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Structure Geotechnical Report

F.A.P. 869 (IL. 34)
Section 104B-1
Saline County
Job No. D-99-021-10
Contract No. 78166
PTB No. 148-035
F.A.P. 869 (IL. Route 34) Over Gassaway Branch
Proposed S.N. 083-0069
Existing S.N. 083-0026

Prepared By:
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November 12, 2012

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Exp 11/30/2013

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11/12/2012

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Tables and Figures

1. Project Description

Introduction

The proposed project will replace the bridge (SN 083-0026) carrying IL. Route 34 over Gassaway Branch in Saline County, Illinois. The project is located approximately 0.1 mile west of Galatia, Illinois on IL. Route 34. The subsurface exploration was conducted by District Nine Geotechnical Unit in March 2009. Figure 1 and 2 show the structure location and soil boring locations, respectively.

Scope

The scope of work will include reviewing available subsurface information for the project area, performing necessary engineering analyses, and formulating recommendations presented in this report.

2. Existing Structure

The existing structure over Gassaway Branch (S.N. 083-0026) was constructed in 1928 and rebuilt in 1976. The rebuild of 1976 included removal of the original cast in place concrete superstructure, widening of the abutments, and constructing a new precast prestressed concrete deck-beam superstructure. The total single-span structure length is approximately 53 feet from back to back of abutments along the centerline of the road. The existing deck width is 33 feet, and the abutments are skewed at 25-degrees to the center of the roadway. The existing abutments were constructed in 1928 and are founded on untreated timber piles. The tip elevations for the timber piles vary from El 363 to El 350. The capacities of these untreated timber piles vary from 10 to 15 tons.

The existing substructures are to be removed. The location of the existing structure relative to the proposed structure is shown in Figure 2.

3. Proposed Structure

The proposed structure will be a three-span bridge with a 39-ft 2-in wide cast-in-place concrete deck. The substructure will consist of integral abutments and bent-type piers. Span lengths will be 29-ft 4-5/8-in at the west end, 34-ft 0-in at the center, and 29-ft 4-5/8-in at the east end. The new piers are located in front (towards main water channel) of the existing abutments. The new west and east abutments are located behind the existing abutments in the existing bridge approach embankments.

The proposed structure is expected to have factored abutment and pier vertical reactions of approximately 590 and 1190 kips, respectively.

There will be no significant change in final grade of the proposed roadway from the existing. The existing bridge and slopes will be cut to widen the waterway with final cut slope of 1.0V:2.0H.

4. Site Investigation

The bridge is located in the Gassaway Branch watershed. The ground is relatively flat, except for the creek channel. At the bridge site, the river channel is approximately 46 feet wide with flow from north to south. The existing approaches are approximately 1-foot below the 100-year event and 12.0 feet above the streambed. Figure 2 is a site plan showing the existing topography and the proposed bridge.

IDOT District 9 drilled two Borings (1-S and 2-S) in March 2009. These borings, 1-S and 2-S, were drilled through the bridge approaches to depths of 65 and 56 feet below grade, respectively. Rock core samples were not taken at either boring. Boring locations are shown in Figure 2.

5. Generalized Subsurface Conditions

Subsurface Materials

The subsurface profile at the bridge site consists of alluvial and residual soils overlying bedrock. The native soil profile consists of layers of grey silt loam, black to brown silty clay loam, brown mottled grey silty clay to silty clay loam, and grey clay to silty clay. A layer of loose sand was found in Boring 1-S from depth of 39.5 ft to 43.5 ft. Consistency of the upper silt loam to silty clay layers is very soft to medium stiff with a range of unconfined strengths 0.2 tsf to 0.8 tsf. The silty clay to clay layer below El 363 at Boring 1-S and El 370 at Boring 2-S to bedrock has a consistency of medium stiff to very stiff with unconfined strength ranging between 0.7 tsf to 2.3 tsf. Hard to very dense grey conglomerate is exhibited in both borings (from El 345 to El 340) above grey clay shale. The drilling was advanced 1 ft (Boring 2-S) to 10 ft (Boring 1-S) into the clay shale bedrock with hollow stem augers. Boring 1-S and 2-S were terminated at El 330 and El 339, respectively.

A subsurface data profile is shown in Figure 3. Boring logs are included in Appendix A.

Groundwater Levels

Groundwater levels were encountered during drilling in both borings. Water levels were noted at El 380.9 and El 359.7 in Boring 1-S and Boring 2-S, respectively, at the completion of drilling.

Groundwater is expected to fluctuate depending on the water level in Gassaway Branch. Construction of Piers 1 and 2 may be influenced by the water levels in the river.

6. Geotechnical Evaluations

Seismicity

The bridge is located in the New Madrid Seismic Zone and could be subjected to severe seismic loadings. The subsurface profile to a depth of 100 feet consists of approximately 50 feet of predominantly very soft to very stiff silts to clays over 5-ft of hard to dense conglomerate overlaying clay shale bedrock. This profile is indicative of Site Class D. Seismic design parameters for a 1,000-year return period earthquake are given in Table 1. Based on these seismic parameters, the bridge should be assigned to Seismic Performance Zone 3.

Table 1 Seismic Design Parameters

PGA = 0.311	F_{pga} = 1.19	A_S = 0.370
S_S = 0.592	F_a = 1.33	S_{DS} = 0.787
S_1 = 0.151	F_v = 2.20	S_{D1} = 0.332

A liquefaction potential analysis was completed based on information from the two Borings 1-S and 2-S. The borings encountered fine-grained soils that are not considered to be liquefaction-susceptible.

Slope Stability

The proposed approaches are to be built near the same elevation of the existing approaches. The factor of safety for static slope stability of the abutments is 1.9 based on soil parameters derived from SPT values. The minimum permissible factor of safety is 1.5 per IDOT Geotechnical Manual. The global stability during seismic event for the existing embankment was performed using As (PGA modified by the zero-period site factor) from Table 1. The calculated seismic factor of safety is less than the minimum permissible value of 1.0. Seismic slope deformation was then determined using the Newmark procedure. The estimated deformation is approximately 2.5 inches, which is less than the maximum 6 inches acceptable per IDOT Geotechnical Manual. Graphical results of global slope stability analysis are presented in Appendix A.

Settlement

The proposed bridge abutments will be the cut sections of the existing bridge approaches. It is prudent to assume that primary consolidation of compressible soils under any fill placed during construction in 1928 and the rebuild of 1976 is 100 percent complete. No settlement is expected at the proposed structure abutments and piers.

Scour

This bridge will be subject to scour from Gassaway Branch. According to the Hydraulic Report, the total predicted scour for the bridge at the pier locations for the 50-year, 100-year and 500-year events is 23.58 ft, 22.63 ft and 15.97 ft, respectively. Due to overtopping of the bridge during less frequent events, the 50-year event results generate the critical (deepest) estimated scour. Thus, the design for scour is based on the 50-year event. The abutments may be designed assuming no scour, because they will be armored with riprap. A design scour depth reduction is appropriate for the soil conditions found at this bridge. Estimated scour depths after reduction due to subsurface conditions based on Borings 1-S and 2-S are 17.5 ft and 18.9 ft, respectively. Cumulative reductions based on Borings 1-S and 2-S of 26% and 20%, respectively were calculated as per the criteria in the IDOT Bridge Manual. Estimated scour depths after reduction were used as design levels. Design scour elevations to be used for bridge design are given in Table 2.

Table 2 Design Scour Elevations

	West Abutment	West Pier	East Pier	East Abutment
50-year	388.9	365.6	364.2	388.9
100-year	388.9	366.1	364.8	388.9
500-year	388.9	370.5	369.8	388.9

Scour will cause a slight loss of axial resistance and a significant loss of lateral resistance at the piers. If design for the full scour depth at the piers results in unacceptably high costs for the pier foundations, scour countermeasures may be considered. The piers are located at the bottom of the river bank, outside the usual limits for abutment riprap armor.

Mining Activity

The project site is located in township (TWP) 8S, range (RGE) 5E. The Illinois State Geological Survey Directory of Coal Mines indicates an abandoned coal mine just west of the bridge site identified as Mine Index 798. The coal mine was owned by Big Creek Coals, Inc. and was active from 1902 to 1923. The mining varied in depth from El 340 to El 367.

7. Design Recommendations

Integral Abutment

Integral abutments are proposed for this structure. The soil borings at the abutments were evaluated for use on integral abutment pile selection chart as per IDOT Memorandum dated July 25, 2012. The weighted average of undrained shear strength for the critical pile depth (10 ft immediately below the abutment cap) is less than 1.5 tsf. No correction factor is required on determining effective expansion length (EEL) for use on integral abutment pile selection chart.

Driven Piles

The proposed integral abutments and the proposed piers should be supported by H-piles driven to maximum nominal required bearing on bedrock. The bottom elevation of the pile cap at the west and east abutments are approximately El 388.9. The geotechnical pile capacity for the piers is generated assuming pile cut-off elevation of approximately El 390.9. List of design values for several H-Pile sections are given in Table 3. Pile points/shoes will not be required to achieve the desired penetration during pile driving. Test piles are not required at this site because the top of bedrock elevations are consistent. The embedment of the piles at the piers is expected to provide the required lateral resistance. Estimated pile lengths presented in the tables below include the minimum embedment in the pile caps at the abutments and piers.

Table 3 Pile Design Parameters

Location	Pile Type	Factored Resistance Available, R_F (kips)	* Factored Geotech. Loss, R_{Sc} (kips)	Nominal Required Bearing, R_N (kips)	Estimated Pile Length (ft)
West Abutment	HP 10x42	184	---	335	49.0
	HP 12x53	230	---	418	50.0
	HP 12x63	273	---	497	52.0
	HP 14x89	388	---	705	53.0
Pier 1	HP 10x42	169	15	335	51.0
	HP 12x53	212	18	418	51.0
	HP 12x63	255	18	497	52.0
	HP 14x89	366	22	705	54.0
Pier 2	HP 10x42	168	16	335	57.0
	HP 12x53	210	20	418	57.0
	HP 12x63	253	20	497	59.0
	HP 14x89	364	24	705	61.0
East Abutment	HP 10x42	184	---	335	53.0
	HP 12x53	230	---	418	54.0
	HP 12x63	273	---	497	55.0
	HP 14x89	388		705	57.0

* - Factored Geotechnical loss due to scour (R_{Sc})
$R_F = R_N*(0.55)-R_{Sc}$

Nominal required bearing of piles given in Table 3 should be used for extreme event limit state designs.

The structure designer should evaluate lateral resistance of driven piles based on both soil and structure properties. The lateral loading should be considered in the pile design. Lateral soil parameters for generating P-y curves in LPILE or GROUP computer programs are given in Table 4. Lateral analysis should consider strength limits and service limit loads on the piles to determine the desired pile section and lateral deflections. The P-multipliers in AASHTO Table 10.7.2.4-1 should be used in the analyses.

Table 4 LPILE/GROUP Soil Parameters

Location	Bottom Elevation (ft)	Soil Type	Soil Parameters			
West Abutment	388.9	Bottom Pile Cap				
	378.0	stiff clay w/water	c=0.70 ksf	k=100 pci	γ'=0.058 kcf	ε_{50}=0.01
	375.5	V/Loose sand w/water	ϕ=27°	k=20 pci	γ'=0.048 kcf	
	363.0	stiff clay w/water	c=0.68 ksf	k=100 pci	γ'=0.043 kcf	ε_{50}=0.01
	355.5	stiff clay w/ water	c=1.57 ksf	k=100 pci	γ'=0.060 kcf	ε_{50}=0.007
	351.5	Loose sand w/ water	ϕ=30°	k=20 pci	γ'=0.062 kcf	
	345.0	stiff clay w/ water	c=1.60 ksf	k=100 pci	γ'=0.059 kcf	ε_{50}=0.007
	340.0	V/stiff clay w/ water	c=3.75 ksf	k=1000 pci	γ'=0.068 kcf	ε_{50}=0.005
		Weak Rock	q_u=120 psi		γ'=0.073 kcf	
Pier 1	365.6	Scour Elevation				
	363.0	stiff clay w/water	c=0.68 ksf	k=100 pci	γ'=0.043 kcf	ε_{50}=0.01
	355.5	stiff clay w/ water	c=1.57 ksf	k=100 pci	γ'=0.060 kcf	ε_{50}=0.007
	351.5	Loose sand w/ water	ϕ=30°	k=20 pci	γ'=0.062 kcf	
	345.0	stiff clay w/ water	c=1.60 ksf	k=100 pci	γ'=0.059 kcf	ε_{50}=0.007
	340.0	V/stiff clay w/ water	c=3.75 ksf	k=1000 pci	γ'=0.068 kcf	ε_{50}=0.005
		Weak Rock	q_u=120 psi		γ'=0.073 kcf	
Pier 2	364.2	Scour Elevation				
	360.0	stiff clay w/ water	c=0.75 ksf	k=100 pci	γ'=0.054 kcf	ε_{50}=0.007
	355.0	stiff clay w/ water	c=2.20 ksf	k=500 pci	γ'=0.061 kcf	ε_{50}=0.005
	345.0	stiff clay w/ water	c=1.45 ksf	k=100 pci	γ'=0.060 kcf	ε_{50}=0.007
	340.0	V/stiff clay w/ water	c=3.75 ksf	k=1000 pci	γ'=0.068 kcf	ε_{50}=0.005
		strong rock	q_u=1350 psi		γ'=0.086 pci	
East Abutment	388.9	Bottom Pile Cap				
	388.0	stiff clay w/water	c=0.70 ksf	k=100 pci	γ'=0.061 kcf	ε_{50}=0.01
	378.0	soft clay	c=0.45 ksf	k=30 pci	γ'=0.051 kcf	ε_{50}=0.02
	375.0	V/Loose sand w/water	ϕ=29°	k=20 pci	γ'=0.060 kcf	
	370.0	soft clay	c=0.45 ksf	k=30 pci	γ'=0.043 kcf	ε_{50}=0.02
	360.0	stiff clay w/ water	c=0.95 ksf	k=100 pci	γ'=0.054 kcf	ε_{50}=0.007
	355.0	stiff clay w/ water	c=2.20 ksf	k=500 pci	γ'=0.061 kcf	ε_{50}=0.005
	345.0	stiff clay w/ water	c=1.45 ksf	k=100 pci	γ'=0.060 kcf	ε_{50}=0.007
	340.0	V/stiff clay w/ water	c=3.75 ksf	k=1000 pci	γ'=0.068 kcf	ε_{50}=0.005
		strong rock	q_u=1350 psi		γ'=0.086 pci	

Spread Footings

Spread footing foundations are not feasible due to the relatively soft soils found at the site and the anticipated deep scour at the piers.

Drilled Shafts

Drilled shafts could be used at all substructure units; however, they would likely be more costly than driven piles due to the depth of bedrock.

Roadway Approaches

The approach footing support should be designed in accordance with the current IDOT standard. The approach footings will be bearing on soft silty loam (A-4) on the existing approaches. The in-situ subgrade material, soft silty loam, will not provide the maximum service bearing resistance of 2,000 psf required for design. We recommend removal of at least 12 inches of the in-situ material and replacement with compacted "granular embankment special" on geotextile fabric as per IDOT Standard Specifications section 210.

8. Construction Considerations

Temporary Construction Support

The construction sequence will likely require temporary sheet piling along the stage line to retain backfill behind the existing abutments. The maximum excavation line at the west and east abutment is approximately EL 382.5. This assumes excavation to 2-ft below the toe of the abutment slope (El 384.4). The existing embankment and subsoils at both abutments will provide sufficient embedment for cantilever sheet piling. Structural design of the temporary sheet piling can be completed using the procedure in the IDOT Bridge Manual and the charts in Design Guide 3.13.1 – Temporary Sheet Piling Design.

Existing Foundations

There is the possibility of interference during pile driving due to the existing piles and foundations. The Contractor driving or installing the piles should take precautions to avoid any obstructions.

Cofferdam

The most recent borings indicate the water surface elevation in the river to be El 383.8 at the time of drilling (March 2009), whereas the streambed is at El 383.1. The water surface elevation in the river varies depending on the time of the year. Estimated Water Surface Elevation (EWSE) provided on TS&L plans is El 386.3. The height of the water between the anticipated bottom of the underwater structure excavation and the EWSE is 5.7 ft. Cofferdams will be required to complete the installation of the solid wall encasement at the pier locations depending on time of construction. Cofferdam Type 1 is recommended as per IDOT Bridge Manual.

We have been pleased to provide this information. Please contact us if you have any questions regarding this report.

Sincerely,

HANSON PROFESSIONAL SERVICES

Michael I. Musgrove, EIT
Geotechnical Engineer

Reviewed by

Kipkoech K. Chepkoit, Ph.D., P.E.

Senior Geotechnical Engineer

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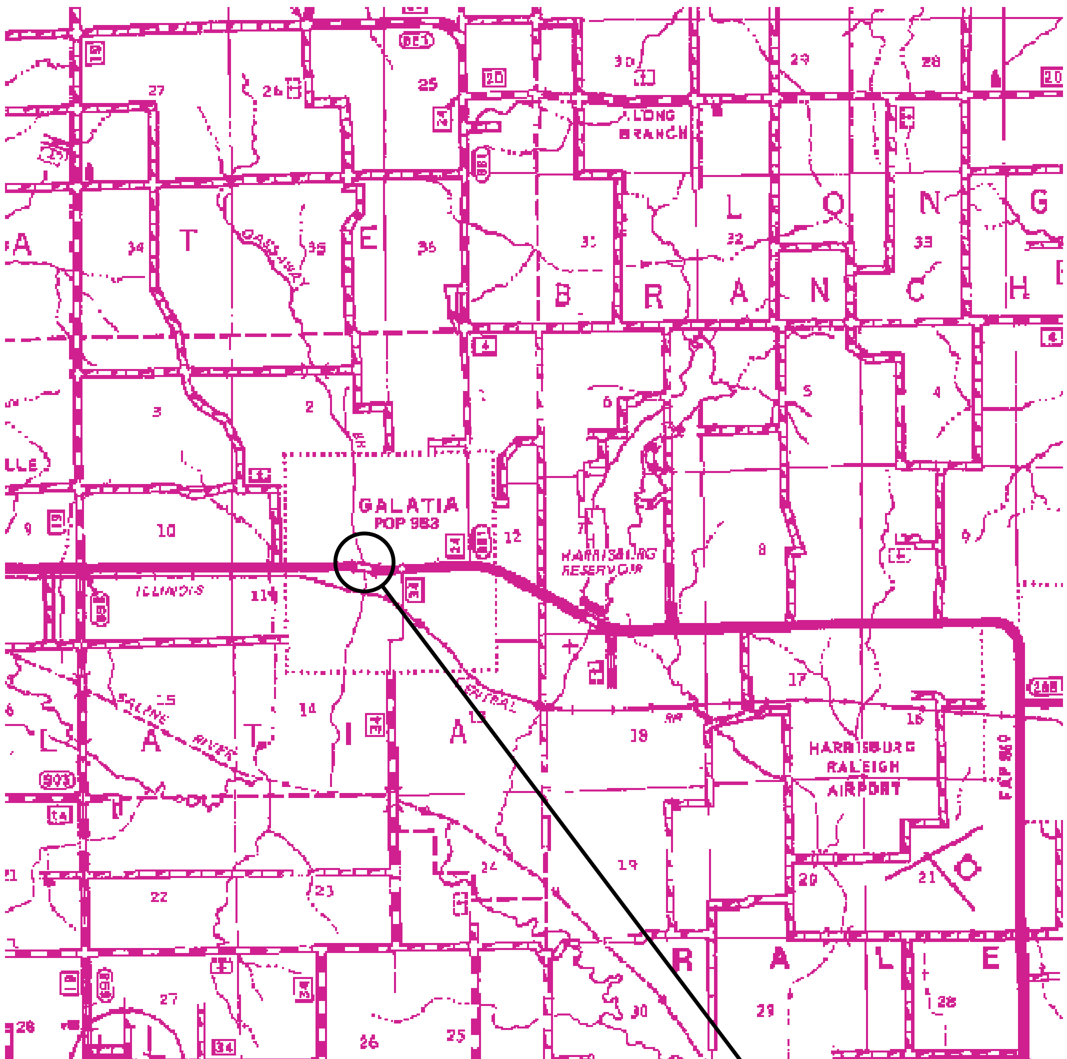
LOCATION MAP

F.A.P. 869 (IL. 34)

Saline County



Structure No. 083-00**69**
F.A.P. 869 (IL. 34)
over
Gasaway Branch

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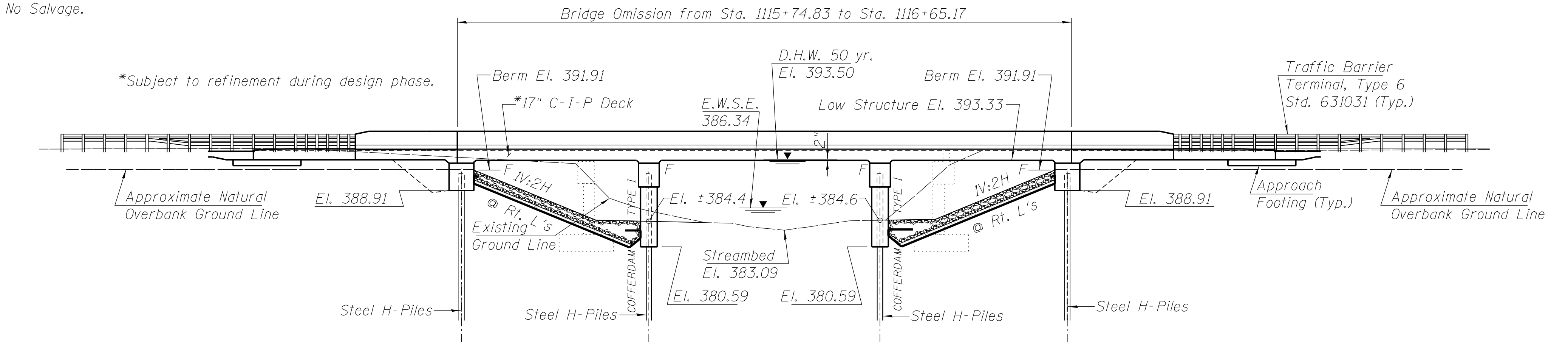
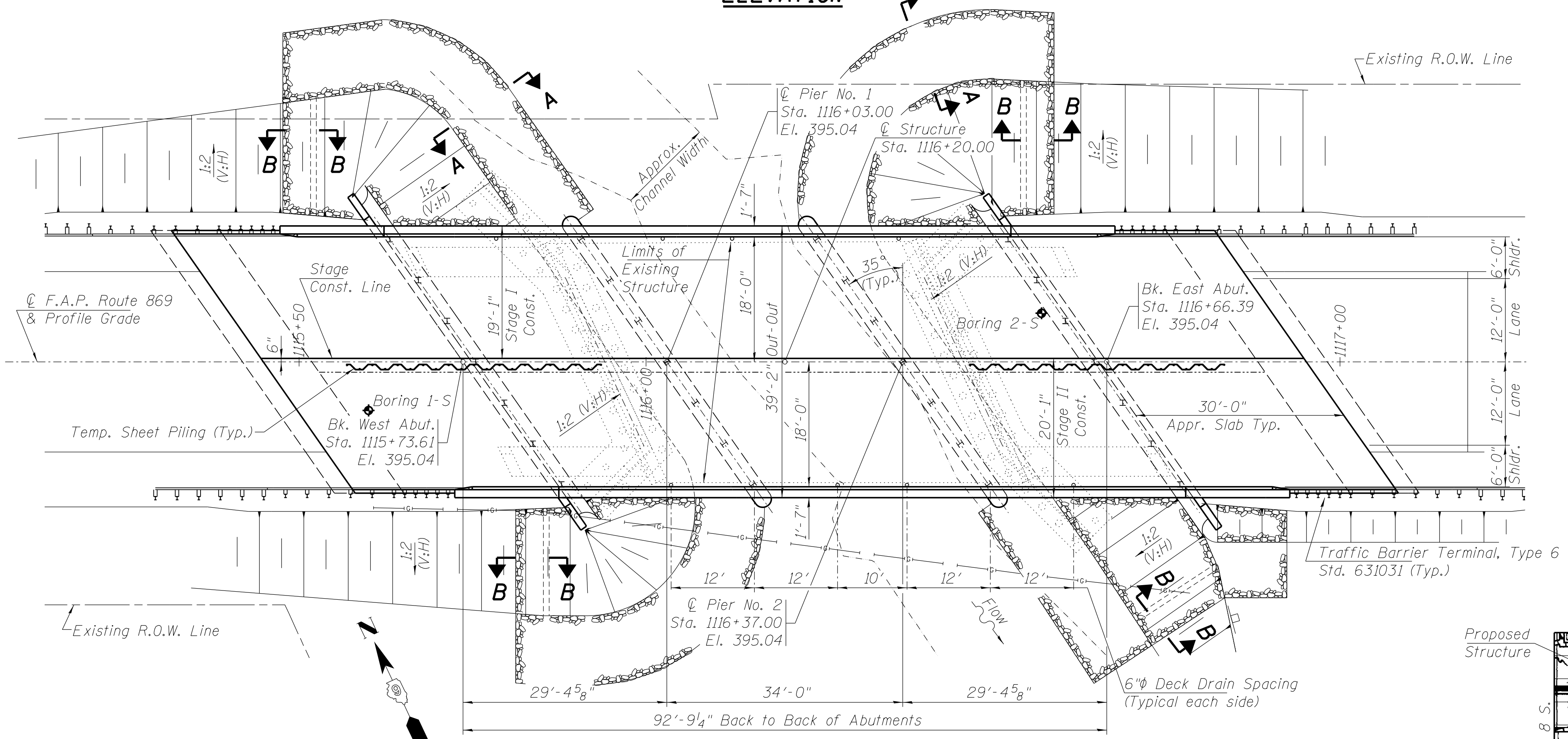
LOCATION MAP
F.A.P. 869 (IL. 34) over Gasaway Branch STR. NO. 083-00 69 SALINE COUNTY
08H0131

B.M.#1020: Chiseled "□" on top of N.W. Wingwall of Existing Structure No. 083-0026. Elev. 392.865
Existing Structure (No. 083-0026):
Originally constructed in 1928 and reconstructed in 1976. The original 1928 superstructure was removed, the existing closed reinforced concrete abutments were modified to accomodate the new 21" PPC Deck Beam Superstructure. The present structure is a Single Span measuring 53'-0⅝" back to back of abutments, with an out to out width of 33'-0". The existing ℄ of Structure is at Sta. 1116+20.00.
The Structure is to be removed and replaced using stage construction.
No Salvage.

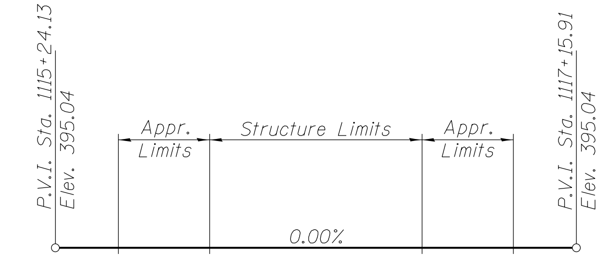
*Subject to refinement during design phase.



ELEVATION



PLAN



PROFILE GRADE - IL. RTE. 34

(Along ℄ of Roadway)

DESIGN SCOUR ELEVATION TABLE

		W. Abut.	Pier 1	Pier 2	E. Abut.
Design Scour Elevation (ft.)	Q 50	388.9	365.6	364.2	388.9
	Q 100	388.9	366.1	364.8	388.9
	Q 500	388.9	370.5	369.8	388.9

WATERWAY INFORMATION

Drainage Area = 5.30 Sq. Mi. Existing & Proposed Low Grade Elev. 394.70 @ Sta. 1105+54

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
Ten-Year	10	1759	343	385	392.0	0.1	0.3	392.1	392.3
Design	50	2897	366	468	393.5	1.6	0.7	395.1	394.2
Base	100	3412	366	468	394.3	1.4	1.0	395.7	395.3
Existing Overtopping	38	2738	366	-	393.3	1.4	-	394.7	-
Proposed Overtopping	58	3055	-	468	393.6	-	1.1	-	394.7

SEISMIC DATA

Seismic Performance Zone (SPZ) = 3
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.33
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.79
Soil Site Class = D

HIGHWAY CLASSIFICATION

F.A.P. Rte. 869 - IL. Rte. 34
Functional Class: Minor Arterial, (Non-Urban)
ADT: 3860 (2008) ; 5190 (2028)
ADTT: 355 (2008) ; 480 (2028)
DHV: 520 (2028)
Design Speed: 40 m.p.h.
Posted Speed: 40 m.p.h.
2-Way Traffic
Directional Distribution: 50:/50

LEGEND

Indicates Boring Location

DESIGN SPECIFICATIONS

2012 AASHTO LRFD Bridge Design Specifications,
6th Edition with 2012 Interims

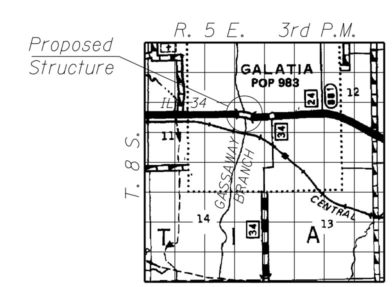
LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)



LOCATION SKETCH

GENERAL PLAN
IL. ROUTE 34 over GASSAWAY BRANCH
F.A.P. ROUTE 869 - SECTION 104B-1
SALINE COUNTY
STATION 1116+20.00
STRUCTURE NO. 083-0069

FILE NAME = 78166_086-0069_TSL.dgn
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USER NAME = huffm00028	DESIGNED - MNM	REVISED -	
PROFESSIONAL DESIGN FIRM LICENSE #184-001084	CHECKED - TEH	REVISED -	
PLOT SCALE =	DRAWN - Rod	REVISED -	
PLOT DATE = 11/13/2012	CHECKED - MNM	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET NO. 01 OF 02 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
869	104B-1	SALINE		

CONTRACT NO. 78166
ILLINOIS FED. AID PROJECT

Boring 1-S (2009)

Sta. 1115+60, 7' RT

	N	Qu	w%	
394.9				Asphalt over Concrete
393.4	15			Crushed Limestone Aggregate
391.4	3	0.5B	24	Medium to soft, very moist, brown, Silt Loam A-4
387.9	16	0.7S	17	Medium, damp to moist, brown mottled grey, Silt Loam A-4
385.4	4	0.5S	21	Medium to soft, very moist, brown mottled grey, Silt Loam A-4
382.9	5	0.9B	24	Medium, very moist, brown mottled grey, Silty Clay Loam A-4
380.9 ▽ AD	4	0.7B	21	
377.9 ▽ DD	2	0.2B	26	Very soft, very moist to wet, brown, Sandy Clay Loam with sand seams
375.4	1 WH	0.7	28	Medium, very moist, grey, Clay A7-6
	WH	0.6B	28	
369.9	2	0.7B	24	Medium, very moist, grey, Silty Clay A7-6
	WH	0.6B	28	
	2	0.8B	35	
362.9	7	1.8B	21	Stiff, moist, grey, Clay to Silty Clay A7-6
360.4	6	1.3B	29	Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6
357.9	5	1.6B	20	Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6 with sand seams
355.4	9		19	Loose, very moist, brown, Silty Sand with Gravel: 62% Sand, 15% Silt, 6% Clay, 17% Gravel
351.4	7	1.6B	21	Stiff, moist, grey, Clay to Silty Clay A7-6
344.9	100/12			Hard to very dense, damp, grey, Conglomerate
339.9	100/8"			Hard, dry, grey, Clay Shale
	100/4"			
329.9	100/4"			Bottom of hole = 64.8 feet

Free water observed at 17.0 feet

Elevation referenced to BM @ N.W wingwall; Elev. = 392.9 ft.

To convert "N" values to "N60" multiply by 1.25

Boring 2-S (2009)

Sta. 1116+57, 7' LT

	N	Qu	w%	
394.7				Asphalt over Concrete
393.2				Crushed Limestone Aggregate
391.7	11	0.8S	16	Medium, moist, brown, Silt Loam A-4
	4	0.6B	22	
387.7	2	0.3B	22	Soft, very moist, grey, Silty Clay Loam A-4
	3	0.4B	34	
382.7	2	0.5B	23	Soft to medium, very moist, grey and brown, Silty Clay Loam A-6
	2	0.6B	22	
377.7	6	0.2B	21	Very soft, very moist, brown, Sandy Clay Loam A-4 with Sand seams
375.2	WH	0.6B	27	Medium, very moist, grey, Clay to Silty Clay A7-6
372.7	WH	0.3B	27	Soft, very moist, grey, Clay to Silty Clay A7-6
370.2	3	1.2B	31	Stiff, moist, grey, Clay A7-6
	4	1.1B	18	
365.2	2	0.7B	20	Medium, very moist, grey, Clay to Silty Clay A7-6
	3	0.8B	22	
360.2 (359.7 ▽ AD)	9	2.3B	19	Very stiff, moist, grey and brown, Clay Loam A-6
	9	2.1B	16	
355.2	10	1.7B	17	Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6
350.2 ▽ DD	5	1.2B	39	Stiff, moist, grey, Clay A-6
344.7	61			Very dense, damp, grey and brown, Conglomerate
339.7	100/11"			Hard, dry, grey, Clay Shale
338.7				Bottom of hole = 55.4 feet

Free water observed at 44.5 feet

Elevation referenced to BM @ NW wingwall; Elev. = 392.9 ft.

To convert "N" values to "N60" multiply by 1.25

Notes:
1. Borings 1-S (2009) and 2-S (2009) were drilled March 16-18, 2009.
2. AD - After Drilling
3. DD - During Drilling

FIGURE 2: SUBSURFACE DATA PROFILE
STRUCTURE NO. 083-0069

SHEET NO. 1	F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1 SHEET	869	104B-1	SALINE	-	
			CONTRACT NO. 78166		
		ILLINOIS	FED. AID PROJECT		

Appendix

Appendix A - Geotechnical Data

The following data is attached to this report:

- IDOT District 9 Boring Logs
- Global Slope Stability Results

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Nine Materials

Bridge Foundation Boring Log

FAP (IL 34) Over Gasaway Branch

Route: FAP 869 (IL 34) Structure Number: 083-0026 Date: 3/16/2009

Section 104B-DR Bored By: Rich Moberly

County: Saline Location: WCL of Galatia Checked By: Rob Graeff

Boring No 1-S
Station 1115+60
Offset 7' Rt CL
Ground Surface 394.9 Ft

Surf Wat Elev: 383.8
Ground Water Elevation
when Drilling 377.9
At Completion 380.9
At: Hrs:

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Asphalt over Concrete					
	393.4				
Crushed Limestone Aggregate			4		
			9		
	391.4		6		
Medium to soft, very moist, brown, Silt Loam A-4					
		5.0	1		
			1	0.5B	24
			2		
	387.9				
Medium, damp to moist, brown mottled grey, Silt Loam A-4			3		
			7	0.7S	17
			9		
	385.4				
Medium to soft, very moist, brown mottled grey, Silt Loam A-4		10.0	1		
			2	0.5S	21
			2		
	382.9				
Medium, very moist, brown mottled grey, Silty Clay Loam A-4			1		
			2	0.9B	24
			3		
		15.0	1		
			2	0.7B	21
			2		
	377.9				
Very soft, very moist to wet, brown, Sandy Clay Loam with sand seams			1		
			1	0.2B	26
			1		
	375.4				
Medium, very moist, grey, Clay A7-6		20.0	WH		
			1	0.7	28
			WH		
			WH		
			WH	0.6B	28
			WH		
	369.9	25.0	WH		
Medium, very moist, grey, Silty Clay A7-6			1	0.7B	24
			1		
			WH		
			WH	0.6B	28
			WH		
		30.0	WH		
			1	0.8B	35
			1		
	362.9				
Stiff, moist, grey, Clay to Silty Clay A7-6			1		
			3	1.8B	21
			4		
	360.4				
Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6		35.0	1		
			2	1.3B	29
			4		
	357.9				
Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6 with sand seams			1		
			2	1.6B	20
			3		
	355.4				
Loose, very moist, brown, Silty Sand with Gravel 62% Sand 15% Silt 6% Clay 17% Gravel		40.0	3		
			5		19
			4		
	351.4				
Stiff, moist, grey, Clay to Silty Clay A7-6					
		45.0	2		
			3	1.6B	21
			4		
	344.9	50.0	7		

N-Std Pentr Test: 2" OD Sampler, 140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

Route: FAP 869 (IL 34)

Date: 3/16/2009

Section: 104B-DR

County: Saline

Boring No: 1-S

Station: 1115+60

Offset: 7' Rt CL

Ground Surface: 394.9 Ft

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Hard to very dense, damp, grey, Conglomerate			100/12		
	339.9	55.0	12		
Hard, dry, grey, Clay Shale			100/8"		
		60.0	100/4"		
	329.9	65.0	100/4"		
		70.0			
		75.0			

Bottom of hole = 64.8 feet

Free water observed at 17.0 feet

Elevation referenced to BM @ NW wingwall; Elev.= 392.9 feet

To convert "N" values to "N60" multiply by 1.25

DEPTH	BLOWS	Qu tsf	W%
80.0			
85.0			
90.0			
95.0			
100.0			

N-Std Pentr Test: 2" OD Sampler,140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Nine Materials

Bridge Foundation
Boring Log

AP 8((IL 34) Over Gasaway Branch

oute: FAP 869 (IL 34) **Structure Number:** 083-0026 **Date:** 3/18/2009

ection 104B-DR **Bored By:** Rich Moberly

ounty: Saline **Location:** WCL of Galatia **Checked By:** Rob Graeff

oring No 2-S
tation 1116+57
ffset 7' Lt CL
round Surface 394.7 Ft

Surf Wat Elev: 383.8
Ground Water Elevation
when Drilling 350.2
At Completion 359.7
At: Hrs:

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Asphalt over Concrete					
	393.2				
Crushed Limestone Aggregate			3		
	391.7		6		
Medium, moist, brown, Silt Loam A-4			5	0.8S	16
		5.0	1		
			2	0.6B	22
			2		
	387.7				
Soft, very moist, grey, Silty Clay Loam A-4			1		
			1	0.3B	22
			1		
		10.0	1		
			2	0.4B	34
			1		
	382.7				
Soft to medium, very moist, grey and brown, Silty Clay Loam A-6			1		
			1	0.5B	23
			1		
		15.0	1		
			1	0.6B	22
			1		
	377.7				
Very soft, very moist, brown, Sandy Clay Loam A-4 with Sand seams			1		
			2	0.2B	21
			4		
	375.2				
Medium, very moist, grey, Clay to Silty Clay A7-6		20.0	WH		
			WH	0.6B	27
			WH		
	372.7				
Soft, very moist, grey, Clay to Silty Clay A7-6			WH		
			WH	0.3B	27
			WH		
	370.2				
		25.0	WH		

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Stiff, moist, grey, Clay A7-6			1	1.2B	31
			2		
			1		
			1	1.1B	18
			3		
	365.2				
Medium, very moist, grey, Clay to Silty Clay A7-6		30.0	WH		
			1	0.7B	20
			1		
			WH		
			1	0.8B	22
			2		
	360.2				
Very stiff, moist, grey and brown, Clay Loam A-6		35.0	1		
			4	2.3B	19
			5		
			1		
			4	2.1B	16
			5		
	355.2				
Stiff, moist, grey, Silty Clay to Silty Clay Loam A-6		40.0	1		
			4	1.7B	17
			6		
	350.2				
Stiff, moist, grey, Clay A7-6		45.0	1		
			2	1.2B	39
			3		
	344.7	50.0	6		

N-Std Pentr Test: 2" OD Sampler,140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

Date: 3/18/2009

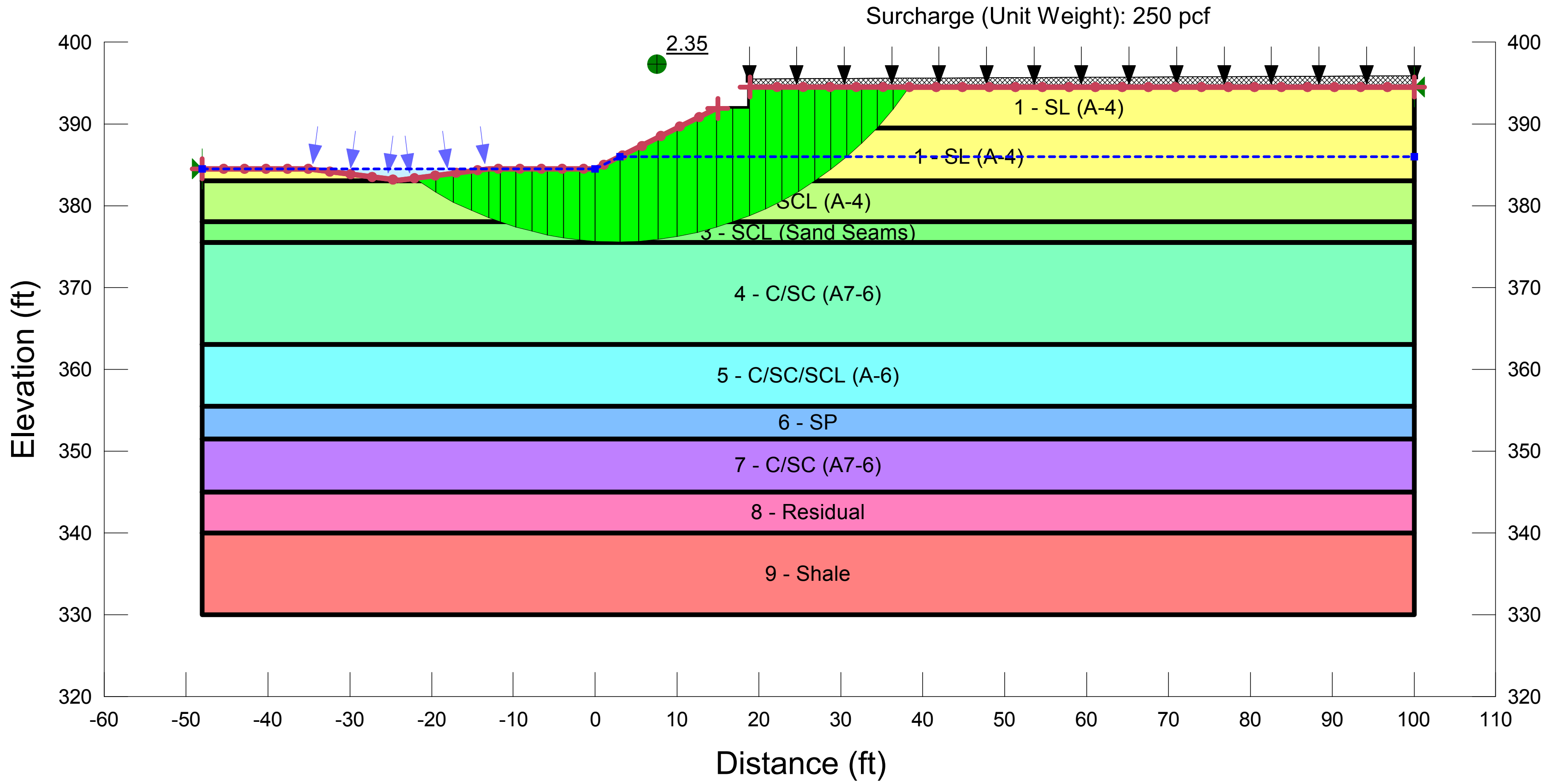
Route: FAP 869 (IL 34)
Section: 104B-DR
County: Saline

Boring No: 2-S
Station: 1116+57
Offset: 7' Lt CL
Ground Surface: 394.7 Ft

Description	DEPTH	BLOWS	Qu tsf	W%
Very dense, damp, grey and brown, Conglomerate		21		
		40		
339.7	55.0	10		
Hard, dry, grey, Clay Shale		100/11"		
338.7				
Bottom of hole = 55.4 feet				
Free water observed at 44.5 feet				
Elevation referenced to BM @ NW wingwall; Elev. = 392.9 feet	60.0			
To convert "N" values to "N60" multiply by 1.25				
	65.0			
	70.0			
	75.0			

Description	DEPTH	BLOWS	Qu tsf	W%
	80.0			
	85.0			
	90.0			
	95.0			
	100.0			

N-Std Pentr Test: 2" OD Sampler,140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)



Name: 1 - SL (A-4) Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 567 psf
Name: 2 - SCL (A-4) Model: Undrained (Phi=0) Unit Weight: 118 pcf Cohesion: 800 psf
Name: 3 - SCL (Sand Seams) Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion: 0 psf Phi: 27 °
Name: 4 - C/SC (A7-6) Model: Undrained (Phi=0) Unit Weight: 105 pcf Cohesion: 680 psf
Name: 5 - C/SC/SCL (A-6) Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1567 psf
Name: 6 - SP Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion: 0 psf Phi: 31 °
Name: 7 - C/SC (A7-6) Model: Undrained (Phi=0) Unit Weight: 121 pcf Cohesion: 1600 psf
Name: 8 - Residual Model: Undrained (Phi=0) Unit Weight: 130 pcf Cohesion: 3750 psf
Name: 9 - Shale Model: Undrained (Phi=0) Unit Weight: 135 pcf Cohesion: 8500 psf

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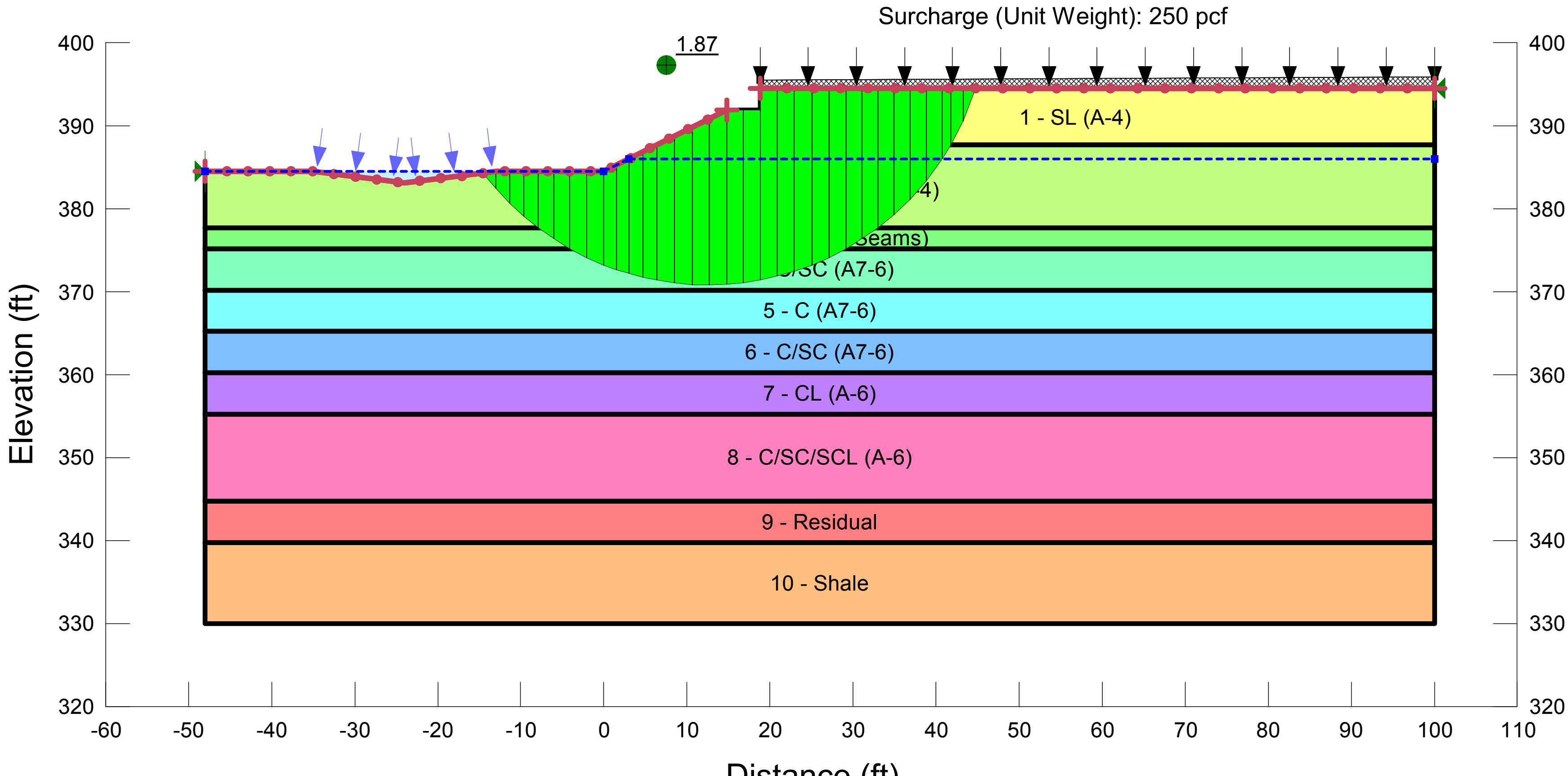
WEST ABUTMENT
BORING 1-S

HANSON



Name: 1 - SL (A-4) Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 700 psf
Name: 2 - SCL (A-4) Model: Undrained (Phi=0) Unit Weight: 113 pcf Cohesion: 450 psf
Name: 3 - SCL (Sand Seams) Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion: 0 psf Phi: 29 °
Name: 4 - C/SC (A7-6) Model: Undrained (Phi=0) Unit Weight: 105 pcf Cohesion: 450 psf
Name: 5 - C (A7-6) Model: Undrained (Phi=0) Unit Weight: 117 pcf Cohesion: 1150 psf
Name: 6 - C/SC (A7-6) Model: Undrained (Phi=0) Unit Weight: 116 pcf Cohesion: 750 psf
Name: 7 - CL (A-6) Model: Undrained (Phi=0) Unit Weight: 123 pcf Cohesion: 2200 psf
Name: 8 - C/SC/SCL (A-6) Model: Undrained (Phi=0) Unit Weight: 122 pcf Cohesion: 1450 psf
Name: 9 - Residual Model: Undrained (Phi=0) Unit Weight: 130 pcf Cohesion: 3750 psf
Name: 10 - Shale Model: Undrained (Phi=0) Unit Weight: 135 pcf Cohesion: 8500 psf

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EAST ABUTMENT
BORING 2-S

HANSON