Structure Geotechnical Report

F.A.P. 836 (IL 49)
Section 116BR-1
Edgar County

Contract No. 70608
PTB #176 / Item #16 – Work Order #2

Existing S.N. 023-0019
Proposed S.N. 023-0035

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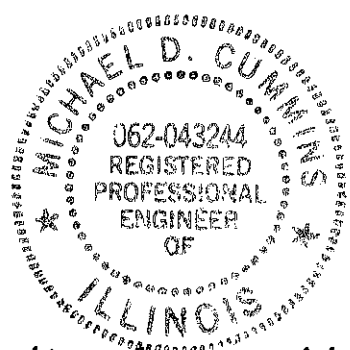


Michael D. Cummins 3/3/17
EXP. 11/30/17

Originally Submitted: March 11, 2016
Revised October 21, 2016
Re-revised March 2, 2017

TABLE OF CONTENTS

I. Project Description

Proposed Structure Information

The proposed structure is a two-span 48" web weathering steel plate girder bridge with a cast in place R.C. deck. The structure will have a bk. to bk. of abutment length of 213'-6 1/2" with two clear spans measuring 120'-0" and 90'-0". The substructure will consist of integral abutments and a solid wall pier. The proposed structure will be built at station 465+76 and have a 20° right forward skew to accommodate the channel alignment through the structure. The structure will have a clear width of 32'-0" from face to face of parapet and an out-to-out width of 35'-2".

Existing Structure

The existing structure was built in 1928 as 3 span Reinforced Concrete T-Beam bridge. In 1980 the piers and closed abutments were widened and the superstructure was replaced and widened with a precast prestressed concrete deck beam bridge on a widened substructure. The back to back of abutments length is 162'-0", out to out width is 33'-0" and clear width of 32'-6".

II. Subsurface Exploration and Testing

The soil borings were provided by IDOT District 5 personnel. A total of three (3) borings were taken. Two (2) borings were taken in 2011 and one (1) is older, taken in 1979. Based on the boring data, a layer of hard clay loam till is present, within a few feet below streambed. This till has high unconfined compressive strengths and N Values. Please see the attached Soil Borings and Subsurface Data Profile Plot for more information.

III. Geotechnical Evaluations

Settlement

Settlement of the pile and drilled shaft supported structure should be negligible. Since we are maintaining the existing roadway profile, no additional fill, and the presence of relatively stiff soils at the bottom of the piles and drilled shafts, settlement is not a concern.

Seismic Considerations

No special seismic measures are recommended given the soil profile and small acceleration coefficient. The seismic hazard for the site was analyzed per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications

Seismic Performance Zone = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.159g
Design Spectral Acceleration at 0.2 sec. (SD2) = 0.306g
Soil Site Class = D

III. Geotechnical Evaluations (continued)

Liquefaction

Liquefaction Analysis was performed in accordance with the Geotechnical Manual Design Guide. The only potential liquefaction affecting the foundation design of this bridge was at the top 5 to 10 feet of the pier boring (Boring 2). This potential liquefaction zone at the pier would be above the pier footing, if a pile supported footing is used, and would not affect the pier piles. A drilled shaft pier might have a small amount of downdrag loading due to liquefaction induced settlement but this loading is expected to be negligible. This loading is considered negligible because the drilled shafts would be designed for much larger loads and the soil in the liquefaction zone would be ignored due to scour.

Scour

Please see the Design Scour Elevation Table shown on the attached TSL Drawing. The scour elevations in this table were taken from the Hydraulic report and reduced according to the Bridge Manual Section 2.3.6.3.2. The proposed abutments and pier are shown on the attached TSL Drawing as per the Hydraulic Report.

The proposed spill-thru abutments will be protected from scour by stone riprap and the design scour elevation is the bottom of abutment elevation.

The top of a footing at the pier should be set below streambed at approximately Elev. 625.0. Due to scour a spread footing is not recommended. The bottom of a 3 foot thick pile supported footing would be Elev. 622.0 and the bottom of 4 foot thick seal coat (estimated thickness based on experience) would be Elev. 618.0. The pier scour elevation, Elev. 622.9, is above the bottom of the proposed pier footing and therefore does not affect the design of the piles for a pile supported pier. A proposed drilled shaft pier would need to be designed ignoring the contribution of material above the design scour elevation.

Slope Stability

The new abutments will be constructed behind the existing abutments. The existing embankment at the abutments will be cut at 2:1 slope to accommodate new integral abutments. The existing soil in this slope area varies from a medium clayey loam to very stiff clay, therefore slope stability is not a concern.

IV. Foundation Evaluation and Design Recommendations

Based on the soil conditions encountered and the design information, it is recommended that the proposed bridge be supported on a spill thru, pile supported integral abutments and a fixed, solid walled, pile supported or drilled shaft pier. The recommendations for the abutments and pier are as follows.

Abutments

Piles were evaluated for this site in accordance with ABD Memo 12.3 and the "New (Not-Yet-Published) Integral Abutment Policy" as directed by BBS and FGU. Please see the attached draft Integral Abutment Pile Selection Chart. The piles considered include Metal Shells and Steel H-piles with the use of Metal Shell Piles recommended by the FGU. Although H piles are suitable for the soil profile and could be driven into the very stiff clay, the estimated pile lengths, based on current policy, are lengthy and therefore are no longer recommended. Driving shoes are recommended for Metal Shell Piles to minimize potential damage to the piles during driving into very stiff clay. The appropriate pile sections were derived based on a total estimated factored design load of 1240 Kips and the estimated pile lengths are shown in Table 1.

Table 1
Abutments – Estimated Pile Lengths

Pile Type	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (ft.)	
			South Abutment	North Abutment
MS 12"x0.25"	355	196	30	30
MS 14"x0.25"	416	229	30	30
MS 14"x0.312"	516	284	30	30
HP 12x53	419	76*	Beyond Limits of Boring Log	Beyond Limits of Boring Log

Notes: * The Factored Resistance Available at the bottom of the boring log is shown above. The Maximum Nominal Required Bearing of the pile can be achieved, but beyond limits of boring. Abutment Pile Cutoff Elevations = 648.5 North Abutment; 648.2 South Abutment

Estimated Pile Length Notes

The IDOT STATIC METHOD OF ESTIMATING PILE LENGTH Excel spreadsheet was used to estimate the pile lengths for various driven piles.

The factored resistance available (given above) includes the reduction for geotechnical resistance.

The actual pile depth should be determined based on the test piles and as per IDOT standard practice, one test pile should be driven at each abutment. Per section 3.10.1.11 of the IDOT Bridge manual (2012), the minimum pile spacing should be 3 pile diameters, and the maximum pile spacing should not be more than 8 feet.

IV. Foundation Evaluation and Design Recommendations (continued)

Pier

Preliminary bridge design computations were performed to compute the loads to the pier and preliminary pier details were estimated so that cost comparisons could be made for different pier types. A spread footing is not recommended due to scour concerns. The pier boring indicates the presence of hard clay loam till, extending below the 100 Year Design Scour Elevation 622.9 to the bottom of the boring, except for a 2 foot thick very dense sand layer below Elevation 612.7. A cost comparison was made between a Solid Walled Pier on a Pile Supported Footing and a Drilled Shaft Pier. This comparison showed that the Drilled Shaft Pier is more economical and it does not require a cofferdam or seal coat. The Drilled Shaft Pier is therefore the recommended option. Details of the options considered are as follows:

Driven Pile Foundation - Pier

A solid wall pier on a driven pile supported footing is one of the preferable options. This type of pier will require a Type 2 Cofferdam with seal coat and the piles should be designed to develop the required resistance below the seal coat. It is assumed that the top of footing will be set below streambed and that the bottom of the footing and seal coat will be below the 100 year Design Scour Elevation 622.9. The piles considered include Metal Shells and Steel H piles. Metal Shell Piles driven into this hard till will be somewhat short. H piles are suitable for this soil profile and can be driven into the hard till, although estimated pile lengths, based on current policy, are lengthy and extend beyond the available boring data. Driving shoes are recommended for Metal Shell Piles to minimize potential damage to the piles during driving into the hard till.

The appropriate pile sections were derived based on a total estimated factored design load of 2980 Kips and the estimated pile lengths for the pier are shown in Table 2.

Table 2
Pier - Estimated Pile Lengths

Pile Type	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length Below Seal Coat (feet)	Estimated Total Pile Length (feet)
MS 12"x0.25"	353	193	11	16
MS 14"x0.312"	513	279	12	17
HP 10x42	335	72*	Beyond Limits of Boring Log	Beyond Limits of Boring Log
HP 12x53	414	87*	Beyond Limits of Boring Log	Beyond Limits of Boring Log
HP 14x73	575	106*	Beyond Limits of Boring Log	Beyond Limits of Boring Log

Notes: * The Factored Resistance Available at the bottom of the boring log is shown above. The Maximum Nominal Required Bearing of the pile can be achieved, but beyond limits of boring. See the Estimated Pile Length Notes below Table 1.
Pile Cutoff Elevation = Elev. 623.0 (Bot. of Footing Elev. 622.0, Bot. of Seal Coat Elev. 618.0)

Foundation Evaluation and Design Recommendations (continued)

Drilled Shaft Foundation - Pier

A drilled shaft pier with webwall was determined to be more economical than the solid wall pier on driven pile supported footing, based on a cost comparison. The drilled shaft pier with webwall also does not require a cofferdam and seal coat. A minimum of four (4) drilled shafts should be provided to allow for stage construction. The drilled shafts should be designed so that they develop the required resistance below the 100 year Design Scour Elevation 622.9. Groundwater should be expected to be at or near the ground level, where the pier is to be constructed. The top of the bank in this area varies from Elevation 633.0 to Elevation 637.0, based on the survey. A temporary casing will be required during drilling due to the presence of sand near the ground surface and due to a 2 foot thick dense sand layer closer to the proposed tip elevation. This temporary casing should be withdrawn during concrete placement.

Preliminary estimated factored side resistance values are given in Table 3 for the various layers in the pier boring. The preliminary estimated factored end bearing resistance values for the estimated tip elevations are also given in Table 3. Potential drilled shaft sections were evaluated based on a total estimated factored design vertical load of 2380 kips to the drilled shaft pier. Based on these design parameters, a minimum of four (4) 4 foot diameter drilled shafts bearing near the end of the pier boring are anticipated. These preliminary estimates using approximate foundation loadings and configurations should be re-evaluated during the final design. Lateral loadings will need to be determined by the designer and the drilled shafts will need to be analyzed based on the final loadings, shaft spacing, shaft diameter and any additional testing that may be available. This project appears to meet the criteria requiring a Geotechnical Design Memorandum for final design.

Table 3
Drilled Shafts at Pier

Layer Elevations Top & Bottom (Feet)	Material	End Resistance		Side Resistance	
		Nominal Unit Tip Resistance (ksf)	Resistance Factor	Nominal Unit Side Resistance (ksf)	Resistance Factor
622.9 to 612.7	Till Qu= 9.4 tsf to 10 tsf	80	0.40	2.39	0.45
612.7 to 610.7	Dense Sand	60	0.50	1.63	0.55
610.7 to 607.2	Till Qu= 10.9 tsf	80	0.40	2.39	0.45

Note: Drilled shafts should be designed to utilize both side resistance and end bearing in accordance with the Bridge Manual 3.10.2.1. and as allowed by AASHTO 10.8.3.5.

V. Construction Considerations

The proposed bridge will be constructed using staged construction, building approximately half of the bridge at a time. Based on the height of the soil to be retained, temporary soil retention system is recommended supporting the Stage traffic.

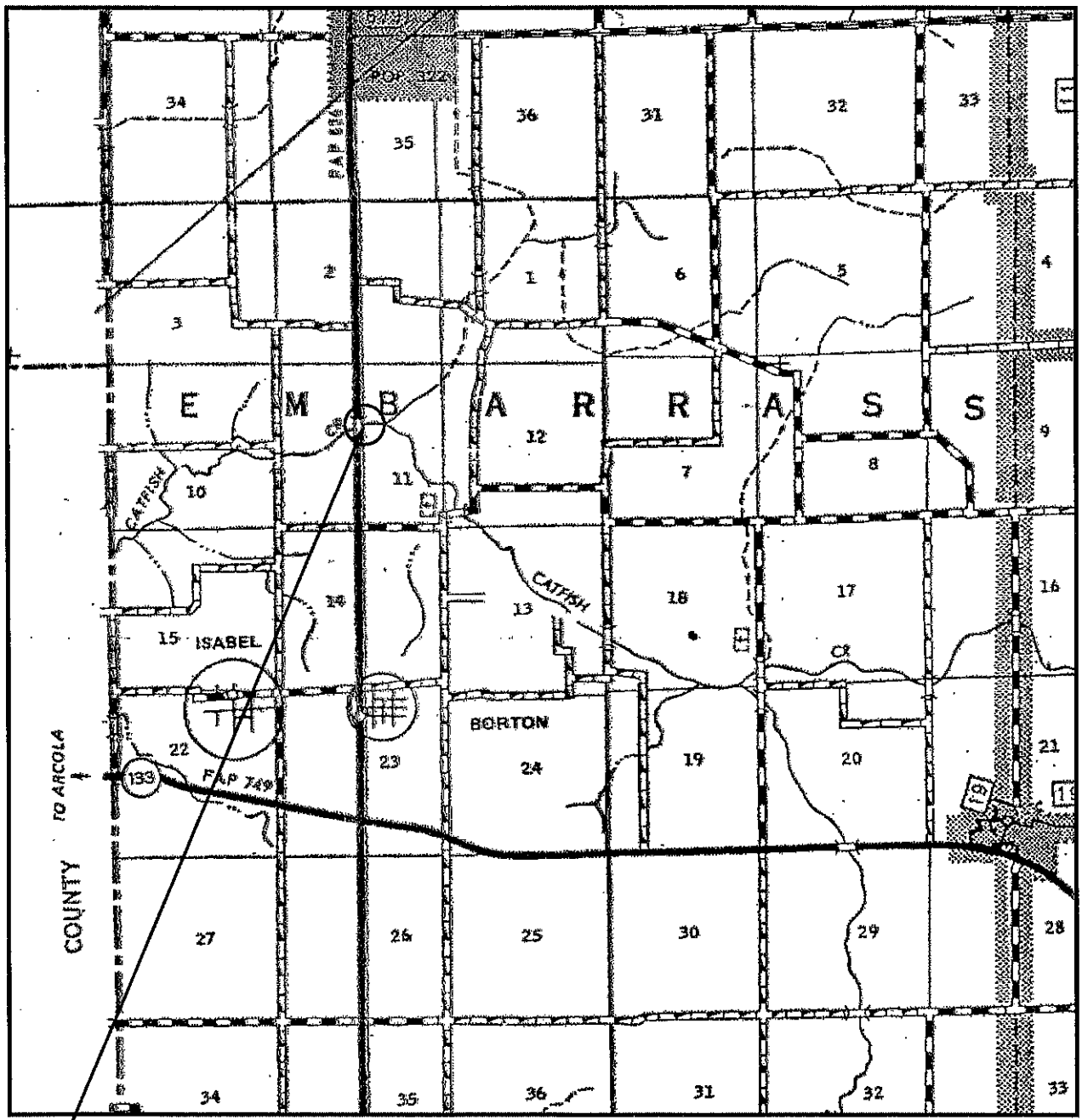
A cofferdam will not be required for the Drilled Shaft Pier.

VI. Attachments

- **Location Map**
- **Final (as submitted) TSL Drawing 2-15-2017**
- **Soil Boring Profile**
- **Soil Borings**
- **Draft Integral Abutment Pile Selection Chart**

LOCATION MAP

SN 023-0035 Proposed
SN 023-0019 EXIST.
FAP 836 (IL-49) over Catfish Creek
2.5 miles N. of IL-133
Contract 70608 – Section 116BR-1

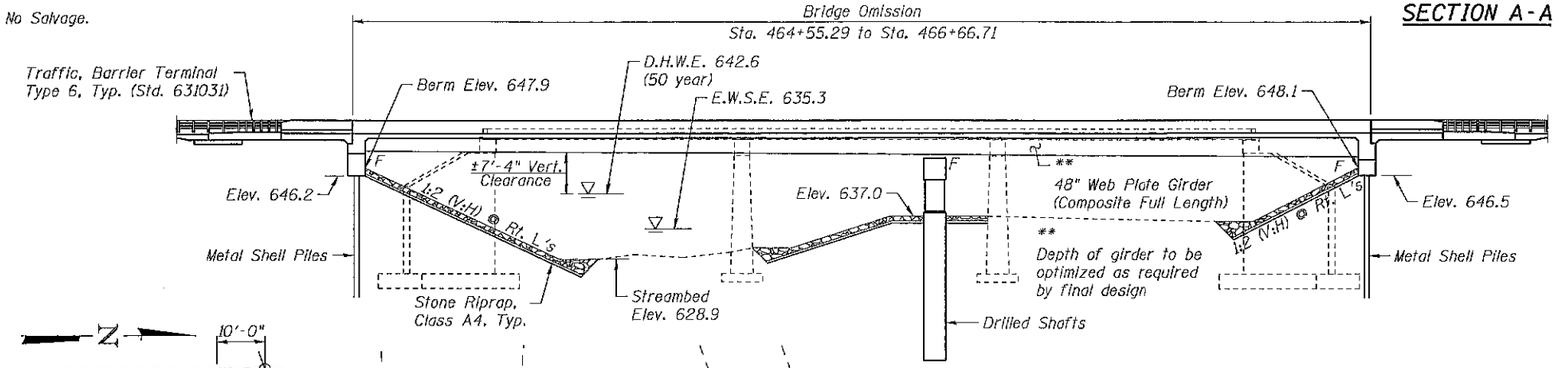


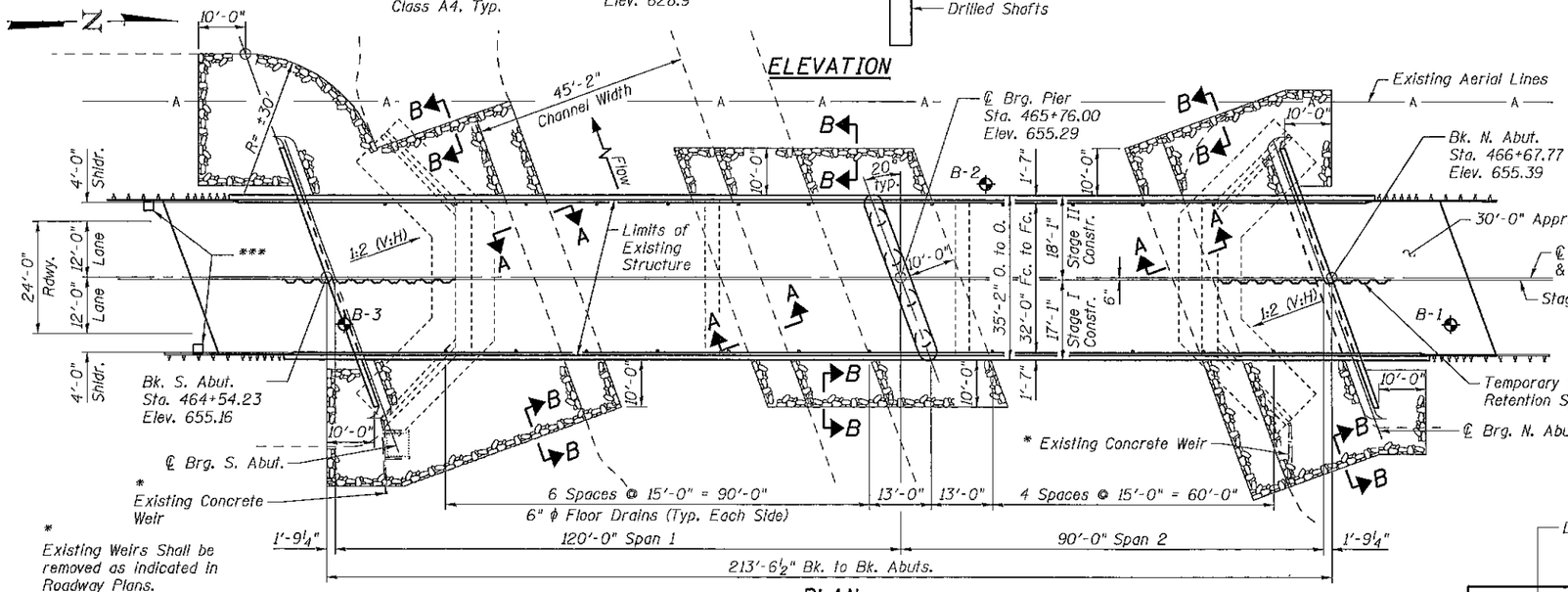
Bench Mark: B.M. 4852-1: Chiseled square on the west edge of the south concrete bridge approach pavement of S.N. 023-0019, Elevation 654.65.

Existing Structure: S.N. 023-0019 originally built in 1928 as SBI Route 49, Section 116B at Station 465+78 as a 3-span reinforced concrete T-beam bridge. In 1980 the piers and abutments were widened and the superstructure was replaced with a widened PPC deck beam superstructure. The substructure consists of closed R.C. abutments on pile supported spread footings and two R.C. solid wall hammerhead piers on pile supported spread footings. The structure is 162'-0" back-to-back of abutments and 33'-0"out-to-out of deck with a clear roadway width of 32'-6". Existing structure is not skewed and is to be removed and replaced under staged construction.

There are weirs on the upstream side of the structure that accept the adjacent ditch flow.

No Salvage.





* Existing Weirs Shall be removed as indicated in Roadway Plans.

*** Include inlets beyond bridge as required by design.

DESIGN SCOUR ELEVATION TABLE

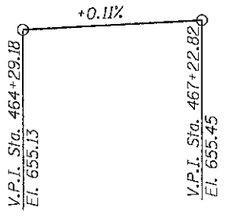
Event/Limit State	Design Scour Elevations (ft.) S. Abut.	Pier	N. Abut.	Item 113
Q100	646.2	622.9	646.5	
Q500	646.2	621.2	646.5	8
Design	646.2	622.9	646.5	
Check	646.2	621.2	646.5	

WATERWAY INFORMATION

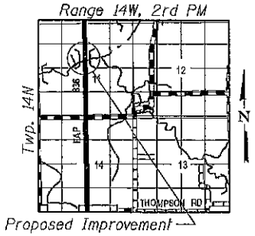
Drainage Area = 65.4 mi² Low Grade Elev. 655.06 Ft. @ Sta. 463+00

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Prop.	Nat. H.W.E.	Head - Ft. Exist.	Prop.	Headwater El. Exist.	Prop.
	10	3240	839	1139	641.3	0.3	0.1	641.6	641.4
Design	50	5060	990	1358	642.6	0.5	0.2	643.1	642.8
Base	100	5850	1047	1443	643.1	0.6	0.3	643.7	643.4
Overtopping									
Max. Calc.	500	7740	1163	1617	644.1	0.9	0.4	645.0	644.5

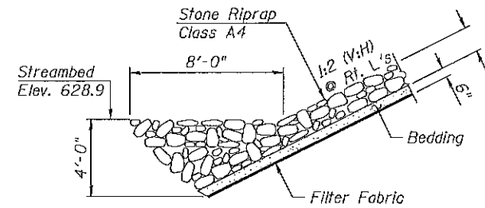
10 Year Velocity Through Exist. Bridge = 4.02 fps
10 Year Velocity Through Prop. Bridge = 2.86 fps



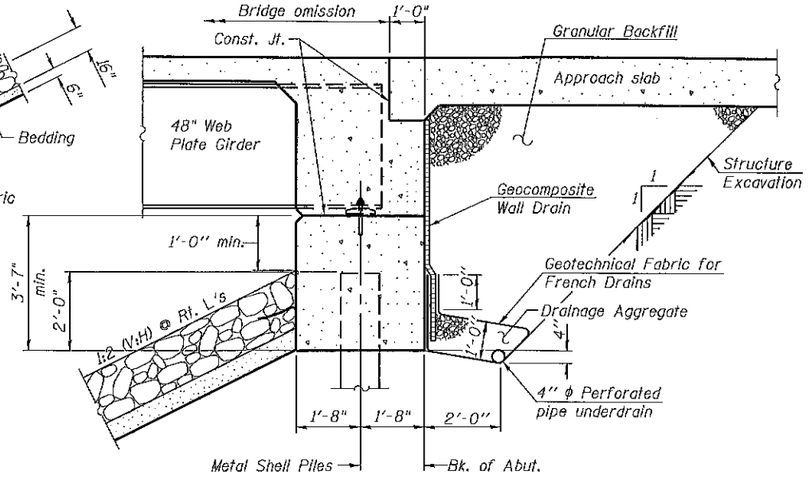
PROFILE GRADE
(Along ℄ IL 49)



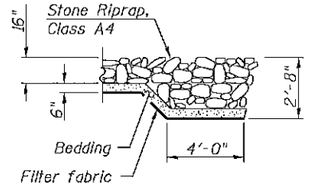
LOCATION SKETCH



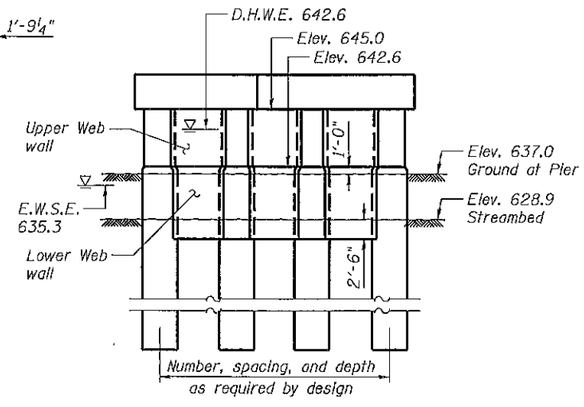
SECTION A-A



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



SECTION B-B



PIER SKETCH

HIGHWAY CLASSIFICATION

F.A.P. 836-(IL 49)
Functional Class: Minor Arterial
ADT: 1200 (2013); 1350 (2031)
ADTT: 270 (2013); DHV: 110
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two -Way Traffic
Directional Distribution: 50:50

LOADING HL-93

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

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 and 2016 Interims

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50W)

SEISMIC DATA

Seismic Performance Zone (SPZ) =2
Design Spectral Acceleration at 1.0 sec. (S_{D1}) =0.159g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) =0.306g
Soil Site Class =D

GENERAL PLAN
IL 49 OVER CATFISH CREEK
F.A.P. 836 SECTION 116-BR-1
EDGAR COUNTY
STATION 465+76.00
STRUCTURE NO. 023-0035

CEC Cummins Engineering Corporation
Civil and Structural Engineering

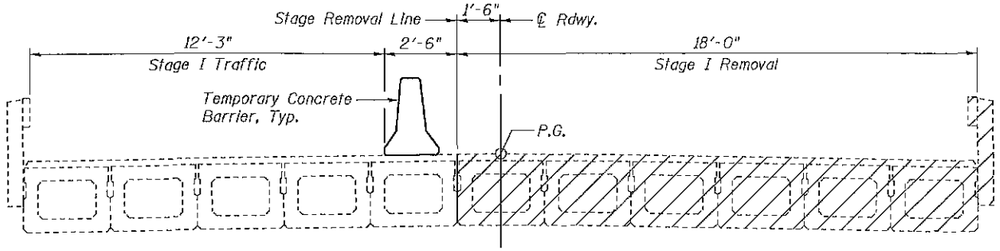
JOB = 2399.2	DESIGNED - AAN	REVISED -	
FILE = 9238036-70808-TSL-002_RIP.dgn	CHECKED - MDC	REVISED -	
DATE = 2/15/2017	DRAWN - SJS	REVISED -	
	CHECKED - MDC	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

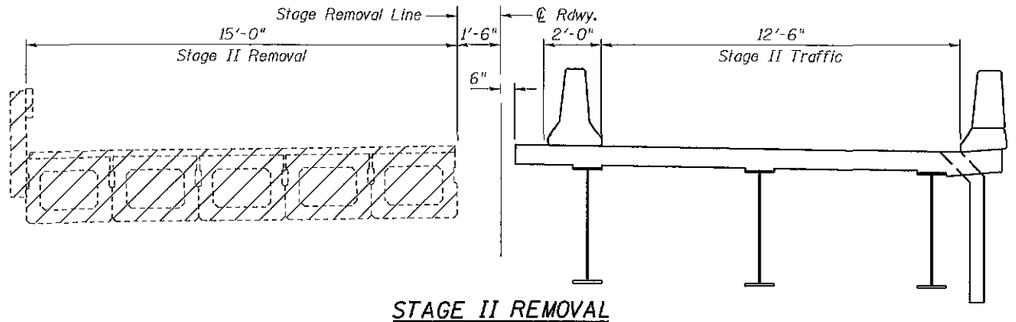
GENERAL PLAN
STRUCTURE NO. 023-0035
SHEET NO. 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
836	116-BR-1	EDGAR		
		CONTRACT NO. 70608		
		ILLINOIS FED. AID PROJECT		

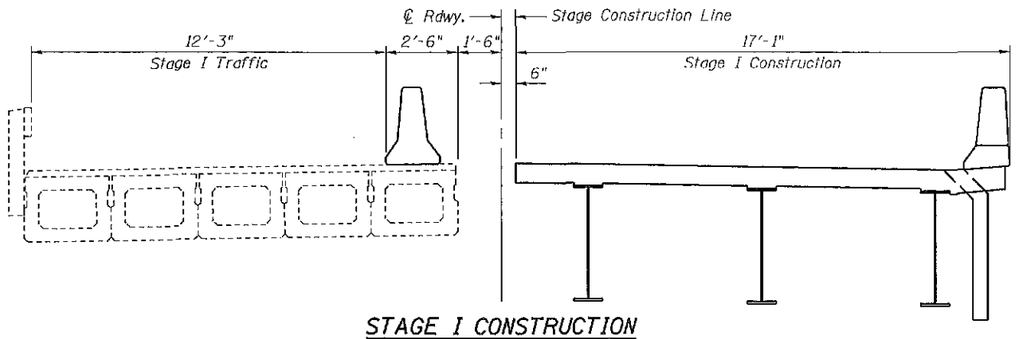
Hatched area indicates Removal of Existing Structures.



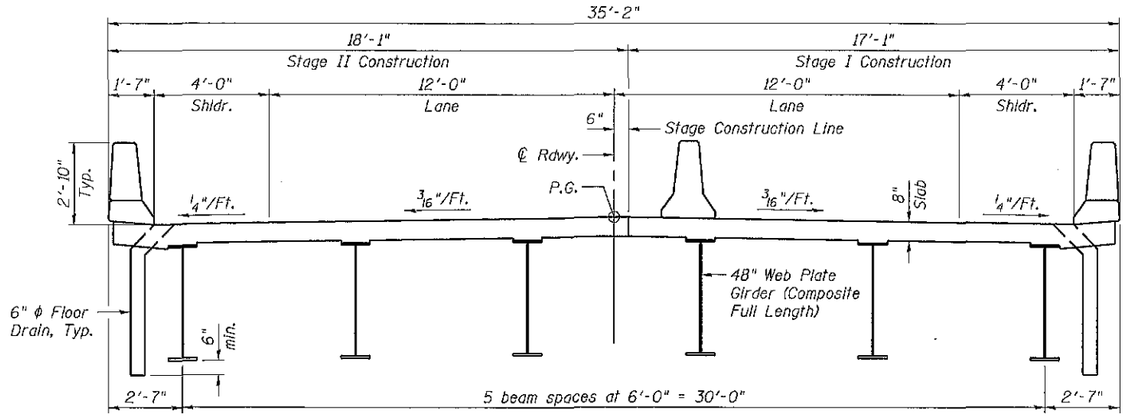
STAGE I REMOVAL
(Looking North)



STAGE II REMOVAL
(Looking North)

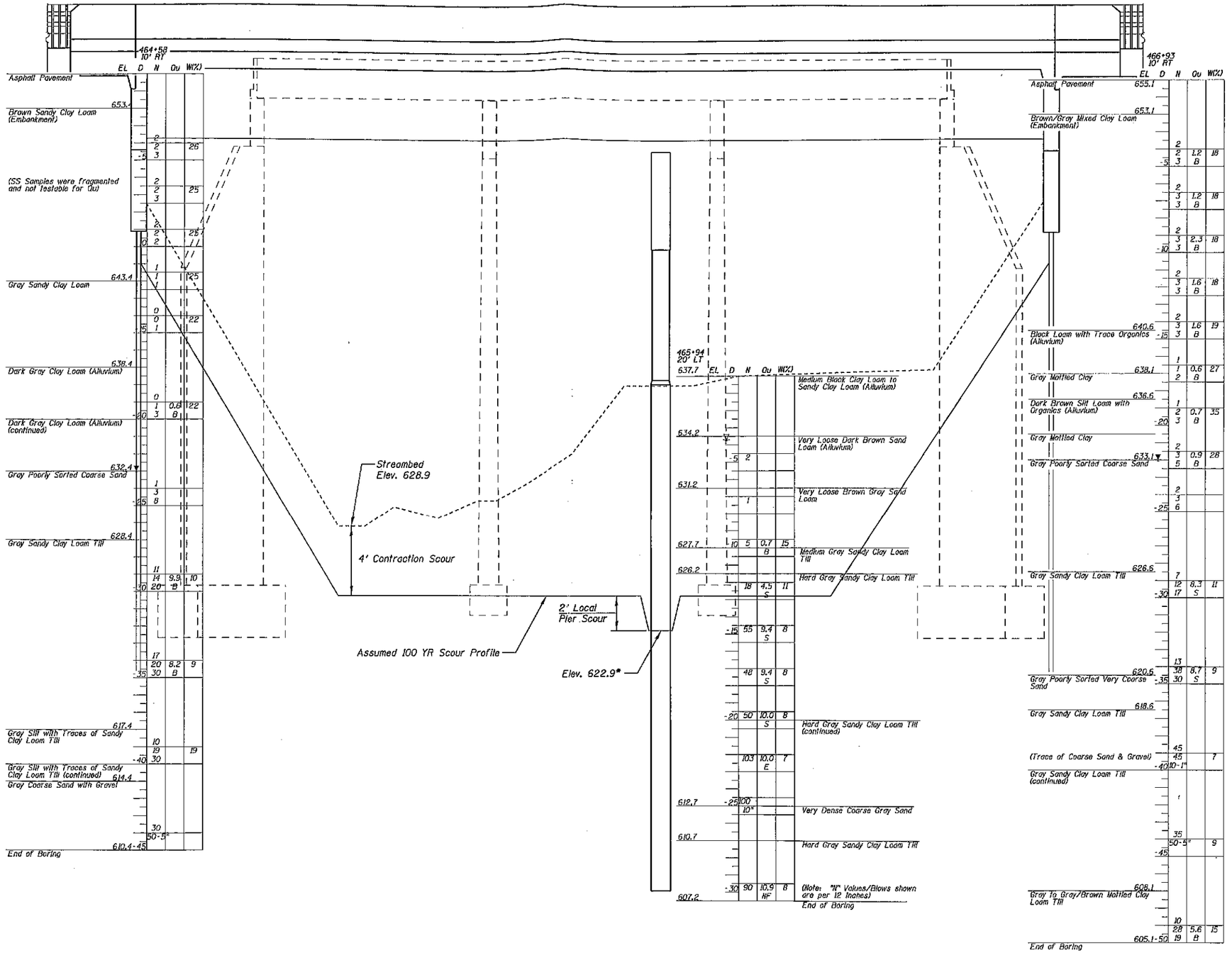


STAGE I CONSTRUCTION
(Looking North)



STAGE II CONSTRUCTION
(Looking North)

CEC Cummins Engineering Corporation Civil and Structural Engineering	JOB = 2399.2 FILE = 0230035-70608-TSL-002.RIP.dgn DATE = 2/15/2017	DESIGNED - AAN CHECKED - MDC DRAWN - SJS CHECKED - MDC	REVISED - REVISED - REVISED - REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	STAGING CROSS SECTIONS STRUCTURE NO. 023-0035 SHEET NO. 2 OF 2 SHEETS	F.A.P. RTE. 836	SECTION 116-BR-1	COUNTY EDGAR	TOTAL SHEETS	SHEET NO.
								CONTRACT NO. 70608		
								ILLINOIS FED. AID PROJECT		



*Adjusted per B.M. 2.3.6.3.2

CEC Cummins Engineering Corporation — Civil and Structural Engineering	JOB = 2399.2	DESIGNED - MDC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	SUBSURFACE DATA PROFILE STRUCTURE NO. 023-0035
	FILE = 0230035-70608-BoringProfile-001.dgn	CHECKED - AAN	REVISED -		EXHIBIT NO. 1 OF 1 SHEETS
	DATE = 10/24/2016	DRAWN - SJS	REVISED -		
		CHECKED - MDC	REVISED -		

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
836	116-BR-1	EDGAR		
		CONTRACT NO. 70608		
		ILLINOIS FED. AID PROJECT		

Illinois Department of Transportation

CAE ✓
NJF ✓
BJH ✓
TJB ✓
& SEC FILE
GMS

To: Program Development

From: Project Implementation - Materials

Subject: Soil Borings*

Date: October 7, 2011

Scott A Lackey RHW

*FAP 836 (IL 49)
Section: 116BR-1
Contract No. 70608
Edgar County
Structure No.: 023-0019E/023-0035P

IL 49 over Catfish Creek 2.5 Miles North of IL 133.

Attached are the foundation boring logs for the above captioned structur e. Please note that Boring #2 (Pier) was completed in 1979 therefore the "N" values shown on this boring log are per 12 inches in lieu of the curre nt norm of 6 inches.

If you have any questions, or require any additional information, please contact Ron Wagoner, Region 3 - Di strict 5 Geotechnical Engineer, at (217) 466-7271.

CNA/gjn

Attachment

S:\SOILS\2011 Soil Works\Soil Borings\023-0019 Catfish Creek IL 49\023-0019E_0035P.docx

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/5/11

ROUTE FAP 836 (IL 49) DESCRIPTION IL 49 over Catfish Creek 2.5 Miles North of IL 133 LOGGED BY CNA

SECTION 116BR-1 LOCATION NE, SEC. 11, TWP. 14N, RNG. 14W, 2nd PM GPS:

COUNTY Edgar DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 023-0019E/0035P
Station 465+77.5 E/465+76P North
BORING NO. 1 South Abut.
Station 466+93 (Exist.)
Offset 10.0 ft Rt.
Ground Surface Elev. 655.1 ft

Surface Water Elev. 630.5 ft
Stream Bed Elev. 628.5 ft
Groundwater Elev.:
First Encounter 633.1 ft ▼
Upon Completion Wash Bored ft
After ____ Hrs. ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
655.1 Asphalt Pavement			
653.1 Brown/Gray Mixed Clay Loam (Embankment)	2		
	2	1.2	18
-5	3	B	
	2		
	3	1.2	18
	3	B	
	2		
	3	2.3	18
-10	3	B	
	2		
	3	1.6	18
	3	B	
	2		
640.6	3	1.6	19
Black Loam with Trace Organics (Alluvium) -15	3	B	
	1		
638.1	1	0.6	27
Gray Mottled Clay	2	B	
636.6			
Dark Brown Silt Loam with Organics (Alluvium)	1		
	2	0.7	35
-20	3	B	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
634.6 Gray Mottled Clay	2		
633.1 ▼ Gray Poorly Sorted Coarse Sand	3	0.9	28
	5	B	
	2		
	3		
-25	6		
626.6 Gray Sandy Clay Loam Till	7		
	12	8.3	11
-30	17	S	
	13		
620.6	38	8.7	9
Gray Poorly Sorted Very Coarse Sand -35	30	S	
618.6 Gray Sandy Clay Loam Till	45		
(Trace of Coarse Sand & Gravel)	45		7
-40	10-1"		

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.
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)

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/5/11

ROUTE FAP 836 (IL 49) DESCRIPTION IL 49 over Catfish Creek 2.5 Miles North of IL 133 LOGGED BY CNA

SECTION 116BR-1 LOCATION NE, SEC. 11, TWP. 14N, RNG. 14W, 2nd PM GPS:

COUNTY Edgar DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 023-0019E/0035P
Station 465+77.5 E/466+76P

BORING NO. North 1 South Abut.
Station 466+93 (Exist.)
Offset 10.0 ft Rt.
Ground Surface Elev. 655.1 ft

Surface Water Elev. 630.5 ft
Stream Bed Elev. 628.5 ft

Groundwater Elev.:
First Encounter 633.1 ft ▼
Upon Completion Wash Bored ft
After ____ Hrs. ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Gray Sandy Clay Loam Till *(continued)*
	35			
-45	50-5"		9	
608.1				Gray to Gray/Brown Mottled Clay Loam Till
	10			
	28	5.6	15	
605.1 -50	19	B		
				End of Boring
-55				
-60				

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.
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)

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transformation

SOIL BORING LOG

Date 6/5/79

ROUTE FAP 836 (IL 49) DESCRIPTION IL 49 over Catfish Creek 2.5 Miles North of IL 133 LOGGED BY TGB

SECTION 116BR-1 LOCATION NE, SEC. 11, TWP. 14N, RNG. 14W, 2nd PM GPS:

COUNTY Edgar DRILLING METHOD Hollow Stem Auger HAMMER TYPE Manual

STRUCT. NO. 023-0019E/0035P
Station 465+77.5 E/465+76P

BORING NO. 2 Pier
Station 465+94 (Exist.)
Offset 20.0 ft Lt.
Ground Surface Elev. 637.7 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion 634.0 ft ▽
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				Medium Black Clay Loam to Sandy Clay Loam (Alluvium)
634.2				▽
				Very Loose Dark Brown Sand Loam (Alluvium)
-5	2			
631.2				Very Loose Brown Gray Sand Loam
	1			
627.7 -10	6	0.7 B	15	Medium Gray Sandy Clay Loam Till
626.2				Hard Gray Sandy Clay Loam Till
	18	4.5 S	11	
-15	55	9.4 S	8	
	48	9.4 S	8	
-20	50	10.0	8	

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
		S		Hard Gray Sandy Clay Loam Till *(continued)*
	103	10.0 E	7	
612.7 -25	100 - 10"			Very Dense Coarse Gray Sand
610.7				Hard Gray Sandy Clay Loam Till
-30	90	10.9 NF	8	(Note: "N" Values/Blows shown are per 12 Inches)
607.2				End of Boring
-35				
-40				

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An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.
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 10/5/11

ROUTE FAP 836 (IL 49) DESCRIPTION IL 49 over Catfish Creek 2.5 Miles North of IL 133 LOGGED BY RRW

SECTION 116BR-1 LOCATION NE, SEC. 11, TWP. 14N, RNG. 14W, 2nd PM GPS:

COUNTY Edgar DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 023-0019E/0035P
Station 465+77.5 E/465+76P
BORING NO. South 3 North Abut.
Station 464+58 (Exist.)
Offset 10.0 ft Rt.
Ground Surface Elev. 655.4 ft

Surface Water Elev. 630.5 ft
Stream Bed Elev. 628.5 ft
Groundwater Elev.:
First Encounter 632.4 ft ▼
Upon Completion Wash Bored ft
After ____ Hrs. ____ ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Asphalt Pavement			
653.4			
Brown Sandy Clay Loam (Embankment)			
	2		
	2		26
-5	3		
(SS Samples were fragmented and not testable for Qu)			
	2		
	2		25
	3		
	2		
	2		25
-10	2		
	1		
643.4			
Gray Sandy Clay Loam			
	1		25
	1		
	0		
	0		22
-15	1		
638.4			
Dark Gray Clay Loam (Alluvium)			
	0		
	1	0.6	22
-20	3	B	
Dark Gray Clay Loam (Alluvium) (continued)			
632.4 ▼			
Gray Poorly Sorted Coarse Sand			
	1		
	3		
-25	8		
628.4			
Gray Sandy Clay Loam Till			
	11		
	14	9.9	10
-30	20	B	
	17		
	20	8.2	9
-35	30	B	
617.4			
Gray Silt with Traces of Sandy Clay Loam Till			
	10		
	19		19
-40	30		

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.
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)

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Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/5/11

ROUTE FAP 836 (IL 49) DESCRIPTION IL 49 over Catfish Creek 2.5 Miles North of IL 133 LOGGED BY RRW

SECTION 116BR-1 LOCATION NE, SEC. 11, TWP. 14N, RNG. 14W, 2nd PM GPS:

COUNTY Edgar DRILLING METHOD Hollow Stem Auger HAMMER TYPE Automatic

STRUCT. NO. 023-0019E/0035P
Station 466+77.5 E/466+76P
BORING NO. South 3 North Abut.
Station 464+58 (Exist.)
Offset 10.0 ft Rt.
Ground Surface Elev. 665.4 ft

Surface Water Elev. 630.5 ft
Stream Bed Elev. 628.5 ft
Groundwater Elev.:
First Encounter 632.4 ft ▼
Upon Completion Wash Bored ft
After ____ Hrs. ____ ft

Material	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray Silt with Traces of Sandy Clay Loam Till *(continued)*	614.4			
Gray Coarse Sand with Gravel		30		
		50-5"		
	610.4 -45			
End of Boring	-50			
	-55			
	-60			

An assumed centerline elevation of 100.00 and station of 10+00 is used when this information is not available.
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)

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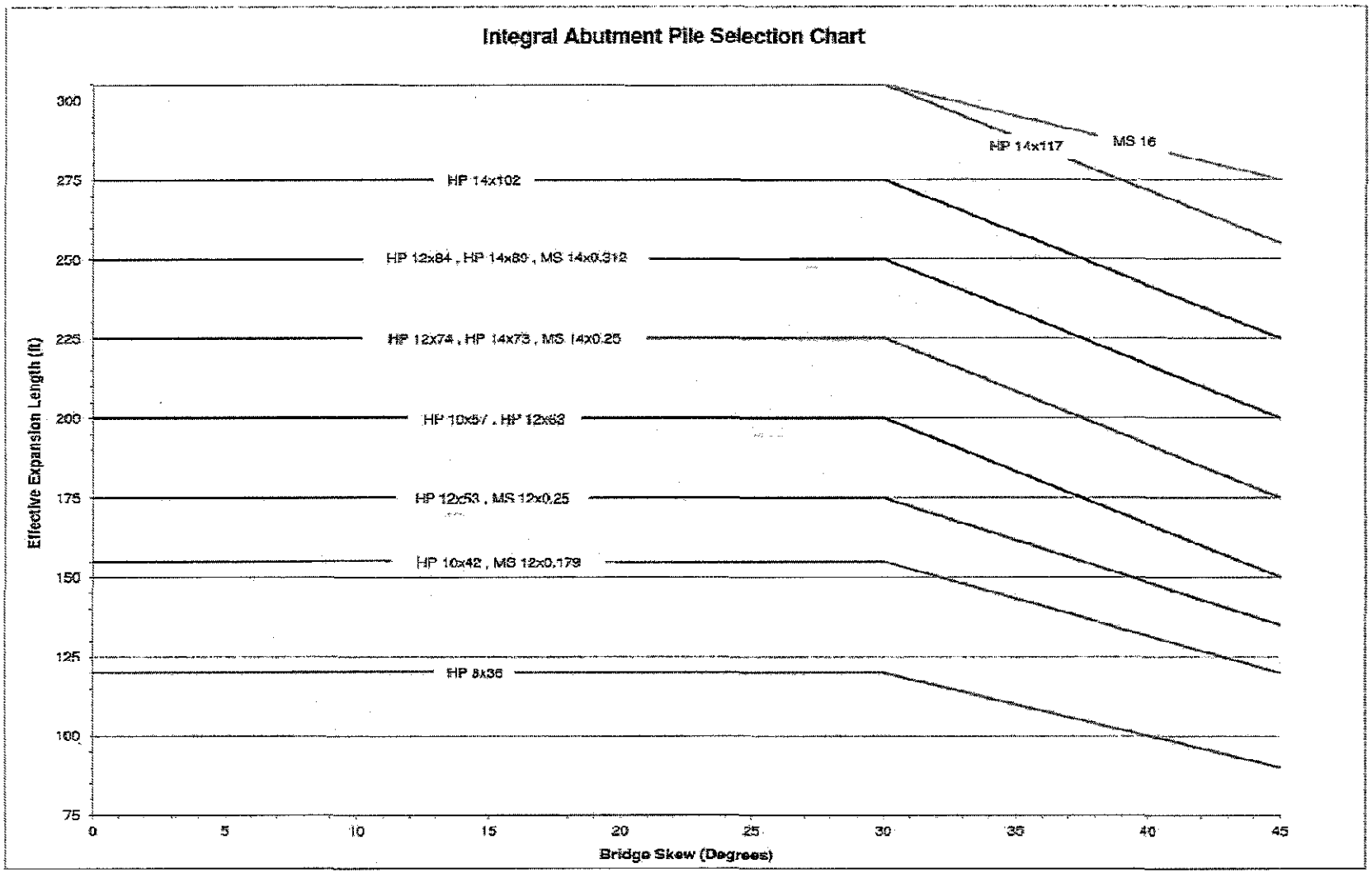
Integral Abutment Pile Selection Chart
Effective Expansion Length (ft)
300
275
250
225
200
175
150
125
100
75
0
5
10
15
20
25
30
35
40
45
Bridge Skew (Degrees)
HP 14x117
MS 16
HP 14x102
HP 12x84 , HP 14x89 , MS 14x0.312
HP 12x74 , HP 14x73 , MS 14x0.25
HP 10x57 , HP 12x63
HP 12x53 , MS 12x0.25
HP 10x42 , MS 12x0.179
HP 8x36

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 1/7/2014

STRUCTURE NUMBER	2399.2	
STRUCTURE TYPE	MULTI-SPAN	
STRUCTURE SKEW	20	DEGREES
TOTAL STRUCTURE LENGTH	210.00	FT
LONGEST END SPAN LENGTH	120.00	FT

ABUTMENT #1 DATA

ABUTMENT NAME	South	
ABUTMENT REFERENCE BORING	B-3	
BOTTOM OF ABUTMENT ELEVATION	646.2	FT
ESTIMATED NUMBER OF PILES AT ABUT.	6	

ABUTMENT #2 DATA

ABUTMENT NAME	North	
ABUTMENT REFERENCE BORING	B-1	
BOTTOM OF ABUTMENT ELEVATION	646.5	FT
ESTIMATED NUMBER OF PILES AT ABUT.	6	

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
644.90	1.30		4	1.7
643.40	1.50		2	1.2
641.40	2.00		1	0.7
638.40	3.00		1	0.7
636.20	2.20		4	1.7

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
644.60	1.90	2.3		
642.10	2.50	1.6		
640.60	1.50	1.6		
638.10	2.50	1.6		
636.50	1.60	0.6		

10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1 = 1.14 TSF

WEIGHTED AVERAGE Qu FOR ABUTMENT #2 = 1.57 TSF

PILE STIFFNESS MODIFIER FOR ABUTMENT #1

Equal to 1.0 since ave. Qu < 1.5 = 1.00

PILE STIFFNESS MODIFIER FOR ABUTMENT #2

= 1/(1.45-[0.3*1.57]) = 1.02

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1*6*0+1.02*6*210]/[1*6+1.02*6] = 106.16 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1.02*6*0+1*6*210]/[1.02*6+1*6] = 103.84 FT

EFFECTIVE EXPANSION LENGTH (EEL) CALCULATION

CONTROLLING ABUTMENT	ABUT. #1 South	
CONTROLLING EXPANSION LENGTH (DISTANCE TO CENTROID OF STIFFNESS FROM CONTROLLING ABUTMENT)	106.16	FT
WEIGHTED AVE. Qu FOR CONTROLLING ABUTMENT	1.14	TSF
Qu CORRECTION FACTOR	N/A	
EFFECTIVE EXPANSION LENGTH (EEL)	106.16	FT

FEASIBLE PILE TYPES PER CHART IN ABD MEMO 12.3 BASED ON SKEW AND EEL OR MODIFIED EEL:

PILE SIZES AT OR ABOVE THE LENGTH LINE AT THE INTERSECTION WITH THE SKEW LINE ARE ALLOWED FOR USE WITH THIS INTEGRAL ABUTMENT STRUCTURE

AVAILABLE PILE SIZES:

HP 8X36, HP 10X42, MS 12x0.179, HP 12X53, MS 12x0.25, HP 10X57, HP 12X63, HP 12X74, HP 14X73, MS 14x0.25, HP 12X84, HP 14X89, MS 14x0.312, HP 14X102, HP 14X1