

ARKANSAS DEPARTMENT OF TRANSPORTATION



SUBSURFACE INVESTIGATION

STATE JOB NO. 090472

FEDERAL AID PROJECT NO. NHPP-0004(807) & 9030

LITTLE SUGAR & TANYARD CREEKS STRS. & APPRS. (BELLA VISTA) (S)

STATE HIGHWAY 340 SECTION 1

IN BENTON 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 STATE HIGHWAY AND TRANSPORTATION DEPARTMENT

January 4, 2017

TO: Mr. Trinity Smith, Engineer of Roadway Design

SUBJECT: Job No. 090472
Little Sugar & Tanyard Creeks Strs. & Apprs. (S)
Route 340 Section 1
Benton County

Transmitted herewith is the requested Soil Survey test results for the above referenced job. The project consists of replacing two bridges on Highway 340. Samples were obtained in the existing travel lanes and ditch line. There were no paved shoulders within the project. Due to utility conflicts a bulk sample was not obtained. Based on soil type and jobs in the surrounding area an estimated R-Value of 5 is recommended.

Based on laboratory results of samples obtained, the subgrade soils consist primarily of low plasticity cherty clay. Isolated locations of highly plastic clay were encountered within the project limits. Cross sections are not currently available; it is assumed that the construction grade line will closely match that of the existing roadway. The subgrade soils are expected to provide a stable working platform with normal drying and compactive efforts, if the weather is favorable during construction. Rock was encountered at station 122+00, 21 feet right of centerline at a depth of 4.5 feet. No slides were observed within the project limits.

Additional earthwork requirements will be made upon request when plans are further developed.

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 located near Gravette.
2. Asphalt Concrete Hot Mix

Type	Asphalt Cement %	Mineral Aggregate %
Surface Course	5.3	94.7
Binder Course	4.3	95.7
Base Course	4.1	95.9



Michael C. Behson
Materials Engineer

MCB:pt:bjj
Attachment

cc: State Constr. Eng. – Master File Copy
District 9 Engineer
System Information and Research Div.
G. C. File

JOB: 090472

Arkansas State Highway Transportation Department

JOB NAME: LITTLE SUGAR & TANYARD CREEK STRS. & APPRS. (S)

Materials Division

COUNTY NO. 4 DATE TESTED 12/29/2016

Michael Benson, Materials Engineer

STA.#	LOC.	DEPTH	COLOR	#4 #10 #40 #80 #200					L.L.	P.I.	SOIL CLASS	LAB #:	%MOISTURE
				S	I	E	V	E					
106+00	06RT	0-5	BROWN	80	63	47	42	39	21	4	A-4(0)	S521	16.2
114+00	09LT	0-5	BROWN	82	69	55	51	47	23	5	A-4(0)	S522	18.4
122+00	06RT	0-5	BROWN	91	82	71	68	65	23	8	A-4(2)	S523	17.4
122+00	21RT	0-4.5Z	BROWN	72	50	31	25	21	ND	NP	A-1-B(0)	S524	10.4
130+00	12LT	0-5	BROWN	81	67	53	48	45	49	33	A-7-6(9)	S525	14.8
130+00	18LT	0-5	BROWN	80	63	47	42	38	25	11	A-6(1)	S526	10
130+00	24LT	0-5	BROWN	88	73	54	47	43	23	7	A-4(0)	S527	12.6

comments: W=MULTIPLE LAYERS, X=STRIPPED,Z=AUGER REFUSAL

Tuesday, January 03, 2017

JOB: 090472

Arkansas State Highway Transportation Department

DATE TESTED
12/29/2016

JOB NAME: LITTLE SUGAR & TANYARD CREEK STRS. & APPRS. (S)

Materials Division

COUNTY NO. 4

Michael Benson, Materials Engineer

STA.# LOC. **PAVEMENT SOUNDINGS**

106+00	06RT	ACHM SC 6.0W	ACHM BC ---	BST ---	AGG BASE CRS CL-7 9.0
114+00	09LT	ACHM SC ---	ACHM BC 5.0	BST 3.0W	AGG BASE CRS CL-7 7.0
122+00	21RT	ACHMSC ---	ACHMBC ---	BST ---	AGG BASE CRS CL-7 ---
122+00	06RT	ACHM SC 4.0W	ACHM BC 7.0	BST ---	AGG BASE CRS CL-7 7.0
130+00	24LT	ACHMSC ---	ACHMBC ---	AGG BASE CRS CL-7 ---	
130+00	18LT	ACHMSC ---	ACHMBC ---	BST ---	AGG BASE CRS CL-7 3.0
130+00	12LT	ACHMSC 7.0XW	ACHMBC 6.0	BST 4.0	AGG BASE CRS CL-7 5.0

comments: W=MULTIPLE LAYERS,X=STRIPPED,Z=AUGER REFUSAL

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT - LITTLE ROCK, ARKANSAS
MATERIALS DIVISION

MICHAEL BENSON, MATERIALS ENGINEER

*** SOIL SURVEY / PAVEMENT SOUNDING TEST REPORT ***

DATE	- 12/29/16	SEQUENCE NO.	- 1
JOB NUMBER	- 090472	MATERIAL CODE	- SSPS
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 04
SUPPLIER NAME	- STATE	DISTRICT NO.	- 09
NAME OF PROJECT	- LITTLE SUGAR & TANYARD CREEK STRS. & APPRS. (S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS	DATE SAMPLED	- 12/20/16
LOCATION	- BENTON COUNTY	DATE RECEIVED	- 12/28/16
SAMPLED BY	- THORNTON/BATES	DATE TESTED	- 12/29/16
SAMPLE FROM	- TEST HOLE		
MATERIAL DESC.	- SOIL SURVEY PAVEMENT SOUNDINGS		

LAB NUMBER	-	20164134	-	20164135	-	20164136
SAMPLE ID	-	S521	-	S522	-	S523
TEST STATUS	-	INFORMATION ONLY	-	INFORMATION ONLY	-	INFORMATION ONLY
STATION	-	106+00	-	114+00	-	122+00
LOCATION	-	06RT	-	09LT	-	06RT
DEPTH IN FEET	-	0-5	-	0-5	-	0-5
MAT'L COLOR	-	BROWN	-	BROWN	-	BROWN
MAT'L TYPE	-		-		-	
LATITUDE DEG-MIN-SEC	-	36 28 35.70	-	36 28 35.60	-	36 28 31.80
LONGITUDE DEG-MIN-SEC	-	94 15 21.80	-	94 15 12.00	-	94 15 4.90
% PASSING	2	IN.	-	-	-	-
	1 1/2	IN.	-	-	-	-
	3/4	IN.	-	100	-	100
	3/8	IN.	-	95	-	96
	NO. 4		-	80	-	91
	NO. 10		-	63	-	82
	NO. 40		-	47	-	71
	NO. 80		-	42	-	68
	NO. 200		-	39	-	65
LIQUID LIMIT	-	21	-	23	-	23
PLASTICITY INDEX	-	4	-	5	-	8
AASHTO SOIL	-	A-4 (0)	-	A-4 (0)	-	A-4 (2)
UNIFIED SOIL	-		-		-	
% MOISTURE CONTENT	-	16.2	-	18.4	-	17.4
ACHM SC	(IN)	-		6.0W	-	4.0W
ACHM BC	(IN)	-		---	-	7.0
BST	(IN)	-		---	-	---
AGG BASE CRS CL-7	(IN)	-		9.0	-	7.0

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED, Z=AUGER REFUSAL

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 - 12/29/16 SEQUENCE NO. - 2
JOB NUMBER - 090472 MATERIAL CODE - SSPS
FEDERAL AID NO. - TO BE ASSIGNED SPEC. YEAR - 2014
PURPOSE - SOIL SURVEY SAMPLE SUPPLIER ID. - 1
SPEC. REMARKS - NO SPECIFICATION CHECK COUNTY/STATE - 04
SUPPLIER NAME - STATE DISTRICT NO. - 09
NAME OF PROJECT - LITTLE SUGAR & TANYARD CREEK STRS. & APPRS. (S)
PROJECT ENGINEER - NOT APPLICABLE
PIT/QUARRY - ARKANSAS
LOCATION - BENTON COUNTY DATE SAMPLED - 12/20/16
SAMPLED BY - THORNTON/BATES DATE RECEIVED - 12/28/16
SAMPLE FROM - TEST HOLE DATE TESTED - 12/29/16
MATERIAL DESC. - SOIL SURVEY PAVEMENT SOUNDINGS

LAB NUMBER	20164137	20164138	20164139
SAMPLE ID	S524	S525	S526
TEST STATUS	INFORMATION ONLY	INFORMATION ONLY	INFORMATION ONLY
STATION	122+00	130+00	130+00
LOCATION	21RT	12LT	18LT
DEPTH IN FEET	0-4.5Z	0-5	0-5
MAT'L COLOR	BROWN	BROWN	BROWN
MAT'L TYPE			
LATITUDE DEG-MIN-SEC	36 28 31.70	36 28 32.30	36 28 32.30
LONGITUDE DEG-MIN-SEC	94 15 5.00	94 14 55.70	94 14 55.70
% PASSING			
2 IN.			
1 1/2 IN.			
3/4 IN.	100	100	100
3/8 IN.	87	96	95
NO. 4	72	81	80
NO. 10	50	67	63
NO. 40	31	53	47
NO. 80	25	48	42
NO. 200	21	45	38
LIQUID LIMIT	ND	49	25
PLASTICITY INDEX	NP	33	11
AASHTO SOIL	A-1-B(0)	A-7-6(9)	A-6(1)
UNIFIED SOIL			
% MOISTURE CONTENT	10.4	14.8	10.0
ACHMSC (IN)	---	7.0XW	---
ACHMBC (IN)	---	6.0	---
BST (IN)	---	4.0	---
AGG BASE CRS CL-7 (IN)	---	5.0	3.0

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED, Z=AUGER REFUSAL

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	- 12/29/16	SEQUENCE NO.	- 3
JOB NUMBER	- 090472	MATERIAL CODE	- SSPS
FEDERAL AID NO.	- TO BE ASSIGNED	SPEC. YEAR	- 2014
PURPOSE	- SOIL SURVEY SAMPLE	SUPPLIER ID.	- 1
SPEC. REMARKS	- NO SPECIFICATION CHECK	COUNTY/STATE	- 04
SUPPLIER NAME	- STATE	DISTRICT NO.	- 09
NAME OF PROJECT	- LITTLE SUGAR & TANYARD CREEK STRS. & APPRS. (S)		
PROJECT ENGINEER	- NOT APPLICABLE		
PIT/QUARRY	- ARKANSAS		
LOCATION	- BENTON COUNTY	DATE SAMPLED	- 12/20/16
SAMPLED BY	- THORNTON/BATES	DATE RECEIVED	- 12/28/16
SAMPLE FROM	- TEST HOLE	DATE TESTED	- 12/29/16
MATERIAL DESC.	- SOIL SURVEY PAVEMENT SOUNDINGS		

LAB NUMBER	- 20164140	-	-
SAMPLE ID	- S527	-	-
TEST STATUS	- INFORMATION ONLY	-	-
STATION	- 130+00	-	-
LOCATION	- 24LT	-	-
DEPTH IN FEET	- 0-5	-	-
MAT'L COLOR	- BROWN	-	-
MAT'L TYPE	-	-	-
LATITUDE DEG-MIN-SEC	- 36 28 32.30	-	-
LONGITUDE DEG-MIN-SEC	- 94 14 55.70	-	-
% PASSING	2 IN.	-	-
	1 1/2 IN.	-	-
	3/4 IN.	- 100	-
	3/8 IN.	- 95	-
	NO. 4	- 88	-
	NO. 10	- 73	-
	NO. 40	- 54	-
	NO. 80	- 47	-
	NO. 200	- 43	-

LIQUID LIMIT	- 23	-	-
PLASTICITY INDEX	- 7	-	-
AASHTO SOIL	- A-4(0)	-	-
UNIFIED SOIL	-	-	-
% MOISTURE CONTENT	- 12.6	-	-

ACHMSC	(IN)	-	-
ACHMBC	(IN)	-	-
AGG BASE CRS CL-7	(IN)	-	-
		-	-
		-	-
		-	-
		-	-
		-	-

REMARKS - W=MULTIPLE LAYERS, X=STRIPPED, Z=AUGER REFUSAL

AASHTO TESTS : T24 T88 T89 T90 T265

Memo

To: Mike Burns / Chuck Wipf
Company: Crafton Tull Associates
From: Mark Wyatt *MW*
Date: March 18, 2020
Job No: 17-125
Re: Supplemental Recommendations
Proposed Temporary MSE Walls "A" and "B" at East Bridge End
Bridge 05155 – Hwy. 340 Over Little Sugar Creek
ARDOT Job 090472, Little Sugar & Tanyard Creeks Strs. & Apprs (S)
Bella Vista, Benton County, Arkansas

Mike and Chuck,

As requested, we have reviewed the available information on the Temporary Mechanically Stabilized Earth (MSE) Retaining Walls "A" and "B". These temporary walls are planned at the east bridge end for the Bridge 05155 replacement, Hwy. 340 over Little Sugar Creek. This review has included consideration of the available subsurface information, including the results of borings drilled for prior construction. This submittal provides recommendations and conclusions for bearing capacity and global stability of the proposed temporary MSE wall based on the information available. This particular project phase is part of the Little Sugar & Tanyard Creek Strs & Apprs (S) project which is designated as ARDOT Job No. 090472. The report of the geotechnical investigation was provided on June 27, 2019.

Project Description

Relevant design drawings for the MSE walls were provided by the Engineer (CTA) and are included in Attachment 1. The tops of the temporary walls are planned at El 1004± and wall height varies from 20 ft to 23 feet.

Relevant Subsurface Conditions

Relevant logs of borings drilled in the plan temporary MSE wall vicinity (Borings 1 and 2) are included in Attachment 2. The approximate boring locations are shown on the bridge layout provided in Attachment 1. Additionally, the boring logs provided on the original construction documents have been considered. These borings were performed by the Arkansas State Highway Commission (ASHC). The construction drawing showing the bridge layout with record boring logs is also shown in Attachment 2.

Based on the results of these borings, the surface and near-surface soils at the wall locations are anticipated to be firm to stiff brown silty clay or clay, or loose to medium dense brown sandy fine

to coarse gravel. These soils exhibit low to moderate shear strength, low to medium relative density, and moderate to high compressibility.

The overburden soils are underlain by moderately hard to dark brownish gray slightly weathered shale and low hardness gray and yellowish gray highly weathered sandstone. Because of the sloping terrain of the river bank, with the rock depth generally following the terrain, rock could be encountered at variable elevations in the temporary MSE wall locations. The shale, limestone, and dolostone rock units at the bridge location are often interbedded. The upper weathered shale units may contain silty clay and/or clay laminations, seams and layers in weathered units while the limestone may contain pyrite partings. The limestone, dolostone, and shale exhibit variable degrees of weathering within the upper 5 to 10 feet. However, weathering generally decreases and rock quality increases with depth.

Bearing Capacity

The bottom of Temporary MSE Wall A is planned at about El 982. The bottom of Temporary MSE Wall B is planned at about El 986.5. The available subsurface information indicates that the Temporary MSE wall bearing stratum will be stiff silty.

The temporary walls may be founded in compact stiff silty clay or clay with chert, dolomite, and shale fragments or medium dense sandy fine to coarse gravel. The bearing stratum at the undercut bottom must be field verified by the Engineer or Department. Where non-compact soft to firm silty clay/clay, loose gravel, or otherwise unsuitable soils are encountered at the plan wall bottom elevation, undercutting will be warranted. Undercuts on the order of 2 ft, more or less, could be required to develop suitable bearing. Undercuts should be deepened as required to bear in suitable foundation strata. Undercuts should extend at least 6 ft outside the reinforced zone to the extent possible.

Undercut backfill should consist of crushed stone aggregate base (Standard Specifications Section 303, Class 7), Select Granular Backfill (AASHTO M43 No. 57), or approved alternates. For temporary MSE wall undercuts backfilled with free-draining Select Granular Backfill, we recommend that provision be made for drainage of infiltrated surface water and groundwater.

For the temporary MSE walls bearing on compact stiff silty clay or clay with chert, dolomite, and shale fragments or medium dense sandy fine to coarse gravel or compacted undercut backfill as recommended above, a nominal unit bearing resistance of 7750 lbs per sq ft is recommended. A resistance factor (ϕ) of 0.65 is also recommended for the wall bearing. Consequently, a factored unit bearing resistance (q_R) of 5000 lbs per sq ft is considered suitable for the temporary MSE wall bearing on the recommended bearing strata. A minimum embedment depth of 4 ft below lowest adjacent grade is recommended for the temporary MSE walls. Suitable bearing strata must be field verified.

Resistance to wall sliding can be evaluated using an ultimate friction factor ($\tan \delta$) value of 0.32 between the recommended bearing strata and the temporary MSE wall reinforced zone bases. A resistance factor (ϕ) of 1.0 is recommended for evaluation of sliding resistance. Long-term post-construction settlement of the wall foundation soil is expected to be less than 1 inch.

Global Stability

Stability analyses were performed to verify the global (external) stability of temporary MSE Walls A and B. It is understood that the temporary MSE walls will be designed by Others on behalf of the Contractor. Internal wall stability must be verified by the Wall Designer.

MSE wall backfill in the reinforced zone must comply with the Designer's specifications. As a minimum, the reinforced zone backfill is expected to comply with Standard Specifications Section 303, Class 7 or Select Granular Backfill (AASHTO M43 #57). For the purposes of modeling the reinforced backfill zone, a minimum total unit weight (γ) of 125 lbs per cu ft was assumed.

To evaluate suitability of the temporary MSE walls, slope stability analyses have been performed. A 250 lbs per sq ft uniform traffic surcharge was included for the stability analyses. Stability analyses were performed using the computer program SLOPE/W 2007¹ and a Morgenstern-Price analysis. For global stability, four (4) general loading conditions were evaluated, i.e., end of construction, long term, rapid drawdown, 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 0.028. For evaluating the rapid drawdown condition, a water surface elevation drop from El 982 to El 972 was assumed.

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 this study indicate that global stability of the plan Temporary MSE Walls A and B configurations are acceptable with respect to all loading conditions evaluated.

The results of the stability analyses are summarized in Attachment 3. Graphical results of stability analyses are also provided in Attachment 3.

Closing

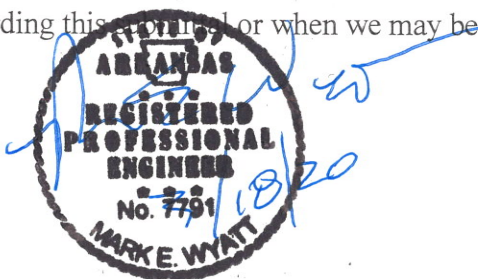
The results and recommendations for the Temporary MSE Walls A and B provided herein have been developed based on the information provided by the Engineer, the results of the relevant borings, and our understanding of the project. It must be noted that no borings were specifically drilled in the plan Temporary MSE wall alignments. Modification or revision of the recommendations discussed herein could be warranted if subsurface conditions significantly at variance with those encountered in the borings.

The following attachments are included and complete this submittal.

Attachment 1	Relevant Design Drawings
Attachment 2	Relevant Boring Logs
Attachment 3	Results of Stability Analyses

* * * * *

Please contact us should you have any questions regarding this submittal or when we may be of further service.

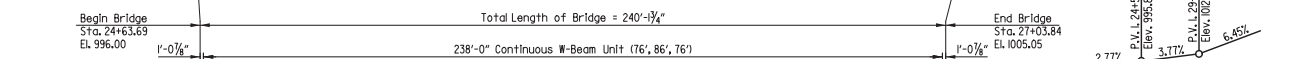
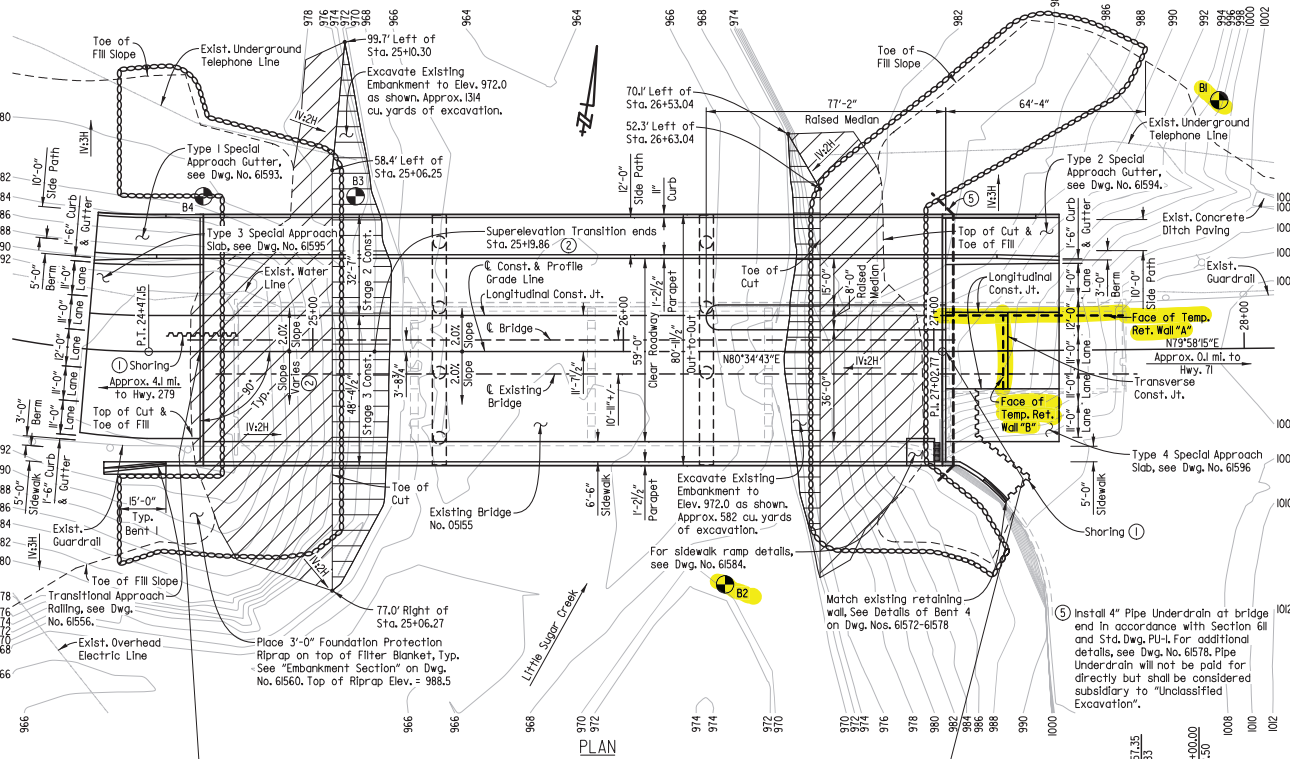


¹ Slope/W 2007; GEO-SLOPE International; 2008.

ATTACHMENT 1

USER: CTAUSER
 DESIGN FILE: G:\NIT0700L\Hwy340\TRANSP\gdn\bridge\090472x2.dgn
 PLOTTED: 2/14/2020 2:57:08 PM
 SCALE: 40,0000 1" = 100'

For R/W Data, See Roadway Plans.
 ① Shoring will be required to retain the roadway embankment during construction. See SP Job No. 090472 "Shoring" for details.



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

① 1 1/4" Poured Silicone Jt.
 Proposed Grade Line Along C. Bridge
 Type "H" Metal bridge rail right side only.
 Type "H2" & "H3" Metal bridge rail left side only.

② See "SUPERELEVATION TRANSITION SKETCH" on Dwg. No. 61560.
 For Soil Boring Information, see Dwg. No. 61560

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.		58	110

GENERAL NOTES ① 07481 LAYOUT 61559

BENCH MARK: Vertical Control Data are shown on Survey Control Details.

CONSTRUCTION SPECIFICATIONS: Arkansas State Highway and Transportation Department Standard Specifications for Highway Construction (2014 edition) with applicable Supplemental Specifications and Special Provisions. Section and Subsection refer to the Standard Construction Specifications unless otherwise noted in the Plans.

DESIGN SPECIFICATIONS: AASHTO LRFD Bridge Design specifications (7th Edition) with current Interim specifications.

LIVE LOADING: HL-93 SEISMIC PERFORMANCE ZONE: I S_{DD} = 0.085 SITE CLASS: C

MATERIALS AND STRENGTHS:
 Class S(AE) Concrete (Superstructure) f'c = 4,000 psi
 Class S Concrete (Substructure) f'c = 3,500 psi
 Reinforcing Steel (AASHTO M 31 or M 322 Type A, Gr. 60) f_y = 60,000 psi
 Structural Steel (ASTM A709, Gr. 36) F_y = 36,000 psi
 Structural Steel (ASTM A709, Gr. 50W) F_y = 50,000 psi

BORING LOGS: Boring logs may be obtained from the Construction Contract Procurement Section of Program Management Division.

STEEL PILING: Piling in End Bent 1 and Wing A of End Bent 4 shall be HP 12x53 (Gr.50) and shall be driven with an approved air, steam or diesel hammer to a minimum safe bearing capacity of 97 tons per pile and into the material designated as limestone on the boring legend. Piling in End Bent 4 shall be HP 14x89 (Gr.50) and shall be driven with an approved air, steam or diesel hammer to a minimum safe bearing capacity of 63 tons per pile and into the material designated as shale on the boring legend. Lengths of piling shown are for estimating quantities and for use in determining payment for cut-off and build-up in accordance with Section 805. Piles in end bents to be driven after excavation to bottom of cap or footing are complete. On all piles, the Contractor shall use approved steel H-pile driving points.

PREFORING: Preforing is required for all piles in Bent 4. Preforing shall be to a minimum 3' depth into material designated as shale on the boring legend. The actual size and depth of preforing shall be determined in the field by the Engineer. The Contractor shall be responsible for keeping prefored holes free of debris prior to driving piles and backfilling which may require the use of temporary casings or other methods. After driving is completed, the prefored hole shall be backfilled with Class S Concrete to the top of the rock and the remaining length backfilled in accordance with Subsection 805.08(c). Any related cost for backfilling and temporary casing will not be paid for directly, but shall be considered subsidiary to the item "Preforing."

DRILLED SHAFTS: Drilled shafts in Bents 2 and 3 shall be constructed in accordance with Special Provision Job No. 090472 "Drilled Shaft Foundations". Drilled shafts shall be socketed a minimum of 10' into competent rock designated as moderately hard to hard shale on the boring legend. No adjustment to plan tip elevations shall be made without prior approval from the Engineer.

CROSSHOLE SONIC LOGGING: Nondestructive testing shall be performed on each drilled shaft in accordance with Special Provision Job No. 090472 "Nondestructive Testing of Drilled Shafts".

PAINTING: All Grade 50W structural steel, except galvanized members and surfaces in contact with concrete, within five feet of bridge deck expansion joints shall be painted as specified in Subsection 807.75. The color of paint shall be Brown equior close to Federal Std. 595B, Color Chip No. 30070 and as approved by the engineer. The finish system may be applied in the shop. Any damage to the paint system occurring during transport or installation shall be corrected according to the manufacturer's recommendations at no cost to the Department.

For Additional General Notes see Dwg. No. 61560.

HYDRAULIC DATA

FLOOD DESCRIPTION	FREQUENCY		DISCHARGE CFS	① NATURAL W.S. ELEVATION FEET	W.S. ELEVATION WITH BACKWATER FEET
	YEARS	PERCENT			
DESIGN	50	2.0	29,681	988.4	988.0
BASE	100	1.0	33,771	989.6	989.1
EXTREME	500	0.2	47,749	993.8	992.5
OVERTOPPING	82	0.25	32,299	---	988.5

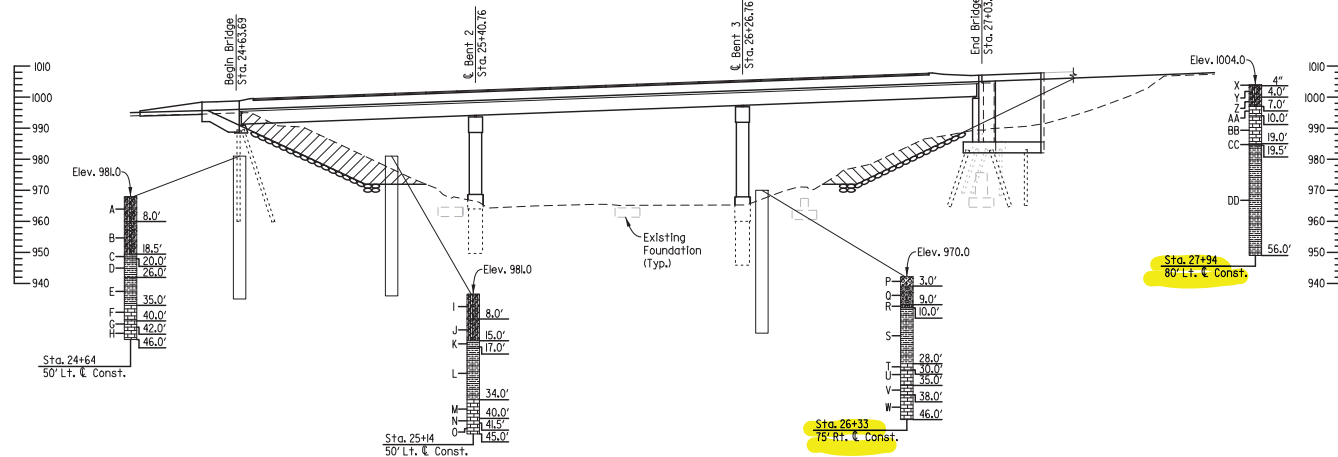
- ① Unconstricted water surface elevation without structure or roadway approaches. 100 ycr. backwater elevation for existing structure = 989.6 feet
- ② Proposed Low Bridge Chord Elev. = 99.34 feet at Station 24+65.76
- ③ Drainage Area = 102.8 sq. miles
Historical H.W. Elev. = N/A

SHEET 1 OF 2
 LAYOUT OF BRIDGE
 HIGHWAY 340 OVER LITTLE SUGAR CREEK
 LITTLE SUGAR & TANYARD CREEKS
 STRS. & APPRS. (BELLA VISTA) (S)
 BENTON COUNTY
 ROUTE 340 SEC. 1
 ARKANSAS STATE HIGHWAY COMMISSION
 LITTLE ROCK, ARK.

DRAWN BY: BNC DATE: 11-20-18 FILENAME: b090472x2.dgn
 CHECKED BY: CAW DATE: 12-03-18 SCALE: 1" = 20'
 DESIGNED BY: KRM DATE: 11-28-18
 BRIDGE NO. 07481 DRAWING NO. 61559



DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
JOB NO. 090472							59	110
LAYOUT							61560	



GENERAL NOTES (Cont'd)

BRIDGE DECK: The concrete bridge deck shall be given a trowel finish as specified for final finishing. In Sub-Section 802.19 for Class 5 Tined Bridge Roadway Surface Finish, the shared use path and sidewalk shall be given a Class 6, Broomed Finish.

PROTECTIVE SURFACE TREATMENT: Class 2 Protective Surface Treatment shall be applied to the roadway surface, roadway face and top of parapet walls, median, side path surface, sidewalk surface, and face of curb.

DETAIL DRAWINGS:

Stage Construction	61561-61565
End Bent 1	61566-61569
Intermediate Bent 2 and 3	61570-61571
End Bent 4	61572-61578
Elastomeric Bearings	61579
238'-0" Continuous Composite W-Beam Unit	61580-61589
Type 1 Special Approach Gutters	61593
Type 2 Special Approach Gutters	61594
Type 3 Special Approach Slab	61595
Type 4 Special Approach Slab	61596
General Notes for Steel Bridge Structures	55006
Details for Steel Bridge Structures	55007
Standard Details for Poured Silicone Joints	55008
Steel H-Piles	55020

DRAWING NUMBER

EXISTING BRIDGE: Existing Bridge No. 05155 (Log Mile 4.14) is 47.0' wide (42.0' clear roadway) and 287.0' long and consists of comp. W-beam units supported by a concrete pile cap and bent, concrete column intermediate bents on spread footings, and a deep concrete abutment on pile footings. Plans of the existing structure, if available, may be obtained upon request to the Construction Contract Procurement Section of the Program Management Division.

REMOVAL AND SALVAGE: After Stage 3A construction is complete and open to traffic, the Contractor shall remove existing Bridge No. 05155, including existing riprap, in accordance with Section 205. Removal of existing riprap will not be paid for directly but shall be considered subsidiary to the item "Removal of Existing Bridge Structure (Site No. ...)". All material from the existing bridge shall become the property of the Contractor except the following which shall remain the property of the State:

Type B Steel Bridge Rail and connecting hardware

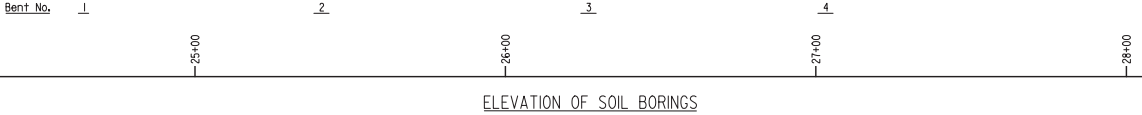
The Contractor shall notify the Department prior to removal to determine the specific pieces deemed salvageable. The Contractor shall provide temporary storage and on site loading onto ARDOT equipment for removal of salvage items from the site. This work shall be considered incidental to the item "Removal of Existing Bridge Structure".

The existing concrete pile footings at Bent 4 shall be removed entirely. The top of existing piles at Bent 4 shall be cut off 0.5' below the bottom of proposed pile footing. The Contractor shall compare the locations of the existing piling to the plan location of the proposed piling. The Contractor shall notify the Engineer of any conflicts prior to driving piling.

MAINTENANCE OF TRAFFIC: See Roadway Plans and Special Provisions for more information.

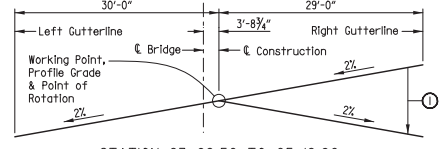
"N" VALUES

Sta. 24+64 - 50' Left of Const. C.L.	Sta. 25+4 - 50' Left of Const. C.L.	Sta. 26+33 - 75' Right of Const. C.L.	Sta. 27+94 - 80' Left of Const. C.L.
0.5-1.5, N=6	0.5-1.5, N=6	0.5-1.5, N=7	1.0-2.0, N=11
2.5-3.5, N=6	2.5-3.5, N=11	2.5-3.5, N=8	2.5-3.5, N=10
4.5-5.5, N=4	4.5-5.5, N=11		4.5-5.5, N=11
6.5-7.5, N=4	6.5-7.5, N=4		6.5-7.5, N=23
9.0-10.0, N=7	9.0-10.0, N=4		9.0-9.5, N=50/1"
14.0-15.0, N=9	14.0-14.5, N=50/4"		
18.5-19.0, N=25/0"	18.0-18.5, N=25/0"		



BORING LEGEND

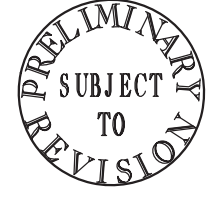
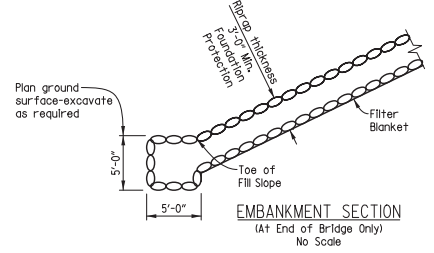
- A. Loose dark brown clayey fine sand w/a little fine to coarse gravel (fill)
- B. Loose brown clayey fine to coarse gravel
- C. Moderately hard dark gray highly weathered shale, carbonaceous
- D. Moderately hard dark brownish gray slightly weathered shale, carbonaceous, horizontal bedding w/occasional pyrite inclusions and close jointing
- E. Moderately hard dark brownish gray shale, carbonaceous, thinly bedded, flat bedded w/occasional pyrite inclusions
- F. Moderately hard to hard light gray and gray limestone w/some fossils, close sandy limestone layers and occasional calcite inclusions
- G. Hard light gray dolostone
- H. Hard light gray and gray limestone, slightly sandy, flat bedded w/occasional chert nodules, and some calcite inclusions
- I. Loose dark brown clayey fine to coarse gravel, sandy (fill)
- J. Medium dense brown clayey fine to coarse gravel
- K. Moderately hard dark gray highly weathered shale, carbonaceous
- L. Moderately hard dark brownish gray slightly weathered shale, flat bedded, carbonaceous w/occasional pyrite inclusions
- M. Moderately hard light gray and gray limestone w/some chert nodules and occasional fossils
- N. Hard light grayish tan dolostone w/occasional pyrite inclusions
- O. Hard light gray and gray limestone w/occasional chert nodules and pyrite inclusions
- P. Loose brown clayey fine to coarse gravel
- Q. Loose brown sandy fine to coarse gravel
- R. Stiff brown silty clay w/some fine coarse gravel
- S. Moderately hard to hard dark brownish gray slightly weathered shale, carbonaceous, flat bedded w/some pyrite inclusions
- T. Hard gray limestone
- U. Hard light gray and gray limestone, flat bedded w/close to very close bluish green mudstone laminations
- V. Hard light gray dolostone, flat bedded w/close greenaceous dolostone zones
- W. Hard light gray and gray limestone, arenaceous, flat bedded w/some calcite inclusions and calcite crystal filled vugs
- X. Asphalt Concrete
- Y. Stiff brown silty clay w/numerous chert fragments (fill)
- Z. Stiff gray, reddish brown and brown clay w/occasional shale fragments and ferrous stains (fill)
- AA. Low hardness gray and yellowish gray highly weathered limestone w/silty clay seams
- BB. Moderately hard light gray and gray slightly weathered limestone, flat bedded w/occasional pyrite inclusions
- CC. Low hardness greenish gray calcareous mudstone
- DD. Moderately hard dark brownish gray shale, carbonaceous and flat bedded, w/occasional pyrite inclusions



STATION 23+89.56 TO 25+19.86
(Looking Ahead)

SUPERELEVATION TRANSITION METHOD OF ROTATION

Ⓢ Cross slope varies from 2% up from Profile Grade (Sta. 23+89.56) to 2% down from Profile Grade (Sta. 25+19.86).



SHEET 2 OF 2

LAYOUT OF BRIDGE

HIGHWAY 340 OVER LITTLE SUGAR CREEK

LITTLE SUGAR & TANYARD CREEKS

STRS. & APPRS. (BELLA VISTA) (S)

BENTON COUNTY

ROUTE 340 SEC. 1

ARKANSAS STATE HIGHWAY COMMISSION

LITTLE ROCK, ARK.

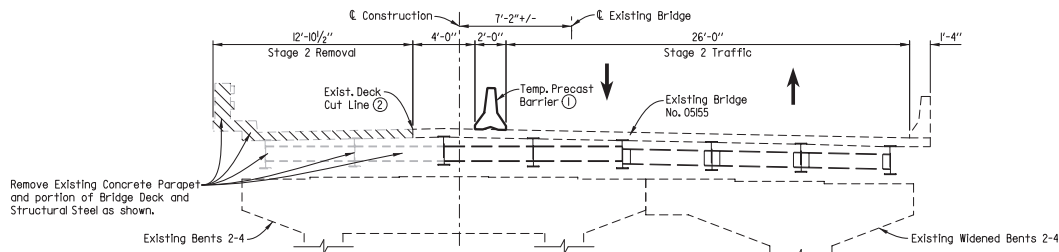
DRAWN BY: **BWC** DATE: **8-20-18** FILENAME: **b090472x2.i2.dgn**

CHECKED BY: **CAW** DATE: **12-03-18** SCALE: **1" = 20'**

DESIGNED BY: **KRM** DATE: **8-12-18**

BRIDGE NO. 07481 **DRAWING NO. 61560**

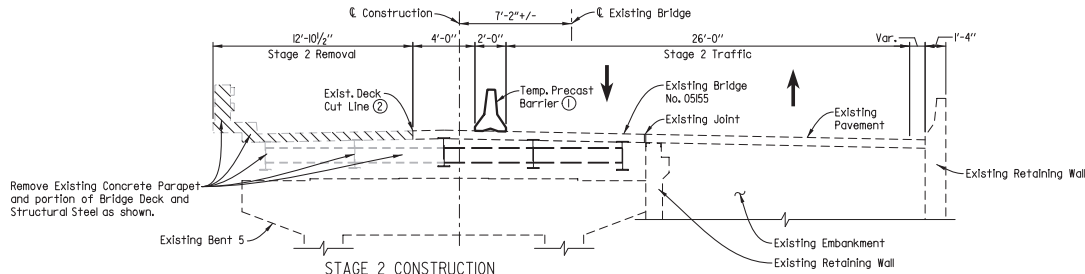
DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
JOB NO. 090472							60	110
07481							STAGE CONST.	



Remove Existing Concrete Parapet and portion of Bridge Deck and Structural Steel as shown.

Existing Bents 2-4

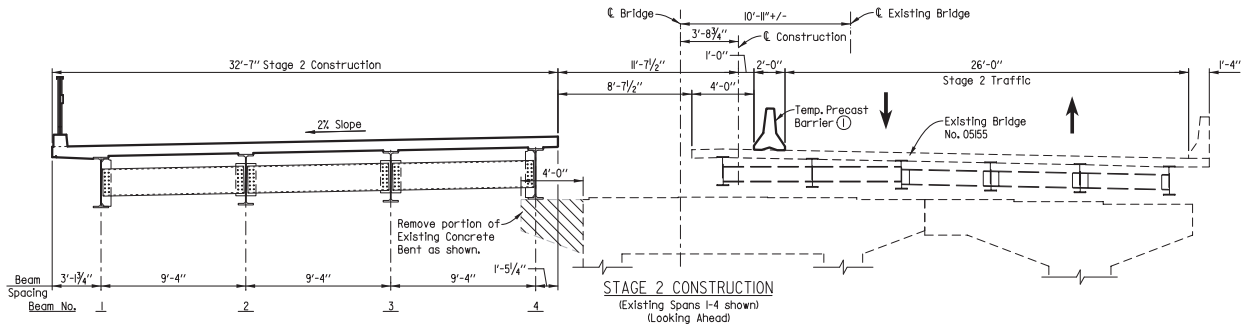
STAGE 2 CONSTRUCTION
(Existing Spans 1-4 shown)
(Looking Ahead)



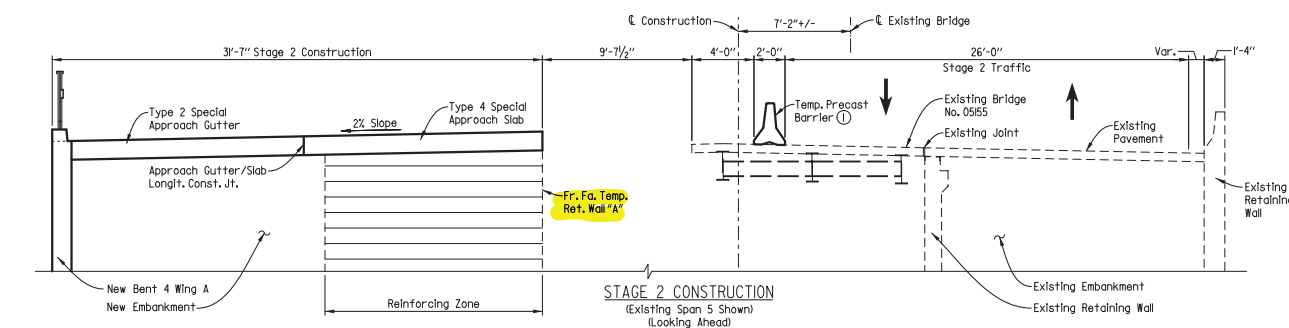
Remove Existing Concrete Parapet and portion of Bridge Deck and Structural Steel as shown.

Existing Bent 5

STAGE 2 CONSTRUCTION
(Existing Span 5 shown)
(Looking Ahead)

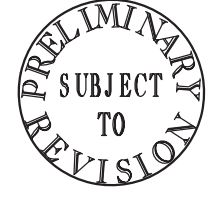


STAGE 2 CONSTRUCTION
(Existing Spans 1-4 shown)
(Looking Ahead)



STAGE 2 CONSTRUCTION
(Existing Span 5 Shown)
(Looking Ahead)

- Notes:
- ① For Details of Temporary Precast Barrier, See Std. Dwg. TC-4, Do not attach Temporary Precast Barrier to new or existing deck.
 - ② Full Depth Saw Cut.

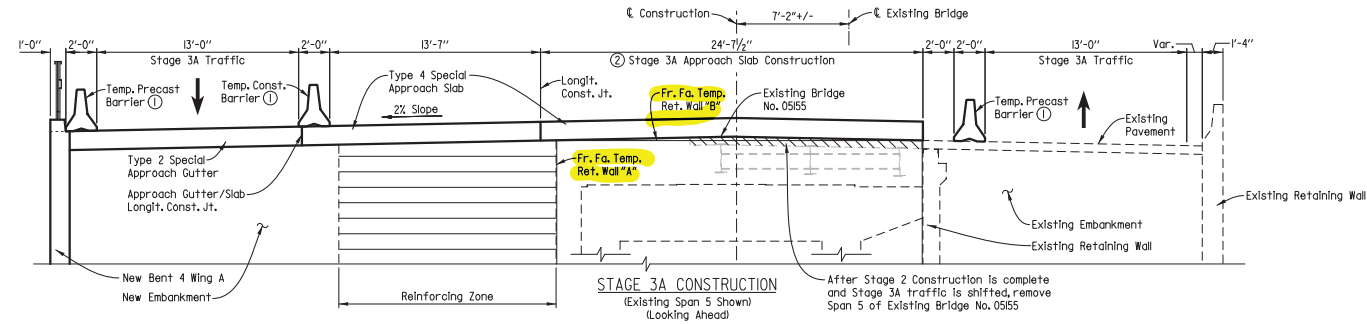
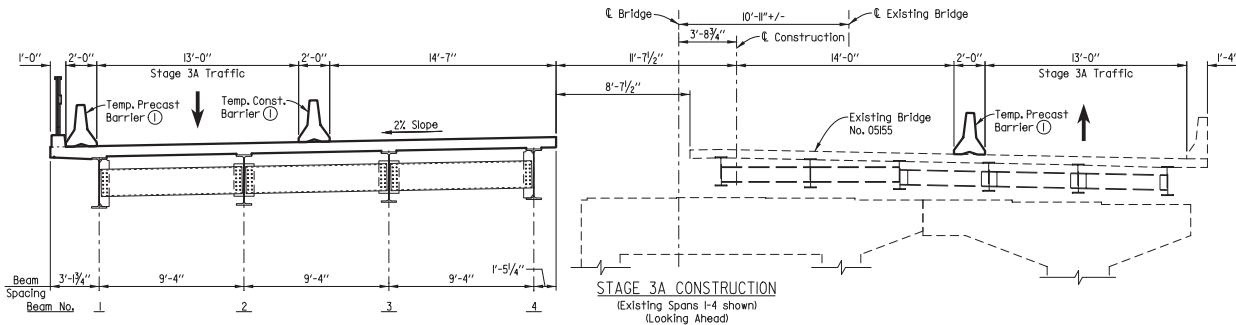


SHEET 1 OF 5
DETAILS OF STAGE CONSTRUCTION
HIGHWAY 340 OVER LITTLE SUGAR CREEK
BENTON COUNTY
 ROUTE SEC.
ARKANSAS STATE HIGHWAY COMMISSION
 LITTLE ROCK, ARK.

DESIGNED BY: BWC DATE: 8-20-18 FILENAME: b090472x2.13.dgn
 CHECKED BY: CAW DATE: 8-29-18 SCALE: 1/4" = 1'-0"
 BRIDGE NO. 07481 DRAWING NO. 61561

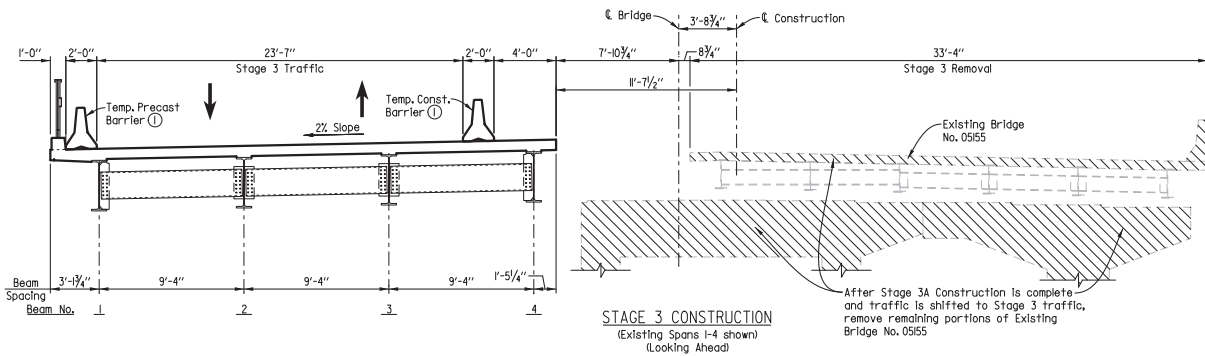
USER: CTAUSER
 DESIGN FILE: G:\170700L\Hwy340\TRANSP\ dgn\bridge\b090472x2.13.dgn
 PLOTTED: 2/14/2020 2:57:09 PM
 SCALE: 8,0000 / / in.

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO. 090472		61		110
				07481		STAGE CONST.		61562



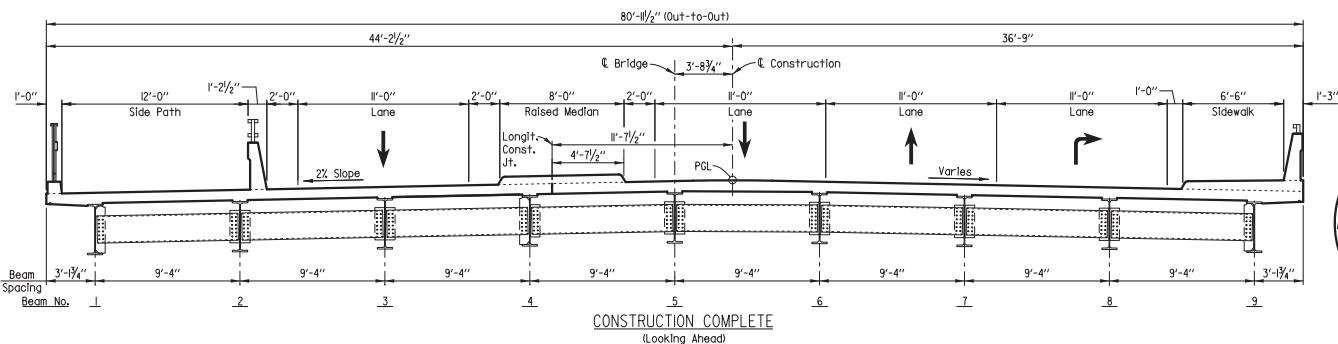
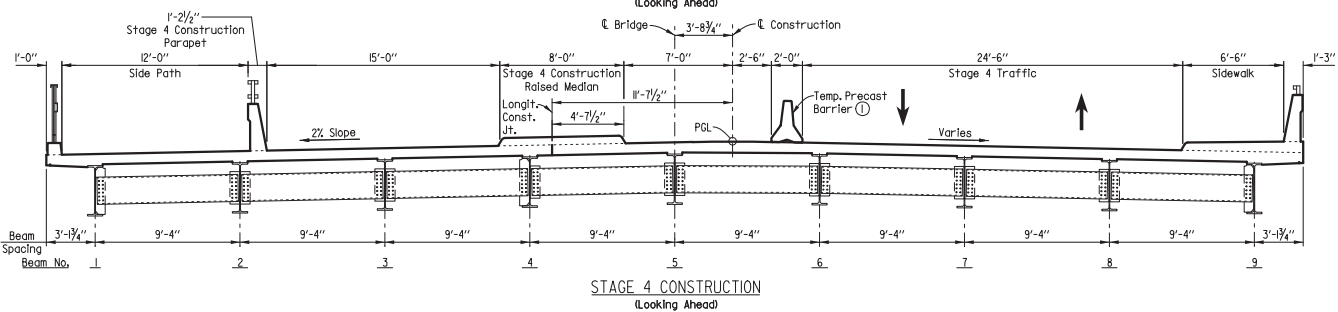
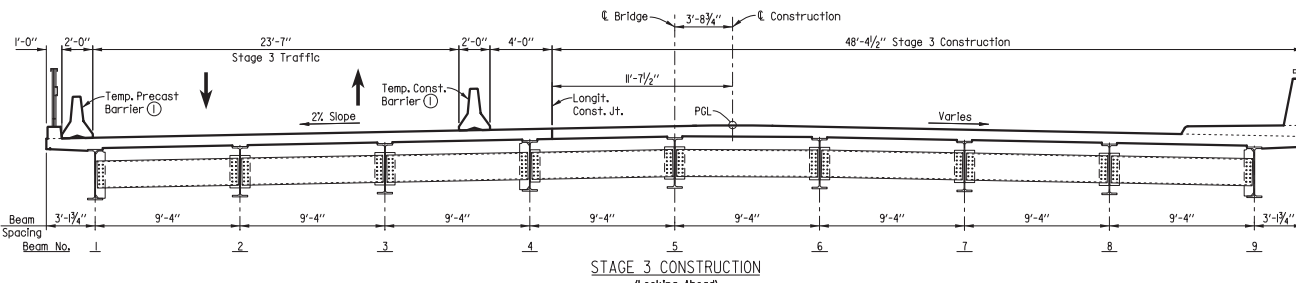
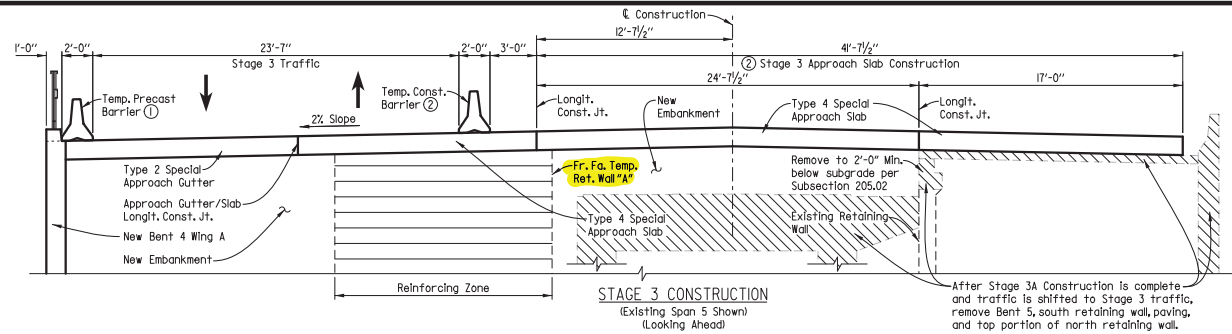
Notes:

- ① For Details of Temporary Precast Barrier, See Std. Dwg. TC-4. Do not attach Temporary Precast Barrier to new deck.
- ② Portions of approach slab to be constructed in Stage 3A and Stage 3. See Dwg. No. 61564 for details.



SHEET 2 OF 5
DETAILS OF STAGE CONSTRUCTION
HIGHWAY 340 OVER LITTLE SUGAR CREEK
BENTON COUNTY
 ROUTE SEC.
ARKANSAS STATE HIGHWAY COMMISSION
 LITTLE ROCK, ARK.
 DRAWN BY: BWC DATE: 8-20-18 FILENAME: b090472x2_14.dgn
 CHECKED BY: CAW DATE: 8-29-18 SCALE: 1/4" = 1'-0"
 DESIGNED BY: NRM DATE: 8-12-18
 BRIDGE NO. 07481 DRAWING NO. 61562

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
JOB NO. 090472							62	110
07481							STAGE CONST. 61563	



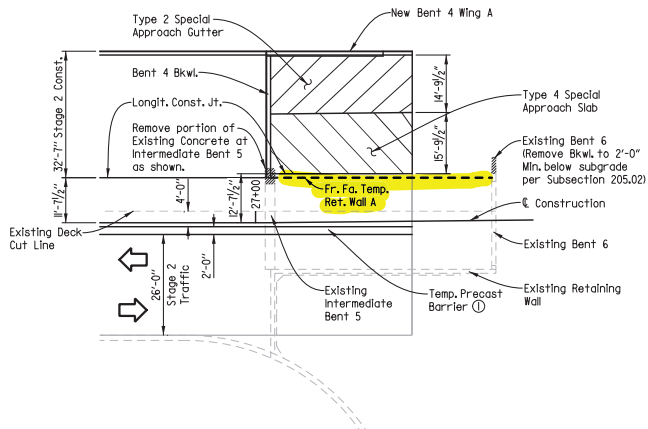
- Notes:
- ① For Details of Temporary Precast Barrier, See Std. Dwg. TC-4. Do not attach Temporary Precast Barrier to new deck.
 - ② Portions of approach slab to be constructed in Stage 3A and Stage 3. See Dwg. No. 61564 for details.



SHEET 3 OF 5
DETAILS OF STAGE CONSTRUCTION
HIGHWAY 340 OVER LITTLE SUGAR CREEK
BENTON COUNTY
 ROUTE SEC.
ARKANSAS STATE HIGHWAY COMMISSION
 LITTLE ROCK, ARK.
 DRAWN BY: BWC DATE: 8-20-18 FILENAME: b090472x2_15.dgn
 CHECKED BY: CAW DATE: 8-29-18 SCALE: 1/4" = 1'-0"
 DESIGNED BY: KRM DATE: 8-12-18
 BRIDGE NO. 07481 DRAWING NO. 61563

USER: CTAUSER
 DESIGN FILE: G:\170700L\Hwy340\TRANSP\ dgn\bridge\b090472x2_15.dgn
 PLOTTED: 2/14/2020 2:57:00 PM SCALE: 8,0000 / 1 in.

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO. 090472		63	110	
				07481		STAGE CONST.		61564



STAGE 2 CONSTRUCTION
(Plan View at Bent 4)
Scale: 1/8" = 1'-0"

STAGE 2 BENT 4 CONSTRUCTION SEQUENCE

- 2.1 Remove left exterior girder and adjacent interior girder and portions of existing bridge deck
- 2.2 Remove portion of Existing Backwall on Bent 6
- 2.3 Construct Bent 4 to Longt. Const. Jt.
- 2.4 Construct Temporary Retaining Wall "A"
- 2.5 Construct Type 2 Special Approach Gutter and Type 4 Special Approach Slab to Longt. Const. Jt.

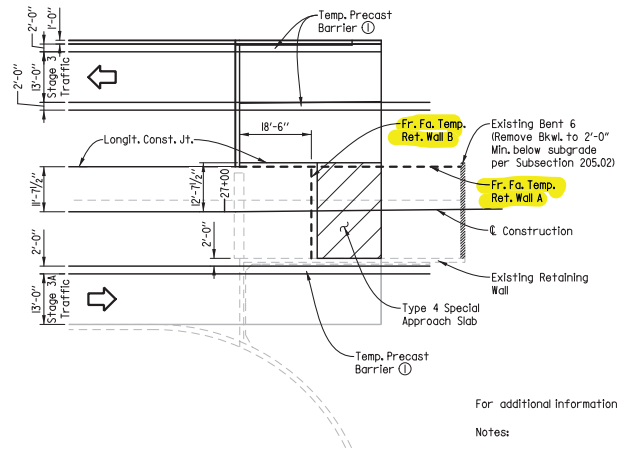
STAGE 3A BENT 4 CONSTRUCTION SEQUENCE

- 3A.1 Shift west bound traffic
- 3A.2 Remove portions of existing bridge deck, Bent 5 to Existing wall, and remove portion of Existing Backwall on Bent 6
- 3A.3 Construct Temporary Retaining Wall "B"
- 3A.4 Construct ahead portion of Type 4 Special Approach Slab to transverse Const. Jt.

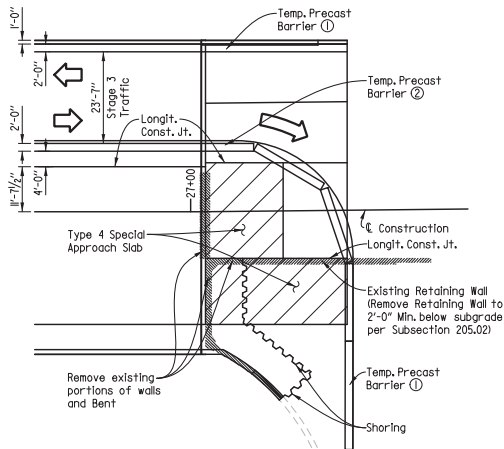
STAGE 3 BENT 4 CONSTRUCTION SEQUENCE

- 3.1 Shift east bound traffic
- 3.2 Remove remaining Existing Bent 5, Existing Retaining wall, and remove portion of Existing North Retaining wall
- 3.3 Construct remaining Bent 4, Retaining wall, and remaining portion of Type 4 Special Approach Slab

Notes: The Contractor may submit a different stage construction sequence for approval by the Engineer.



STAGE 3A CONSTRUCTION
(Plan View at Bent 4)
Scale: 1/8" = 1'-0"



STAGE 3 CONSTRUCTION
(Plan View at Bent 4)
Scale: 1/8" = 1'-0"

For additional information, see Dwg. Nos. 6156-61563.

Notes:

- ① For Details of Temporary Precast Barrier, See Std. Dwg. TC-4. Do not attach Temporary Precast Barrier to new deck.
- ② For Details of Temporary Precast Barrier, See Std. Dwg. TC-4. Do not attach Temporary Precast Barrier to new Approach Slab.



SHEET 4 OF 5
DETAILS OF STAGE CONSTRUCTION
HIGHWAY 340 OVER LITTLE SUGAR CREEK
BENTON COUNTY
ROUTE SEC.
ARKANSAS STATE HIGHWAY COMMISSION
LITTLE ROCK, ARK.
DRAWN BY: BWC DATE: 1-29-19 FILENAME: b090472x2.16.dgn
CHECKED BY: CAW DATE: 12-06-19 SCALE: 1/8" = 1'-0"
DESIGNED BY: KRM DATE: 1-22-19
BRIDGE NO. 07481 DRAWING NO. 61564

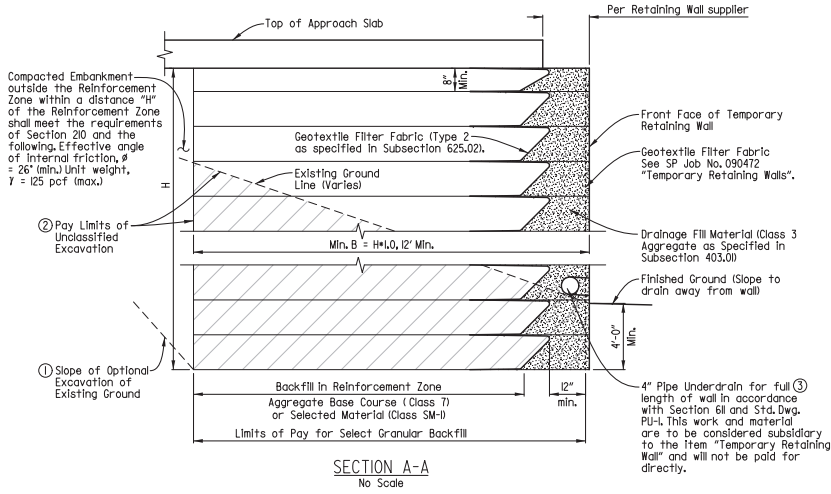
DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	090472	64	110	
				107481	RETAINING WALLS		61565	

TABLE OF VARIABLES
FOR TEMPORARY RETAINING WALLS AT BENT 4

POINT	STATION	OFFSET	TOP OF WALL ELEVATION	BOTTOM OF WALL ELEVATION
A	27+04.34	12.58' LT. (4)	1003.68	985.50
B	27+16.34	12.58' LT. (4)	1005.83	1004.45
C	27+22.34 (4)		1004.36	986.44
D	27+22.34 (4)	0.00'	1004.61	986.44
E	27+22.34 (4)	12.00' RT.	1004.37	986.44

Stations shown are along Construction Hwy. 340. Stations and offsets are measured to the outside face of Temporary Retaining Wall. Elevations shown are to top of Temporary Retaining Wall.

(4) Actual offset from edge of approach slab shall be determined by the temporary retaining wall manufacturer. The Contractor shall adjust the wall layout accordingly.



GENERAL NOTES:

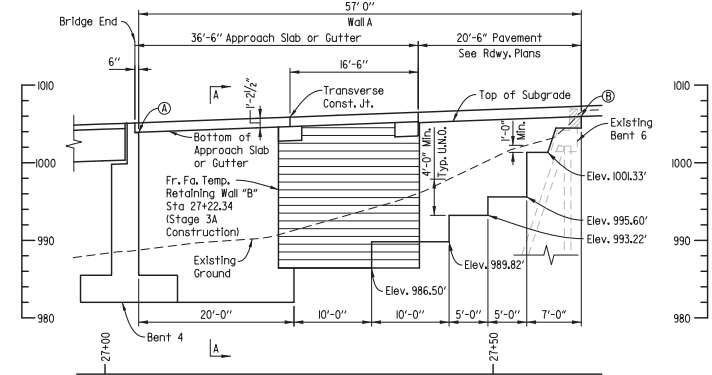
FOUNDATION MATERIAL: The bottom of Reinforcement Zone shall be set a minimum of 4'-0" into the material designated as Stiff Cherty Clay (F10) on the boring legend. A factored bearing resistance of 41 ksf is recommended for the existing foundation material based on an estimated width of the reinforcement zone. See Job SP No. 090472 "Temporary Retaining Walls" for more information.

UNDERCUTTING & BACKFILL: Large scale undercut is not anticipated. However, if soft or unstable material is encountered beneath the retaining wall and reinforcement zone, it shall be removed and backfilled with Select Granular Backfill. Depth and area of any required undercutting shall be determined by the Engineer.

Any excavation and backfill required for undercutting shall be paid for as "Unclassified Excavation" and "Select Granular Backfill" in accordance with SP Job No. 090472 "Temporary Retaining Walls".

See SP Job No. 090472 "Temporary Retaining Walls" for additional information.

- The Contractor has the option of using a cut slope or shoring to maintain stability of the cut. Any excavation beyond the limits of the reinforcement zone or any shoring used will not be paid for directly, but shall be considered incidental to the Item "Temporary Retaining Wall". See SP Job No. 090472 "Temporary Retaining Walls" for additional information.
- Excavation within the reinforcement zone will be paid for as Unclassified Excavation in accordance with SP Job No. 090472 "Temporary Retaining Walls".
- 4" underdrain and pipe lateral (non-perforated) in accordance with Section 61 and Std. Dwg. PU-1. Lateral underdrains shall be spaced at 50'-0" o.c., max., and placed at the ends of walls. This work and material shall be considered subsidiary to the Item "Temporary Retaining Walls" and shall not be paid for directly.



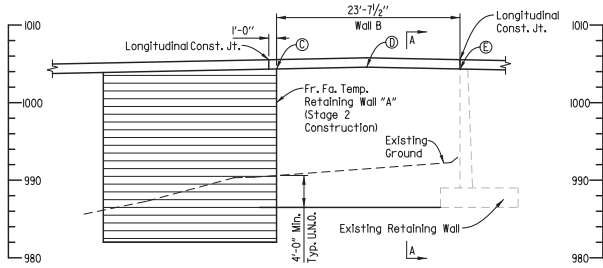
ELEVATION OF TEMPORARY RETAINING WALL "A" AT BENT 4

(Looking Left)
Scale: 1/8" = 1'-0"

For additional information, see Details of Staged Construction on Dwg. Nos. 61561-61564.

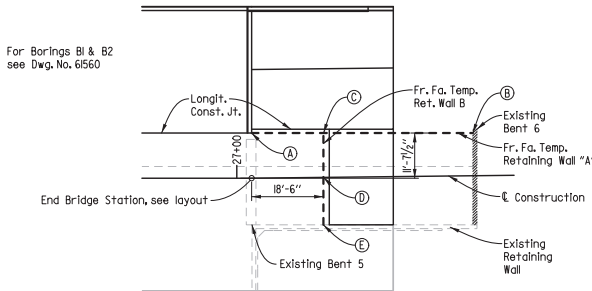
TABLE OF QUANTITIES
(FOR INFORMATION ONLY)

LOCATION	UNIT	ITEM NO. 210	SP JOB 090472	SP JOB 090472
		UNCLASSIFIED EXCAVATION	SELECT GRANULAR BACKFILL	TEMPORARY RETAINING WALL
Bent 4		CU. YD.	CU. YD.	SQ. FT.
WALL A - B		195	641	897
WALL C - D		57	139	209
WALL D - E		58	143	209
TOTALS		310	923	1315



ELEVATION OF TEMPORARY RETAINING WALL "B" AT BENT 4

(Looking Ahead @ Sta. 27+22.34)
Scale: 1/8" = 1'-0"



PLAN OF TEMPORARY WALLS "A" & "B" AT BENT 4

Scale: 1/8" = 1'-0"



SHEET 5 OF 5
DETAILS OF STAGE CONSTRUCTION
HIGHWAY 340 OVER LITTLE SUGAR CREEK
BENTON COUNTY
ROUTE SEC.
ARKANSAS STATE HIGHWAY COMMISSION
LITTLE ROCK, ARK.
DRAWN BY: BWC DATE: 1-29-19 FILENAME: b090472x2.IT.dgn
CHECKED BY: CAW DATE: 12-01-19 SCALE: 3/8" = 1'-0"
DESIGNED BY: NRM DATE: 1-22-19
BRIDGE NO. 07481 DRAWING NO. 61565

ATTACHMENT 2



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

LOG OF BORING NO. 1

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 11 ft /Wash

LOCATION: Approx Sta 3+39, 80 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT							
			SURF. EL: 1004±			0.2	0.4	0.6	0.8	1.0	1.2	1.4			
						+							+		
						10	20	30	40	50	60	70			
			4 inches: Asphalt Concrete												
			Stiff brown silty clay w/numerous chert fragments (fill) - firm to stiff below 2 ft	11			●	+	+						24
				10				●							
5			Stiff gray, reddish brown and brown clay w/occasional shale fragments and ferrous stains (fill)	11				+	●	- - - - -					94
				23					●						
10			Low hardness gray and yellowish gray highly weathered limestone w/silty clay seams - moderately hard below 8 ft	50/1"			●								
			Moderately hard light gray and gray slightly weathered limestone, flat bedded w/occasional pyrite inclusions - auger refusal at 11 ft - hard below 12 ft												
15															98 98
			- chert seam at 17 ft												
															97 80
20			Low hardness greenish gray calcareous mudstone												
			Moderately hard dark brownish gray shale, carbonaceous and flat bedded, very thinly bedded w/occasional pyrite inclusions												
															100 67
25															
			- highly weathered clayey shale layer from 25.5 - 26 ft - with numerous mechanical breaks below 26 ft - high-angle fractures with ferrous stains at 27.8 ft												78 68

RECRODN200-2, 17-125.GPJ, 6-27-19

COMPLETION DEPTH: 56.0 ft
DATE: 4-5-18

DEPTH TO WATER
IN BORING: Dry to 11 ft

DATE: 4/5/2018



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

LOG OF BORING NO. 1

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 11 ft /Wash

LOCATION: Approx Sta 3+39, 80 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD										
						PLASTIC LIMIT +	WATER CONTENT ●	LIQUID LIMIT +													
						0.2	0.4	0.6	0.8	1.0	1.2	1.4									
						10	20	30	40	50	60	70									
35			- core barrel plugged at 36 - 41 ft, little recovery																		
40																					
45																					
50																					
55																					

RECRODN200-2, 17-125.GPJ, 6-27-19

COMPLETION DEPTH: 56.0 ft
DATE: 4-5-18

DEPTH TO WATER
IN BORING: Dry to 11 ft

DATE: 4/5/2018



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

LOG OF BORING NO. 2

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 5+10, 75 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD
						0.2 0.4 0.6 0.8 1.0 1.2 1.4	PLASTIC LIMIT +	WATER CONTENT ●			
			SURF. EL: 970±				10 20 30 40 50 60 70				
			Loose brown clayey fine to coarse gravel	7			+ - ●		16		
5			Loose brown sandy fine to coarse gravel - water at 3 ft	8			●		4		
10			Stiff brown silty clay w/some fine to coarse gravel				●				
15			Moderately hard to hard dark brownish gray slightly weathered shale, carbonaceous, flat bedded w/some pyrite inclusions - high angle fracture at 12.8 ft					$q_u = 2730$ psi, TUW = 161 pcf	90	80	
20								$q_u = 2720$ psi, TUW = 161 pcf	87	82	
25								$q_u = 2480$ psi, TUW = 157 pcf	90	90	
			Hard gray limestone					$q_u = 8480$ psi, TUW = 165 pcf	96	96	

COMPLETION DEPTH: 46.0 ft
DATE: 4-20-18

DEPTH TO WATER
IN BORING: 3 ft

DATE: 4/20/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 2

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 5+10, 75 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT					- No. 200 %	% Recovery	% RQD	
						0.2	0.4	0.6	0.8	1.0				1.2
						PLASTIC LIMIT +		WATER CONTENT ●		LIQUID LIMIT +				
						10	20	30	40	50	60	70		
35			Hard light gray and gray limestone, flat bedded w/close to very close bluish green mudstone laminations - with some chert nodules below 30 ft										97	97
			Hard light gray dolostone, flat bedded w/close arenaceous dolostone zones											
40			Hard light gray and gray limestone, arenaceous, flat bedded w/some calcite inclusions and calcite crystal filled vugs - less arenaceous from 40 - 41 ft - with more calcite inclusions below 41 ft										95	95
45													98	98
50														
55														

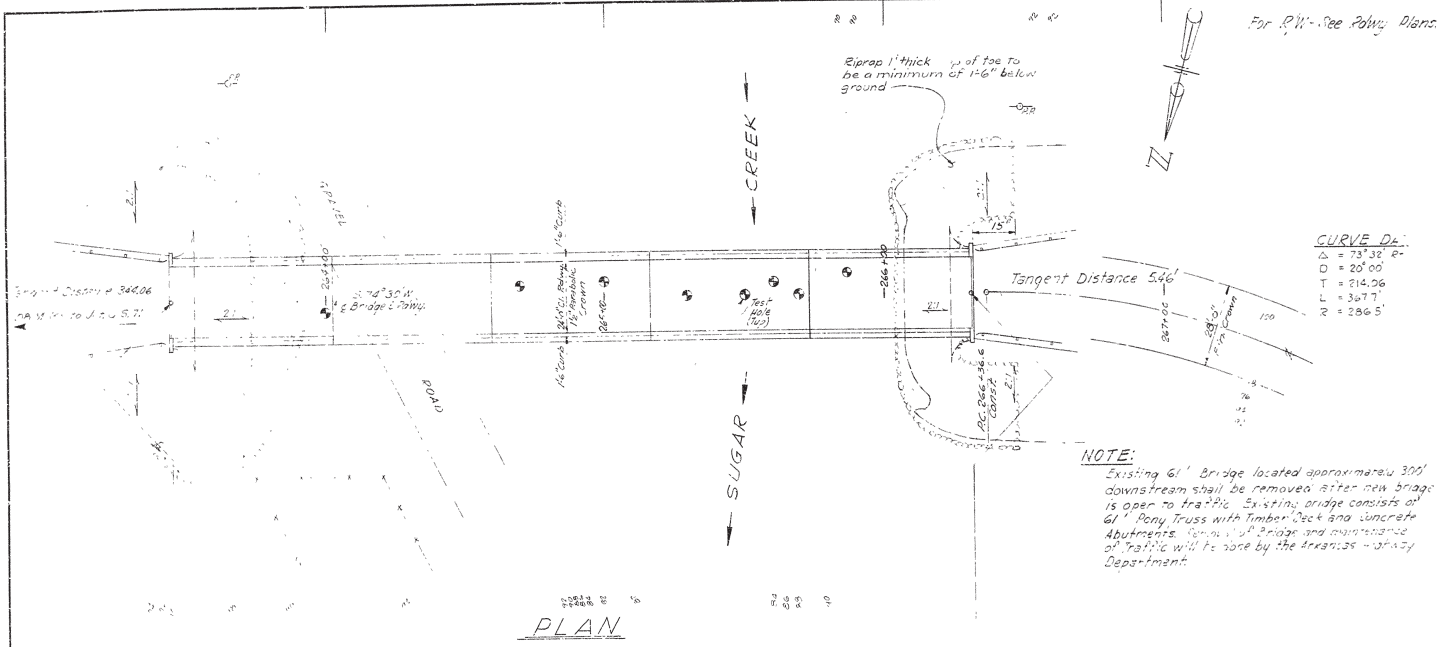
COMPLETION DEPTH: 46.0 ft
DATE: 4-20-18

DEPTH TO WATER
IN BORING: 3 ft

DATE: 4/20/2018

RECRODN200-2, 17-125.GPJ, 6-27-19

FED. ROAD DIST. NO.	STATE	FED. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
6	ARK.			3	19
JOB NO.		9332		E 19	



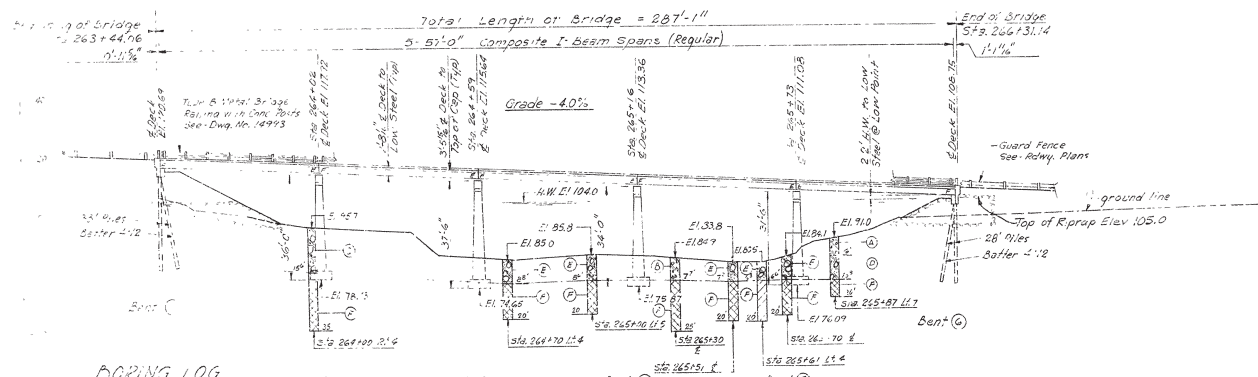
CURVE DATA:
 $\Delta = 73.32^\circ$
 $D = 207.00'$
 $T = 214.26'$
 $L = 367.7'$
 $R = 286.5'$

NOTE:
 Existing 61' bridge located approximately 300' downstream shall be removed. After new bridge is open to traffic, existing bridge consists of 61' Pony Truss with Timber Deck and concrete Abutments. Removal of bridge and maintenance of traffic will be done by the Arkansas Highway Department.

GENERAL NOTES
 Bench Mark - N.T.S. 6" x 11" 1". Station 264 + 05, Elevation 100.00 assumed.
 Rock excavations shall be made to neat lines of concrete footings. Care shall be exercised to avoid shattering of rock faces by excessive blasting. Concrete in footings shall be poured directly against excavation surfaces of rock. Footings to be a minimum 1'-6" into strata.
 All concrete to be cured in the dry.
 All filling shall be 12883 and shall be driven to a minimum capacity of 44 tons per site and into the material designated as strata on the boring logs. Lengths of fill shown are for estimated quantities only. Proper lengths shown, cut-off or bulldozed, if necessary, to be paid for in accordance with the Standard Specifications.
 Piles in wet bents to be driven after embankment to subgrade is in place.
 For Details of 24" Bents see Div. No. 15112.
 For Details of Intermediate Bents see Div. No. 15112.
 For Details of Composite I-beam Gans see Div. Nos. 15112 and 15113.

SPECIFICATIONS: Arkansas State Highway Commission Standard Specifications for Highway Construction, Edition of 1955, the 1966 Supplemental Specifications, and applicable Special Provisions.
DESIGN SPECIFICATIONS: AASHTO 1992
 Live Loading: HS
 Unit Stresses: Class A Concrete (A-15) 840 psi
 Class B Concrete (A-10) 1,200 psi
 Reinforcing Steel 20,000 psi
 Structural Steel (A 36) 20,000 psi
 Foundation Pressure 9,000 psi, Sp. II

PLAN



BORING LOG

- (A) Brown Sand, 1/2" Gravel
- (B) Brown Clay & Gravel
- (C) Brown Clay Gravel & Sand
- (D) Comp. Clay Gravel & Sand
- (E) Clay Gravel & Sand
- (F) Hard Blue Shale

ELEVATION

Area = 119 SQ. MILES
 Cont. = 0.8

**LAYOUT OF
 BRIDGE OVER SUGAR CREEK
 SUGAR CREEK BRIDGE**

**BENTON COUNTY
 ROUTE 340 SEC. 1
 ARKANSAS STATE HIGHWAY COMMISSION**

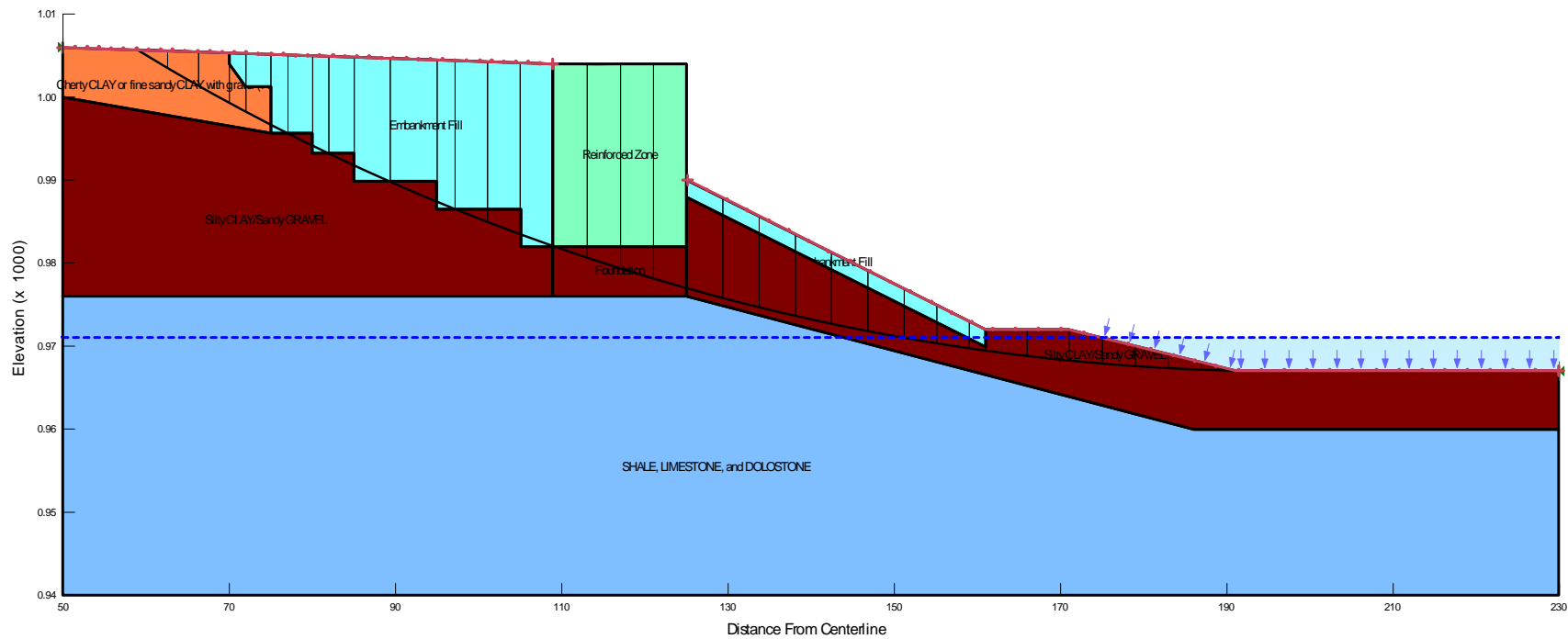
W.P. Carson
 BRIDGE ENGINEER

LITTLE ROCK, ARK.
 DRAWN BY: J.S. DATE: 1-30-67 SCALE: 1" = 20'
 CHECKED BY: D.H. DATE: 1-30-67
BRIDGE NO. 5155 DRAWING NO. 15501

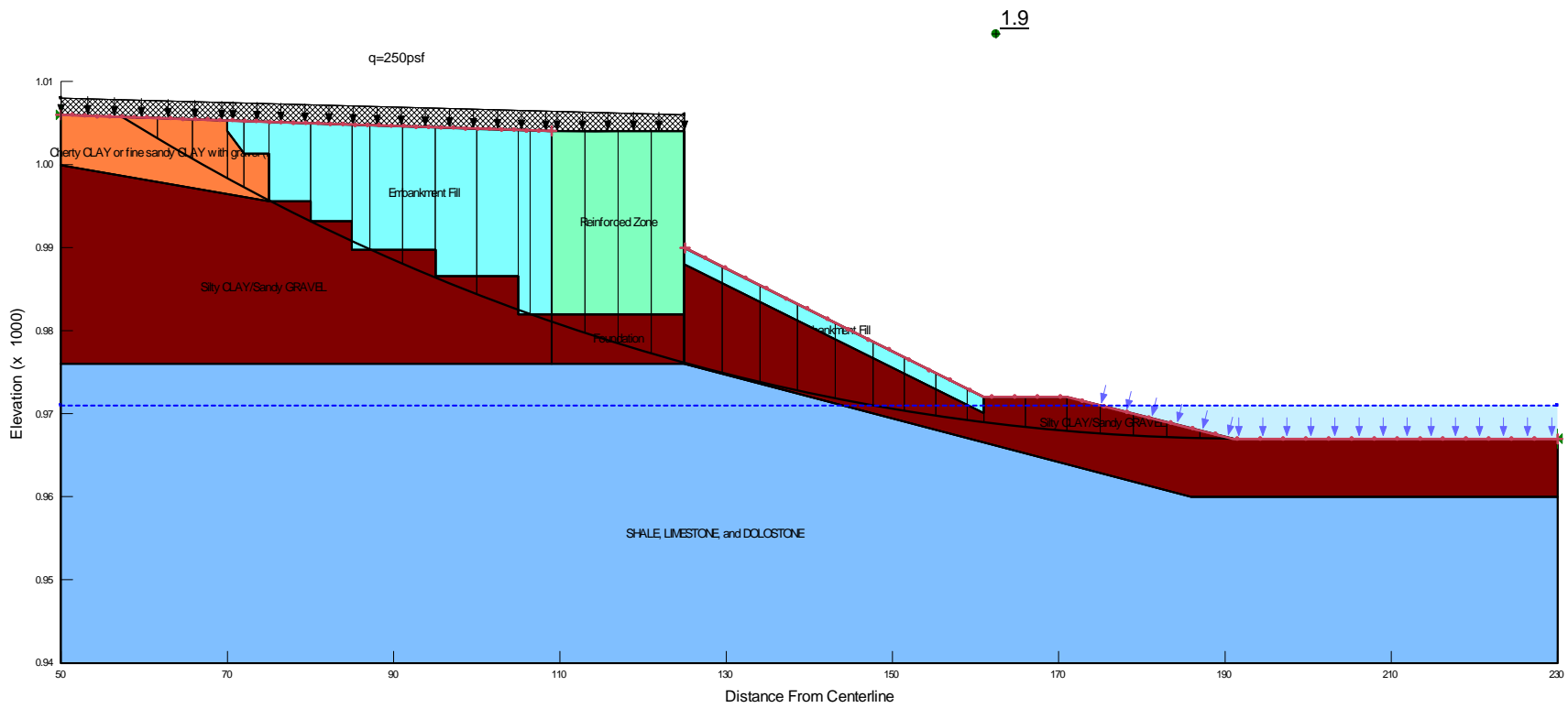
ATTACHMENT 3

Summary of Stability Analysis Results
Bridge 05155 over Little Sugar Creek – Temporary MSE Walls
ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

Project Feature	Design Loading Condition	Calculated Minimum Factor of Safety
Temporary Wall A	End of Construction	2.4
	Long Term	1.9
	Rapid Drawdown from El 982 to El 972	1.5
	Seismic ($k_h = A_s/2 = 0.028$)	1.8
Temporary Wall B	End of Construction	2.7
	Long Term	2.1
	Rapid Drawdown from El 982 to El 972	2.0
	Seismic ($k_h = A_s/2 = 0.028$)	2.1

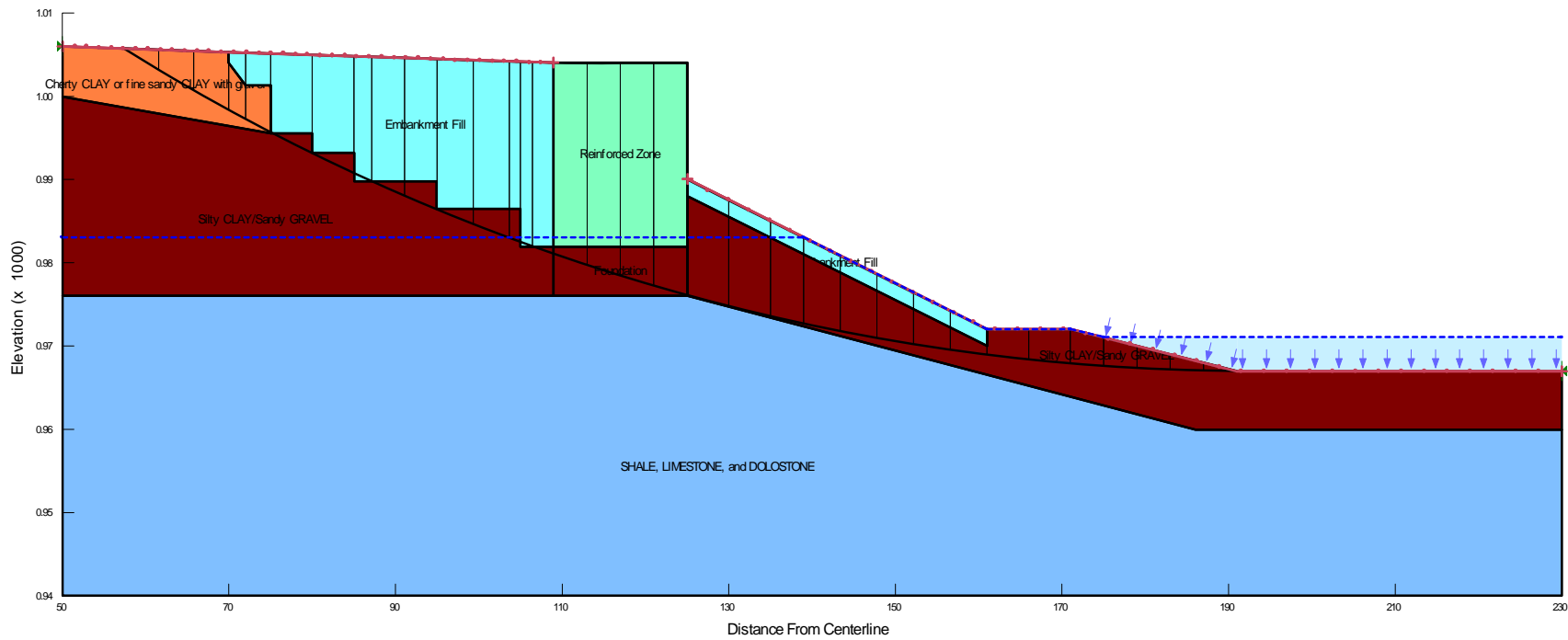


Results of Stability Analyses – End of Construction
Temporary Wall A
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



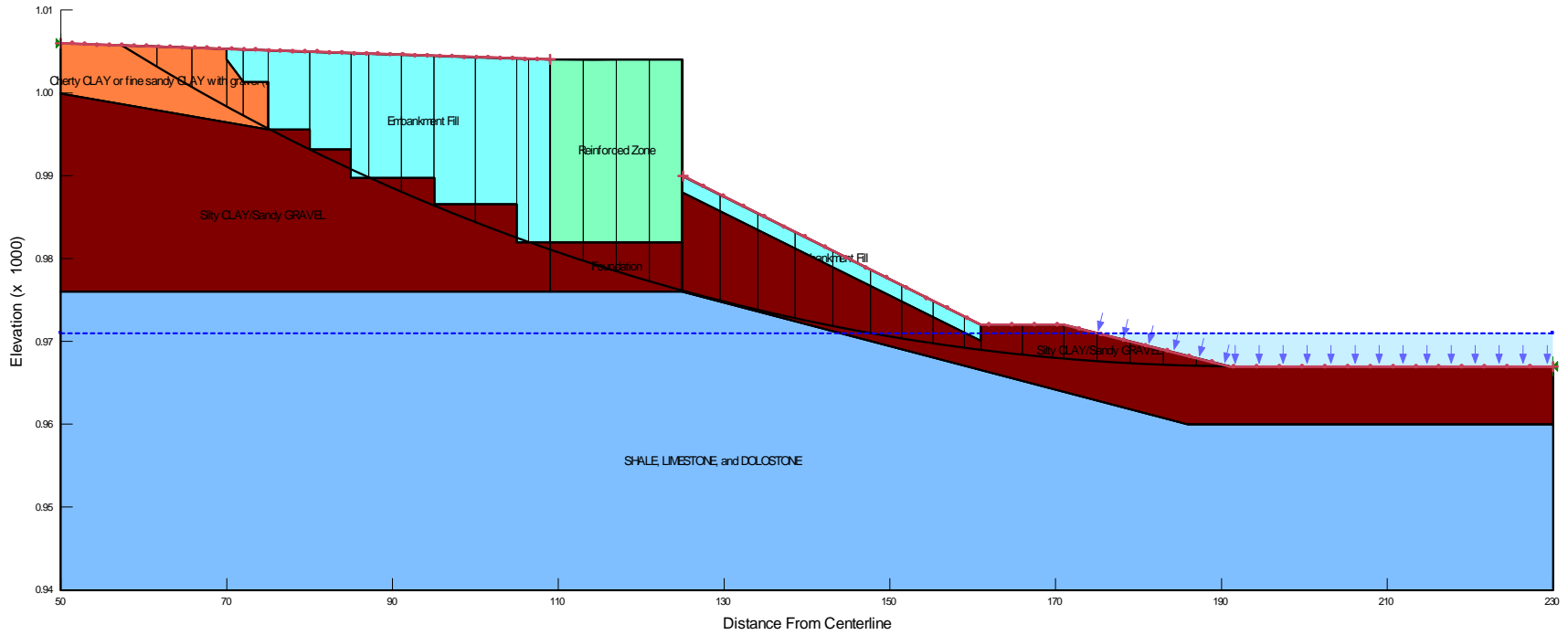
Results of Stability Analyses – Long Term Condition
 Temporary Wall A
 Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas

1.5

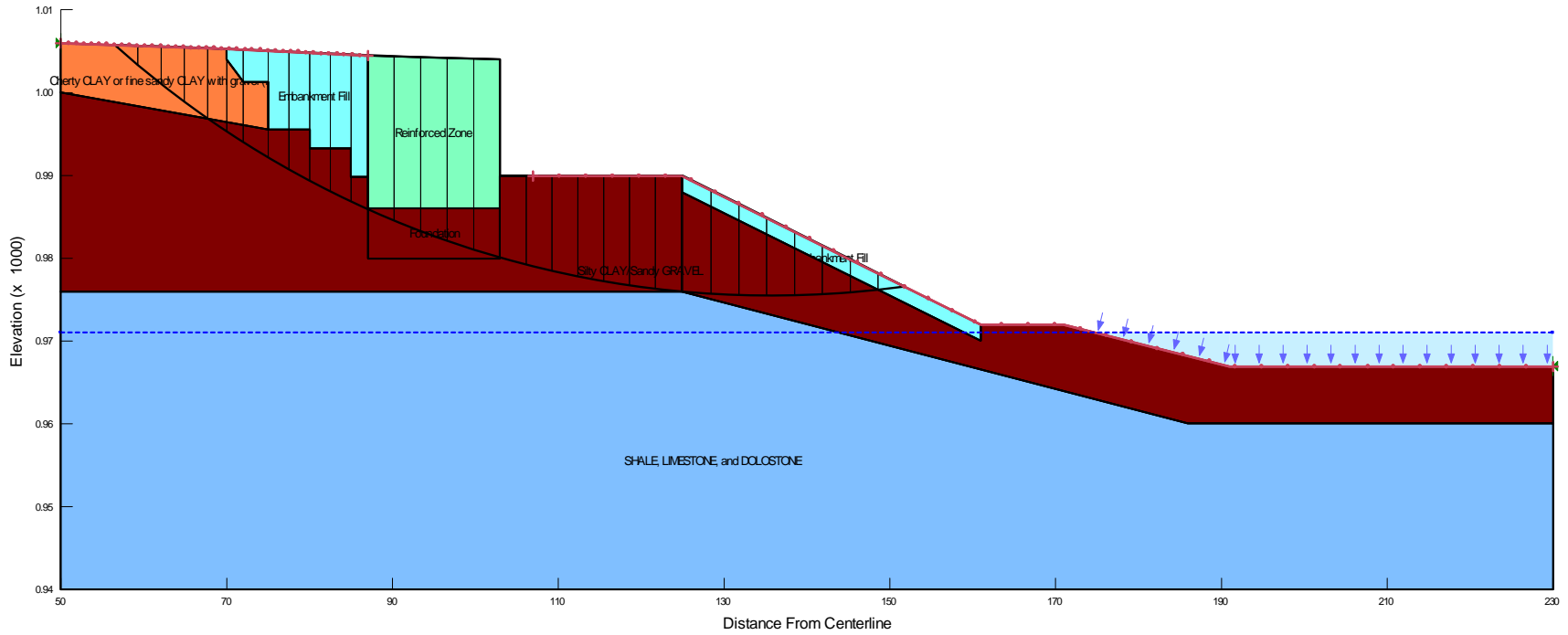


Results of Stability Analyses – Rapid Drawdown Condition, EI 982 to EI 972
Temporary Wall A
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

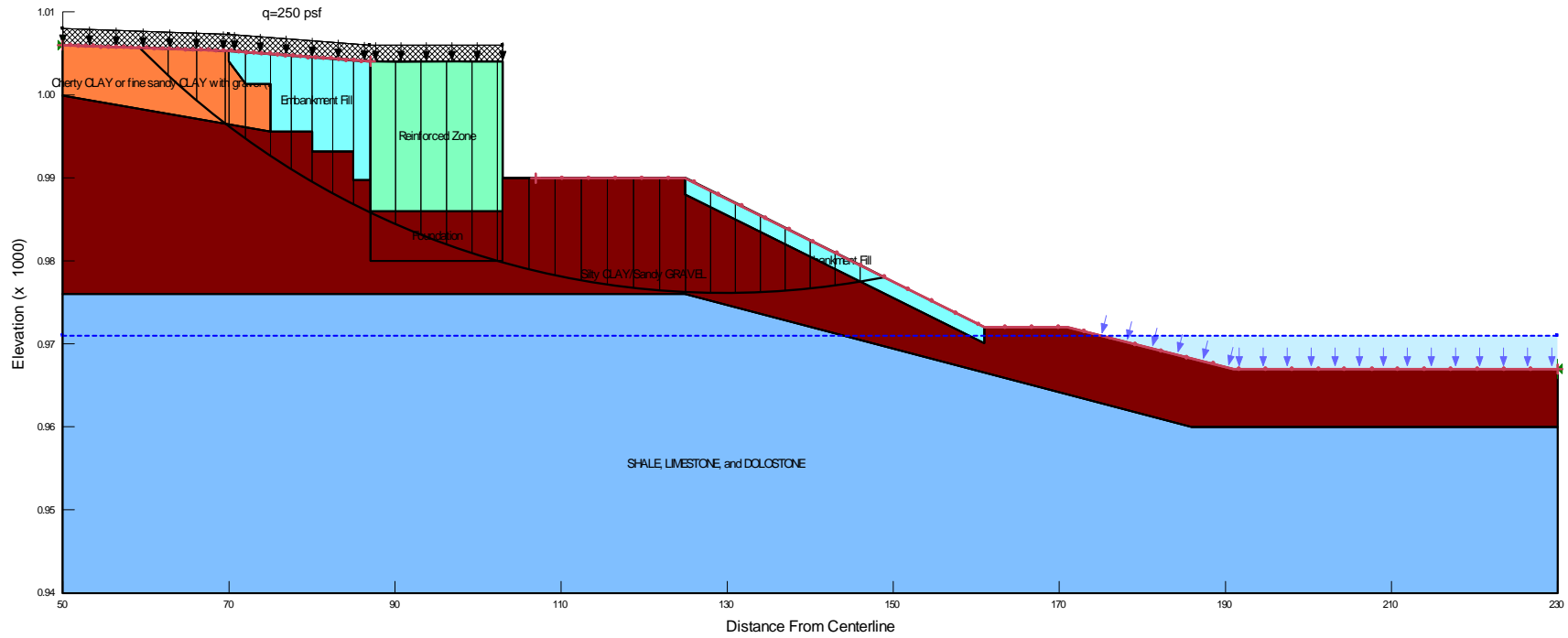
1.8



Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
Temporary Wall A
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

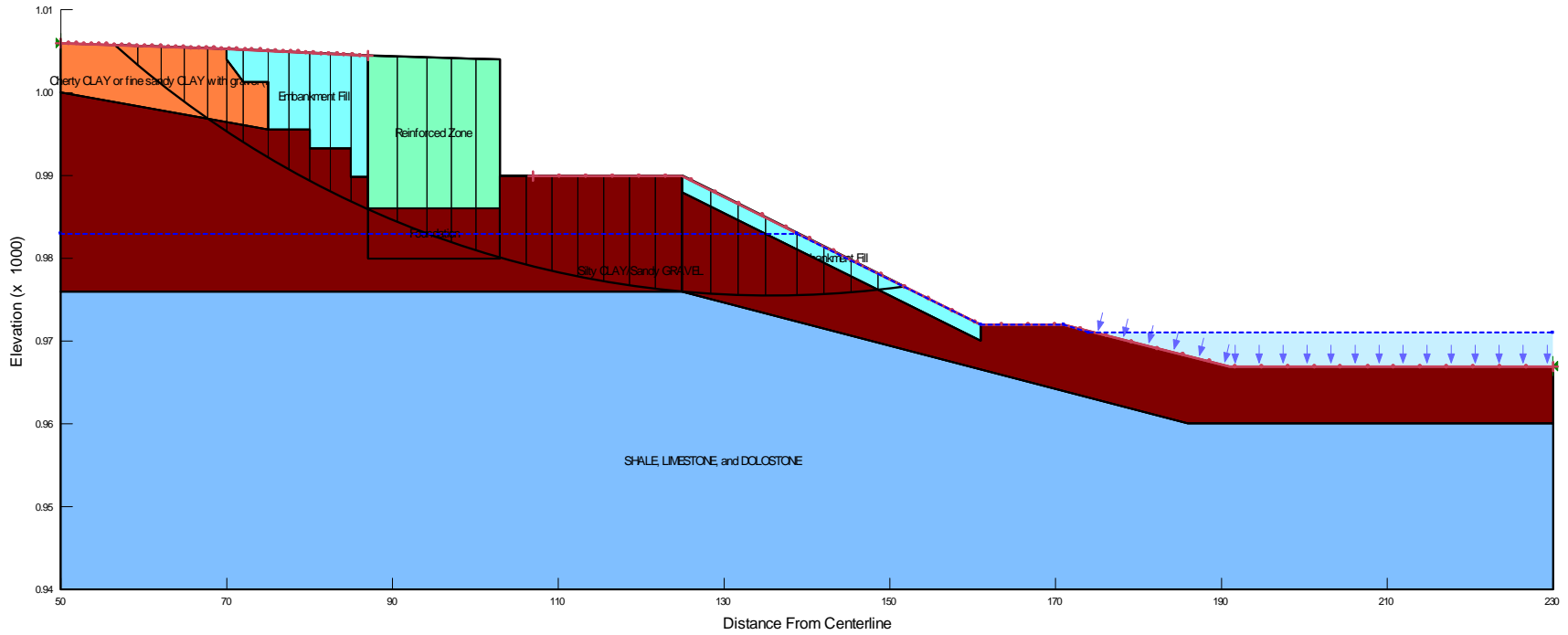


Results of Stability Analyses – End of Construction
Temporary Wall B
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

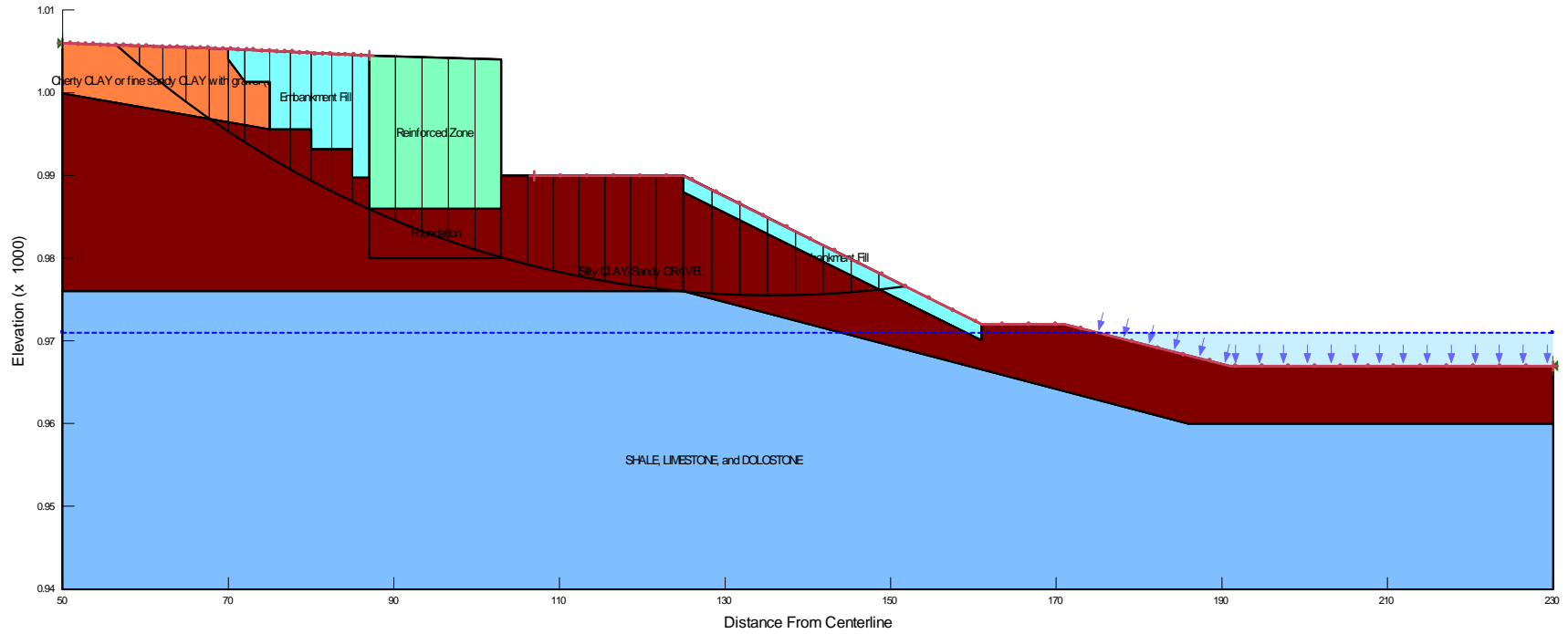


Results of Stability Analyses – Long Term Condition
Temporary Wall B
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

2.0



Results of Stability Analyses – Rapid Drawdown Condition, EI 982 to EI 972
Temporary Wall B
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
Temporary Wall B
Bridge 05155 over Little Sugar Creek - ARDOT Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

June 27, 2019
Job No. 17-125

Crafton Tull & Associates, Inc.
901 North 47th Street, Suite 200
Rogers, Arkansas 72756

Attn: Mr. Mike Burns, P.E.
Senior Vice President, Transportation

**GEOTECHNICAL INVESTIGATION
ARDOT JOB 090472, LITTLE SUGAR & TANYARD CREEKS STRS. & APPRS (S)
BRIDGE 05155 – HWY. 340 OVER LITTLE SUGAR CREEK
BELLA VISTA, BENTON COUNTY, ARKANSAS**

INTRODUCTION

Submitted herein are the final results of the geotechnical investigation performed for ARDOT Job 090472 Little Sugar & Tanyard Creek Strs & Apprs (S). Specifically, these recommendations are for Bridge 05155, Hwy. 340 over Little Sugar Creek in Bella Vista, Benton County, Arkansas. This geotechnical investigation was authorized on behalf of Crafton Tull & Associates, Inc. (Engineer) by the subconsultant agreement of February 7, 2017. Preliminary results for the Hwy. 340 over Little Sugar Creek replacement bridge were provided during the course of this study. Interim foundation recommendations results for the Hwy. 340 over Little Sugar Creek replacement bridge were provided on May 24, 2018. Bridge plans were subsequently revised.

We understand that the Hwy. 340 over Little Sugar Creek replacement bridge will be a continuous composite W-beam unit with three (3) spans and a total bridge length of about 240 feet. Preliminary plans are to support the foundation loads at the bridge ends on driven steel piles. The foundation loads at the interior bents are expected to be supported on drilled shafts. The new bridge will have simple slopes at the bridge ends. A concrete end wall is included at the east end of the bridge (Bent 4). A preliminary bridge layout is provided in Appendix A.

Recommendations for seismic site classification and bridge foundations for the planned bridge are discussed in the following report sections. Additionally, stability analyses have been performed for the planned slopes at the bridge ends and subgrade parameters have been provided

for use in pavement design. The results of the subsurface exploration program and laboratory test results are included in the attachments.

SUBSURFACE EXPLORATION

Subsurface conditions at the Hwy. 340 over Little Sugar Creek replacement bridge location were investigated by drilling six (6) sample and core borings to depths of 10 to 56 ft and excavating two (2) test pits to 2.5-ft depth. Borings 1 through 4 were drilled to 45- to 56-ft depth in or near the plan bridge alignment. Borings P1 and P2 were drilled in plan roadway alignment areas. The site vicinity is shown on Plate 1. The approximate boring locations in the project alignment are shown on Plate 2A and 2B. Approximate boring station location and center line offset are also shown on the logs.

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 12. 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. Keys to the terms and symbols used on the boring logs are presented as Plates 13 and 14. The subsurface exploration program for the Hwy. 340 over Little Sugar Creek replacement bridge is summarized on Plate 15. Photographs of rock cores recovered from the structure borings are provided in Appendix B.

The borings were drilled with a truck-mounted SIMCO 2800 rotary-drilling rig and a track-mounted CME 850X rotary drilling rig using a combination of dry-auger and rotary-wash drilling procedures. Samples were typically obtained at 2-ft intervals to 10-ft depth and at 5-ft intervals thereafter. Samples were recovered 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. Where rock hardness precluded recovery with the split-spoon, cuttings were recovered for use in visual classification.

Representative samples of the shale, limestone, and dolostone bedrock were obtained using a 5-ft-long NQ_{WL}-size double-tube core barrel with a diamond or carbide bit. For each core run, the percent recovery was determined as the ratio of recovery to total length of core run. Rock Quality

Designation (RQD) was also determined for the core run as the sum of intact, sound rock core greater than 4-in. length divided by the total length of the run and expressed in percent. Both these values are presented in the right hand columns of the log forms, opposite the corresponding core run. Where rock was not cored cuttings were collected for visual examination. Photographs of the recovered rock cores are provided in Appendix B.

All samples were extruded or otherwise removed from samplers in the field. Samples were visually classified by the field geologist or engineer and 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 the final water level readings.

LABORATORY TESTING

To evaluate pertinent soil and rock properties, laboratory tests consisting of classification tests, natural water content determinations, and uniaxial compressive strength of rock cores were performed. A total of 32 natural water content determinations were performed to develop a soil water content profile for each boring. 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, nine (9) liquid and plastic limit (Atterberg limits) determinations and 11 sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the log as pluses inter-connected with a dashed line using the water content scale. 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 designations, are summarized in Appendix C. Grain-size distribution curves are also provided in Appendix C.

Selected rock core samples were tested for unit weight and compressive strength. The test results are indicated on the boring logs, in lbs per sq in., at the appropriate depth. The total unit

weight (TUW) is also noted on the logs. A summary of the compression test results is also provided in Appendix C.

Two (2) laboratory moisture-density relationship (Proctor) tests were performed on representative bulk soil samples obtained in the approach road alignment to evaluate the moisture-density relationship of on-site subgrade soils. The Proctor tests and bulk sample classification test results are provided in Appendix D. Pavement subgrade support properties of the potential subgrade soils were evaluated by performing two (2) California Bearing Ratio (CBR) tests on the collected bulk samples. The CBR results are also provided in Appendix D.

GENERAL SITE and SUBSURFACE CONDITIONS

Site Conditions

The Hwy. 340 Bridge over the Little Sugar Creek (Bridge 05155) is planned at Hwy 340 Sta 24+64 to Sta 27+04 in Benton County, Arkansas. The new bridge will replace the existing bridge currently spanning the creek. At this location, the channel is relatively broad and well formed. The east bank slopes steeply down to the channel and there is an existing retaining wall at the east bridge end. The west bank is less steep than the east, sloping down to the channel. Sand and gravel bars are common in the channel. The flood plain around the channel is mixed open areas and wooded. West of the creek is a golf course. The existing Hwy. 340 roadway is a two-lane highway bordered by both shallow ditches and steep hillsides from apparent prior site grading. Surface drainage of the existing roadway is good and drainage of the surrounding terrain varies from poor to fair.

Site Geology

The Geologic Map of Arkansas¹ indicates the project site is located in the mapped exposures of the undivided Chattanooga Shale, Penters Chert, and Clifty Limestone outcrops. The Chattanooga Shale is a black, fissile clay shale that typically weathers into thin flakes. The upper part of the formation may be slightly sandy and usually contains abundant pyrite. The thickness of the Chattanooga ranges up to about 85 feet. The Penters Chert formation is comprised of a fine-grained, fossiliferous, dolomitic limestone with some chert and siliceous replacement overlain by massive, dense, mottled gray chert with some subordinate limestone units. The Penters is of a sporadic exposure in its outcrop area. The Clifty Limestone formation is a thin, very sandy limestone with a few fossils.

¹ Geologic Map of Arkansas, Arkansas Geologic Commission and U.S. Geologic Survey; 1993

Seismic Conditions

Based on the site geology and the average soil and rock conditions revealed by the borings, a Seismic Site Class C (very dense soil and soft rock profile) is considered fitting for the Hwy 340 replacement bridge location with respect to the criteria of the AASHTO LRFD Bridge Design Specifications Seventh Edition 2014².

Given the project location and AASHTO code-based values, the 1.0-sec period spectral acceleration coefficient for Site Class C (S_1) is 0.050 and the 1.0-sec period spectral acceleration coefficient (S_{D1}) value for Site Class C is 0.085. Utilizing these parameters, Table 3.10.6-1³ indicates that a Seismic Performance Zone 1 is fitting for the Hwy 340 bridge 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 0.056 for a Seismic Site Class C for the bridge location.

Subsurface Conditions

In light of the results of the borings, the subsurface stratigraphy at the Little Sugar Creek bridge location may be generalized into several primary strata as follows.

- Stratum I: The on-site embankment fill is a variable mixture including soft to stiff brown, gray, reddish brown, silty clay, clay, and fine sandy clay, fine to coarse gravel and varying amounts of shale fragments and medium dense silty fine sand and crushed stone. The fill extends to depths ranging from 7 to 8 ft in the bridge alignment and to depths of 6 to 8 ft in the pavement boring locations. The fill exhibits variable plasticity and variable poor to good compaction. The embankment fill soils typically classify as A-1-a, A-1-b, A-2-4, A-2-6 and A-7-6 by the AASHTO classification system (AASHTO M 145), which correlates with poor to good subgrade support for pavement structures.
- Stratum II: The natural surface and near-surface overburden soils are loose to very dense clayey fine to coarse gravel with varying amounts of fine to coarse sand. The natural overburden soils extend to depths of 7 to 18 feet. The fine to coarse gravel has low to high relative density and high to low compressibility. The natural overburden soils typically classify as A-1-a, A-2-4, and A-4 by the AASHTO classification system, correlating with fair to good subgrade support for pavement structures.
- Stratum III: The basal stratum encountered in the borings includes variable units of low hardness to hard gray, light gray, and yellowish gray weathered limestone, limestone, arenaceous limestone, light gray dolostone, dark brown weathered carbonaceous shale, and shale. The shale, limestone, and dolostone units are

² AASHTO LRFD Bridge Design Specifications, 7th Edition; AASHTO; 2014.

³ AASHTO LRFD Bridge Design Specification, AASHTO; 2012

often interbedded. The upper weathered shale units may contain silty clay and/or clay laminations, seams and layers in weathered units while the limestone may contain pyrite partings. The shale limestone, dolostone, and shale have variable degrees of weathering within the upper 5 to 10 feet. However, weathering generally decreases and rock quality increases with depth. Rock bedding is typically flatly dipping.

To aid in visualizing subsurface conditions in the bridge alignment, a generalized subsurface profile provided in Appendix E. 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 shown on the profile and described elsewhere in this report may vary.

Groundwater Conditions

Groundwater was encountered at 3- to 15-ft depth at the bridge location in April 2018. Seasonal seeps and springs could be locally present as infiltrated surface water migrates from areas of higher terrain through the overburden soils and upper fractured zones of the rock. Perched water could also occur locally at shallow depths within the fill-soil-rock interface. Groundwater levels will vary, depending upon seasonal precipitation, surface runoff and infiltration, and water levels in the nearby Little Sugar Creek and other surface water features.

ANALYSES and RECOMMENDATIONS

Foundation Design for Bridges

Foundations for the new 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 our understanding of the project, we recommend that foundation loads be supported on steel piling at the bridge ends (Bents 1 and 4) and on drilled shafts at the interior bents (Bents 2 and 3). Recommendations for foundations are discussed in the following report sections.

Abutments – Steel Piles. Driven steel HP12×53 or HP14×73 piles are recommended for support of the bridge foundation loads at the abutments. Point-bearing steel piles driven to refusal should extend through the embankment fill, the natural overburden soils, and low hardness weathered limestone into the moderately hard to hard slightly weathered limestone or the moderately hard to hard slightly weathered shale. Piles should be driven to practical refusal. We recommend that all the steel piles be fitted with rock points. Other pile sizes or types may be evaluated if desired.

Piles should be designed based on applicable AASHTO Load and Resistance Factor Design (LRFD) design procedures⁴. An effective resistance factor (ϕ) of 0.50 is recommended for geotechnical determination of factored uplift capacities.

Bearing capacities of steel piles driven to refusal should be determined using the LRFD structural design procedure. We recommend that nominal (ultimate) resistance (P_n) of HP piles be determined based on the yield strength of steel H piles (f_y) and the net end area (A_{net}) of the section. An effective resistance factor (ϕ) of 0.50 is recommended for structural determination of factored bearing capacities. This effective resistance factor for H piles has been based on the assumption of severe driving conditions.

Post-construction settlement of piles driven to refusal will be negligible. Given the plan to utilize the existing embankments and the age of the existing embankments, downdrag loads due to long-term embankment settlement are considered negligible.

Estimated pile tip elevations are summarized below in Table 1.

Table 1: Estimated Tip Elevations of Steel Piles Driven to Refusal

Abutment No.	Estimated Pile Tip Elevation, ft	Comments
4 (East Abutment) – back wall and middle wall	972	Bear in moderately hard to hard slightly weathered limestone
4 (East Abutment) – front wall	968	Bear in moderately hard to hard slightly weathered limestone
1 (West Abutment)	960	Bear in moderately hard to hard slightly weathered shale

It should be noted that tip elevations shown in the table above are estimates only based on the results of the relevant borings and the inferred surface elevations at the particular locations. Pile capacity and final depth must be field verified.

⁴ Load and Resistance Factor Design (LRFD) for Highway Bridge Substructures, Publication No. FHWA HI-98-032, National Highway Institute, May 2001.

Piles should be installed in compliance with ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 805. Pre-boring is not expected to be required for pile installation. We recommend that steel piles at the abutments be driven with a hammer system capable of delivering at least 22 ft-kips per blow. Practical pile refusal may be defined as a penetration of 0.5 in. or less for the final 10 blows. We also recommend that driving be limited to a maximum of about 20 blows per ft for steel piles.

Intermediate Bents (Bents 2 and 3) – Drilled Shafts. We recommend drilled shafts be used to support foundation loads at the interior bents. Drilled shafts should be founded a minimum of 5 ft or one and one-half (1.5) shaft diameters, whichever is greater, into the moderately hard to hard slightly weathered dark brownish gray shale. For drilled shafts founded in the moderately hard to hard shale as recommended, a maximum nominal/ultimate bearing capacity of 200 kips per sq ft is recommended. A resistance factor (ϕ) of 0.50 is recommended for drilled shaft end bearing. Consequently, a maximum factored end-bearing capacity of 100 kips per sq ft is recommended. Settlement of properly installed drilled shaft foundations founded in the competent slightly weathered shale/shale should be negligible. Drilled shafts bearing in competent rock should be sized for compression loads based on the end-bearing capacity alone.

Resistance to uplift loads will be developed by circumferential shaft friction. Drilled shafts will penetrate the overburden soils and zones of highly weathered shale to bear in the competent slightly weathered shale. Uplift resistance for the top 5 ft of shaft penetration length and all penetration through the overburden soils, whichever is longer, should be neglected. For shaft penetration into the moderately hard to hard slightly weathered shale and shale, a maximum nominal/ultimate skin resistance value of 3750 lbs per sq ft is recommended. An increased ultimate skin friction value of 11.75 kips per sq ft may be applied to penetration into the moderately hard to hard slightly weathered shale. For evaluation of uplift capacity, a resistance factor (ϕ) of 0.40 is recommended for shaft skin friction.

Drilled shaft resistance to lateral forces will be developed by the passive resistance of the weathered shale and shale bearing strata. Detailed lateral load analyses can be performed when specific information on lateral loads, shaft dimensions, etc. are available.

A minimum shaft diameter of 36 in. and a minimum shaft length of 12 ft are recommended for drilled shafts. Based on the results of the borings, estimated minimum shaft bottom elevations are summarized in Table 2 below.

Table 2: Estimated Minimum Bottom Elevations of Drilled Shafts

Bent No.	Estimated Minimum Shaft Bottom El, ft	Comments
2	955	Bear in moderately hard to hard slightly weathered shale
3	954	Bear in moderately hard to hard slightly weathered shale

As-built drilled shaft lengths will vary with the required penetration into the bearing stratum and specific subsurface conditions. Depending on specific subsurface conditions and rock quality, as well as load magnitude, localized deepening or shortening of shaft lengths will be warranted. All drilled shaft excavations must be observed by the Engineer to verify suitable bearing and adequate penetration.

Embankment Slope Stability

The replacement bridge will include new end slope configurations on the east and west ends of the bridge as well as side slopes on either side of the bridge. The plan embankment configurations for the north and south bridge ends are planned with 2-horizontal to 1-vertical (2H:1V) configurations. For the side slopes at either bridge end, 2H:1V configurations are planned.

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 stability analyses. Stability analyses were performed using the computer program SLOPE/W 2007⁵ and a Morgenstern-Price analysis. For the embankment slopes, four (4) general loading conditions were evaluated, i.e., End of Construction, Long Term, Rapid Drawdown, 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 0.028. For evaluating the rapid drawdown condition, a water surface elevation drop from El 982 to El 972 has been assumed.

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.

⁵ Slope/W 2007; GEO-SLOPE International; 2008.

The results of the stability analyses performed for this study indicate that stability of the plan embankment side and end slope configurations are acceptable with respect to all loading conditions evaluated. It is our conclusion that the plan embankment slope configurations are suitable with respect to slope stability.

The stability analysis results are summarized in Appendix F. Graphical results of stability analyses are also provided in Appendix F.

Subgrade Support

The results of the borings and laboratory test results indicate that the subgrade soils in the project alignment vary widely from silty fine sand, fine sandy silt, to silty clay with chert fragments (AASHTO A-1-a to A-2-6). It is expected that locally available borrow for use as unclassified embankment fill will be comprised of similar soils.

In light of the results developed during the course of this study and a minimum CBR of 8, the following are recommended for subgrade support parameters.

- Subgrade Resilient Modulus (M_R): 4030 lbs per sq inch
- R value: 18.8
- Modulus of subgrade reaction (k): 125 lbs per sq in. per inch

Areas of unsuitable subgrade should be improved by undercut and replacement. Alternatively, improvement by addition of lime, Portland cement or an approved alternative additive may be considered. Laboratory testing must be performed to confirm the suitability of lime, cement or other additive to improve weak and unstable subgrade areas and improve subgrade support. We recommend a minimum treatment depth of 8 in. where lime- or cement-modified subgrade is utilized. The addition of lime, cement, or other alternative modification additives must be approved by the Engineer.

Site Grading and Subgrade Preparation

Site grading/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.

The depth of stripping will be variable, with deeper stripping depths in wooded areas, and less stripping required in the areas of higher terrain. 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.

Where existing pavements are to be demolished, consideration may be given to utilizing the processed asphalt concrete and aggregate base for embankment fill. In this case, the demolished materials should be thoroughly blended and processed to a reasonably well-graded mixture with a maximum particle size of 2 in. as per Standard Specifications for Highway Construction, 2014 Edition, Section 212. If abandoned pavements are within 3 ft of the plan subgrade elevation, the existing pavement surface should be scarified to a minimum depth of 6 inches. The scarified material should be recompacted to a stable condition.

Following required pavement demolition, 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 1 ft, more or less.

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 10 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. The existing drainage features

should be completely mucked out and all loose and/or organic soils removed prior to fill placement.

Fill and backfill 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 or foundation strata that become saturated by ponding water or runoff should be excavated to undisturbed soil or rock. The embankment subgrade should be evaluated by the Engineer during subgrade preparation.

Shallow perched groundwater could be 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 backfill (Standard Specifications for Highway Construction, 2014 Edition, Section 207), or clean aggregate (Standard Specifications for Highway Construction, 2014 Edition, Subsections 403.01 and 403.02 Class 3 mineral aggregate)

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 to achieve the minimum pile length is not generally anticipated, but could be warranted where large rock fragments are encountered in the on-site fill. Based on local experience, we recommend a hammer system capable of delivering at least 22,000 per blow for the steel piles at the bridge ends. 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.

As a minimum, safe bearing capacity of production piles should be determined by Standard Specifications for Highway Construction, 2014 Edition, Section 805.09, Method A. 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 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 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.

Drilled Shafts

Groundwater could be encountered in drilled shaft excavations. Limited seepage into drilled shaft excavations can probably be controlled by close coordination of drilling, cleanup and concrete placement. We recommend that casing be on site in the event it is needed to control seepage and/or caving into shaft excavations. Drilled shaft excavations should essentially be dry at the time of concrete placement. Where more than about 3 in. of water is present in shaft excavations, the excavation should be dewatered prior to concrete placement. Where shaft excavations cannot be dewatered, underwater concrete placement should be performed with a

concrete pump fitted with a rigid end extension. A muck bucket or similar tools should be utilized to clean the shaft excavation bottom prior to underwater concrete placement.

Some hard drilling could be experienced when advancing drilled shafts into the more resistant units of the moderately hard weathered shale, shale, moderately hard to hard limestone, limestone, and dolostone. Heavy-duty drilling equipment and rock drilling tools will be required to advance shaft excavations to the recommended minimum penetration in these more resistant units. Coring or other rock excavation methods is likely to be required to achieve the recommended penetration into the shale, limestone, and dolostone bearing strata. All drilled shaft excavations should be observed by the Engineer to verify suitable bearing and adequate penetration.

CLOSURE

The Engineer or Department or a designated representative thereof should monitor site preparation, grading work and foundation and pavement construction. Subsurface conditions significantly at variance with those encountered in the borings and test pits 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 submittal.

Plate 1	Site Vicinity
Plates 2A and 2B	Plans of Borings
Plates 3 through 12	Boring Logs
Plates 13 and 14	Keys to Terms and Symbols
Plate 15	Summary of Subsurface Exploration
Appendix A	Preliminary Bridge Layout
Appendix B	Rock Core Photographs
Appendix C	Summary of Laboratory Test Results
Appendix D	Subgrade Test Results
Appendix E	Generalized Subsurface Profile
Appendix F	Abutment Slope 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, E.I.
Staff Engineer

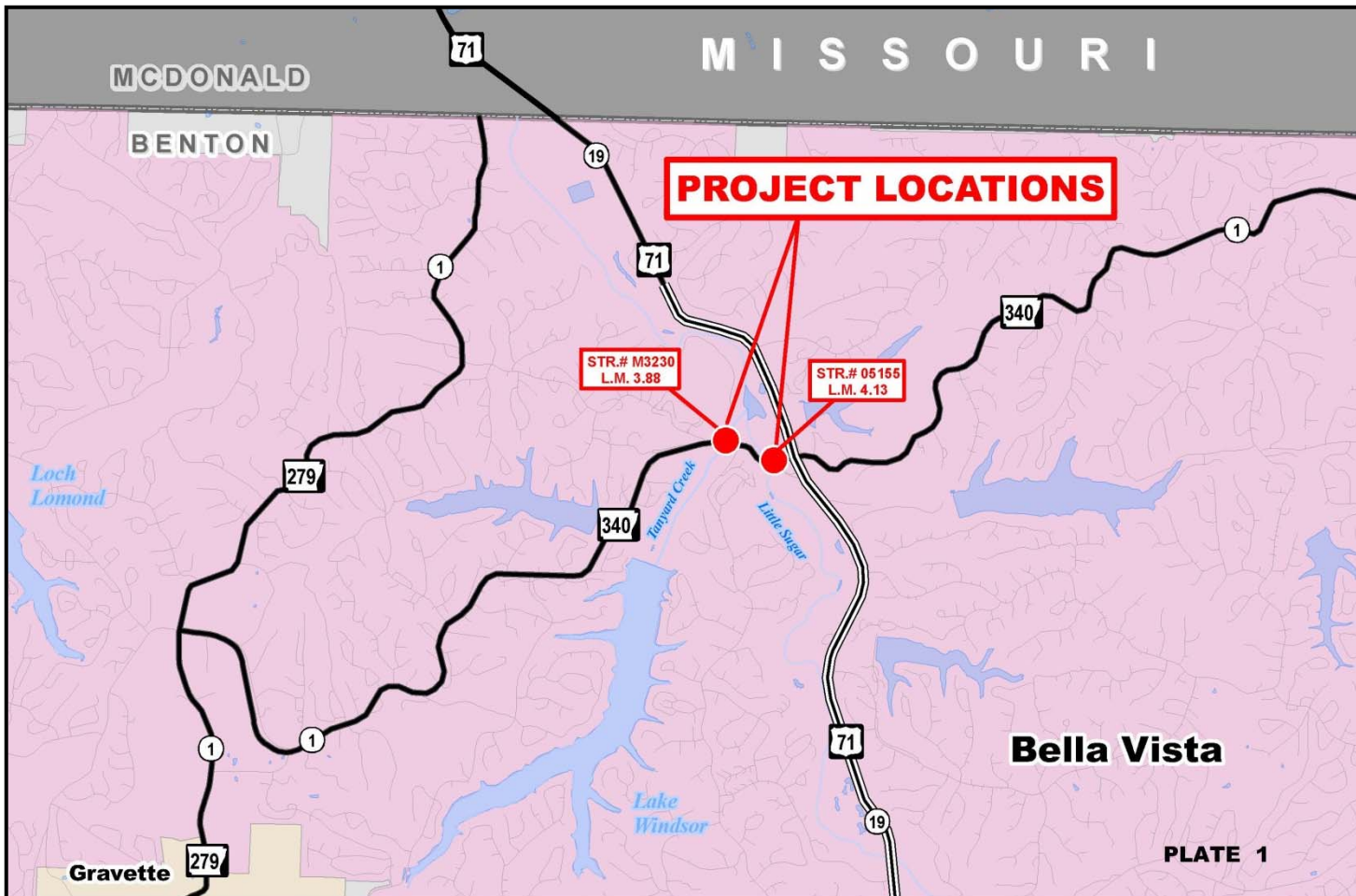


Mark E. Wyatt, P.E.
President



BJD/MEW:jw

Copies Submitted: Crafton Tull & Associates, Inc.
 Attn: Mr. Mike Burns, P.E. (1-electronic)
 Attn: Mr. Chuck Wipf, P.E. (1-electronic)



Job 090472
Little Sugar & Tanyard Creeks Strs. & Apprs (S)
 Hwy. 340, Sec. 1
 Benton County

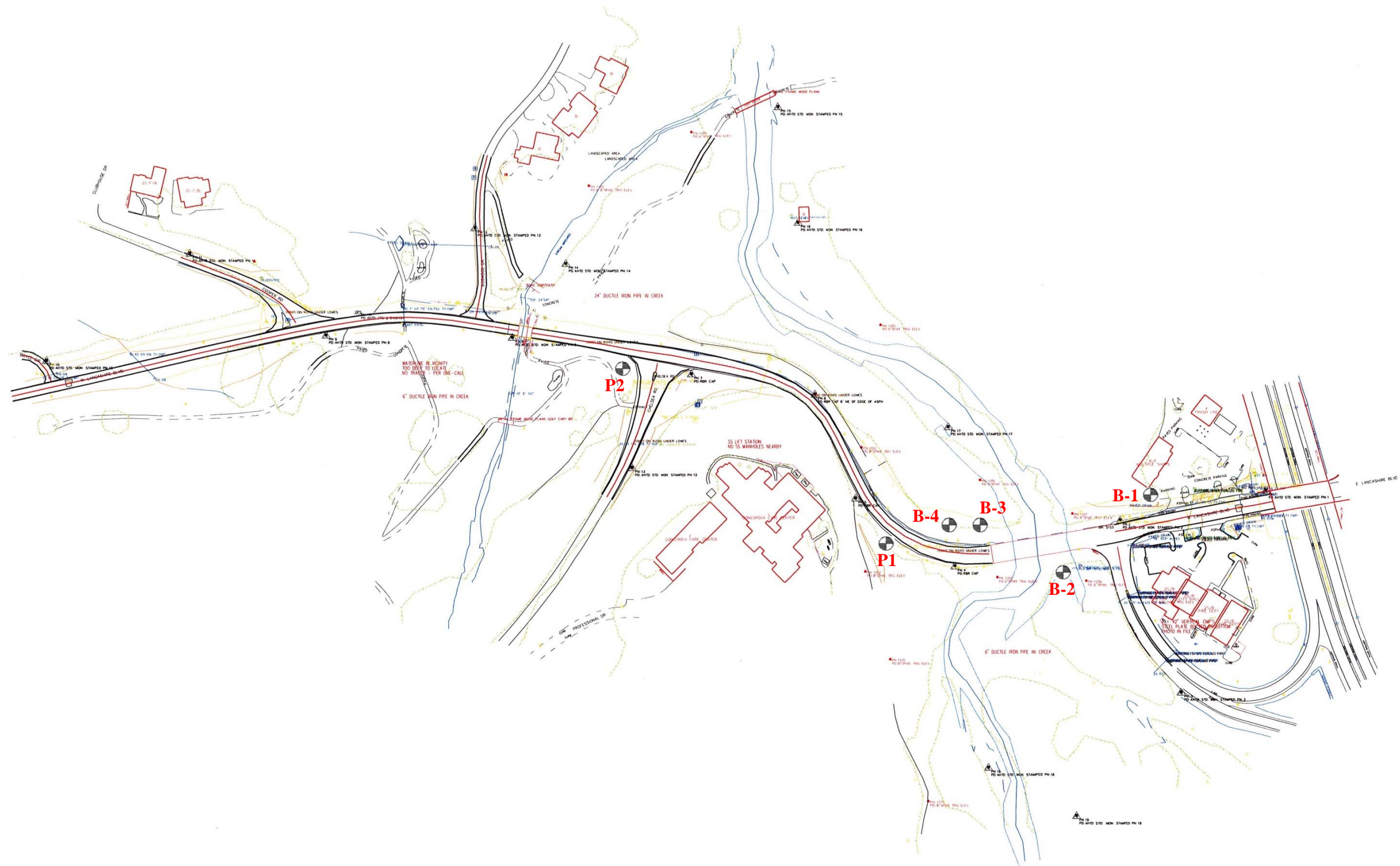
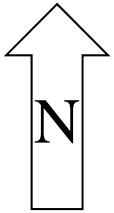


**Grubbs, Hoskyn,
 Barton & Wyatt, INC.**
 CONSULTING ENGINEERS

Site Vicinity Map
 ARDOT 090472 Hwy 340
 Bridge Replacements
 Bella Vista, Arkansas

Job No. 17-125

Plate 1



PLAN OF BORINGS
ARDOT 090472 – Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

Scale: N.T.S.

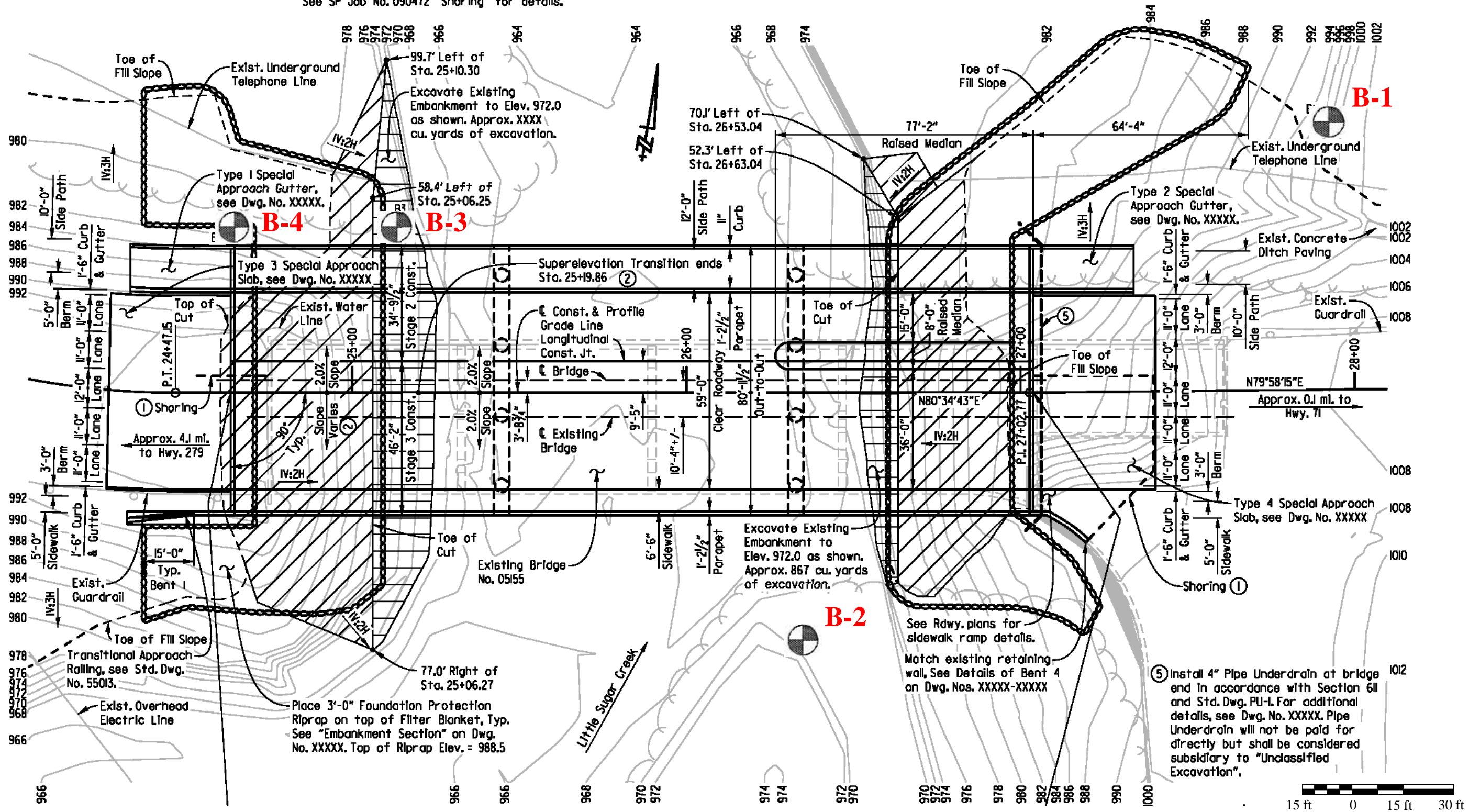
Date: June 2019

Job No. 17-125

PLATE 2A

For R/W Data, See Roadway Plans.

① Shoring will be required to retain the roadway embankment during construction. See SP Job No. 090472 "Shoring" for details.



PLAN OF BORINGS
 ARDOT 090472 – Bridge 05155 over Little Sugar Creek
 Bella Vista, Arkansas

Scale: As Shown
 Date: June 2019

Job No. 17-125

PLATE 2B



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

LOG OF BORING NO. 1

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 11 ft /Wash

LOCATION: Approx Sta 3+39, 80 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT							
			SURF. EL: 1004±			0.2	0.4	0.6	0.8	1.0	1.2	1.4			
						10	20	30	40	50	60	70			
			4 inches: Asphalt Concrete												
			Stiff brown silty clay w/numerous chert fragments (fill) - firm to stiff below 2 ft	11			●	+	+					24	
				10				●							
5			Stiff gray, reddish brown and brown clay w/occasional shale fragments and ferrous stains (fill)	11				+	●	- - - - -	+			94	
				23					●						
10			Low hardness gray and yellowish gray highly weathered limestone w/silty clay seams - moderately hard below 8 ft	50/1"			●								
			Moderately hard light gray and gray slightly weathered limestone, flat bedded w/occasional pyrite inclusions - auger refusal at 11 ft - hard below 12 ft												
15														98	98
			- chert seam at 17 ft												
														97	80
20			Low hardness greenish gray calcareous mudstone												
			Moderately hard dark brownish gray shale, carbonaceous and flat bedded, very thinly bedded w/occasional pyrite inclusions												
25															
			- highly weathered clayey shale layer from 25.5 - 26 ft - with numerous mechanical breaks below 26 ft - high-angle fractures with ferrous stains at 27.8 ft												
														100	67
														78	68

COMPLETION DEPTH: 56.0 ft
DATE: 4-5-18

DEPTH TO WATER
IN BORING: Dry to 11 ft

DATE: 4/5/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 1

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 11 ft /Wash

LOCATION: Approx Sta 3+39, 80 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD								
						PLASTIC LIMIT +	WATER CONTENT ●	LIQUID LIMIT +											
						0.2	0.4	0.6	0.8	1.0	1.2	1.4							
						10	20	30	40	50	60	70							
35			- core barrel plugged at 36 - 41 ft, little recovery																
40																			
45																			
50																			
55																			

COMPLETION DEPTH: 56.0 ft
DATE: 4-5-18

DEPTH TO WATER
IN BORING: Dry to 11 ft

DATE: 4/5/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 2

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 5+10, 75 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD
						0.2 0.4 0.6 0.8 1.0 1.2 1.4	PLASTIC LIMIT +	WATER CONTENT ●			
SURF. EL: 970±											
			Loose brown clayey fine to coarse gravel	7			+ - ●		16		
5			Loose brown sandy fine to coarse gravel - water at 3 ft	8		●			4		
10			Stiff brown silty clay w/some fine to coarse gravel			●					
15			Moderately hard to hard dark brownish gray slightly weathered shale, carbonaceous, flat bedded w/some pyrite inclusions - high angle fracture at 12.8 ft					$q_u = 2730$ psi, TUW = 161 pcf	90	80	
20								$q_u = 2720$ psi, TUW = 161 pcf	87	82	
25								$q_u = 2480$ psi, TUW = 157 pcf	90	90	
			Hard gray limestone					$q_u = 8480$ psi, TUW = 165 pcf	96	96	

RECRODN200-2, 17-125.GPJ 6-27-19

COMPLETION DEPTH: 46.0 ft
DATE: 4-20-18

DEPTH TO WATER
IN BORING: 3 ft

DATE: 4/20/2018



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

LOG OF BORING NO. 2

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 5+10, 75 ft Lt

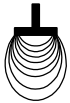
DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT					- No. 200 %	% Recovery	% RQD	
						0.2	0.4	0.6	0.8	1.0				1.2
						+	-			+				
						10	20	30	40	50	60	70		
35			Hard light gray and gray limestone, flat bedded w/close to very close bluish green mudstone laminations - with some chert nodules below 30 ft									97	97	
			Hard light gray dolostone, flat bedded w/close arenaceous dolostone zones									95	95	
40			Hard light gray and gray limestone, arenaceous, flat bedded w/some calcite inclusions and calcite crystal filled vugs - less arenaceous from 40 - 41 ft - with more calcite inclusions below 41 ft									98	98	
45														
50														
55														

COMPLETION DEPTH: 46.0 ft
DATE: 4-20-18

DEPTH TO WATER
IN BORING: 3 ft

DATE: 4/20/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 3

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 17 ft /Wash

LOCATION: Approx Sta 6+17, 50 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD	
						PLASTIC LIMIT +	WATER CONTENT ●	LIQUID LIMIT +				
SURF. EL: 981±												
5	(Symbol for loose to medium dense gravel)	(Symbol for loose to medium dense gravel)	Loose dark brown clayey fine to coarse gravel, sandy (fill)	6		●	+	+	30			
			- medium dense at 2 to 6 ft	11		●						
				11			●					
			- loose below 6 ft	9		●						
10	(Symbol for medium dense brown clayey fine to coarse gravel)	(Symbol for medium dense brown clayey fine to coarse gravel)	Medium dense brown clayey fine to coarse gravel	14		●			22			
			- dense to very dense below 13 ft	50/4"		●						
15	(Symbol for shale)	(Symbol for shale)	Moderately hard dark gray highly weathered shale, carbonaceous									
			- water at 15 ft									
20	(Symbol for shale)	(Symbol for shale)	Moderately hard dark brownish gray slightly weathered shale, flat bedded, carbonaceous w/occasional pyrite inclusions	25/0"								
												$q_u = 1910 \text{ psi}, \text{ T UW} = 166 \text{ pcf}$
25	(Symbol for shale)	(Symbol for shale)										
												$q_u = 2180 \text{ psi}, \text{ T UW} = 159 \text{ pcf}$

COMPLETION DEPTH: 45.0 ft
DATE: 4-11-18

DEPTH TO WATER
IN BORING: 15 ft

DATE: 4/11/2018

RECRODN200-2 17-125.GPJ 6-27-19



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

LOG OF BORING NO. 3

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 17 ft /Wash

LOCATION: Approx Sta 6+17, 50 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD					
						PLASTIC LIMIT +	WATER CONTENT ●	LIQUID LIMIT +								
						0.2	0.4	0.6	0.8	1.0	1.2	1.4				
						10	20	30	40	50	60	70				
			- slightly vuggy below 33 ft													
35			Moderately hard light gray and gray limestone w/some chert nodules and occasional fossils													
			- dolostone at 36.5 - 38 ft													
40			Hard light grayish tan dolostone w/occasional pyrite inclusions													
			Hard light gray and gray limestone w/occasional chert nodules and pyrite inclusions													
45																
50																
55																

$q_u = 2480$ psi, TUV = 151 pcf

10094

$q_u = 7620$ psi, TUV = 168 pcf

100100

$q_u = 7340$ psi, TUV = 168 pcf

$q_u = 11810$ psi, TUV = 172 pcf

100100

COMPLETION DEPTH: 45.0 ft
DATE: 4-11-18

DEPTH TO WATER
IN BORING: 15 ft

DATE: 4/11/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 4

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 6+67, 50 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT							
			SURF. EL: 981±			0.2	0.4	0.6	0.8	1.0	1.2	1.4			
						+							+		
5			Loose dark brown clayey fine sand w/a little fine to coarse gravel (fill) - medium dense at 2 to 6 ft	8			+	●					+		
				16				●							
				14				●							
			- very loose to loose below 6 ft	4											
10			Loose brown clayey fine to coarse gravel	7				●	+	+					
				9				●							
15			- water at 14 ft												
20			Moderately hard dark gray highly weathered shale, carbonaceous - auger refusal at 20 ft in shale	25/0"											
25			Moderately hard dark brownish gray slightly weathered shale, carbonaceous, ~ horizontal bedding - with occasional pyrite inclusions and close jointing from 20 - 26.2 ft												100 15
			Moderately hard dark brownish gray shale, carbonaceous, thinly bedded, flat bedded w/occasional pyrite inclusions												96 96

COMPLETION DEPTH: 46.0 ft
DATE: 4-4-18

DEPTH TO WATER
IN BORING: 14 ft

DATE: 4/4/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. 4

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: Approx Sta 6+67, 50 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %	% Recovery	% RQD				
						PLASTIC LIMIT +	WATER CONTENT ●	LIQUID LIMIT +							
						0.2	0.4	0.6	0.8	1.0	1.2	1.4			
						10	20	30	40	50	60	70			
35			- with some calcareous inclusions below 34 ft Moderately hard to hard light gray and gray limestone w/some fossils, close sandy limestone layers and occasional calcite inclusions												10097
40			Hard light gray dolostone												100100
45			Hard light gray and gray limestone, slightly sandy, flat bedded w/occasional chert nodules, and some calcite inclusions - dolostone layer from 44.5 - 45.5 ft												100100
50															
55															

COMPLETION DEPTH: 46.0 ft
DATE: 4-4-18

DEPTH TO WATER
IN BORING: 14 ft

DATE: 4/4/2018

RECRODN200-2, 17-125.GPJ, 6-27-19



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

LOG OF BORING NO. P1

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger

LOCATION: Approx Sta 22+90, 10 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT							- No. 200 %	
						0.2	0.4	0.6	0.8	1.0	1.2	1.4		
			SURF. EL: 993±											
			Medium dense brown silty fine sand w/some chert fragments and crushed stone (fill)	27										19
			- with some crushed stone at 2.5 ft	50/6"										
5				30										
				16										
10			Firm brown silty clay w/chert fragments (possible fill)	8										
			- auger refusal at 11 ft in apparent limestone											
15														

COMPLETION DEPTH: 11.0 ft
DATE: 4-11-18

DEPTH TO WATER
IN BORING: Dry

DATE: 4/11/2018

LGBNEW 17-125.GPJ 6-27-19



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

LOG OF BORING NO. P2

ARDOT 090472 - Bridge 05155 over Little Sugar Creek
Bella Vista, Arkansas

TYPE: Auger

LOCATION: Approx Sta 14+55, 15 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT					
			SURF. EL: 990±			0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						10	20	30	40	50	60	70	
			Medium dense dark brown and tan crushed stone w/some fine sandy silt (fill)	26									9
				20									
5			Stiff reddish brown silty clay w/some chert fragments (possible fill) - water at 5 ft	16									
			Soft tan and brown silty clay w/some chert fragments - firm below 8 ft	4									
				9									
10													
15													

LGBNEW 17-125.GPJ 6-27-19

COMPLETION DEPTH: 10.0 ft
DATE: 4-11-18

DEPTH TO WATER
IN BORING: Dry

DATE: 4/11/2018



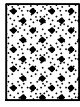
SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES

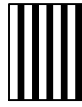
(SHOWN IN SYMBOLS COLUMN)



Gravel



Sand



Silt

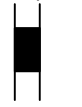


Clay

Predominant type shown heavy

SAMPLER TYPES

(SHOWN ON SAMPLES COLUMN)



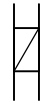
Shelby
Tube



Rock
Core



Split
Spoon



No
Recovery



Cutting

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) 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.

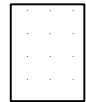
POORLY GRADED - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

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

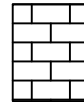


BORING LOG TERMS – ROCK

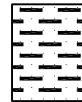
ROCK TYPES
(SHOWN IN SYMBOLS COLUMN)



Sandstone



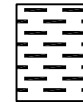
Limestone



Siltstone



Coal



Shale

<p>Joint Characteristics -</p> <p>Bedding Characteristics -</p> <p>Lithologic Characteristics -</p> <p>Parting - Seam - Layer - Stratum -</p> <p>Hardness-</p> <p>Texture -</p> <p>Structure -</p>	<p><u>Spacing</u></p> <p>Very Close Close Moderately Close Wide Very Wide</p> <p>Very Thin Thin Medium Thick Massive</p> <p>Clayey Shaly Calcareous (limy) Siliceous Sandy (Arenaceous) Silty Plastic Seams</p> <p>Less than 1/16 inch 1/16 to 1/2 inch 1/2 to 12 inches Greater than 12 inches</p> <p>Soft (S) - Reserved for plastic material alone.</p> <p>Friable (F) - Easily crumbled by hand, pulverized or reduced to powder and is too soft to be cut with a pocket knife.</p> <p>Low Hardness (LH) - Can be gouged deeply or carved with a pocket knife.</p> <p>Moderately Hard (MH) - Can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and scratch is readily visible after the powder has been blown away.</p> <p>Hard (H) - Can be scratched with difficulty; scratch produces little powder and is often faintly visible; traces of the knife steel may be visible.</p> <p>Very hard (VH) - Cannot be scratched with a pocket knife. Knife steel marks left on surface.</p> <p>Fine - Barely seen with naked eye Medium - Barely seen up to 1/8 in. Coarse - 1/8 in. to 1/4 in.</p> <p><u>Bedding</u> Flat - 0° - 5° Gently Dipping - 5° - 35° Moderately Dipping - 35° - 55° Steeply Dipping - 55° - 85°</p> <p>Fractures, scattered Open Cemented or Tight</p> <p>Fractures, closely spaced Open Cemented or Tight</p> <p>Brecciated (Sheared and Fragmented) Open Cemented or Tight</p> <p>Joints Faulted Slickensides</p>	<p><u>Degree of Weathering -</u></p> <p>Fresh - No visible signs of decomposition or discoloration. Rings under hammer impact.</p> <p>Slightly Weathered - Slight discoloration inwards from open fractures, otherwise similar to fresh.</p> <p>Moderately Weathered - Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock, but cores cannot be broken by hand or scraped by knife. Texture preserved.</p> <p>Highly Weathered - Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric</p> <p>Completely Weathered - Minerals decomposed to soil but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.</p> <p>Residual Soil - Advanced state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.</p>	<p><u>Solution and Void Conditions -</u></p> <p>Solid, contains no voids Yuggy (pitted) Vesicular (igneous) Porous Cavities Cavernous</p> <p><u>Swelling Properties -</u></p> <p>Nonswelling Swelling</p> <p><u>Slaking Properties -</u></p> <p>Nonslaking Slakes slowly on exposure Slakes readily on exposure</p>	<p><u>Rock Quality Designation (RQD) -</u></p> <table border="0"> <thead> <tr> <th>RQD (Percent)</th> <th>Diagnostic Description</th> </tr> </thead> <tbody> <tr> <td>Greater than 90</td> <td>Excellent</td> </tr> <tr> <td>75 - 90</td> <td>Good</td> </tr> <tr> <td>50 - 75</td> <td>Fair</td> </tr> <tr> <td>25 - 50</td> <td>Poor</td> </tr> <tr> <td>Less than 25</td> <td>Very Poor</td> </tr> </tbody> </table>	RQD (Percent)	Diagnostic Description	Greater than 90	Excellent	75 - 90	Good	50 - 75	Fair	25 - 50	Poor	Less than 25	Very Poor
RQD (Percent)	Diagnostic Description															
Greater than 90	Excellent															
75 - 90	Good															
50 - 75	Fair															
25 - 50	Poor															
Less than 25	Very Poor															

SUMMARY of SUBSURFACE EXPLORATION

PROJECT: ArDOT 090472 - Hwy. 340 over Little Sugar Creek (Bridge 05155)

LOCATION: Bella Vista, Benton County, Arkansas

GHBW JOB No.: 17-125

Boring No.	Station Reference	Approx Sta	Approx Offset, ft	Approx Surf El, ft	Completion Depth, ft
1	Hwy 340	3+39	80 Rt	1004	56
2	Hwy 340	5+10	75 Lt	970	46
3	Hwy 340	6+17	50 Rt	981	45
4	Hwy 340	6+67	50 Rt	981	46
P1	Hwy 340	22+90	10 Rt	993	11
P2	Hwy 340	14+55	15 Rt	990	10

APPENDIX A

USER: CTAUSER
 DESIGN FILE: G:\17107001\Hwy340\TRANSP\dgn\br\lidge\090472x2_11.dgn
 PLOTTED: 5/23/2019 2:10:40 PM SCALE: 40,0000' / 1" / in.

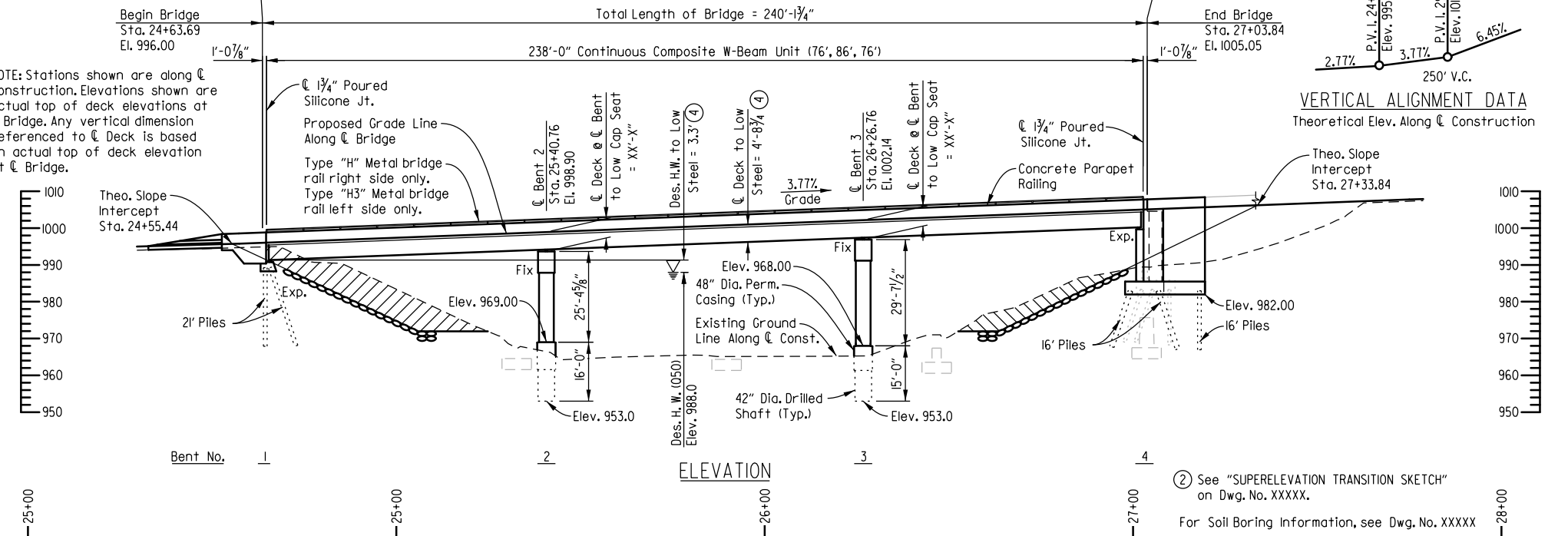
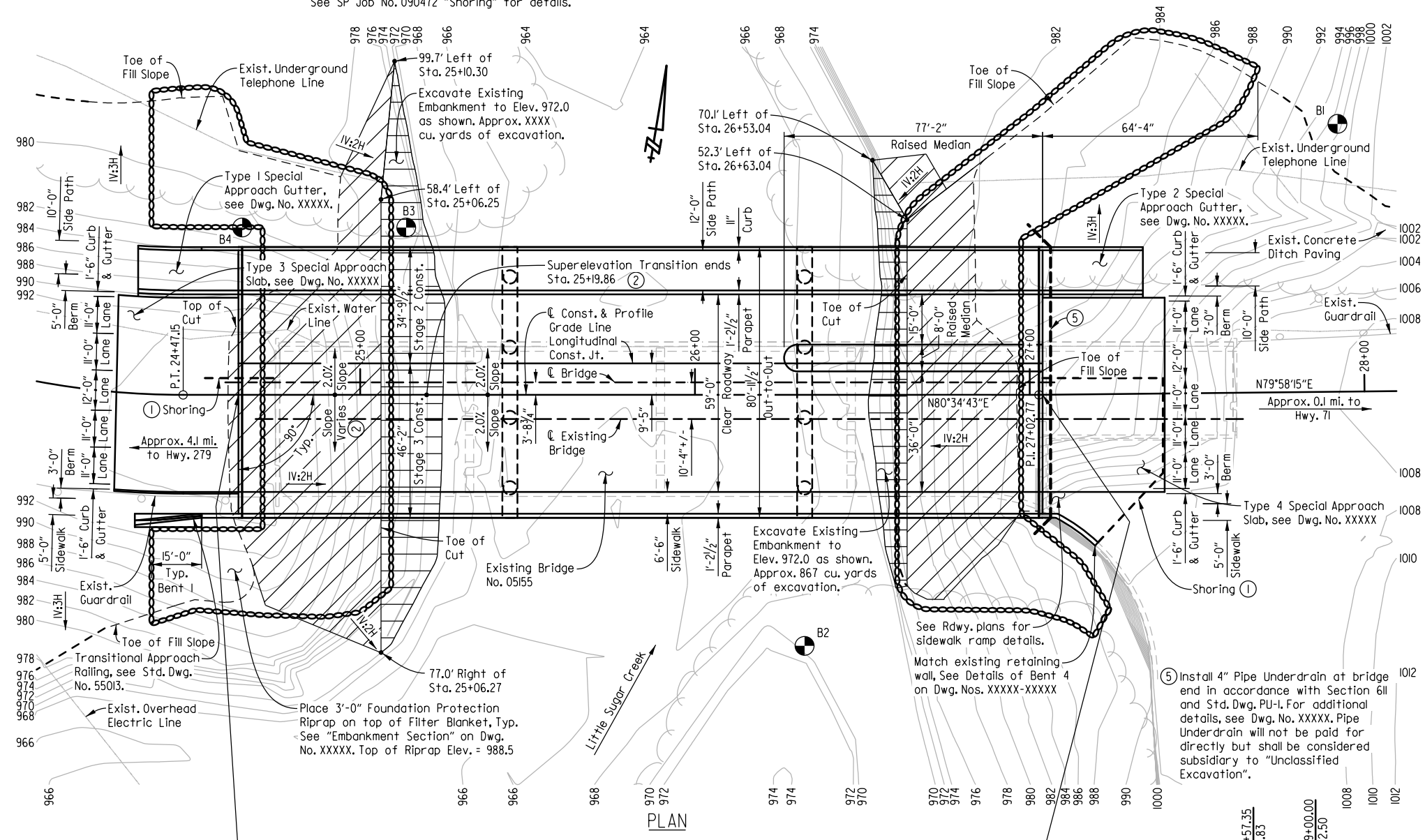
For R/W Data, See Roadway Plans.

① Shoring will be required to retain the roadway embankment during construction. See SP Job No. 090472 "Shoring" for details.

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED. RD. DIST. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
						JOB NO.	090472	30
						XXXXX	LAYOUT	XXXXX

GENERAL NOTES

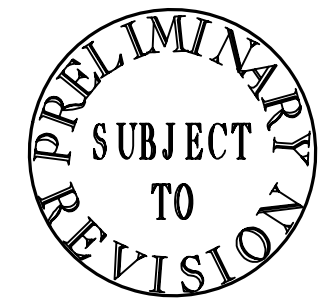
- BENCH MARK: Vertical Control Data are shown on Survey Control Details.
- CONSTRUCTION SPECIFICATIONS: Arkansas State Highway and Transportation Department Standard Specifications for Highway Construction (2014 edition) with applicable Supplemental Specifications and Special Provisions. Section and Subsection refer to the Standard Construction Specifications unless otherwise noted in the Plans.
- DESIGN SPECIFICATIONS: AASHTO LRFD Bridge Design specifications (7th Edition) with current Interim specifications.
- LIVE LOADING: HL-93 SEISMIC PERFORMANCE ZONE: I $S_{DI} = 0.085$ SITE CLASS: C
- MATERIALS AND STRENGTHS:
 Class S(AE) Concrete (Superstructure) $f'_c = 4,000$ psi
 Class S Concrete (Substructure) $f'_c = 3,500$ psi
 Reinforcing Steel (AASHTO M 31 or M 322 Type A, Gr. 60) $f_y = 60,000$ psi
 Structural Steel (AASHTO M 270, Gr. 36) $F_y = 36,000$ psi
 Structural Steel (AASHTO M 270, Gr. 50W) $F_y = 50,000$ psi
- BORING LOGS: Boring logs may be obtained from the Construction Contract Procurement Section of Program Management Division.
- STEEL PILING: Piling in End Bent 1 shall be HP 12x53 (Gr.50) and shall be driven with an approved air, steam or diesel hammer to a minimum safe bearing capacity of 97 tons per pile and into the material designated as limestone on the boring legend. Piling in End Bent 4 shall be HP 14x89 (Gr.50) and shall be driven with an approved air, steam or diesel hammer to a minimum safe bearing capacity of 163 tons per pile and into the material designated as shale on the boring legend. Lengths of piling shown are for estimating quantities and for use in determining payment for cut-off and build-up in accordance with Section 805. Piles in end bents to be driven after excavation to bottom of cap or footing are complete. On all piles, the Contractor shall use approved steel H-Pile driving points.
- PREBORING: Preboring is required for all piles in Bent 4. Preboring shall be to a minimum 3' depth into material designated as XXXX on the boring legend. The actual size and depth of preboring shall be determined in the field by the Engineer. The Contractor shall be responsible for keeping prebored holes free of debris prior to driving piles and backfilling which may require the use of temporary casings or other methods. After driving is completed, the prebored hole shall be backfilled with Class S Concrete to the top of the rock and the remaining length backfilled in accordance with Subsection 805.08(a). Any related cost for backfilling and temporary casing will not be paid for directly, but shall be considered subsidiary to the item "Preboring."
- DRILLED SHAFTS: Drilled shafts in Bents 2 and 3 shall be constructed in accordance with Special Provision Job No. 090472 "Drilled Shaft Foundations". Drilled shafts shall be socketed a minimum of 10' into competent rock designated as moderately hard to hard shale on the boring legend. No adjustment to plan tip elevations shall be made without prior approval from the Engineer.
- CROSSHOLE SONIC LOGGING: Nondestructive testing shall be performed on each drilled shaft in accordance with Special Provision Job No. 090472 "Nondestructive Testing of Drilled Shafts".
- PAINTING: All Grade 50W structural steel, except galvanized members and surfaces in contact with concrete, within five feet of bridge deck expansion joints shall be painted as specified in Subsection 807.75. The color of paint shall be Brown equal or close to Federal Std. 595B, Color Chip No. 30070 and as approved by the engineer. The finish system may be applied in the shop. Any damage to the paint system occurring during transport or installation shall be corrected according to the manufacturer's recommendations at no cost to the Department.
- For Additional General Notes see Dwg. No. XXXXX.



HYDRAULIC DATA

FLOOD DESCRIPTION	FREQUENCY YEARS	DISCHARGE CFS	NATURAL W.S. ELEVATION FEET	W.S. ELEVATION WITH BACKWATER FEET
DESIGN	50	29,681	988.1	988.0
BASE	100	33,771	989.0	988.1
EXTREME	500	47,749	992.4	992.5
OVERTOPPING	82	32,250	----	989.0

- ③ Unconstricted water surface elevation without structure or roadway approaches. 100 yr. backwater elevation for existing structure = 989.6 feet
- ④ Proposed Low Bridge Chord Elev. = 991.33 feet at Station 24+65.19
 Drainage Area = 102.8 sq. miles
 Historical H.W. Elev. = N/A



SHEET 1 OF 2
 LAYOUT OF BRIDGE
 HIGHWAY 340 OVER LITTLE SUGAR CREEK
 LITTLE SUGAR & TANYARD CREEKS
 STRS. & APPRS. (BELLA VISTA) (S)
 BENTON COUNTY
 ROUTE 340 SEC. 1
 ARKANSAS STATE HIGHWAY COMMISSION
 LITTLE ROCK, ARK.

DRAWN BY: BWC DATE: 11-20-18 FILENAME: b090472x2_11.dgn
 CHECKED BY: CAW DATE: 12-03-18 SCALE: 1" = 20'
 DESIGNED BY: KRM DATE: 11-12-18
 BRIDGE NO. XXXXX DRAWING NO. XXXXX

APPENDIX B

B-03
B-1E

17125
B-1
56+7

17-125
B-1
12-21'
Grubbs, Hoskyn,
Barton & Wyatt, INC.
CONSULTING ENGINEERS
RUN1. 12'-16'
RUN2. 16'-21'



Raynolds Wrap

DRILLER OR COMPANY

1/2 in. 5R. Camples

17125

B-1

S. 8.9

17-125

B-1

21'-31'

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

RUN 1) 21-26'

RUN 2) 26-31'



17125
B-1
E 10+11

17-125
B-1
31'-41'
Grubbs, Hoskyn,
Barton & Wyatt, INC.
CONSULTING ENGINEERS
RUN 1.) 31'-36'
RUN 2.) 36'-41'

136

HOLE# _____ OF _____ BOXES
HOLE# _____ OF _____ BOXES

17125

B-1

5-12+13

17-125

B-1

41'-51'

Grubbs, Hoskyn,
Barton & Wyatt

RUN 1.) 41'-46'

RUN 2.) 46'-51'



17-125

B-1

51-56'



Grubbs, Hoskyn,
Barton & Wyatt INC.
CONSULTING ENGINEERS



17-125
B-2
11'-21'
Grubbs, Hoskyn,
Barton & Wyatt INC.
CONSULTING ENGINEERS
RUN 1. 11'-16'
RUN 2. 16'-21'

17-125
B-2
5-127



Waste, 2017, 2018



NO. 79

41

B-2E

10-0-18
B-2W 0-18

17-125
B-2
21'-31'
Grubbs, Hoskyn,
Barton & Wyatt, INC.
CONSULTING ENGINEERS
RUN 1. 21-26
RUN 2. 26-31

PROPERTY
BOX NO.
79

25



13-26 0-18

17-125
B-2
31-41'
Grubbs, Hoskyn,
Barton & Wyatt, INC.
CONSULTING ENGINEERS
RUN1. 31-36
RUN2. 36-41'

PROPERTY
BOX NO.
TO



77-125
B-2
41'-46'



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



17125

B-3

20-30

17-125
B-3
20'-30'
Grubbs, Moskyn,
Horton & Wyatt
INC.
RUN 1.) 20'-25'
RUN 2.) 25'-30'



17125
B-3

10 + 11

17-125

B-3

30'-40'



Grubbs, Hoskyn,
Barton & Wyatt
INC.
CONSULTING ENGINEERS

RUN 1.) 30'-35'

RUN 2.) 35'-40'



PROJECT
DATE
NO. DEPTH FROM

5-12-13

17-125
B-3
40'-45'



17-125

B-4

22-31'

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

RUN 1.) 22'-27'

RUN 2.) 27'-31'



17125

17-125
B-4
31'-41'

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

RUN 1.) 31'-36'
RUN 2.) 36'-41'



17125
B-4

17-125
B-4
41'-46'

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



APPENDIX C

SUMMARY of LABORATORY TEST RESULTS

PROJECT: ARDOT 090472 Hwy 340 Bridge Replacements

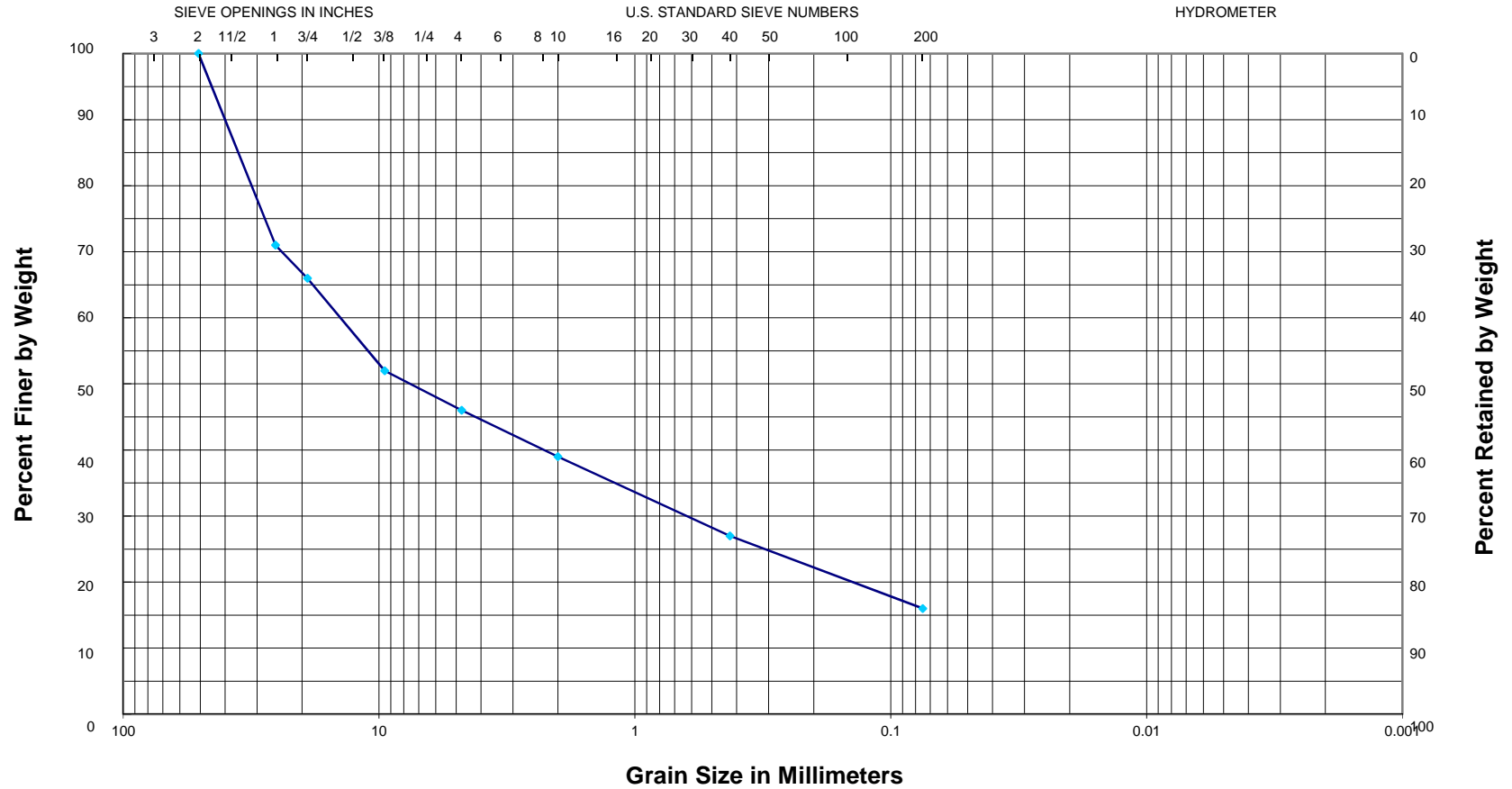
LOCATION: Bella Vista, Benton County, Arkansas

JOB NUMBER: 17-125

Boring No.	Sample Depth, ft	Water Content, %	Atterberg Limits			Sieve Analysis - Percent Passing								Unified Class.	AASHTO Class.
			Liquid Limit	Plastic Limit	Plasticity Index	2 in.	1 in.	3/4 in.	3/8 in.	#4	#10	#40	#200		
						-----	-----	-----	-----	-----	-----	-----	-----		
1	1-2	13	29	21	8	-----	-----	-----	-----	41	-----	-----	24	GC	A-2-6
1	4.5-5.5	30	65	22	43	-----	-----	-----	-----	-----	-----	-----	94	CH	A-7-6
2	0.5-1.5	40	38	29	9	100	71	66	52	46	39	27	16	GM	A-2-4
2	4.5-5.5	16	-----	-----	-----	100	71	42	12	9	8	6	4	GP	A-1-a
3	0.5-1.5	16	32	20	12	-----	-----	-----	-----	52	-----	-----	30	GC	A-2-6
3	9-10	14	-----	-----	-----	-----	-----	-----	-----	43	-----	-----	22	GC	A-4
4	0.5-1.5	24	33	21	12	-----	-----	-----	-----	74	-----	-----	33	SC	A-2-6
4	9-10	18	30	22	8	-----	-----	-----	-----	51	-----	-----	12	GP-GC	A-2-4
P1	0.5-1.5	5	NONPLASTIC			100	100	100	85	70	53	33	19	SM	A-1-b
P2	0.5-1.5	10	NONPLASTIC			100	100	92	62	46	32	17	9	GP-GM	A-1-a
P2	4.5-5.5	9	36	17	19	-----	-----	-----	-----	-----	-----	-----	-----	CL	A-6

17-125

GRAIN SIZE CURVE



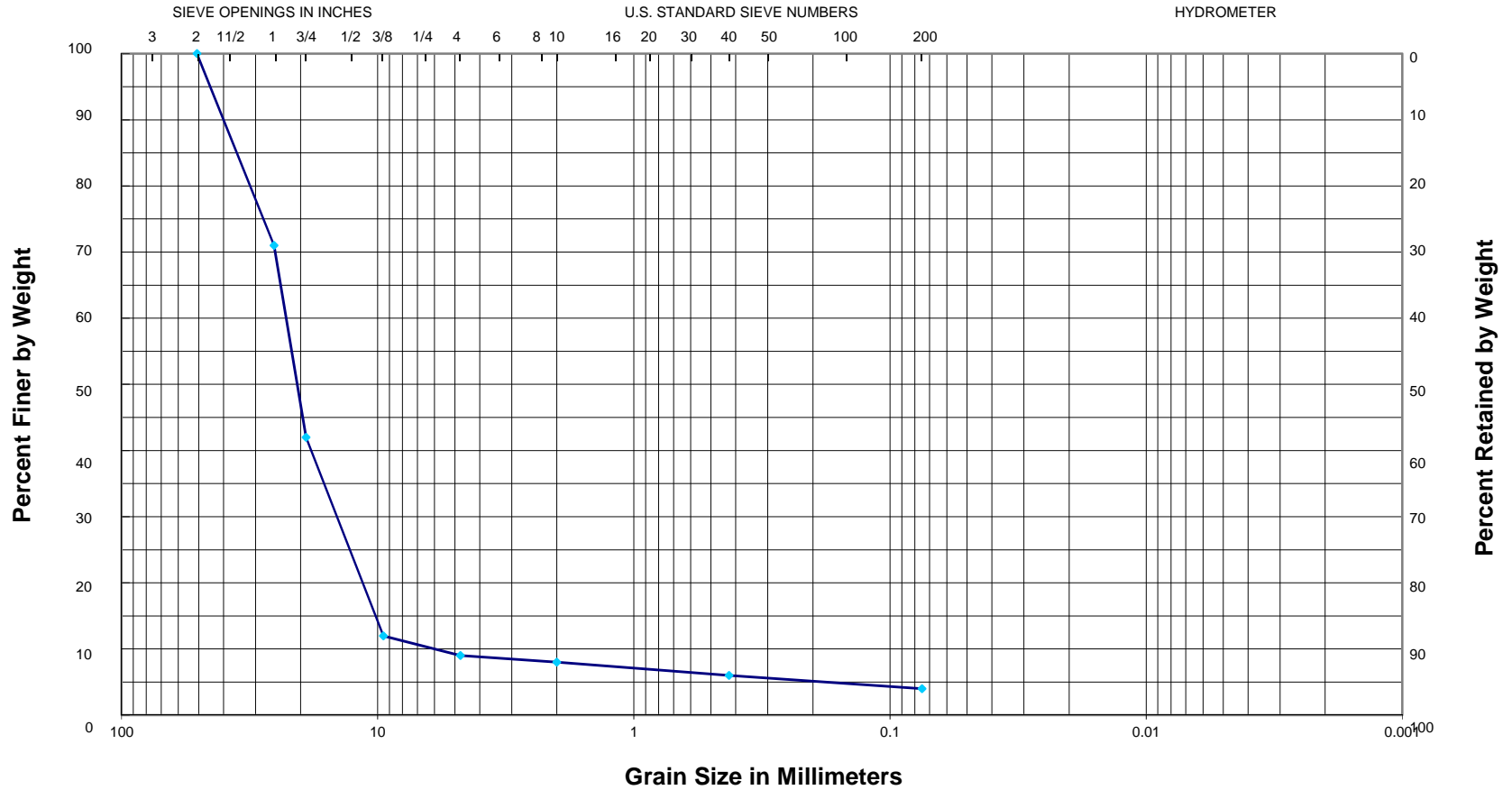
GRAVEL		SAND			SILT	OR	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE			

Sample: Boring 2, 0.5-1.5 ft; LL = 38, PL = 29, PI = 9
 Description: Brown clayey fine to coarse chert fragments (fill)

USCS = GM AASHTO = A-2-4

17-125

GRAIN SIZE CURVE



GRAVEL		SAND			SILT	OR	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE			

Sample: Boring 2, 4.5-5.5 ft; NONPLASTIC
 Description: Brown fine to coarse gravel, slightly sandy

USCS = GP AASHTO = A-1-a

17-125

GRAIN SIZE CURVE



GRAVEL		SAND			SILT	OR	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE			

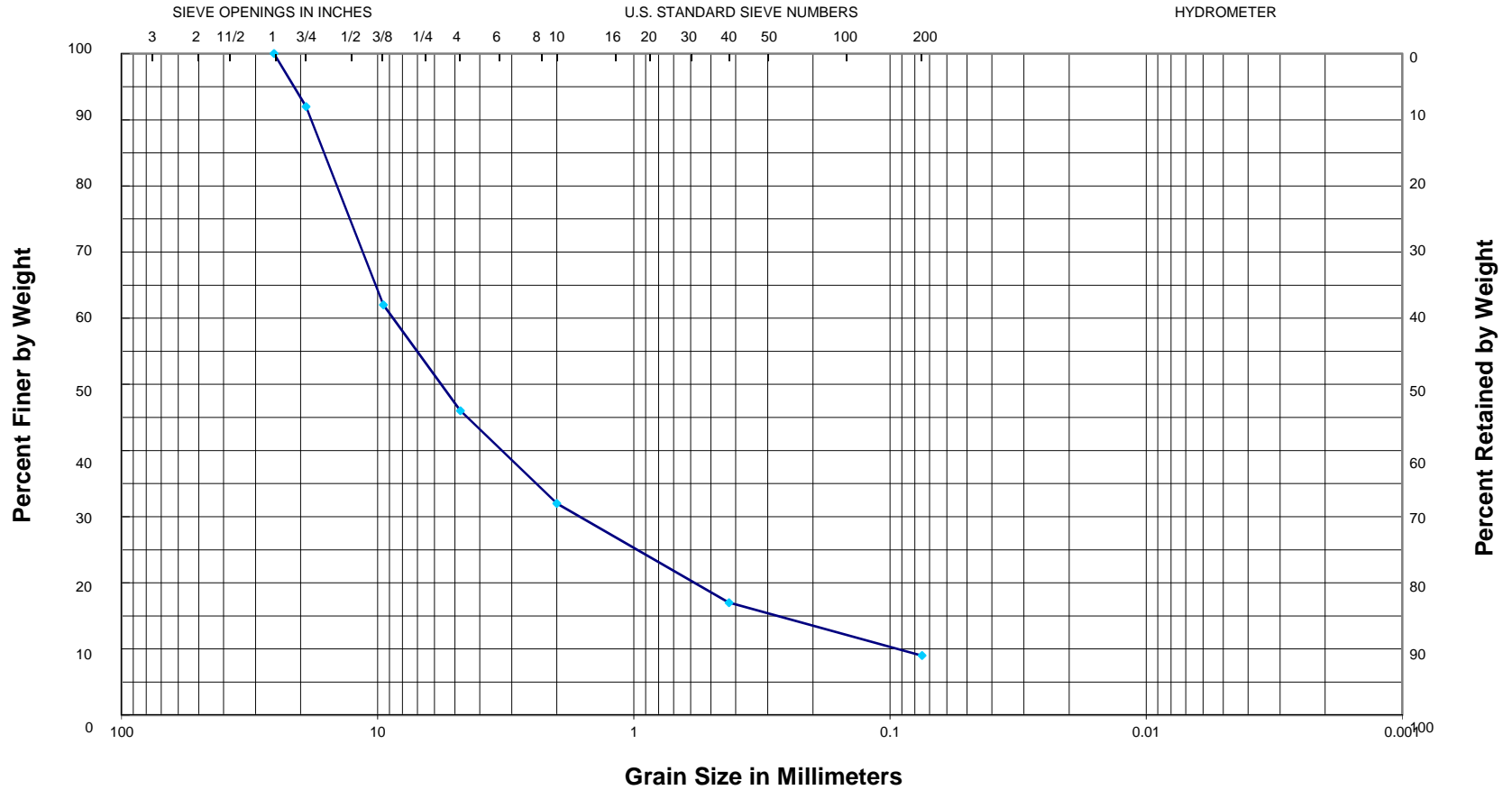
Sample: Boring P1, 0.5-1.5 ft; NONPLASTIC

Description: Brown silty fine to coarse sand with some crushed stone and chert fragments (fill)

USCS = SM AASHTO = A-1-b

17-125

GRAIN SIZE CURVE



GRAVEL		SAND			SILT	OR	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE			

Sample: Boring P2, 0.5-1.5 ft; NONPLASTIC

Description: Dark brown and tan fine sandy silt with crushed stone fragments (fill)

USCS = GP-GM AASHTO = A-1-a

SUMMARY of COMPRESSION TEST RESULTS

PROJECT: ArDOT 090472 - Hwy. 340 over Little Sugar Creek (Bridge 05155)

LOCATION: Bella Vista, Benton County, Arkansas

GHBW JOB No.: 17-125

Boring No.	Depth, ft	Total Unit Weight, pcf	Compressive Strength, psi	Sample Description
1	12-12.5	163	5,820	Weathered limestone
1	16-16.5	167	11,060	Weathered limestone
1	22-22.5	160	2,300	Shale
1	34-34.5	170	2,290	Shale
1	42-42.5	153	2,210	Shale
1	46-46.5	164	2,200	Shale
1	51-51.5	160	2,350	Shale
2	12-12.5	161	2,730	Shale
2	17-17.5	161	2,720	Shale
2	22-22.5	157	2,480	Shale
2	28-28.5	165	8,480	Limestone
2	31-31.5	163	11,650	Limestone
2	36-36.5	168	9,320	Dolostone
2	41.5-42	168	4,970	Limestone
3	22.5-23	166	1,910	Shale
3	26-27.2	159	2,180	Shale
3	31-31.8	151	2,480	Shale
3	35.5-36	168	7,620	Limestone
3	40-40.6	168	7,340	Dolostone
3	43-43.5	172	11,810	Limestone
4	26.2-26.8	161	2,290	Shale
4	29-29.5	161	2,450	Shale
4	35-35.5	170	6,930	Limestone
4	38-38.5	169	7,690	Limestone
4	41-41.5	166	5,360	Dolostone
4	43-43.5	167	5,090	Limestone

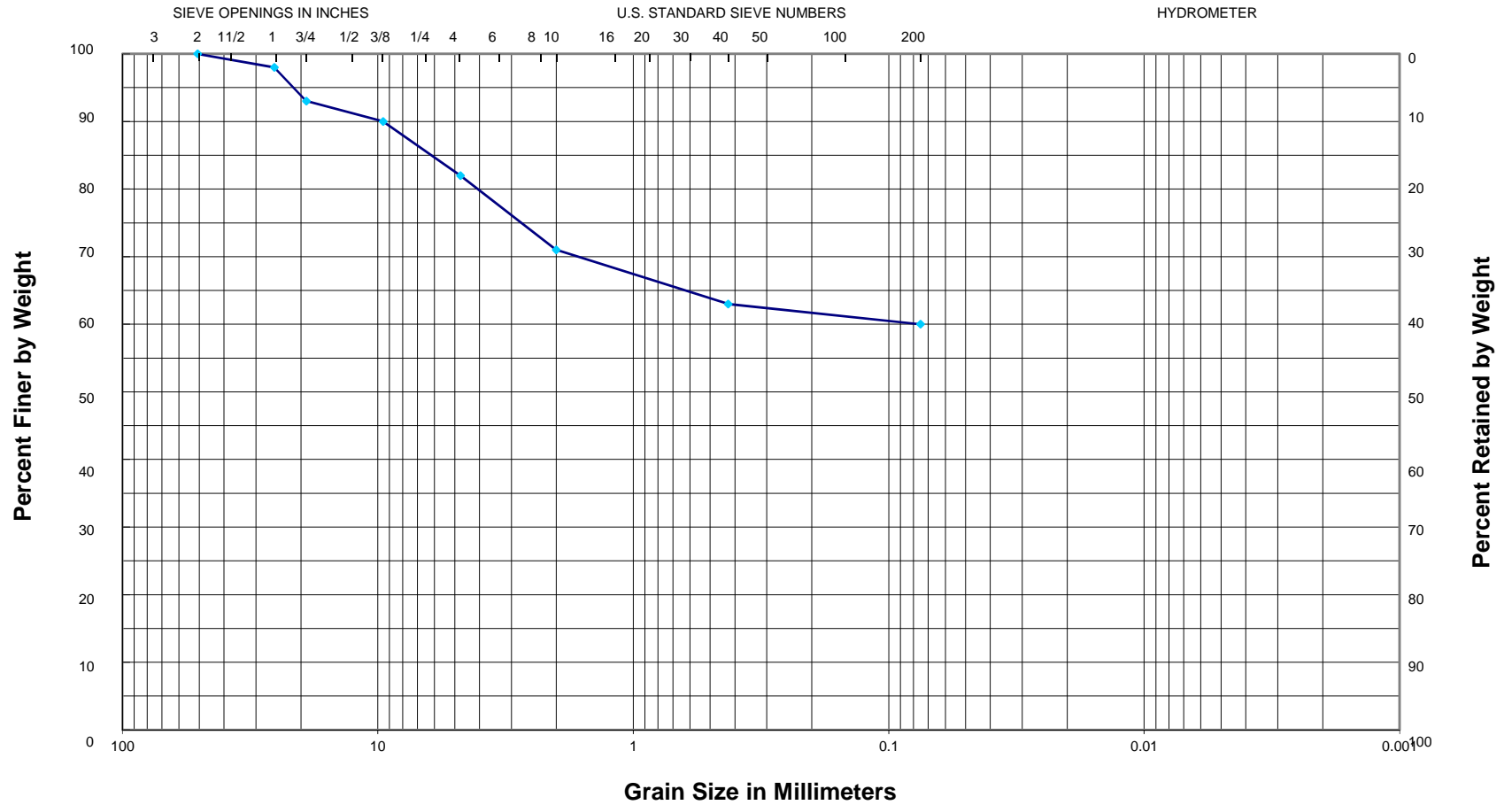
Notes:

1. All tests performed on NQwl rock cores
2. Tested as per ASTM D2938

APPENDIX D

17-125

GRAIN SIZE CURVE



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Sample: Test Pit 3/8A, 1-2.5ft
 Atterberg Limits: LL = 32, PL = 15, PI = 17

Description: Reddish brown fine to coarse sandy CLAY w/ a little chert fragments
 Classification: USCS = CL; AASHTO = A-6

REPORT OF STANDARD PROCTOR TEST (AASHTO T-99)

Project: ARDOT Job No. 090472 Highway 340 Bridge Replacements Job No: 17-125
 Material Description: Reddish brown fine to coarse sandy clay CLAY w/ a little chert fragments
 Location Sampled/Source: 3/8A
 Sample Depth, ft: 1-2.5
 Date Sampled: 3/8/2018
 Date Tested: 3/16/2018
 Tested By: LLC

LAB COMPACTION PROCEDURE: AASHTO T-99 Method: C	
Maximum Unit Dry Wt. (pcf):	112.8
Optimum Water Content (%):	14.0

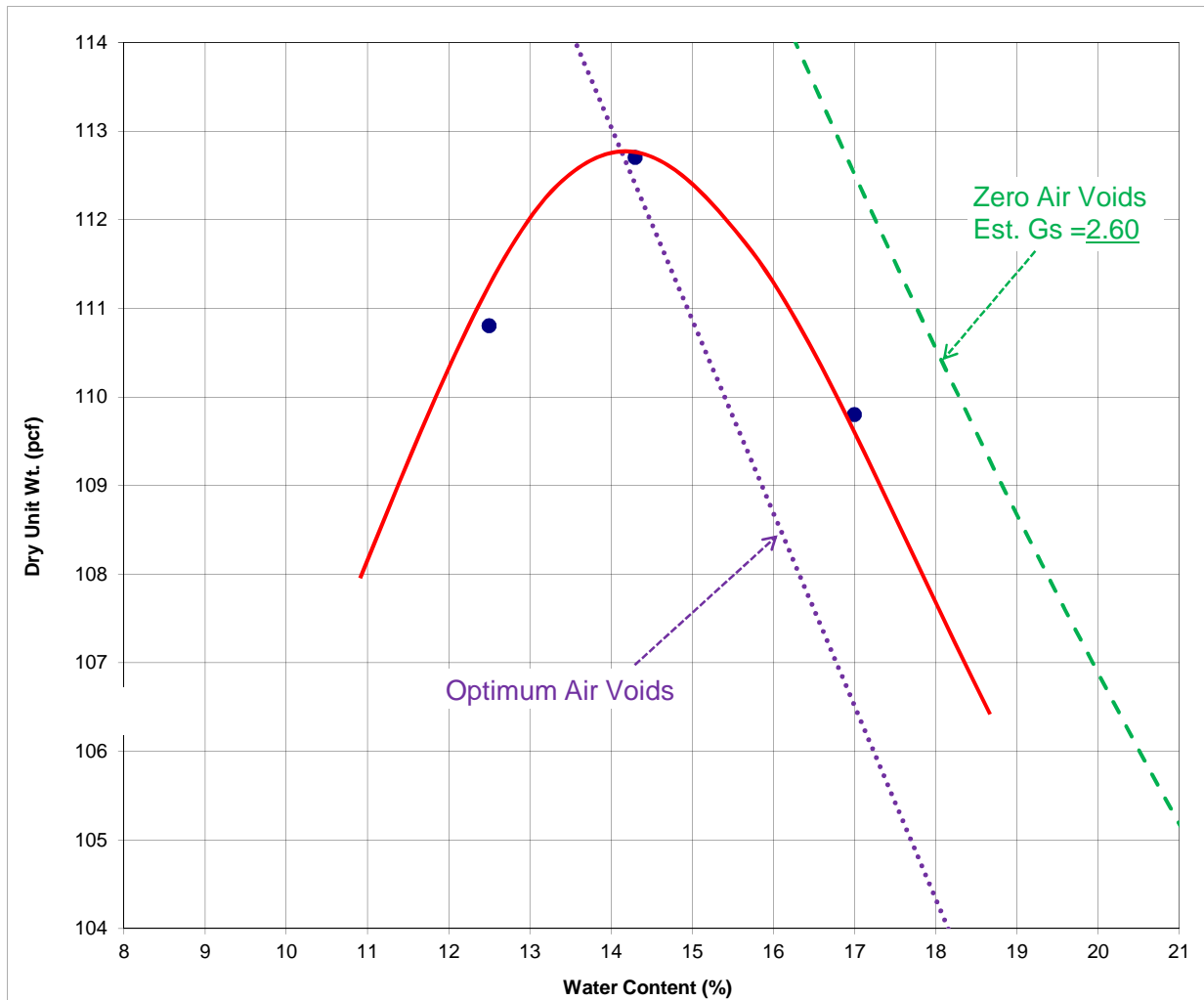
ATTERBERG LIMITS AASHTO T-89 & T-90
Liquid Limit: 32
Plastic Limit: 15
Plasticity Index: 17

USCS Classification:
CL

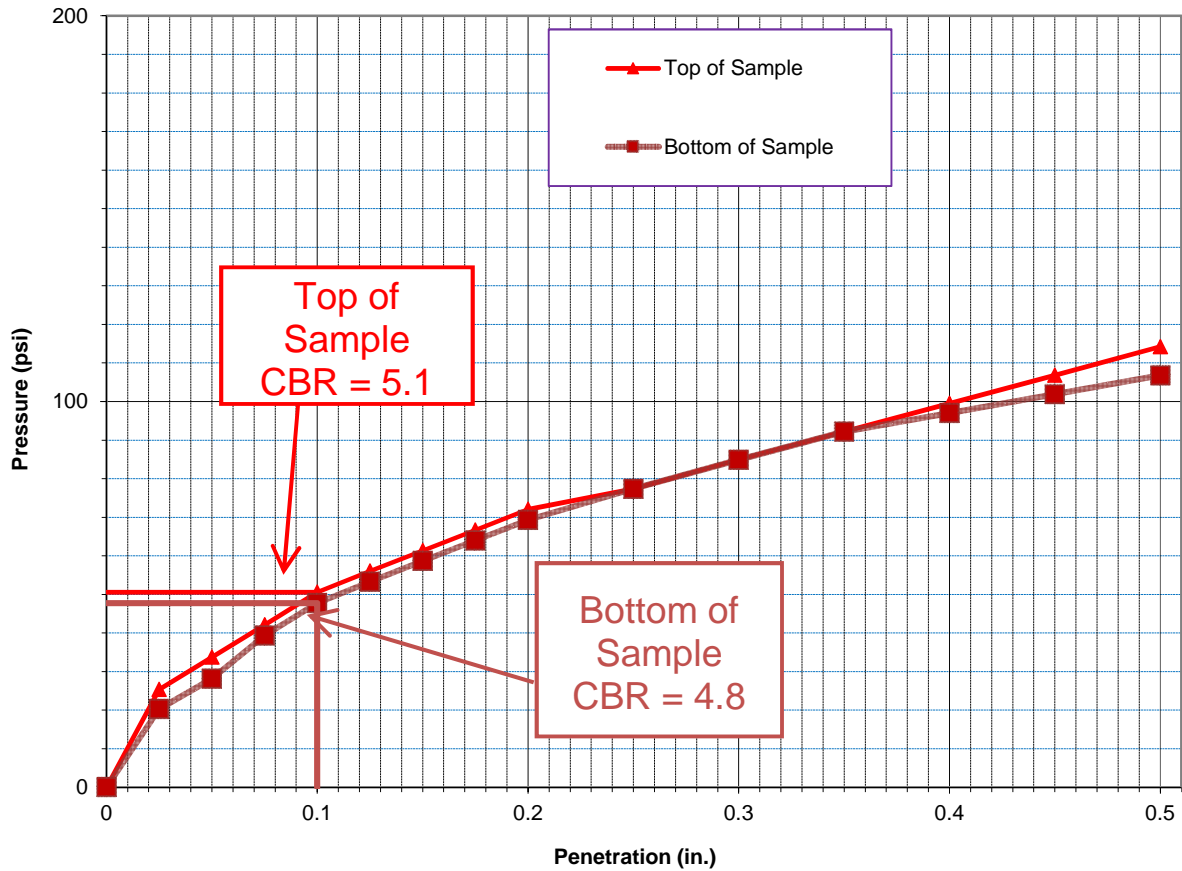
AASHTO Classification:
A-6

GRADATION AASHTO T-88	
Sieve Number	Percent Passing
3 in.	100
2 in.	98
3/4 in.	93
3/8 in.	90
#4	82
#10	71
#40	63
#200	60

As Received Water Content: 15.8 %



Laboratory CBR Test Report (AASHTO T-193)



Test Pit/Depth, ft.	Classification		Natural Moisture Content, %	Assumed Specific Gravity	Liquid Limit, %	Plastic Limit, %	% Passing No.4	% Passing No.200
	USCS	AASHTO						
1-2.5	CL	A-6	15.8	2.6	32	15	82	60
PROCTOR TEST RESULTS (AASHTO T-99 A)				MATERIAL DESCRIPTION				
Optimum Moisture Content = 14% Maximum Dry Density = 112.8 pcf				Reddish brown fine to coarse sandy clay CLAY w/ a little chert fragments				

SAMPLE 3/8A

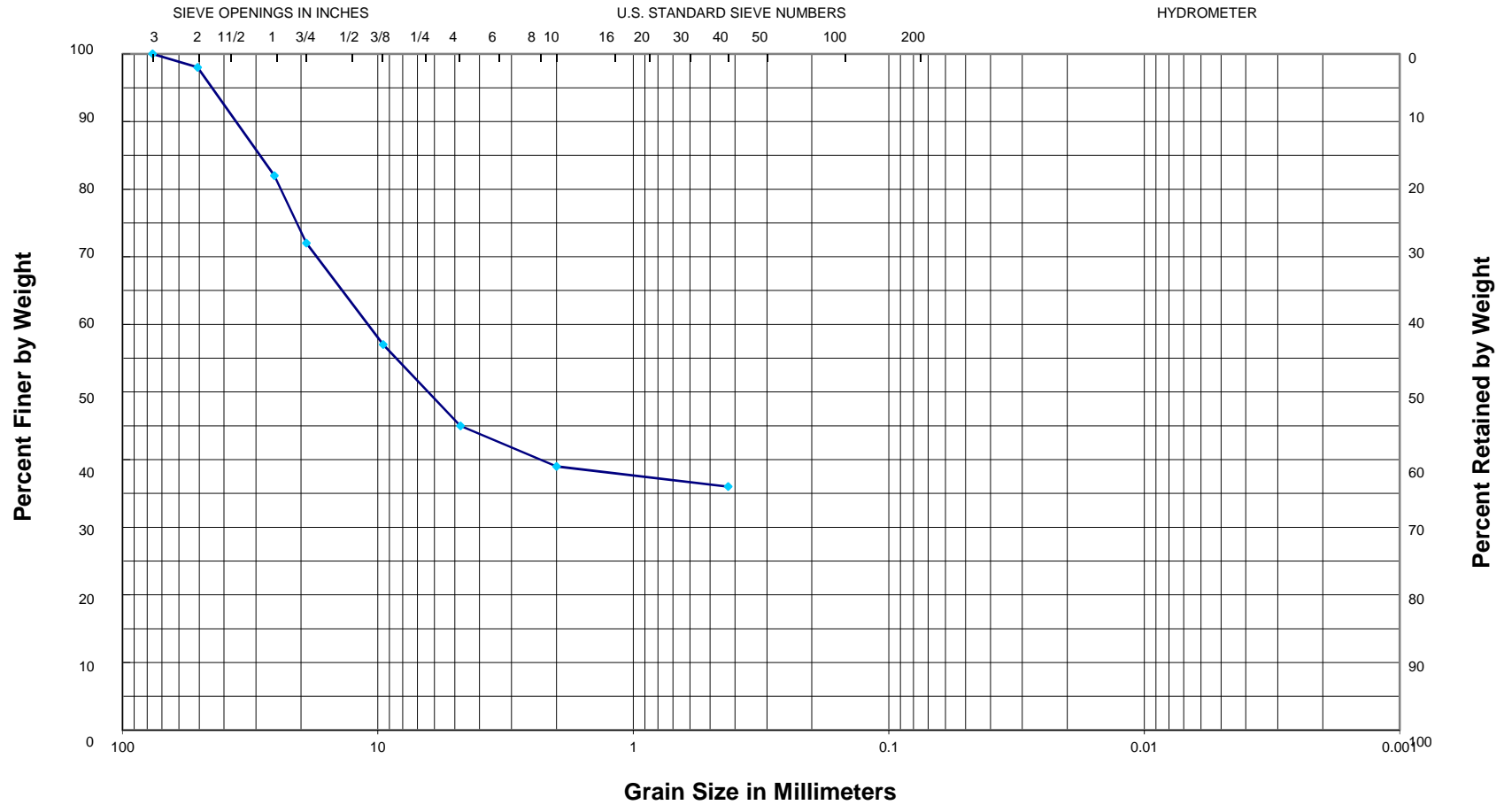


**Grubbs, Hoskyn,
Barton & Wyatt, INC.**
CONSULTING ENGINEERS

Project: 090472 Highway 340 Bridge Replacements
GHBW Project No.: 17-125
Location: Bella Vista, Arkansas
Sample Date: 3/8/2018
Test Date: 3/16/2018

17-125

GRAIN SIZE CURVE



GRAVEL		SAND			SILT	OR	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE			

Sample: Test Pit 3/8B, 1-2.5ft
 Atterberg Limits: LL = 27, PL = 19, PI = 8

Description: Grayish brown clayey fine to coarse GRAVEL, sandy
 Classification: USCS = GC; AASHTO = A-4

REPORT OF MODIFIED PROCTOR TEST (AASHTO T-180)

Project: ARDOT Job No. 090472 Highway 340 Bridge Replacements Job No: 17-125
 Material Description: Grayish brown clayey fine to coarse GRAVEL, sandy
 Location Sampled/Source: 3/8B
 Sample Depth, ft: 1-2.5
 Date Sampled: 3/8/2018
 Date Tested: 3/16/2018
 Tested By: MM

LAB COMPACTION PROCEDURE: AASHTO T-180 Method: D	
Maximum Unit Dry Wt. (pcf):	117.9
Optimum Water Content (%):	12.1

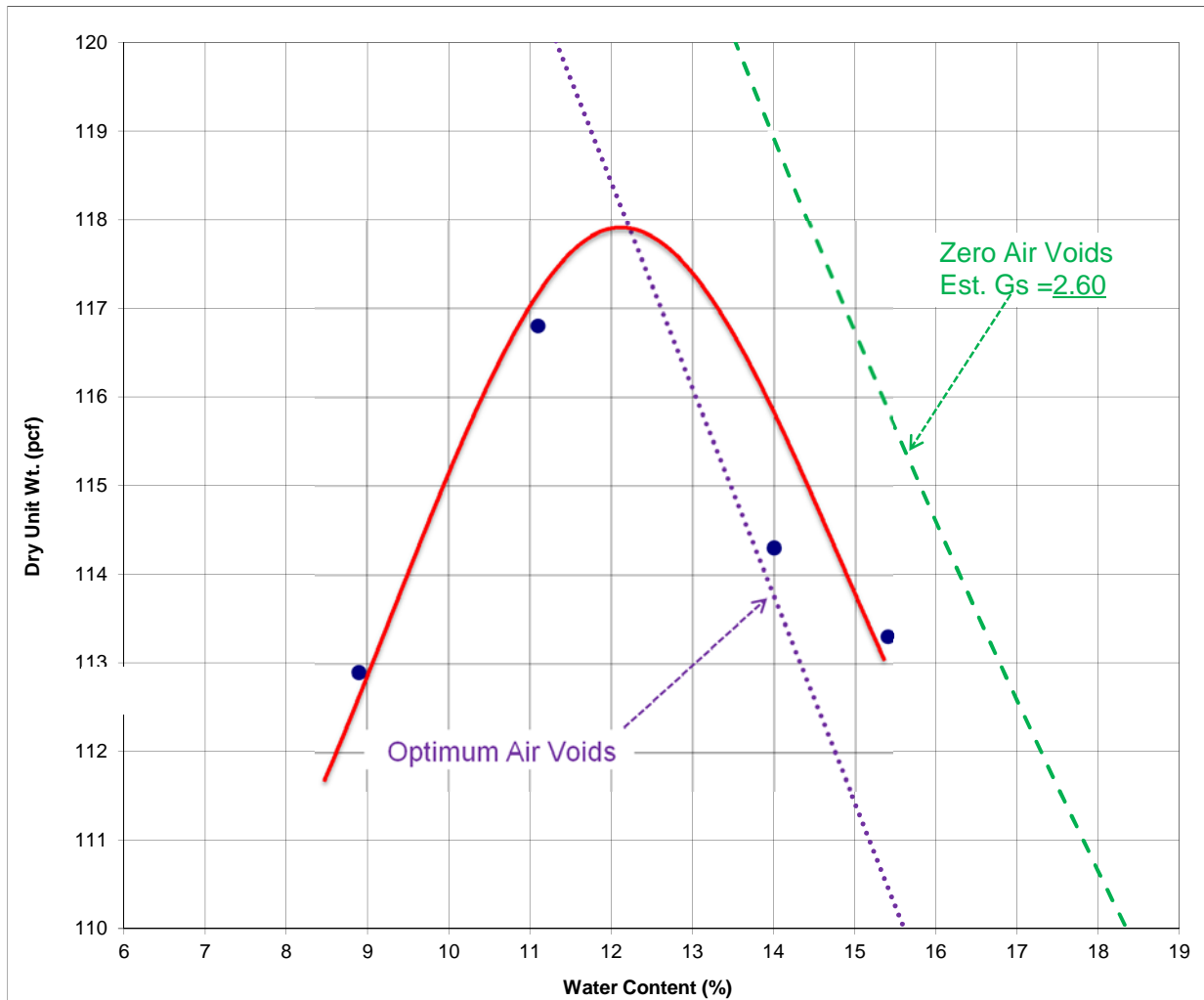
ATTEBERG LIMITS AASHTO T-89 & T-90
Liquid Limit: 27
Plastic Limit: 19
Plasticity Index: 8

USCS Classification:
GC

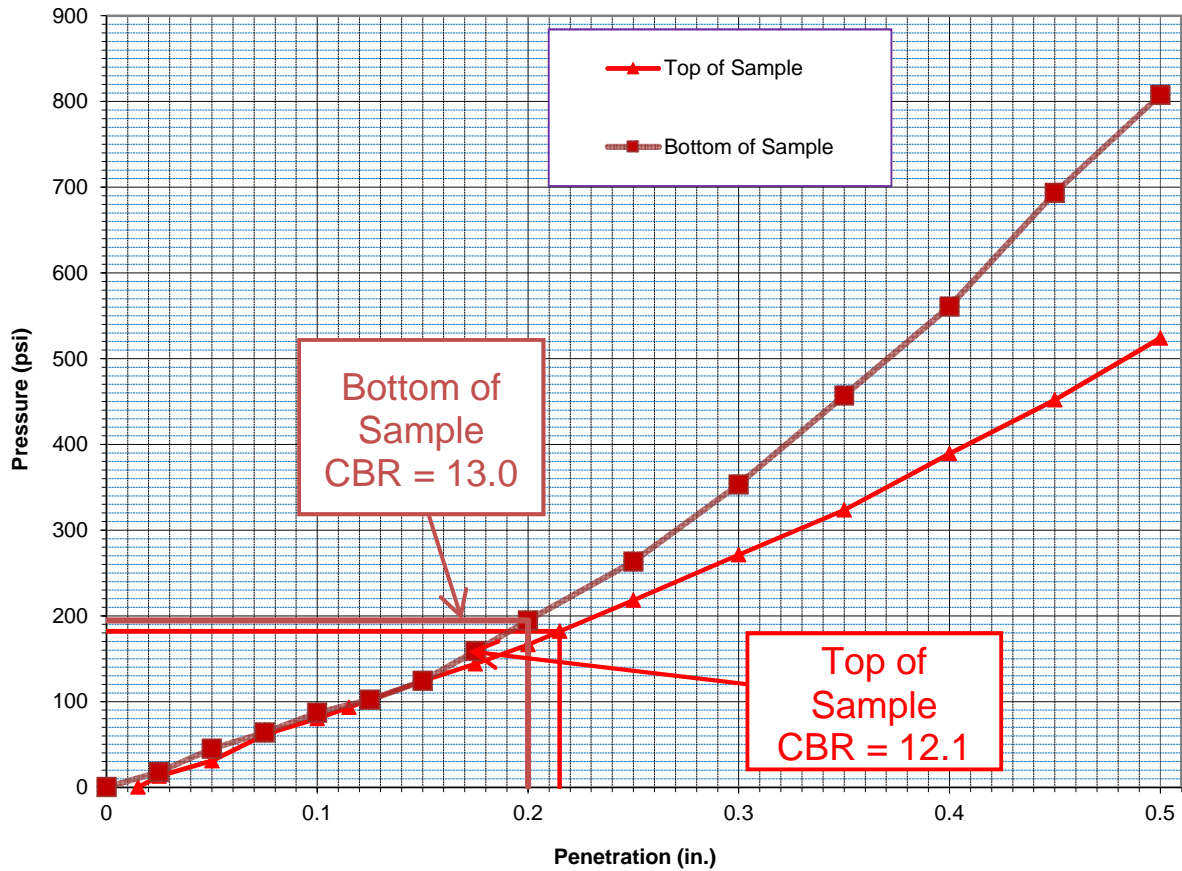
AASHTO Classification:
A-4

GRADATION AASHTO T-88	
Sieve Number	Percent Passing
3 in.	100
2 in.	98
3/4 in.	82
3/8 in.	72
#4	57
#10	45
#40	39
#200	36

As Recieved Water Content: 12.1 %



Laboratory CBR Test Report (AASHTO T-193)



Test Pit/Depth, ft.	Classification		Natural Moisture Content, %	Assumed Specific Gravity	Liquid Limit, %	Plastic Limit, %	% Passing No.4	% Passing No.200
	USCS	AASHTO						
1-2.5	GC	A-4	12.1	2.6	27	19	57	36
PROCTOR TEST RESULTS (AASHTO T-99 A)				MATERIAL DESCRIPTION				
Optimum Moisture Content = 12.1% Maximum Dry Density = 117.9 pcf				Grayish brown clayey fine to coarse GRAVEL, sandy				

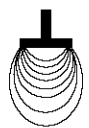
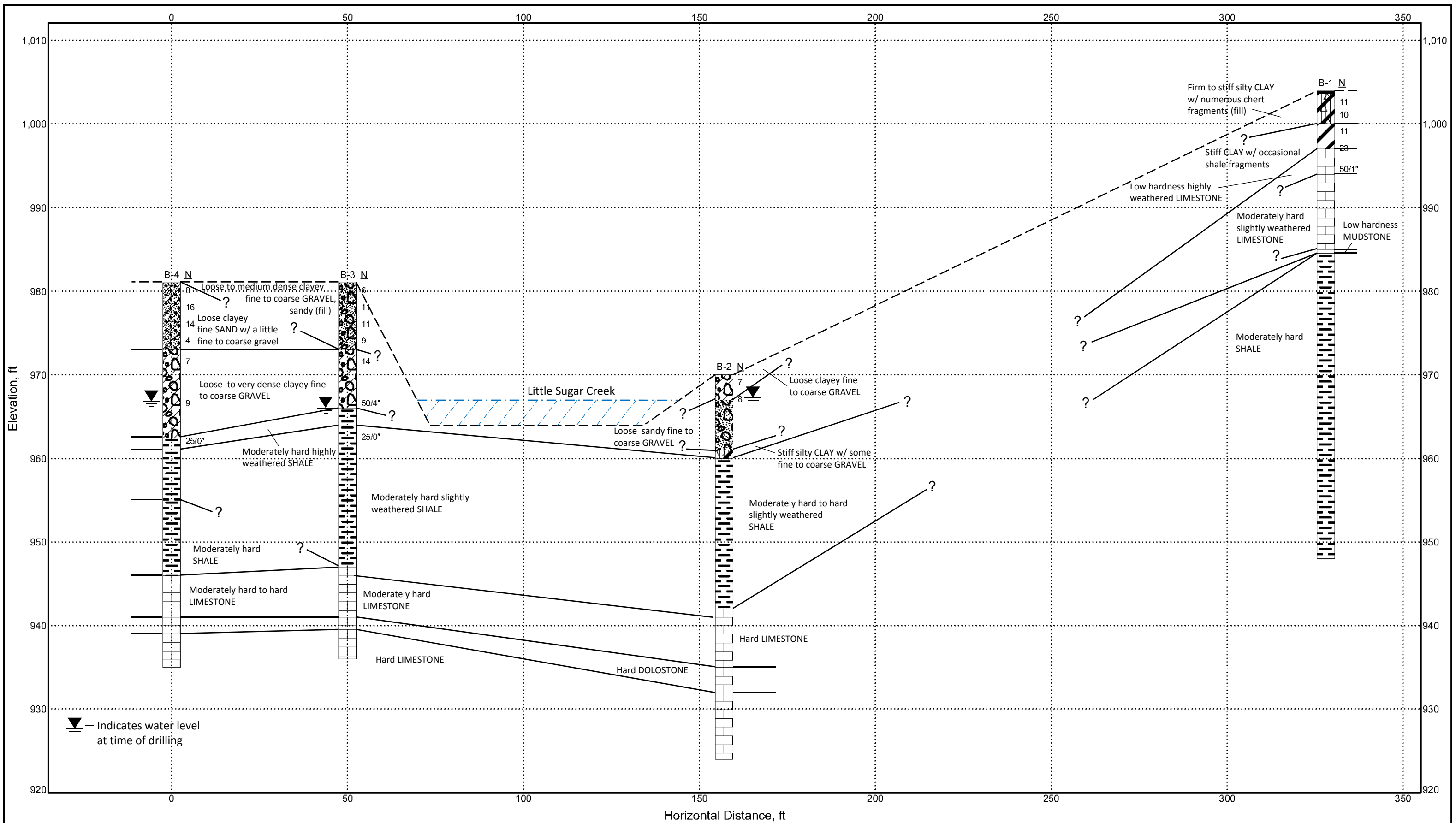
SAMPLE 3/8B



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

Project: 090472 Highway 340 Bridge Replacements
GHBW Project No.: 17-125
Location: Bella Vista, Arkansas
Sample Date: 3/8/2018
Test Date: 3/16/2018

APPENDIX E



**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
 ARDOT 090472 - Bridge 05155 over Little Sugar Creek
 Bella Vista, Arkansas
 Project Number: 17-125

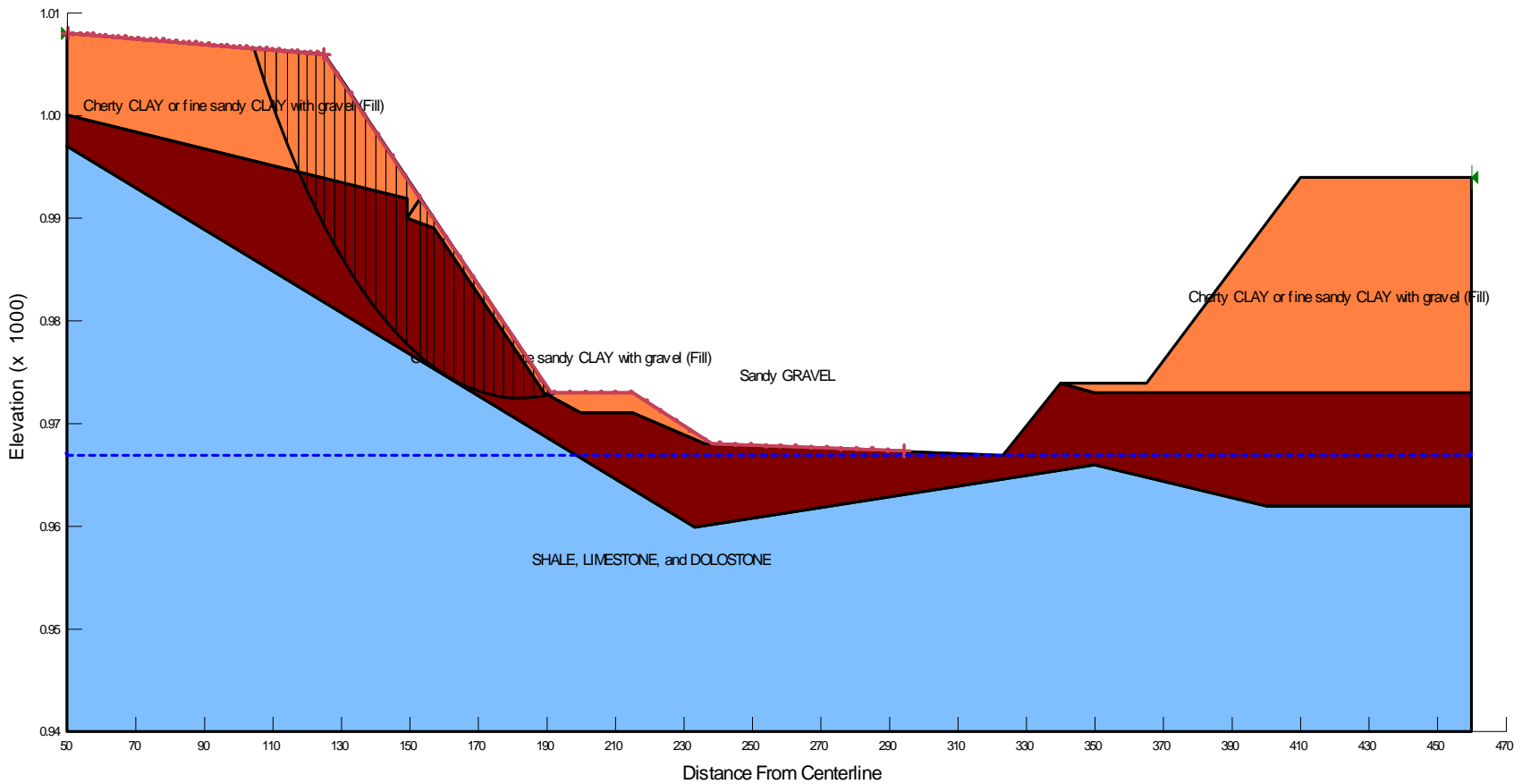
Plate

APPENDIX F

Summary of Stability Analysis Results
Bridge 05155 over Little Sugar Creek
AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

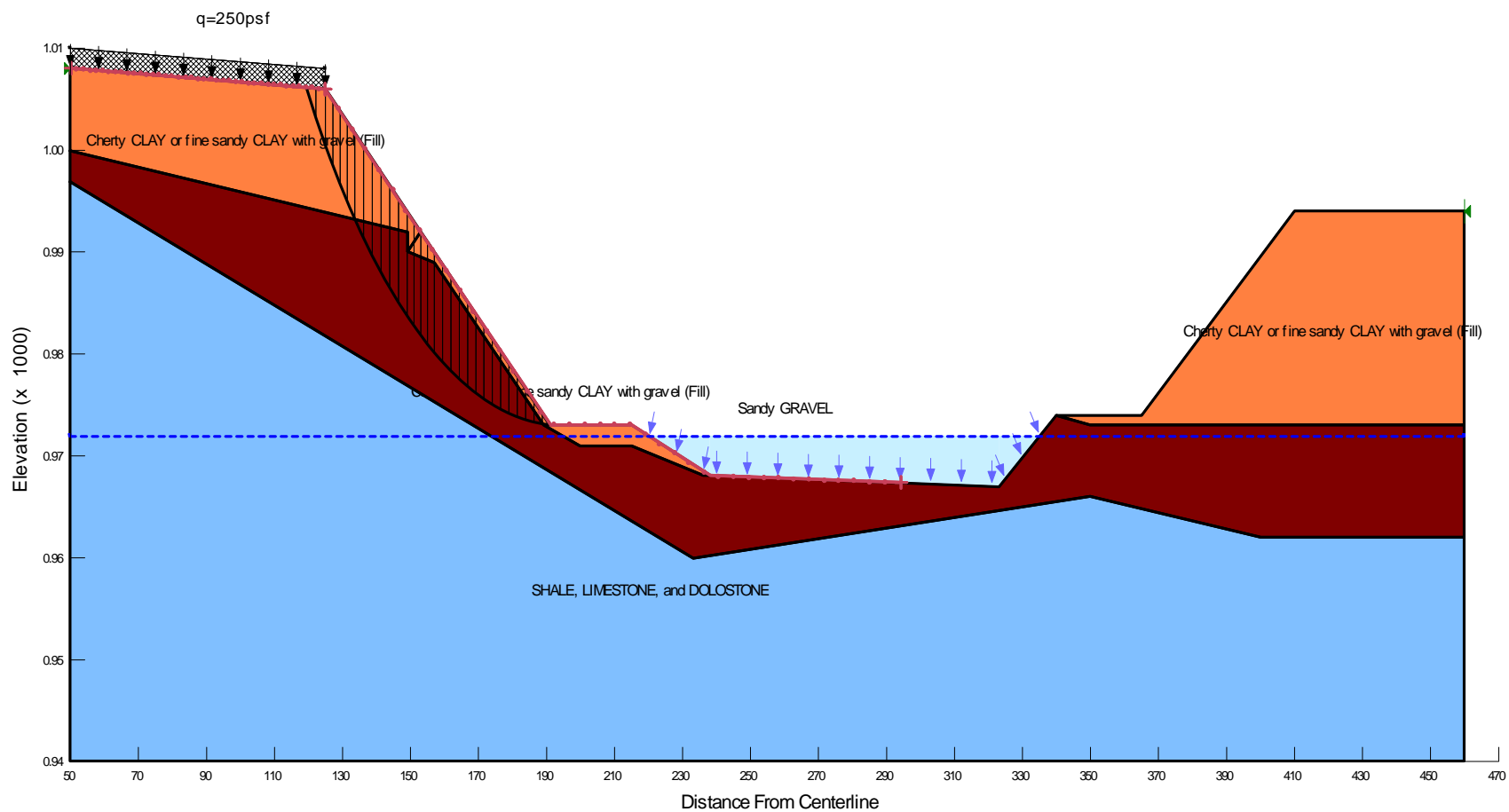
Bridge End	Design Loading Condition	Calculated Minimum Factor of Safety
East End Slope (Bent 4) (2H:1V)	End of Construction	2.2
	Long Term	1.5
	Rapid Drawdown from El 982 to El 972	1.2
	Seismic ($k_h = A_s/2 = 0.028$)	1.5
East Side Slope (Bent 4) (2H:1V)	End of Construction	4.0
	Long Term	4.0
	Rapid Drawdown from El 982 to El 972	3.8
	Seismic ($k_h = A_s/2 = 0.028$)	3.8
West End Slope (Bent 1) (2H:1V)	End of Construction	3.0
	Long Term	2.5
	Rapid Drawdown from El 982 to El 972	2.4
	Seismic ($k_h = A_s/2 = 0.028$)	2.5
West End Side Slope (Bent 1) (2H:1V)	End of Construction	2.4
	Long Term	2.3
	Rapid Drawdown from El 982 to El 972	2.1
	Seismic ($k_h = A_s/2 = 0.028$)	2.3

2.2



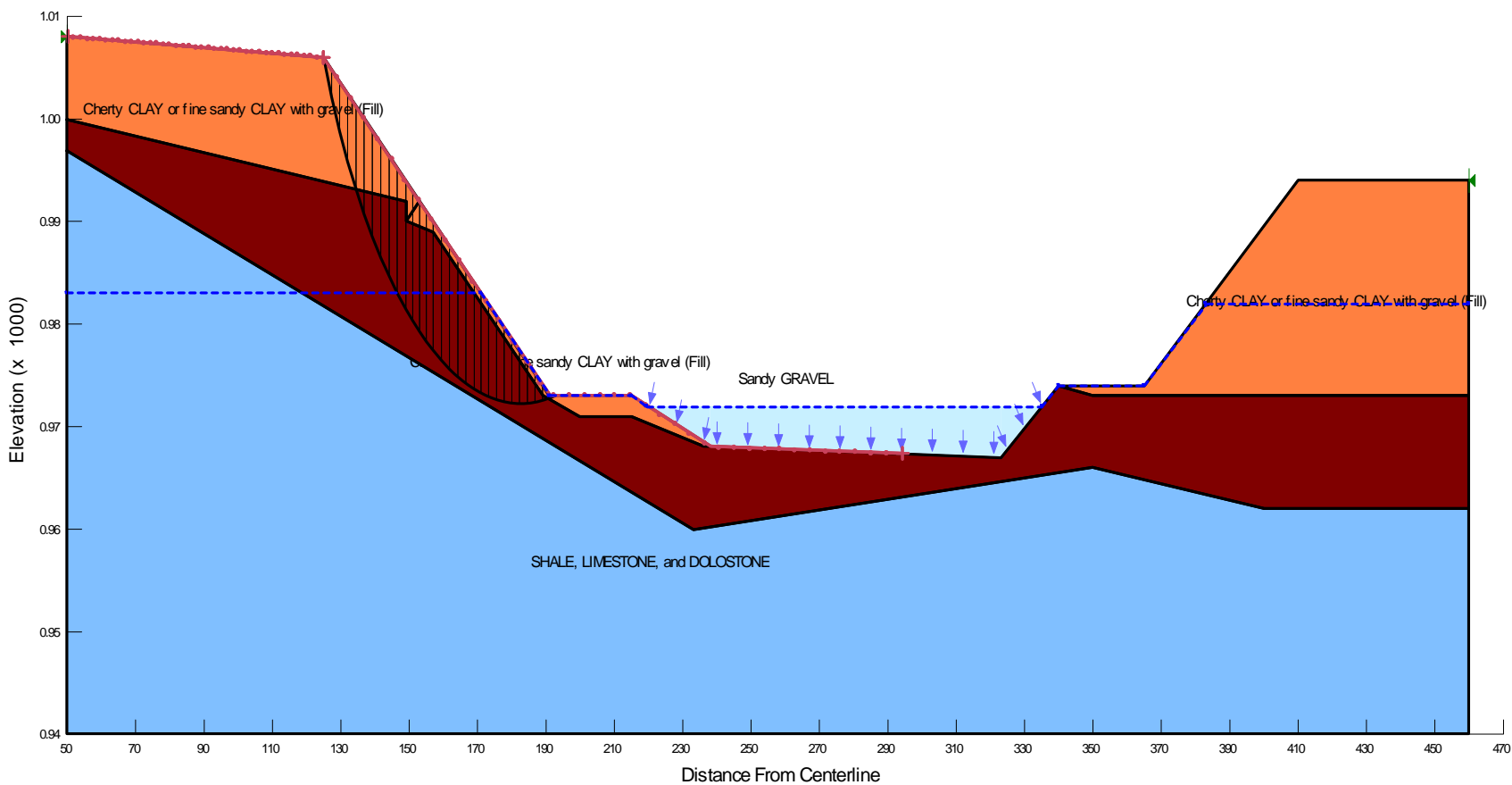
Results of Stability Analyses – End of Construction
East End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

1.5



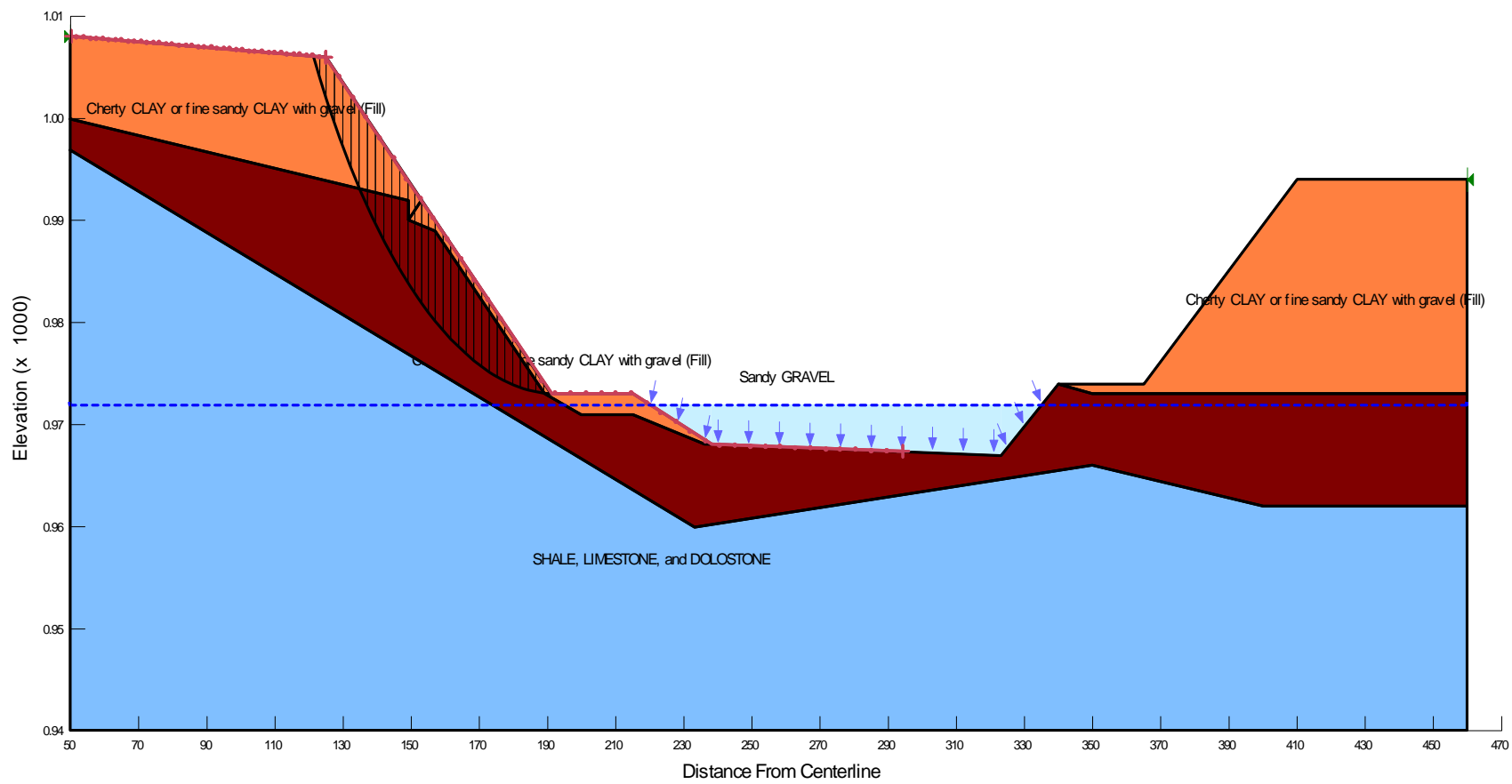
Results of Stability Analyses – Long Term Condition
East End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

1.2

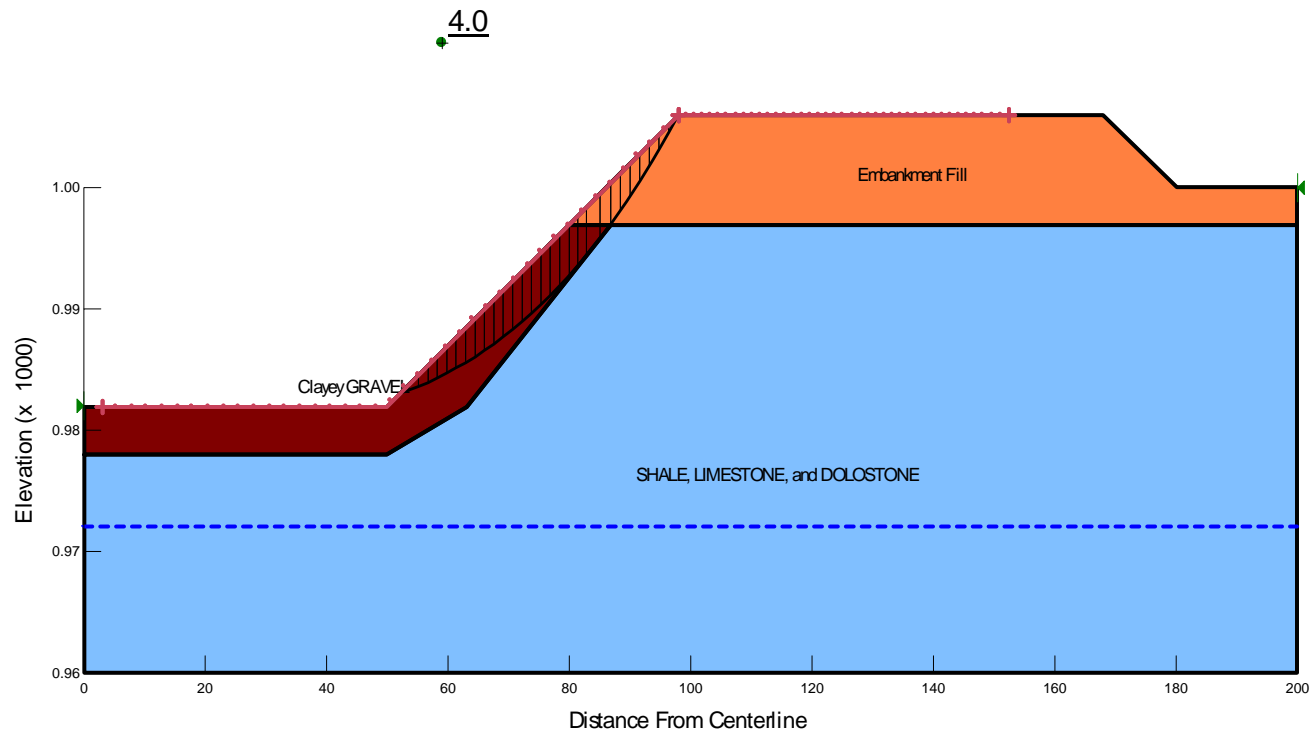


Results of Stability Analyses – Rapid Drawdown Condition, EI 982 to EI 972
East End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

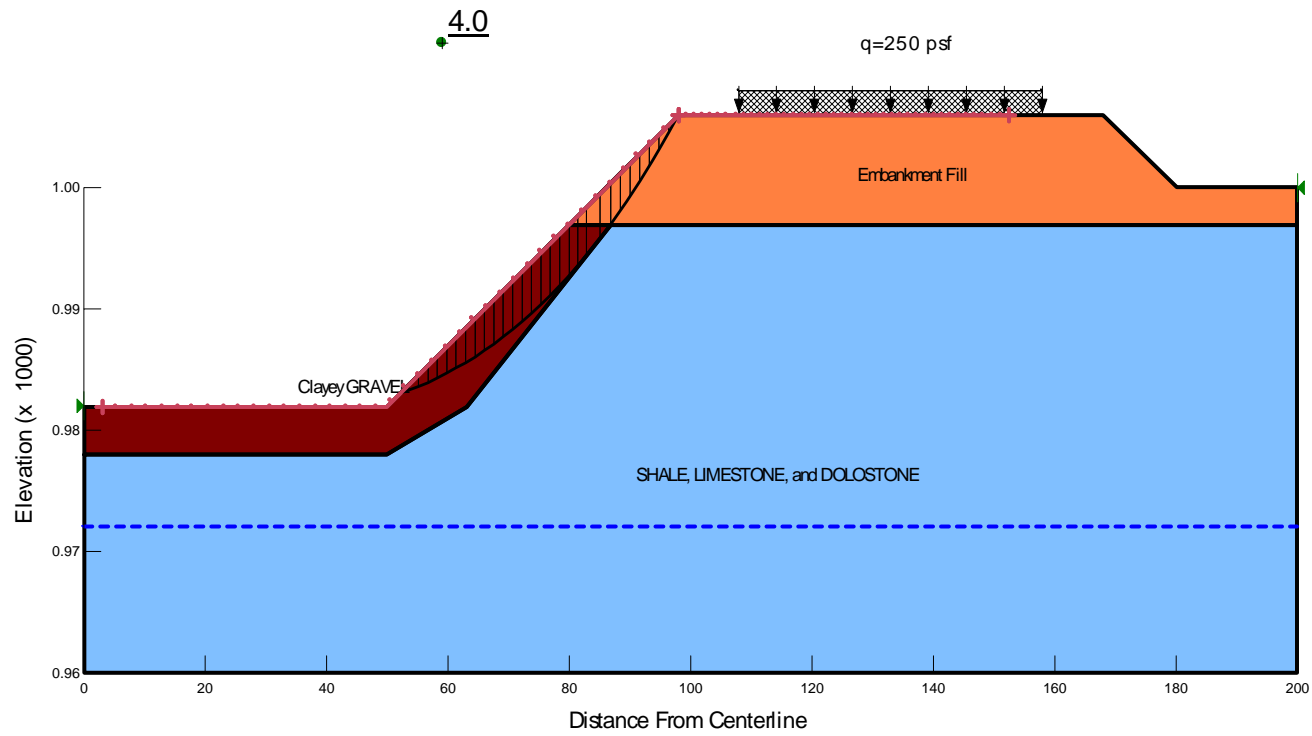
1.5



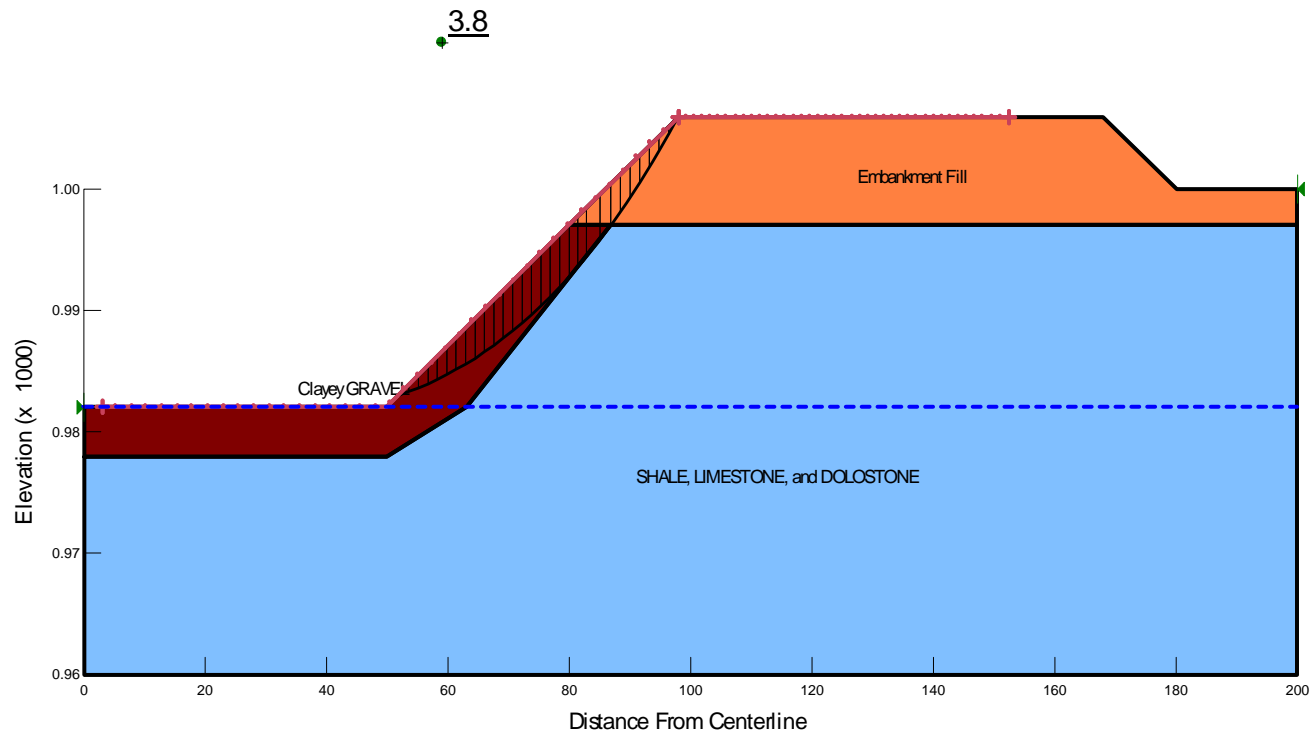
Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
East End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



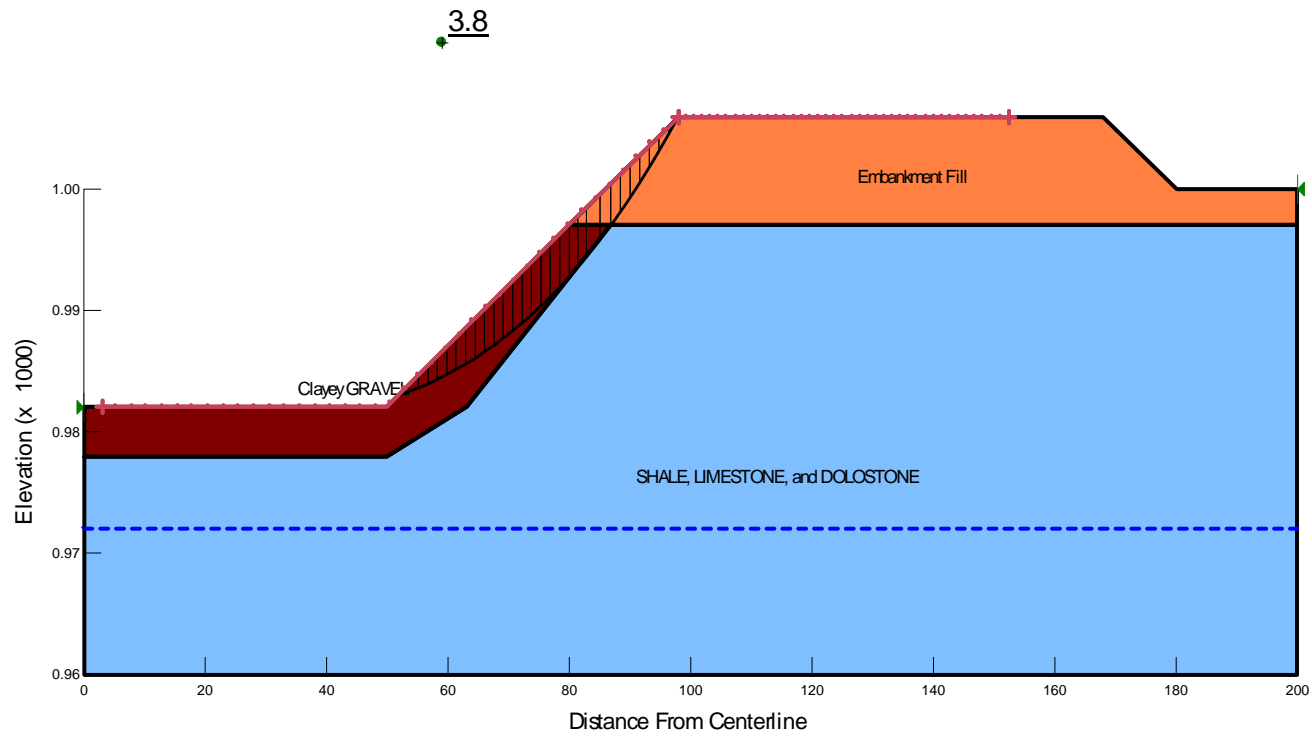
Results of Stability Analyses – End of Construction
 East End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas



Results of Stability Analyses – Long Term Condition
 East End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas

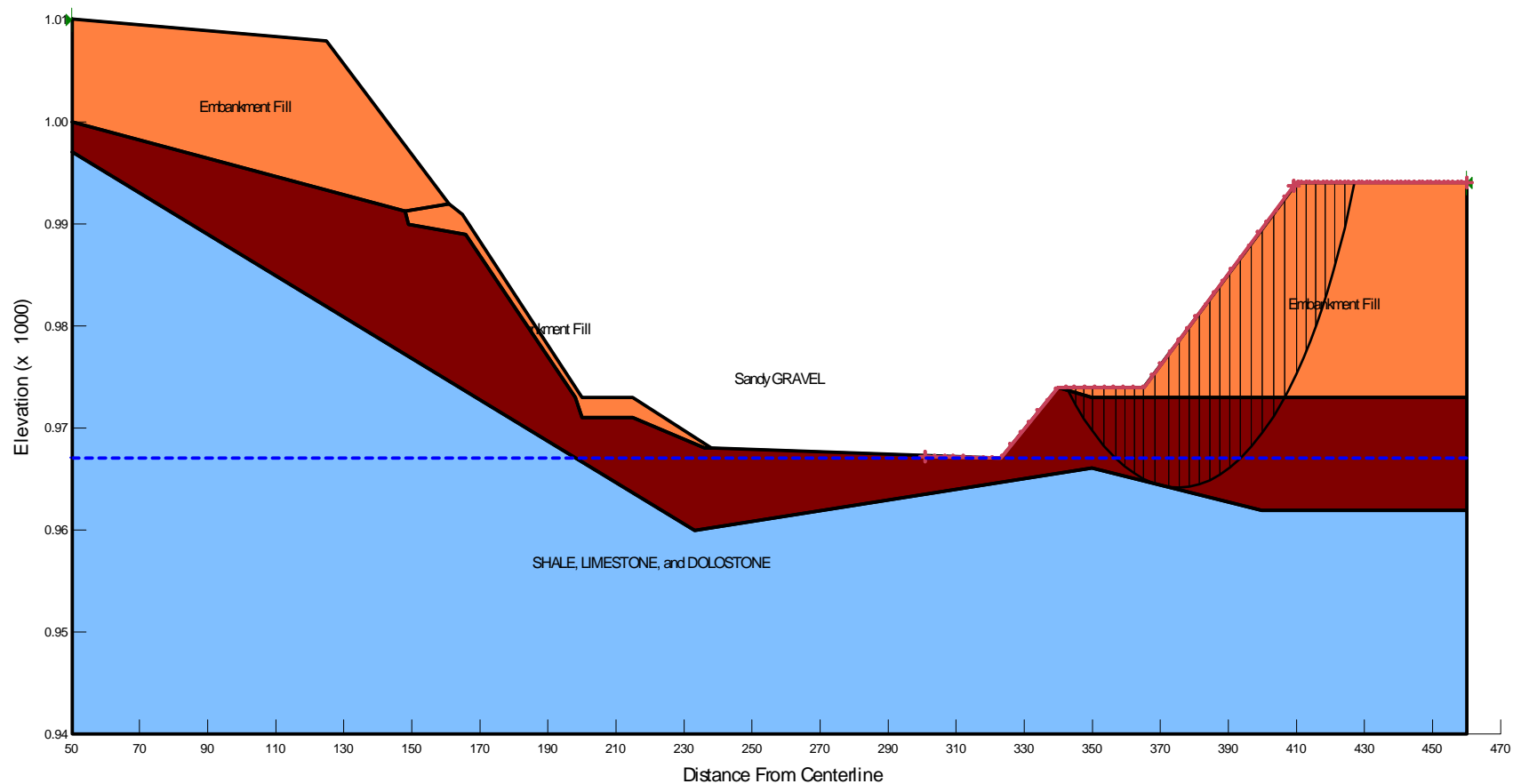


Results of Stability Analyses – Rapid Drawdown Condition, EI 982
 East End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas



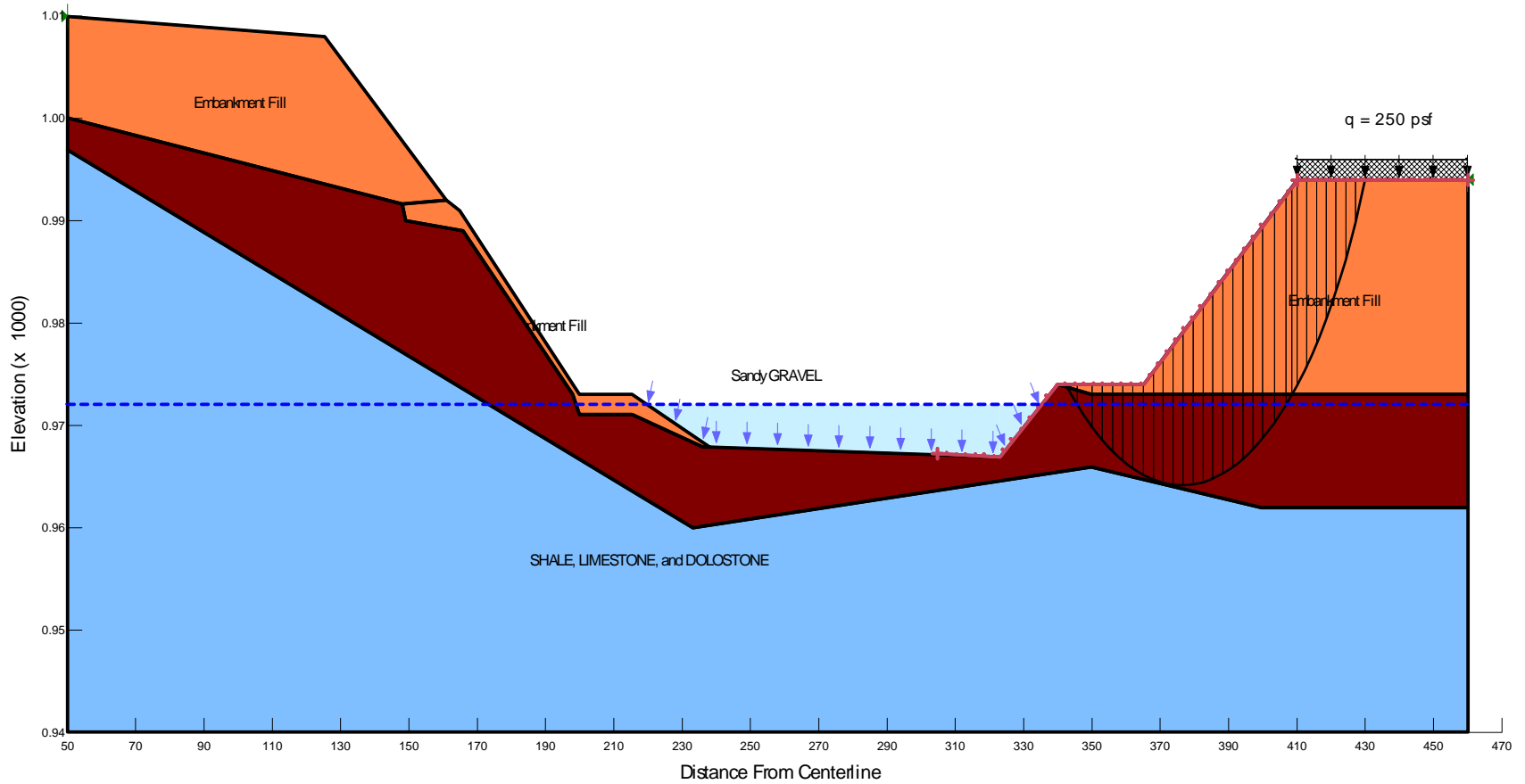
Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
 East End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas

3.0

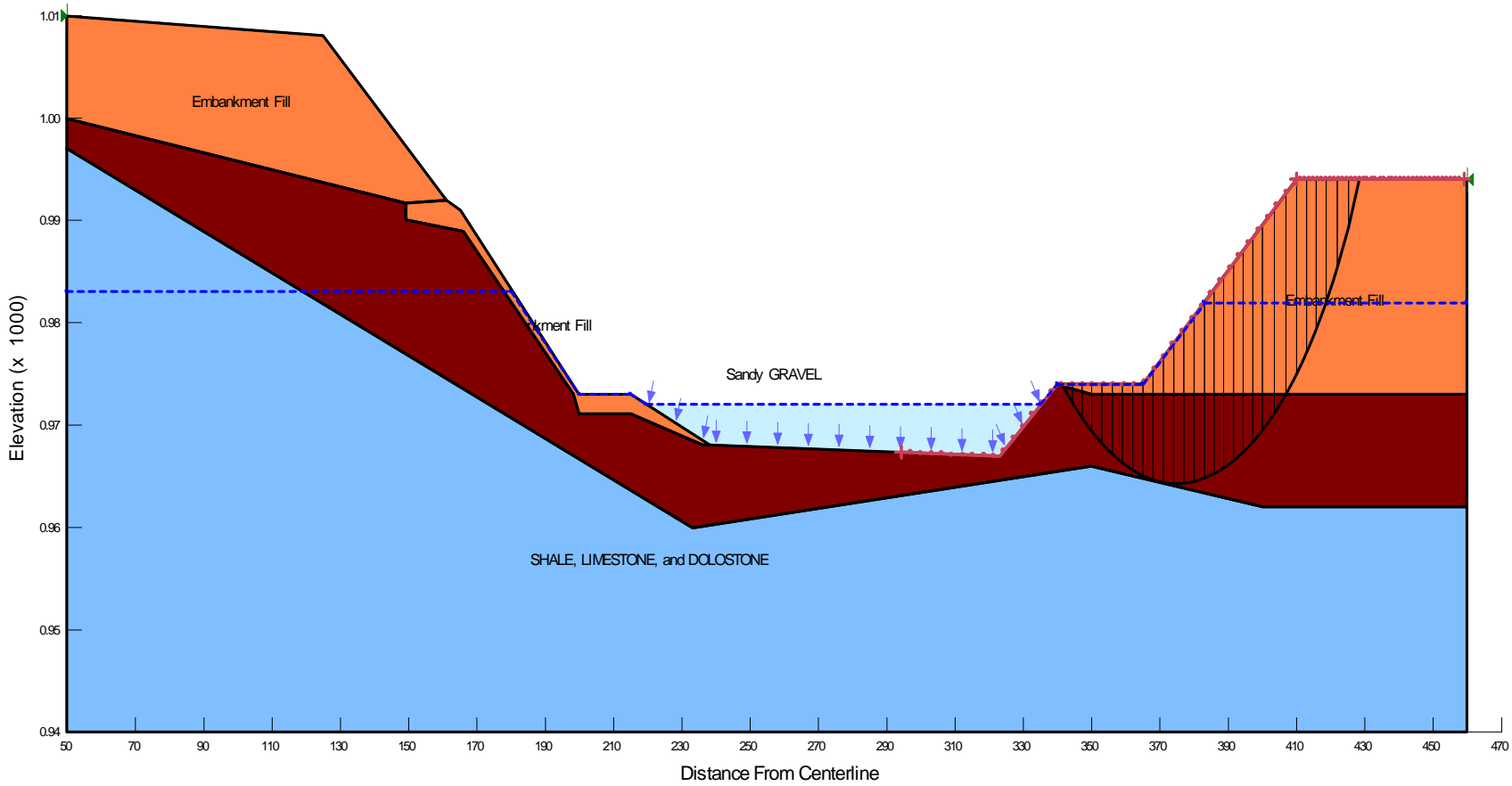


Results of Stability Analyses – End of Construction
West End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas

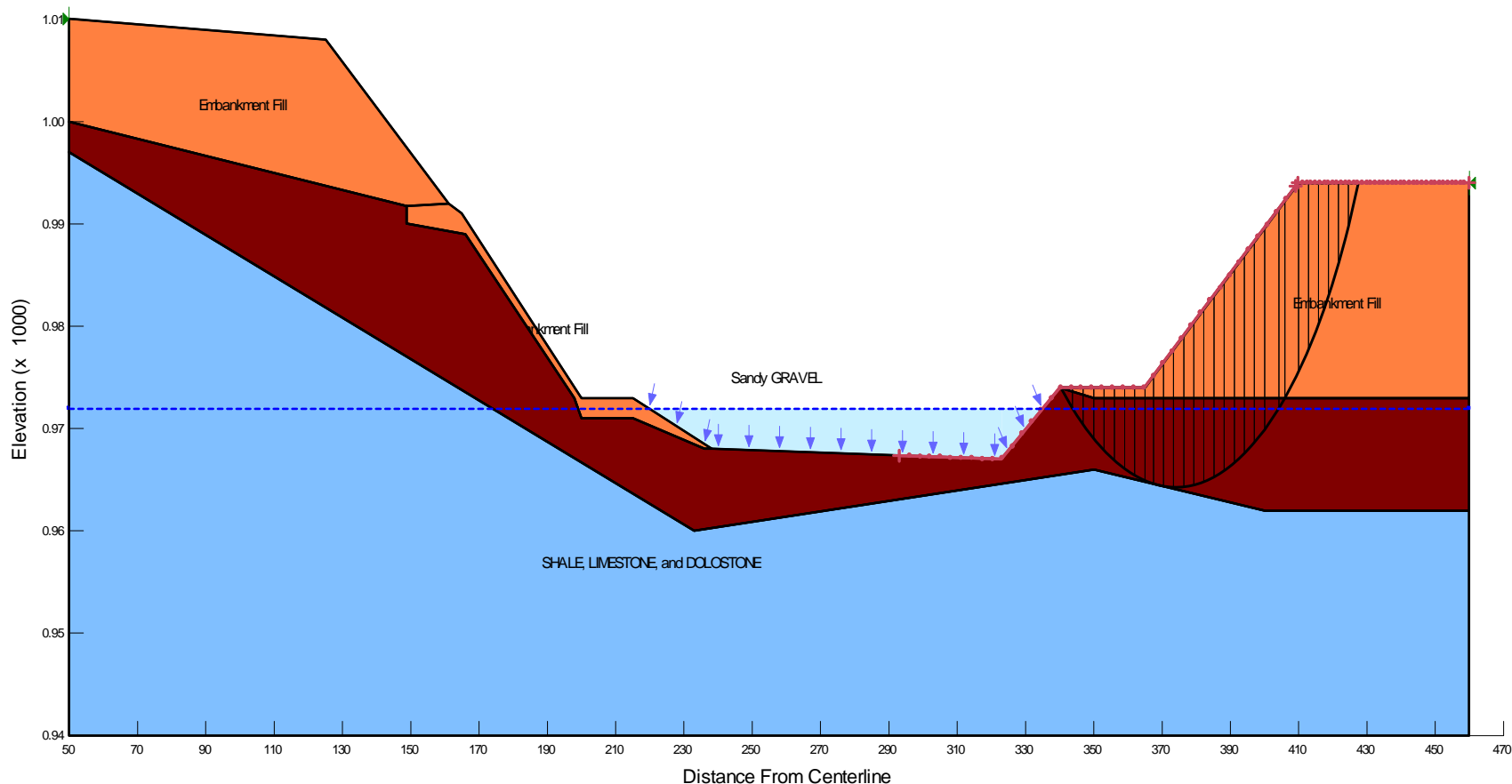
2.5



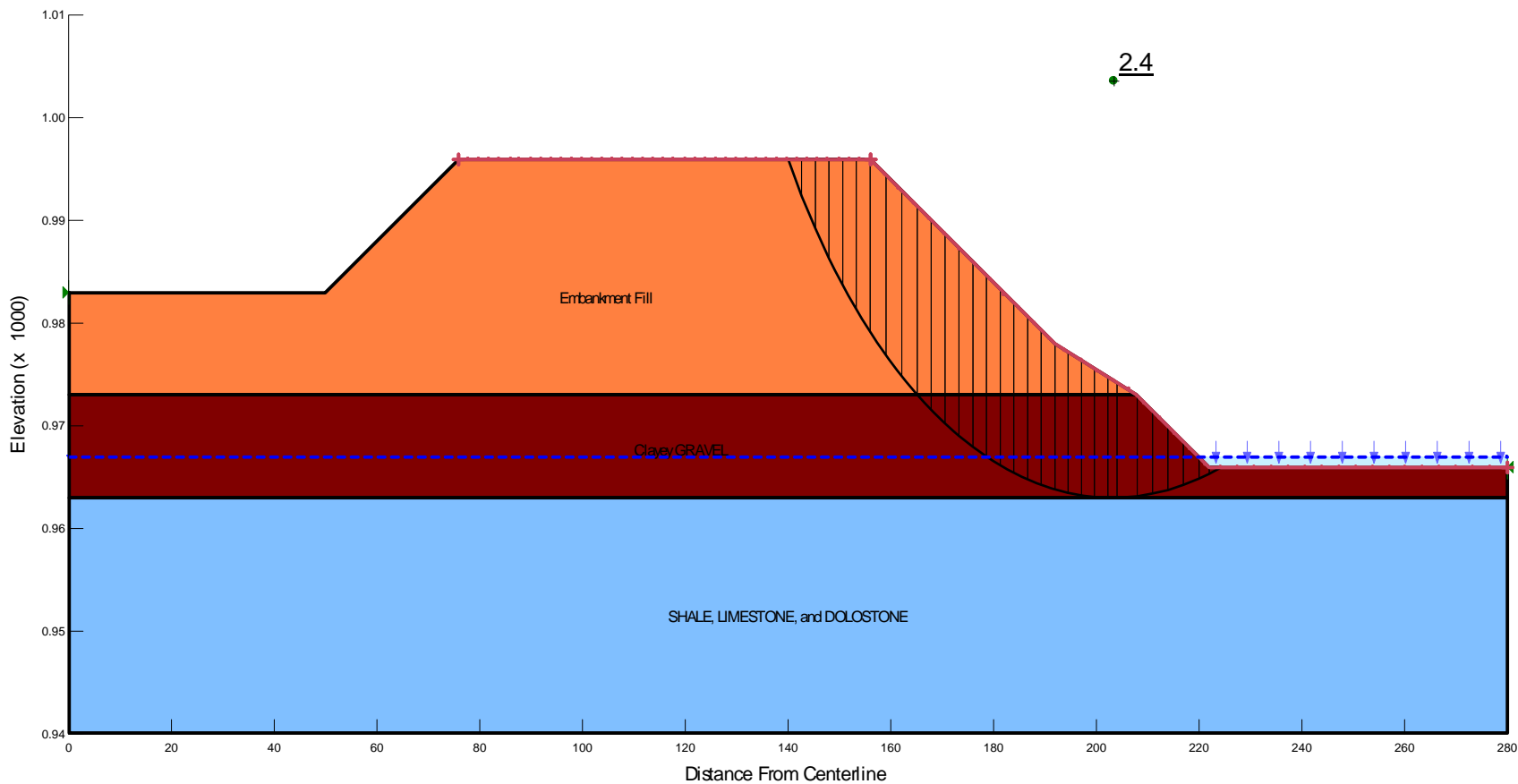
Results of Stability Analyses – Long Term Condition
West End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



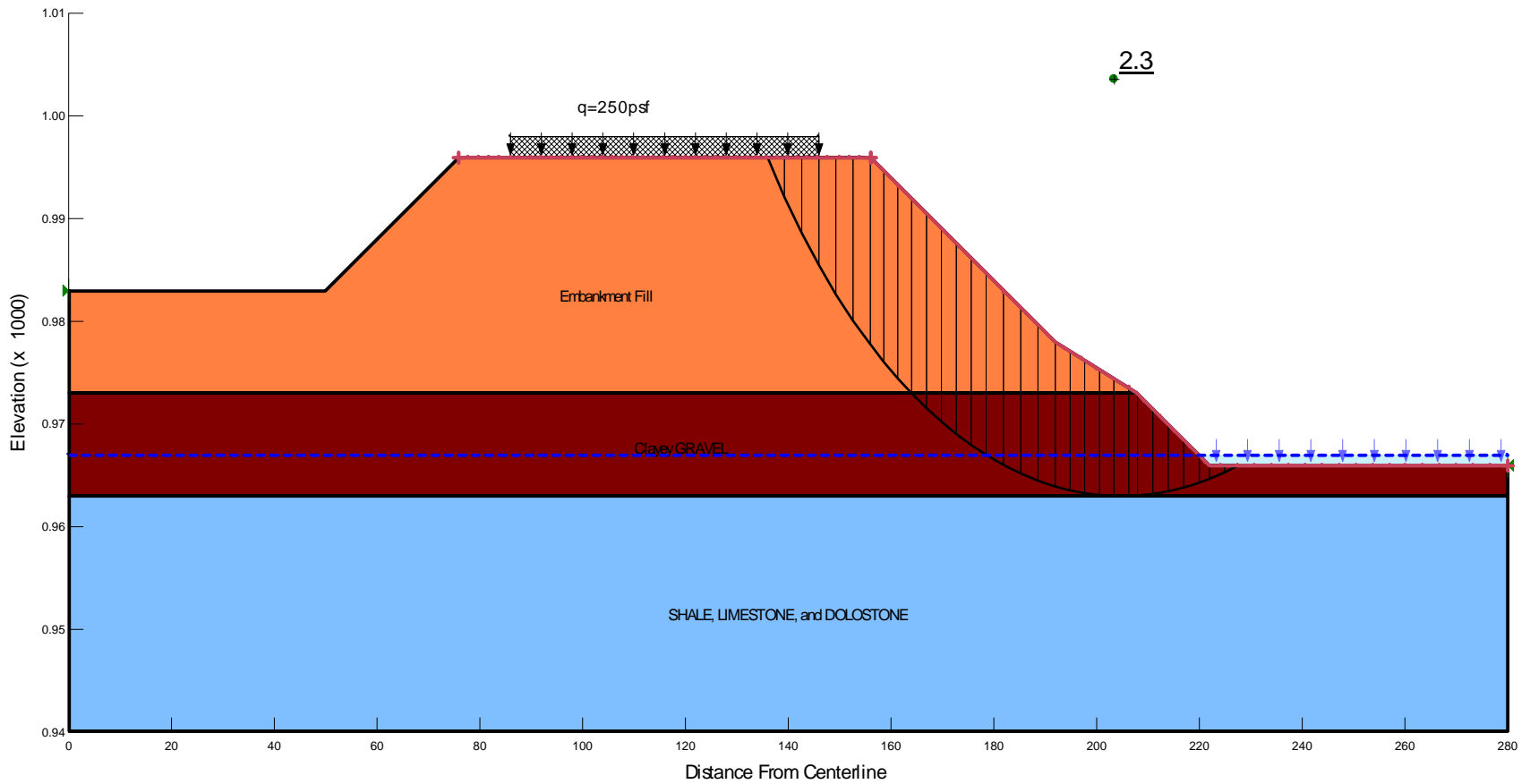
Results of Stability Analyses – Rapid Drawdown Condition, EI 982 to EI 972
West End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



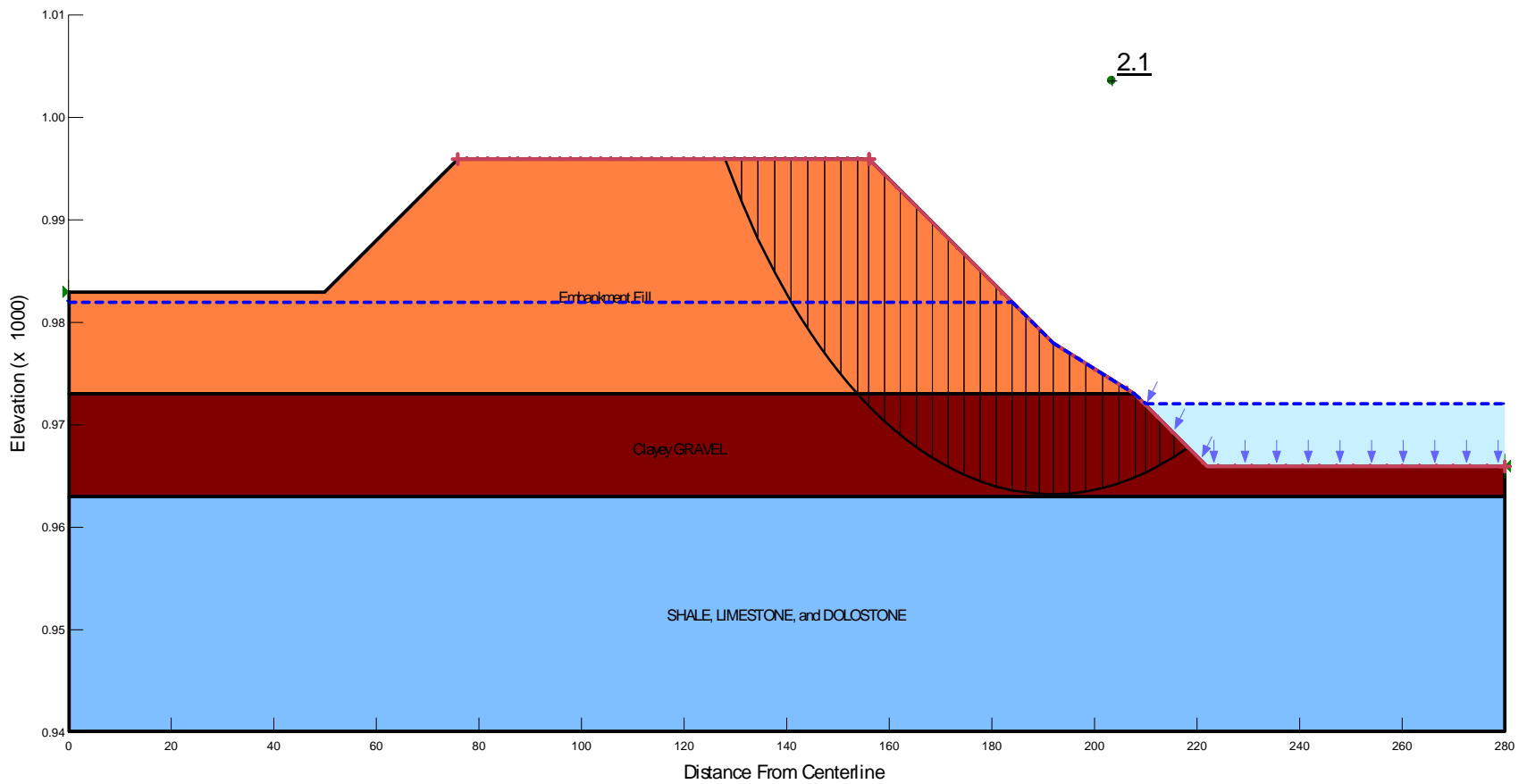
Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
West End Slope
Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
GHBW Job No. 17-125
Bella Vista, Arkansas



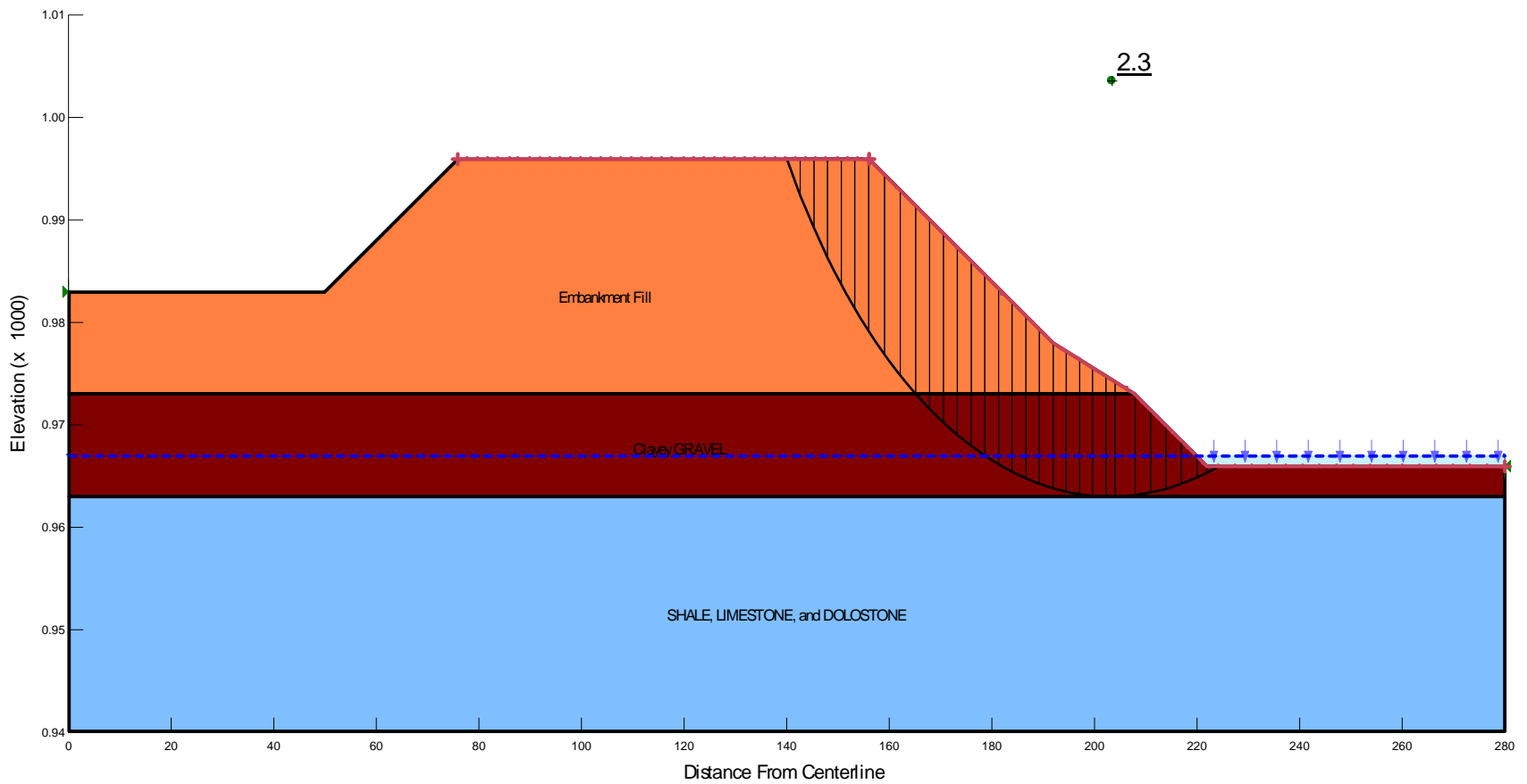
Results of Stability Analyses – End of Construction
 West End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas



Results of Stability Analyses – Long Term Condition
 West End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas



Results of Stability Analyses – Rapid Drawdown Condition, EI 982 to EI 972
 West End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas



Results of Stability Analyses – Seismic Condition ($k_h = A_S / 2 = 0.028$)
 West End Side Slope
 Bridge 05155 over Little Sugar Creek - AHTD Job No. 090472
 GHBW Job No. 17-125
 Bella Vista, Arkansas