Structure Geotechnical Report

SN 013-0042 (Existing SN-013-0005)

> U.S. Route 50 F.A.P. Route 327 Section (7-2B) B Clay Count

D-97 002-03 Contract No. 94777

Approved by: Riyad Wahab

Prepared by: Paul Guthrie

IDOT BBS

Central Geotechnical Unit

217-524-468

Date: August 15, 2007

Prepared for: BBS Planning & Design Units

Attachments: Preliminary General Plans

Location Map Subsurface profile Boring Logs

Project Description and Proposed Structure Information

The existing structure number is 013-0005. The existing structure was built in 1952 as F.A.P.-13, Section 7,2BF, 7-2B-I-1 at station 1291+65.75 as a 9 span wide flange beam structure 490 ft back-to-back of abutments. Substructure supported on untreated timber piles. Bridge rail replacement in 1985 with 2 inch bituminous overlay.

The existing bridge is to be removed and replaced. The proposed structure will be 510 ft and 7 inches back-to-back of abutments with the centerline it station 129+82.50. Traffic is to be maintained utilizing staged construction. The superstructure and the substructures will be designed according to the 2004 LRFD AASHTO with 2005/2006 Interims design specifications.

The proposed structure number is 013-0042. According to the General Plans, the structure is to be a 5 span structure with integral abutments. The structure is to be 510'-7" Bk. to Bk. of Abut. Traffic will be maintained unizing staged construction. The factored loadings per substructure, provided by the Planning Unit, are as follows:

Abutments	884 kips
Pier 1	2232 kips
Piers 2 & 3	2632 kips
Pier 4	2820 kips

Subsurface Exploration

A total of four brings were drilled between July 27, 2006 and August 22, 2006 by the District 7 drill crew. The locations of the borings relative to the proposed structure are shown on the attached boring log plot. The groundwater elevations observed at each boring are as follows:

Boring 1 after 24 hours at 405.0 ft Boring 2 at 399.8 ft at first encounter Boring 3 at 419.3 ft after 168 hours Boring 4 at 418.0 ft after 24 hours

Borings 1, 2, and 3 indicate the presence of loose sand with blow counts as low as 0. The three borings are relatively consistent in the elevations of these very loose sands. The loose sands range from approximately 394 ft. to 389 ft.

Rock cores were taken at borings 1, 2 and 3. While no rock cores were taken at Boring 4, the boring indicates the top of sandy clay shale at elevation 348.25 ft. The results of the rock core testing are shown in the table below.

Table 1. Rock Core Results

Boring	Rock Description	Start Elevation	End Elevation	Qu Range	RQD
	Description	(ft)	(ft)	(tsf)	(%)
1	Sandstone	334.91	329.91	418	45
2	Sandy clay shale	337.05	327.05	169-256	9-82
3	Sandy clay shale &	000.00	040.00	0,,	60.75
	sandstone	328.96	318.96	6-258	60-75

Geotechnical Evaluation

Settlement

Our settlement analyses indicate settlement is so a concern at any of the substructures since no change in grade is proposed.

Slope stability

Based on our analyses, the FOS against slope failure is adequate at both abutments. Based on the Geotechnical Manual page 3-33, Figure 3.4, a horizontal bedrock acceleration of 0.09g was used in the seismic analysis of the end slopes.

Seismic Considerations

Seismic Data

The Seismic Performance Zone is zone = 1
Bedrock Acceleration Coefficient = 0.09g
Site Coefficient = 1.5

Liquefaction

Since the Seismic Performance Zone is 1 for this structure, no liquefaction analyses were performed.

Scour

Based on discussions with the Hydraulics Unit, it was decided that the design scour depths for piers 1, 2, 3 and 4, should be 8 ft, 8 ft, 15.7 ft, and 15.7 ft, respectively.

Therefore, assuming a ground elevation of 415.0 ft for piers 1, 2 & 3 and a ground elevation of 410.0 ft for pier 4, we recommend the scour elevations in the Design Scour Table below be used on the Plans. In this table, the design scour elevation for both abutments is assumed to be the elevation of the bottom of the cap.

Table 2. Design Scour Table

Design Scour	West	Pier 1	Pier 2	Pier 3	Pier 4	East
Elevation	Abut.					Abut.
r - 1	400-75	407.0	407-0	200-2	2042	-420-75-
feet	420.75	407.0	407. 0	3 99 .3	394.3	420.75

Mining Activities

According to the Illinois State Geological Survey, no mining activity has taken place at the project site in the past.

Foundation Evaluations and Design Recommendations

Spread Footings

Spread footings are not feasible at any of the substructures. The low soll strengths would not provide the necessary bearing capacities needed to carry the design loads for this structure.

Piles

Driven H-piles appear to be the most viable option for all substructures. However, proposed piles at both abutments should be spaced appropriately to ensure there is no conflict with the existing battered piles at the west abutment. Since settlement is not a concern at any of the substructures, there are a gootechnical losses from down drag at any of the substructures. We recommend test offes at the west abutment and piers 1 & 4 to allow for possible variation in bedrock slevations. Also, metal shoes will not be necessary. The following tables give the pile type & size, nominal required bearing, factored resistance available, and estimated pile length. The estimated depth to bedrock varies from 75 ft to 95 ft across the pite. Please note that HP10s should be avoided when the lengths exceed 75 ft the to their tendency to wander and the same thing holds true for HP12s when their lengths exceed 100 ft. Also, metal shell piles do not appear to be feasible at any of the substructures. According to the preliminary factored loads provided by the Planning Unit and our preliminary analyses, metal shell piles will obtain only a fraction of the less tance needed before reaching elevations just above bedrock at any of the substructures. This makes the metal shell piles susceptible to damage during driving.

Table 3 West Abutment Pile Lengths (Top of pile @ 421.75)

L Abdillient ne	Lenguis (10p	51 PIIC (0) +2 1.70
Nominal	Factored	Pile
Required	Resistance	Length
Bearing	Available	
(kips)	(kips)	(ft)
120	60	58
140	70	62
160	80	66
180	90	70
240	120	73
260	130	74
280	140	75
300	150	76
334	167	77
120	60	58
140	70	61
160	80	65
180	90	69
200	100	73
	Nominal Required Bearing (kips) 120 140 160 180 240 260 280 300 334 120 140 160 180	Required Bearing Resistance Available (kips) (kips) 120 60 140 70 160 80 180 90 240 120 260 130 280 140 300 150 334 167 120 60 140 70 160 80 180 90

	260	130	74
	280	140	75
	300	150	76
	320	160	77
12X53	120	60	55
	140	70	58
	160	80	61
	180	90	64
	200	100	67
	220	110	71
	300	150	74
	340	170	75
12X63	120	60	55
	140	70	1.5
	160	80	6)
	180	90	64
	200	100	67
	220	110	70
	240	120	73
	300	50	74
	340	170	75
12X74	120	60	55
	140	70	57
	160	80	60
	180	90	63
	/200	100	66
	220	110	70
	240	120	73
12X84	120	60	54
	140	70	57
	160	80	60
	180	90	63
	200	100	66
	220	110	69
	240	120	72
		170	74
	340	170	7 -

Table 4. Pier 1 Pile Lengths (Top of pile @ 423.0)

	T Pile Lenguis	(10h oi bile @ 2	
HP Steel	Nominal	Factored	Pile
Pile Size	Required	Resistance	Length
	Bearing	Available	
	(kips)	(kips)	(ft)
12X63	400	200	79
	440	220	80
	460	230	81
	496	248	82
12X74	400	200	78
	440	220	79
	460	230	80
	500	250	.*.82
	520	260	XX
	560	280	84
	588	294	85
12X84	400	200	78
12/104	440	22	79
	480	6/1	80
	500	X	81
		270	83
	540		84
	580	290	
	600	300	85
14X73	400	200	77
	440	220	78
	500	250	80
	* 578	289	82
14X89	400	200	76
	440	220	77
	480	240	79
	520	260	80
_	560	280	81
	600	300	82
	620	310	83
	680	340	85
14X102	400	200	76
	440	220	77
	460	230	78
	500	250	79
	540	270	80
	560	280	81
	600	300	82
	640	320	83
	660	330	84
		350	85
117117	700		75
14X117	400	200	76
	440 460	220 230	77

480	240	78
520	260	79
560	280	80
600	300	81
620	310	82
660	330	83
680	340	84
720	360	85

Table 5	Pier 2 Pile	Lenaths (Top of	pile (ത 408.0)	1
labic c.			1000		$(\omega_{i}, i \cup \cup i \cup j)$	

Table 5. Pier	2 Pile Lengths	(Top of pile @ 4	
HP Steel	Nominal	Factored	Pile
Pile Size	Required	Resistance	Length
	Bearing	Available	
	(kips)	(kips)	(N)
12X53	260	130	73
	280	140	74
	320	160	75
	380	198	77
	418	(. 209)	79
12X63	260	150	72
	280	140	73
,	300	150	74
	360	180	76
	380	190	77
	420	210	78
	440	220	79
	460	230	80
12X74	260	130	72
	280	140	73
	300	150	74
	340	170	75
	380	190	76
	400	200	77
	440	220	78
	480	240	80
	500	250	81
	560	280	83
12X84	260	130	71
	280	140	72
	320	160	74
	360	180	75
	400	200	76
	420	210	77
	460	230	- 79
	480	240	80
	520	260	81
_	580	290	83
14X73	360	180	74
L			

	400	200	75
	460	230	77
	500	250	78
	540	270	80
	578	289	81
14X89	360	180	74
	400	200	75
	440	220	76
	460	230	77
	500	250	78
	540	270	79
	560	280	80
	600	300	. 84
	620	310	
14X102	360	180	7.3
	400	200	74
	440	220	75
	500	250	77
	540	270	79
	580	C 290	80
	620	310	81
	640	320	82
14X117	380	190	73
	420	210	74
	460	230	75
	500	250	77
	540	270	78
	580	290	79
	600	300	80
	640	320	81
	660	330	82

Table 6. Pier 3 Pile Lengths (Top of pile @ 400.0)

	0 1 110 H0119 1110	(
HP Steel	Nominal	Factored	Pile Length
Pile Size	Required	Resistance	
	Bearing	- Available -	
			(ft)
	(kips)	(kips)	
10X42	200	100	50
	220	110	54
	240	120	56
	260	130	58
	280	140	61
	300	150	63
	334	167	64
10X57	200	100	49
	220	110	53
	240	120	55

	260	130	57]
	280	140	60	1
	300	150	62]
	400	200	64	
	454	227	65	
12X53	260	130	53	
	280	140	55	KIN
	300	150	57	
	320	160	59	
	340	170	61	() •
	360	180	62	
	418	209	63	
12X63	260	130	. 52	
	280	140		
	300	150	55	
	320	160	58	
	340	170	60	
	360	180	62	
	460	230	64	·
	496	(248)	65	
12X74	260	130	52	
	280	140	54	
	300	150	56	
	320	160	58	
	340	170	60	
	360	180	62	
	380	190	63	
	480	240	64	
	520	260	65	
	589	294	66	
12X84	260	130	. 54	j
	280	140	56	
	300	150	58	
	320	160	59	
	340	170	61	
	360	180	63	
	600	300	66	
	640	320	67	
	664	-332	68	

Table 7. Pier 4 Pile Lengths (top of pile @ 423.0)

		(top of pile @ 4	
HP Steel	Maximum	Factored	Pile
Pile Size	Nominal	Resistance	Length
	Required	Available	
:	Bearing		
			(61)
	(kips)	(kips)	(ft)
14X74	340	170	98
	500	250	99
	588	294	100
14X89	360	180	98
	500	250	99
	600	300	100
	664	332	* 104
14X102	420	210	X 98
	640	320	99
	700	350	100
	720	360	101
	760	380	103
	780	690 ×	104
	810	400	105
14X117	440	220	98
	660	330	99
	720	360	100
	740	370	101
	788	390	103
	820	410	105
	860	430	107

Table 8. East Abutment Pile Lengths (Top of pile @ 421.75)

	J	pile (0 421.73)
Nominal	Factored	Pile
Required	Resistance	Length
Bearing	Available	
(kips)	(kips)	(ft)
120	60	55
140	70	67
160	80	80
120	60	53
140	70	65
160	80	78
180	90	83
120	60	43
140	70	53
160	. 80	63
180	90	77
200	100	80
220	110	84
240	120	87
	Nominal Required Bearing (kips) 120 140 160 120 140 160 180 120 140 200 220	Nominal Required Bearing Factored Resistance Available (kips) (kips) 120 60 140 70 160 80 120 60 140 70 160 80 180 90 120 60 140 70 160 80 180 90 180 90 200 100 220 110

260	130	88
		89
		91
		92
		40
		50
		63
		71
		80
		84
		87
		89
		9
		39
140		48
160	80	61
180	90	69
200	100	80
220	(11)	83
280	140	89
	160	91
240	170	93
120	60	38
	70	47
	80	58
	90	68
	100	80
		83
		86
		93
		95
	180 200 220 280 260	280 140 500 250 520 260 120 60 140 70 160 80 180 90 200 100 220 110 240 120 280 140 300 150 340 170 120 60 140 70 160 80 180 90 200 10 240 170 120 60 140 70 160 80 160 140 240 170 180 90 200 100 220 110 240 120 340 170

Lateral load analyses were performed for the strong axis of the piles using COM624. The depth to fixity in Tables 9, 10, 11, 12, 13 and14 are from the same assumed top of pile elevations used in Tables 3, 4, 5, 6, 7, and 8.

Table-9. West-Abutment-Lateral-Load-Analyses-

Lateral			Depth to F	ixity (feet)		
Load (kips)	10X42	10X57	12X53	12X63	12X74	12X84
2.5	2.6	2.7	2.7	2.8	2.9	2.9
5.0	3.2	3.4	3.4	3.5	3.6	3.6
7.5	3.6	3.8	3.8	3.9	4.0	4.1
10.0	4.0	4.2	4.2	4.3	4.4	4.5
15.0	4.5	4.7	4.7	4.8	5.0	5.1

Table 10. Pier 1 Lateral Load Analyses

Lateral	Depth to Fixity (feet)											
Load (kips)	12X63	12X74	12X84	14X73	14X89	14X102	14X117					
1	17.4	17.5	17.5	17.4	17.5	17.4	17.6					
2	17.9	18.1	18.1	18.0	18.1	17.9	18.2					
3	18.3	18.4	18.4	18.3	18.4	18.2	186					
4	18.6	18.7	18.7	18.6	18.7	18.5	18.9					
5	18.8	19.0	19.0	18.9	19.0	18.8	19.2					

Table 11. Pier 2 Lateral Load Analyses

			aa , alang							
Lateral	Depth to Fixity (feet)									
Load	12X63	12X74	12X84	14X73	14X89	14X102	14X117			
(kips)						·				
2.5	4.7	4.8	4.9	4.7	4.8	4.9	5.0			
5.0	6.1	6.2	6.3	6.1	6.3	6.4	6.5			
7.5	7.0	7.1	7.1	6.5	7 .1	7.2	7.3			
10.0	7.5	7.6	7.4	1.5	7.7	7.8	7.9			
15.0	8.1	8.3	8.4	8.2	8.4	8.5	8.6			

Table 40	Dian 2	Leterelle) ,	·		1.
Lateral	z. Pier 3	Lateral Lo ◆			(feet)		
Load (kips)	12X63	12X74	12X84	14X73	14X89	14X102	14X117
2.5	4.1	A.	4.2	4.1	4.3	4.4	4.6
5.0	4.8	4.0	5.0	4.2	4.9	5.0	5.0
7.5	5.2	5.3	5.4	4.7	5.4	5.5	5.6
10.0	5.4	5.5	5.6	5.1	5.7	5.8	5.9
15.0	5.9	6.0	6.0	5.6	6.1	6.2	6.3
20.0	6.5	6.5	6.5	5.9	6.4	6.5	6.6

Table 13. Pier 4 Lateral Load Analyses

	W. C.												
Lateral	Depth to Moment Fixity (feet)												
Load	12X63	12X74	12X84	14X73	14X89	14X102	14X117						
(kips)													
1	30.5	30.6	30.6	30.6	30.8	31.0	31.0						
2	30.5	30.6	30.6	30.6	30.8	31.0	31.0						
3=	30.5	30:6	30.6	30.6	30.8	31.0	31.0						
4	30.7	30.6	30.7	30.7	30.8	31.0	31.0						
5	30.8	30.7	30.9	30.9	30.9	31.0	31.0						

Table 14. East Abutment Lateral Load Analyses

Lateral			Depth to F	Fixity (feet)		
Load (kips)	10X42	10X57	12X53	12X63	12X74	12X84
2.5	2.6	2.7	2.7	2.8	2.9	2.9
5.0	3.2	3.4	3.4	3.5	3.6	3.6
7.5	3.6	3.8	3.8	3.9	140	4.1
10.0	4.0	4.2	4.2	4.3	4.4	4.5
15.0	4.5	4.7	4.7	4.9	3.0	5.1

Drilled Shafts

Drilled shafts are not feasible due to the low soil strengths and excessive depth to bedrock.

Construction Considerations

Existing Battered Piles

Proposed piles at the west abutment should be spaced appropriately to avoid any interference with the existing battered biles.

Temporary Sheet Piling

The General Plans indicate staged construction will be utilized to maintain traffic during construction. The maximum retained heights are approximately 14.7 ft and 19.7 ft at the West and East abutments, respectively. Cantilevered sheet piling is not feasible at either abutment due to possible hard driving. A temporary soil retention system design will be needed at both a utments. In addition we recommend that the CGU be contacted during the Final Design Phase to better determine the construction options available.

Cofferdams

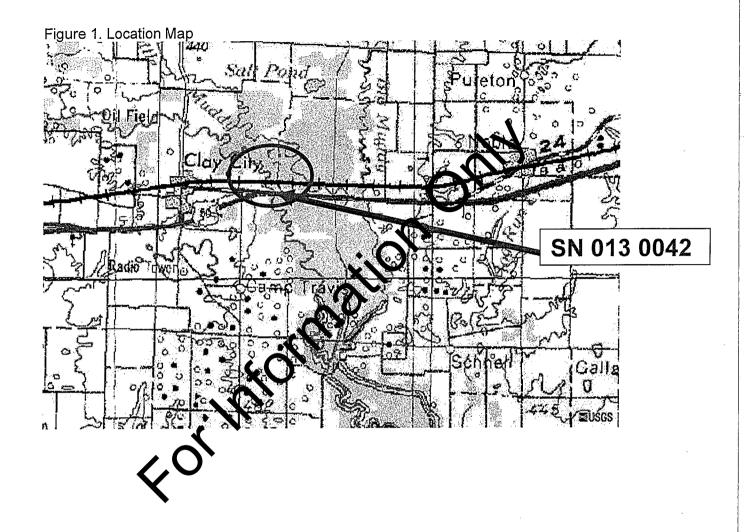
Cofferdams will be needed at piers 3 and 4. Our analyses indicate that cantilevered sheet piling is not feasible at either pier. However, braced sheet piling is feasible at both piers. Our preliminary analyses indicate that a 3 foot seal coat will be needed at pier 3 due to the granular nature of the soil below the footing along with the need to pour the footing in the dry. Also, our preliminary analyses indicate a 4 foot seal coat thickness at pier 4 will be needed.

Based on survey data-in-the-Hydraulics-Report, the Hydraulics Unit calculated the Estimated-Water-Surface-Elevation-(EWSE)-to-be-at-401-feet.—According-to-the-Bridge—Manual (page 2-77), the design water elevation will be at an elevation of 404 ft for both cofferdams. The top of the cofferdams will be at 415 ft and 410 ft for the pier 3 and pier 4, respectively.

Backfill

Porous granular embankment (special) will be placed in the temporary excavations behind both abutments according to ABD memo 05-3.

Class A5 stone riprap will be placed at the toe of each abutment end slope.





Illinois Department of Transportation

Memorandum

To:

Tim Jackson

Attn.: Mike Allen

From:

Terry Hoekstra

By:

David Mille

Subject:

Foundation Boring Logs*

Date:

September 22, 2006

Route:

FAP 327 (US 50)

Section:

7-7B/B-1

County:

Clay Clay City

Township

94777

Jos Number:

D-97-002-03

Structure No.:

No.: Existing 013-0005

ocation:

0.8 mile West of Richland County line.

Attach d are thee (3) copies of the foundation boring logs for the above captions section.

If you have any questions, or require any additional information, please contact David Miller, District Geotechnical Engineer, at (217) 342-8233.

Terry Hoekstra, P.E.

District Materials Engineer

DKM

-Attachments



Map Datum WGS

Ë

710

W 88 deg

Latitude N 38

SOIL BORING LOG

Page $\underline{1}$ of $\underline{4}$

Date 7/27/06

LOGGED BY E. Sandschafer ROUTE FAP 327 (US 50) DESCRIPTION_ Little Muddy River SECTION (7-2B)B-1 LOCATION Sec 14 - SW 1/4, Sec 15 - SE 1/4, Sec 22 - NE 1/4, Sec 23 - NW 1/4, SEC., TWP. 3 N, COUNTY Clay DRILLING METHOD Hollow stem auger & split spoon HAWMER TYPE D В U D В U М М 403.<u>00</u> ft Surface Water El STRUCT, NO. 013-0005 C O Ε L C 0 E L 1291+66 Stream Bed El 391.40 ft Station ____ Ρ 0 S Р 0 S п Т W S т W S **Groundwater Elev** BORING NO. Н S Qu Т Qu Т 1292+47 Station ____ First Encounter 395.5 ft 4<u>03.0</u> ft Offset 24.40ft Lt Upon. Completion (ft) (/6") (ft) (/6") (tsf) (%) (tsf) (%)405.0 **ft** Ground Surface Elev. 415.01 Hrs. 22 3 Very soft, very damp, brown to wet, gray, fine grained, gray, SILTY LOAM. 3 assing #200 sieve. 0 0 23 7% passing #200 sieve. O 0 23 0 22 0.6 4% passing #200 sieve. В Gray, SILTY LOAM. 0 Very loose, wet, gray, fine grained, 6 SAND. 6% passing #200 sieve. 0 20 23 11 0.3 13 1 В 0 9 4% passing #200 sieve. 29 12 17 ō 0.1 0 11 В 0 0.1 29 0 0 400.51 Very soft, wet, gray, SANDY 0-6 LOAM w/ several wood chunks. 6% passing #200 sieve. 5 19 1 0.1 33 1 В 10 0.1-119 Very loose, wet, gray, fine grained, SAND. 3 0

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

395.01

BBS, from 137 (Rev. 8-99)



SOIL BORING LOG

Page <u>2</u> of <u>4</u>

Date 7/27/06

COUNTY							/ 1/4, Sec 15 - SE 1/4, Se em auger & split spoon	•				
STRUCT. NO Station BORING NO Station Offset _ Ground Surface Very soft, wet, g	013-0005 1291+66 1 1292+47 24.40ft Lt ce Elev. 415.01		D E P T H	B L O W S	U C S Qu	M O I S T (%)	Surface Water Elev. Stream Bed Elev. Groundwater Elev. First Encounter Upon Completion After 24 Hrs. Very Stin, Eamp, gray, (continued)	395.5 ft 403.0 ft ft	D E P T H	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
√ery stiff, damp,	gray, CLAY TILL.	370.51	15	9 12 16	3.9 B	10						
		-	-50	10 17 21	4.8 B	9				6 11 17	4.5 B	10
			-55									
			1									

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)
BBS, from 137 (Rev. 8-99)



deg 41.255 min, Longitude W 88 deg 17.710 min, Map Datum WGS 84

SOIL BORING LOG

Page <u>3</u> of <u>4</u>

Date ___7/27/06__

- III. Dept. of	114113. 5-7								
ROUTE FAP 327 (US	50) DESCRIPTION	ON		Little Muc	ddy River		LOGGED B	Y E. Sandscha	<u>fer</u>
SECTION(7-2	B)B-1 L(OCATION_	Sec 14 -	SW 1/4, S	Sec 15 - SE	1/4, Sec 22 -	NE 1/4, Sec 23 -	NW 1/4, SEC.,	<u>TW</u> P. 3 N,
COUNTY Clay	DRILLIN	IG METHOE	Hollov	v stem aug	ger & split sr	poon H	MER TYPE	Auto 140#	_
STRUCT. NO0 Station1 BORING NO Station1: Offset2e Ground Surface Elev CLAY SHALE. Borehole continued with coring.	291+66 1 292+47 4.40ft Lt 7, 415.01 ft 7334.91	50/1" 50/0" 	C S Qu (tsf) (t	O Stro I Grou T Firs	ace Water E eam Bed E undwater El et Encyunte on Complet er 24 Hr	er 39 lev.: er 36 lev.: er 40	3.00 ft 1.40 ft 95.5 ft 03.0 ft 05.0 ft		
		<u>-95</u>							
					· · · · · · · · · · · · · · · · · · ·				



ROCK CORE LOG

Page <u>4</u> of <u>4</u>

Date <u>7/27/06</u>

ROUTE FAP 327 (US 50) DESCRIP	TION	Little Muddy River		_ LOGGED BY E. Sandschafer					
SECTION (7-2B)B-1	LOCATION Sec 14 -	SW 1/4, Sec 15 - SE 1/	/4, Sec 22 - N	<u>E 1/4</u>	, Sec 2	23 - NV	N 1/4, SE	C., TW	/P. 3 N,
COUNTY Clay CORII STRUCT. NO. 013-0005 Station 1291+66 BORING NO. 1 Station 1292+47 Offset 24.40ft Lt Ground Surface Elev. 415.01 Gray, slightly weathered, SANDSTONE	NG METHOD Rotary CORING BARREL Core Diameter Top of Rock Elev Begin Core Elev.	v, surf set diamond bit NW, conv TYPE & SIZE split ir 2.06 in 334.91 ft	dbl bl	C O R E (#)	R E C O V E R Y (%)	R . Q . D .	CORE T I M E (min/ft) 0.5	S T R E N G T H	
Unconfined Compressive Strength = 4 Gas forced fine sand into augers, drill parrel into borehole for another sample Extent of exploration.	oipe and core barrel. U		329.91 -85						
Benchmark: National Geodetic Sulvey 424.02'. Provided by Program Develop on the bearing seat area of the fast ab	Vertical Control Mark (oment. Located on SE utment.	(Brass Tablet) Q294 = corner of existing bridge							
			-95			and a second			
			-100						

Color pictures of the cores

Cores will be stored for examination until

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

BBS, form 138 (Rev. 8-99)



Map Datum WGS

Ę,

W 88 deg 17.740 p

Longitude

.255 min,

SOIL BORING LOG

Page 1 of 3

Date 8/4/06

ROUTE FAP 327 (US 50) DESCRIPTION Little Muddy River LOGGED BY E. Sandschafer (7-2B)B-1 LOCATION Sec 14 - SW 1/4, Sec 15 - SE 1/4, Sec 22 - NE 1/4, Sec 23 - NW 1/4, SEC., TWP. 3 N, COUNTY Clay DRILLING METHOD Hollow stem auger & split spoon Auto 140# В U D В U М 013-0005 Surface Water Ele STRUCT. NO. Ε Ε С C 0 L 0 1291+66 Stream Bed Elev. 891.40 ft Station Р S P 0 S 0 Ī Т Т Т W W S S BORING NO. Groundwater Elev Т Н S T Н S Qu 1290+97 Qu Station First Encounter 22.30ft Lt Washed ft Offset pletion (ft) (/6") (ft) (/6") (tsf) (%) (tsf) (%) **Ground Surface Elev.** 416.75 Hrs. Medium, damp, brown mottled wet, gray, fine grained, 0 19 gray, SILTY CLAY. 5% passing #200 sieve. 0 0 7% passing #200 sieve. 22 0 (continued) 393.45 0 Gray, SILTY LOAM. Loose, wet, gray, fine grained, SAND. 0.8 3 23 11% passing #200 sieve. В 3 Soft, damp, brown, SILTY LO 0 5 0 25 6 25 0.4 7% passing #200 sieve. 2 7 В Very soft, wet, brown mottled gray, 0 SANDY LOAM. 17 25 1 0.3 5% passing #200 sieve. В 7 1 0 ō 0.1 .0. В 0 8 -35 10% passing #200 sieve. 23 0.1 14 10 1 В 0 -0--0.1--0-

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Soft, gray, SANDY LOAM w/ fine

BBS, from 137 (Rev. 8-99)



Latitude N 38 deg 41.255 min, Longitude W 88 deg 17.740 min, Map Datum WGS 84

SOIL BORING LOG

Page <u>2</u> of <u>3</u>

Date 8/4/06

	•											
ROUTE FAP 3	27 (US 50) DESCF	RIPTION			Lit	tle Muddy River	LOGGI	ED B	Y <u>E. S</u>	Sandso	hafer	-
SECTION	(7-2B)B-1	LOCATI	ON_S	Sec 14	4 - SW	/ 1/4, Sec 15 - SE 1/4, Sec 22	2 - NE 1/4, Sec	23 -	NW 1/	4, SEC	., TW	/ P. 3
COUNTY	Clay DF	RILLING ME	THOD	<u>Hol</u>	low st	em auger & split spoon H	MMER TYPE		Auto	140#		_
Station BORING NO Station Offset Ground Surfa	013-0005 1291+66 2 1290+97 22.30ft Lt ace Elev. 416.75 o, gray, CLAY TILL.	D E P T H (ff)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)	Stream Bed Elev. Groundwater Elev First Engunter	483.00 ft 391.40 ft 399.8 ft /ashed ft N/A ft	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)	
		3\frac{1}{2}	9 12 17	2.5 B	9			-65				
	X		4 9 13	2.4 B	11	Very dense, damp, gray, CL TILL.	347.25 .AY	-70	19 21 31			
3 1	10 10 10 10 10 10 10 10 10 10 10 10 10 1											··· ···
		-55			A control of the cont			-75 -				
						* Hard. moist, gray, SANDY SHALE.	CLAY					
Stiff, damp, gray	, SILTY LOAM.	357.25	5			*	337.25 ,337.05,-	-80	50/2"			
, ,		-001		1		· · · · · · · · · · · · · · · · · · ·					į.	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)



ROCK CORE LOG

Page $\underline{3}$ of $\underline{3}$

Date 8/4/06

ROUTE FAP 327 (US 50) DESCRIPTION Little Muddy River		_ L(OGGE	D BY	E. Sand	schafer	_
SECTION (7-2B)B-1 LOCATION _ Sec 14 - SW 1/4, Sec 15 - SE 1/4,	Sec 22 - N	E 1/4	Sec 2	23 - N\	N 1/4, SE	EC., TW	/ P. 3 N,
COUNTY Clay CORING METHOD Rotary, surf set diamond bit NW, conv di	bl blit.	1	R E C	R	CORE	S T R	
STRUCT. NO. 013-0005 CORING BARREL TYPE & SIZE split is Station 1291+66 Core Diameter 2.06 in	D E	0 0 0	0 V	Q .	I M	E N	
BORING NO. 2 Top of Rock Elev. 337.05 ft Station 1290+97 Begin Core Elev. 337.05 nt Offset 22.30ft Lt 22.30ft Lt 22.30ft Lt 22.30ft Lt 237.05 22.30ft Lt 237.05 22.30ft Lt 22.30ft Lt 237.05 22.30ft Lt 22.30ft Lt<	P T H	R E	E R Y		E	G T H	
Ground Surface Elev. 416.75 ft	(ft)	(#)	(%)		(min/ft)	(tsf)	
Unconfined Compressive Strength = 169 tsf (depth & 0 to 83.4')	337.0580		100	79	0.6		
Gray, SANDY CLAY SHALE w/ thin black layering. Unconfined Compressive Strength = 256 tsf (depth 88.3' to 88.7')	85		100	82	0.5		
	327.05						
Extent of exploration. Benchmark: National Geodetic Survey Vertical Control Mark (Brass Tablet) Q294 = 424.02'. Provided by Program Development. Located on SE corner of existing bridge, on the bearing seat area of the East abutment.	90			į			
	95						
				·			<u>:</u> .
			-		·		

Color pictures of the cores	
Cores will be stored for exa	mination until



Latitude N 38 deg 41.247 min, Longitude W 88 deg 17.671 min, Map Datum WGS 84

SOIL BORING LOG

Page <u>1</u> of <u>4</u>

Date 8/7/06

ROUTE FAP 327 (US 50) DESCRI	PTION		ittle Muddy River	LOGGED E	BY E. Sands	chafer
SECTION (7-2B)B-1	LOCATION	Sec 14 - S	W 1/4, Sec 15 - SE 1/4, Sec 22	2 - NE 1/4, Sec 23 -	- NW 1/4, SE	<u>C., TW</u> P. 3 N
COUNTY Clay DRIL	LLING METHO	D Hollow:	stem auger & split spoon H	MMER TYPE	Auto 140#	<u> </u>
STRUCT. NO. 013-0005 Station 1291+66 BORING NO. 3 Station 1294+40 Offset 9.00ft Rt Ground Surface Elev. 428.76	D B E L P O T W H S - ft (ft) (/6")	U M C O S I S Qu T	Stream Bed Elev. Groundwater Elev First Encounter Upon Completion	48.3.00 ft E P T T H H 413.8 ft 419.3 ft (ft)	L C O S W	M O I S T
2 1/4" asphalt on 10" concrete		(,, (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stick very soft, very damp	, brown	2 0.5 3 B	25
Medium to stiff, damp, brown, CLAY w/ trace sand and fine gravel.	3 3		Ly ()		, 0 0.1 0 B	27
	5 1 3 4	1.0 17 B	_		0 0.1 0 B	28
~	1 - 1 - 3 4	1.0 18 B			0 0.4 0 B	22
Stiff, damp, gray, SANDY CLAY LOAM.	9.26 -10 3 -4 5	1.7 13 B			0 0.4 0 B	26
Medium to stiff, damp, brown/red/gray, CLAY.	6.76	1.0′, 18 B			-	The state of the s
Medium to stiff, damp, gray, SILTY CLAY.	4.26 2 2 4	0.7 23 B	Very loose, wet, gray, fine digrained, SAND. 5 % pass #200 sieve.	394.26 -35	0 0	23
	2 34	-1.623- -B-				
40	9.26			388.76 -40	3	

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)



SOIL BORING LOG

Page $\underline{2}$ of $\underline{4}$

8/7/06 Date

ROUTE FAP 327 (US 50) DESC	RIPTION	!			Lit	tle Muddy River	LOGGI	ED B	Y <u>E. S</u>	Sandso	hafer
SECTION (7-2B)B-1	LOC	ATI	ON_	Sec 14	4 - SV	/ 1/4, Sec 15 - SE <u>1/4, Sec 22 - NE</u> 1	1/4, Sec	23 -	NW 1/	4, SEC	:., TWI
COUNTY Clay D	RILLING	ME	THOD	Hol	llow st	em auger & split spoon His Winds	TYPE		Auto	140#	
STRUCT. NO. 013-0005 Station 1291+66	_	D E P	B L O	U C S	M 0 1	Surface Water Flag 403.00 Stream Bed Elev. 391.40		DEP	BLO	UCS	M 0 1
BORING NO. 3 Station 1294+40 Offset 9.00ft Rt		T H	W S (/6")	Qu (tof)	S T (%)	Groundwater Elev.: First Englurier	ft	T H (ft)	(/6")	Qu (tsf)	S T (%)
Ground Surface Elev. 428.76 Medium, wet, gray, fined grained,	ft ((ft)	7	(tsf)	21	After 16 Hrs. 419.3 Midding, wet, gray, fine grained,	_ ft	(11)	6	(151)	16
SAND. 9% passing #200 sieve.	_	-	10			6% passing #200 sieve.			10		
	*				~	O		·—			
	_	, p	,					·			
,	_		•	1	•						
			X	J							`
	•		10								
		45	20		15			-65			
3% passing #200 sieve.	~ _		23								
	O'	\dashv]					_			
Y	_	()									
•							,				
		,				,		\dashv			
		-50	7		18			<u>-70</u>			
6% passing #200 sieve.		\dashv	9	ĺ	10		•	- ES-			
	_	_					•				
•	_		ł			•		 .			ĺ
		+						. \dashv			
			==::::		<u></u>				WE		
							354.26				
		-55				Very stiff, damp, gray, CLAY TILL		· 作 -75	7		i
•						to SANDY CLAY TILL.	•	_	13 19	4.0 B	10
	-					,	-		19	, D	
	· · <u> </u>										. [
	ſ	\dashv				e e como a communicación de communicació	-				
		<u> </u>									
		_	_					_			



SOIL BORING LOG

Page <u>3</u> of <u>4</u>

Date 8/7/06

ROUTE FAP 327 (US 50) DESCRI	PTION	Little Muddy River	LOGGED BY E. Sandsch	<u>nafer</u>
SECTION (7-2B)B-1	LOCATION Sec 1	14 - SW 1/4, Sec 15 - SE 1/4, Sec	22 - NE 1/4, Sec 23 - NW 1/4, SEC.	<u>, TW</u> P. 3 N,
COUNTY Clay DRIL	LING METHOD Ho	ollow stem auger & split spoon	HAMMER TYPE Auto 140#_	
STRUCT. NO. 013-0005 Station 1291+66 BORING NO. 3	D B U E L C P O S T W	M O Surface Water Elev. Stream Bed Elev. Groundwater Elev.	493.00 ft 391.40 ft	
Station 1294+40 Offset 9.00ft Rt Ground Surface Elev. 428.76	- H S Qu - ft (ft) (/6") (tsf)	T First Encounter Upon Convoletion	393.8 ft 413.8 ft 419.3 ft	
Very stiff, damp, gray, CLAY TILL to SANDY CLAY TILL. (continued)	KO	Calle		
⟨ C	85 4 8 1.9 1.1 B 1.9	11		
	-95			
Wet, gray, fine grained, SAND.	2.96 20 40 2.06 50/2"	19		

Latitude N 38 deg 41.247 min, Longitude W 88 deg 17.671 min, Map Datum WGS 84

Borehole continued with rock

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)

The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS from 137.6

BBS, from 137 (Rev. 8-99)



ROCK CORE LOG

Page <u>4</u> of <u>4</u>

Date 8/7/06

ROUTE FAP 327 (US 50) DESCRIF	PTION	1	Little Muddy F	iver		L	.OGGE	D BY	E. Sand	schafer	-
SECTION (7-2B)B-1	LOCATION	Sec 14 - S	W 1/4, Sec 1	5 - SE 1/4	1, Sec 22	- NE 1/4	1, Sec	23 - N\	// 1/4, S I	C., TW	P. 3 N,
COUNTY Clay COR	ING METHOD	Rotary, s	surf set diamo	nd bit		4	R	R	CORE	S T	
STRUCT. NO. 013-0005 Station 1291+66	_ CORING E		'PE & SIZE 2.06	W, conve split in in		D C E O	0 V	Q ·	T I M	R E N	
BORING NO. 3 Station 1294+40 Offset 9.00ft Rt		Rock Elev ore Elev		_ ft		P R T E H	R Y	D .	E	G T H	
Ground Surface Elev. 428.76	ft		_: <u>`</u> C),		(ft) (#)			(min/ft)	(tsf)	
Gray, SANDY CLAY SHALE. Unconfined Compressive Strength = Gray, moderately weathered, SANDS	K	02.5 to 10.2	.9)		328.96		100	60	0.7		
Gray, moderately weathered, SANDS	1000	•			<u>_</u>	105	100	75	0.8		
Unconfined Compressive Strength = Gray, moderately weathered, SANDY	268 tsf (depth CAY SHALE	<u>104.8' to 10</u>	5.2')		<u>323.26</u> – – – – – – – – – – – – – – – – – – –						
Extent of exploration.			***********		318.96	110					
Benchmark: National Geodetic Surve 424.02'. Provided by Program Develo on the bearing seat area of the East a	pment. Locate	rol Mark (Br ed on SE co	rass Tablet) Q rner of existin	294 = g bridge,	· -						
		a i i man a parametri di man Republica									
			and the same of th	addition a colonia del		115					
	<u> </u>		· · · · · ·	:							
					_						

Color pictures of the cores

Cores will be stored for examination until___

The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

BBS, form 138 (Rev. 8-99)



Map Datum WGS 84

Ħ, 780

W 88 deg

deg 41.252 min,

atitude N 38

Page $\underline{1}$ of $\underline{3}$

Date 8/22/06

LOGGED BY E. Sandschafer ROUTE FAP 327 (US 50) DESCRIPTION Little Muddy River SECTION _____ (7-2B)B-1 LOCATION _ Sec 14 - SW 1/4, Sec 15 - SE 1/4, Sec 22 - NE 1/4, Sec 23 - NW 1/4, SEC., TWP. 3 N, COUNTY Clay DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE D В U М D В u М Surface Water E 3.00 ft STRUCT. NO. ____ 013-0005 Ε C 0 Ε L С 0 L 1291+66 391.40 ft Stream Bed E ev. Station _____ Р Ρ 0 S 0 S Т Т W S W S BORING NO. Groundwater Elev Н Qu Т S Qu Т Station ____ 1289+13 First Encounter 384.4 ft Washed_ft Offset ____ 8.00ft Rt pletion (ft) (/6") (tsf) (%) (ft) (/6") (tsf) (%) Ground Surface Elev. 428.85 Hrs. 25 2 3/4" asphalt on 10" concrete y soft, very damp, 0.4 2 wn/red, SILTY LOAM. pavement. 3 В 427.85 Brown, SILTY CLAY. 426.85 0 Very soft, very damp, brown, SILTY LOAM. 0 0.1 0 В Medium to stiff, damp, brown, SILTY CLAY. 17 0 0.3 24 1.0 В В 0 0 1 25 3 0 0.3 1.0 18 4 В В Medium to stiff borwn mottled 0 gray, CLAY w/ trace Silt. 0 0.5 3 0.8 21 4 0 В 3 4 1.1 20 Stiff, damp, gray marbled red, SILTY CLAY w/ hair roots. Very soft, damp, gray, SANDY 0---2-LOÁM. 22 0.1 22 3 1.2 0 4 В٠ 1 В 3 3 1.8 22 409.35 0

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)



SOIL BORING LOG

Page <u>2</u> of <u>3</u>

Date 8/22/06

ROUTE FAP 327 (US	50) DESCRIPTION	N			Lit	tle Muddy River	ьо	GGED E	Y <u>E. :</u>	Sandso	<u>chafer</u>
SECTION (7-2	<u>PB)B-1</u> LC	CAT	ION_	Sec 14	4 - SV	/ 1/4, Sec 15 - SE 1/4, Se	ec 22 - NE 1/4,	Sec 23 -	NW 1/	/4, SEC	<u>., TW</u>
COUNTY Clay	DRILLIN	G ME	THOE	<u>Hol</u>	llow st	em auger & split spoon	HALMMER TY	PE	Auto	140#	
STRUCT. NO. 0 Station 1	13-0005 1291+66	D E P	B L O	U C S	М О І	Surface Water Elev Stream Bed Elev.	408.00 ft 391.40 ft		B L O	U	M O I
BORING NO	289+13	H	S	Qu	S T	Groundwater Elev.: First Encyunier Upon Conseletion	384.4 ft Washed ft		W S	Qu	S T
Ground Surface Elev	<u>/. 428.85</u> ft		(/6")	(tsf)		After 24 Hrs.	418.0 ft	(ft)	(/6")	(tsf)	(%) 11
Medium, wet, fine grain w/ Gravel.	388.35 ned, SAND		, 2 5	0.1 B	,21	Vity str, damp, gray, (continued)	CLAY HLL.		10 16	2.3 B	11
			Ç	S				<u>-</u>			
			7		15			65			
8% passing #200 sieve	1.0	<u> </u>	15					-			
	X							_			
		-50	4			·		-70	8		
4% passing #200 sieve			7 9		20				12 17	2.1 B	10
		*									
										:=	
								- <u> </u>			
		<u>-55</u>						<u>-75</u>			
						· .					
·							· · · · · · · · · · · · · · · · · · ·				
/ery stiff, damp, gray, 0	369.35		7				348		28		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

"BBS, from 137 (Rev. 8-99)



SOIL BORING LOG

Page <u>3</u> of <u>3</u>

Date 8/22/06

ROUTE FAP 327 (US 50) DESC	RIPTION	Little Muddy River	LOGGED E	BY E. Sandschafer
SECTION (7-2B)B-1	LOCATION _Se	ec 14 - SW 1/4, Sec 15 - SE 1/4, S	Sec 22 - NE 1/4, Sec 23 -	NW 1/4, SEC., TWP.
COUNTY Clay D	RILLING METHOD _	Hollow stem auger & split spoon	HAMMER TYPE	Auto 140#
STRUCT. NO. 013-0005 Station 1291+66	E L	U M Surface Water Elev. C O Stream Bed Elev.	403.00 ft 391.40 ft	
BORING NO. 4 Station 1289+13 Offset 8.00ft Rt	T W H S	Qu S Groundwater Elev.: First Engounter Upon Completion	384.4 ft Washedft	
Ground Surface Elev. 428.85 Very dense, moist, gray, SANDY		(%) After 24 Hrs.	418.0 ft	
CLAY SHALE. Extent of exploration.	348.25 = 50/5" 50/2"			·
Benchmark: National Geodetic Survey Vertical Control Mark (Brass Tablet) Q294 = 424.02'. Provided by Program Development. Located on SE corner of existing bridge, on the	40			
bearing seat area of the East abutment.	25			
4				
•				
	<u>-90</u>			
			,	
	-95		BANKKANIANIANIANIANIANIANIANIANIANIANIANIANIA	
<u> </u>				