STRUCTURE GEOTECHNICAL REPORT (Revised)

Existing SN: 051-0051
Proposed SN: 051-0065

F. A. S. 1806 (IL 250)
Over Unnamed Stream
Section 2B-1
Lawrence County

Contract No.: 74106
Job No.: P-97-026-05
D-97-035-05

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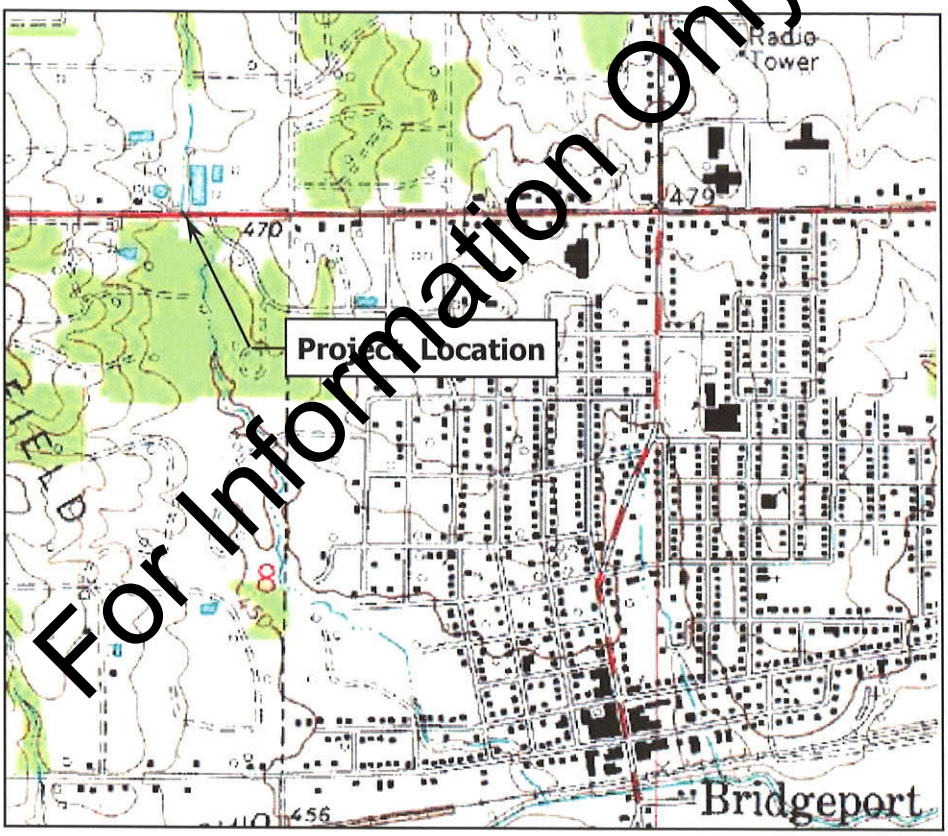
Report Date (Revised): August 7, 2009
Report Date (Original): April 24, 2009

Attachments: SGR Responsibility Checklist
Boring Location Map

1.0 Project Description

The purpose of this geotechnical study is to explore the existing subsurface conditions present at the existing structure (SN 051-0051) carrying FAS 1806 (IL 250) over an unnamed stream in Southwest ¼ of Section 5 and Northwest ¼ of Section 8, Township 3 North, Range 12 West, 3rd PM in Lawrence County approximately 0.7 miles west of Bridgeport, IL.



2.0 Existing and Proposed Structure Information

Existing Structure

The existing structure (Existing Structure Number 051-0051) is a single-span, reinforced concrete slab bridge supported by two closed abutments on spread footings on untreated wooden piles. The original structure was constructed in 1924 with a superstructure 20'-0" in length face to face of abutments with a 32'-3" roadway width on a 0° skew. All four corners of the structures are protected with the Texas Turndown end sections.

Proposed Structure

The proposed structure is a single span steel wide flange bridge having 45'-0" back to back of integral abutments using a beam or plate girder on the existing skew and alignment. The proposed face to face parapet clear width is 36'-0". The proposed bridge will have 2:1 end-slope and open abutments set back to avoid the existing substructure units.

3.0 Site Investigation, Subsurface Exploration and Generalized Subsurface Conditions

No existing soils information could be obtained for the existing structure. Two new soil test borings, 1-East and 2-West were advanced IDOT personnel in October 2008. Test boring 1-East was advanced at station 234+65 (Elev. 460.51), test boring 2-West was advanced at station 235+55 (Elev. 460.93).

The soil profile encountered is described as gray, stiff sandy clay to sandy clay loam from just below asphalt /concrete surface (Elev. 460.51 – 460.93) to Elevation 456.01 (1-East) and Elevation 455.13 (2-West). Moisture contents in the sandy clay and sandy clay loam ranged from 16 to 17 percent. In both soil borings, the sandy clay and sandy clay loam transitioned into a gray, soft to very soft (muck) silty loam that extended to depths of approximately 7 feet. Moisture contents in the very soft (muck) ranged from 20 to 27 percent. The soft to very soft silty loam transitioned into a brown/gray to gray, medium to stiff, sandy clay loam in both borings. The brown to gray, medium to stiff, sandy clay loam extended to depths of 10.2 feet in boring 2-West and 12 feet in boring 1-East.

Continuing with 1-East, the brown to gray medium to stiff sandy clay loam transitioned into a blue, stiff clay. The blue, stiff, clay extended to a depth of 14.5 feet (Elev. 446.01). The blue stiff clay transitioned back into a gray, medium to stiff silty loam that extended to a depth of 20 feet (Elev. 440.51). Moisture contents within the silty loam ranged from 47 to 50 percent. Wood fragments were observed within the samples collected within the silty loam stratum. The medium to stiff silty loam transitioned into a gray, soft silty loam that extended to a depth of 25 feet (Elev. 435.51). Moisture contents within the soft, silty loam ranged from 18 to 27 percent. The silty loam transitioned into a gray, stiff to very stiff, clay loam till to silty clay till and extended to a depth of 49.5 feet (Elev. 411.01) where a gray, very dense, silty clay shale was encountered. The boring was terminated in the gray, very dense, silty clay shale at a depth of 50.3 feet (Elev. 410.21).

Beneath the brown to gray, medium to stiff sandy clay loam, previously mentioned, 2-West transitioned into a red marbled gray, stiff to very stiff, sandy clay loam till. The sandy clay loam till extended to a depth of 39.5 (Elev. 421.43) where a gray very dense, silty clay shale was encountered. The very dense gray clay shale was described as slightly to moderately weathered. The very dense, gray clay shale was cored from a depth of 40.4 feet (Elev. 420.53) to 50.4 (Elev. 410.53) were the exploration was terminated. Unconfined compressive strength tests yielded results of 7.9 to 14.2 tons per square feet (tsf).

Groundwater was observed in soil boring 1-East at a depth of 45.1 feet (Elev. 415.5) at completion of the boring and 8.51 feet (Elev. 452.0) after 7 days. Due to coring activities, groundwater levels could not be ascertained immediately. After 24-hours, groundwater was observed in soil boring 2-West at a depth of 5.73

4.0 Geotechnical Evaluations

A. Settlement

Based on the proposed project information, the existing grade will be raised approximately 1.9 feet at each abutment and tapered back into the existing grade under the approach slabs. Based on preliminary settlement calculations, the increase in stress due to the increase in fill would produce only minor settlements in the range of 1-inch near the eastern abutment and less than 1-inch near the western abutment. However, the majority of the settlement is anticipated to take place during construction of the approaches.

Based on the soil data, the potential settlement should not adversely affect the approach pavement. In addition, an anticipated allowable bearing capacity of 2,000 pounds per square feet (psf) should be adequate for fill placement.

However, based on the soil boring data, the natural moisture contents of the upper silty clays were mostly above 20%. Therefore, it is possible that some settlement could occur under the proposed abutments due to the increase in soil stress from the bridge structural loadings. As a result, due to the settlement potential and type of proposed abutment (integral), spread footing foundations would not be feasible for this structure.

B. Slope Stability

Based on available soil boring information and recommendations from the IDOT Geotechnical Manual, slope stability calculations have been conducted using the XSTABL computer program. The proposed structure endslopes will be stone riprap (Class A4) protected. The use of 1:2 (V:H) endslopes yielded acceptable static Factors of Safety of greater than 1.9 for the west and east embankment, respectively. A seismic analysis yielded acceptable Factors of Safety of greater than 1.5 for the west and east embankments, respectively.

C. Seismic Considerations

Based on the requirements of the 2008 IDOT Bridge Manual and the 2009 Design Guide – AGMU Memo 09.1 – Seismic Site Class Definition, the required seismic data shall be based on new USGS seismic hazard maps for 7% probability of exceedance in 75 years (1000 year return period) and the 2008 AASHTO LRFD Bridge Design Specifications Manual.

Based on the seismic hazard maps the following coefficients should be used in design:

S_s=0.352 g, F_a=1.52; therefore Design Spectral Accelerations at 0.2 sec, (S_{Ds})=0.534 g

S_1=0.097 g, F_v=2.40; therefore Design Spectral Acceleration at 1.0 sec, (S_{D1})=0.232 g

According to Table 3.10.3.1-1 (Site Class Definitions) of the 2008 AASHTO LRFD Manual, the project site soil profile is most accurately described as the AASHTO Soil Site Class D.

According to Table 3.10.6-1 (Seismic Zones) of the 2008 AASHTO LRFD Manual, the Seismic Performance Zone is most accurately described as (SPZ)=2 ($0.15<S_{D1}\leq 0.30$)

According to the boring log data, liquefaction of soil layers does not appear to be a concern.

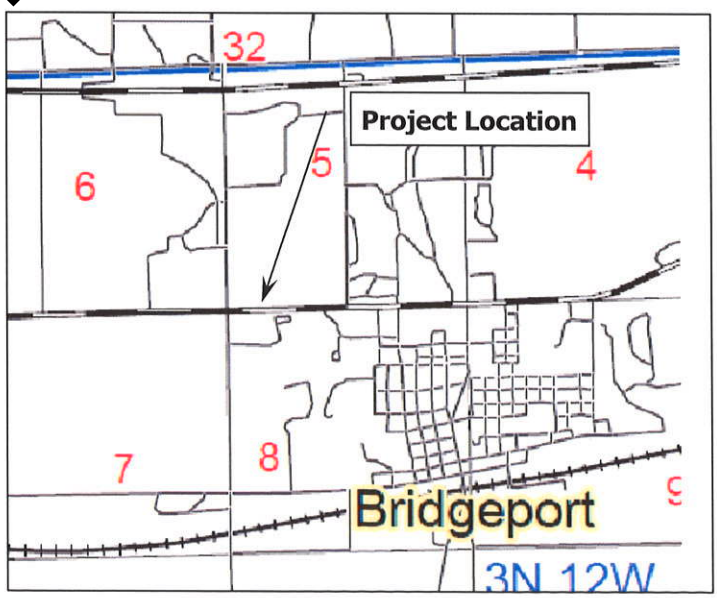
D. Scour

Based on the revised Hydraulic Report dated July 1, 2008, the anticipated scour depth for the 100 year flood event under pressure flow is 8.0 feet. Based on boring data, the in-situ soils at the stream bottom elevation are sandy, silty clay loams with soft consistencies. Therefore, no reduction in the Hydraulic Report scour depths is warranted. The proposed structure will include open (integral) abutments protected by riprap, Therefore, based on the 2008 IDOT Bridge Manual (page 2-80), the design scour is typically set at the bottom of the abutment or pile encasement and not at the predicted scour.

Design Scour Elevation (ft)	West Abutment	East Abutment
	455.95	455.72

E. Mining Activity

Based on a review of the Illinois State Geological Survey's on-line collection of County Coal Maps and Directories, the proposed structure is not located over a mine or mined out area.



5.0 Foundation Evaluations and Design Recommendations

Based on the results of the subsurface exploration, current site conditions observed, and laboratory results, items of geotechnical interest and considerations are discussed in the following sections. A summary of the estimated abutment loadings is provided in the appendix.

A. Spread Footings

Based on the soil boring logs, several stratum of soils in the upper soil zones consisted of soft to stiff silty clay loam soils that were above 20% natural moisture. Due to the proposed use of an integral abutment structure and the potential for settlement, spread footing foundations would not be feasible for this structure.

B. Drilled Shafts / Piers

An integral abutment structure has been proposed at this site. Due to the soil type and wet conditions in the lower depths, drilled shaft foundation would require special treatment such as casing and are therefore not recommended.

C. Piles

Based on the IDOT Bridge Manual, driven piling is the preferable alternative for the integral abutment type. Based on the limitations set forth in the IDOT Bridge Manual steel H-piles or metal shell piles may be used for the proposed structure. However, due to the presence of shallow clay shale bedrock and seismic conditions, end bearing H-piles are recommended

According to the boring logs, the clay shale bedrock is fairly competent. Design calculations were conducted to obtain the nominal required bearing as directed by the IDOT Bridge Manual and Design Guide 3.10.1 – LRFD Geotechnical Pile Design Procedure.

The piles were extended to the clay shale bedrock. Using the required nominal unit end bearing resistance (q_p) value for shale (3888 ksf as directed on page 3.10.1-2 of the Design Guide) times the end bearing area of the pile, the nominal required bearing values were obtained. However, due the end bearing on the clay shale, the nominal required bearing values calculated exceeded the maximum nominal required bearing for each steel HP section. As a result, it is recommended that the end-bearing H-piles be driven to the maximum nominal required bearing capacity for the pile size chosen.

As stated in the IDOT Bridge Manual when H-piles are driven to their maximum nominal required bearing and the majority of resistance is developed in rock, the estimated length of the pile shall include the amount of penetration into rock. Given the fairly competent nature of the clay shale bedrock, a penetration of approximately 4.0 feet into the shale is anticipated. It should be noted that the pile data sheets provided do not supersede IDOT pile foundation design policy.

Table 1 and Table 2 provided below gives the anticipated rock bearing elevations for the west and east abutments, respectively based on soil boring data and estimated pile length. The pile lengths are based on 2 feet embedment into the integral abutment and 4 feet embedment into shale bedrock. In addition, the Tables provide the nominal required bearing (which in this case is the piles maximum nominal required bearing) and the factored resistance allowable for each H-pile type.

Table 1 East Abutment (Estimated End Bearing Pile Length / Pile Capacity)

Top H-Pile Elevation (includes 2' into abutment)	Top of Clay Shale Bedrock Elevation (based on boring logs 1-East)	Est. H-Pile Bottom Elevation (includes 4' penetration into clay shale bedrock)	Est. End Bearing Pile Length (ft)	Pile Type	Nominal Required Bearing** (kips) ** NRB is same as Max NRB due to end Bearing on Shale	Factored Resistance Allowable (kips)
457.72	411.01	407.01	50.71	HP 8X36	286	143
				HP 10X42	335	167.5
				HP 10X57	454	227
				HP 12X53	419	209.5
				HP 12X63	497	248.5
				HP 12X74	589	294.5
				HP 12X84	664	332
				HP 14X73	578	289
				HP 14X89	705	352.5
				HP 14X102	810	405

Table 2 West Abutment (Estimated End Bearing Pile Length / Pile Capacity)

Top H-Pile Elevation (includes 2 feet into abutment)	Top of Clay Shale Bedrock Elevation (based on boring logs 2-West)	Est. H-Pile Bottom Elevation (includes 4' penetration into shale bedrock)	Est. End Bearing Pile Length (ft)	Pile Type	Nominal Required Bearing** (kips) ** NRB is same as Max NRB due to end Bearing on Shale	Factored Resistance Allowable (kips)
457.95	421.43	417.43	40.52	HP 8X36	286	143
				HP 10X42	335	167.5
				HP 10X57	454	227
				HP 12X53	419	209.5
				HP 12X63	497	248.5
				HP 12X74	589	294.5
				HP 12X84	664	332
				HP 14X73	578	289
				HP 14X89	705	352.5
				HP 14X102	810	405

Due to the difference in elevation (approx 10 feet) between the East and West abutment borings, one test pile is recommended at each abutment. Since the piles are recommended to be end bearing on shale, metal shoes should not be required. As per AASHTO, single span bridges do not require seismic design considerations. Therefore, a seismic lateral loading analysis was not conducted.

Pile capacities data sheets have also been provided in the Appendix which list various pile types nominal required bearing and factored resistance allowable based on pile lengths shorter that the anticipated rock bearing pile lengths provided in Tables 1 and 2. The pile capacity data sheets provided in the Appendix were developed for preliminary pile drivability analysis only. As stated in the preceding paragraphs, it is recommended that the piles be extended to the clay shale bedrock for end-bearing capacity.

Design Capacity Limitations

There are no downdrag, liquefaction, scour or settlement issues at this structure that would result in capacity loss of the piling. Therefore, no design capacity limitations are necessary.

5.4 Construction Considerations

Temporary Sheeting and Soil Retention

Based on available project information, traffic will be detoured around the project area therefore; staged construction and need for temporary sheeting or soil retention structures should not be required.

Cofferdams and Underwater Structure Excavation Protection

Both the east and west abutments are pile supported and are to be cast above the expected normal water elevation. Therefore, no cofferdams, seal coats or underwater structure excavation protection should be necessary

Site and Soil Conditions

Based on project information, the bridge approach grades will be raised approximately 1.9 feet at each abutment. It is recommended that during the earth work activities and prior to fill placement, that the approach grades be inspected by means of proofrolling. Any area judged to be soft or unsuitable should be undercut and replaced with properly compacted engineered fill. Engineered fill placement should be monitored by nuclear density testing methods to ensure compaction requirements have been met.

Based on site conditions the used of granular working platforms does not appear warranted. Based on the type of structure replacement, no temporary geotextile walls or temporary mechanically stabilized earth walls will be needed.

Foundation Construction

Shale bedrock was encountered at relatively shallow depths of approximately 39.5 to 49.5 feet below grade at the west and east abutments. The soils above the bedrock were mainly silty clay loams ranging in consistencies from medium to stiff. Given the soil conditions, H-piles should be able to be driven to bedrock using normal pile driven techniques. Since the end-bearing piles will be driven through silty clays to shale bedrock, metal pile shoes should not be required.

5.5 Computations

Pile bearing capacities were developed as per IDOT Bridge Manual and Design Guide 3.10.1 LRFD Geotechnical Pile Design Procedure. Slope stability calculations were conducted using XSTABL.

6.0 Geotechnical Data

Subsurface boring logs and boring profile sheet are provided in the appendix of this report.

Appendix A

Structure Geotechnical Report Responsibility Checklist

Illinois Department of Transportation

Structure Geotechnical Report Responsibility Checklist

Structure Number: 051-0015 (prop.) 051-0065 (exist.) Contract Number: 74106 Date: 4/24/2009
Route: FAS 1806 (IL 250) Section: 2B-1 County: Lawrence
TSL plans by: Thouvenot, Wade & Moerchen, Inc.
Structure Geotechnical Report and Checklist by: Geotech Engineering & Testing, Inc.

IDOT Structure Geotechnical Report Approval Responsibility : ☐ Qualified District Geotechnical Personnel ☒ BBS Central Geotechnical Unit

	Yes	No	N/A
Geotechnical Data, Subsurface Exploration and Testing			
All pertinent existing boring data, pile driving data, site inspection information included in the report?	☒	☐	☐
Are the preliminary substructure locations, foundation needs, and project scope discussions between Geotechnical Engineer and Structure Planner included in the report?	☒	☐	☐
All ground and surface water elevations shown on all soil borings and discussed in the report?	☒	☐	☐
Has all existing and new exploration and test data been presented on a subsurface data profile?	☒	☐	☐
Is the exploration and testing in accordance with the IDOT Geotechnical Manual policy?	☒	☐	☐
Are the number, locations, depths, sampling, testing, and subsurface data adequate for design?	☒	☐	☐
Geotechnical Evaluations			
Have structure or embankment settlement amounts and times been discussed in report?	☒	☐	☐
Does the report provide recommendations/treatments to address settlement concerns?	☐	☐	☒
Has the critical factor of safety against slope instability been identified and discussed in the report?	☒	☐	☐
Does the report provide recommendations/treatments to address stability concerns?	☐	☐	☒
Is the seismic design data (PGA, amplification category, etc.) noted in the report?	☒	☐	☐
Have the vertical and horizontal limits of any liquefiable layers been identified and discussed?	☒	☐	☐
Has seismic stability been discussed and have any slope deformation estimates been provided?	☒	☐	☐
Has the report discussed the proximity of ISGS mapped mines or known subsidence events?	☒	☐	☐
Has scour been discussed, any Hydraulics Report depths reported & soil type reductions made?	☒	☐	☐
Do the Factors of Safety meet AASHTO and IDOT policy requirements?	☒	☐	☐
Geotechnical Analyses and Design Recommendations			
When spread footings are recommended, has a bearing capacity and footing elevation been provided for each substructure or footing region?	☐	☐	☒
Has footing sliding capacity been discussed?	☐	☐	☒
When piles are recommended, does the report include a table indicating estimated pile lengths vs. a range of feasible required bearings and design capacities for each pile type recommended?	☒	☐	☐
Have any downdrag, scour, and liquefaction reductions in pile capacity been addressed?	☐	☐	☒
Will piles have sufficient embedment to achieve fixity and lateral capacity?	☒	☐	☐
Have the diameters & elevations of any pile pre-coring been specified (when recommended)?	☐	☐	☒
Has the need for test piles been discussed and the locations specified (when recommended)?	☒	☐	☐
Has the need for metal shoes been discussed and specified (when recommended)?	☒	☐	☐
When drilled shafts are recommended, have side friction and/or end-bearing values been provided?	☐	☐	☒
Has the feasibility of using belled shafts been discussed when terminating above rock, or have estimated top of rock elevations been provided when extending into rock?	☐	☐	☒
Have shaft fixity, lateral capacity, and min. embedment been discussed?	☐	☐	☒
When retaining walls are required, has feasibility and relative costs for various wall types been discussed?	☐	☐	☒
Have lateral earth pressures and backfill drainage recommendations been discussed?	☐	☐	☒
Has ground modification been discussed as a way to use a less expensive foundation or address feasibility concerns?	☐	☐	☒
Have any deviations from IDOT Geotechnical Manual or Bridge Manual policy been recommended?	☐	☒	☐
Construction Considerations			
Has the need for cofferdams, seal coat, or underwater structure excavation protection been discussed?	☒	☐	☐
Has stability of temporary construction slopes vs. the need for temporary walls been discussed?	☒	☐	☐
Has the feasibility of cantilevered sheeting vs. a temporary soil retention system been discussed?	☒	☐	☐
Has the feasibility of using a geotextile wall vs. a temp. MSE for any temp fill retention been noted?	☐	☐	☒

"In order to aid in determining the level of departmental review, please attach additional documentation or reference specific portions of the SGR to clarify any checklist responses that reflect deviation from IDOT policy/practice."

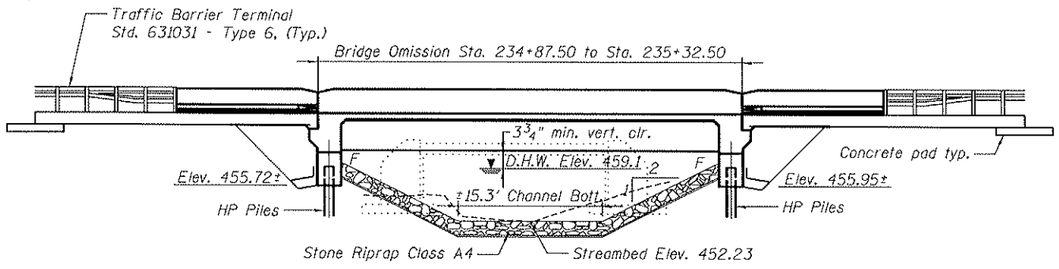
Appendix B

Boring Location Map

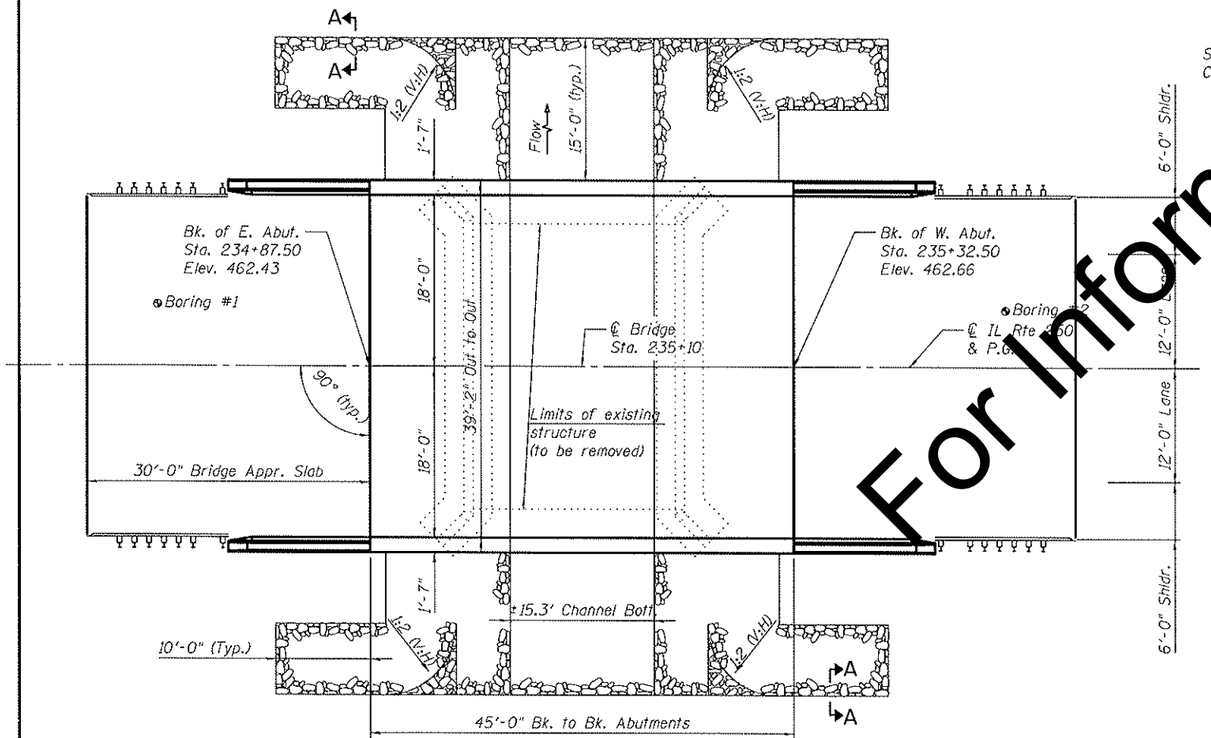
Bench Mark: B.M. 509-Chiseled square on southeast wing wall of S.N. 051-0051 Elev. 460.39

Existing Structure: S.N. 051-0051 was built in 1924 as a single span reinforced concrete deck slab structure on closed abutments with pile supported footings. It consists of a superstructure 20'-0" in length, (face to face of abutments), and provides a width of 32'-2" out to out. The structure was constructed without a skew. Traffic will be detoured.

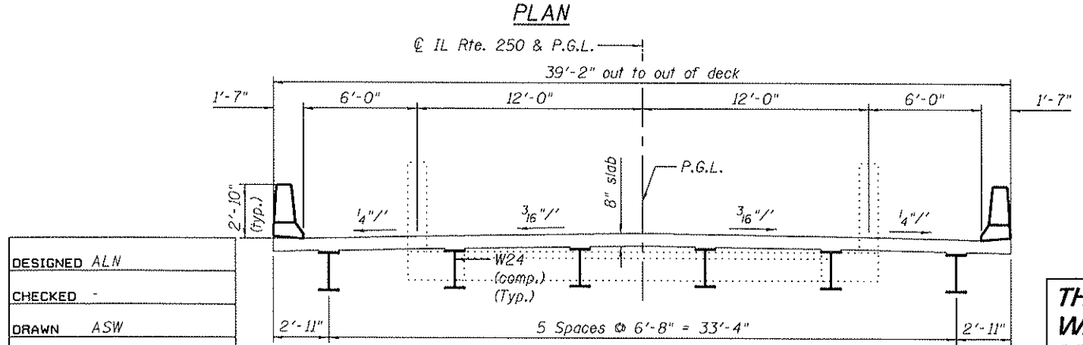
Salvage: None.



ELEVATION

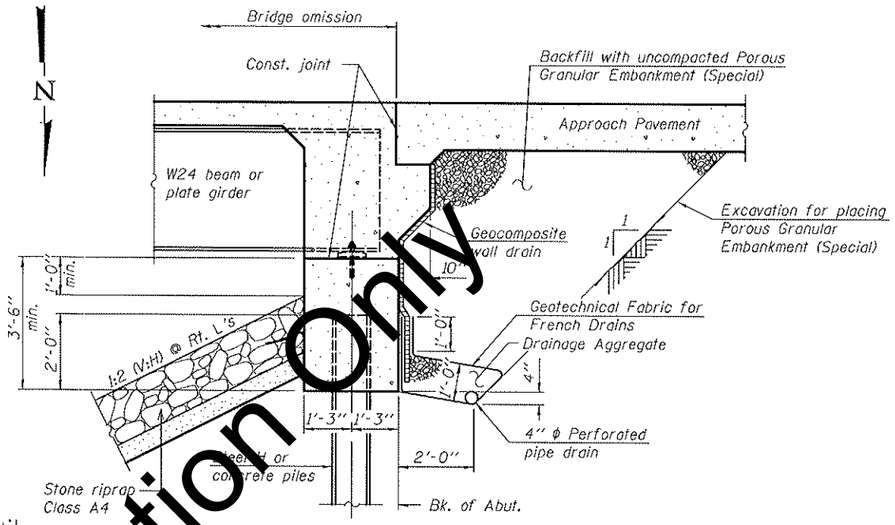


PLAN

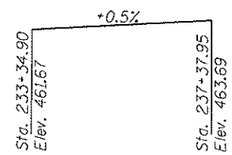


CROSS-SECTION

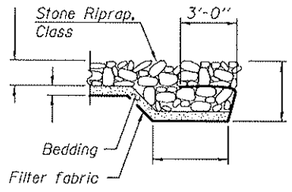
DESIGNED	ALN
CHECKED	-
DRAWN	ASW
CHECKED	ALN



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. L's)



PROFILE GRADE
(along ℄ IL Rte 250)



SECTION A-A

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.164g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.432g
Soil Site Class = C

DESIGN SPECIFICATIONS

2007 AASHTO LRFD Bridge Design Specifications with 2008 Interims

LOADING HL-93

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

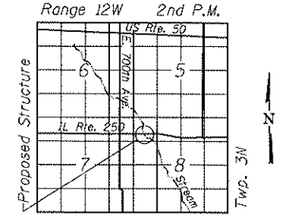
DESIGN STRESSES

FIELD UNITS

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

HIGHWAY CLASSIFICATION

F.A.S. Rte. 1806-IL. Rte. 250
Functional Class: Rural Major Collector
ADT: 3051 (2010); 3655 (2030)
ADTT: 232 (2010); 278 (2030)
DHV: 402 (2030)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
2-Way Traffic
Directional Distribution: 50:50



LOCATION SKETCH

DESIGN SCOUR ELEVATION TABLE

Design Scour Elevation (ft.)	W. Abut.	E. Abut.
	452.72	452.95

WATERWAY INFORMATION

Drainage Area = 1.0 sq. mi. Low Grade Elev. 461.50 @ Sta. 232+65.90

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Hwt. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	630	106	170	458.4	0.5	0	458.9	458.4
Design	50	1072	117	198	459.1	1.8	0.6	460.9	459.7
Base	100	1279	117	206	459.3	1.8	1.0	461.1	460.3
Overtopping	35	1000	117	N/A	459.0	1.7	N/A	460.7	N/A
Max. Calc.	500	1801	117	211	459.8	1.9	1.8	461.7	461.6

DRAFT

GENERAL PLAN & ELEVATION
ILLINOIS ROUTE 250 OVER A STREAM
F.A.S. RT. 1806 SEC. 2B-1
LAWRENCE COUNTY
STATION 235+10
STRUCTURE NO. XXX-XXXX

THOUVENOT, WADE & MOERCHEN, INC.
CORPORATE OFFICE
4940 Old Collinsville Road
Swansea, Illinois 62226
Tel: 618.624.4488
Fax: 618.624.6888
SWANSEA • WATERLOO • EDWARDSVILLE • CARBONDALE • ST. CHARLES
TWM
ENGINEERS ◆ SURVEYORS ◆ PLANNERS

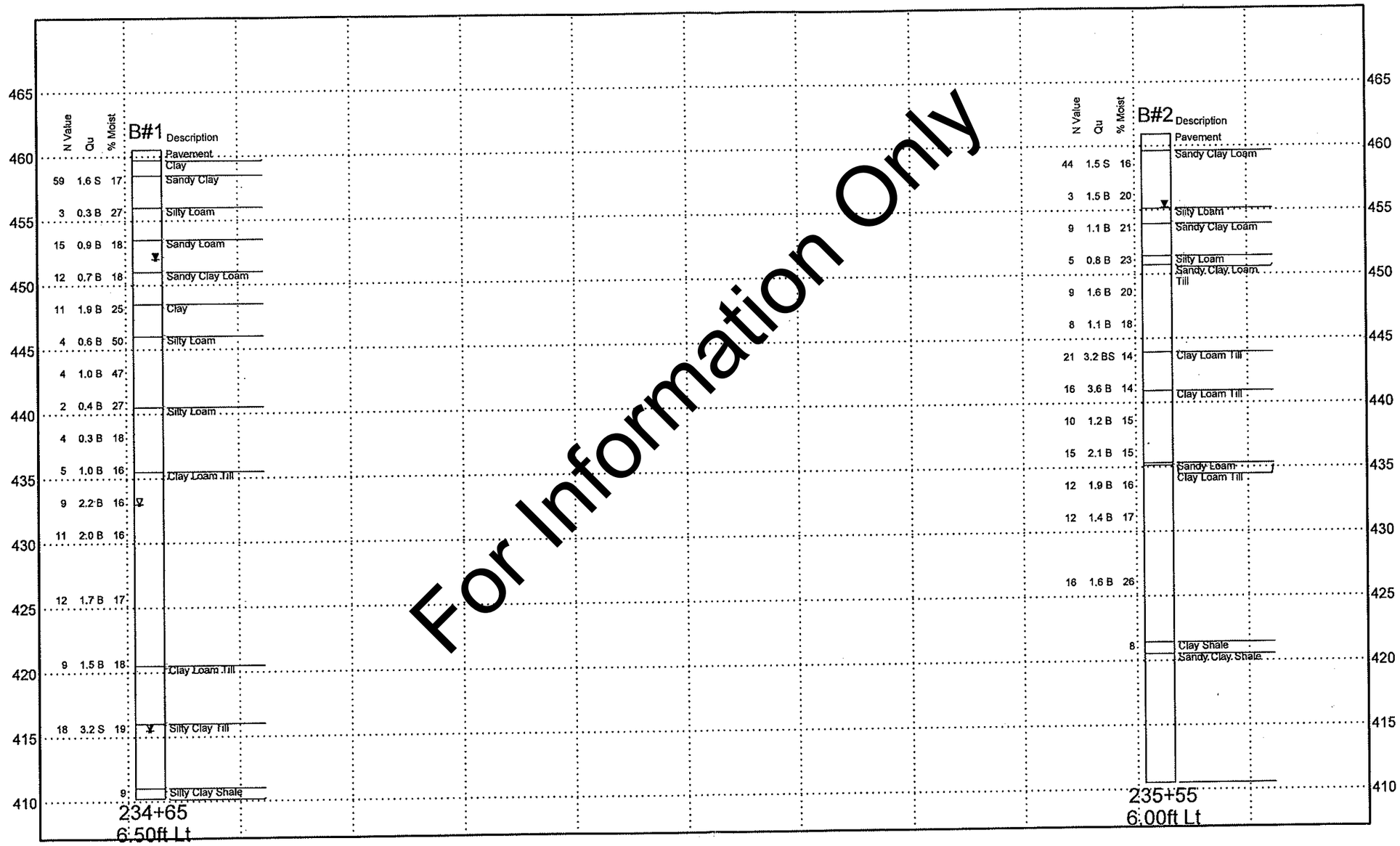
SHEET NO. 1
1 SHEET

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1806	2B-1	LAWRENCE	-	
		CONTRACT NO. 74106		
FED. ROAD DIST. NO. _	ILLINOIS	FED. AID PROJECT		

Appendix C

Boring Profile Sheet

Located in the Sec 5 - SW 1/4, Sec 8 - NW 1/4 of Section , Township 3 N, Range 12 W of the 3 P.M.



NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

VARIATIONS IN SUBSURFACE CONDITIONS MAY EXIST BETWEEN BORINGS

Groundwater
First Encounter
Completion
after (refer to log) hours

Abbreviations
WOH - Sampler Advanced by Weight of Hammer, WOP - Weight of Pipe
B.S. - Before Seating

SUBSURFACE DATA PROFILE

Route: FAS 1806

Section: 2B-1

County: Lawrence

SUBSURFACE DATA PROFILE 051-0051.GPJ D6TEMPLT.GDT 08/11/25

SUBSURFACE DATA PROFILE 051-0051.GPJ D6TEMPLT.GDT 08/11/25

Appendix D

Soil Boring Logs

Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/28/08

ROUTE FAS 1806 **DESCRIPTION** IL 250 over Un-named stream **LOGGED BY** E. Sandschafer

SECTION 2B-1 **LOCATION** Sec 5 - SW 1/4, Sec 8 - NW 1/4, **SEC.**, **TWP.** 3 N, **RNG.** 12 W, 3 **PM**

COUNTY Lawrence **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** Auto 140#

STRUCT. NO. 051-0051
Station 235+10

BORING NO. 1 East
Station 234+65
Offset 6.50ft Lt
Ground Surface Elev. 460.51 ft

Surface Water Elev. Dry ft
Stream Bed Elev. 452.19 ft

Groundwater Elev.:
First Encounter 433.0 ft
Upon Completion 415.5 ft
After 168 **Hrs.** 452.0 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				2 3/8" asphalt on 7 1/2" concrete pavement. 459.71
				Gray, CLAY. 458.51
	15			Stiff, damp, gray, SANDY CLAY.
	22	[illegible]	17	
	37	S		
				456.01
-5				Soft, very damp, gray, SILTY LOAM.
	2	0.3	27	
	1	B		
				453.51
	5			Medium, damp, brown/gray, SANDY LOAM.
	5	0.9	18	
	10	B		
				451.01
-10	4			Medium, damp, red marbled gray, SANDY CLAY LOAM.
	7	0.7	18	
	5	B		
				448.51
	4			Stiff, damp, blue, CLAY.
	5	1.9	25	
	6	B		
				446.01
-15	0			Medium to stiff, damp, gray, SILTY LOAM. *With Wood fragments.*
	2	0.6	50	
	2	B		
	0			
	2	1.0	47	
	2	B		
				440.51
-20	0			
				Soft, very damp, gray, SILTY LOAM.
	1	0.4	27	
	1	B		
	0			
	2	0.3	18	
	2	B		
				435.51
-25	0			Stiff, damp, gray, CLAY LOAM TILL.
	2	1.0	16	
	3	B		
	2			
	4	2.2	16	
	5	B		
-30	3			
	4	2.0	16	
	7	B		
-35	3			
	5	1.7	17	
	7	B		
				420.51
-40	2			

Latitude W 87 deg 46.276 min, Longitude N 38 deg 42.974 min, Map Datum WGS 84

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)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/28/08

ROUTE FAS 1806 **DESCRIPTION** IL 250 over Un-named stream **LOGGED BY** E. Sandschafer

SECTION 2B-1 **LOCATION** Sec 5 - SW 1/4, Sec 8 - NW 1/4, **SEC.**, **TWP.** 3 N, **RNG.** 12 W, 3 **PM**

COUNTY Lawrence **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** Auto 140#

STRUCT. NO. 051-0051
Station 235+10

BORING NO. 1 East
Station 234+65
Offset 6.50ft Lt
Ground Surface Elev. 460.51 ft

Surface Water Elev. Dry ft
Stream Bed Elev. 452.19 ft

Groundwater Elev.:
First Encounter 433.0 ft
Upon Completion 415.5 ft
After 168 **Hrs.** 452.0 ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff, damp, gray, CLAY LOAM TILL.		3 6	1.5 B	18
416.01	-45			
Very stiff, damp, gray, SILTY CLAY TILL.		7 11	3.2 S	19
411.01				
Very dense, moist, gray, SILTY CLAY SHALE. 410.21	-50	41		
		50/3" 50/1"		9
Extent of exploration.				
Benchmark: BM 509 chiseled square on SE wingwall of existing structure, Sta 235+00, 17.5' Rt = 460.39' elevation. Provided by Program Development.	-55			
	-60			

Latitude W 87 deg 46.276 min, Longitude N 38 deg 42.974 min, Map Datum WGS 84

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)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/27/08

ROUTE FAS 1806 **DESCRIPTION** IL 250 over Un-named stream **LOGGED BY** E. Sandschafer

SECTION 2B-1 **LOCATION** Sec 5 - SW 1/4, Sec 8 - NW 1/4, **SEC.** , **TWP.** 3 N, **RNG.** 12 W, 3 **PM**

COUNTY Lawrence **DRILLING METHOD** Hollow stem auger & split spoon **HAMMER TYPE** Auto 140#

STRUCT. NO. 051-0051
Station 235+10

BORING NO. 2 West
Station 235+55
Offset 6.00ft Lt
Ground Surface Elev. 460.93 ft

Surface Water Elev. Dry ft
Stream Bed Elev. 452.19 ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion Washed ft
After 24 **Hrs.** 455.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				5" asphalt on 10" concrete pavement.
				459.63
				Stiff, damp, gray, SANDY CLAY LOAM.
	17			
	28		16	
	16	S		
-5				
	2	1.5	20	
	1	B		
				455.13
				Very soft, wet, gray, SILTY LOAM muck.
				453.93
				Stiff, damp, gray, SANDY CLAY LOAM.
	3			
	4	1.1	21	
	5	B		
				451.43
-10	2			Soft, very damp, gray, SILTY LOAM.
				450.73
	2	0.8	23	Stiff, damp, red marbled gray, SANDY CLAY LOAM TILL.
	3	B		
	2			
	4	1.6	20	
	5	B		
-15	1			
	4	1.1	18	
	4	B		
				443.93
	5			Very stiff, damp, brown marbled gray, CLAY LOAM TILL.
	8	3.2	14	
	13	BS		
				440.93
-20	4			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	6	3.6	14	Stiff, damp, gray, CLAY LOAM TILL.
	10	B		
	3			
	4	1.2	15	
	6	B		
-25	3			
	6	2.1	15	
	9	B		
				435.33
				Gray, SANDY LOAM.
				435.13
				Stiff, damp, gray, CLAY LOAM TILL.
	3			
	5	1.9	16	
	7	B		
-30	3			
	5	1.4	17	
	7	B		
-35	3			
	5	1.6	26	
	11	B		
				421.43
-40	40			

Latitude W 87 deg 46.279 min, Longitude N 38 deg 42.976 min, Map Datum WGS 84

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)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/27/08

ROUTE FAS 1806 DESCRIPTION IL 250 over Un-named stream LOGGED BY E. Sandschafer

SECTION 2B-1 LOCATION Sec 5 - SW 1/4, Sec 8 - NW 1/4, SEC., TWP. 3 N, RNG. 12 W, 3 PM

COUNTY Lawrence DRILLING METHOD Hollow stem auger & split spoon HAMMER TYPE Auto 140#

STRUCT. NO. 051-0051
Station 235+10

BORING NO. 2 West
Station 235+55
Offset 6.00ft Lt
Ground Surface Elev. 460.93 ft

Surface Water Elev. Dry ft
Stream Bed Elev. 452.19 ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion Washed ft
After 24 Hrs. 455.2 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
420.53	50/4" 50/1"		8	Very dense, moist, gray, CLAY SHALE. *(continued)*
				Borehole continued with rock coring.
-45				
-50				
-55				
-60				

Latitude W 87 deg 46.279 min, Longitude N 38 deg 42.976 min. Map Datum WGS 84

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)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 10/27/08

ROUTE FAS 1806 **DESCRIPTION** IL 250 over Un-named stream **LOGGED BY** E. Sandschafer

SECTION 2B-1 **LOCATION** Sec 5 - SW 1/4, Sec 8 - NW 1/4, **SEC.** , **TWP.** 3 N, **RNG.** 12 W, 3 **PM**

COUNTY Lawrence **CORING METHOD** Rotary, surf set diamond bit

STRUCT. NO. 051-0051
Station 235+10

CORING BARREL TYPE & SIZE NW, conv dbl bbl split inner

Core Diameter 2.06 in
Top of Rock Elev. 421.43 ft
Begin Core Elev. 420.53 ft

BORING NO. 2 West
Station 235+55
Offset 6.00ft Lt
Ground Surface Elev. 460.93 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Gray, slightly to moderately weathered, SANDY CLAY SHALE. 420.53		B2C1	77	75	1.3	
Rock core B2C1 from 43.4' to 43.9' depth Qu = 7.9 tsf.	-45					
		B2C2	100	100	1.1	
Rock core B2C2 from 49.9' to 50.4' depth Qu = 14.2 tsf. 410.53	-50					
Extent of exporation.						
Benchmark: BM 509 chiseled square on SE wingwall of existing structure, Sta 235+00, 17.5' Rt = 460.39' elevation. Provided by Program Development.	-55					
	-60					

Color pictures of the cores Available on request
Cores will be stored for examination until 10/27/09
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Appendix E

Pile Table (West Abutment & East Abutment)

Table 3 East Abutment / Pile Capacity (Friction)			
Pile Type	NRB (kips)	FRA (kips)	Est. Length (ft.)
HP 8 x 36	122.5	61.3	40
	160.0	80.0	45
HP 10 x 42	146.8	73.4	40
	174.0	87.0	45
HP 10 x 57	149.8	74.9	40
	177.5	88.8	45
HP 12 x 53	174.2	87.1	40
	206.8	103.4	45
HP 12 x 63	175.7	87.9	40
	208.8	104.4	45
HP 12 x 74	177.6	88.8	40
	211.1	105.5	45
HP 12 x 84	179.2	89.6	40
	212.9	106.5	45
HP 14 x 73	203.6	101.8	40
	242.3	121.2	45
HP 14 x 89	205.8	102.9	40
	245.0	122.5	45
HP 14 x 102	207.6	103.8	40
	247.2	123.6	45
HP 14 x 117	209.7	104.9	40
	249.6	124.8	45

Table 4 West Abutment / Pile Capacity (Friction)			
Pile Type	NRB (kips)	FRA (kips)	Est. Length (ft.)
HP 8 x 36	113.3	56.7	30
	131.7	65.9	35
HP 10 x 42	135.7	67.9	30
	157.8	78.9	35
HP 10 x 57	138.4	69.2	30
	161.0	80.5	35
HP 12 x 53	160.9	80.5	30
	187.2	93.6	35
HP 12 x 63	162.4	81.2	30
	188.9	94.5	35
HP 12 x 74	164.1	82.1	30
	191.0	95.5	35
HP 12 x 84	165.6	82.8	30
	192.6	96.3	35
HP 14 x 73	188.1	94.1	30
	218.9	109.5	35
HP 14 x 89	190.2	95.1	30
	221.3	110.7	35
HP 14 x 102	191.8	95.9	30
	223.3	111.6	35
HP 14 x 117	193.7	96.9	30
	225.4	112.7	35

Appendix F

Estimated Abutment Loading Data

THOUVENOT, WADE & MOERCHEN, INC.

TWM
◆ Consulting Engineers ◆
◆ Land Surveyors ◆
◆ Planners ◆

CORPORATE OFFICE
4940 Old Collinsville Road
Swansea, Illinois 62226
Tel: 618.624.4488
Fax: 618.624.6688

JOB 080276B WO#2
SHEET NO. _____ OF _____
CALCULATED BY ALN DATE 8/7/09
CHECKED BY _____ DATE _____
SCALE _____

Summary of Total Load per Abut.
(no Load Factors)

DC1	DC2	DW	Abut. DL	LL
98.1 K	19.8 K	39.6 K	88.7 K	178.0 K

DC1 : Beams & Deck Dead Load
DC2 : Parapet Dead Load
DW : Future Wearing Surface
LL : Live Load, no impact
Abut DL : Dead Load of abut. concrete

Appendix G

Bureau of Bridges & Structures Speed Letters

Speed Letter

Illinois Department of Transportation

Bureau of Bridges & Structures • 2300 S. Dirksen Parkway • Springfield, Illinois 62764

To: Geotech Engineering & Testing, Inc.
500 South 17Th Street
P.O. Box 120
Paducah, KY 42003

Attention: Mark Workman

Date: 7/6/09	Job No.: P-97-026-05
SN: 051-0065	Contract No.: 74106
Route: FAS 1806	
Section: 2B-1	
County: Lawrence	
Other: IL 250 over A Stream	

Subject: **Structure Geotechnical Report (SGR) Review**

We are Sending:

☐ Structure Geotechnical Report ☐ Foundation/Wall Design Details ☐ Settlement/Stability Analysis
☐ Approval ☒ Comments ☐ Special Provisions ☐

These Are:

☐ Approved As Submitted ☐ Approved Subject to Changes & Comments Below
☒ Returned for Revisions and Re-submittal ☐ For Your Use ☐ For Review and Comments
☐

Remarks:

Following our review of your SGR dated 04/24/09 and subsequent discussion with Chris Farmer on 06/17/09, we ask that Geotech Engineering & Testing, Inc. revise and resubmit the SGR within 30 days, to address the issues below so we can complete our review and provide approval.

- Estimated settlement times (T_{90}) should be provided in the SGR when settlement is expected. If the majority of settlement is expected to take place during construction then this should be stated in the SGR.

- As per ABD 08.3, settlement and bearing capacity should be addressed in the SGR as it pertains to bridge approach pavement. If settlement is expected to adversely affect the approach pavement, or if bearing capacity will be deficient, remedial actions should be discussed in the SGR.

- Estimated loadings used during foundation feasibility assessment should be included in the SGR.

- The Design Scour Table should be changed in the SGR as shown below to reflect the bottom of abutment elevations shown on the TSL.

West Abutment	East Abutment
455.95	455.72

Continued Next Page

By Todd E. Hanna
For The Engineer of Bridges & Structures
11/06/08

Copies To: Thouvenot, Wade And Moerchen, Inc.
Roger L. Driskell - District 7 Attn:Timothy S. Jackson

rmw/nhb

- Our independent analysis using borings 1 and 2 produced a soil site class of D. Therefore, the seismic data should be revised in the SGR as shown below to be consistent with what is recommended for the TSL.

Seismic Performance Zone = 2
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.232
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.534
Soil Site Class = D

If you have any questions or need further assistance, please contact Nicholas H. Beckmann at (217)-558-2298 or Riyad M. Wahab at (217)-782-2704 of our Foundations and Geotechnical Unit.