ARKANSAS DEPARTMENT OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. 061610

FEDERAL AID PROJECT NO. NHPP-0043(35)

I-40 STR. & APPRS. (HWY. 15) (S)

STATE HIGHWAY 15 **SECTION** 11

IN LONOKE **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.

ARKANSAS DEPARTMENT OF TRANSPORTATION
ARDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

October 1, 2019

TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 061610
I-40 Str. & Apprs. (S)
Route 15 Section 11
Lonoke County

Attached is the requested soil survey, strength data, and Resilient Modulus test results for the above referenced job. The project consists of replacing the Highway 15 bridge crossing Interstate 40. Samples were taken in the existing travel lanes, shoulders and ditch line.

The subgrade soils consist primarily of non-plastic sand with some gravel. The subgrade soils are expected to provide a stable working platform with conventional processing if the weather is favorable during construction.

The Right of Way is wooded and based on seasonal conditions the ditches may contain water. If embankment encroaches into the ditches and Right of Way, the water must be drained and the trees and vegetation cleared. All soft unstable organic material should be undercut prior to embankment construction, anticipated to be no more than two feet.

Additional earthwork recommendations will be made upon request when plans are further developed and cross sections are available.

Listed below is the additional information requested for use in developing the plans:

1. The Qualified Products List (QPL) indicates that Aggregate Base Course (Class CL-7) is available from commercial producers in the vicinity of Cabot.

2. Asphalt Concrete Hot Mix

Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	5.1	94.9
Binder Course	4.4	95.6
Base Course	4.2	95.8

Michael C. Benson
Materials Engineer

MCB:pt:bjj
Attachment
cc: State Constr. Eng. – Master File Copy
District 6 Engineer
System Information and Research Div.
G. C. File

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER
*** SOIL SURVEY STRENGTH TEST REPORT ***

DATE - 09/23/2019
JOB NUMBER - 061610

SEQUENCE NO. - 1
MATERIAL CODE - SSRV
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 43
DISTRICT NO. - 06

JOB NAME - I-40 STR. & APPRS. (HWY. 15)(S)

STATION LIMITS	R-VALUE AT 240 psi
BEGIN JOB - END JOB	12
RESILIENT MODULUS STA. LM 2.68	10087

REMARKS -
-

AASHTO TESTS : T190

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
MATERIALS DIVISION

AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
RECOMPACTED SAMPLES

Job No.	061610	**Material Code**	SSRVPS
Date Sampled:	8/6/2019	**Station No.:**	LM 2.68
Date Tested:	September 10, 2019	**Location:**	27'RT
Name of Project:	I-40 STR. & APPRS. (HWY. 15)(S)		
County:	**Code:** 43 **Name:** LONOKE		
Sampled By:	THORNTON	**Depth:**	0-5
Lab No.:	20192421	**AASHTO Class:**	A-6 (8)
Sample ID:	RV806	**Material Type (1 or 2):**	2
LATITUDE:		**LONGITUDE:**	

1. Testing Information:

Preconditioning - Permanent Strain > 5% (Y=Yes or N= No)	N
Testing - Permanent Strain > 5% (Y=Yes or N=No)	N
Number of Load Sequences Completed (0-15)	15

2. Specimen Information:

Specimen Diameter (in):	
Top	3.96
Middle	3.96
Bottom	3.95
Average	3.96
Membrane Thickness (in):	0.01
Height of Specimen, Cap and Base (in):	8.02
Height of Cap and Base (in):	0.00
Initial Length, Lo (in):	8.02
Initial Area, Ao (sq. in):	12.22
Initial Volume, AoLo (cu. in):	98.01

3. Soil Specimen Weight:

Weight of Wet Soil Used (g):	3161.90

4. Soil Properties:

Optimum Moisture Content (%):	13.3
Maximum Dry Density (pcf):	113.4
95% of MDD (pcf):	107.7
In-Situ Moisture Content (%):	N/A

5. Specimen Properties:

Wet Weight (g):	3161.90
Compaction Moisture content (%):	13.6
Compaction Wet Density (pcf):	122.92
Compaction Dry Density (pcf):	108.20
Moisture Content After Mr Test (%):	13.3

6. Quick Shear Test (Y=Yes, N=No, N/A=Not Applicable): #VALUE!

7. Resilient Modulus, Mr: 12763(Sc)^-0.18297(S3)^0.22694

8. Comments _____

9. Tested By: GW **Date:** September 10, 2019

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
MATERIALS DIVISION

AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS
RECOMPACTED SAMPLES

Job No.	061610	**Material Code**	SSRVPS
Date Sampled:	8/6/2019	**Station No.:**	LM 2.68
Date Tested:	September 10, 2019	**Location:**	27'RT
Name of Project:	I-40 STR. & APPRS. (HWY. 15)(S)		
County:	**Code:** 43 **Name:** LONOKE		
Sampled By:	THORNTON	**Depth:**	0-5
Lab No.:	20192421	**AASHTO Class:**	A-6 (8)
Sample ID:	RV806	**Material Type (1 or 2):**	2
LATITUDE:		**LONGITUDE:**	

PARAMETER	*Chamber Confining Pressure*	*Nominal Maximum Axial Stress*	*Actual Applied Max. Axial Load*	*Actual Applied Cyclic Load*	*Actual Applied Contact Load*	*Actual Applied Max. Axial Stress*	*Actual Applied Cyclic Stress*	*Actual Applied Contact Stress*	*Average Recov Def. LVDT 1 and 2*	*Resilient Strain*	*Resilient Modulus*
DESIGNATION	S_3	S_{cyclic}	P_{max}	P_{cyclic}	$P_{contact}$	S_{max}	S_{cyclic}	$S_{contact}$	H_{avg}	ε_r	M_r
UNIT	psi	psi	lbs	lbs	lbs	psi	psi	psi	in	in/in	psi
Sequence 1	6.0	2.0	25.3	22.5	2.7	2.1	1.8	0.2	0.00086	0.00011	17,134
Sequence 2	6.0	4.0	47.5	44.7	2.8	3.9	3.7	0.2	0.00183	0.00023	16,022
Sequence 3	6.0	6.0	70.2	66.6	3.6	5.7	5.4	0.3	0.00298	0.00037	14,669
Sequence 4	6.0	8.0	93.9	87.9	6.1	7.7	7.2	0.5	0.00436	0.00054	13,234
Sequence 5	6.0	10.0	116.9	108.4	8.4	9.6	8.9	0.7	0.00583	0.00073	12,207
Sequence 6	4.0	2.0	25.1	22.4	2.7	2.1	1.8	0.2	0.00098	0.00012	15,022
Sequence 7	4.0	4.0	47.2	44.4	2.7	3.9	3.6	0.2	0.00209	0.00026	13,973
Sequence 8	4.0	6.0	68.9	66.1	2.7	5.6	5.4	0.2	0.00336	0.00042	12,905
Sequence 9	4.0	8.0	92.4	87.3	5.1	7.6	7.1	0.4	0.00473	0.00059	12,120
Sequence 10	4.0	10.0	115.5	108.0	7.5	9.4	8.8	0.6	0.00624	0.00078	11,362
Sequence 11	2.0	2.0	25.1	22.4	2.7	2.1	1.8	0.2	0.00113	0.00014	12,975
Sequence 12	2.0	4.0	46.8	44.1	2.7	3.8	3.6	0.2	0.00240	0.00030	12,056
Sequence 13	2.0	6.0	68.2	65.4	2.7	5.6	5.4	0.2	0.00384	0.00048	11,177
Sequence 14	2.0	8.0	90.5	86.3	4.2	7.4	7.1	0.3	0.00536	0.00067	10,560
Sequence 15	2.0	10.0	113.6	107.0	6.6	9.3	8.8	0.5	0.00696	0.00087	10,087

TESTED BY GW DATE September 10, 2019

REVIEWED BY _____ DATE _____

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT

MATERIALS DIVISION

AASHTO T 307-99 - RESILIENT MODULUS OF SUBGRADE SOILS

RECOMPACTED / THINWALL TUBE SAMPLES

Job No.	061610	**Material Code**	SSRVPS
Date Sampled:	8/6/2019	**Station No.:**	LM 2.68
Date Tested:	September 10, 2019	**Location:**	27'RT
Name of Project:	I-40 STR. & APPRS. (HWY. 15)(S)		
County:	**Code:** 43 **Name:** LONOKE		
Sampled By:	THORNTON	**Depth:**	0-5
Lab No.:	20192421	**AASHTO Class:**	A-6 (8)
Sample ID:	RV806	**Material Type (1 or 2):**	2
LATITUDE:		**LONGITUDE:**	

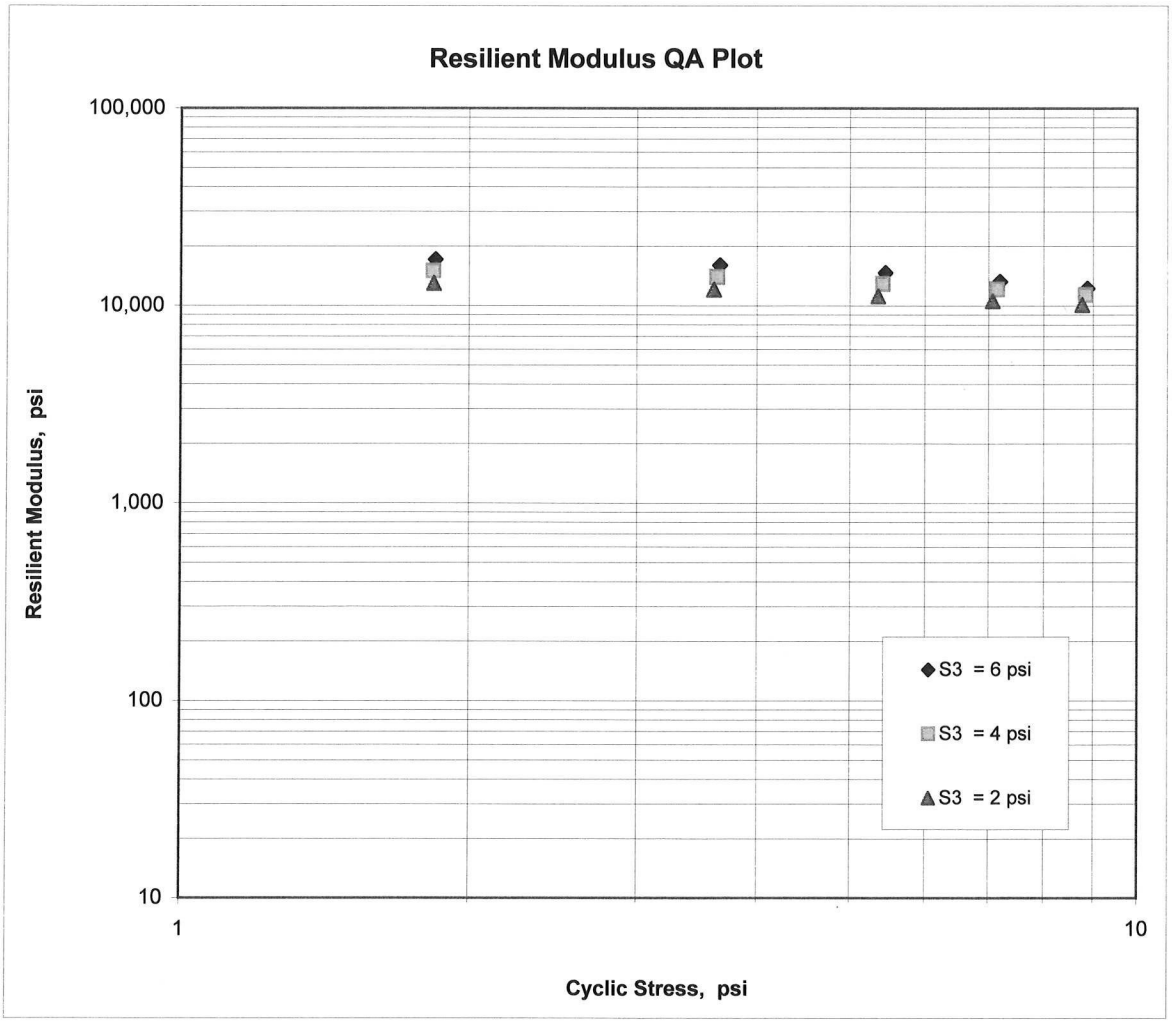
$$M_R = K1\ (S_C)^{K2}\ (S_3)^{K5}$$

K1 = 12,763

K2 = -0.18297

K5 = 0.22694

R^2 = 0.96



ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER
*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 09/24/19
JOB NUMBER - 061610
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE
NAME OF PROJECT - I-40 STR. & APPRS. (HWY. 15)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - LONOKE, COUNTY
SAMPLED BY - THORNTON
SAMPLE FROM - TEST HOLE
MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

SEQUENCE NO. - 1
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 43
DISTRICT NO. - 06

DATE SAMPLED - 08/06/19
DATE RECEIVED - 08/07/19
DATE TESTED - 09/23/19

LAB NUMBER	20192418	20192419	20192420
SAMPLE ID	S800	S801	S802
TEST STATUS	INFORMATION ONLY	INFORMATION ONLY	INFORMATION ONLY
STATION	LM 2.68	LM 2.68	LM 2.68
LOCATION	06 RT	15 RT	27 RT
DEPTH IN FEET	0-5	0-5	0-5
MAT'L COLOR	BROWN	BR/GR	BROWN
MAT'L TYPE			
LATITUDE DEG-MIN-SEC	34 48 1.10	34 48 1.10	34 48 1.10
LONGITUDE DEG-MIN-SEC	91 59 40.10	91 59 40.00	91 59 39.80
% PASSING 2 IN.			
1 1/2 IN.			
3/4 IN.		100	
3/8 IN.	100	99	100
NO. 4	98	98	99
NO. 10	94	94	98
NO. 40	89	89	96
NO. 80	71	83	82
NO. 200	54	74	68
LIQUID LIMIT	ND	ND	ND
PLASTICITY INDEX	NP	NP	NP
AASHTO SOIL	A-4(0)	A-4(0)	A-4(0)
UNIFIED SOIL			
% MOISTURE CONTENT	12.8	16.7	15.4
ACHM SC (IN)	4.0	5.0W	---
ACHM BC (IN)	2.5	---	---
AGG. BASE CRS. CL-7 (IN)	8.0	8.0	---

REMARKS - W=MULTIPLE LAYERS

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER
*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE - 09/24/19
JOB NUMBER - 061610
FEDERAL AID NO.- TO BE ASSIGNED
PURPOSE - SOIL SURVEY SAMPLE
SPEC. REMARKS - NO SPECIFICATION CHECK
SUPPLIER NAME - STATE
NAME OF PROJECT - I-40 STR. & APPRS. (HWY. 15)(S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - LONOKE, COUNTY
SAMPLED BY - THORNTON
SAMPLE FROM - TEST HOLE
MATERIAL DESC. - SOIL SURVEY - R VALUE- PAVEMENT SOUNDINGS

SEQUENCE NO. - 2
MATERIAL CODE - SSRVPS
SPEC. YEAR - 2014
SUPPLIER ID. - 1
COUNTY/STATE - 43
DISTRICT NO. - 06

DATE SAMPLED - 08/06/19
DATE RECEIVED - 08/07/19
DATE TESTED - 09/23/19

LAB NUMBER	20192421	20192422	20192423
SAMPLE ID	S803	S804	S805
TEST STATUS	INFORMATION ONLY	INFORMATION ONLY	INFORMATION ONLY
STATION	LM 2.9	LM 2.9	LM 2.9
LOCATION	6 LT	15 LT	24 LT
DEPTH IN FEET	0-5	0-5	0-5
MAT'L COLOR	BROWN	BROWN	BROWN
MAT'L TYPE			
LATITUDE DEG-MIN-SEC	34 48 11.90	34 48 11.90	34 48 11.90
LONGITUDE DEG-MIN-SEC	91 59 40.10	91 59 40.20	91 59 40.30
% PASSING 2 IN.			
1 1/2 IN.			
3/4 IN.	100		
3/8 IN.	98		
NO. 4	97	100	100
NO. 10	95	99	
NO. 40	91	95	
NO. 80	62	89	
NO. 200	33	81	94
LIQUID LIMIT	ND	27	ND
PLASTICITY INDEX	NP	10	NP
AASHTO SOIL	A-4(0)	A-4(0)	A-4(8)
UNIFIED SOIL			
% MOISTURE CONTENT	16.6	11.2	20.5
ACHM SC (IN)	6.0W	2.0	---
ACHM BC (IN)	---	1.5	---
AGG. BASE CRS. CL-7 (IN)	8.0	8.0	---

REMARKS - W=MULTIPLE LAYERS

AASHTO TESTS : T24 T88 T89 T90 T265

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION
MICHAEL BENSON, MATERIALS ENGINEER
*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE	- 09/24/19	SEQUENCE NO.	- 1
JOB NUMBER	- 061610	MATERIAL CODE	- RV
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 43
SUPPLIER NAME	- STATE	DISTRICT NO.	- 06
NAME OF PROJECT	- I-40 STR. & APPRS. (HWY. 15)(S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS		
LOCATION	- LONOKE, COUNTY	DATE SAMPLED	- 08/06/19
SAMPLED BY	- THORNTON	DATE RECEIVED	- 08/07/19
SAMPLE FROM	- TEST HOLE	DATE TESTED	- 09/23/19

MATERIAL DESC. - SOIL SURVEY - RESISTANCE R-VALUE ACTUAL RESULTS

LAB NUMBER	- 20192421	-	-
SAMPLE ID	- RV806	-	-
TEST STATUS	- INFORMATION ONLY	-	-
STATION	- LM 2.68	-	-
LOCATION	- 27 RT	-	-
DEPTH IN FEET	- 0-5	-	-
MAT'L COLOR	- BROWN	-	-
MAT'L TYPE	-	-	-
LATITUDE DEG-MIN-SEC	- 34 48 1.10	-	-
LONGITUDE DEG-MIN-SEC	- 91 59 39.80		
% PASSING 2 IN.	-	-	-
1 1/2 IN.	-	-	-
3/4 IN.	- 100	-	-
3/8 IN.	- 99	-	-
NO. 4	- 97	-	-
NO. 10	- 96	-	-
NO. 40	- 94	-	-
NO. 80	- 92	-	-
NO. 200	- 88		
LIQUID LIMIT	- 28	-	-
PLASTICITY INDEX	- 11	-	-
AASHTO SOIL	- A-6(8)	-	-
UNIFIED SOIL	-	-	-
% MOISTURE CONTENT	-		

REMARKS - W=MULTIPLE LAYERS

AASHTO TESTS : T24 T88 T89 T90 T265

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

P.O. Box 30970
Little Rock, Arkansas 72260-0970
#1 Trigon Place 72209
(501) 455-2536
FAX (501) 455-4137

November 2, 2020
Job No. 20-083

Garver, LLC
4701 Northshore Drive
North Little Rock, Arkansas 72118

Attn: Mr. John Ruddell, P.E., S.E.
Vice President, Bridge Design Manager

GEOTECHNICAL INVESTIGATION
ARDOT JOB 061610 I-40 STR. & APPRS. (HWY. 15) (S)
LONOKE COUNTY, ARKANSAS

INTRODUCTION

This report provides the final results of the geotechnical investigation performed for ARDOT Job 061610 I-40 Str. & Apprs. (Hwy. 15) (S). Specifically, results and geotechnical recommendations relevant to the replacement of the Hwy. 15 over Interstate 40 bridge in Lonoke County, Arkansas are provided herein. This geotechnical investigation was authorized on behalf of Garver, LLC by the subconsultant agreement of May 9, 2019. This study has been performed in general accordance with the Agreement of May 9, 2019. Notice to proceed was received on July 28, 2020. Results of this study have been provided to Garver, LLC (Engineer) as data were developed.

The existing bridge will be replaced with a new bridge in an offset alignment east of the existing overpass. We understand the replacement bridge structure will be a continuous plate girder unit with three (3) bents, two (2) spans, and a total length of approximately 302 feet. We also understand that a foundation system consisting of steel shell piles is planned for all bents. Foundation loads of the new bridge are anticipated to be moderate. MSE retaining walls (Retaining Wall Nos. 1 and 2) are planned at the south and north bridge ends (Bents 1 and 3), respectively. A preliminary bridge layout is included in Appendix A.

The purposes of this geotechnical study were to explore subsurface conditions at the replacement bridge location and to develop recommendations to guide design and construction of foundations, MSE walls, and earthwork. These purposes have been achieved by a multi-phased study that has included the following.

- Drilling sample borings to evaluate subsurface conditions and obtain soil samples for laboratory testing.
- Performing laboratory tests to evaluate pertinent engineering properties of the foundation and subgrade strata.
- Analyzing field and laboratory data to develop recommendations for foundation design, embankment configurations, and construction considerations.

The results of the subsurface exploration program and laboratory test results are included in the attachments. Recommendations for design and construction are discussed in subsequent report sections.

SUBSURFACE EXPLORATION

Subsurface conditions at the replacement bridge location were investigated by drilling three (3) sample borings to depths of 80 to 100 ft below existing grades in the structure areas (Borings S1, S2, and S3) and six (6) sample borings to depths of 20 to 50 ft in or near the plan wall alignments (Borings W1 through W6). The site vicinity is shown on Plate 1. The approximate boring locations at the replacement bridge location are shown on Plate 2. Logs of the borings, presenting descriptions of the subsurface strata encountered and results of the field and laboratory tests, are included as Plates 3 through 16. The approximate centerline station and offset of the boring locations are noted on the logs. In addition, the approximate ground surface elevation, as inferred from the topographic information provided by the Engineer, is also shown on the logs. It must be recognized that the elevations shown are approximate and actual elevations may vary. A key to the terms and symbols used on the boring logs is presented as Plate 17. A generalized subsurface profile in the bridge alignment is provided in Appendix B.

The borings were drilled with a truck-mounted SIMCO 2800 rotary-drilling rig and track-mounted CME-55 and CME-850X rotary-drilling rigs. A combination of dry-auger and rotary-wash drilling techniques was utilized to advance the borings. Samples were obtained using a 2-in.-diameter split-barrel sampler driven into the strata by blows of a 140-lb automatic hammer with 30-in. drop in accordance with Standard Penetration Test (SPT) procedures. The number of blows required to drive the standard split-barrel sampler the final 12 in. of an 18-in. total drive, or a portion thereof, is defined as the Standard Penetration Number (N). Recorded N-values are shown on the boring logs in the "Blows Per Ft" column.

All samples were removed from samplers in the field. Samples were then visually classified by the geotechnical technician. Representative samples were placed in appropriate containers to

prevent moisture loss and/or disturbance during transfer to our laboratory for further examination and testing.

The borings were advanced using dry-auger procedures to the extent possible to facilitate evaluation of shallow groundwater conditions. Observations regarding groundwater are noted in the lower-right portion of each log and are discussed in subsequent sections of this report. All boreholes were backfilled after obtaining final water level readings.

LABORATORY TESTING

To evaluate pertinent soil properties, laboratory tests consisting of classification tests and natural water content determinations were performed. A total of 95 natural water content determinations were performed to develop information on *in-situ* soil water content. Water content results are plotted on the boring log forms in accordance with the scale and symbols shown in the legend located in the upper-right corner of the logs.

To verify field classification and to evaluate soil plasticity, 40 liquid and plastic limit (Atterberg limits) determinations and 50 sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the logs as pluses inter-connected with a dashed line using the water content scale or are denoted as "non-plastic". The percentage of soil passing through the No. 200 Sieve is noted in the "- No. 200 %" column on the appropriate log forms. Classification test results, along with soil classification by the Unified Soil Classification System and AASHTO Classification System and grain size distribution curves, are presented in Appendix C.

GENERAL SITE and SUBSURFACE CONDITIONS

Site Conditions

The project location is in the western portion of Lonoke County where Highway 15 crosses over Interstate 40. The project site is about 5 miles west of the Lonoke town center and located just northeast of the Remington Arms Plant. The area surrounding the bridge location is mostly undeveloped woodlands with agricultural and some commercial development. The subject alignment crosses over I-40, which is a four-lane divided interstate roadway with a wide median. Surface drainage of the interstate is facilitated by swales on each side of the roadway.

The existing bridge is a two-lane roadway with the bridge ends and approaches on earthen embankments. The abutment embankments have simple slopes. The bridge deck is visibly in poor

condition. The alignment of the new bridge is east of the existing bridge. The surrounding terrain is mostly flat with poor to fair surface drainage.

Site Geology

The project alignment is located in the Mississippi Embayment Physiographic Province. The site vicinity is in the mapped exposure of Quaternary Terrace Deposits. The Terrace deposits are flood-plain deposits comprising terraces of gravel, sand, silt, and clay and mixtures of any or all of these clastic materials. The overall thickness of the Terrace Deposits varies and individual horizontal and vertical distributions of soil units are highly variable. The Terrace Deposits are typically underlain at variable depths by well-consolidated Tertiary Period sediments. Bedrock (Paleozoic rocks) in the site vicinity is reported to be in excess of 600 ft deep.

Seismic Conditions

Based on the site geology, the average soil conditions revealed by the borings, and our experience in the area, a Seismic Site Class D (stiff soil profile) is considered fitting for the Hwy. 15 over I-40 replacement bridge location with respect to the criteria of the AASHTO LRFD Bridge Design Specifications Seventh Edition 2014[1]. Given the replacement bridge location and AASHTO code-based values, the 1.0-sec period spectral acceleration coefficient for Site Class D (S_1) is 0.101 and the 1.0-sec period spectral acceleration coefficient (S_{D1}) value for Site Class D is 0.243. Utilizing these parameters, Table 3.10.6-1[2] indicates that a Seismic Performance Zone 2 is fitting for the Hwy. 15 bridge over I-40 site. In reference to the 2011 edition of the AASHTO Guide Specifications, the Peak Ground Acceleration (PGA) having a 7 percent chance of exceedance in 75 years (or mean return period of approximately 1000 years) is predicted to be 0.231 for a Seismic Site Class D for the bridge location.

Analyses were performed to evaluate the liquefaction potential of the foundation soils. These analyses were performed utilizing the procedures proposed by Idriss and Boulanger[3] in 2008. An earthquake Moment Magnitude (M_w) value of 5.0 and a design PGA (A_S) value of 0.231 were utilized in the liquefaction analyses.

The results of liquefaction analyses are presented in Appendix D as plots of calculated factors of safety against liquefaction versus depth. The calculated factor of safety against

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1 AASHTO LRFD Bridge Design Specifications, 7th Edition; AASHTO; 2014.
2 AASHTO LRFD Bridge Design Specification, AASHTO; 2012
3 "Soil Liquefaction during Earthquakes." Earthquake Engineering Research Institute, MNO-12, Idriss and Boulanger, 2008.

liquefaction was determined as the ratio of cyclic shear stress required to cause liquefaction (soil strength) to cyclic shear stress induced by an earthquake (earthquake loading). The liquefaction analysis results indicate that for a design earthquake with a 7 percent chance of exceedance in 75 years (or mean return period of approximately 1000 years), the liquefaction potential is low for the replacement bridge site.

Subsurface Conditions

Subsurface conditions revealed by the borings performed for the replacement bridge can be summarized into the following general stratigraphy.

Stratum I: The existing embankment fill found at the bridge ends is variable and includes very soft to stiff brown, tan, reddish brown, and gray clay, silty clay, and fine sandy clay. These soils typically classify as A-6 or A-7-6 by the AASHTO classification system (AASHTO M 145), which correlates with very poor to fair subgrade support for pavement structures. The embankment fill exhibits variable poor to fair compaction with high to moderate compressibility. Fill content and compaction is likely to vary within the embankment.

Stratum II: The natural upper soil units at the replacement bridge location are firm to very stiff gray, tan, yellowish tan, and reddish brown silty clay and clay extending to variable depths of 38 to 53ft (approximately El 209 to El 219). The fine-grained clayey soils have variable low to high plasticity, low to moderate shear strength, and high to low compressibility. In general, shear strength increases and compressibility decreases with depth.

Stratum III: Medium dense to very dense reddish tan silty fine sand is below the natural soils of Stratum II and extend to approximately El 184 to El 196. The silty fine sand exhibits medium to high relative density and low compressibility, and typically has in excess of 30 percent passing the No. 200 sieve.

Stratum IV: Underlying Stratum III to in excess of the depths of exploration is dense to very dense reddish tan to tan to gray fine sand and fine to medium sand. These granular soils exhibit high relative density and low compressibility.

To aid in visualizing subsurface conditions at the replacement bridge alignment, a generalized subsurface profile is provided in Appendix B. It should be recognized that the stratigraphy illustrated by the profile has been inferred between discrete boring locations. In view of the natural variations in stratigraphy and conditions, variations from the stratigraphy illustrated by the profile should be anticipated. Additionally, the natural transition between strata is generally gradual, and the stratigraphy described in the sections above may vary.

Groundwater Conditions

Shallow groundwater was locally encountered at 6-ft depth in August 2020. The variable depth and volume of groundwater is indicative of locally perched water. Groundwater levels will

vary, depending on seasonal precipitation, surface runoff and infiltration, and water levels in nearby drainage features.

ANALYSES and RECOMMENDATIONS

Bridge Foundation Design

Foundations for the replacement bridge must satisfy two (2) basic and independent design criteria: a) foundations must have an acceptable factor of safety against bearing failure under maximum design loads, and b) foundation movement due to consolidation or swelling of the underlying strata should not exceed tolerable limits for the structures. Construction factors, such as installation of foundations, excavation procedures, and surface and groundwater conditions must also be considered.

In light of the results of the borings performed for this study, the anticipated moderate bridge foundation loads, and for constructability, we recommend that foundation loads of the replacement bridge be supported on piling. Given the medium to high relative density of the granular soil units (Strata III and IV), we recommend that piles extend to these units with relatively high bearing capacity and low compressibility. Recommendations for piling foundations are discussed in the following paragraphs.

Pile Foundations

We recommend the bridge foundation loads be supported on a deep foundation system comprised of steel shell piles. We understand that 18-in.-diameter steel shell piles are planned at the bridge bents. All steel shell piles will be filled with concrete after initial driving. Shear rings, shear studs, or alternatives may be considered on the inside walls of the steel shells to enhance bonding between the concrete and the steel shells.

Nominal single pile capacity curves for 18-in.-diameter steel shell piles are provided in Attachment 1. Pile capacities for the end bents, i.e., Bents 1 and 3 have been developed based on the assumption that bridge ends will be cut to the MSE wall subgrade elevation at El 248±, with casing installed to the abutment cap bottoms. Piles will not mobilize bearing capacity until below El 248±.

Based on AASHTO LRFD geotechnical design procedures, an effective resistance factor (φ_{stat}) of 0.45 is recommended for evaluation of factored pile compression capacity. For evaluation of factored pile uplift capacities, a resistance factor (φ_{up}) of 0.35 is recommended. These resistance factors are based on Strength Limit States. For Extreme Event Limit States, such as earthquake

loading and collision, resistance factors of 1.0 and 0.8 are recommended for evaluating compression and uplift capacities, respectively. Post-construction settlement of piles installed to the recommended factored capacities should be less than 1.0 inch.

Given an anticipated construction sequence with cut at the bridge ends to the plan subgrade at about El 248 and embankment fill placement in excess of 30 days prior to pile driving, downdrag loads on piles are expected to be negligible. Pre-boring is not expected to be required for pile installation.

The nominal axial capacities are based on single, isolated foundations. Piles spaced closer than three (3) pile diameters may develop lower individual capacity due to group effects. The potential for group capacity reductions should be evaluated for pile spacing closer than three (3) diameters.

Battered piles can be utilized to resist lateral loads. The axial capacity of battered piles may be taken as equivalent to that of a vertical pile with the same tip elevation and embedment. Special driving equipment is typically required where pile batter exceeds about 1-horizontal to 4-vertical.

Computed capacities for driven piling are based on driving piles to the required penetration, rather than use of jetting or other methods. When jetting, etc., is used to aid pile installation the conditions used in calculations may not be met. Hence, capacities may be significantly different and calculated capacities should be re-evaluated. Pile capacity and as-built depth must be field verified.

Lateral Load Analysis Parameters.

We understand that lateral load analyses of the pile foundations will be performed by Others. Recommended parameters for use in lateral load analyses are summarized in Appendix E. The summaries are based on the depth of pile penetration below the pile caps. At the bridge ends, the depth between the pile caps (±El 269) and the MSE wall subgrade (±El 248) is neglected.

The values shown in Appendix F have been selected based on published correlation with classification and engineering properties and static loading conditions. In addition, group action should be considered where the pile spacing in the direction of loading is less than eight (8) pile diameters. In this case, the subgrade modulus value (k) should be reduced based on the ratio of spacing to pile diameter. Recommended reduction factors are summarized in the table below.

Pile Spacing in Direction of Loading (D=pile diameter)	Capacity Reduction Factor
8D	1.0
6D	0.7

Pile Spacing in Direction of Loading (D=pile diameter)	Capacity Reduction Factor
4D	0.4
3D	0.25

WEAP Driveability Analyses

To evaluate suitable driving equipment, driveability analyses have been performed for representative bents utilizing wave equation analysis of piles (WEAP) and the computer program GRLWEAP 2010[4]. A yield strength (f_y) of 50 kips per sq in. was assumed for the 18-in.-diameter steel shell piles. Various open-ended hammers were utilized for the driveability analyses. Hammer and pile cushion information was based on manufacturer-recommended values. A summary of recommended minimum pile hammer energy values for the 18-in.-diameter steel shell piles at each bent is provided in the table below.

Bent No.	**Cap bottom El, ft**	**Estimated tip El, ft**	**Pile length, ft**	**Nominal pile capacity, tons**	**Recommended minimum hammer energy, kip-ft**
1	269	204	65	225	83.820
2	244	191	53	285	107.078
3	269	204	65	225	83.820

A detailed summary of recommended minimum pile hammer energy and graphical results of the drivability analyses are provided in Appendix H.

Mechanically Stabilized Earth (MSE) Walls

The project includes mechanically stabilized earth (MSE) retaining walls on both bridge ends. Wall height varies from a nominal 2 ft to 26 ft, with the maximum height of the walls near the center of the wall alignment and the height tapering out away from the bridge ends and parallel to the roadway. Design of MSE walls must include consideration of both internal and external stability. Design with respect to internal stability must be performed by the specific wall designer based on final plans and configurations. Analyses have been performed to verify external (global) stability and bearing capacity.

MSE Wall Bearing. The natural subgrade and foundation soils in the wall alignment generally consists of soft to stiff silty clay. These soils exhibit low to moderate shear strength and moderate to low compressibility. Depending on final grading plans, some undercut and replacement

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4 GRLWEAP 2010; Pile Dynamics, Inc.

or ground improvement by will be required to improve bearing capacity and to limit settlement. MSE wall bearing recommendations are summarized below.

1. Wall 1 – South bridge end
    a. Undercut for ground improvement
        i. Undercut 4 to 9 ft below plan El subgrade, i.e., to ±El 244 to ±El 239
        ii. Backfill with ARDOT Standard Specifications Section 302, SM-1, ARDOT Standard Specifications Section 303, Class 7 crushed stone aggregate base, or Select Granular Backfill (AASHTO M43 No. 57).
        iii. Nominal bearing on undercut backfill: 6000 lbs per sq ft
    b. Rammed aggregate pier alternative
        i. Install rammed aggregate piers under reinforced zone of wall
        ii. Estimated length: 14 to 16 ft below leveling pad / subgrade, i.e., El 234± to El 232±
        iii. Estimated area ratio: 20 to 30 percent
        iv. Nominal bearing on undercut backfill: 10,000 lbs per sq ft
        v. Rammed aggregate pier design and construction must be provided by approved specialty contractors on behalf of the Contractor.
2. Wall 2 – North bridge end
    a. Bear in natural stiff silty clay or compacted undercut backfill
    b. Localized undercuts on the order of 2 ft, more or less, could be required to develop suitable bearing.
    c. Backfill undercuts with ARDOT Standard Specifications Section 303, Class 7 crushed stone aggregate base, or Select Granular Backfill (AASHTO M43 No. 57).
    d. Nominal bearing on stiff silty clay or undercut backfill: 7500 lbs per sq ft
3. Resistance factor (φ_b) for bearing resistance: 0.65
4. Resistance to sliding
    a. for bearing on silty clay or undercut backfill: 0.35
    b. for bearing on rammed aggregate pier improved foundation: 0.40
5. Resistance factor (φ_τ) for sliding resistance: 1.0

Subgrade and foundation preparation in the wall locations and under all embankments must include stripping all organics and thorough proof-rolling. The MSE wall leveling pads and reinforced zones should bear as recommended above and at a minimum depth of 2 ft below lowest adjacent grade. A minimum wall embedment of 2 ft is recommended.

The suitability of the MSE wall bearing strata must be field verified by the Engineer at the time of construction. Where undercuts are warranted, these should extend a minimum horizontal distance determined by a 1-horizontal to 1-vertical (1H:1V) projection beyond the reinforced zone to the undercut bottom. Where existing structures limit the undercut extent, the undercut limits should be field verified and adjusted as needed.

Where seepage into undercuts is apparent or positive drainage cannot be assured, Select Granular Backfill should be fully encapsulated in a filter fabric geotextile complying with ARDOT Standard Specifications Subsection 625.02, Type 2.

Global Stability - MSE Walls at Bridge Abutments. Stability analyses were performed to verify global stability of the MSE walls at both the north and south bridge abutments for the Hwy. 15 over I-40 Bridge. To evaluate suitability of the plan configurations, slope stability analyses have been performed. A 250 lbs per sq ft uniform surcharge from vehicles was included for the purposes of stability analyses. Stability analyses were performed using the computer program SLOPE/W 2020[5] and a Bishop analysis. For the embankment slopes, three (3) general loading conditions were evaluated, i.e., End of Construction, Long Term, and Seismic Conditions. For analysis of the seismic condition, a horizontal seismic acceleration coefficient (k_h) of one-half the peak acceleration (A_s) was used, a value of 0.115.

For the purposes of the stability analyses, unclassified embankment as per Standard Specifications for Highway Construction, 2014 Edition, Subsection 210.06 was assumed for embankment fill. Accordingly, an undrained shear strength value of 1500 lbs per sq ft has been assumed for the embankment fill. Depending on the specific borrow utilized for embankments, verification of stability could be warranted.

The results of the stability analyses performed for the walls are provided in Appendix H. These results indicate acceptable stability for all conditions analyzed.

Site Grading and Subgrade Preparation

Site grading and site preparation in the bridge alignment should include necessary clearing and grubbing of trees and underbrush and stripping the organic-containing surface soils in work areas. Where fill depths in excess of 3 ft are planned, stumps may be left after close cutting trees to grade, as per ARDOT criteria. Otherwise, tree stumps must be completely excavated and stumpholes properly backfilled.

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5 Slope/W 2020; GEO-SLOPE International; 2020.

The depth of stripping will be variable, with deeper stripping depths in wooded areas, and less stripping required in the predominant open areas. In general, the stripping depth is estimated to be about 6 to 9 in. in cleared areas but may be 18 to 24 in. or more in the localized wooded areas and areas with thick underbrush. The zone of organic surface soils should be completely stripped in the embankment footprint areas and at least 5 ft beyond the projected embankment toe to the extent possible.

Following required clearing and grubbing and stripping, and prior to fill placement or otherwise continuing with subgrade preparation, the extent of weak and unsuitable soils should be determined. Thorough proof-rolling should be performed to verify subgrade stability. Proof-rolling should be performed with a loaded tandem-wheel dump truck or similar equipment. Unstable soils exhibiting a tendency to rut and/or pump should be undercut and replaced with suitable fill. Care should be taken that undercuts, stump holes, and other excavations or low areas resulting from subgrade preparation are properly backfilled with compacted fill. Based on the results of the borings, localized undercutting could be required to develop subgrade stability. Potential undercut depths are estimated to be on the order of 2 to 4 ft, more or less. Deeper undercuts could be required for ground improvement in the footprints of MSE reinforced zones.

In areas of deep fills, the potential exists for use of thick initial lifts ("bridging"), as per ARDOT criteria. Bridge lifts will be subject to some consolidation. Settlement of a primarily granular fill suitable for use in bridging would be expected to be relatively rapid and long-term post-construction settlement would not be expected to be a significant concern. Where clayey soils are placed in thick lifts, long term settlement will be more significant. Consequently, we recommend that the use of "bridging" techniques be limited to granular borrow soils, i.e., sand or gravel. Where fill amounts are limited to less than about 3 ft, bridging will be less effective and the potential for undercut or stabilization will increase. Use of bridging techniques and fill lift thickness must be specifically approved by the Engineer or Department.

Subgrade preparation and mass undercuts should extend at least 5 ft beyond the embankment toes to the extent possible. Subgrade preparation in roadway areas should extend at least 3 ft outside pavement shoulder edges to the extent possible. Where existing drainage features will be backfilled, these should be completely mucked out and all loose and/or organic soils removed prior to fill placement.

With the exception of reinforced zones of MSE walls and MSE wall undercuts, fill and backfill for embankment construction may consist of unclassified borrow free of organics and

other deleterious materials as per Standard Specifications for Highway Construction, 2014 Edition, Subsection 210.06. Granular soils must be protected from erosion with a minimum 18-in.-thick armor of clayey soil. The on-site silty clay and sandy clay are typically suitable for this use.

Subgrade preparation should comply with Standard Specifications for Highway Construction, 2014 Edition, Section 212. Embankments should be constructed in accordance with Standard Specifications for Highway Construction, 2014 Edition, Section 210. Fill and backfill should be placed in nominal 6- to 10-in.-thick loose lifts. All fill and backfill must be placed in horizontal lifts. Where fill is placed against existing slopes, short vertical cuts should be "notched" in the existing slope face to facilitate bonding of horizontal fill lifts. The in-place density and water content should be determined for each lift and should be tested to verify compliance with the specified density and water content prior to placement of subsequent lifts.

CONSTRUCTION CONSIDERATIONS

Groundwater and Seepage Control

Positive surface drainage should be established at the start of the work, be maintained during construction and following completion of the work to prevent surface water ponding and subsequent saturation of subgrade soils. Density and water content of all earthwork should be maintained until the retaining wall, embankments, and bridge work is completed.

Subgrade soils that become saturated by ponding water or runoff should be excavated to undisturbed soil. The embankment subgrade should be evaluated by the Engineer during subgrade preparation.

Groundwater was locally encountered at 6-ft depth in the borings drilled in August 2020. This is considered perched water and true groundwater levels are expected to be considerably deeper. Nevertheless, shallow perched groundwater could be locally encountered in the near-surface soils. The volume of groundwater produced can be highly variable depending on the condition of the soils in the immediate vicinity of the excavation. In addition, seasonal surface seeps or springs could develop.

Seepage into excavations and cuts can typically be controlled by ditching or sump-and-pump methods. If seepage into excavations becomes a problem, backfill should consist of select granular backfill (AASHTO M43, No. 57 stone), stone backfill (Standard Specifications for Highway Construction, 2014 Edition, Section 207), or approved alternates extending up to an elevation above the inflow of seepage. In areas of seepage infiltration, the granular fill should be

encapsulated with a filter fabric complying with Standard Specifications for Highway Construction, 2014 Edition, Subsection 625.02, Type 2 and vented to positive discharge. Where surface seeps or springs are encountered during site grading, we recommend the seepage be directed via French drains or blanket drains to positive discharge at daylight or to storm drainage lines.

Piling

Piles should be installed in compliance with Standard Specifications for Highway Construction, 2014 Edition, Section 805. Pre-boring is not anticipated to be required for pile installation. Recommendations for minimum pile hammer energy are provided in Appendix G. A specific review and analysis of the pile-hammer system proposed by the Contractor should be performed by the Engineer or Department prior to hammer acceptance and start of pile installation.

The density of the predominantly granular overburden soils increases with depth. As a result, difficult driving could be experienced at depth. Use of a higher energy hammer could be warranted for hard driving conditions. Any use of vibrating or jetting for pile installation should be approved by the Engineer or Department. If piles are installed by vibrating or jetting, the geotechnical capacity of piles should be re-evaluated if these values are utilized in design. Where piles are advanced by approved vibrating or jetting, we recommend that the final 5 ft of penetration, or driving to refusal, be achieved with an impact hammer.

Safe bearing capacity of production piles should be determined by Standard Specifications for Highway Construction, 2014 Edition, Section 805.09, Method B. Driving records should be available for review by the Engineer during pile installation. Piles should be carefully examined prior to driving and piles with structural defects should be rejected. Any splices in steel shell piles should develop the full cross-sectional capacity of un-spliced piles.

Pile installation should be monitored by qualified personnel to maintain specific and complete driving records and to observe pile installation procedures. Blow counts on steel shell piles should be limited to about 20 blows per inch. We recommend that practical pile refusal be defined as a penetration of 0.5 in. or less for the final 10 blows.

CLOSURE

The Engineer or Department or a designated representative thereof should monitor site preparation, grading work and foundation construction. Subsurface conditions significantly at variance with those encountered in the borings should be brought to the attention of the

Geotechnical Engineer. The conclusions and recommendations of this report should then be reviewed in light of the new information.

The following illustrations are attached and complete this final report.

Plate 1	Site Vicinity
Plate 2	Plan of Borings
Plates 3 through 16	Boring Logs
Plate 17	Key to Terms and Symbols
Appendix A	Preliminary Bridge Layout
Appendix B	Generalized Subsurface Profile
Appendix C	Classification Test Results
Appendix D	Liquefaction Analysis Results
Appendix E	Nominal Pile Capacity Curves
Appendix F	Lateral Load Analyses Parameters
Appendix G	Driveability Analyses - WEAP
Appendix H	Stability Analyses Results

* * * * *

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report, or if we may be of additional assistance, please call on us.

Sincerely,

GRUBBS, HOSKYN,
BARTON &WYATT, INC.

Ben Davis (AW)

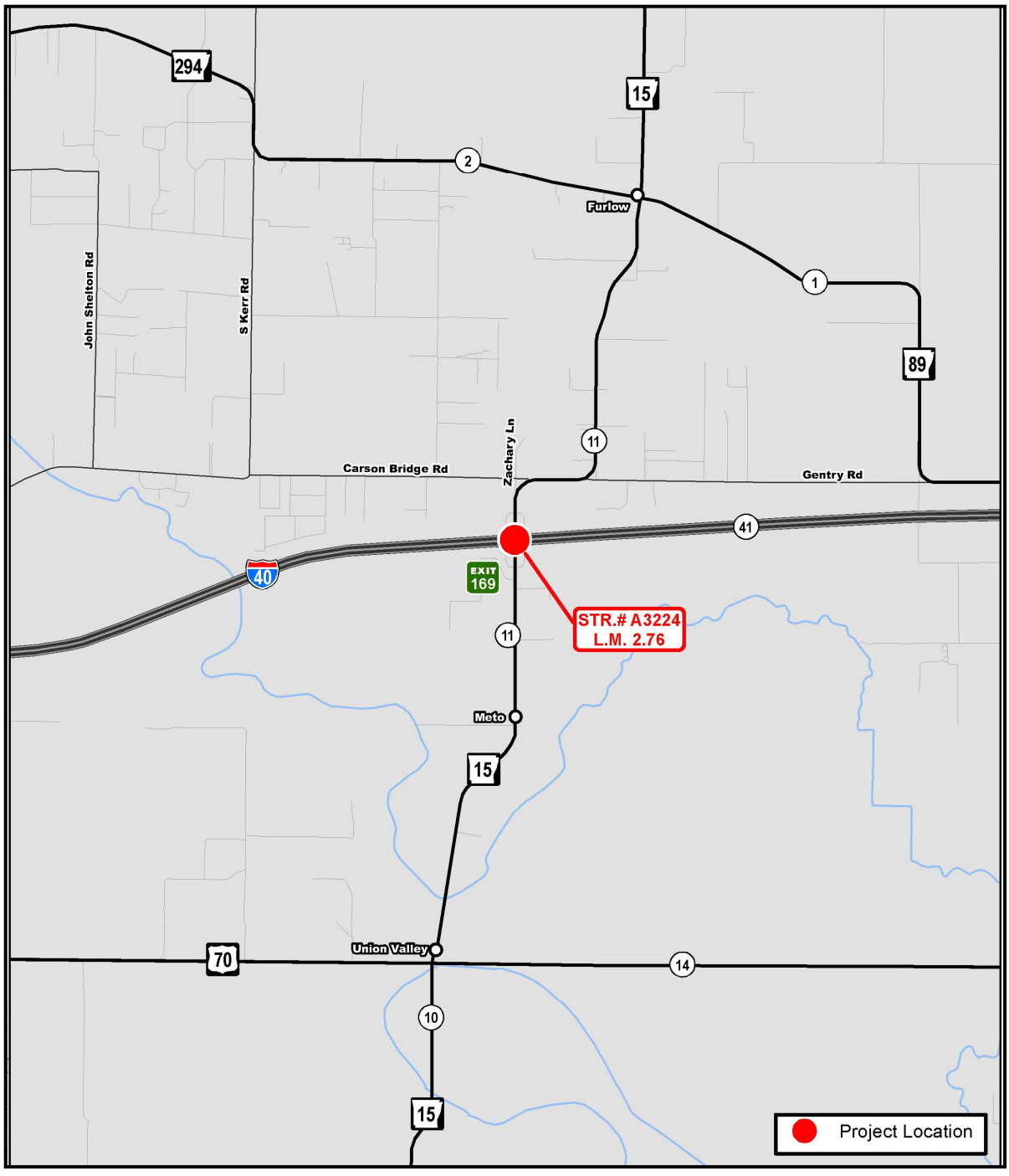
Ben Davis, P.E.
Project Engineer

Mark E. Wyatt, P.E.
President

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7791
MARK E. WYATT

BJD/MEW:jw

Copies Submitted: Garver, LLC
Attn: Mr. John H. Ruddell, P.E., S.E. (1-email)

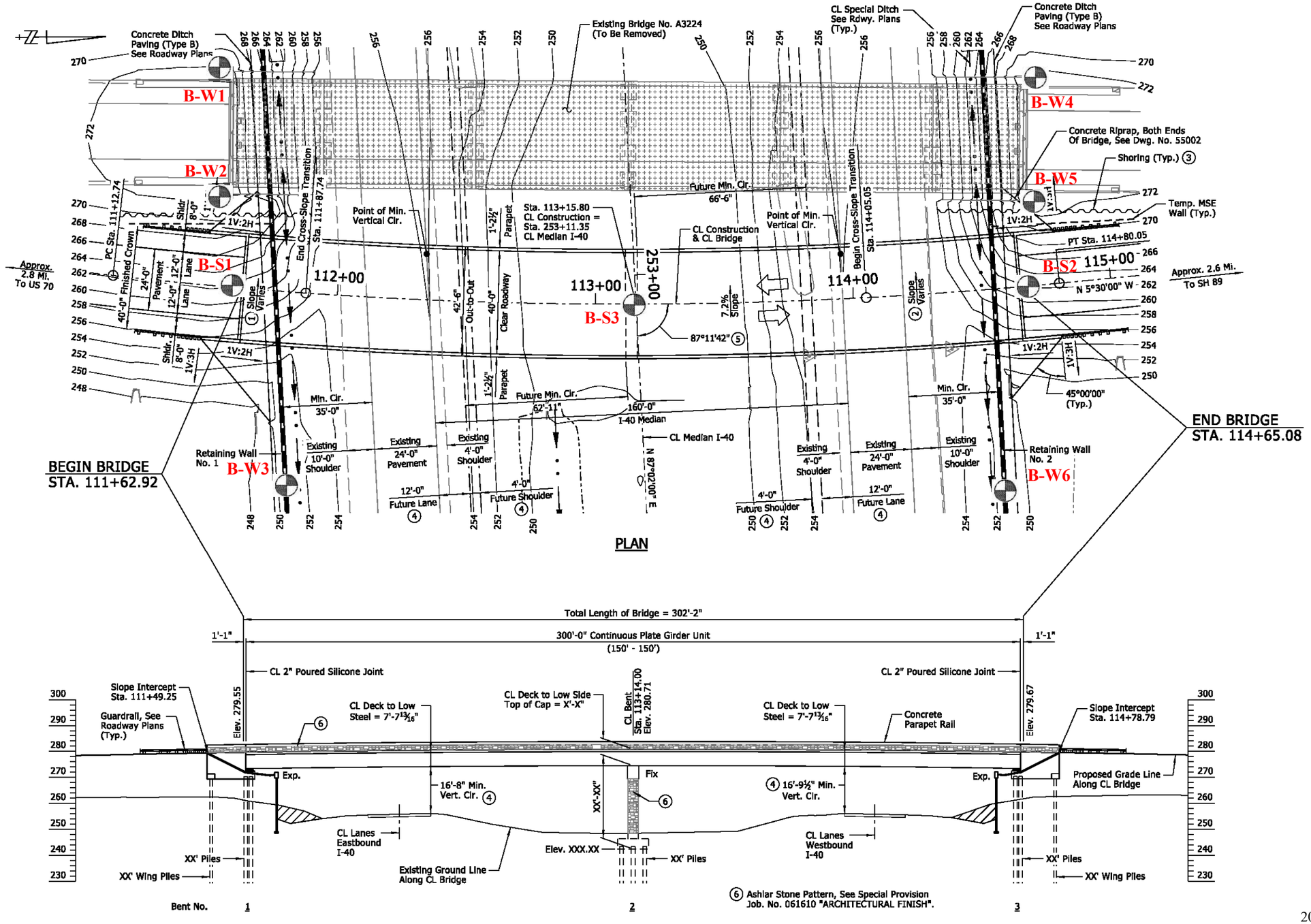


Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

SITE VICINITY MAP
061610 – Remington Rd. over I-40
Lonoke County, Arkansas

Job No. 20-083

Plate 1



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PLAN OF BORINGS
061610 – Remington Road over I-40
Lonoke County, Arkansas

Scale: As Shown

Job No. 20-083

PLATE 2

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LOG OF BORING NO. S1

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 18 ft /Wash

LOCATION: Approx Sta 111+60, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 262±				
			Firm reddish brown, tan and gray clay (fill)	8			
				9			99
5			- soft below 4 ft	6			
				4			
10				6			
			Stiff gray and tan silty clay, sllightly sandy	12			90
15							
20				13			
			Stiff reddish brown clay	15			99
25							
30				11			
			Stiff tan, gray and reddish brown silty clay	13			
35							
40				23			94
			- firm at 43 to 48 ft	8			

COMPLETION DEPTH: 100.0 ft
DATE: 8-10-20

DEPTH TO WATER
IN BORING: Dry to 18 ft

DATE: 8/10/2020

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LOG OF BORING NO. S1

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 18 ft /Wash

LOCATION: Approx Sta 111+60, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			(continued)				
50			- stiff below 48 ft	22			
55			Medium dense reddish tan silty fine sand	27			33
60			- dense to very dense below 58 ft	50/6"			
65				50/3"			
70				50/8"			
75				50/10"			
80			Dense to very dense reddish tan fine sand, slightly silty	50/10"			11
85				50/8"			
				50/8"			7

COMPLETION DEPTH: 100.0 ft
DATE: 8-10-20

DEPTH TO WATER
IN BORING: Dry to 18 ft

DATE: 8/10/2020

LGBNEW 20-083.GPJ 10-6-20

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LOG OF BORING NO. S1

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 18 ft /Wash

LOCATION: Approx Sta 111+60, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
95			(continued)	50/7"			
100				50/6"			
105							
110							
115							
120							
125							
130							

COMPLETION DEPTH: 100.0 ft
DATE: 8-10-20

DEPTH TO WATER
IN BORING: Dry to 18 ft

DATE: 8/10/2020

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LOG OF BORING NO. S2

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 33 ft /Wash

LOCATION: Approx Sta 114+70, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 262±				
			Very soft brown, tan and gray silty clay (fill)	3			
			- firm and sandy at 2 to 4 ft	7			
5			- soft at 4 to 8 ft	6			95
				5			
			- stiff below 8 ft				
10				11			
			Stiff reddish brown silty clay				
15				21			
20				13			99
25				12			
			Stiff tan and gray silty clay				
30				11			94
35				13			
40				13			
			Dense reddish tan silty fine sand	46			46

COMPLETION DEPTH: 100.0 ft
DATE: 8-14-20

DEPTH TO WATER
IN BORING: Dry to 33 ft

DATE: 8/14/2020

LGBNEW 20-083.GPJ 10-6-20

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LOG OF BORING NO. S2

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 33 ft /Wash

LOCATION: Approx Sta 114+70, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			(continued)				
50			- dense to very dense at 48 to 63 ft	50/11"			
55				50/8"			
60				50/8"			
65			- dense below 63 ft	50			
70			Dense to very dense tan fine sand, slightly silty	50/10"			
75				50/8"		●	12
80				50/8"			
85			Dense to very dense tan fine to medium sand, slightly silty	50/8"		●	8
				50/10"			

COMPLETION DEPTH: 100.0 ft
DATE: 8-14-20

DEPTH TO WATER
IN BORING: Dry to 33 ft

DATE: 8/14/2020

LGBNEW 20-083.GPJ 10-6-20

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Consulting Engineers

LOG OF BORING NO. S2

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 33 ft /Wash

LOCATION: Approx Sta 114+70, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			(continued)				
95			Dense gray fine sand, slightly clayey w/trace fine gravel	47		+ – + ●	11
100				40			
105							
110							
115							
120							
125							
130							

COMPLETION DEPTH: 100.0 ft
DATE: 8-14-20

DEPTH TO WATER
IN BORING: Dry to 33 ft

DATE: 8/14/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. S3

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 15 ft /Wash

LOCATION: Approx Sta 113+16, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 249±				
			Medium dense reddish tan fine sandy silt (fill)	14			
			Very loose gray silt, wet	3			
5			Very soft gray and brown silty clay, slightly sandy	3			82
			Stiff gray and brown clay	19			
10			Firm reddish brown clayey silt, wet	9			97
15			Stiff reddish brown silty clay	12			
20			- firm to stiff below 18 ft	10			97
25			Stiff gray and yellowish tan silty clay	22			94
30			Very stiff reddish brown and gray silty clay	27			
35			- stiff below 33 ft	18			96
40			Dense reddish tan silty fine sand w/silt seams and layers	49			32
				33			

COMPLETION DEPTH: 80.0 ft
DATE: 8-6-20

DEPTH TO WATER IN BORING: 6 ft

DATE: 8/6/2020

LGBNEW 20-083.GPJ 10-6-20

PLATE 9

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. S3

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger to 15 ft /Wash

LOCATION: Approx Sta 113+16, CL

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
50			(continued)	39			
55			Dense reddish tan fine sand, slightly silty	45			
60			- dense to very dense below 58 ft	50/8"			8
65				50/8"			
70				50/6"			
75				50/6"			11
80				50/8"			
85							

COMPLETION DEPTH: 80.0 ft
DATE: 8-6-20

DEPTH TO WATER IN BORING: 6 ft

DATE: 8/6/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W1

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 111+45, 85 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 272±				
			Stiff brown fine sandy clay w/crushed stone, dry (fill)	16			
			- with more silt and concrete fragments at 2 to 4 ft	16			72
5			- very soft below 4 ft	3			
			Very soft reddish brown, tan and gray silty clay (fill)	0/WOH			97
			- soft at 8 to 13 ft	5			
10							
			- firm at 13 to 18 ft	9			
15							
			- soft at 18 to 23 ft	4			
20							
			- firm below 23 ft	8			
25							
			Loose gray and tan silt	8		-NON-PLASTIC-	93
30							
			Stiff reddish brown clay	20			99
35							
			- with silt pockets to 38 ft	16			100
40							

COMPLETION DEPTH: 40.0 ft
DATE: 8-7-20

DEPTH TO WATER IN BORING: Dry

DATE: 8/7/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W2

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 111+50, 30 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 272±				
			Firm brown and tan fine sandy clay w/crushed stone (fill) - dry to 2 ft - very soft at 2 to 4 ft - soft below 4 ft	9 3 5			47
10			Soft reddish brown, tan and gray silty clay (fill) - firm at 8 to 18 ft	4 9			98
15				8			
20			- soft below 18 ft	6			95
25			Soft gray silty clay, slightly sandy	6			89
30			- firm to stiff below 28 ft	10			
35			Stiff reddish brown silty clay w/clayey silt seams and layers	12			99
40			- firm at 38 to 43 ft	7			
45			- stiff below 43 ft	19			
50			Very stiff yellowish tan and brown silty clay	33			94

COMPLETION DEPTH: 50.0 ft
DATE: 8-7-20

DEPTH TO WATER IN BORING: Dry

DATE: 8/7/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W3

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 111+75, 75 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 251±				
			Stiff brown sandy silty clay w/crushed stone, dry (fill)	23			
			Firm tan and gray silty clay	8			96
5			- firm to stiff at 4 to 6 ft	10			
			- soft below 6 ft	4			
			Stiff tan and gray clay	18			
10							
			- soft at 13 to 18 ft	6			
15							
			- stiff below 18 ft	11			100
20							
25							

COMPLETION DEPTH: 20.0 ft
DATE: 8-7-20

DEPTH TO WATER IN BORING: Dry

DATE: 8/7/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W4

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 114+70, 80 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 272±				
			Stiff reddish brown fine sandy clay w/crushed stone (fill)	11			
			- soft below 2 ft	5			67
5			Soft reddish brown, tan and gray silty clay (fill)	4			91
				5			
10				4			
			- firm to stiff at 13 to 18 ft	10			95
15							
			- stiff at 18 to 23 ft	17			
20							
			- firm below 23 ft	7			
25							
			Stiff red silty clay	13			99
30							
			- tan below 33 ft	15			
35							
				21			95
40							

COMPLETION DEPTH: 40.0 ft
DATE: 8-6-20

DEPTH TO WATER IN BORING: Dry

DATE: 8/6/2020

LGBNEW 20-083.GPJ 10-6-20

PLATE 14

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W5

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 114+70, 35 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 272±				
			Very soft reddish brown fine sandy clay w/crushed stone (fill)	4			
			- firm below 2 ft	8			68
5			Very soft reddish brown, tan and gray silty clay (fill)	3			
				3			96
			- firm at 8 to 13 ft	8			95
10							
			- stiff below 13 ft				
15				11			
20				12			
			Stiff gray and tan silty clay				
25				19			
			Stiff reddish brown clay				
30				18			
35				18			98
40				19			

COMPLETION DEPTH: 40.0 ft
DATE: 8-6-20

DEPTH TO WATER IN BORING: Dry

DATE: 8/6/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. W6

061610 - Remington Road over I-40
Lonoke County, Arkansas

TYPE: Auger

LOCATION: Approx Sta 114+51, 75 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 251±				
			Stiff gray and tan silty clay (fill)	14			91
			Stiff reddish brown silty clay	11			93
5				12			
			Medium dense reddish brown silt, slightly sandy	14			86
			Firm to stiff red silty clay	10			98
10							
			- soft with clayey silt seams and layers at 13 to 18 ft	5			
15							
			- stiff below 18 ft	15			
20							
25							

COMPLETION DEPTH: 20.0 ft
DATE: 8-6-20

DEPTH TO WATER IN BORING: 12.3 ft

DATE: 8/6/2020

LGBNEW 20-083.GPJ 10-6-20

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

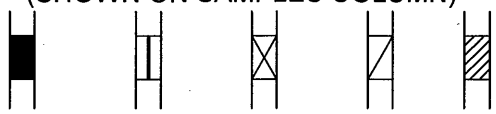
SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES
(SHOWN IN SYMBOLS COLUMN)

Gravel Sand Silt Clay

Predominant type shown heavy

SAMPLER TYPES
(SHOWN ON SAMPLES COLUMN)



Shelby Tube | Rock Core | Split Spoon | No Recovery | Cutting

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (I) Clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	N-VALUE	RELATIVE DENSITY
VERY LOOSE	0-4	0-15%
LOOSE	4-10	15-35%
MEDIUM DENSE	10-30	35-65%
DENSE	30-50	65-85%
VERY DENSE	50 and above	85-100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) Inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT.
VERY SOFT	Less than 0.25
SOFT	0.25-0.50
FIRM	0.50-1.00
STIFF	1.00-2.00
VERY STIFF	2.00-4.00
HARD	4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

TERMS CHARACTERIZING SOIL STRUCTURE

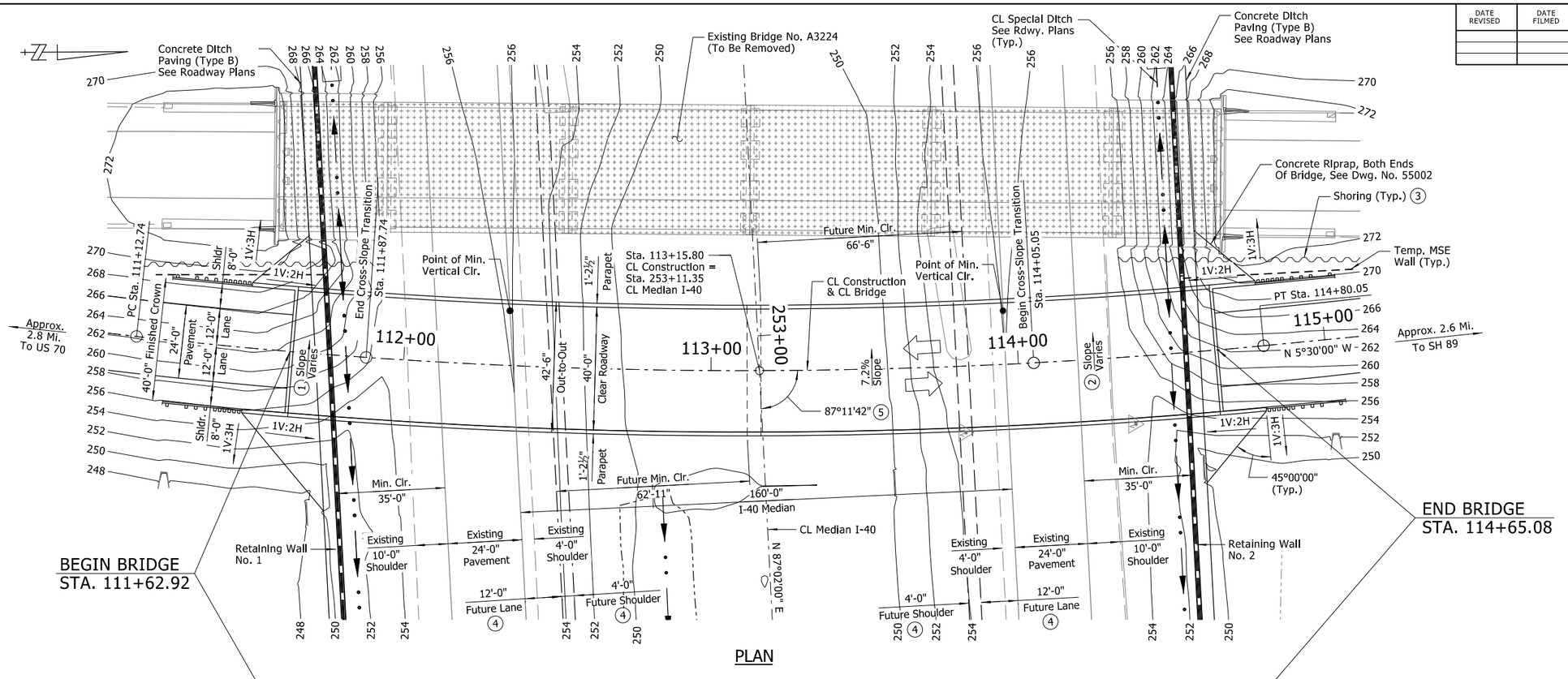
SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.
FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
LAMINATED - composed of thin layers of varying color and texture.
INTERBEDDED - composed of alternate layers of different soil types.
CALCAREOUS - containing appreciable quantities of calcium carbonate.
WELL GRADED - having a wide range in grain sizes and substantial amounts of all intermediate particle sizes.
POORLY GRADED - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

Terms used on this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No.3-357, Waterways Experiment Station, March 1953

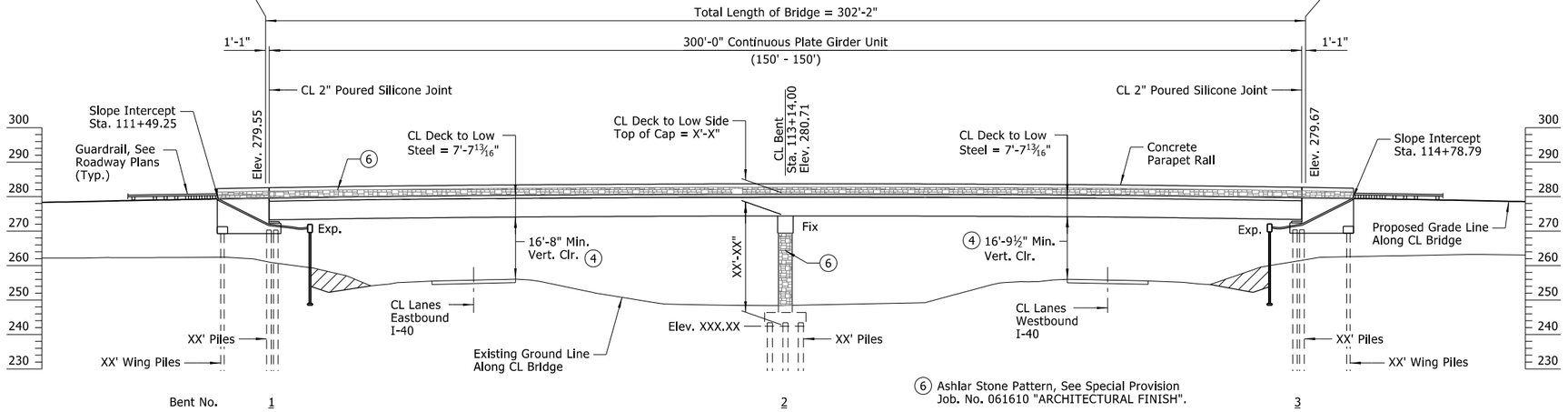
KEY 7-28-11

APPENDIX A

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		061610	$SN101$	ST
				1 $BNXX$		LAYOUT		$DN101$



PLAN



ELEVATION

6 Ashlar Stone Pattern, See Special Provision Job. No. 061610 "ARCHITECTURAL FINISH".

NOTES:
Use Type Special Approach Gutters at each end of bridge. See Dwg. No. $DNXXXX$.

Use Type Special Approach Slab at each end of bridge. See Dwg. No. $DNXXXX$.

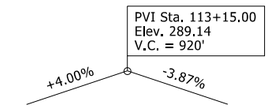
1. See "CROSS-SLOPE TRANSITION SKETCH NO. 1" on Dwg. No. $DNXXXX$.
2. See "CROSS-SLOPE TRANSITION SKETCH NO. 2" on Dwg. No. $DNXXXX$.
3. See Special Provision Job. No. 061610 "SHORING".
4. Span configuration and vertical profile have been set to accommodate 12'-0" future widening of existing I-40. Cross-slope of future lane is assumed to slope 2% towards median.
5. Angle measured between CL Median I-40 and local tangent to CL Construction at Sta. 113+15.80.

NOTES:
For "GENERAL NOTES", see Dwg. No. $DNXXXX$.

For "ELEVATION OF SOIL BORINGS", "BORING LEGEND", & "N-VALUES", see Dwg. No. $DN103$.

CL Construction is on a 3°15'00" curve left. CL Girders and the longitudinal lines of both the bridge and approach slabs shall be constructed on curves concentric with CL Construction. CL Joints of Bents 1 & 3 and CL Bent of Bent 2 shall be constructed on radial lines to CL Construction.

Excavate existing embankment at both ends of bridge as shown. Approx. XXX cubic yards of excavation.



VERTICAL CURVE DATA

Hwy. 15
(Theoretical Grade Along CL Construction)

HORIZONTAL CURVE DATA

CL Hwy. 15
PI = 112+97.06
Δ = 11°56'15" Lt.
D = 3°15'00"
T = 184.32'
L = 376.31'
e = 0.072
R = 1,762.95'

NOTE:
Stations shown are along CL Construction. Elevations shown are actual top of deck elevations at CL Bridge. Any vertical dimension referenced to CL Deck is based on actual top of deck elevation at CL Bridge.

FOR R/W DATA, SEE ROADWAY PLANS

PRELIMINARY NOT FOR CONSTRUCTION

BRIDGE ENGINEER

SHEET 1 OF 3
LAYOUT OF BRIDGE
HIGHWAY 15 OVER I-40
I-40 STRS. & APPRS. (HWY 15) (S)
LONOKE COUNTY

ROUTE 15 SEC. 11

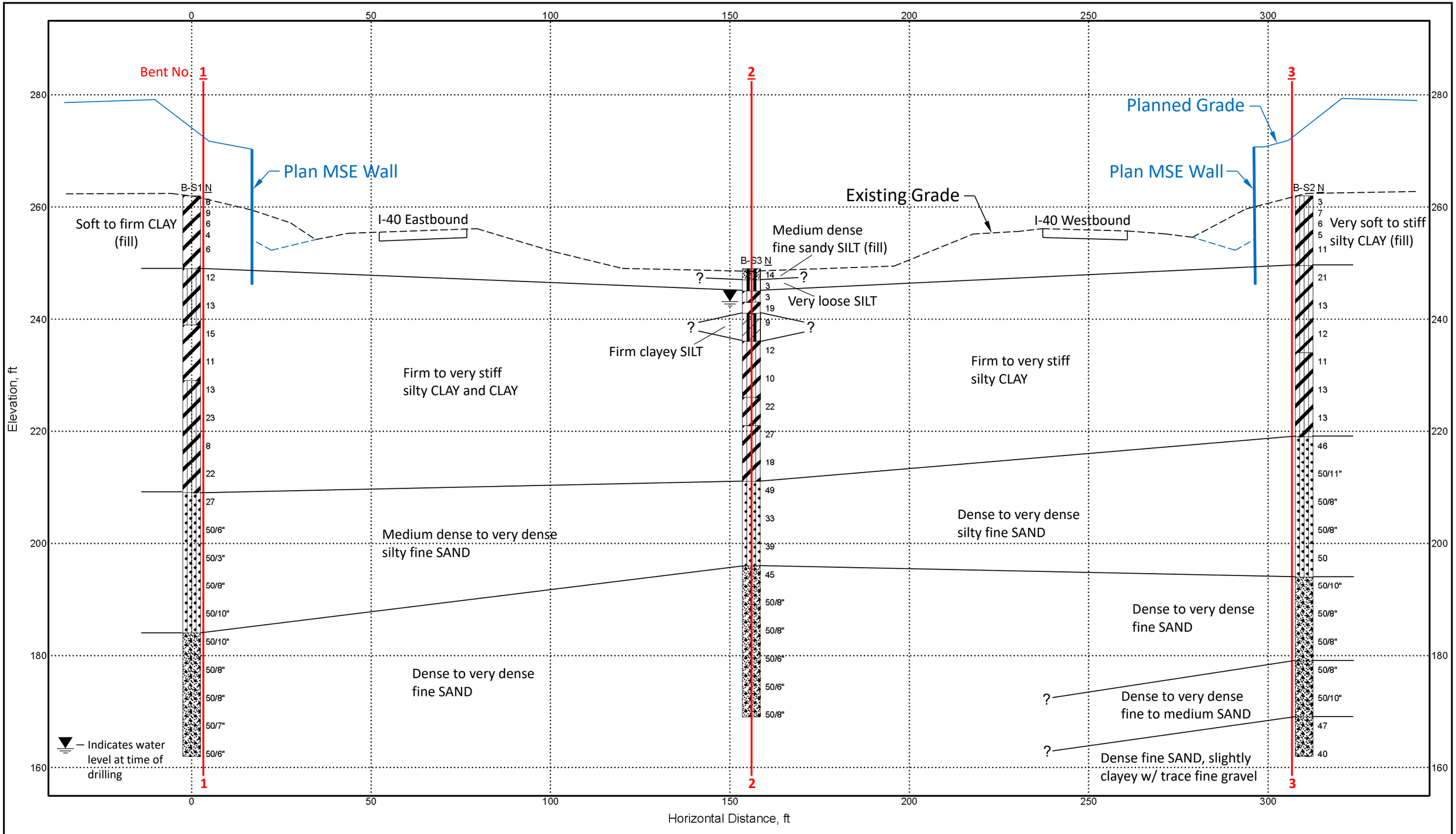
ARKANSAS STATE HIGHWAY COMMISSION

LITTLE ROCK, ARK.

DRAWN BY: CWT DATE: JULY 2020 FILENAME: b061610_xx.dgn
CHECKED BY: JHR DATE: JULY 2020 SCALE: 1" = 20'
DESIGNED BY: JME DATE: JULY 2020
BRIDGE NO. $BN01$ DRAWING NO. $DN101$

JMEdwards 7/30/2020 3:54:29 PM
WORKSPACE: ARDOT Bridge (2019)
L:\2017\17017626 - 061610 I-40 Str-Apprs - Hwy 15\Drawings\b061610_L01.dgn
REVISED DATE:

APPENDIX B



Grubbs, Hoskyn, Barton & Wyatt, Inc.

NOTES:
1. Subsurface conditions have been inferred between discrete boring locations. Actual conditions may vary.
2. Ground surface approximate.

SCALE: As Shown

Generalized Subsurface Profile
061610 - Remington Road over I-40
Lonoke County, Arkansas

Project Number: 20-083

APPENDIX C

SUMMARY of CLASSIFICATION TEST RESULTS

PROJECT: 061610 - Remington Road over I-40
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

BORING No.	SAMPLE DEPTH (ft)	WATER CONTENT (%)	ATTERBERG LIMITS			SIEVE ANALYSIS PERCENT PASSING							USCS CLASS.	AASHTO CLASS.
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	1 in.	3/4 in.	3/8 in.	#4	#10	#40	#200		
S-1	2.5-3.5	24	62	20	41	---	---	---	---	---	---	99	CH	A-7-6
S-1	14-15	21	34	14	20	---	---	---	---	---	---	90	CL	A-6
S-1	24-25	39	63	21	42	---	---	---	---	---	---	99	CH	A-7-6
S-1	39-40	20	32	17	15	---	---	---	---	---	---	95	CL	A-6
S-1	54-55	17	-----			---	---	---	100	100	99	33	SM	A-2-4
S-1	79-80	6	-----			100	100	100	100	98	93	9	SP-SM	A-3
S-1	89-90	21	-----			100	100	100	100	98	90	7	SP-SM	A-3
S-2	4.5-5.5	---	35	16	19	---	---	---	99	---	---	95	CL	A-6
S-2	19-20	27	34	17	17	---	---	---	100	---	---	98	CL	A-6
S-2	29-30	22	30	16	14	---	---	---	100	---	---	95	CL	A-6
S-2	44-45	20	-----			---	---	---	100	---	---	46	SM	A-4
S-2	74-75	16	-----			---	---	---	100	---	---	12	SP-SM	A-2-4
S-2	84-85	31	-----			100	100	94	88	83	35	8	SP-SM	A-3
S-2	94-95	35	31	23	8	100	100	100	97	89	69	11	SP-SC	A-2-4
S-3	4.5-5.5	23	31	17	14	---	---	---	100	---	---	82	CL	A-6
S-3	9-10	25	25	21	4	---	---	---	100	---	---	97	CL	A-6
S-3	19-20	27	37	14	23	---	---	---	100	---	---	97	CL	A-6
S-3	24-25	21	32	16	16	---	---	---	100	---	---	94	CL	A-6
S-3	34-35	25	42	16	26	---	---	---	100	---	---	96	CL	A-7-6
S-3	39-40	23	-----			---	---	---	100	---	---	32	SM	A-2-4
S-3	59-60	22	-----			---	---	---	100	---	---	9	SP-SM	A-3
S-3	74-75	29	-----			100	94	93	92	91	87	11	SP-SM	A-2-4
W1	0.5-1.5	6	32	17	15	100	100	79	77	74	75	72	CL	A-6

Grubbs, Hoskyn,
Barton & Wyatt, Inc.
CONSULTING ENGINEERS

PLATE

SUMMARY of CLASSIFICATION TEST RESULTS

PROJECT: 061610 - Remington Road over I-40
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

BORING No.	SAMPLE DEPTH (ft)	WATER CONTENT (%)	ATTERBERG LIMITS			SIEVE ANALYSIS PERCENT PASSING							USCS CLASS.	AASHTO CLASS.
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	1 in.	3/4 in.	3/8 in.	#4	#10	#40	#200		
W1	6.5-7.5	25	36	14	22	---	---	---	100	---	---	97	CL	A-6
W1	29-30	19	NON-PLASTIC			---	---	---	100	---	---	93	ML	A-4
W1	34-35	28	49	20	29	---	---	---	100	---	---	99	CL	A-7-6
W1	39-40	32	73	26	47	---	---	---	100	---	---	100	CH	A-7-6
W2	2.5-3.5	22	28	13	15	100	72	696	65	63	61	47	SC	A-6
W2	6.5-7.5	24	38	16	22	---	---	---	100	---	---	99	CL	A-6
W2	19-20	23	34	17	17	---	---	---	100	---	---	96	CL	A-6
W2	24-25	24	32	19	13	---	---	---	100	---	---	89	CL	A-6
W2	34-35	25	43	20	23	---	---	---	100	---	---	99	CL	A-7-6
W2	49-50	19	35	18	17	---	---	---	100	---	---	94	CL	A-6
W3	2.5-3.5	19	30	17	13	---	---	---	100	---	---	96	CL	A-6
W3	9-10	23	-----			---	---	---	100	---	---	95	ML	A-4
W3	19-20	29	64	23	41	---	---	---	100	---	---	100	CH	A-7-6
W4	2.5-3.5	11	34	13	21	100	100	95	93	92	88	67	CL	A-6
W4	4.5-5.5	24	29	17	12	---	---	---	100	---	---	91	CL	A-6
W4	14-15	24	43	16	27	---	---	---	99	---	---	96	CL	A-7-6
W4	29-30	25	35	19	16	---	---	---	100	---	---	99	CL	A-6
W4	39-40	22	29	19	10	---	---	---	100	---	---	95	CL	A-6
W5	2.5-3.5	15	27	15	12	100	100	93	90	89	87	68	CL	A-6
W5	6.5-7.5	24	46	16	30	---	---	---	100	---	---	96	CL	A-7-6
W5	9-10	23	42	15	27	---	---	---	100	---	---	96	CL	A-7-6
W5	24-25	19	26	18	8	---	---	---	100	---	---	93	CL	A-6

SUMMARY of CLASSIFICATION TEST RESULTS

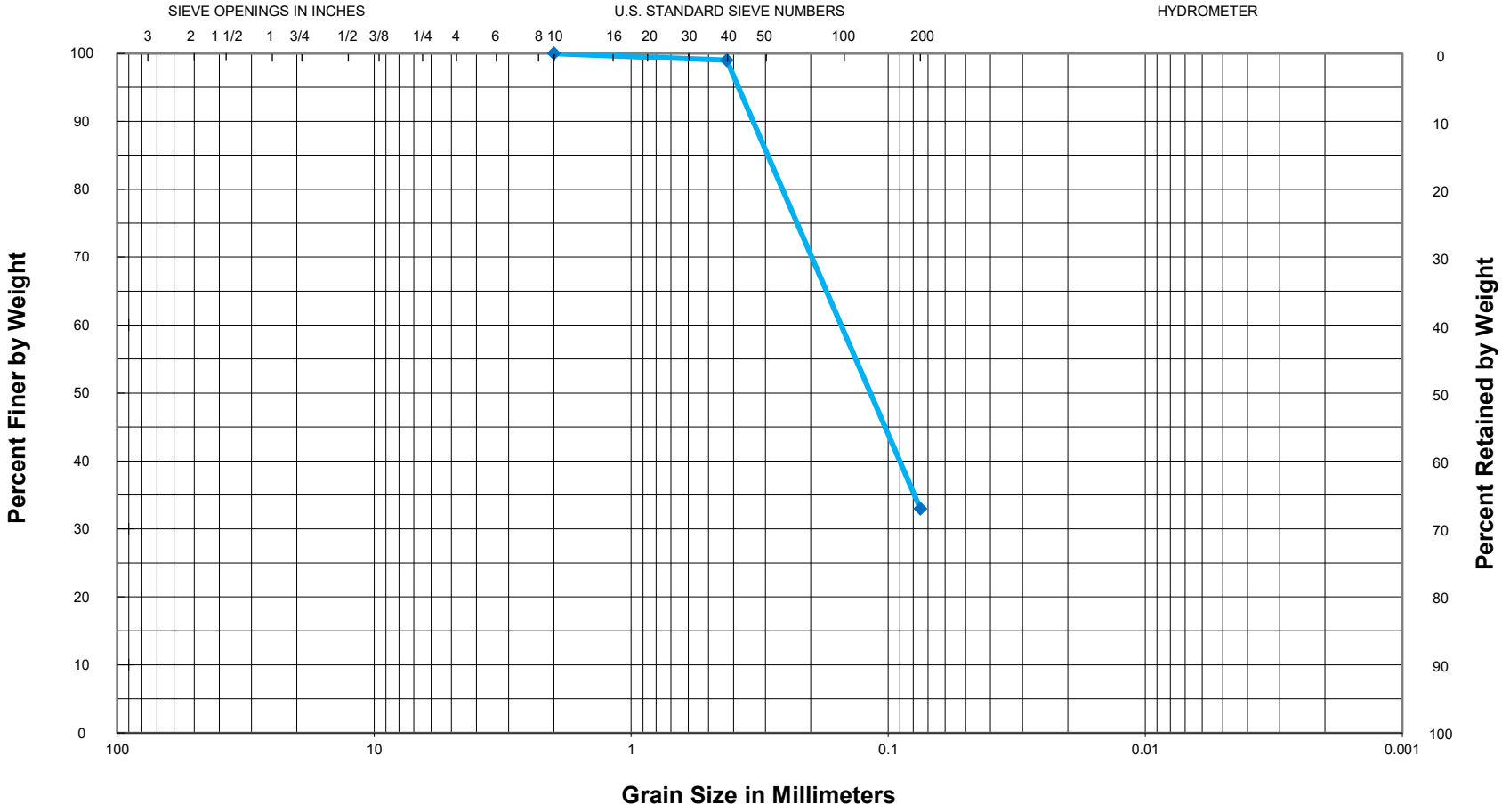
PROJECT: 061610 - Remington Road over I-40
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

BORING No.	SAMPLE DEPTH (ft)	WATER CONTENT (%)	ATTERBERG LIMITS			SIEVE ANALYSIS PERCENT PASSING							USCS CLASS.	AASHTO CLASS.
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	1 in.	3/4 in.	3/8 in.	#4	#10	#40	#200		
W5	34-35	27	35	15	20	---	---	---	100	---	---	98	CL	A-6
W6	0.5-1.5	9	31	16	15	---	---	---	100	---	---	91	CL	A-6
W6	2.5-3.5	16	37	15	22	---	---	---	100	---	---	93	CL	A-6
W6	6.5-7.5	23	NON-PLASTIC			---	---	---	100	---	---	86	ML	A-4
W6	9-10	25	43	16	27	---	---	---	100	---	---	98	CL	A-7-6

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

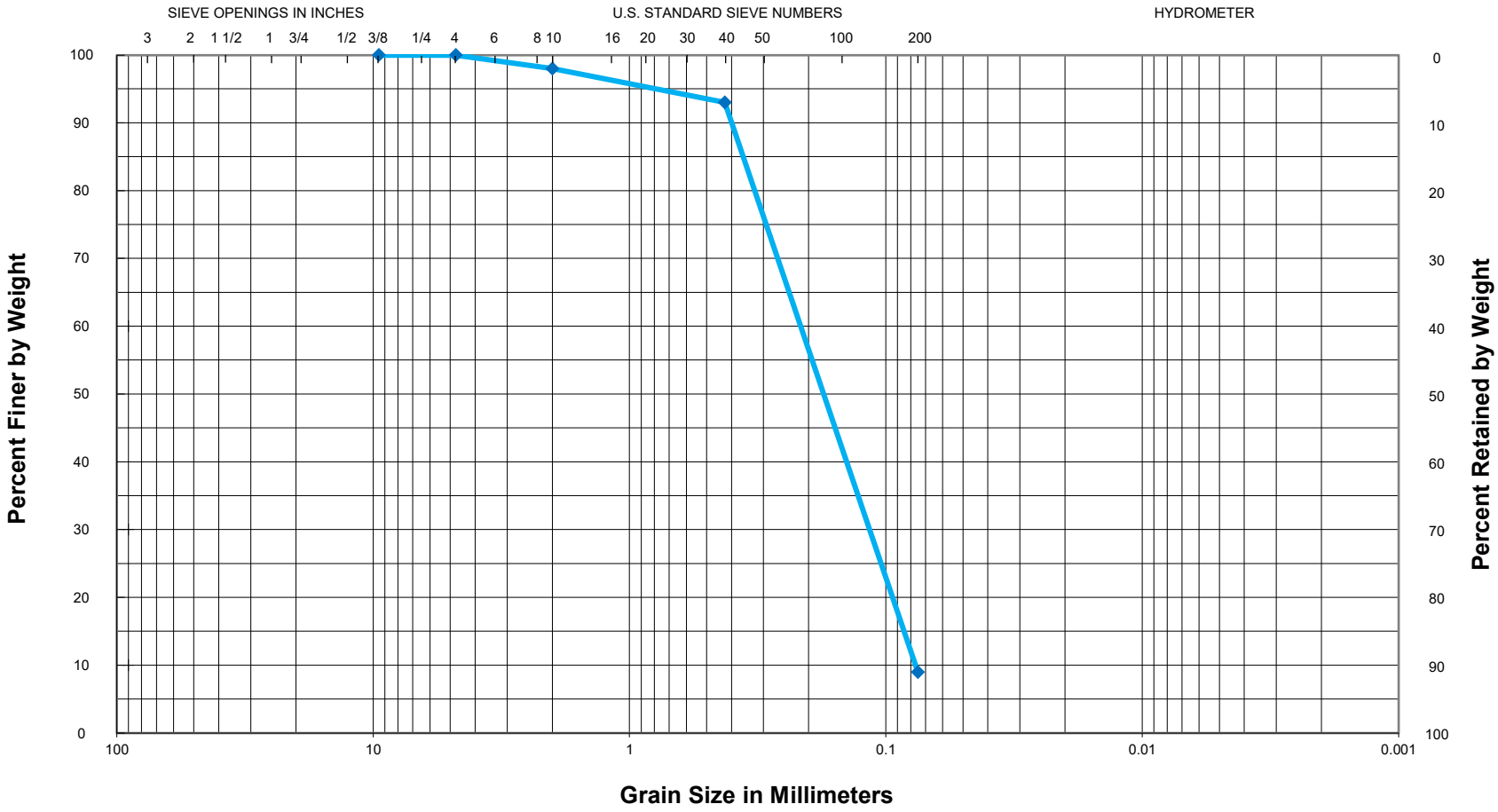
Sample: Boring S1, 54-55 ft
Description: Reddish tan silty fine SAND

USCS Classification = SM
AASHTO Classification = A-2-4

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

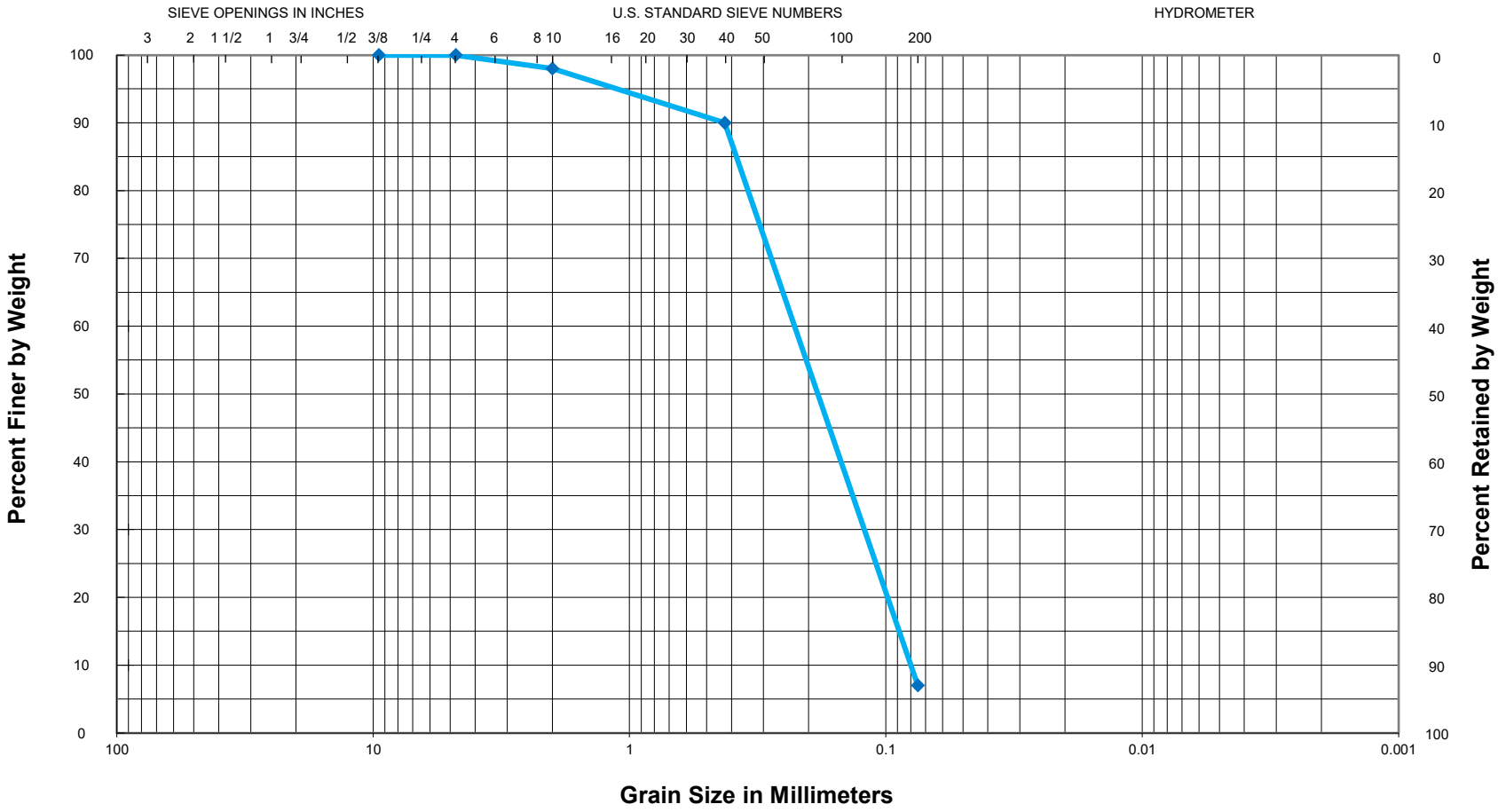
Sample: Boring S1, 79-80 ft.
Description: Reddish tan fine SAND, slightly silty

USCS Classification = SP-SM
AASHTO Classification = A-3

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

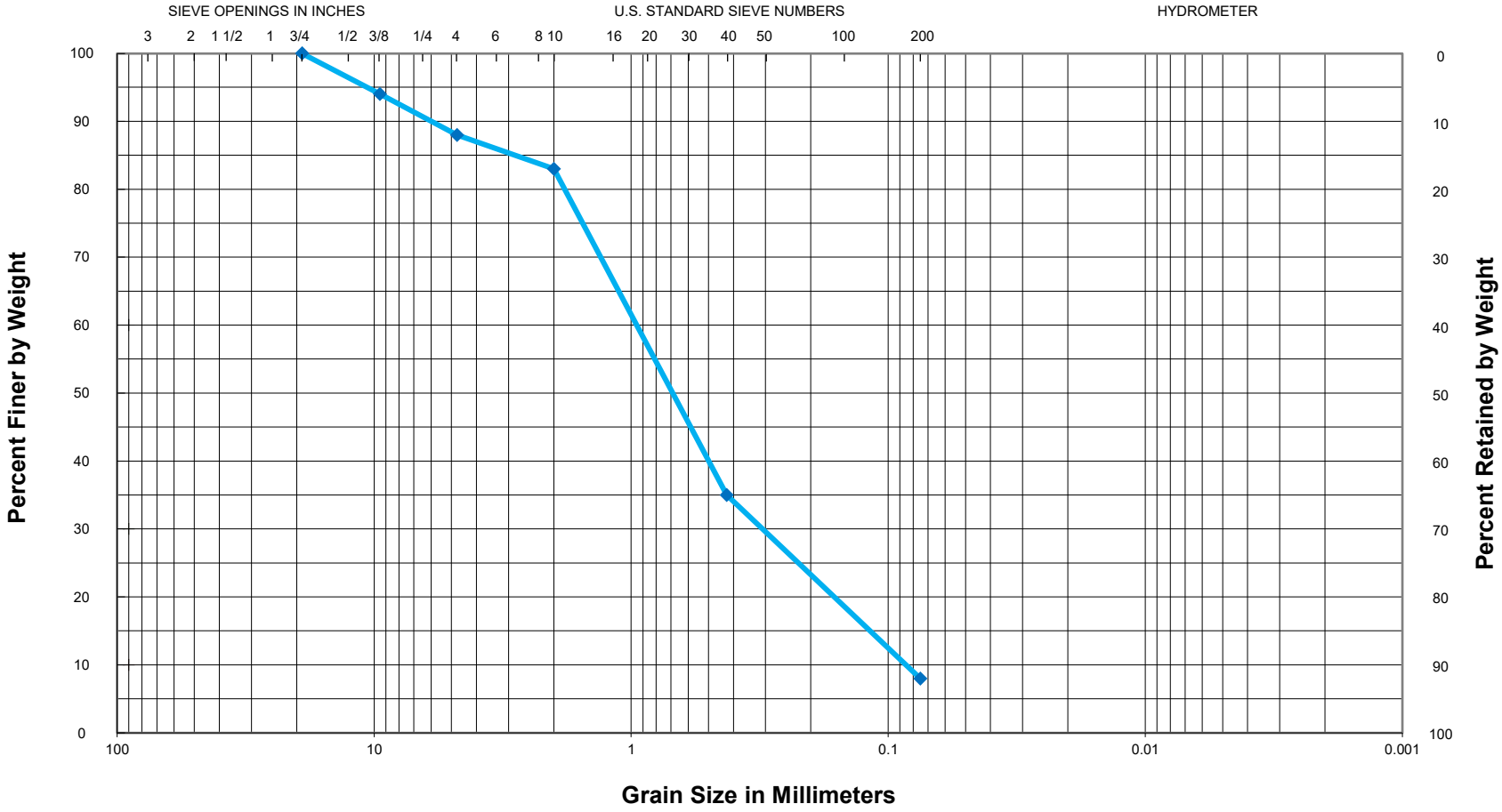
Sample: Boring S1, 89-90 ft
Description: Tan fine SAND, slightly silty

USCS Classification = SP-SM
AASHTO Classification = A-3

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

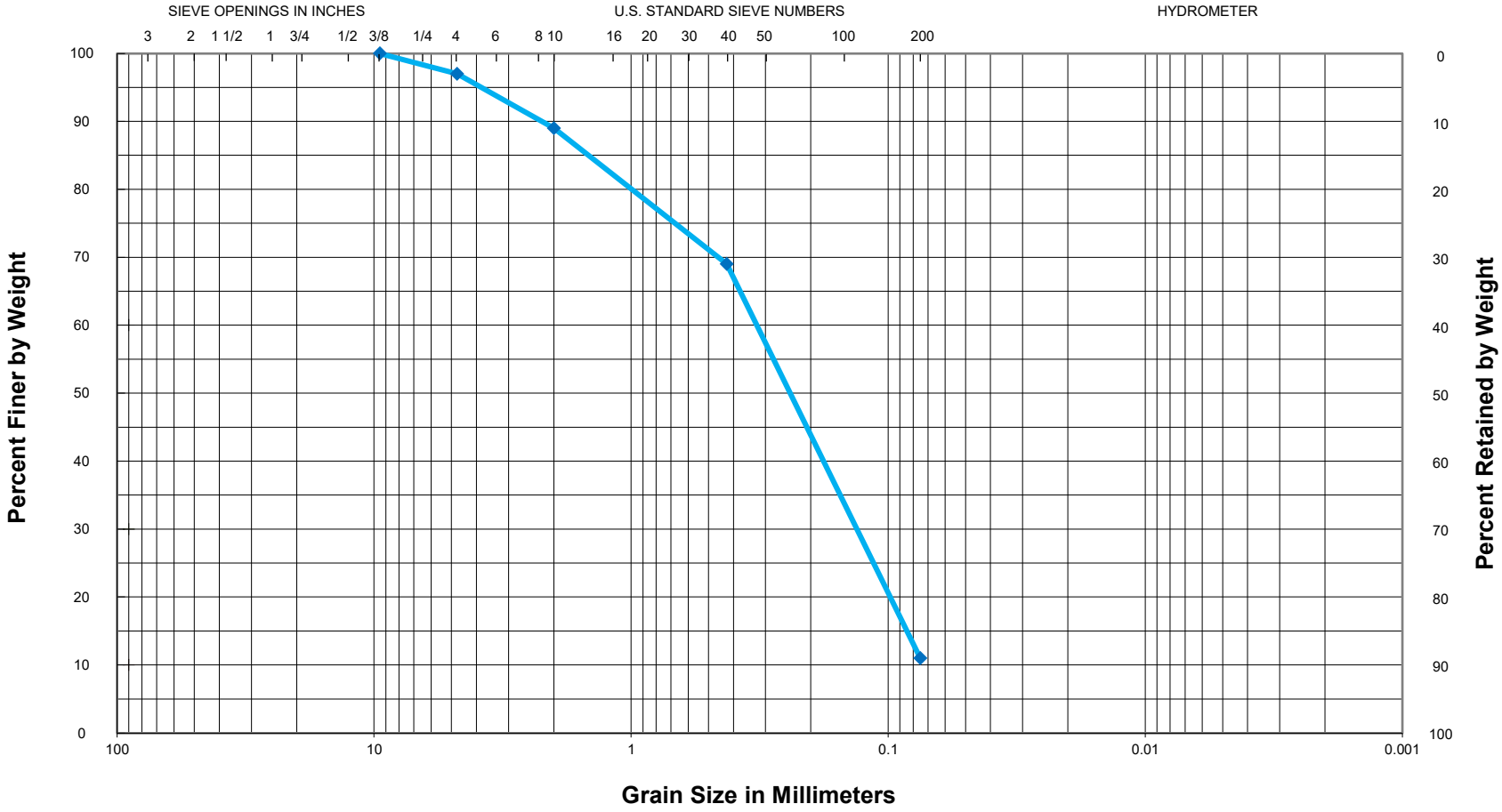
Sample: Boring S2, 84-85 ft
Description: Tan fine to medium SAND, slightly silty w/ a little fine gravel

USCS Classification = SP-SM
AASHTO Classification = A-3

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

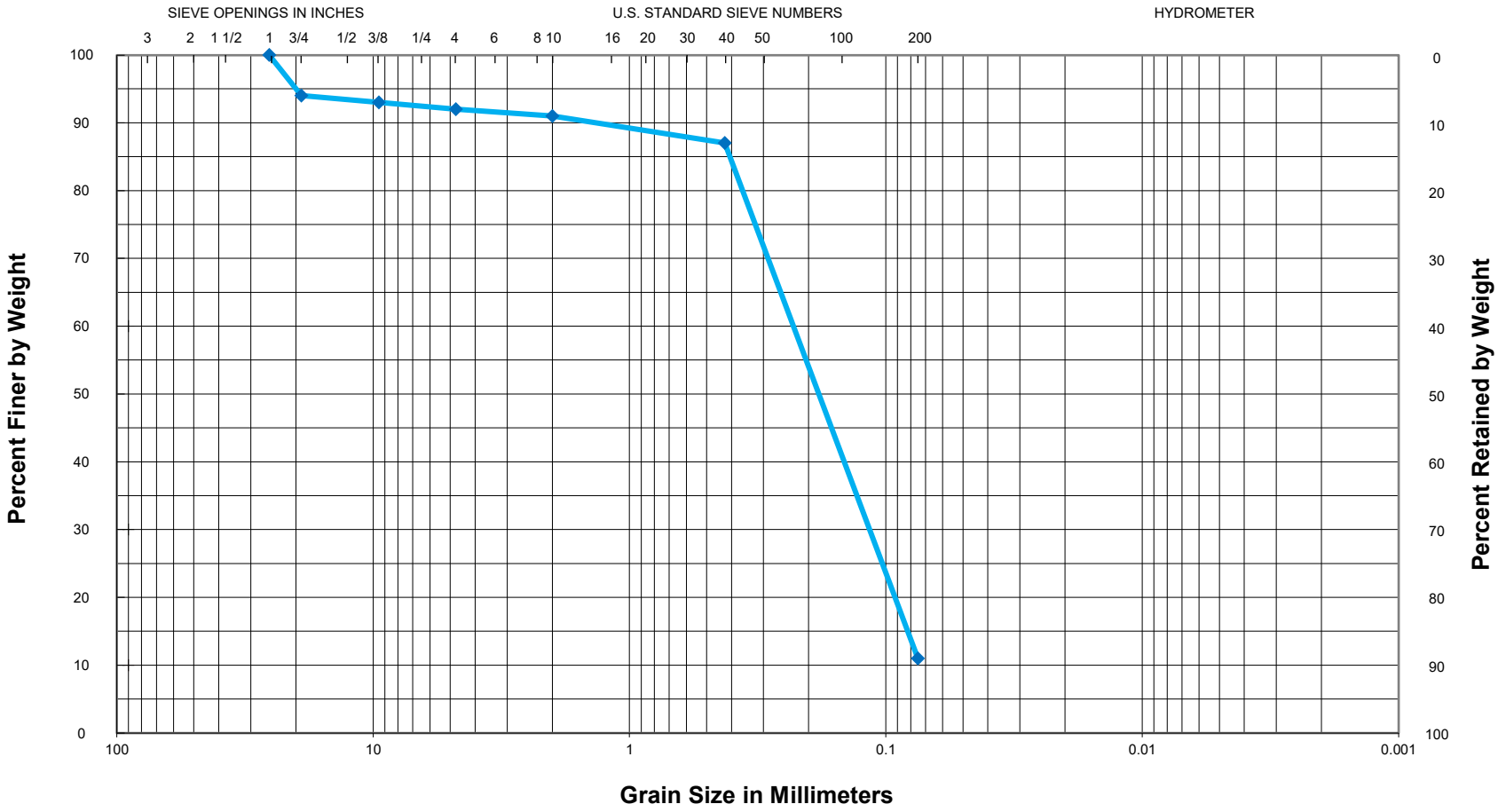
Sample: Boring S2, 94-95 ft; LL = 31, PL = 23, PI = 8
Description: Gray fine to medium SAND, slighlty clayey

USCS Classification = SP-SC
AASHTO Classification = A-2-4

20-083

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Sample: Boring S3, 74-75 ft
Description: Reddish tan fine SAND, slightly silty

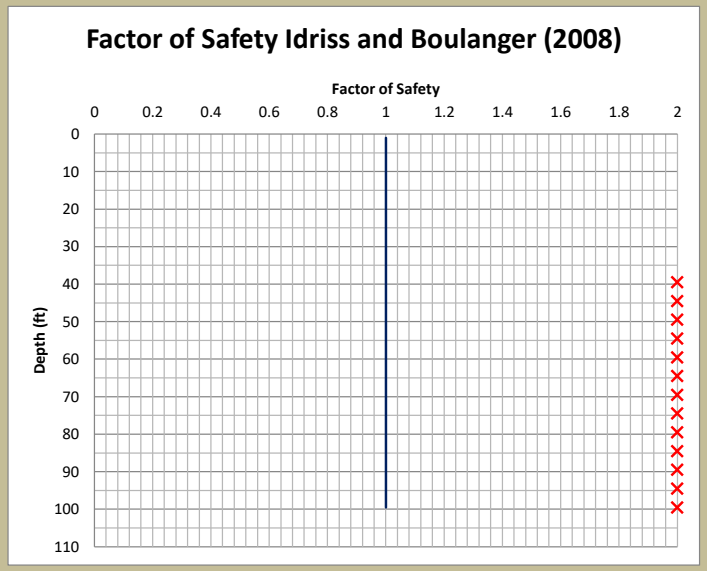
USCS Classification = SP-SM
AASHTO Classification = A-2-4

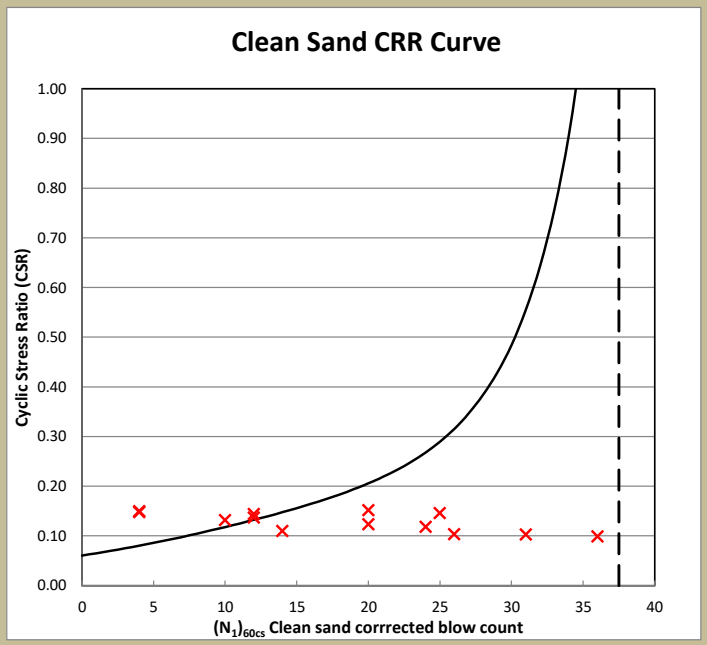
APPENDIX D

RESULTS OF LIQUEFACTION ANALYSIS

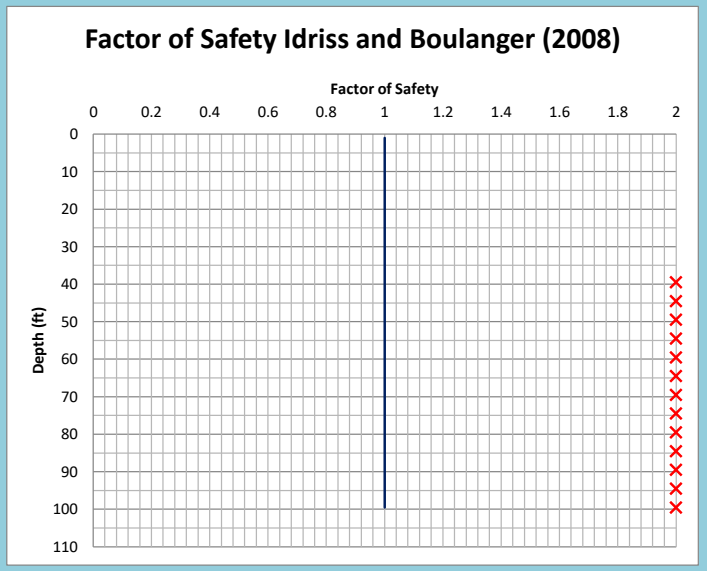
PROJECT: ARDOT Job No. 061610 I-40 Str. & Apprs. (Hwy. 15)(S)

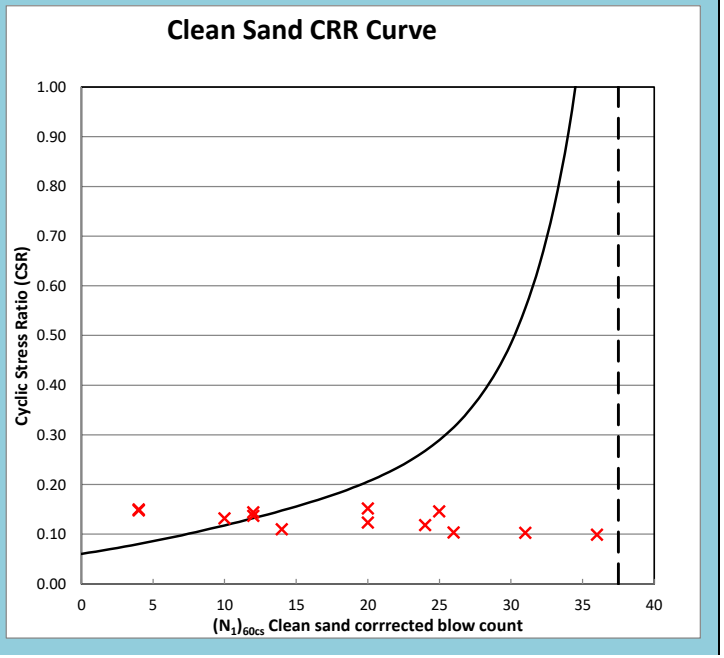
Boring Elevation



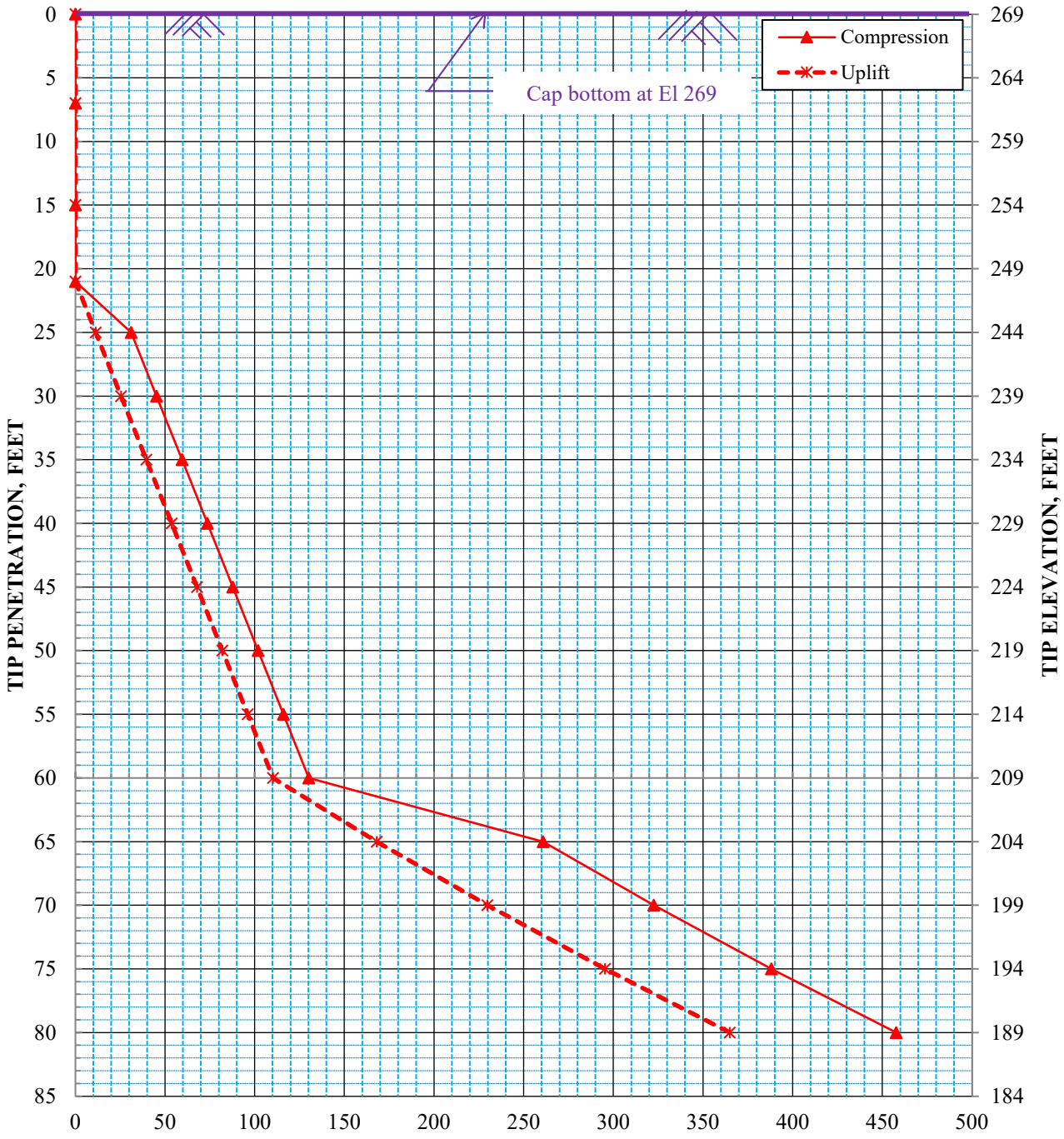


Grade Elevation





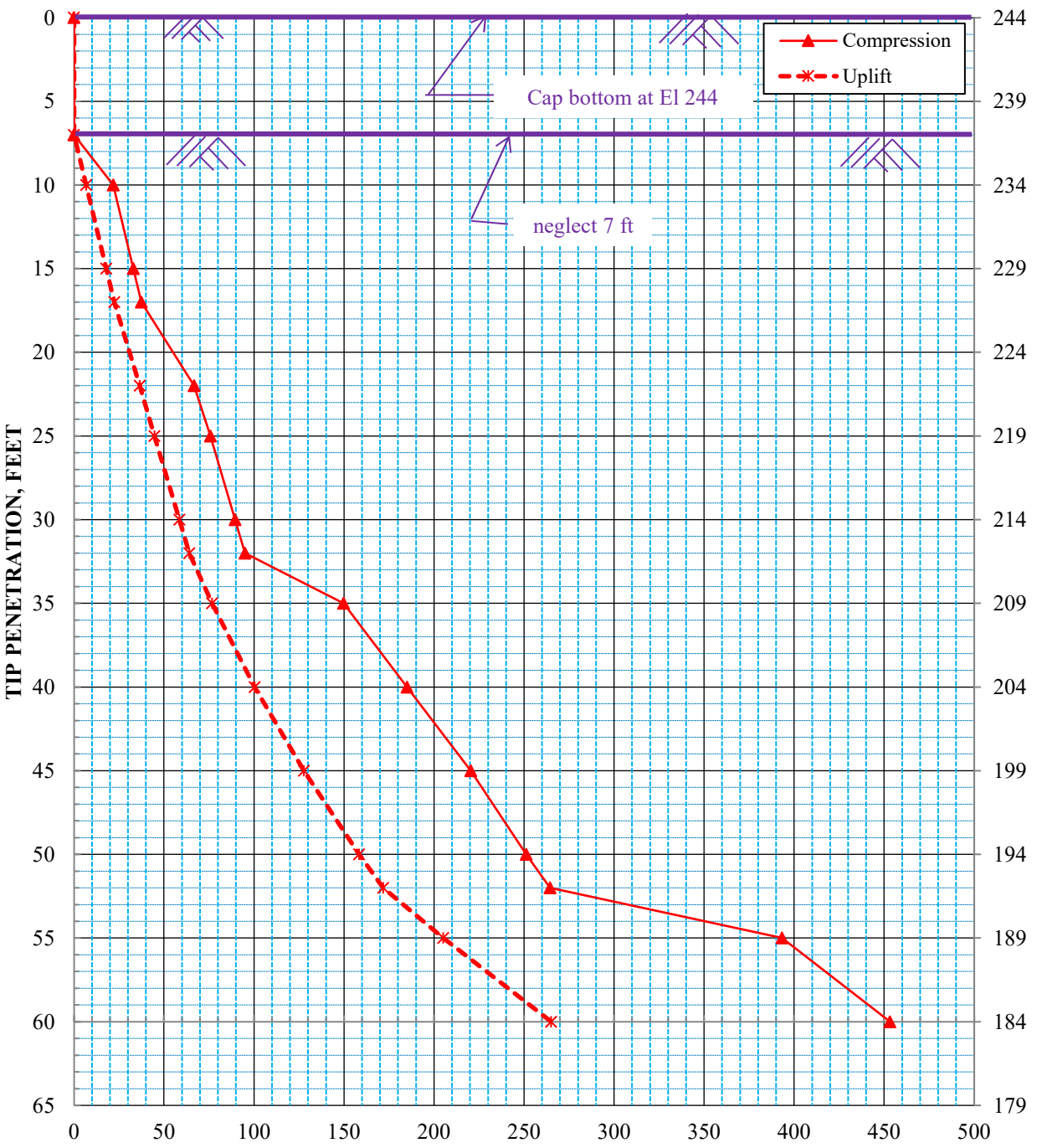
APPENDIX E



NOMINAL SINGLE PILE CAPACITY, TONS

18-in.-diameter Steel Shell Piles
Bent 1 (South Bridge End)
ARDOT 061610 - Hwy. 15 over I-40
Lonoke County, Arkansas

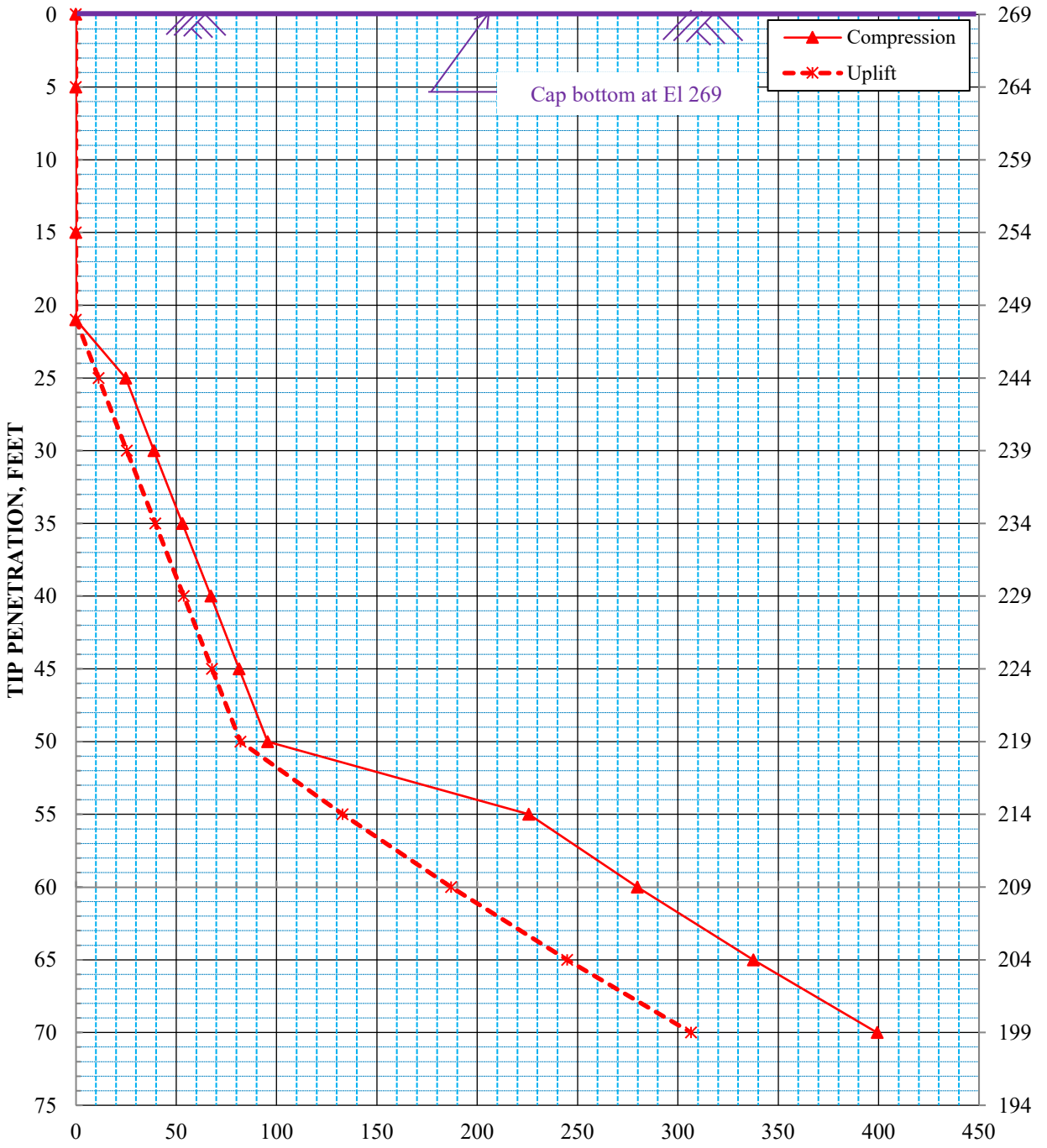
Note: 1. Piles driven from El 248±.
2. No downdrag after ground improvement and embankment construction.



NOMINAL SINGLE PILE CAPACITY, TONS

18-in.-diameter Steel Shell Piles
Bent 2 (Interior)
ARDOT 061610 - Hwy. 15 over I-40
Lonoke County, Arkansas

Note: Piles driven from cap bottom elevation.



NOMINAL SINGLE PILE CAPACITY, TONS

18-in.-diameter Steel Shell Piles
Bent 3 (North Bridge End)
ARDOT 061610 - Hwy. 15 over I-40
Lonoke County, Arkansas

Note: 1. Piles driven from El 248±.
2. No downdrag after ground improvement and embankment construction.

APPENDIX F

SUMMARY OF LATERAL LOAD PARAMETERS
Hwy. 15 over I-40 - Bent 1 (South Bridge End)

PROJECT: Job No. 061610 I-40 Str. & Apprs. (Hwy. 15) (S)
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

Bent 1: Recommended Parameters for Lateral Load Analyses Using LPILE©

Generalized Stratigraphy	**Neglect**	**Stiff silty CLAY / CLAY**	**Dense to very dense silty fine SAND**	**Dense to very dense fine SAND**
Depth below assumed pile cap bottom, ft	0-21	21-60	60-85	85-107+
Approximate El, ft	269-248	248-209	209-184	184-162>
Recommend soil type	Neglect	Stiff Clay with free water	Sand (Reese)	Sand (Reese)
Effective unit weight (γ), lbs per cu ft	125	60	63	63
Cohesion (c), lbs per sq ft	Not applicable	2500	0	0
Angle of internal friction (φ), °	Not applicable	0	35	38
Soil modulus (k), lbs per cu in.	Not applicable	1000	125	125
Strain at 50% (EE50)	Not applicable	0.005	NA	NA

Notes: 1. Cap bottom at El 269±.
2. Piles driven through casing to MSE subgrade at ±El 248. Bearing neglected above El 248±.

SUMMARY OF LATERAL LOAD PARAMETERS
Hwy. 15 over I-40 - Bent 2 (Interior Bent)

PROJECT: Job No. 061610 I-40 Str. & Apprs. (Hwy. 15) (S)
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

Bent 2: Recommended Parameters for Lateral Load Analyses Using LPILE©

Generalized Stratigraphy	**Loose SILT**	**Stiff CLAY**	**Stiff silty CLAY / CLAY**	**Dense silty fine SAND**	**Dense to very dense fine SAND**
Depth below assumed pile cap bottom, ft	0-7	7-17	17-32	32-52	52-65+
Approximate El, ft	244-237	237-227	227-212	212-192	192-179>
Recommend soil type	Sand (Reese)	Stiff Clay with free water	Stiff Clay with free water	Sand (Reese)	Sand (Reese)
Effective unit weight (γ), lbs per cu ft	115	53	60	63	63
Cohesion (c), lbs per sq ft	0	1900	3850	0	0
Angle of internal friction (φ), °	28	0	0	35	38
Soil modulus (k), lbs per cu in.	25	500	1000	125	125
Strain at 50% (EE50)	NA	0.007	0.005	NA	NA

Note: Cap bottom at El 244±

SUMMARY OF LATERAL LOAD PARAMETERS
Hwy. 15 over I-40 - Bent 3 (North Bridge End)

PROJECT: Job No. 061610 I-40 Str. & Apprs. (Hwy. 15) (S)
LOCATION: Lonoke County, Arkansas
GHBW JOB NUMBER: 20-083

Bent 3: Recommended Parameters for Lateral Load Analyses Using LPILE©

Generalized Stratigraphy	**Neglect**	**Stiff silty CLAY**	**Dense to very dense silty fine SAND**	**Dense to very dense fine SAND / Fine to Medium SAND**
Depth below assumed pile cap bottom, ft	0-21	21-50	50-75	75-107+
Approximate El, ft	269-248	248-219	219-194	194-162>
Recommend soil type	Neglect	Stiff Clay with free water	Sand (Reese)	Sand (Reese)
Effective unit weight (γ), lbs per cu ft	125	60	63	63
Cohesion (c), lbs per sq ft	Not applicable	1700	0	0
Angle of internal friction (φ), °	Not applicable	0	35	38
Soil modulus (k), lbs per cu in.	Not applicable	500	125	125
Strain at 50% (EE50)	Not applicable	0.01	NA	NA

Notes: 1. Cap bottom at El 269±.
2. Piles driven through casing to MSE subgrade at ±El 248. Bearing neglected above El 248±.

APPENDIX G

Summary of Recommended Minimum Pile Hammer Energy

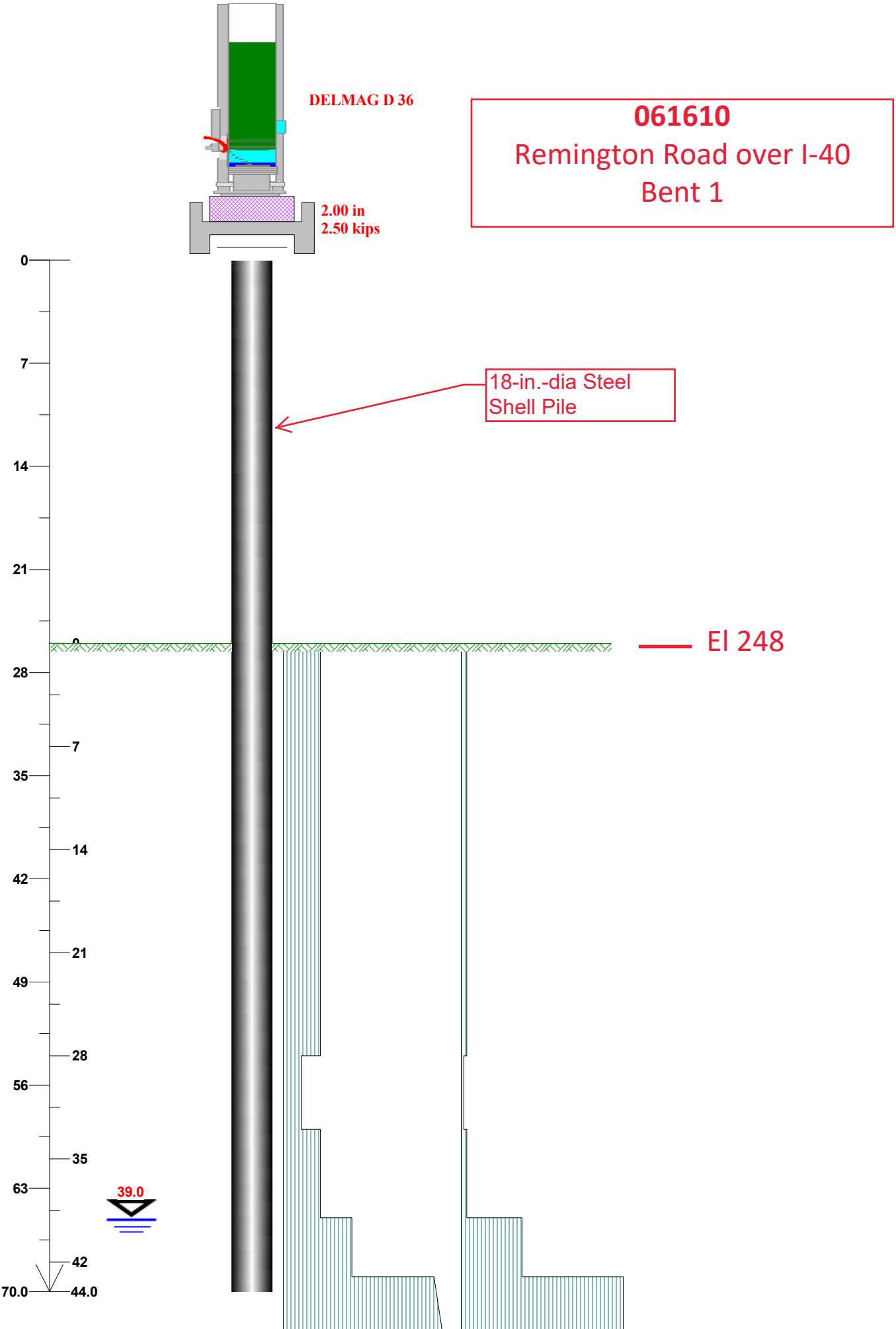
PROJECT: ARDOT Job No. 061610 I-40 Str. & Apprs. (Hwy. 15)(S)

LOCATION: Lonoke County, Arkansas

GHBW JOB No.: 20-083

Bridge	Bent No.	Btm. of Pile Cap (ft)	Pile Length (ft)	Est Tip El (ft)	Pile Diameter (in.)	Nom. Pile Capacity (tons)	Recommended Min Hammer Energy, kip-ft
Hwy. 15 over Interstate 40 (Remington Road)	1	269	65	204	18	225	83.820
	2	244	53	191	18	285	107.078
	3	269	65	204	18	225	83.820

Notes: 1. All piles 18-in.-diameter steel shells
2. Bents 1 and 3 driven through casing with bearing from MSE wall subgrade at ±El 248.
3. Pile length from cap bottom.
4. Nominal pile capacity based on Method B - WEAP determination of bearing capacity.

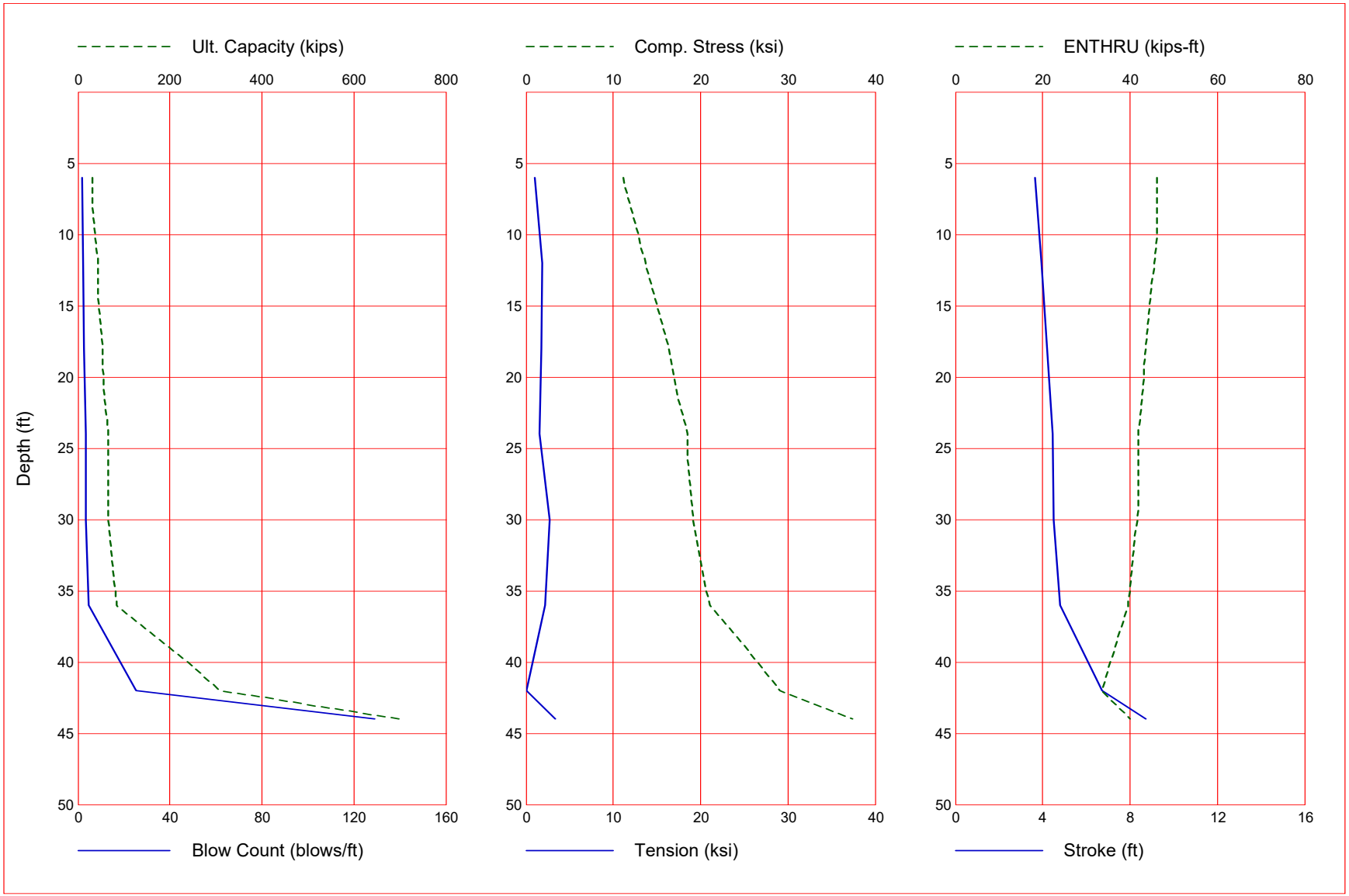

DELMAG D 36
2.00 in
2.50 kips
061610
Remington Road over I-40
Bent 1
0
7
14
21
0
28
7
35
14
42
21
49
28
56
35
63
39.0
42
70.0
44.0
18-in.-dia Steel
Shell Pile
El 248

Bent 1 Delmag D 36:
83.820 kip=ft

Grubbs, Hoskyn, Barton & Wyatt, Inc.
061610 Bent 1

Oct 26 2020
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833



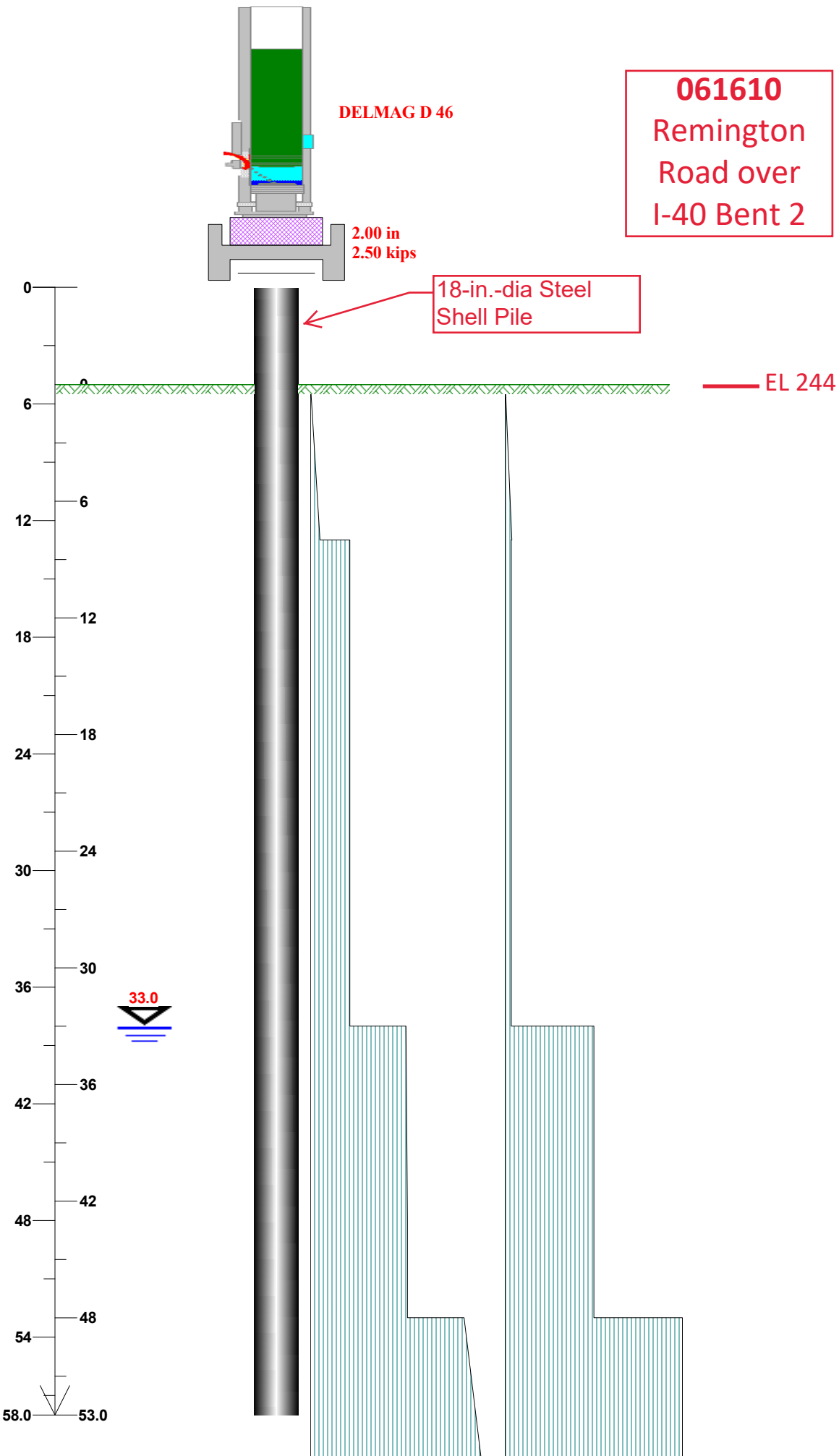
Bent 1 Delmag D 36:
83.820 kip=ft

Grubbs, Hoskyn, Barton & Wyatt, Inc. Oct 26 2020
061610 Bent 1 GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	31.5	11.5	20.0	1.7	11.125	-1.054	3.65	46.2
12.0	43.0	23.0	20.0	2.1	13.754	-1.906	3.93	45.5
18.0	54.5	34.6	20.0	2.8	16.354	-1.774	4.20	43.7
24.0	66.1	46.1	20.0	3.5	18.457	-1.531	4.46	41.9
30.0	65.5	55.6	9.8	3.6	19.111	-2.719	4.50	41.6
36.0	84.2	64.2	20.0	4.8	21.119	-2.230	4.81	39.6
42.0	308.4	87.6	220.8	25.5	29.062	0.000	6.70	33.7
44.0	698.0	109.2	588.8	129.2	37.406	-3.375	8.71	40.0

Total Continuous Driving Time 7.00 minutes; Total Number of Blows 342

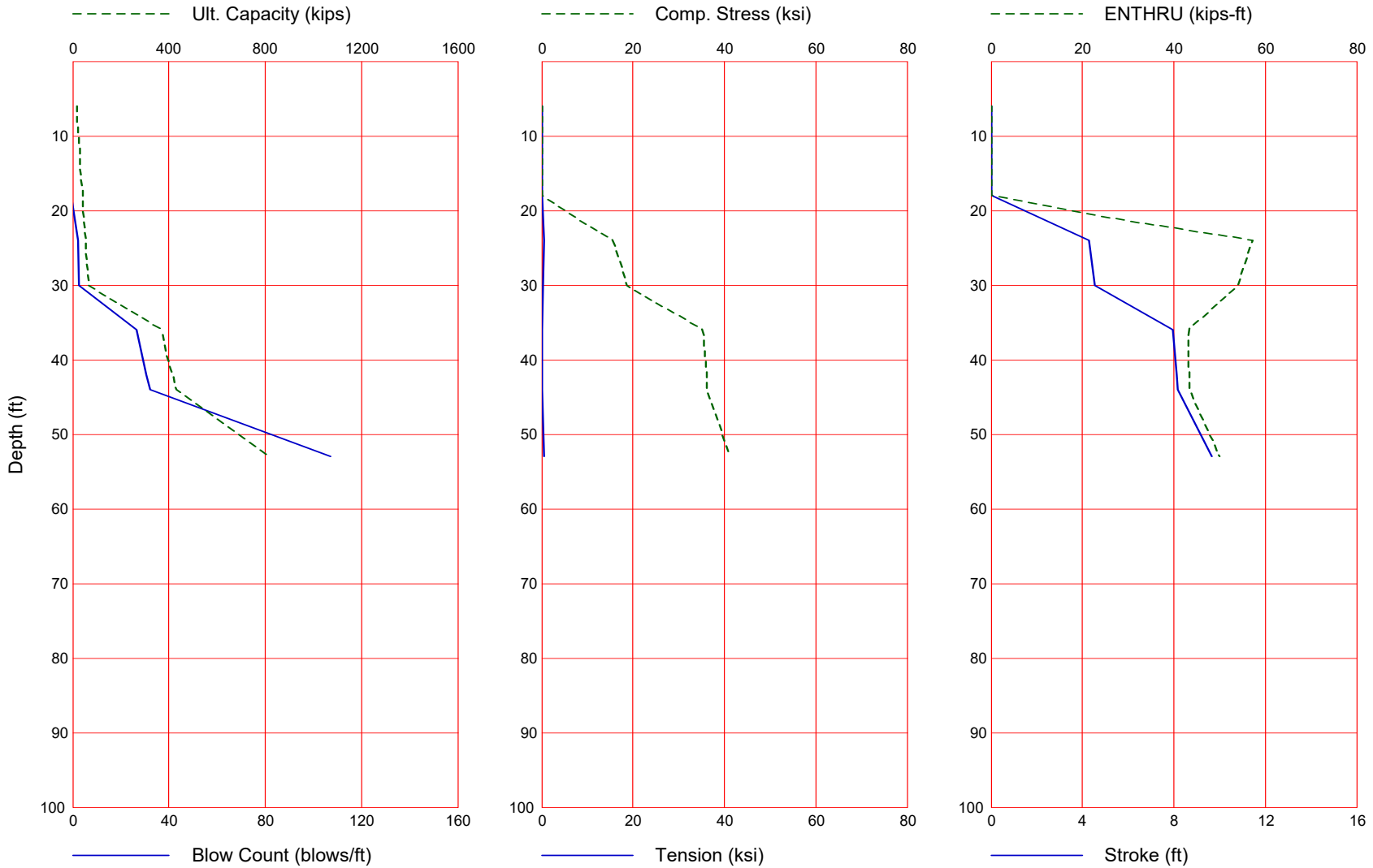

061610
Remington
Road over
I-40 Bent 2
DELMAG D 46
2.00 in
2.50 kips
18-in.-dia Steel
Shell Pile
EL 244
0
6
12
18
24
30
36
42
48
54
58.0
53.0
33.0

Bent 2 Delmag D 46:
107.078 kip-ft

Grubbs, Hoskyn, Barton & Wyatt, Inc.
061610 Bent 1

Oct 26 2020
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833



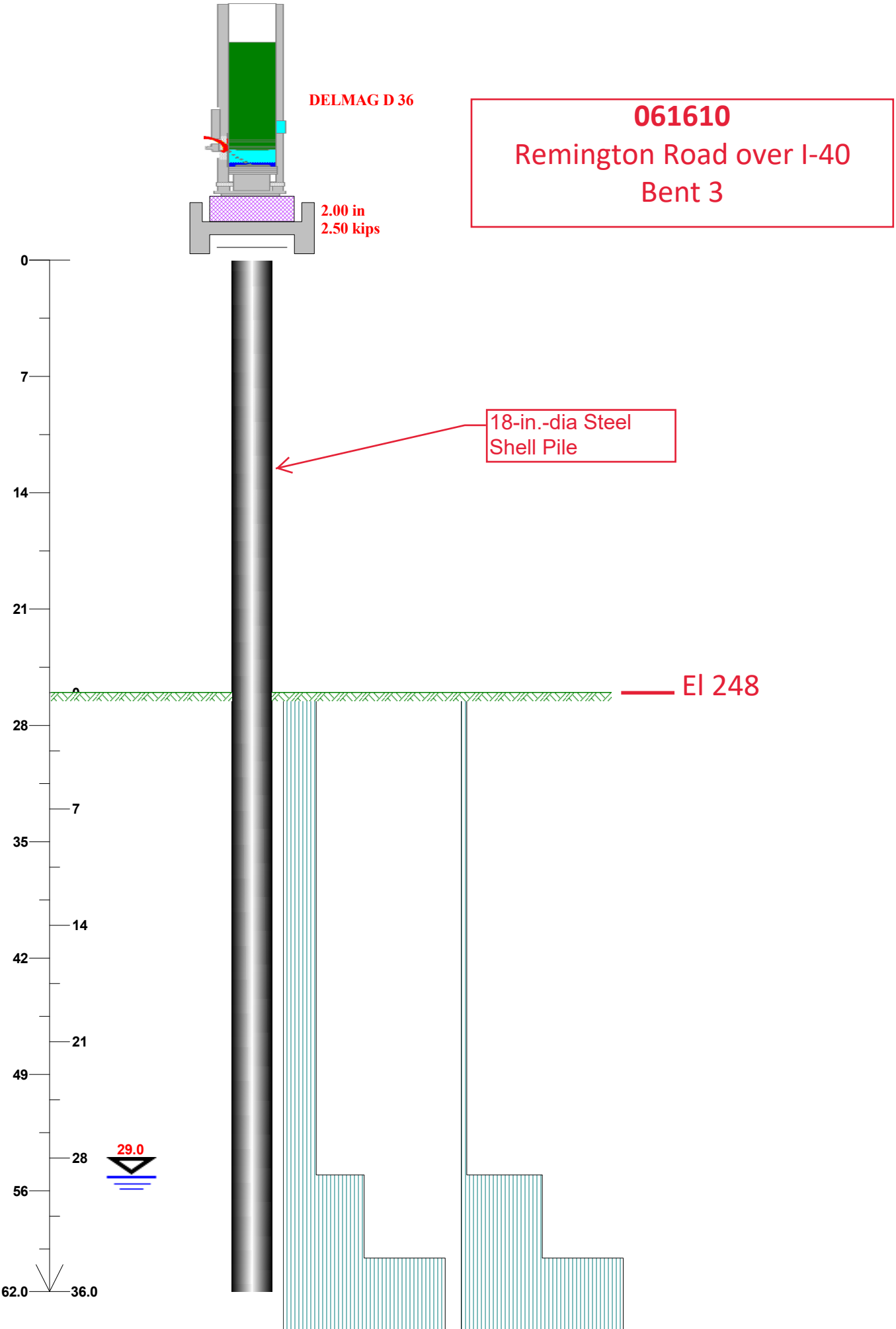
Bent 2 Delmag D 46: 107.078 kip-ft

Grubbs, Hoskyn, Barton & Wyatt, Inc. Oct 26 2020
061610 Bent 1 GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	18.0	1.7	16.3	-1.0	0.000	0.000	0.00	0.0
12.0	30.8	10.8	20.0	-1.0	0.000	0.000	0.00	0.0
18.0	42.3	22.3	20.0	-1.0	0.000	0.000	0.00	0.0
24.0	53.8	33.8	20.0	2.1	15.714	-0.582	4.30	57.2
30.0	65.3	45.3	20.0	2.7	18.587	-0.288	4.56	54.1
36.0	368.7	74.3	294.4	26.4	35.289	0.000	7.97	43.3
42.0	415.6	121.2	294.4	30.4	36.123	0.000	8.12	43.4
44.0	431.3	136.9	294.4	32.0	36.154	0.000	8.17	43.4
53.0	821.6	232.9	588.8	107.0	41.078	-0.604	9.67	50.1

Total Continuous Driving Time 24.00 minutes; Total Number of Blows 962

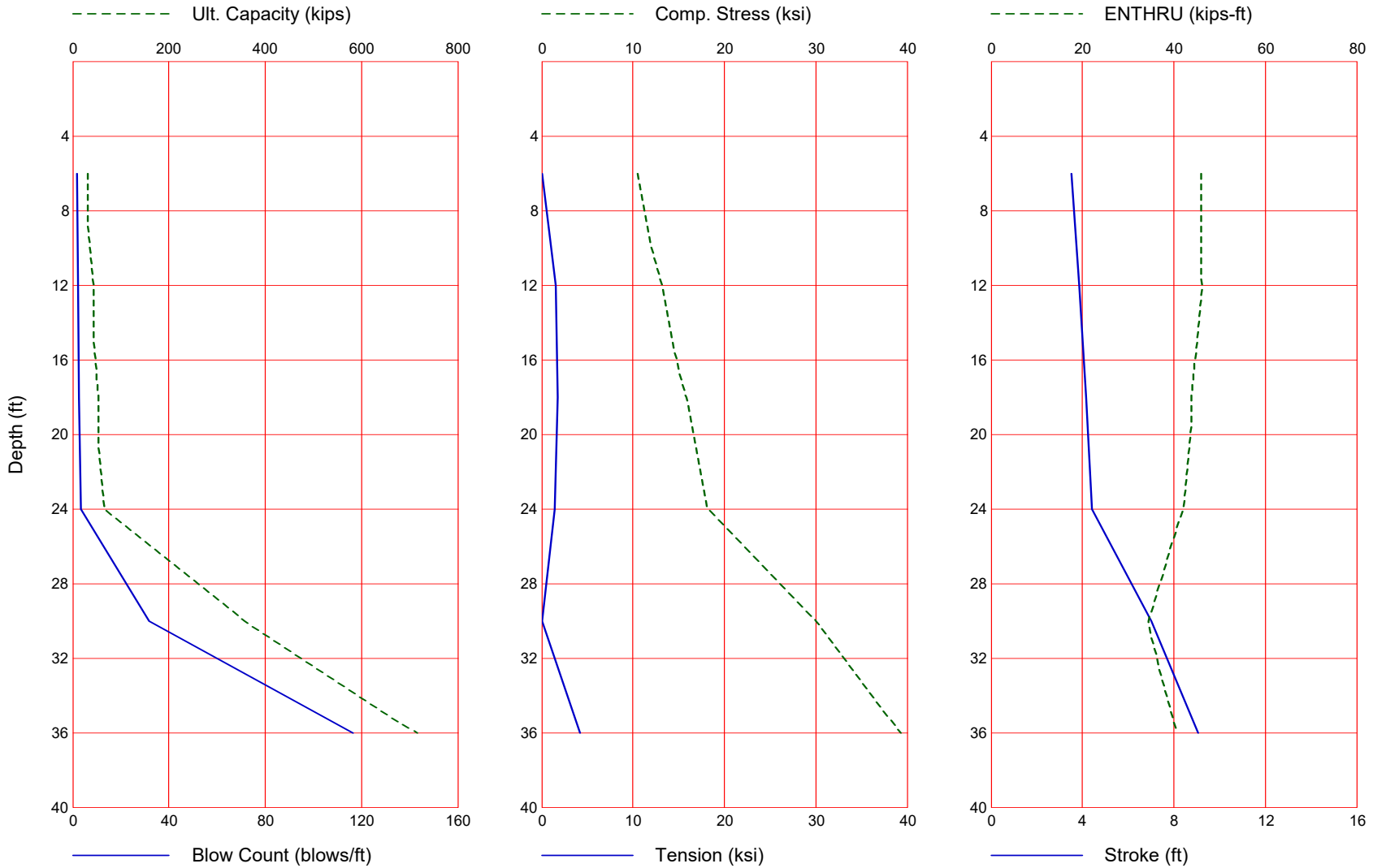

DELMAG D 36
2.00 in
2.50 kips
061610
Remington Road over I-40
Bent 3
0
7
14
21
28
7
35
14
42
21
49
28
56
62.0
36.0
29.0
18-in.-dia Steel
Shell Pile
El 248

Bent 3 Delmag D 36:
83.820 kip=ft

Grubbs, Hoskyn, Barton & Wyatt, Inc.
061610 Bent 3

Oct 26 2020
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833



Bent 3 Delmag D 36: 83.820 kip=ft

Grubbs, Hoskyn, Barton & Wyatt, Inc.
061610 Bent 3

Oct 26 2020
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.500 / 0.833

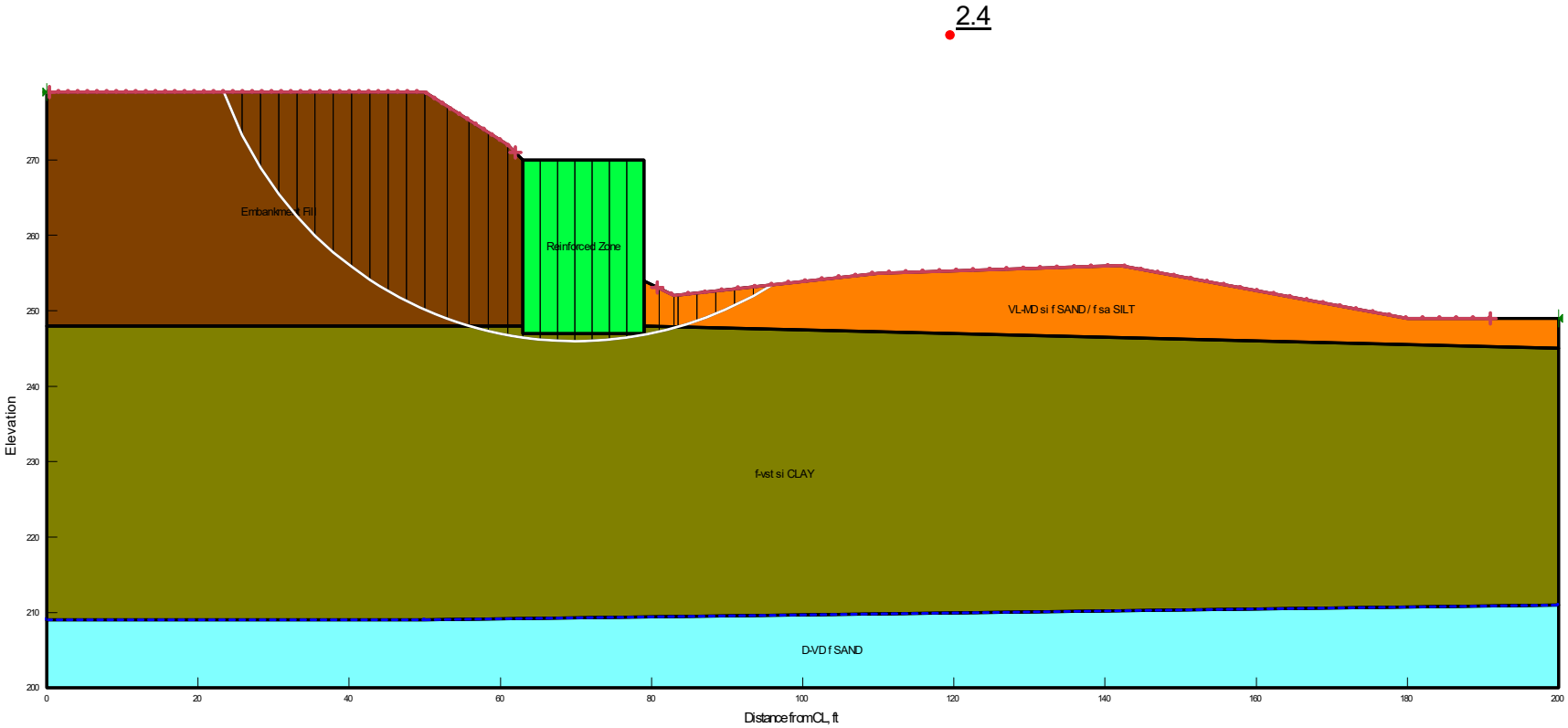
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	31.5	11.5	20.0	1.7	10.455	-0.012	3.54	46.0
12.0	43.0	23.0	20.0	2.1	13.154	-1.528	3.86	46.1
18.0	54.5	34.6	20.0	2.8	15.863	-1.707	4.15	43.9
24.0	66.1	46.1	20.0	3.5	18.145	-1.406	4.41	42.1
30.0	357.9	63.5	294.4	31.6	30.009	0.000	7.02	34.4
36.0	715.2	126.4	588.8	116.6	39.341	-4.199	9.06	40.6

Total Continuous Driving Time 14.00 minutes; Total Number of Blows 601

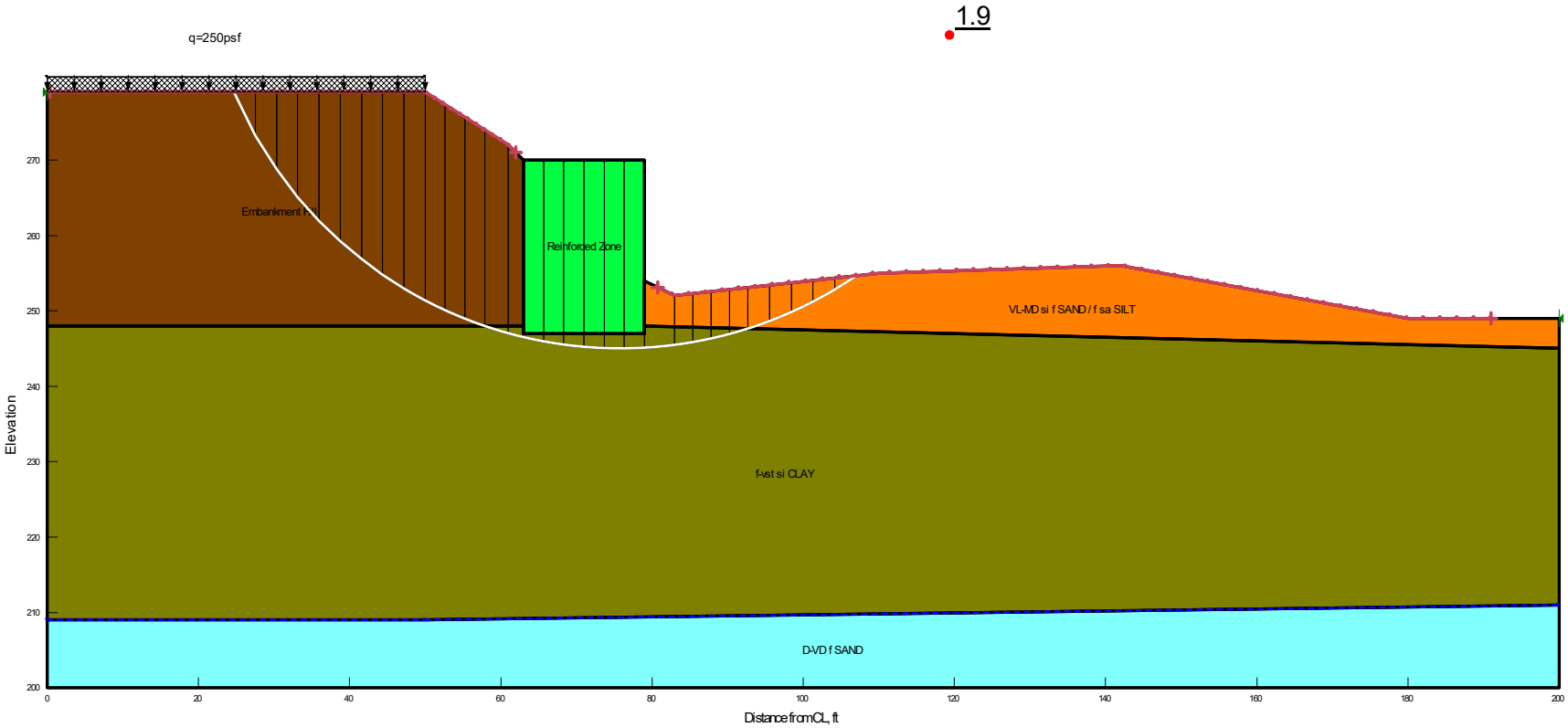
APPENDIX H

Summary of Stability Analysis Results
ARDOT Job No. 061610 Hwy. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas

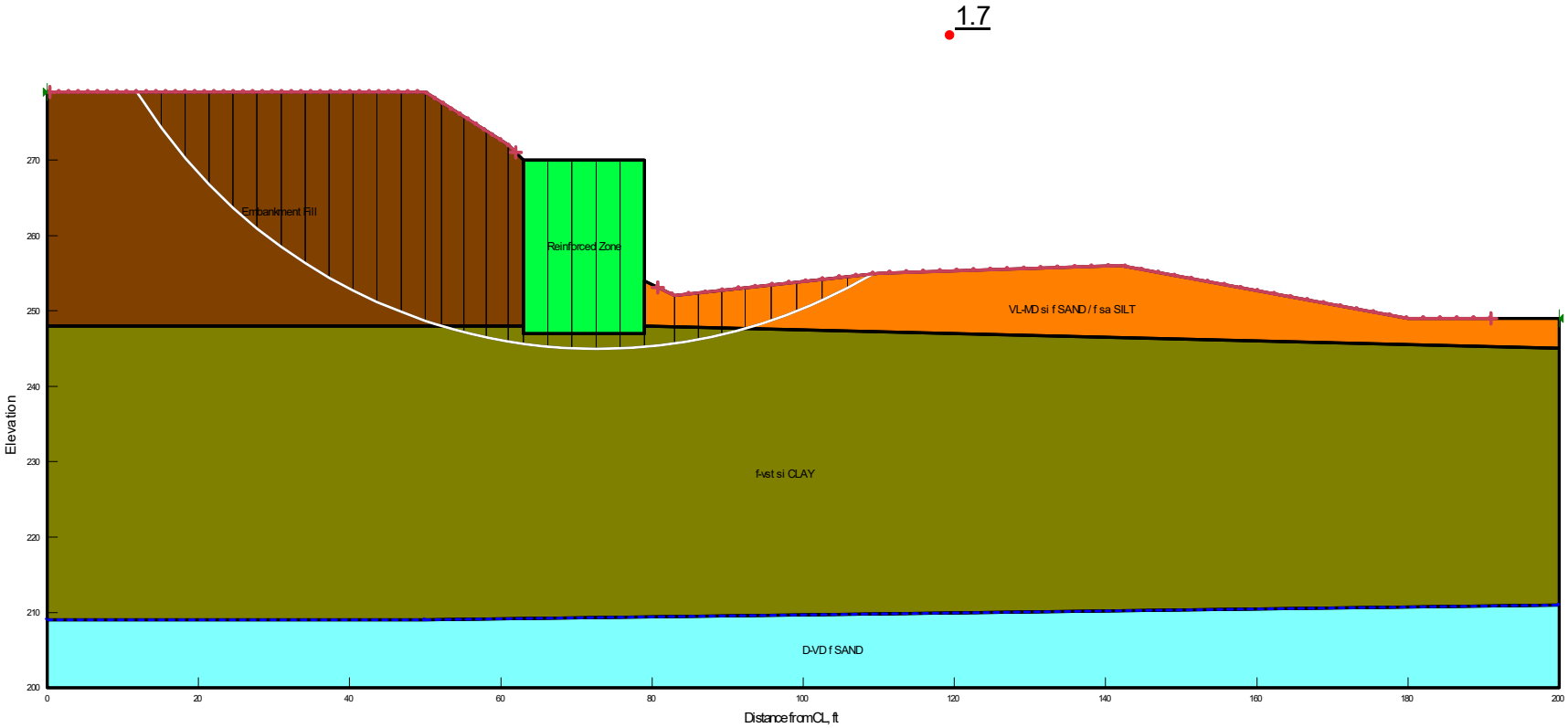
Bridge End	Design Loading Condition	Calculated Minimum Factor of Safety
Bent 1 (South Bridge End)	End of Construction	2.4
	Long Term	1.9
	Seismic ($k_h = 0.5A_S = 0.115$)	1.7
Bent 3 (North Bridge End)	End of Construction	2.6
	Long Term	1.9
	Seismic ($k_h = 0.5A_S = 0.115$)	1.7



Results of Stability Analyses – End of Construction Condition
MSE Wall @ South Bridge End (Bent 1)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas

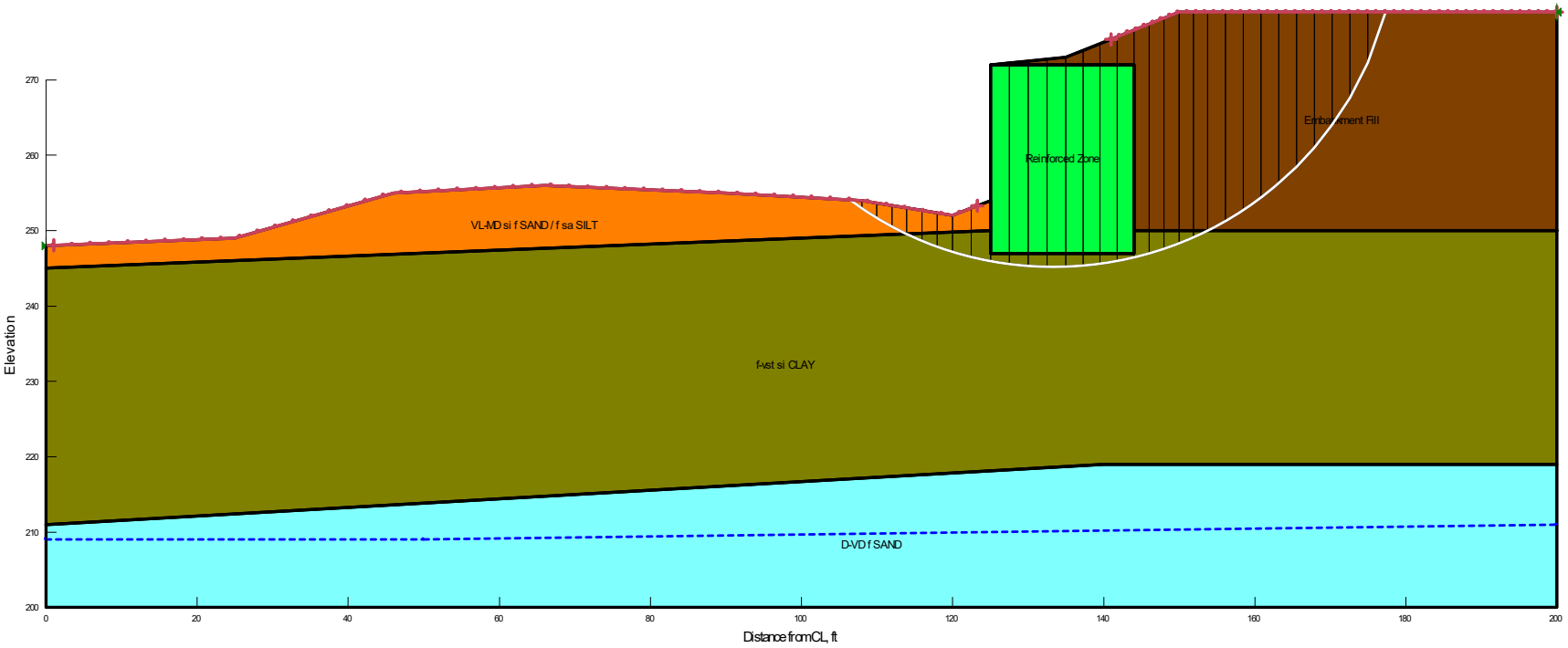


Results of Stability Analyses – Long Term Condition
MSE Wall @ South Bridge End (Bent 1)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas

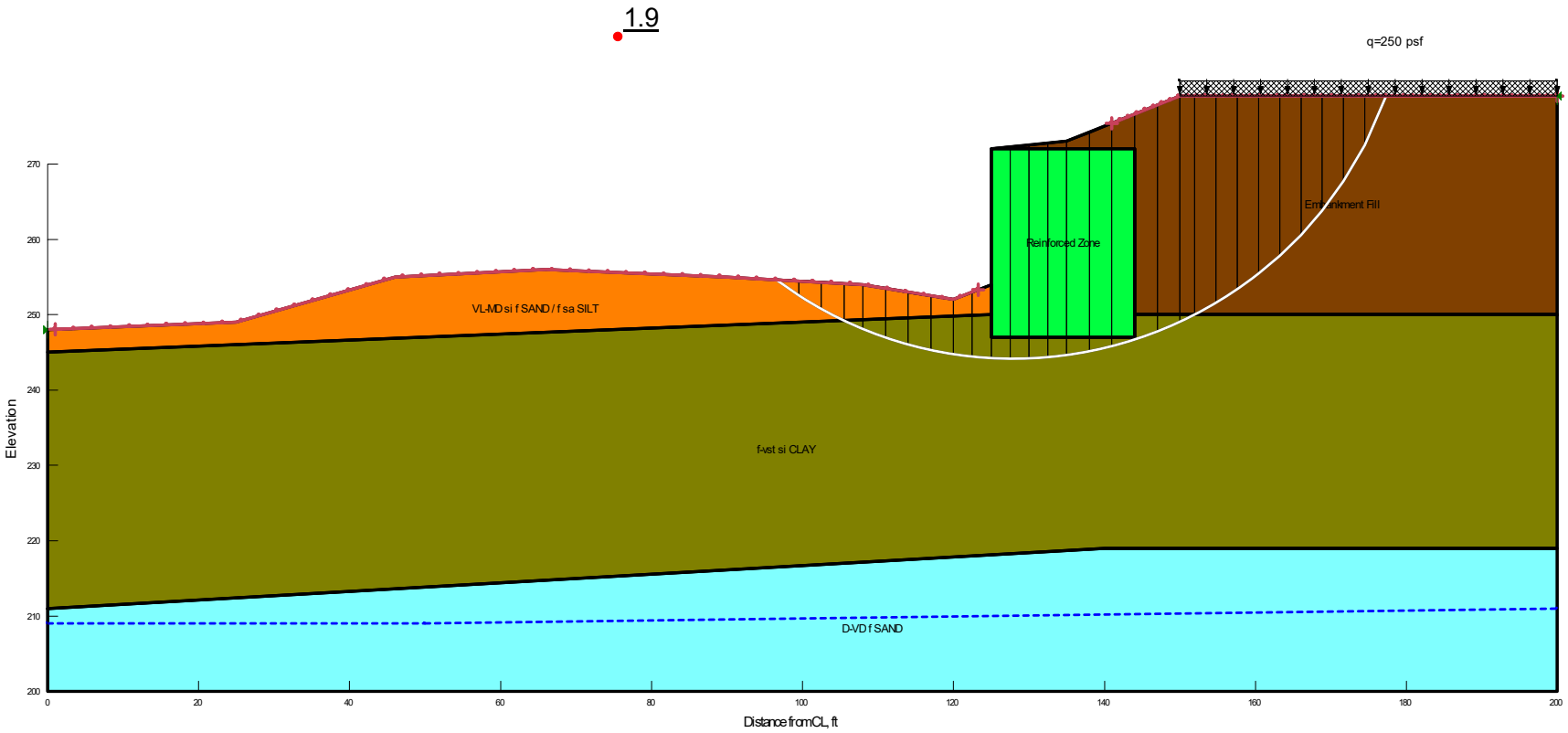


Results of Stability Analyses – Seismic Condition ($k_h = 0.5A_S = 0.115$)
MSE Wall @ South Bridge End (Bent 1)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas

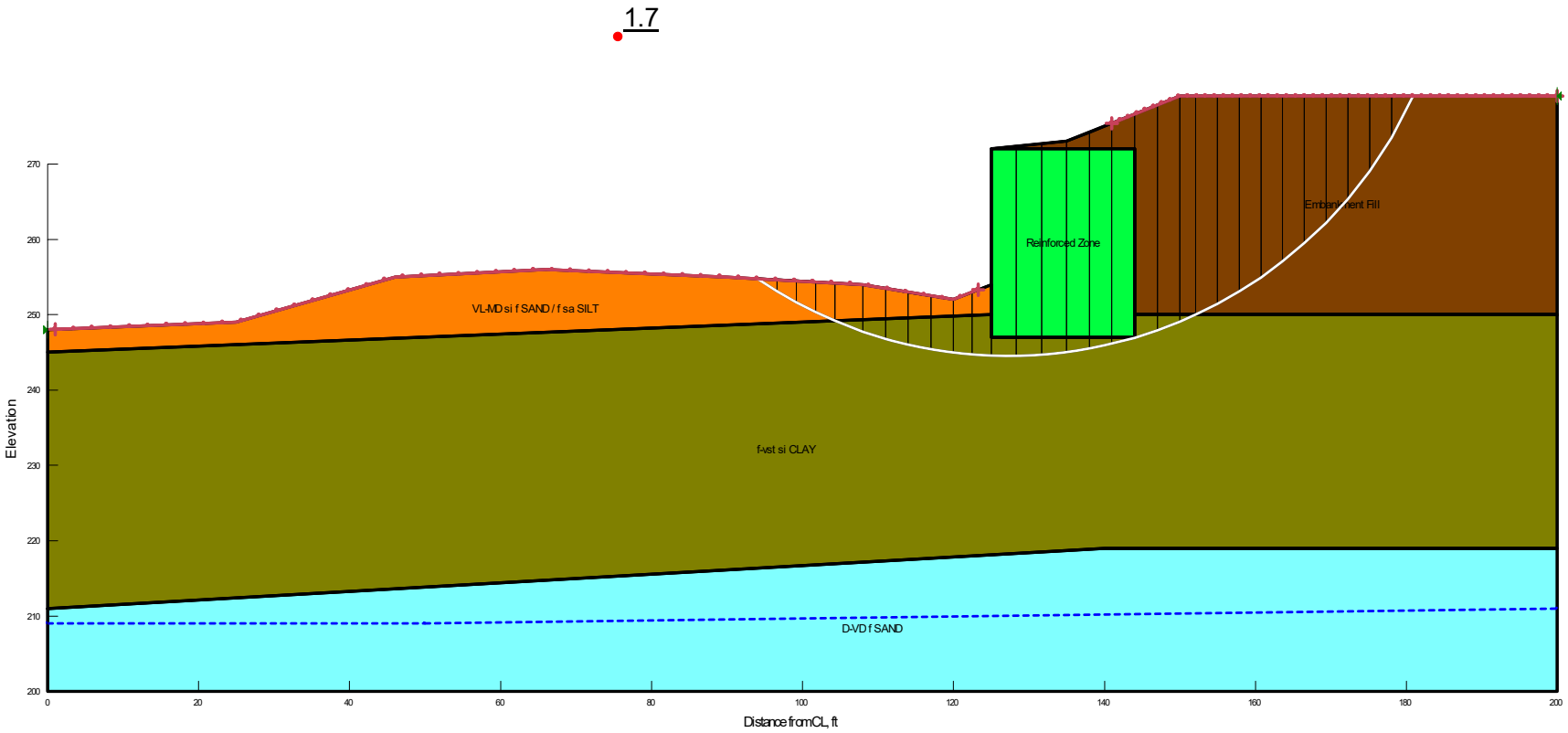
2.6



Results of Stability Analyses – End of Construction Condition
MSE Wall @ North Bridge End (Bent 3)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas



Results of Stability Analyses – Long Term Condition
MSE Wall @ North Bridge End (Bent 3)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas



Results of Stability Analyses – Seismic Condition ($k_h = 0.5A_S = 0.115$)
MSE Wall @ North Bridge End (Bent 3)
ARDOT Job No. 061610 Hw. 15 over I-40
GHBW Job No. 20-083
Lonoke County, Arkansas