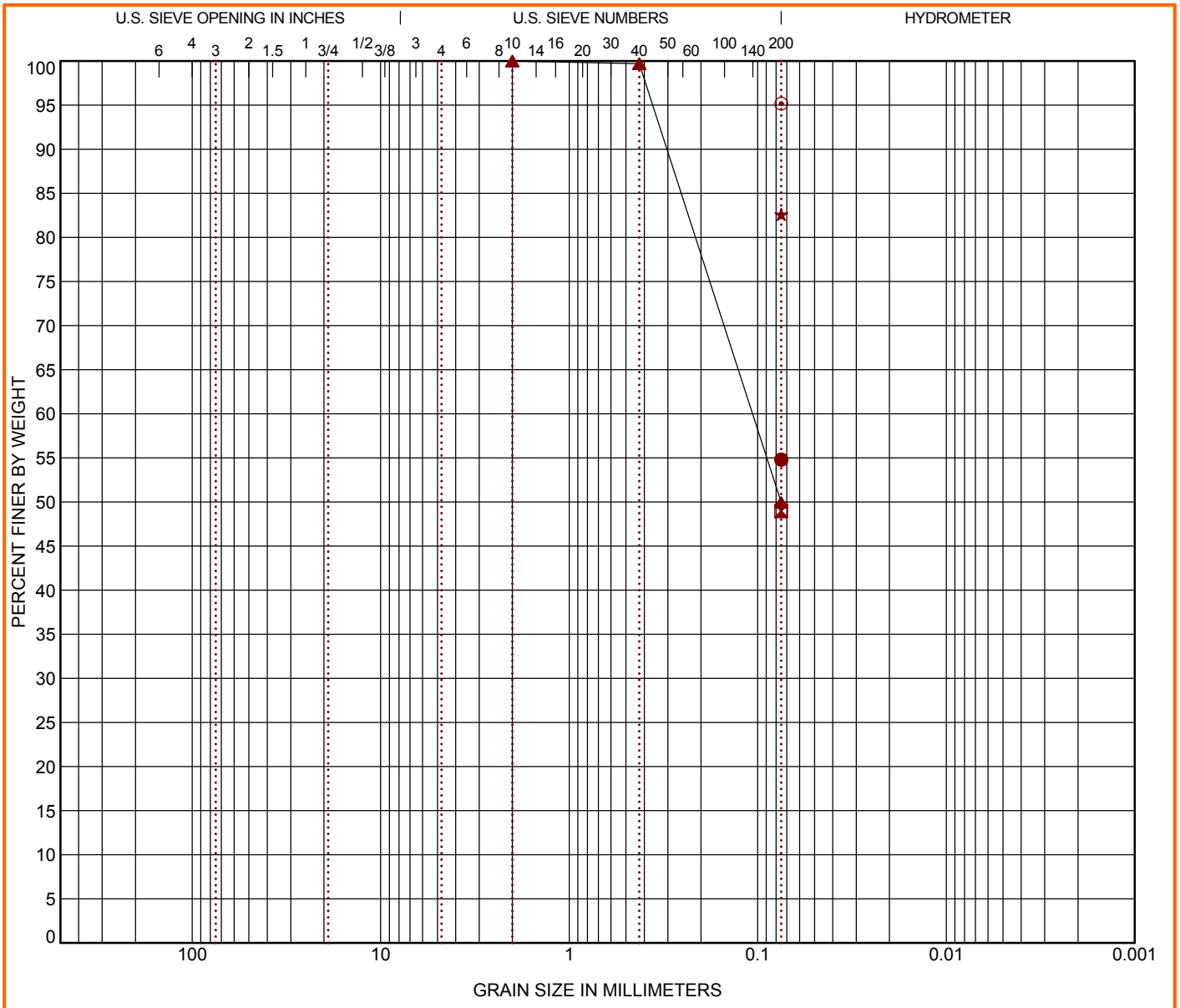

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-5	73.5 - 74.9	SANDY LEAN CLAY (CL)	35	40	19	21		
⊠	B-6	0.5 - 2	SILTY SAND (SM)	18	NP	NP	NP		
▲	B-6	5 - 6.5		19					
★	B-6	18.5 - 20	ELASTIC SILT with SAND (MH)	28	51	32	19		
⊙	B-6	23.5 - 25	FAT CLAY (CH)	29	60	22	38		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-5	73.5 - 74.9	0.075				0.0			54.8	
⊠	B-6	0.5 - 2	0.075				0.0			49.0	
▲	B-6	5 - 6.5	2	0.106			0.0	50.0		50.0	
★	B-6	18.5 - 20	0.075				0.0			82.6	
⊙	B-6	23.5 - 25	0.075				0.0			95.2	

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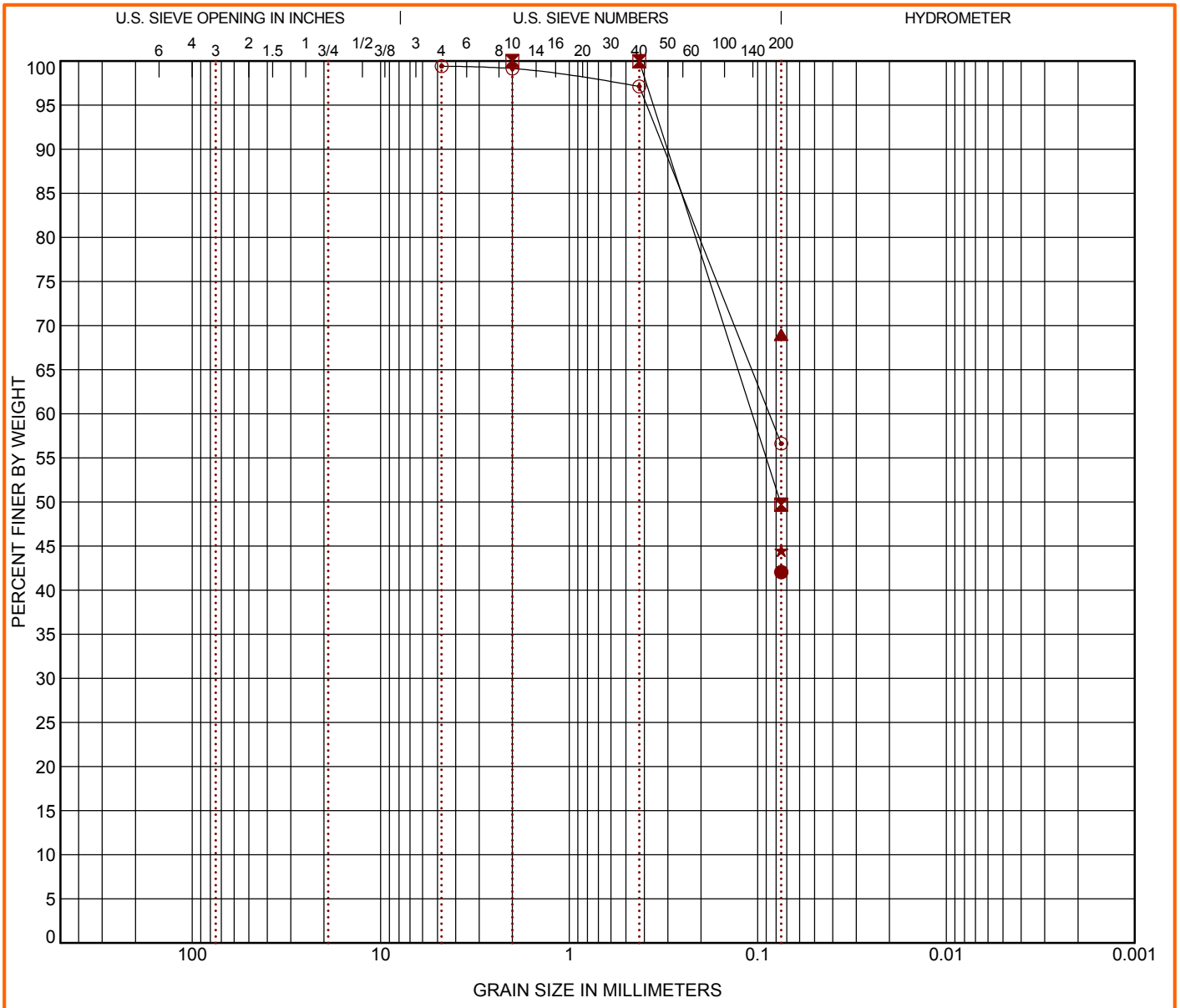

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-6	48.5 - 50	SILTY SAND (SM)	26	36	25	11		
⊠	B-6	58.5 - 59.8		25					
▲	B-6	68.5 - 70	SANDY FAT CLAY (CH)	26	55	19	36		
★	B-6	78.5 - 79.9	CLAYEY SAND (SC)	24	60	21	39		
⊙	R-5	2.5 - 4	SANDY LEAN CLAY (CL)	16	30	11	19		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-6	48.5 - 50	0.075				0.0			42.0	
⊠	B-6	58.5 - 59.8	2	0.107			0.0	50.3		49.7	
▲	B-6	68.5 - 70	0.075				0.0			69.0	
★	B-6	78.5 - 79.9	0.075				0.0			44.5	
⊙	R-5	2.5 - 4	4.75	0.087			0.0	42.8		56.6	

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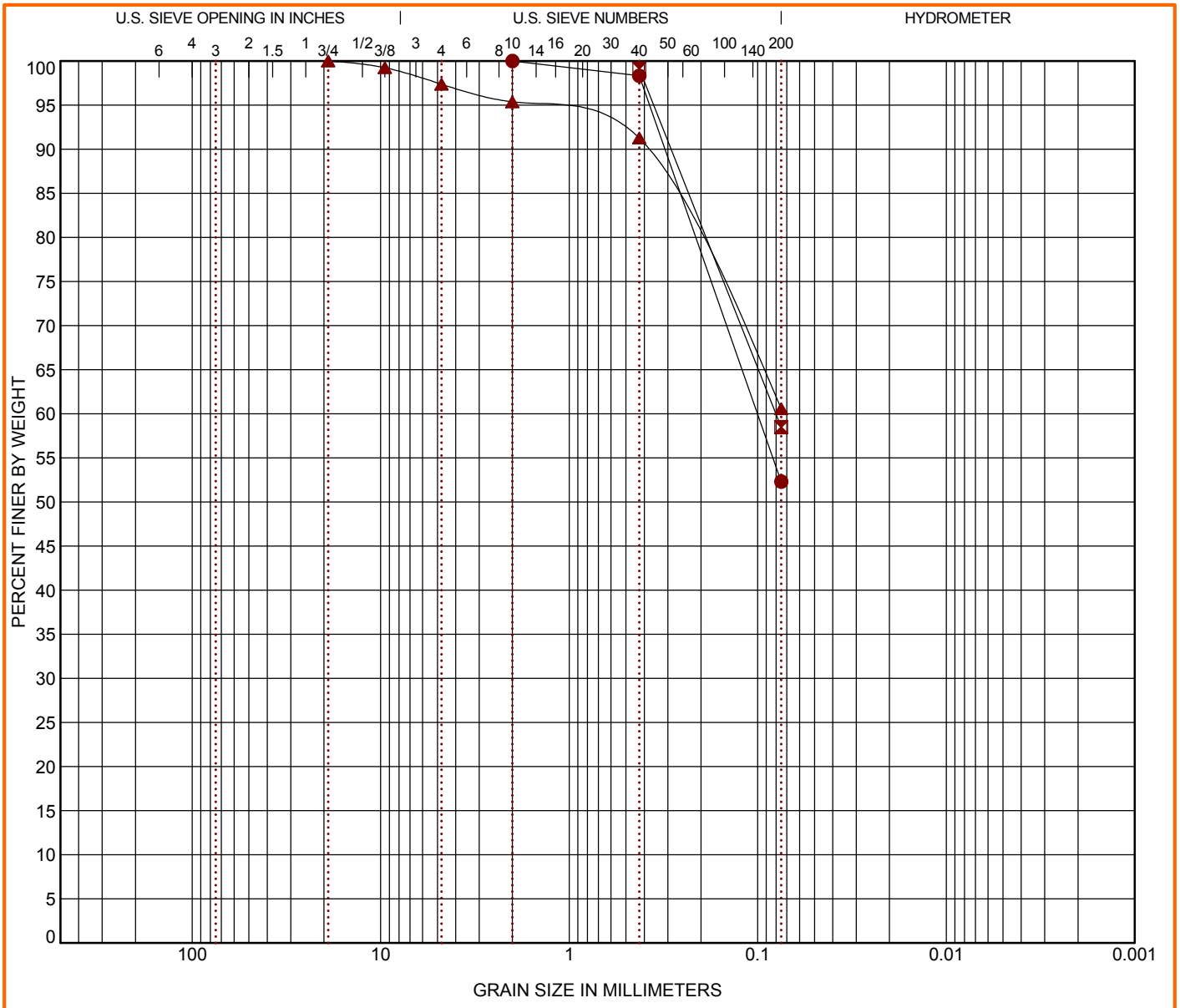

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	R-6	1 - 2.5	SANDY LEAN CLAY (CL)	16	30	12	18		
⊠	S-5	3.5 - 5	SANDY LEAN CLAY (CL)	17	33	12	21		
▲	S-6	3.5 - 5	SANDY LEAN CLAY (CL)	19	28	14	14		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	R-6	1 - 2.5	2	0.1			0.0	47.7		52.3	
⊠	S-5	3.5 - 5	0.425	0.08			0.0	40.6		58.5	
▲	S-6	3.5 - 5	19				2.6	36.8		60.6	

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SITE: Highway 82
Columbia and Union Counties, Arkansas

Terracon
25809 I 30
Bryant, AR

PROJECT NUMBER: 35185110

CLIENT: Michael Baker International, LLC
Little Rock, Arkansas

Laboratory Compaction Characteristics of Soil

4701 North Stiles Ave.
Oklahoma City, OK 73105
(405) 525 0453

Client Name: Michael Baker Int.
Project Name: Job No. 070417 Cornie, Harper & Lapile
Location: Columbia and Union Counties, Arkansas

Source Material: Composite S1 & S2
Sample Description: Sandy Lean Clay, Light Brown

Material Designation: Lab 850 Sample date:
Test Method: Method A
Test Procedure: AASHTO T-99
Sample Preparation: Dry
Rammer: X Mechanical ___ Manual

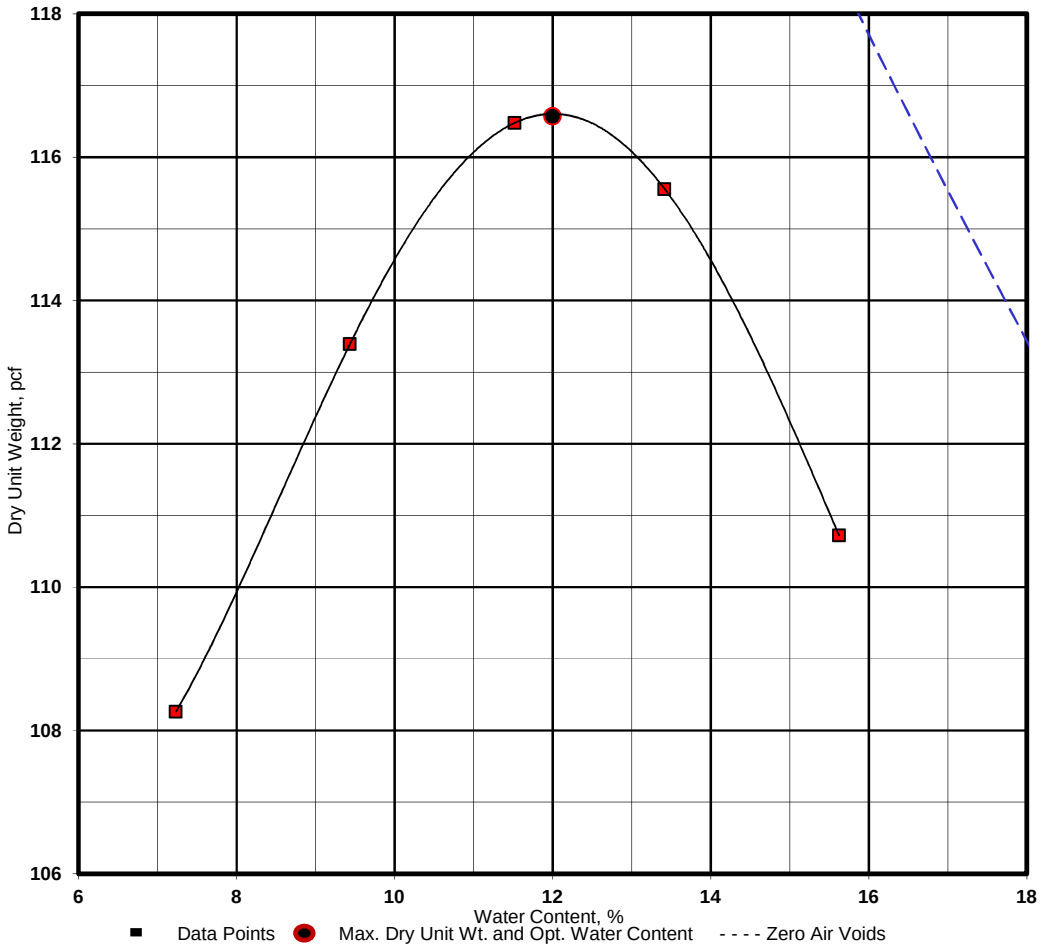
Project No.: 35185110 Date: 01/07/19

TEST RESULTS

Maximum Dry Unit Wt.: 116.6 pcf
Optimum Water Content: 12.0 %

Liquid Limit: 24 Plastic Limit: 15
Plasticity Index: 9
% passing # 200 sieve: 58
AASHTO Class. A-4(2) USCS: CL
Reviewed by:

Zero air voids for specific gravity of 2.70



Laboratory Compaction Characteristics of Soil

Terracon
4701 North Stiles Ave.
Oklahoma City, OK 73105
(405) 525 0453

Client Name: Michael Baker Int.
Project Name: Job No. 070417 Cornie, Harper & Lapile
Location: Columbia and Union Counties, Arkansas

Source Material: Composite S3 & S4
Sample Description: Sandy Lean Clay, Yellowish Brown

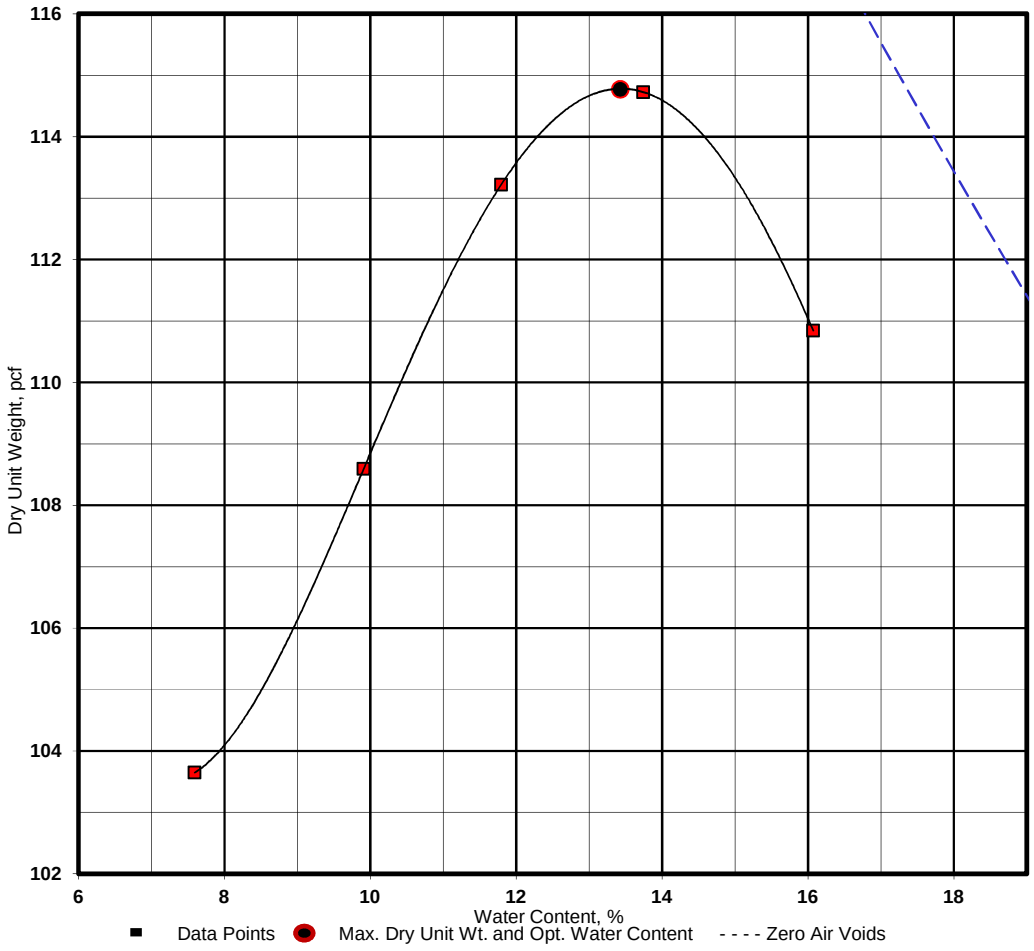
Material Designation: lab 851 Sample date:
Test Method: Method A
Test Procedure: AASHTO T-99
Sample Preparation: Dry
Rammer: X Mechanical ___ Manual

Project No.: 35185110 Date: 01/07/19

TEST RESULTS
Maximum Dry Unit Wt.: 114.8 pcf
Optimum Water Content: 13.4 %

Liquid Limit: 30 Plastic Limit: 16
Plasticity Index: 14
% passing # 200 sieve: 56.6
AASHTO Class. A-4(2) USCS: CL
Reviewed by:

Zero air voids for specific gravity of 2.70



Laboratory Compaction Characteristics of Soil

4701 North Stiles Ave.
Oklahoma City, OK 73105
(405) 525 0453

Client Name: Michael Baker Int.
Project Name: Job No. 070417 Cornie, Harper & Lapile
Location: Columbia and Union Counties, Arkansas

Source Material: Composite S5 & S6
Sample Description: Sandy Lean Clay, Brown

Material Designation: lab 852 Sample date:
Test Method: Method A
Test Procedure: AASHTO T-99
Sample Preparation: Dry
Rammer: X Mechanical ___ Manual

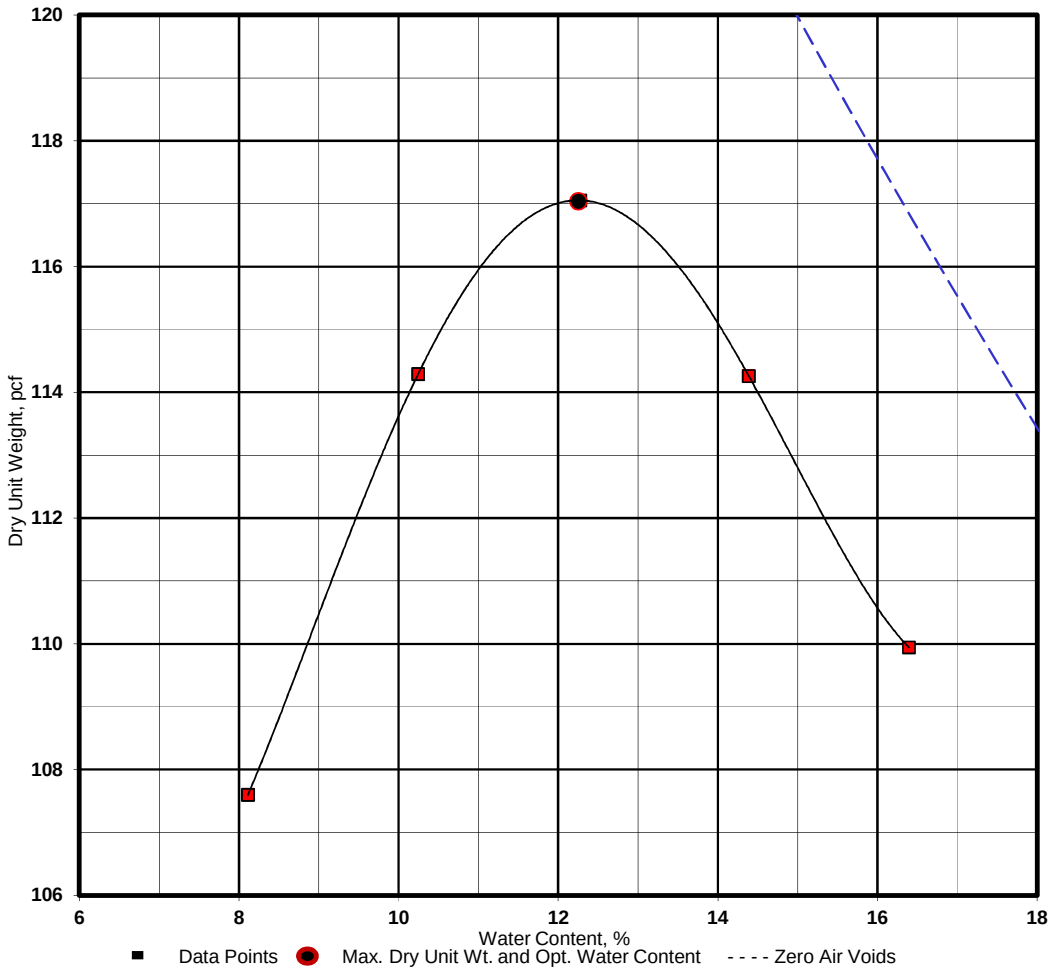
Project No.: 35185110 Date: 01/07/19

TEST RESULTS

Maximum Dry Unit Wt.:	117.0	pcf
Optimum Water Content:	12.3	%

Liquid Limit: 30 Plastic Limit: 15
Plasticity Index: 15
% passing # 200 sieve: 52.8
AASHTO Class. A-6(5) USCS: CL
Reviewed by:

Zero air voids for specific gravity of 2.70



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 14-Feb-19
Lab No.: 35185110 Lab 850 RM 3 omc
Project No.: 35185110

Soil Map Unit: Composite S1 & S2 OMC
Soil Symbol: A-4(2) / CL
Depth (in.): 0 - 60
Compaction Method: Static
Max. Dry Density (pcf): 116.6
Opt. Moisture Content (%): 12.0
Inside Mold Diameter (in): 3.94

Weight of Wet Soil (lb): 6.88
Initial Sample Diameter (in): 3.94
Initial Sample Height (in): 7.87
Initial Sample Area (in^2): 12.17
Sample Volume (in^3): 95.86
Compacted Moisture Content(%): 12.3
Wet Density (pcf): 124.0
Dry Density (pcf): 110.4

Test Date: February 6, 2019

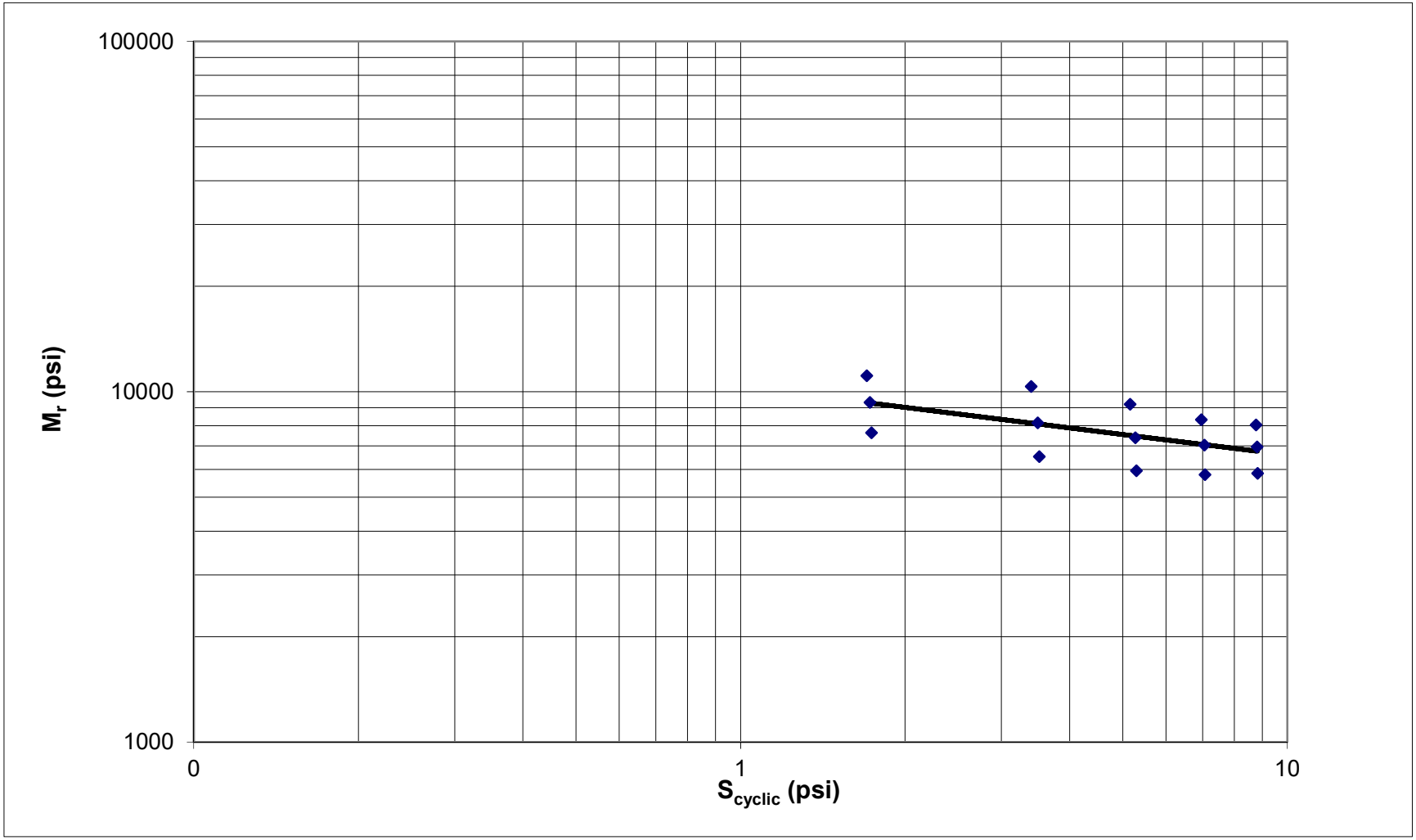
Final Sample Height (in): 7.9
Final Sample Wet Weight (lb): 6.88
Final Moisture Content (%): 12.2
Accumulated Strain (%): 0.20

Percent Passing No. 10: 98
Percent Passing No. 200: 58.0
Liquid Limit: 24
Plasticity Index: 9

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	23.9	20.7	3.1	1.96	1.70	0.257	0.0012	0.0012	0.0012	0.000153	11,108
6.00	4.00	46.9	41.4	5.5	3.85	3.40	0.448	0.0026	0.0026	0.0026	0.000329	10,351
6.00	6.00	70.9	62.8	8.1	5.82	5.16	0.663	0.0044	0.0044	0.0044	0.000560	9,206
6.00	8.00	95.5	84.8	10.7	7.84	6.96	0.881	0.0066	0.0066	0.0066	0.000837	8,319
6.00	10.00	119.9	106.7	13.2	9.85	8.76	1.086	0.0085	0.0086	0.0086	0.001090	8,036
4.01	2.00	24.3	21.0	3.3	2.00	1.73	0.270	0.0014	0.0015	0.0015	0.000185	9,313
4.01	4.00	48.3	42.5	5.8	3.97	3.49	0.474	0.0032	0.0036	0.0034	0.000429	8,149
4.01	6.00	72.5	64.2	8.3	5.95	5.28	0.679	0.0054	0.0059	0.0056	0.000715	7,383
4.01	8.00	96.6	85.9	10.8	7.94	7.05	0.883	0.0077	0.0080	0.0079	0.001002	7,040
4.01	10.00	120.3	107.2	13.1	9.88	8.80	1.074	0.0099	0.0101	0.0100	0.001266	6,952
2.00	2.00	24.2	21.1	3.1	1.99	1.74	0.254	0.0017	0.0018	0.0018	0.000227	7,627
2.00	4.00	48.4	42.8	5.6	3.98	3.52	0.461	0.0040	0.0045	0.0042	0.000539	6,532
2.00	6.00	72.5	64.5	8.0	5.96	5.30	0.657	0.0068	0.0073	0.0070	0.000891	5,948
2.00	8.00	96.5	86.1	10.4	7.93	7.07	0.858	0.0094	0.0097	0.0096	0.001219	5,801
2.00	10.00	120.3	107.4	12.9	9.88	8.82	1.060	0.0118	0.0120	0.0119	0.001510	5,843

Terracon

Date Reported: 2/14/2019 Composite S1 & S2_OMC
Terracon Lab No. 35185110 Lab 850 RM 3 omc
Project No. 35185110

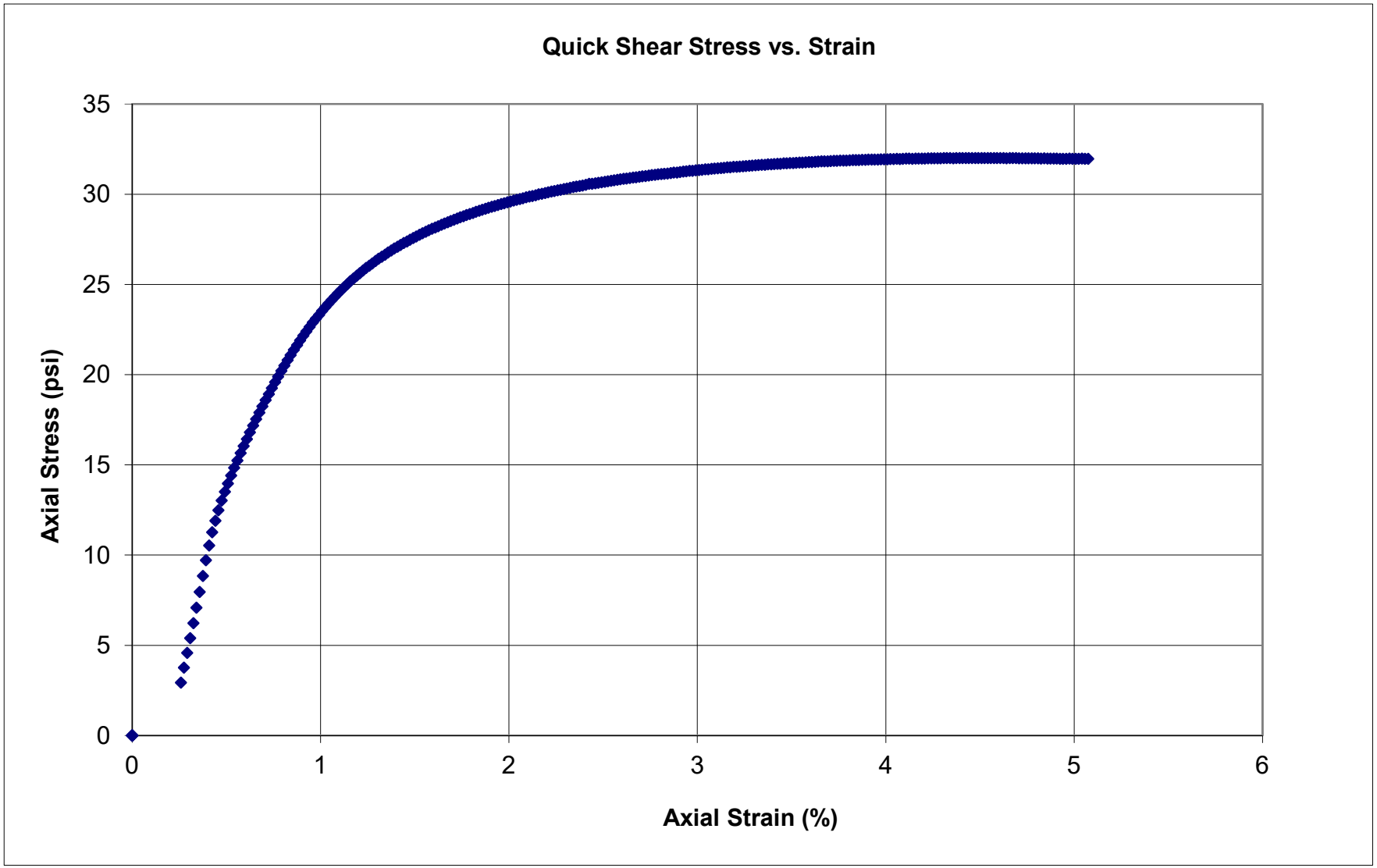


$Mr = K1 \times S_{cylic}^{k2}$

S3 (psi)	K1	K2	R^2
6	12768.3	-0.209	0.95
4	10272.6	-0.188	0.99
2	8239.8	-0.175	0.94
All	10325.8	-0.195	0.33

Terracon

Date Reported: 2/14/2019 Composite S1 & S2_OMC
Terracon Lab No. 35185110 Lab 850 RM 3 omc
Project No. 35185110



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 14-Feb-19
Lab No.: 35185110 Lab 850 RM 3 omc+2.5
Project No.: 35185110

Soil Map Unit: Composite S1 & S2 OMC+2%
Soil Symbol: A-4(2) / CL
Depth (in.) 0 - 60
Compaction Method Static
Max. Dry Density (pcf) 116.6
Opt. Moisture Content (%) 12.0
Inside Mold Diameter (in) 3.94

Weight of Wet Soil (lb) 7.03
Initial Sample Diameter (in) 3.94
Initial Sample Height (in) 7.87
Initial Sample Area (in^2) 12.17
Sample Volume (in^3) 95.86
Compacted Moisture Content(%) 14.7
Wet Density (pcf) 126.7
Dry Density (pcf) 110.5

Test Date: February 6, 2019

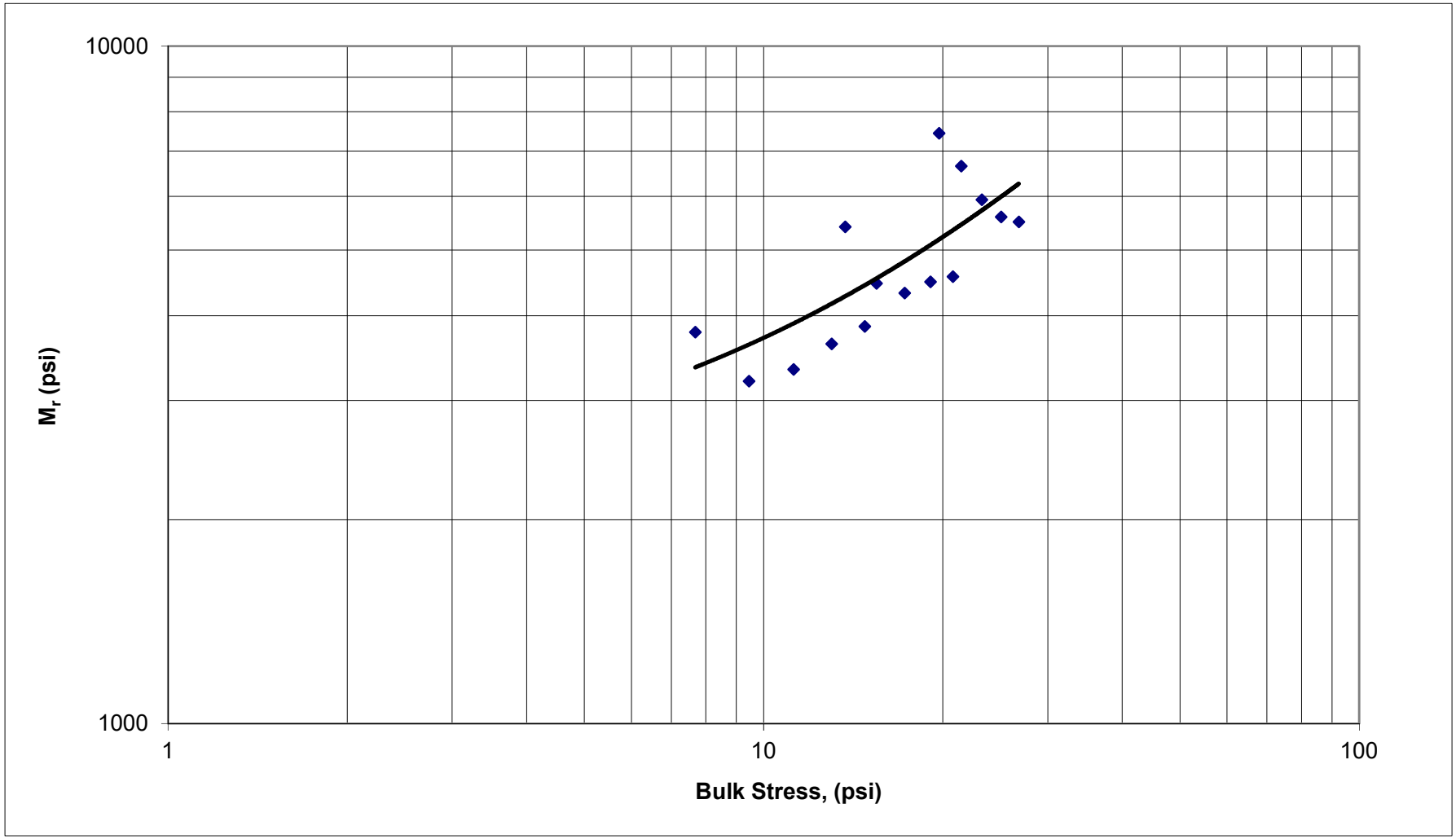
Final Sample Height (in) 7.8
Final Sample Wet Weight (lb) 7.03
Final Moisture Content (%) 14.8
Accumulated Strain (%) 1.26

Percent Passing No. 10 98
Percent Passing No. 200 58.0
Liquid Limit 24
Plasticity Index 9

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	23.4	20.7	2.7	1.92	1.70	0.223	0.0017	0.0019	0.0018	0.000228	7,437
6.00	4.00	47.3	42.2	5.1	3.89	3.47	0.419	0.0039	0.0043	0.0041	0.000521	6,653
6.00	6.00	71.5	63.9	7.6	5.87	5.25	0.625	0.0066	0.0073	0.0070	0.000885	5,930
6.00	8.00	95.7	85.6	10.1	7.86	7.03	0.828	0.0095	0.0103	0.0099	0.001257	5,596
6.00	10.00	119.8	107.2	12.6	9.84	8.81	1.034	0.0121	0.0131	0.0126	0.001601	5,501
4.01	2.00	23.6	20.6	2.9	1.93	1.69	0.242	0.0023	0.0026	0.0025	0.000313	5,409
4.01	4.00	47.4	42.0	5.4	3.90	3.45	0.446	0.0058	0.0064	0.0061	0.000772	4,466
4.01	6.00	71.5	63.7	7.9	5.87	5.23	0.645	0.0091	0.0099	0.0095	0.001211	4,319
4.01	8.00	95.9	85.7	10.2	7.88	7.04	0.838	0.0119	0.0128	0.0123	0.001568	4,488
4.01	10.00	119.4	106.8	12.6	9.81	8.77	1.034	0.0147	0.0155	0.0151	0.001920	4,569
2.00	2.00	23.1	20.4	2.7	1.90	1.67	0.225	0.0032	0.0038	0.0035	0.000443	3,783
2.00	4.00	47.0	41.9	5.2	3.86	3.44	0.425	0.0082	0.0087	0.0085	0.001073	3,202
2.00	6.00	71.1	63.5	7.6	5.84	5.22	0.625	0.0119	0.0127	0.0123	0.001565	3,333
2.00	8.00	95.4	85.3	10.0	7.83	7.01	0.822	0.0148	0.0156	0.0152	0.001929	3,634
2.00	10.00	119.2	106.9	12.3	9.79	8.78	1.014	0.0177	0.0182	0.0179	0.002276	3,857

Terracon

Date Reported: 2/14/2019 Composite S1 & S2 OMC+2%
Terracon Lab No. 35185110 Lab 850 RM 3 omc+2.5
Project No. 35185110



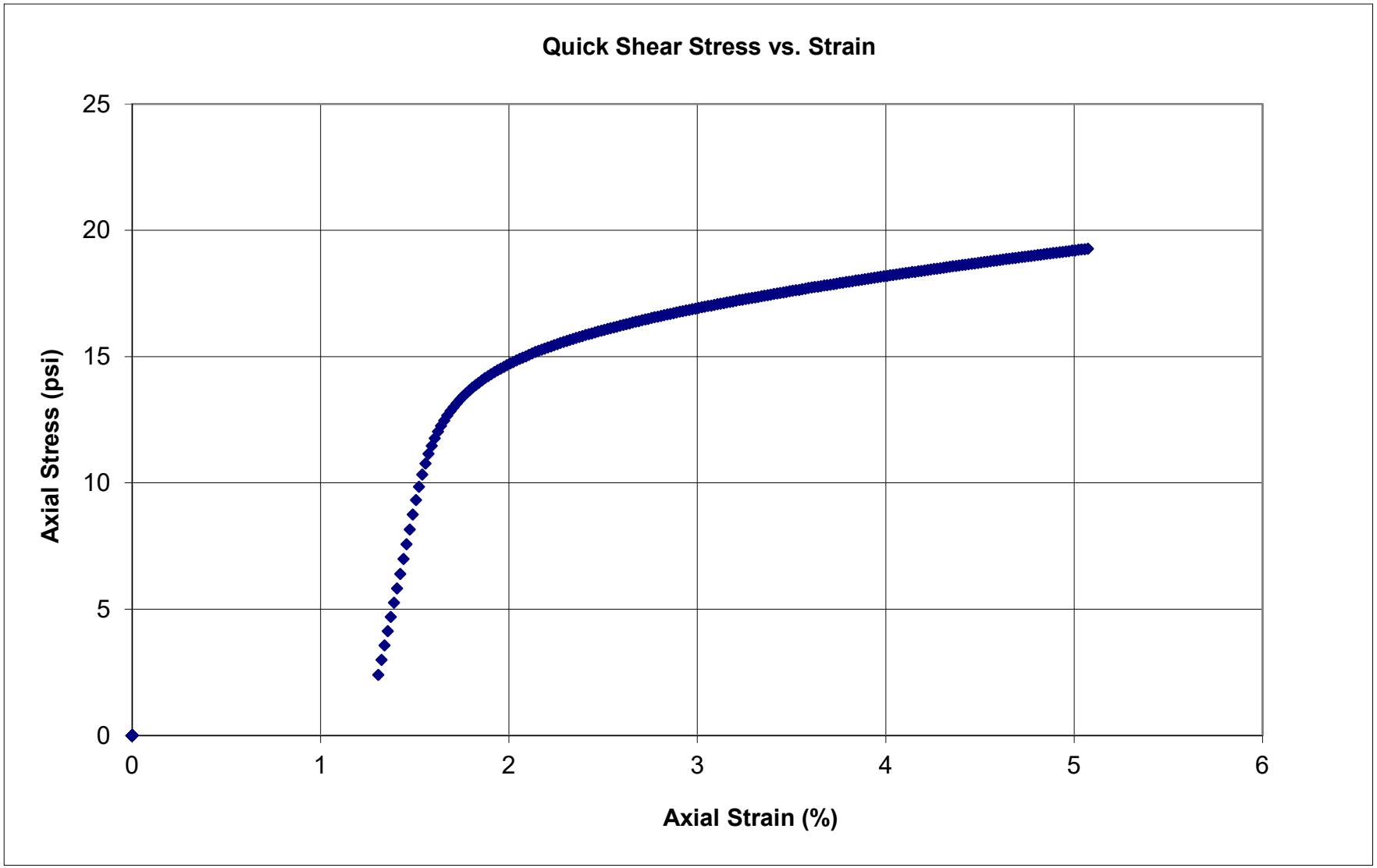
$Mr = K1 \times \Theta^{k2}$

$[\Theta = S_{cyclic} + 3\ (S3)]$

S3 (psi)	K1	K2	R^2
6	151013.1	-1.017	0.95
4	12241.4	-0.342	0.41
2	2972.0	0.075	0.06
All	1106.8	0.516	0.55

Terracon

Date Reported: 2/14/2019 Composite S1 & S2 OMC+2%
Terracon Lab No. 35185110 Lab 850 RM 3 omc+2.5
Project No. 35185110



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 14-Feb-19
Lab No.: 35185110 Lab 851 RM 4 omc
Project No.: 35185110

Soil Map Unit: Composite S3 & S4 OMC
Soil Symbol: A-4(2) / CL
Depth (in.): 0 - 60
Compaction Method: Static
Max. Dry Density (pcf): 114.8
Opt. Moisture Content (%): 13.4
Inside Mold Diameter (in): 3.94

Weight of Wet Soil (lb)	6.86
Initial Sample Diameter (in)	3.94
Initial Sample Height (in)	7.87
Initial Sample Area (in^2)	12.17
Sample Volume (in^3)	95.86
Compacted Moisture Content(%)	13.5
Wet Density (pcf)	123.6
Dry Density (pcf)	108.9

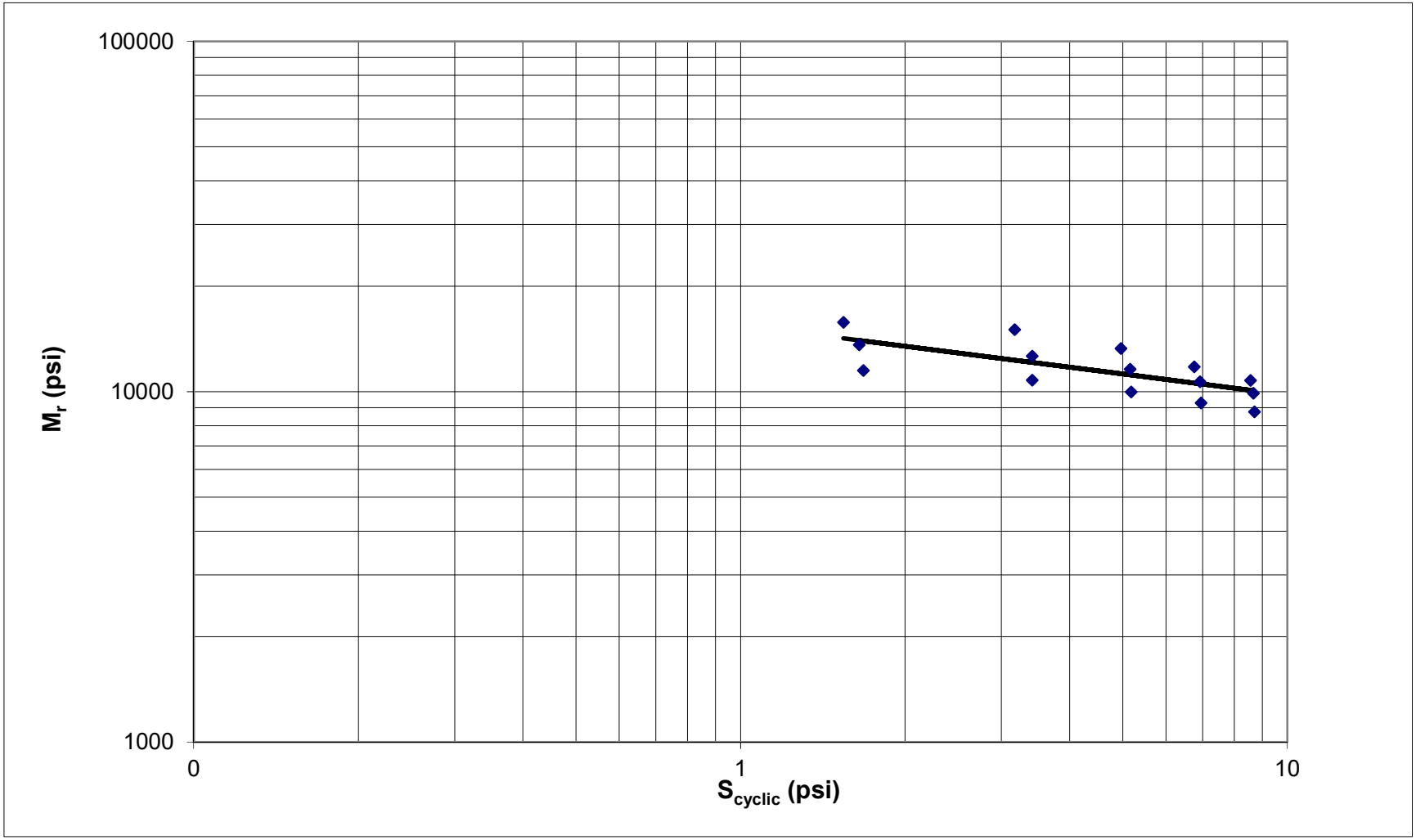
Test Date: February 8, 2019

Final Sample Height (in)	7.9
Final Sample Wet Weight (lb)	6.86
Final Moisture Content (%)	13.4
Accumulated Strain (%)	0.12
Percent Passing No. 10	96
Percent Passing No. 200	56.6
Liquid Limit	30
Plasticity Index	14

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	22.5	18.8	3.7	1.85	1.54	0.304	0.0008	0.0007	0.0008	0.000098	15,773
6.01	4.00	44.7	38.6	6.1	3.67	3.17	0.500	0.0017	0.0016	0.0017	0.000211	15,025
6.00	6.00	69.0	60.4	8.6	5.67	4.96	0.703	0.0030	0.0029	0.0029	0.000373	13,289
6.00	8.00	93.5	82.3	11.2	7.68	6.76	0.919	0.0045	0.0045	0.0045	0.000574	11,783
6.00	10.00	117.7	104.3	13.5	9.67	8.56	1.107	0.0063	0.0062	0.0063	0.000796	10,759
4.01	2.00	23.9	20.1	3.8	1.97	1.65	0.316	0.0009	0.0010	0.0010	0.000121	13,598
4.01	4.00	47.9	41.6	6.4	3.94	3.41	0.522	0.0021	0.0022	0.0021	0.000270	12,627
4.01	6.00	71.7	62.8	8.9	5.89	5.16	0.732	0.0035	0.0035	0.0035	0.000445	11,592
4.01	8.00	95.7	84.3	11.4	7.86	6.92	0.933	0.0051	0.0051	0.0051	0.000649	10,673
4.01	10.00	119.3	105.6	13.7	9.80	8.67	1.129	0.0069	0.0069	0.0069	0.000875	9,905
2.00	2.00	23.8	20.4	3.4	1.96	1.68	0.281	0.0011	0.0012	0.0011	0.000146	11,503
2.00	4.00	47.6	41.6	6.0	3.91	3.42	0.490	0.0024	0.0026	0.0025	0.000317	10,783
2.00	6.00	71.5	63.1	8.4	5.87	5.18	0.693	0.0040	0.0042	0.0041	0.000519	9,977
2.00	8.00	95.5	84.7	10.8	7.84	6.95	0.890	0.0058	0.0060	0.0059	0.000749	9,288
2.00	10.00	119.4	106.0	13.3	9.80	8.71	1.096	0.0078	0.0079	0.0078	0.000994	8,760

Terracon

Date Reported: 2/14/2019 Composite S3 & S4_OMC
Terracon Lab No. 35185110 Lab 851 RM 4 omc
Project No. 35185110

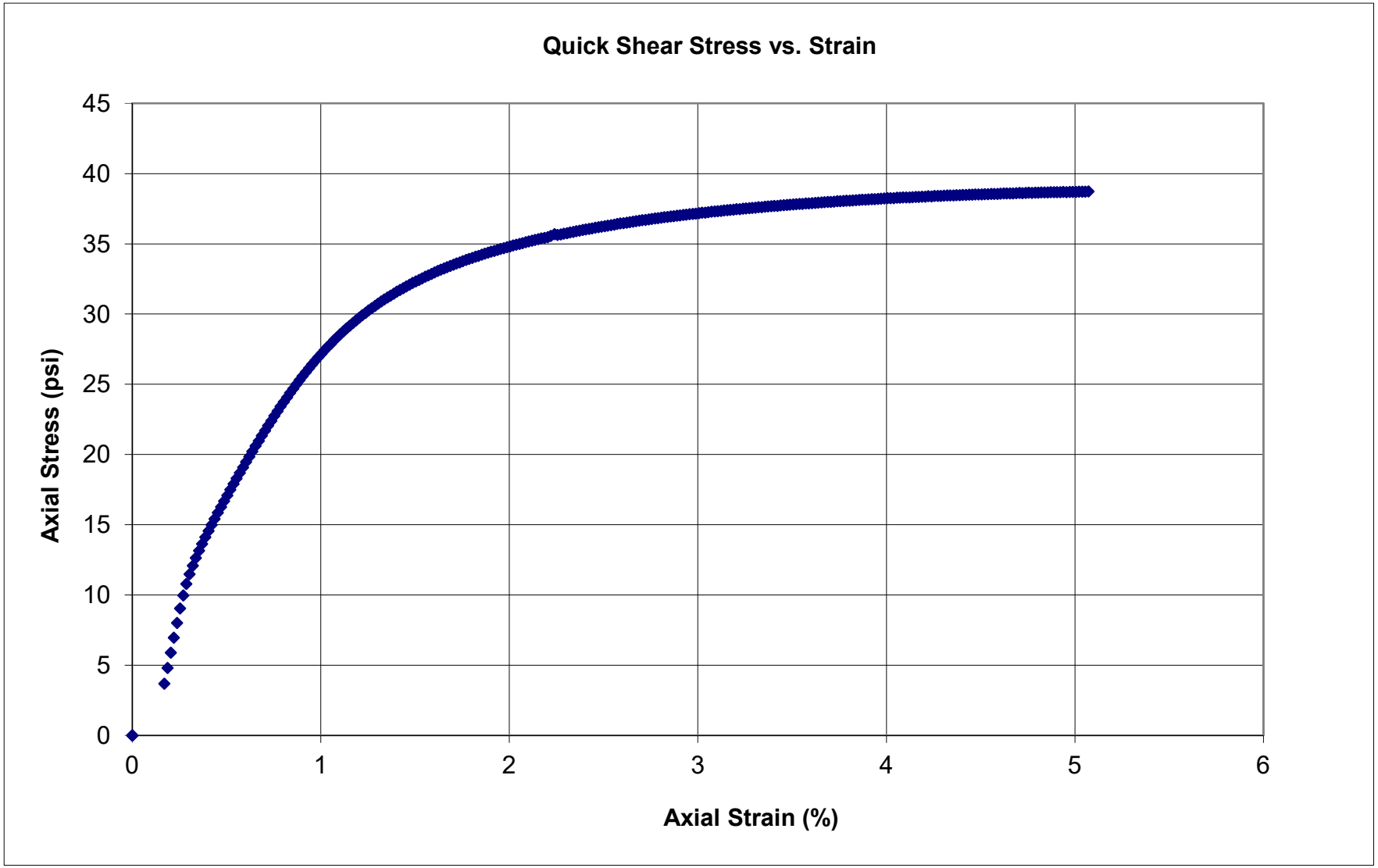


$Mr = K1 \times S_{cylic}^{k2}$

S3 (psi)	K1	K2	R^2
6	18255.4	-0.224	0.90
4	15357.4	-0.188	0.94
2	12812.8	-0.164	0.95
All	15481.4	-0.199	0.51

Terracon

Date Reported: 2/14/2019 Composite S3 & S4_OMC
Terracon Lab No. 35185110 Lab 851 RM 4 omc
Project No. 35185110



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 14-Feb-19
Lab No.: 35185110 Lab 851 RM 4 omc+2.5
Project No.: 35185110

Soil Map Unit: Composite S3 & S4_OMC+
Soil Symbol: A-4(2) / CL
Depth (in.) 0 - 60
Compaction Method Static
Max. Dry Density (pcf) 114.8
Opt. Moisture Content (%) 13.4
Inside Mold Diameter (in) 3.94

Weight of Wet Soil (lb) 7.01
Initial Sample Diameter (in) 3.94
Initial Sample Height (in) 7.87
Initial Sample Area (in^2) 12.17
Sample Volume (in^3) 95.86
Compacted Moisture Content(%) 16.1
Wet Density (pcf) 126.3
Dry Density (pcf) 108.8

Test Date: February 8, 2019

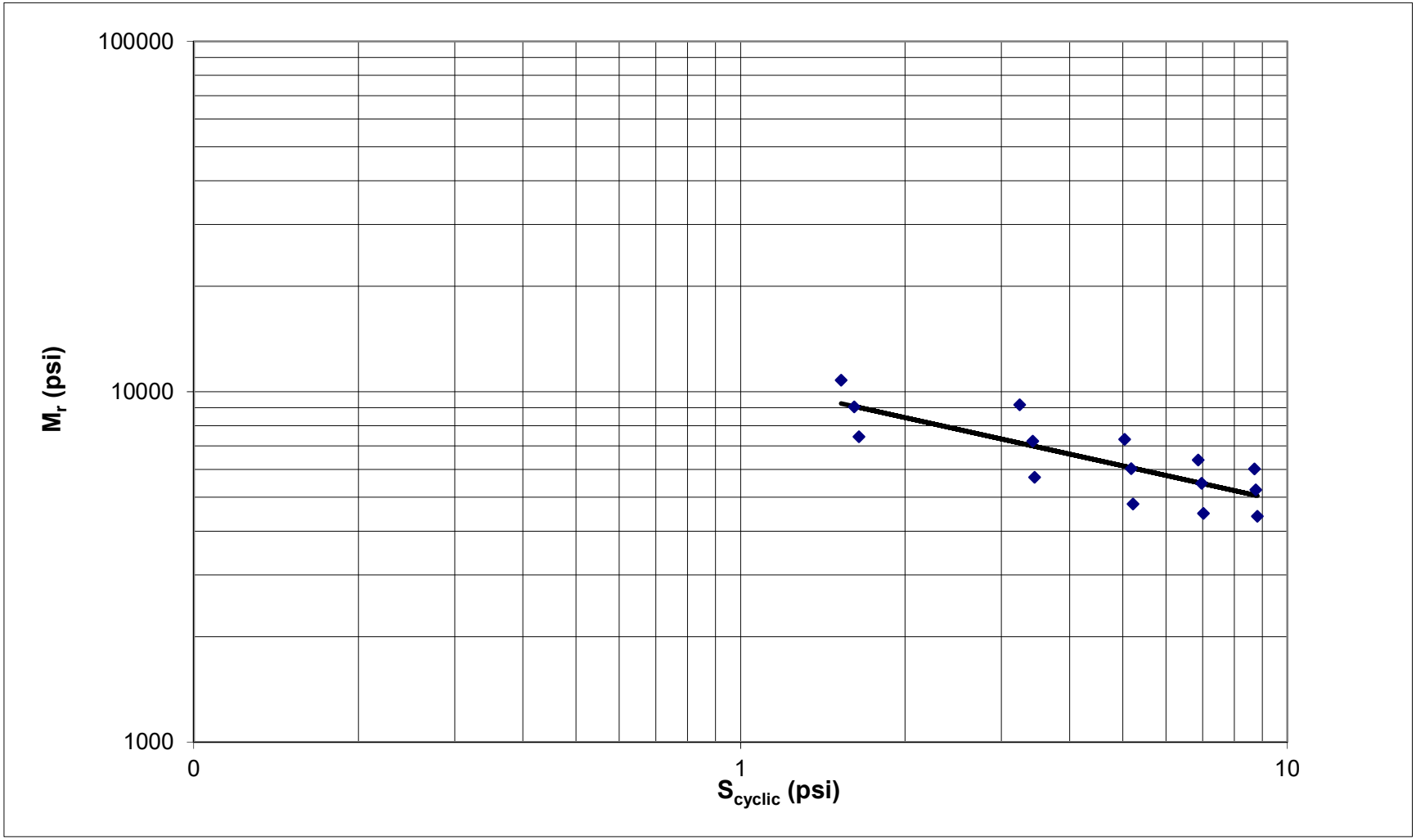
Final Sample Height (in) 7.8
Final Sample Wet Weight (lb) 7.00
Final Moisture Content (%) 15.7
Accumulated Strain (%) 0.51

Percent Passing No. 10 96
Percent Passing No. 200 56.6
Liquid Limit 30
Plasticity Index 14

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	22.9	18.6	4.3	1.88	1.53	0.350	0.0011	0.0011	0.0011	0.000141	10,794
6.00	4.00	46.2	39.4	6.8	3.79	3.24	0.557	0.0028	0.0027	0.0028	0.000353	9,168
6.00	6.00	70.7	61.4	9.4	5.81	5.04	0.769	0.0055	0.0054	0.0054	0.000689	7,310
6.01	8.00	95.6	83.6	12.0	7.85	6.87	0.984	0.0086	0.0084	0.0085	0.001076	6,380
6.00	10.00	120.5	106.1	14.4	9.89	8.71	1.183	0.0115	0.0113	0.0114	0.001446	6,024
4.01	2.00	24.5	19.7	4.8	2.01	1.61	0.396	0.0014	0.0014	0.0014	0.000178	9,056
4.01	4.00	48.8	41.7	7.1	4.00	3.42	0.582	0.0038	0.0036	0.0037	0.000473	7,229
4.01	6.00	72.6	63.1	9.5	5.96	5.18	0.784	0.0068	0.0067	0.0068	0.000859	6,029
4.01	8.00	96.8	84.8	12.0	7.95	6.97	0.987	0.0101	0.0099	0.0100	0.001272	5,479
4.01	10.00	121.0	106.7	14.4	9.94	8.76	1.180	0.0132	0.0131	0.0131	0.001669	5,248
2.00	2.00	24.3	20.0	4.2	1.99	1.65	0.345	0.0018	0.0017	0.0017	0.000221	7,441
2.00	4.00	48.5	42.0	6.4	3.98	3.45	0.529	0.0048	0.0047	0.0048	0.000605	5,700
2.00	6.00	72.4	63.6	8.8	5.94	5.22	0.720	0.0087	0.0086	0.0086	0.001093	4,780
2.00	8.00	96.8	85.5	11.3	7.95	7.02	0.927	0.0124	0.0122	0.0123	0.001561	4,496
2.00	10.00	121.1	107.4	13.7	9.94	8.82	1.126	0.0158	0.0157	0.0158	0.002000	4,408

Terracon

Date Reported: 2/14/2019 Composite S3 & S4_OMC+
Terracon Lab No. 35185110 Lab 851 RM 4 omc+2.5
Project No. 35185110

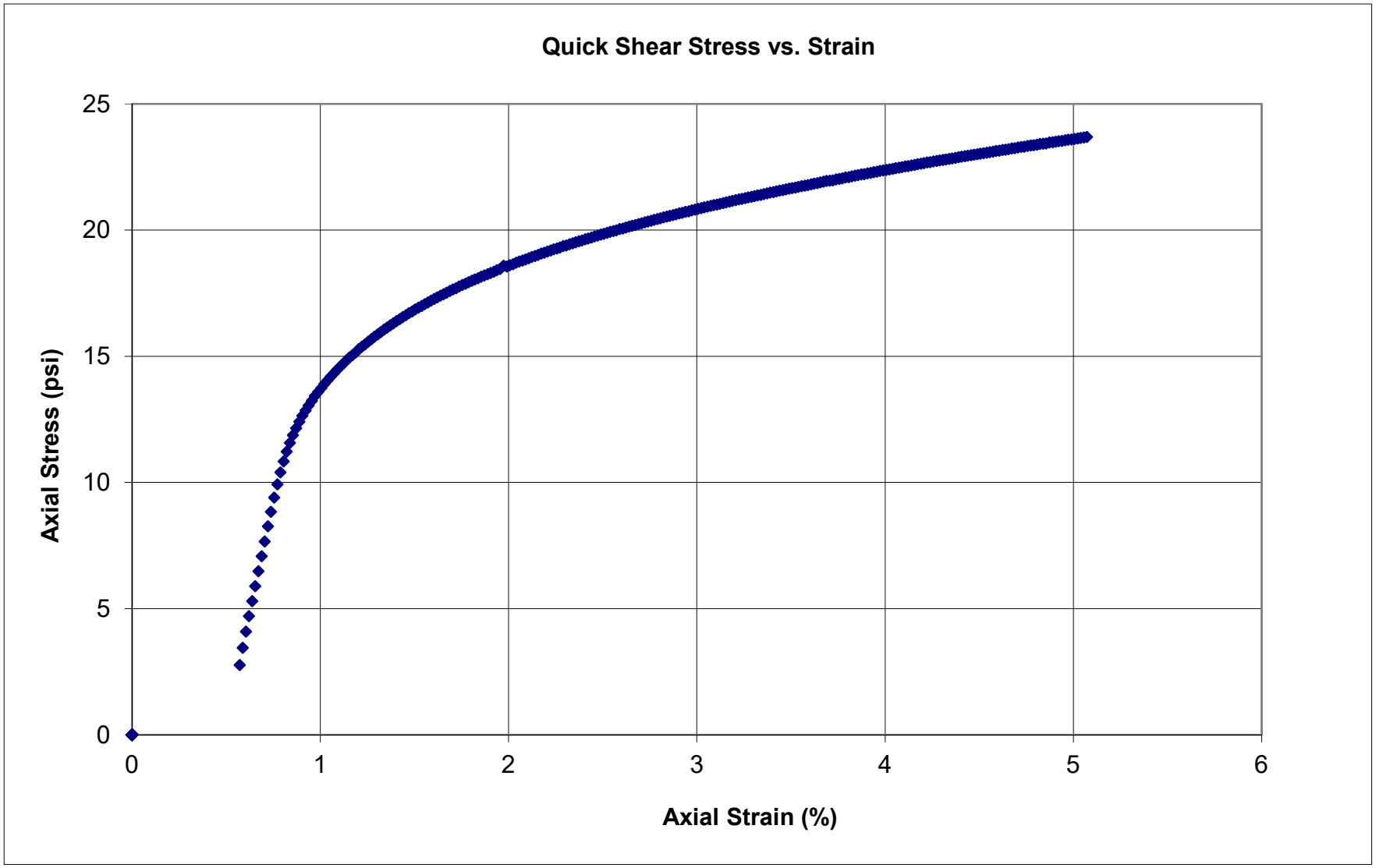


$Mr = K1 \times S_{cylic}^{k2}$

S3 (psi)	K1	K2	R^2
6	12966.8	-0.353	0.97
4	10678.8	-0.335	0.99
2	8591.6	-0.327	0.98
All	10715.7	-0.346	0.64

Terracon

Date Reported: 2/14/2019 Composite S3 & S4_OMC+
Terracon Lab No. 35185110 Lab 851 RM 4 omc+2.5
Project No. 35185110



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 15-Feb-19
Lab No.: 35185110 Lab 852 RM 5 omc
Project No.: 35185110

Soil Map Unit: Composite S5 & S6 OMC
Soil Symbol: A-6(5) / CL
Depth (in.): 0 - 60
Compaction Method: Static
Max. Dry Density (pcf): 117.0
Opt. Moisture Content (%): 12.3
Inside Mold Diameter (in): 3.94

Weight of Wet Soil (lb): 6.93
Initial Sample Diameter (in): 3.94
Initial Sample Height (in): 7.87
Initial Sample Area (in^2): 12.17
Sample Volume (in^3): 95.86
Compacted Moisture Content(%): 12.6
Wet Density (pcf): 124.8
Dry Density (pcf): 110.8

Test Date: February 8, 2019

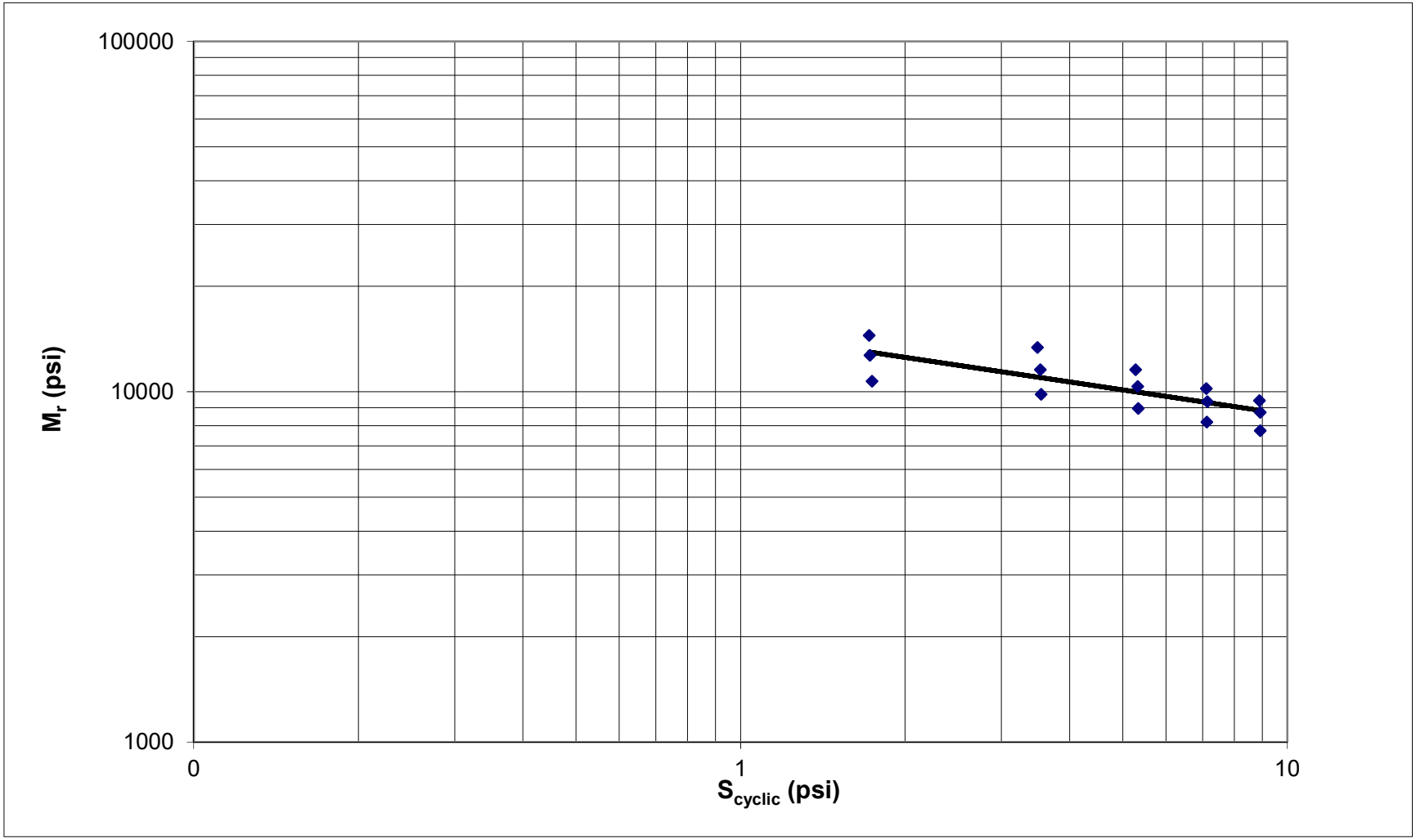
Final Sample Height (in): 7.9
Final Sample Wet Weight (lb): 6.92
Final Moisture Content (%): 12.3
Accumulated Strain (%): 0.13

Percent Passing No. 10: 97
Percent Passing No. 200: 52.8
Liquid Limit: 30
Plasticity Index: 15

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	23.6	20.9	2.7	1.94	1.72	0.223	0.0009	0.0010	0.0009	0.000119	14,476
6.00	4.00	47.5	42.5	5.0	3.90	3.49	0.411	0.0020	0.0021	0.0021	0.000261	13,378
6.00	6.00	72.0	64.3	7.7	5.91	5.28	0.634	0.0036	0.0036	0.0036	0.000456	11,563
6.00	8.00	96.9	86.6	10.3	7.95	7.11	0.844	0.0054	0.0055	0.0055	0.000696	10,211
6.00	10.00	121.3	108.3	12.9	9.96	8.90	1.061	0.0073	0.0075	0.0074	0.000943	9,435
4.01	2.00	24.5	21.0	3.5	2.01	1.72	0.284	0.0010	0.0011	0.0011	0.000136	12,703
4.01	4.00	49.0	43.0	5.9	4.02	3.53	0.486	0.0023	0.0025	0.0024	0.000306	11,562
4.01	6.00	73.3	64.9	8.4	6.02	5.33	0.694	0.0040	0.0041	0.0041	0.000515	10,343
4.01	8.00	97.6	86.9	10.7	8.02	7.14	0.881	0.0059	0.0061	0.0060	0.000762	9,364
4.01	10.00	121.8	108.6	13.2	10.00	8.92	1.084	0.0079	0.0081	0.0080	0.001022	8,727
2.00	2.00	24.2	21.2	3.1	1.99	1.74	0.251	0.0012	0.0013	0.0013	0.000162	10,715
2.00	4.00	48.6	43.2	5.4	3.99	3.54	0.446	0.0027	0.0029	0.0028	0.000360	9,832
2.00	6.00	72.9	65.0	7.9	5.99	5.34	0.647	0.0046	0.0048	0.0047	0.000596	8,955
2.00	8.00	97.2	86.7	10.5	7.98	7.12	0.860	0.0068	0.0069	0.0068	0.000869	8,191
2.00	10.00	121.4	108.6	12.9	9.97	8.92	1.056	0.0090	0.0092	0.0091	0.001152	7,738

Terracon

Date Reported: 2/15/2019 Composite S5 & S6_OMC
Terracon Lab No. 35185110 Lab 852 RM 5 omc
Project No. 35185110

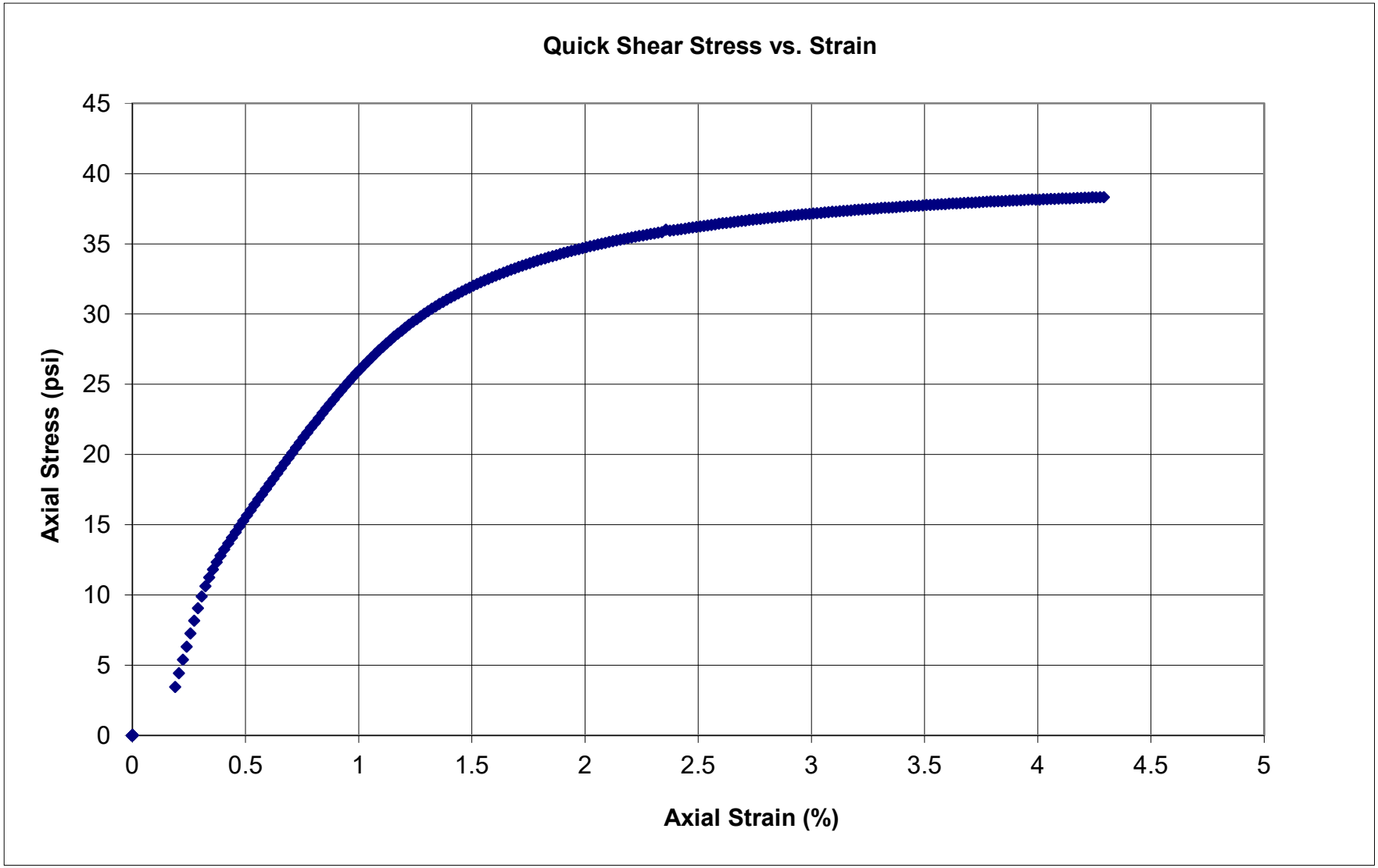


$Mr = K1 \times S_{cylic}^{k2}$

S3 (psi)	K1	K2	R^2
6	17481.1	-0.266	0.93
4	14831.3	-0.230	0.96
2	12270.5	-0.201	0.96
All	14736.0	-0.234	0.60

Terracon

Date Reported: 2/15/2019 Composite S5 & S6_OMC
Terracon Lab No. 35185110 Lab 852 RM 5 omc
Project No. 35185110



Terracon

Resilient Modulus Testing - AASHTO T 307-99 English Units

Report Date: 15-Feb-19
Lab No.: 35185110 Lab 852 RM 5 omc+2.5
Project No.: 35185110

Soil Map Unit: Composite S5 & S6_OMC+
Soil Symbol: A-6(5) / CL
Depth (in.): 0 - 60
Compaction Method: Static
Max. Dry Density (pcf): 117.0
Opt. Moisture Content (%): 12.3
Inside Mold Diameter (in): 3.94

Weight of Wet Soil (lb): 7.08
Initial Sample Diameter (in): 3.94
Initial Sample Height (in): 7.87
Initial Sample Area (in^2): 12.17
Sample Volume (in^3): 95.86
Compacted Moisture Content(%): 14.6
Wet Density (pcf): 127.5
Dry Density (pcf): 111.3

Test Date: February 8, 2019

Final Sample Height (in): 7.8
Final Sample Wet Weight (lb): 7.07
Final Moisture Content (%): 14.7
Accumulated Strain (%): 0.36

Percent Passing No. 10: 97
Percent Passing No. 200: 52.8
Liquid Limit: 30
Plasticity Index: 15

Chamber Confining Pressure (S_3) psi	Nominal Maximum Axial Stress (S_{cyclic}) psi	Actual Applied Max. Axial Load (P_{max}) lb	Actual Applied Cyclic Load (P_{cyclic}) lb	Actual Applied Contact Load ($P_{contact}$) lb	Actual Applied Max. Axial Stress (S_{max}) psi	Actual Applied Cyclic Stress (S_{cyclic}) psi	Actual Applied Contact Stress ($S_{contact}$) psi	Recov. Def. LVDT #1 Reading (H_1) in	Recov. Def. LVDT #2 Reading (H_2) in	Average Recov. Def. LVDT 1 and 2 (H_{avg}) in	Resilient Strain (ϵ_r) in/in	Resilient Modulus (M_r) psi
6.00	2.00	23.1	21.1	2.1	1.90	1.73	0.170	0.0013	0.0012	0.0013	0.000163	10,636
6.00	4.00	47.0	42.5	4.5	3.86	3.49	0.367	0.0031	0.0029	0.0030	0.000381	9,170
6.00	6.00	71.1	64.0	7.1	5.84	5.26	0.586	0.0056	0.0055	0.0056	0.000706	7,449
6.00	8.00	95.7	85.9	9.8	7.86	7.05	0.804	0.0087	0.0086	0.0086	0.001096	6,436
6.00	10.00	120.5	107.8	12.7	9.90	8.85	1.043	0.0114	0.0113	0.0113	0.001441	6,141
4.01	2.00	24.1	21.0	3.0	1.98	1.73	0.250	0.0016	0.0015	0.0016	0.000198	8,735
4.01	4.00	48.3	42.8	5.6	3.97	3.51	0.457	0.0039	0.0039	0.0039	0.000494	7,102
4.01	6.00	72.3	64.4	7.9	5.94	5.29	0.650	0.0069	0.0069	0.0069	0.000879	6,020
4.01	8.00	97.3	86.2	11.0	7.99	7.08	0.906	0.0101	0.0100	0.0101	0.001280	5,534
4.01	10.00	121.4	107.9	13.5	9.97	8.86	1.113	0.0131	0.0130	0.0130	0.001656	5,350
2.01	2.00	24.3	21.0	3.3	2.00	1.73	0.272	0.0019	0.0019	0.0019	0.000240	7,197
2.00	4.00	48.5	43.0	5.5	3.99	3.53	0.455	0.0050	0.0049	0.0050	0.000629	5,611
2.00	6.00	72.6	64.7	8.0	5.96	5.31	0.653	0.0087	0.0087	0.0087	0.001106	4,804
2.00	8.00	97.1	86.5	10.6	7.97	7.10	0.868	0.0124	0.0122	0.0123	0.001563	4,544
2.00	10.00	121.4	108.4	13.0	9.97	8.90	1.067	0.0158	0.0155	0.0156	0.001985	4,484

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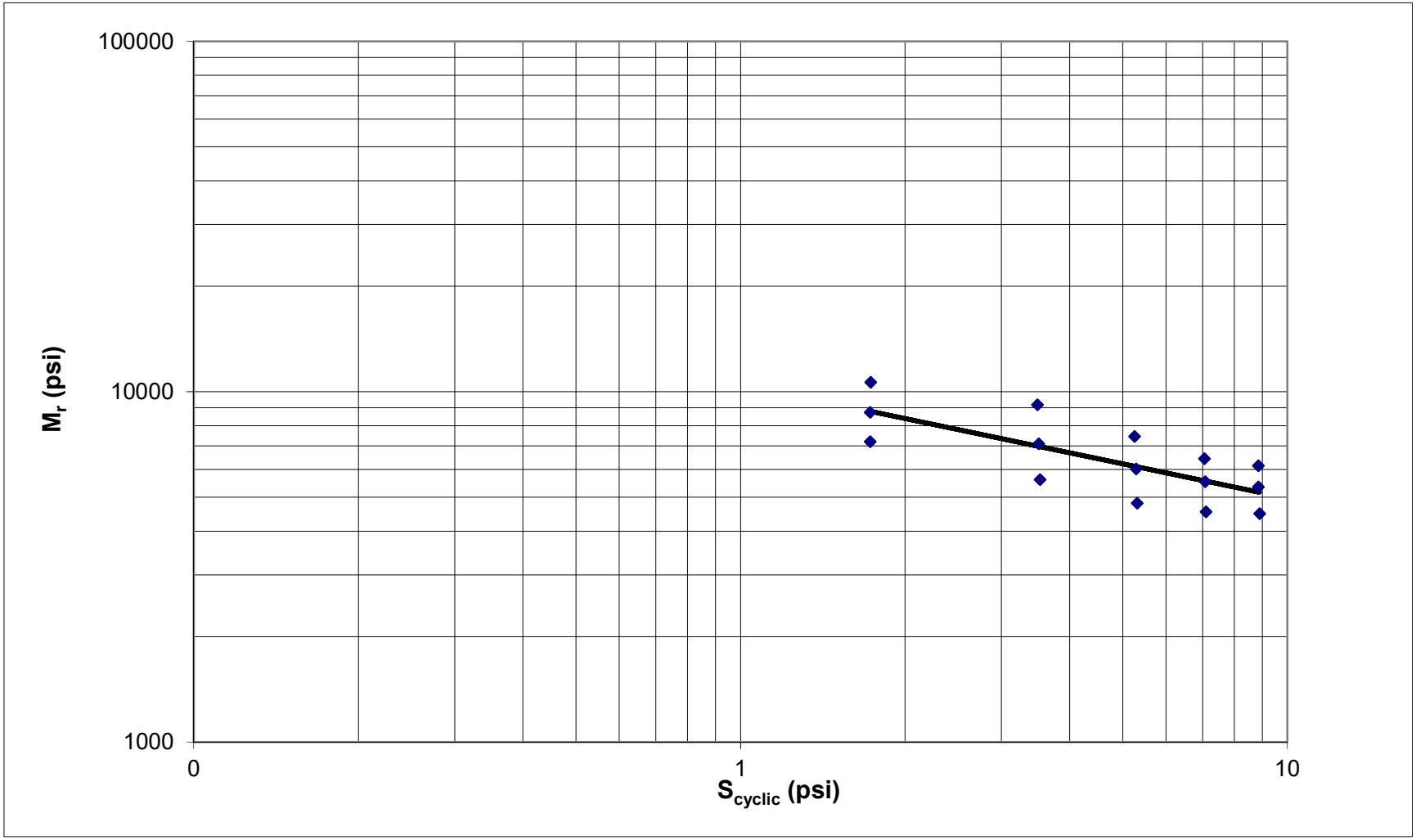
Date Reported: 2/15/2019 Composite S5 & S6_OMC+
Terracon Lab No. 35185110 Lab 852 RM 5 omc+2.5
Project No. 35185110

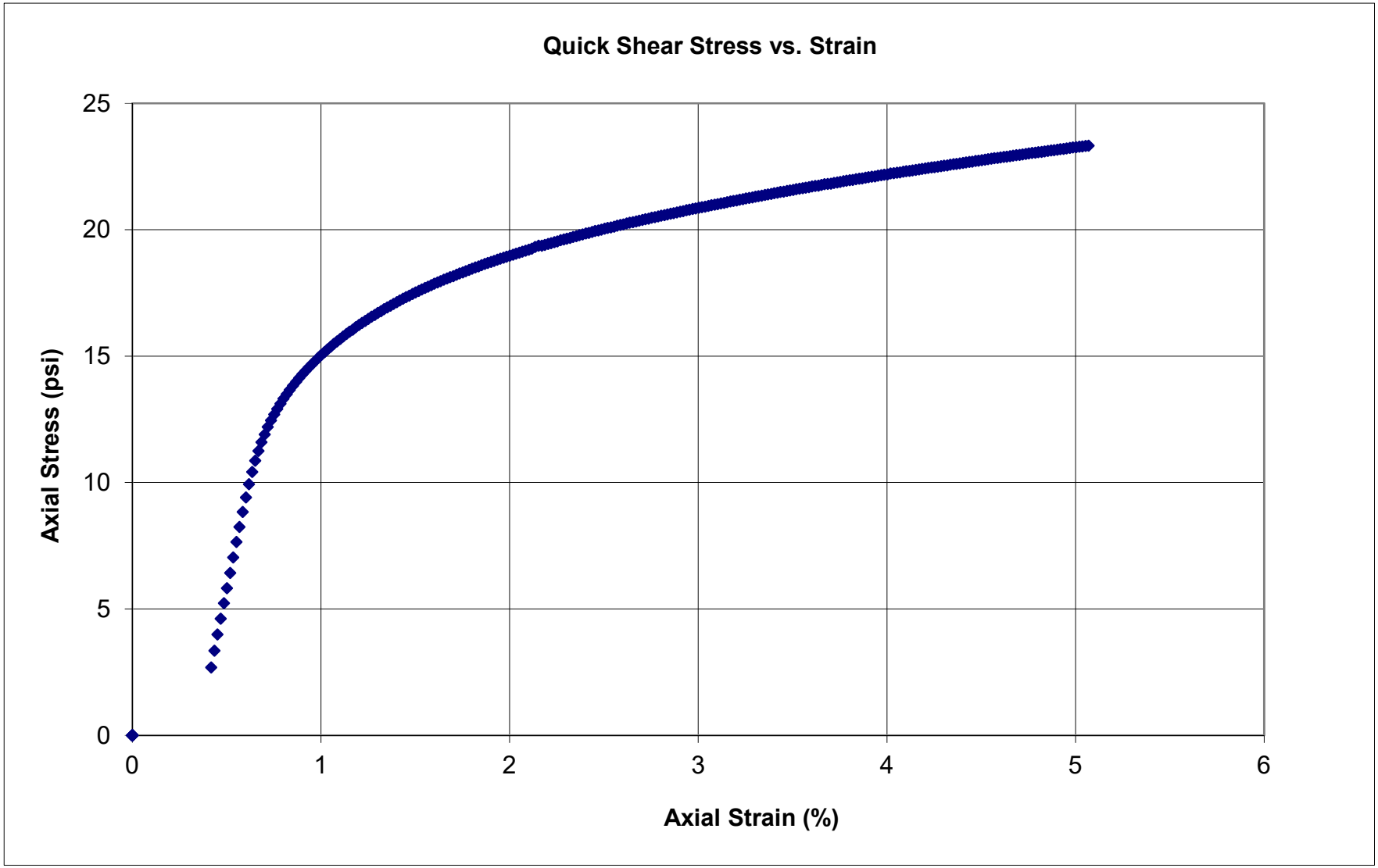


$Mr = K1 \times S_{cylic}^{k2}$

S3 (psi)	K1	K2	R^2
6	13397.0	-0.357	0.97
4	10356.0	-0.312	0.99
2	8308.8	-0.302	0.97
All	10504.9	-0.325	0.57

Terracon

Date Reported: 2/15/2019 Composite S5 & S6_OMC+
Terracon Lab No. 35185110 Lab 852 RM 5 omc+2.5
Project No. 35185110



SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Job No. 070471 Cornie, Harper and Lapile Structures and Approaches ■ Columbia and Union Counties, Arkansas

January 7, 2019 ■ Terracon Project No. 35185110

Terracon GeoReport

SAMPLING

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

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

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

Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

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 (Consistency)	Unconfined Compressive Strength Qu, (psf)	Standard Penetration or N-Value Blows/Ft.
Very Soft	less than 500	0 - 1
Soft	500 to 1,000	2 - 4
Medium Stiff	1,000 to 2,000	4 - 8
Stiff	2,000 to 4,000	8 - 15
Very Stiff	4,000 to 8,000	15 - 30
Hard	> 8,000	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

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

RELATIVE PROPORTIONS OF FINES

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

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)

PLASTICITY DESCRIPTION

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

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

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 ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [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 ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [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"		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.