STRUCTURE GEOTECHNICAL REPORT
US 12/45 OVER ADDISON CREEK
BRIDGE STRUCTURE
EXISTING SN: 016-1036, PROPOSED SN: 016-1351
SECTION 464-B, CONTRACT 60V22
COOK COUNTY, ILLINOIS

for

HBM Engineering Group

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submitted by

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Original: March 6, 2017
Revised: October 9, 2017

Technical Report Documentation Page

1. Title and Subtitle
Structure Geotechnical Report
US 12/45 over Addison Creek
Bridge Structure

2. Report Dates
Original: March 6, 2017
Revised: October 9, 2017

3. Report Type ☒ SGR ☐ RGR
☐ Draft ☒ Final ☒ Revised

4. Route / Section / County
330 / 464-B / Cook

5. IDOT Job / Contract No.
C-91-007-12 / 60V22

6. PTB / Item No.
161/008

5. Existing Structure Number(s)
016-1036

6. Proposed Structure Number(s)
016-1351

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10. Abstract

A new single span slab bridge structure will be constructed replacing the existing three cell culvert over Addison Creek in Cook County, Illinois. This report provides geotechnical recommendations for the design of the proposed structure foundations.

Below the pavement, the soils include up to 8 feet of fill materials consisting of stiff to very stiff, silty clay loam and loose to medium dense silt, sand to gravelly sand. Below fill subgrade soil include 17.5 to 20.0 feet of stiff to hard silty clay to silty clay loam diamicton and 1 to 5.5 feet of very dense gravelly sand weathered bedrock overlying the dolostone bedrock. The seismic performance zone is 1.

It is understood that the proposed bridge structure is recommended to be supported on steel sheet pile embankment and H-piles foundation. The report provides geotechnical recommendations for the design of structure.

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TABLE OF CONTENTS

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STRUCTURE GEOTECHNICAL REPORT
US ROUTE 12/45 OVER ADDISON CREEK
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FOR
HBM ENGINEERING GROUP

1.0 INTRODUCTION

This report presents the results of the Wang Engineering, Inc. (Wang) geotechnical evaluations for the design and construction of a new structure carrying US Route 12/45 over Addison Creek located 0.1 miles north of the intersection of Lake Street with Mannheim Road in the City of Stone Park, Cook County, Illinois. The new structure, proposed to be a slab bridge structure, will replace the existing culvert at the same location. On the *USGS Elmhurst 7.5 Minute Series* map, the proposed structure is located in the SW ¼ of Section 4, Tier 39 N, Range 12 E. A *Site Location Map* is presented as Exhibit 1.

1.1 Existing and Proposed Structures

The existing structure (S.N. 016-1036) was originally constructed in 1924 as a cast-in-place box culvert three cells 10' wide and 4' high and 38'-6" length. The culvert was extended at an unknown date to be 60' long. A second culvert extension in 1964 resulted in a 94'-6" long culvert. In 1969, the center cell of the culvert was removed and dredged to achieve a final middle cell depth of 7'-3" vertical clearance. The culvert was extended to the east in 1974 to become 103'-6" long. The existing structure is planned to be replaced with a slab bridge structure (S.N. 016-1351) supported on sheet piling abutments. The structure is 105’-8” out-to-out deck with a clear span of 44’-6” back-to-back abutments. The grade profile will not be raised. The final *TSL Plan* dated July 11, 2017 is included in Appendix D.

Preliminary service and factored loads provided by the designer, HBM Engineering Group (HBM), are shown in Table 1.

Table 1: Preliminary Foundation Loads

Substructure ID	Service Dead Load (kips)	Service Live Load (kips)	Combined Service Load (kips)	Estimated Total Factored Load (kips)
North Abutment	1366	367	1733	2378
South Abutment	1366	367	1733	2378

2.0 METHODS OF INVESTIGATION

2.1 Subsurface Investigation

Wang performed four soil borings between November 11 and 14, 2013 for the subsurface investigation of the Mannheim Road over Addison Creek structure in Stone Park, Illinois. Based on information received from Millennia Professional Services of Illinois (MPSI), dated November 11, 2013, Wang located the soil borings near the existing structure, as close as existing underground utilities permitted. A *Boring Location Plan* is attached as Exhibit 2.

The borings are designated as SB-01A, SB-01B, SB-02, and SB-03. Boring SB-01A encountered an obstruction at 10 feet bgs and was relocated and renamed as SB-01B and reached the designed depth of 32 feet. Borings SB-02 and SB-03 were terminated at 41 and 33 feet respectively. The as drilled boring locations were provided by MPSI. Boring location data are presented in the *Boring Logs* (Appendix A).

A truck-mounted drilling rig, equipped with hollow stem augers, was used to advance and maintain an open borehole to 10 feet. Mud rotary drilling technique was used from 10 to the top of bedrock. Soil sampling was performed according to AASHTO T 206, "*Penetration Test and Split Barrel Sampling of Soils*." The soil was sampled at 2.5-foot intervals to 30 feet bgs and at 5-foot intervals to boring termination depth. Bedrock cores, 5- and 10-foot long runs, were obtained from Borings SB-01B, SB-02, and SB-03 with an NWD4 size core barrel. Field boring logs prepared and maintained by a Wang field engineer, included lithological descriptions, visual-manual soil classifications, results of pocket penetrometer and Rimac unconfined compressive strength tests, and standard penetration tests (SPT) recorded per 6 inches of split-spoon penetration. After the completion of drilling, all soil samples were transported to Wang's geotechnical laboratory in Lombard, Illinois for further examination and laboratory testing.

Groundwater observations were made during and at the end of drilling operations. Due to safety considerations, the boreholes were backfilled immediately upon completion and the locations were restored as close as possible to their original conditions.

2.2 Laboratory Testing

Soil visual descriptions performed in the field were verified in the laboratory. The testing program included water content determination (AASHTO T 265) on all samples and particle-size analysis (AASHTO T 88) and Atterberg limits (AASHTO T89 and AASHTO T 90) tests on selected samples. The soils were classified according to the IDH Soil Classification System. The results of the laboratory analyses are presented in the *Boring Logs* (Appendix A).

3.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

3.1 Soil Conditions

Detailed descriptions of the lithological units encountered in the borings are presented on the attached *Boring Logs* (Appendix A). Please note that the strata contact lines shown on the *Boring Logs* (Appendix A) and *Subsurface Soil Profile* (Exhibit 3) represent approximate boundaries between soil types. In the field, the actual transition between soil types might be gradual in horizontal and vertical directions.

The pavement consists of 3.5- to 14.0-inch thick asphalt over granular base, except Boring SB-01B which encountered 8.0-inch thick concrete under the 3.5-inch thick asphalt pavement. In descending order, the general lithologic succession encountered beneath the pavement includes 1) man-made ground (fill); 2) stiff to hard stiff silty clay to silty clay loam; 3) very dense gravelly sand; and 4) dolostone bedrock.

(1) Man-made ground (fill)

Underneath the pavement structure, the borings encountered up to 8.0-foot thick granular and cohesive fill. The granular fill consists of loose to medium dense silt, sand, and gravelly sand which has SPT N values of 5 to 21 blows/foot and moisture content (MC) values of 7 to 23%. The cohesive fill consists of stiff to very stiff silty clay loam and has unconfined compressive strength (Qu) values of 1.5 to 2.5 tsf and MC values of 24 to 28%.

(2) Stiff to hard silty clay to silty clay loam

Underneath the fill, the borings encountered 17.5- to 20.0-foot thick of stiff to very stiff, brown and gray to gray silty clay to silty clay loam diamicton with Qu values of 1.5 to 9.7 tsf and MC values of 11 to 28%. Medium dense to very dense silty loam interbeds with SPT N-values of 26 to 58 blows/foot and MC values of 11 to 15% are present throughout.

(3) Very dense gravelly sand

At elevation 608.8 to 611.0 feet (25.5 to 27.0 feet bgs), the borings advanced through up to 5.5-foot thick, very dense, gravelly sand to sandy gravel weathered bedrock with SPT N values more than 50 blows/foot and MC values of 9 to 10%.

(4) Dolostone bedrock

Dolostone bedrock was cored for 5.0 to 10.0 feet from auger refusal at 605.5 to 609.0 feet elevation (27 to 31 feet bgs). The bedrock was described as strong, with very poor to poor rock quality, brown, horizontally bedded, moderately weathered, moderately fractured, slightly vuggy. The rock recovery ranges from 53 to 100% and the rock quality designation (RQD) ranges from 0 to 47%.

3.2 Groundwater Conditions

The groundwater was encountered at 3.0 and 5.5 feet bgs while drilling and was associated with the granular fill, more likely it is perched water.

3.3 Mining Activity

There was no past coal mining activity at the proposed structure location. Lake County is not identified as coal-producing area by Illinois State Geological Survey.

4.0 ANALYSES AND RECOMMENDATIONS

4.1 Scour Considerations

The TSL plan shows a Natural Design High Water Elevation (50-year) of 637.00 feet. Wang understand that the interim streambed elevation matches existing condition and future upstream and downstream elevations will be 626.28 and 626.13 feet, respectively. The Estimated Water Surface Elevation (EWSE) was not shown on TSL plan.

A hydraulic report was prepared for the Department in February 2017 by Atlas Engineering Group, Ltd. (AEG) and provided by HBM. The reduced design scour elevations as provided in the hydraulic report are presented in Table 2.

Table 2: Design Scour Elevations

Event/Limit State	Design Scour Elevations (feet) North Abutment	Design Scour Elevations (feet) South Abutment	Item 113
Q100	617.90	617.40	5
Q200	616.90	616.30	
Design	617.90	617.40	
Check	616.90	616.30	

As per the IDOT Bridge Manual, at open abutments protected with riprap, design scour is typically set not at predicted scour, but at the bottom of the abutment. From a geotechnical point of view considering preventing local erosion, we recommend providing stone riprap at both ends of the structure. This will also minimize long term maintenance and provide protection to the stream bed at the interface.

4.2 Seismic Design Considerations

The Seismic Site Class was determined using IDOT Design Guide *AGMU Memo 09.01 LRFD Seismic Soil Site Class Definition* dated January 7, 2009 and IDOT spreadsheet "*Seismic Site Class Determination*" dated December 13 2010. Based on the subsurface soil profile and bottom of cap established at elevation 630.97 feet, the site is in Seismic Site Class C. The results of *Seismic Site Class Determination* are presented in Appendix C.

The seismic spectral acceleration parameters were determined using the AASHTO computer program "*Seismic Design Parameters, version 2.10*" by specifying location by latitude and longitude. The location of the structure was considered at Latitude of 41.898837 and Longitude of -87.883679. The procedure for determining seismic design data is included in 2009 AASHTO LRFD Bridge Design Specifications. Considering seismic design spectrum values and Soil Site Class and based on Table 3.15.2-1 and Figure 2.3.10-2 in the IDOT 2012 Bridge Manual, the Seismic Performance Zone is 1. The recommended seismic design data for the spread footing foundation are summarized in Table 3.

Table 3: Seismic Design Parameters

Seismic Parameter	Value
Seismic Performance Zone (SPZ)	1
Design Spectral Acceleration at 1.0 sec. ($\mathbf{S_{D1}}$)	0.061g
Design Spectral Acceleration at 0.2 sec. ($\mathbf{S_{DS}}$)	0.113g
Soil Site Class	C

As per 2012 IDOT Bridge Manual, liquefaction analysis is not required for a site located in Seismic Performance Zone 1.

5.0 ANALYSIS AND RECOMMENDATIONS

It is understood that the slab bridge structure is proposed to be supported on steel sheet piling abutments with H-piles foundation. The bottom of the cap will be established at elevation 630.97 feet. It is understood that the bridge structure design will be based on 2014 AASHTO LRFD Bridge Design Specifications except as modified by the IDOT 2012 Bridge Manual. The following sections include geotechnical evaluations and recommendations for the bridge approach embankments, approach slabs, and foundations.

5.1 Approach Embankments and Slabs

Based on the TSL Plan included in Appendix D, Wang understands that the grade profile will only be slightly raised for the bridge approach embankments. The approach slabs can be supported on approach footings. IDOT standard design specifies a maximum applied service bearing pressure of 2.0 ksf for the approach footing. We estimate that the subgrade soils for the approach footing will have an allowable bearing resistance of 2.0 ksf based on the borings performed for the abutments.

5.2 Bridge Structure Foundations

Based on the soil conditions encountered during our investigation, design loads, scour depths, and construction feasibility and cost, the structure could be supported on driven H-piles with a steel sheet pile embankment as proposed by HBM. Foundation design data and recommendations pertaining to construction for the preferred foundation system are presented in subsequent sections of this report.

5.3 Abutments on Driven Piles

The abutments could be supported on driven piles. The most common types of piles used for a bridge structure are steel H-piles designed as friction piles and concrete piles consisting of metal shells filled with concrete either 12” or 14” diameter. Driving the metal shell pile through layers of hard cohesive soil and dense granular soils will be difficult and could possibly damage the pile toe and cause deformation at the pile head. Also due to shorter driven lengths, the metal shell piles will not achieve vertical capacity and may not develop the required fixity for the lateral load capacity. Therefore, we do not recommend using metal shell piles for the abutments support. Steel H-piles designed as friction or end bearing piles could be considered. We recommend considering H-piles with pile shoes if driven to maximum Nominal Required Bearing.

The estimated pile lengths at each abutment for various pile sizes and capacities are shown in Tables 4 through 6. Capacities other than shown in the tables can be provided if required during the design. The estimated pile lengths were calculated using the IDOT spreadsheet *Modified IDOT Static Method of Estimating Pile Length* dated October 18, 2011. The estimated pile lengths include two feet of embedment into the pile cap.

Table 4: Estimated Pile Lengths and Tip Elevation for 10-inch Steel H-Piles

Structure Unit (Boring Reference)	Proposed/ Assumed Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
North Abutment (SB-01B)	630.55	109	60	18	615
		145	80	20	613
		182	100	22	611
		218	120	22	611
		255	140	23	610
		291	160	23	610
		335[1)]	184	24	609
		454[2)]	250	24	609
South Abutment (SB-02, SB-03)	630.55	109	60	20	614
		145	80	23	610

Structure Unit (Boring Reference)	Proposed/ Assumed Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
		182	100	24	609
		218	120	24	609
		255	140	25	608
		279	160	25	608
		335 1)	184	26	607
		454 2)	250	27	606

1) Maximum Nominal Required Bearing for HP 10 x 42
2) Maximum Nominal Required Bearing for HP 10 x 57

Table 5: Estimated Pile Lengths and Tip Elevation for 12-inch Steel H-Piles

Structure Unit (Boring Reference)	Proposed/ Assumed Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
North Abutment (SB-01B)	630.55	109	60	14	619
		145	80	18	615
		182	100	21	612
		218	120	22	611
		255	140	22	611
		291	160	23	611
		364	200	23	610
		418 1)	230	24	609
		497 2)	273	24	609
		589 3)	324	24	609
		664 4)	365	24	609
South Abutment (SB-	630.55	109	60	15	618

Structure Unit (Boring Reference)	Proposed/ Assumed Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
02, SB-03)		145	80	22	611
		182	100	23	610
		218	120	24	609
		255	140	24	609
		291	160	25	608
		327	180	25	608
		419[1)]	230	26	607
		497[2)]	273	27	606
		589[3)]	324	27	606
		664[4)]	365	28	605

1) Maximum Nominal Required Bearing for HP 12 x 53
2) Maximum Nominal Required Bearing for HP 12 x 63
3) Maximum Nominal Required Bearing for HP 12 x 74
4) Maximum Nominal Required Bearing for HP 12 x 84

Table 6: Estimated Pile Lengths and Tip Elevation for 14-inch Steel H-Piles

Structure Unit (Boring Reference)	Proposed/ Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
North Abutment (SB-01B)	630.55	109	60	12	622
		145	80	15	619
		182	100	18	615
		218	120	21	612
		255	140	22	611
		291	160	22	611
		327	180	22	611
		364	200	23	610
		400	220	23	610

Structure Unit (Boring Reference)	Proposed/ Pile Cap Base Elevation (feet)	Nominal Required Bearing, R_N (kips)	Factored Resistance Available, R_F (kips)	Total Estimated Pile Length (feet)	Estimated Pile Tip Elevation (feet)
		578[1]	318	24	609
		705[2]	388	25	608
		810[3]	446	25	608
		929[4]	511	26	607
South Abutment (SB-02, SB-03)	630.55	109	60	14	619
		145	80	17	616
		182	100	22	611
		218	120	23	610
		255	140	24	609
		291	160	24	609
		327	180	25	608
		364	200	25	608
		578[1]	318	26	607
		705[2]	388	27	606
		810[3]	446	28	605
		929[4]	511	28	605

1) Maximum Nominal Required Bearing for HP 14 x 73
2) Maximum Nominal Required Bearing for HP 14 x 89
3) Maximum Nominal Required Bearing for HP 14 x 102
4) Maximum Nominal Required Bearing for HP 14 x 117

The most economical pile sizes should be selected. Due to shorter lengths and by driving only few feet more, H-piles will get maximum structural design capacity. Therefore, we recommend using H-piles driven to their maximum nominal required bearing in rock. The maximum structural design capacity of the pile and the spacing should be as per IDOT 2012 Bridge Manual. One test pile at each abutment should be identified on the plans which should be installed prior to production pile installation. There is no need for a full scale load test.

5.4 Downdrag Loads on Driven Piles

A relative settlement between the piles and surrounding soils of more than 0.4 inch would result in downdrag loads. We estimate the relative settlement at the abutments will be less than 0.4 inches. Thus, downdrag load allowances are not included on the piles supporting the abutments.

5.5 Pile Foundation Settlement

The driven pile foundations designed and constructed as recommended will undergo less than 0.5 inches of settlement.

5.6 Lateral Design Pressures

For design of the abutment walls, we recommend a linearly increasing unfactored lateral pressure of 40 pounds per square foot per foot of depth below horizontal finished grade. Additional lateral load from traffic should include a surcharge of 2 feet of soil considering a unit weight of 125 pounds per cubic foot as per AASHTO Specifications. A Geocomposite Wall Drain should be placed over the entire length of the back face of the abutment walls and connected to a 4” diameter perforated drain pipe in accordance with IDOT Bridge Manual.

5.7 Resistance to Lateral Loads

Lateral loads on piles should be analyzed for maximum moments and lateral deflections. A geotechnical resistance factor of 1.0 should be used. No allowance should be made for the frictional resistance of the concrete cap on soil. The lateral load capacity analysis can be performed using computer programs such as COMP 624P, L-pile, LATPILE or any other such program. The estimated soil parameters that may be used for the analysis of stresses and deflection under lateral loads are presented in Tables 7 and 8. Group action should be considered for piles in soils in calculating total lateral load resistance of the substructures.

Table 7: Recommended Soil Parameters for Lateral Load Analysis
North Abutment (SB-01B)

Soil Layer Elevation Range	Effective Unit Weight, (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Undrained		Drained		
		Cohesion, Cu (psf)	Estimated Friction Angle, φ (Degree)	Estimated Friction Angle, φ' (Degree)		
Clay 630.9*-628.0	58	1500	0	31	500	0.007
Silty Clay 628.0-620.5	58	2500	0	32	1000	0.005
Silty Loam 620.5-618.0	58	0	36	36	130	--
Silty Clay Loam 618.0-615.5	58	6000	0	32	2000	0.004
Silty Loam 615.5-613.5	58	0	36	36	130	--
Silty Clay Loam 613.5-610.5	63	8300	0	32	2000	0.004

*Proposed bottom of pile cap base

Table 8: Recommended Soil Parameters for Lateral Load Analysis
South Abutment (SB-02 and SB-03)

Soil Layer Elevation Range	Effective Unit Weight, (pcf)	Shear Strength Properties			Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
		Undrained		Drained		
		Cohesion, Cu (psf)	Estimated Friction Angle, φ (Degree)	Estimated Friction Angle, φ' (Degree)		
Sandy Clay Loam 630.9*-628.5	48	0	28	28	20	--
Clay to Silty Clay 628.5-620.3	58	2300	0	32	1000	0.005
Silty Loam 620.3-618.0	53	0	34	34	60	--
Silty Clay Loam 618.0-608.8	63	6500	0	32	2000	0.004
Gravelly Sand 608.8-605.5	63	0	36	36	135	--

*Proposed bottom of pile cap base

5.8 Permanent Steel Sheet Piling

It is understood that steel sheet pile abutments without concrete facing will be used. The soil parameters shown in Tables 9 and 10 are recommended to be used for the design of the steel sheet pile walls. The parameters were determined based on the soil conditions encountered in the borings. The design of the wall should ignore 3 feet of riprap/soil in front of the wall measured from the finished streambed elevation in providing passive pressure due to frostheave conditions. In developing the design lateral pressure, the lateral pressure due to surcharge load should be added to the lateral earth pressure. We recommend using granular backfill, if required behind the wall. The water pressure should be added to the earth pressure if weep holes are not provided. The simplified earth pressure distribution shown in the 2012 AASHTO LRFD Design Specifications should be used. Other design details recommended by the IDOT should be followed. Design considerations should include effects from scour on the sheet piling embedment and deflection control at the top of the wall. We recommend considering minimum tip elevation of 615.0 feet.

It should be noted that the vibratory driving of steel sheet piling will very difficult below approximate elevation 619.0 feet. We recommend considering impact driving below elevation 619.0 feet. Driving with an impact hammer below elevation 615.0 feet will be very difficult. We recommend specifying pile point and use of impact hammer for driving steel sheet piles if the tip elevations are designed to be below elevation 619.0.

Table 9: Geotechnical Parameters for Design of Steel Sheet Pile Wall
North Abutment (SB-01B)

Soil Layer Elevation Range	Effective Unit Weight, (pcf)	Shear Strength Properties			Lateral Earth Pressure Cofficient Active (Ka)	Lateral Earth Pressure Cofficient Passive (Kp)
		Undrained		Drained		
		Cohesion, Cu (psf)	Estimated Friction Angle, φ (Degree)	Estimated Friction Angle, φ' (Degree)		
Clay 630.3*-628.0	58	1500	0	31	0.32	3.12
Silty Clay 628.0-620.5	58	2500	0	32	0.31	3.25
Silty Loam 620.5-618.0	58	0	36	36	0.26	3.85
Silty Clay Loam 618.0-615.5	63	6000	0	32	0.31	3.25
Silty Loam 615.5-613.5	63	0	36	36	0.26	3.85
Silty Clay Loam 613.5-610.5	63	8300	0	32	0.31	3.25

*Proposed bottom of pile cap base

Table 10: Geotechnical Parameters for Design of Steel Sheet Pile Wall
South Abutment (SB-02 and SB-03)

Soil Layer Elevation Range	Effective Unit Weight, (pcf)	Shear Strength Properties: Undrained: Cohesion, Cu (psf)	Shear Strength Properties: Undrained: Estimated Friction Angle, φ (Degree)	Shear Strength Properties: Drained: Estimated Friction Angle, φ' (Degree)	Lateral Earth Pressure Cofficient Active (Ka)	Lateral Earth Pressure Cofficient Passive (Kp)
Sandy Clay Loam 630.3*-628.5	48	0	28	28	0.36	2.77
Clay to Silty Clay 628.5-620.3	58	2300	0	32	0.31	3.25
Silty Loam 620.3-618.0	58	0	34	34	0.28	3.54
Silty Clay Loam 618.0-608.8	63	6500	0	32	0.31	3.25

*Proposed bottom of pile cap base

5.9 Stage Construction Considerations

Vehicular traffic on Mannheim Road will be maintained utilizing staged construction. It is understood that the structure will be constructed in three stages. Excavation to an approximate depth of 6 feet (approximate elevation 630.0 feet) below the existing grade will be required to construct pile cap. A temporary cantilever steel sheet piling will be feasible based on the charts included in *Design Guide 3.13.1* (IDOT Bridge Manual).

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Excavation and Utilities

Excavations should be performed in accordance with local, state, and federal regulations. The potential effect of ground movements upon nearby utilities should be considered during construction. Any open excavation to a depth of 5 feet should have a slope of 1.5:1 (H: V) for cohesive soils and 2:1 (H: V) for granular soils or flatter.

6.2 Filling and Backfilling

Embankment fill required to attain the final design subgrade elevations should be in accordance with Section 205 of the IDOT Standard Specifications. All fill and backfill materials should be pre-approved by the site engineer. The fill should be free of organic materials and debris. The backfill behind the walls should be in accordance with IDOT Standard Specifications, Special Provisions, and the 2012 IDOT Bridge Manual.

6.3 Groundwater

Groundwater will be encountered in conjunction with some of the subgrade granular soil materials, and temporary dewatering of pile cap excavations will be required.

7.0 QUALIFICATIONS

The subsurface investigation was performed in accordance with accepted geotechnical engineering practice for the purpose of determining slab bridge structure design and construction recommendations only. Verification of the subsurface conditions for purposes of determining contamination, difficulty of excavation, and trafficability is beyond the scope of this investigation. In the event that any changes in the nature and design of the proposed structure are made, the conclusions and recommendations contained in this report should not be considered valid until the changes are reviewed and the conclusions and recommendations in this report have been modified or verified in writing.

The analysis and recommendations contained in this report are based on the soils encountered at the boring locations shown in Exhibit 2. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until a later stage of construction. Should conditions encountered during excavation and construction operations differ from those encountered in the borings, Wang Engineering, Inc. should be notified so that recommendations can be reviewed and revised if necessary.

It has been a pleasure to assist HBM Engineering Group, Millennia Professional Services of Illinois and IDOT District One on this project. Please call if there are any questions, or if we can be of further service.

License
Expires: 11-30-17

Respectfully Submitted,

MOHAMMED A KOTHAWALA
062-040483
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PROFESSIONAL
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OF
ILLINOIS

WANG ENGINEERING, INC.

MKothawala 10-9-17

Mohammed A. Kothawala, P.E., D.GE
Sr. Project Manager/Sr. Geotechnical Engineer

Corina T. Farez

Corina T. Farez P.E.
Vice President

REFERENCES

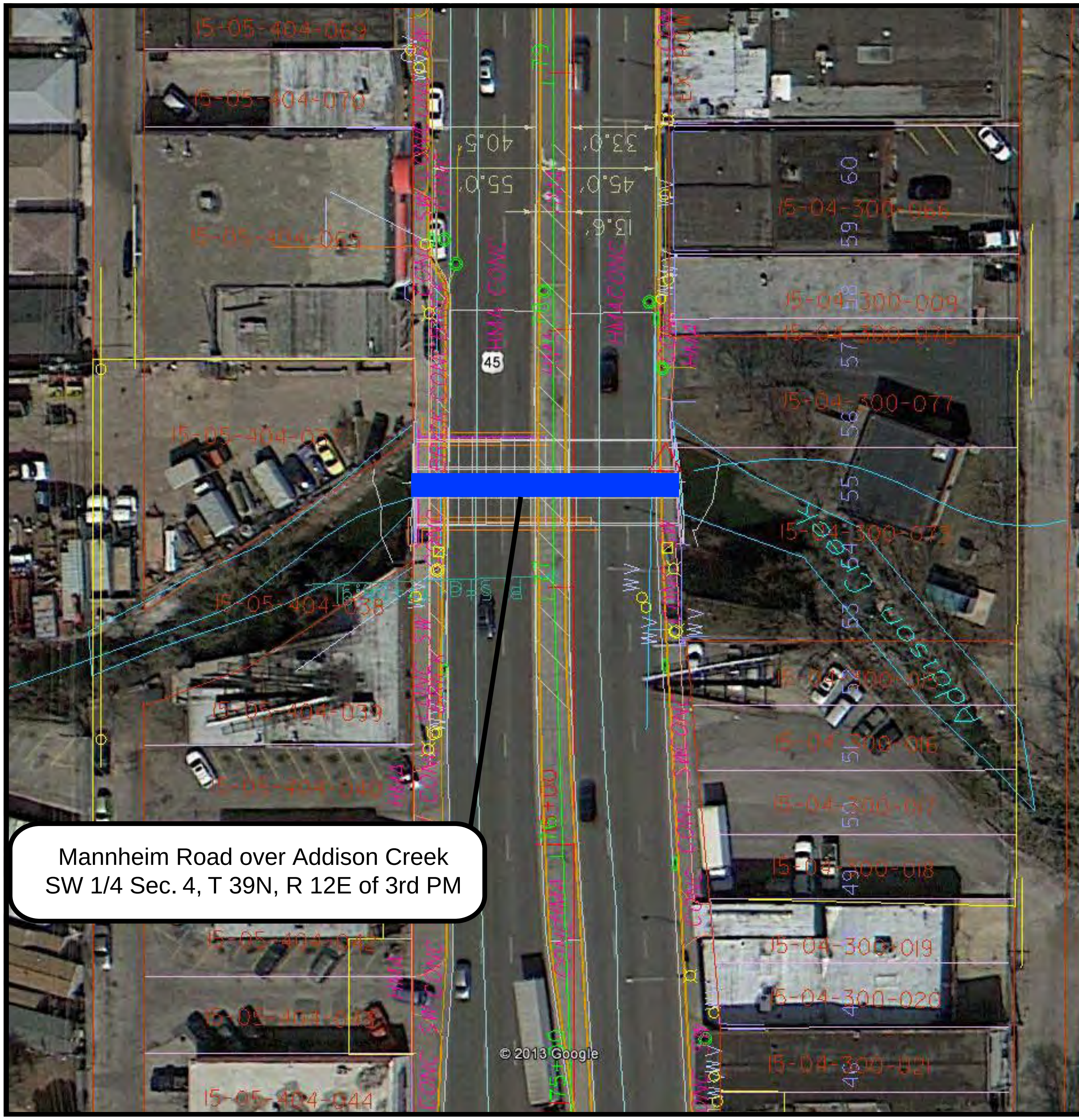
AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2014) *LRFD Bridge Design Specifications*. United States Department of Transportation, Washington, D.C.

ILLINOIS DEPARTMENT OF TRANSPORTATION (1999) *Geotechnical Manual*. IDOT Bureau of Materials and Physical Research, Springfield, IL.

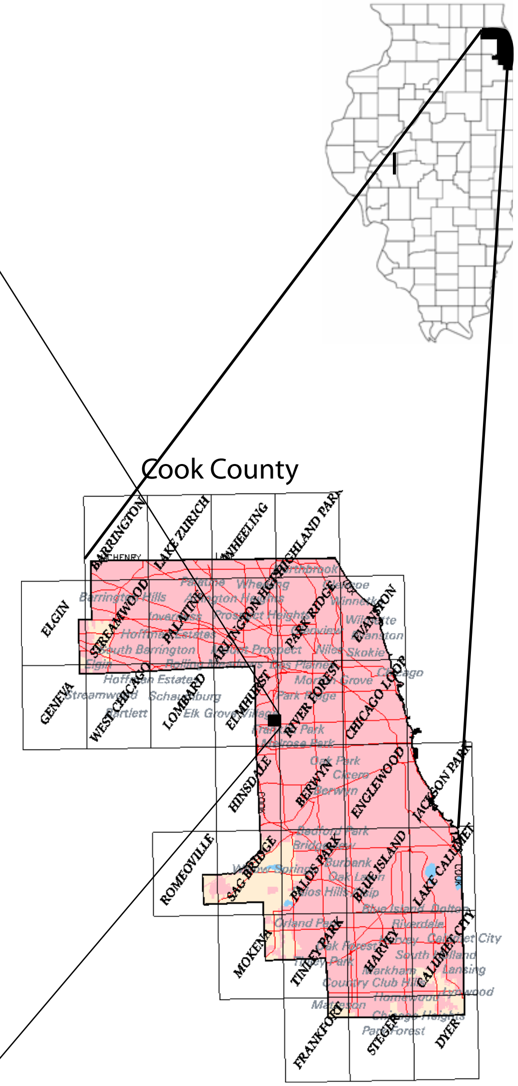
ILLINOIS DEPARTMENT OF TRANSPORTATION (2015) *Standard Specifications for Road and Bridge Construction.* IDOT Division of Highways, Springfield, IL.

ILLINOIS DEPARTMENT OF TRANSPORTATION (2012) *Bridge Manual.* IDOT Bureau of Bridges and Structures, Springfield, IL.

EXHIBITS



0 60 120 Yards

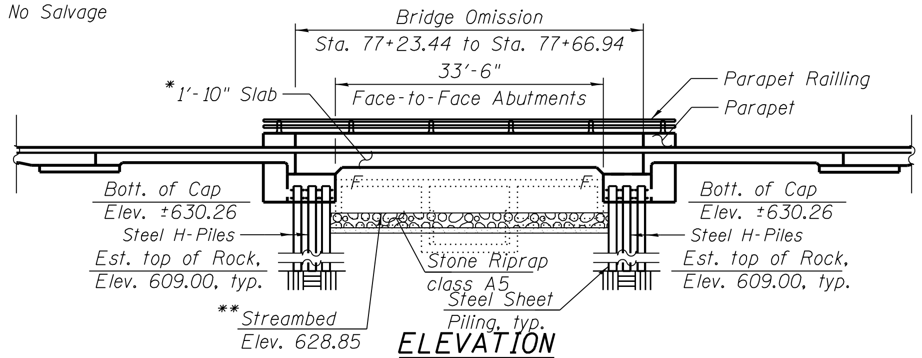


SITE LOCATION MAP: US ROUTE 12/45 OVER ADDISON CREEK COOK COUNTY, IL		
SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: C. Marin CHECKED BY: M. Kothawala
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR MILLENNIA PROFESSIONAL SERVICES of ILLINOIS		616-02-04

Bench Mark: Found square cut in north part of east bridge parapet of Mannheim rd. bridge over Addison Creek. Elev. 637.02.

Existing Structure: S.N. 016-1036 originally constructed in 1924 as a cast-in-place box culvert three cells 10' wide and 4' high and 38'-6" length. The culvert was extended at an unknown date to be 60' long. A second culvert extension in 1964 resulted in a 94'-6" long culvert. In 1969, the center cell of the culvert was removed and dredged to achieve a final middle cell depth of 7'-3" vertical clearance. The culvert was extended to the east in 1974 to become 103'-6" long. Two lanes of traffic shall be maintained for each direction in stage I construction. One lane of traffic shall be maintained for northbound and two lanes for southbound in stage II construction.

No Salvage



ELEVATION

(Wingwall Sheet Piling not Shown For Clarity)
(Looking West)

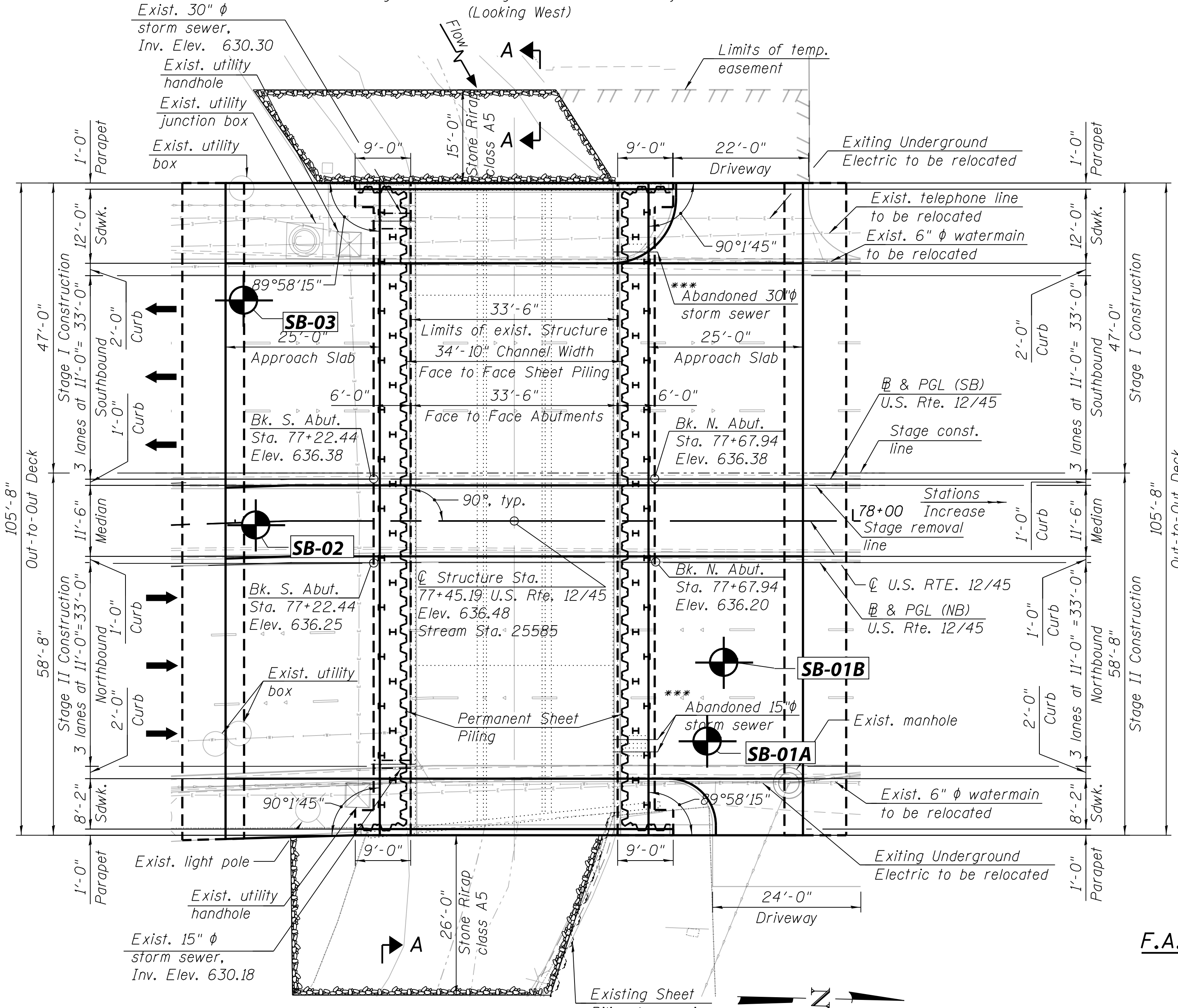
* Slab thickness subject to refinement during the design phase.

** Interim streambed elevation matches existing condition. Future upstream elevation =626.28, future downstream elevation =626.13 per MWRD.

*** Existing sewer is plugged with concrete.

LEGEND

Soil Boring location



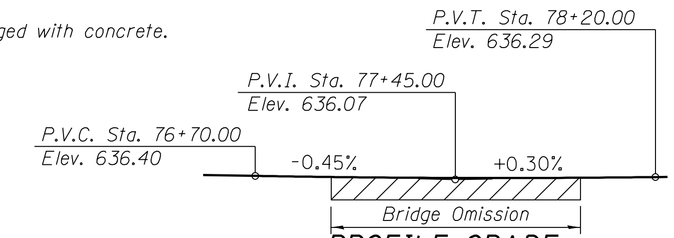
PLAN

WATERWAY INFORMATION

Drainage Area = 8.31 sq. mi. Low Grade Elev. = 635.06 at Sta. 83+30 Max. Recorded H.W.E = 637.33

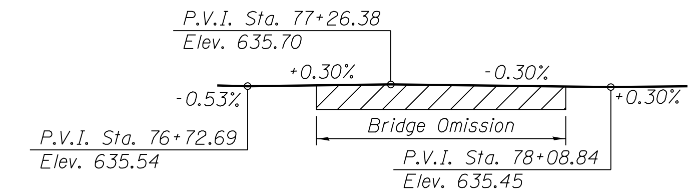
Flood	Freq. Yr.	Discharge-C.F.S Exist.	Discharge-C.F.S Prop.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	2									
	10	494	494	120	130.3	635.90	1.20	0.80	637.00	636.70
Design	50	774	774	120	130.3	637.00	0.80	0.80	637.90	637.90
Base	100	863	863	120	130.3	637.40	0.40	0.40	637.80	637.80
Overtopping										
Max. Calc.	500	1060	1060	120	130.3	638.20	0.00	0.00	638.20	638.20

10-year velocity through the existing structure = 4.10 fps. 10-year velocity through the proposed structure = 3.80 fps.



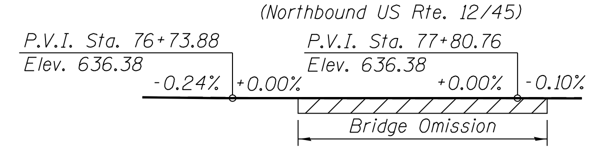
PROFILE GRADE

(Northbound US Rte. 12/45)



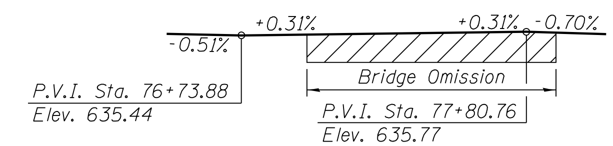
GUTTER PROFILE GRADE

(Northbound US Rte. 12/45)



PROFILE GRADE

(Southbound US Rte. 12/45)



GUTTER PROFILE GRADE

(Southbound US Rte. 12/45)

DESIGN SCOUR ELEVATION TABLE

Design Scour Elevation (ft.)	D.S. Invert	U.S. Invert

SOIL BORING LOCATION

Boring Log No.	Station	Offset
SB-01A	77+76.27	35.96 RT
SB-01B	77+79.16	22.89 RT
SB-02	77+3.28	0.66 RT
SB-03	77+2.75	35.99 LT

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 Interim Revisions.

LOADING HL-93

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.061g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.113g
Soil Site Class = C

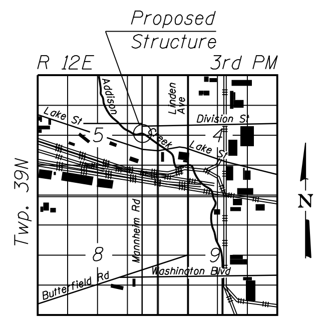
DESIGN STRESSES

FIELD UNITS

f'_c = 3,500 psi
f'_c = 4,000 psi (Superstructure Concrete)
f_y = 60,000 psi (Reinforcement)
f_y = 50,000 psi (AASHTO M270 Grade 50)

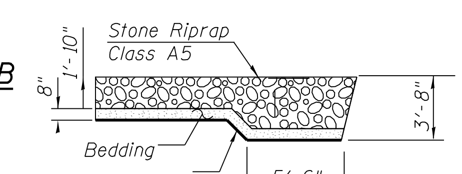
HIGHWAY CLASSIFICATION

F.A.P Rte. 330 - US. Rte. 12/45
Functional Class: Other Principal Arterial
ADT: 39,500(2009); 40,000(2030)
DHV: 3,200 (Two-Way Traffic)
Directional Distribution 50/50
ADTT: 8%
Design Speed: 35 mph
Posted Speed: 30 mph



LOCATION SKETCH

GENERAL PLAN
U.S. RTE. 12/45 OVER ADDISON CREEK
F.A.P. RTE. 330 - SEC. 464-B
COOK COUNTY
STATION 77+45.19
STRUCTURE NO. 016-1351



SECTION A-A

BORING LOCATION PLAN: US ROUTE 12/45 OVER ADDISON CREEK, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 2	DRAWN BY: R. KC CHECKED BY: M. Kothawala

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FOR MILLENNIA PROFESSIONAL SERVICES OF ILLINOIS 616-02-04

HBM ENGINEERING GROUP, LLC CONSULTING & DESIGN INSPECTION & RATING RESEARCH & TESTING
4415 WEST HARRISON ST. SUITE 231 HILLSIDE, IL 60162 PHONE: (708) 236-0900 FAX: (708) 236-0901

0161351-60V22-TSL-001.dgn	DESIGNED - MA, KJD	REVISED
USER NAME = mustafa.alobaidi	DRAWN - MA, KJD	REVISED
PLOT SCALE = 24.00 ' / in.	CHECKED - MI	REVISED
PLOT DATE = 7/13/2015	DATE - 07/13/2015	REVISED

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

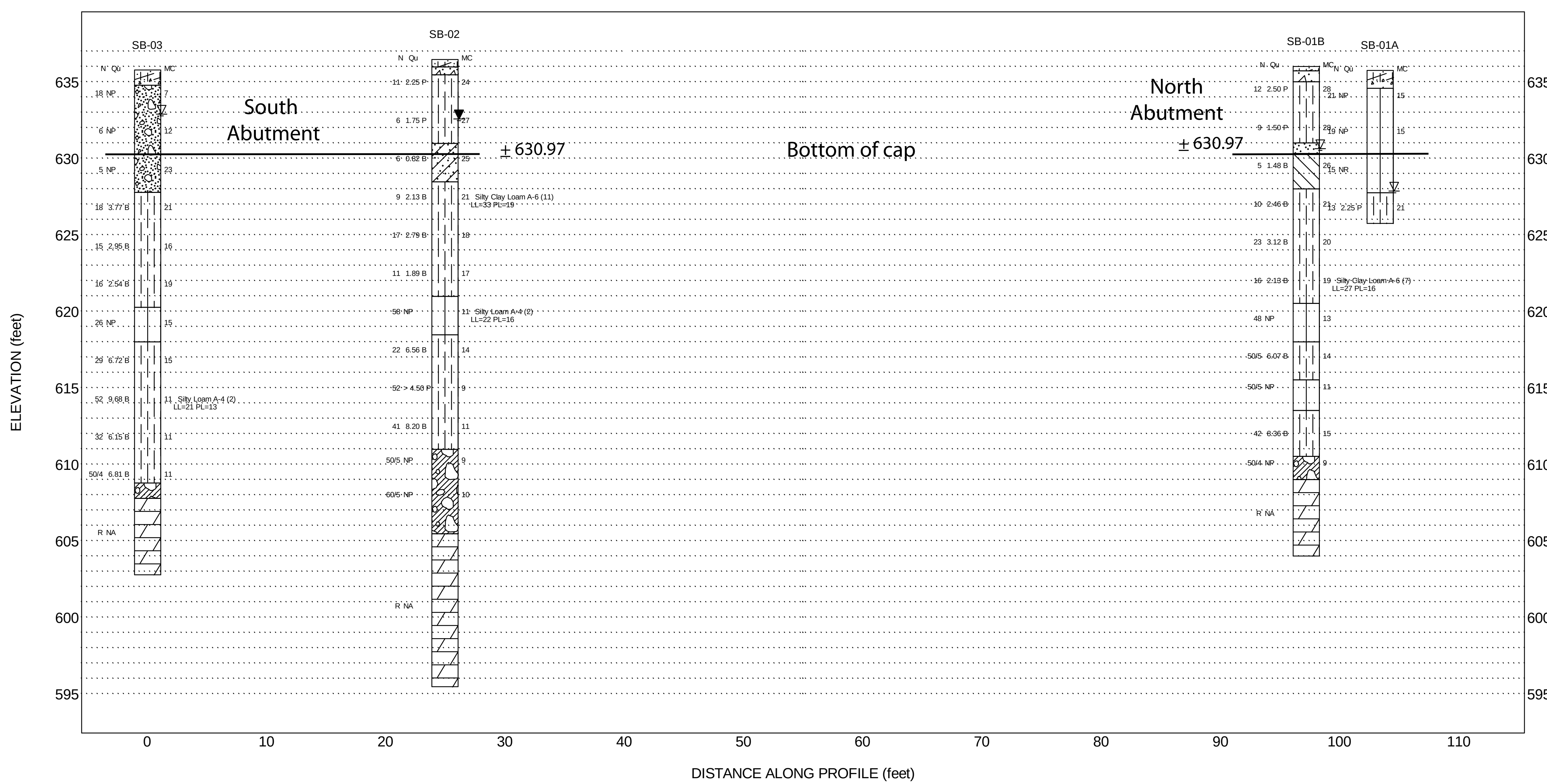
SCALE: SHEET 1 OF 3 SHEETS STA. TO STA.

F.A.I RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
330	464-B	COOK	3	1

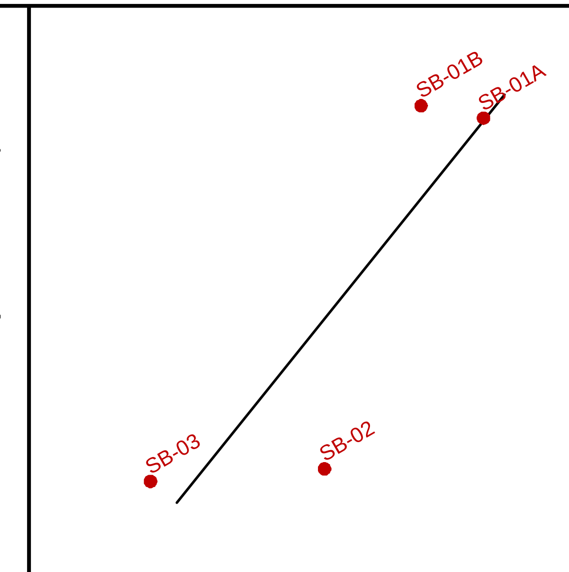
CONTRACT NO. 60V22

ILLINOIS FED. AID PROJECT

FILE PATH = Pw:\1111-532 IDOT PTB161 Item 8 (Various-Various)\Work Order #11 - US 12 over Addison Creek Culvert\Structural\TSL\0161351-60V22-TSL-001.dgn

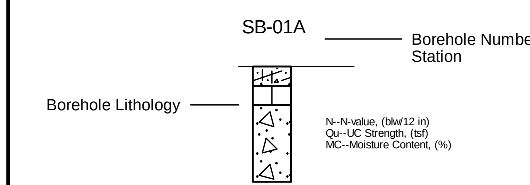


N



Site Map Scale 1 inch equals 40 feet

Explanation:



Water Level Reading at time of drilling.

Water Level Reading 24-hr after drilling or at end of drilling

Horizontal Scale (feet)

Vertical Exaggeration: 1.5x

Lithology Graphics

- Pavement
- IDH Sand, Sandy Loam
- Crushed stone
- IDH Silt, Silty Loam
- IDH Clay
- IDH Sandy Clay, Sandy Clay Loam
- IDH Silty Clay, Silty Clay Loam
- Weathered bedrock
- Gravelly sand, sandy gravel
- Concrete
- Dolomite or Dolomitic Limestone

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Lombard, Illinois 60148

Subsurface Data Profile
SN 016-1351

WEI SINCE 1982

Mannheim Road over Addison Creek
Stone Park, Illinois

JOB NUMBER	PLATE NUMBER
616-02-04	EXHIBIT 3

WEI 11X17 6160204.GPJ WANGENG.GDT 7/21/15

APPENDIX A

Wang Engineering
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Fax: 630 953-9938

BORING LOG SB-01A

WEI Job No.: 616-02-04

Client: **Millennia Professional Services of Illinois**
Project: **Mannheim Road over Addison Creek**
Location: **Stone Park, Illinois**

Datum: NAVD 88
Elevation: 635.74 ft
North: 1906121.24 ft
East: 1106698.68 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	14-inch thick ASPHALT						
634.6	Medium dense, gray SILT, with very fine sand --FILL--			1	8 10 11	NP	15
		5		2	5 9 10	NP	15
				3	11 8 7	NR	
627.7	Very stiff, brown, SILTY CLAY LOAM, trace gravel			4	5 6 7	2.25 P	21
625.7	Boring terminated at 10.00 ft	10					
		15					
		20					
		25					

GENERAL NOTES

Begin Drilling **11-11-2013** Complete Drilling **11-11-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55**
Driller **P&N** Logger **F. Bozga** Checked by **DRAFT**
Drilling Method **3.25" HSA, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **8.00 ft**
At Completion of Drilling **NA**
Time After Drilling **NA**
Depth to Water **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG SB-01B

WEI Job No.: 616-02-04

Client **Millennia Professional Services of Illinois**
Project **Mannheim Road over Addison Creek**
Location **Stone Park, Illinois**

Datum: NAVD 88
Elevation: 636.01 ft
North: 1906123.83 ft
East: 1106685.56 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
635.7	3.5-inch thick ASPHALT --PAVEMENT--					
635.0	8-inch thick CONCRETE --PAVEMENT--					
	Stiff to verry stiff, brown to black, SILTY CLAY LOAM --FILL--		1	3 5 7	2.50 P	28
		5	2	2 3 6	1.50 P	28
631.0	Wet SAND --FILL--					
630.3	Stiff, brown CLAY		3	2 2 3	1.48 B	26
628.0	Verry stiff, brown to gray SILTY CLAY, trace gravel	10	4	3 4 6	2.46 B	21
			5	6 9 14	3.12 B	20
		15	6	4 7 9	2.13 B	19
620.5	Dense, gray, SILTY LOAM		7	21 22 26	NP	13
618.0	Hard, gray SILTY CLAY LOAM, trace gravel 4-inch gray rock fragments --HARD DRILLING--	20	8	9 18 50/5	6.07 B	14
615.5	Verry dense, gray, SILTY LOAM, trace gravel		9	50/5	NP	11
613.5	Hard, gray, SILTY CLAY LOAM, trace gravel	25	10	9 16 26	8.36 B	15

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
610.5	Very dense, brown weathered dolostone fragments --WEATHERED BEDROCK--		11	50/4	NP	9
609.0	Strong, brown, very poor rock mass quality, thin bedded, moderatelly weathered DOLOSTONE, up to 4-inch beds, <4-inch spaced joints, horizontal with less than 0.2-inch infilling, hard joint wall, moderately vuggy, highly fractured --RUN 1 - RECOVERY= 53%-- --RQD = 0% --	30	1	CORE		
604.0	Boring terminated at 32.00 ft	35, 40, 45, 50				

GENERAL NOTES

Begin Drilling	**11-14-2013**	Complete Drilling	**11-14-2013**
Drilling Contractor	**Wang Testing Services**	Drill Rig	**CME-55**
Driller **P&F**	Logger **F. Bozga**	Checked by	**DRAFT**
Drilling Method	**2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**		

WATER LEVEL DATA

While Drilling	**5.50 ft**
At Completion of Drilling	**4 (MUD)**
Time After Drilling	**NA**
Depth to Water	**NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG SB-02

WEI Job No.: 616-02-04

Client: **Millennia Professional Services of Illinois**
Project: **Mannheim Road over Addison Creek**
Location: **Stone Park, Illinois**

Datum: NAVD 88
Elevation: 636.46 ft
North: 1906047.49 ft
East: 1106665.27 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
636.0	6-inch thick, ASPHALT					
635.5	6-inch thick CRUSHED STONE --BASE COURSE--					
	Stiff to very stiff, brown and black SILTY CLAY LOAM --FILL--		1	3 5 6	2.25 P	24
		5	2	2 3 3	1.75 P	27
631.0	Medium stiff, brown and gray SANDY CLAY LOAM --FILL--		3	1 3 3	0.82 B	25
628.5	Stiff to very stiff, brown to gray CLAY to SILTY CLAY, trace gravel	10	4	2 3 6	2.13 B	21
			5	5 8 9	2.79 B	18
		15	6	3 5 6	1.89 B	17
621.0	Very dense, gray SILTY LOAM		7	20 25 33	NP	11
618.5	Hard, gray SILTY CLAY LOAM, trace gravel	20	8	13 9 13	6.56 B	14
			9	25 26 26	> 4.50 P	9
		25	10	14 16 25	8.20 B	11
611.0	Very dense, brown GRAVELLY SAND --WEATHERED BEDROCK-- --HARD DRILLING-- --Possible Cobbles--		11	48 50/5	NP	9
		30	12	60/5	NP	10
605.5	Strong, brown, poor rock mass quality, thin bedded, slightly weathered to fresh DOLOSTONE, up to 12-inch beds, 2- to 12-inch spaced joints, horizontal and oblique with less than 0.2-inch infilling, hard joint wall, slightly weathered joints, moderately vuggy, moderately fractured --RUN 1 - RECOVERY= 100%-- --RQD = 47% --	35, 40	1	CORE		
595.5	Boring terminated at 41.00 ft	45, 50				

GENERAL NOTES

Begin Drilling **11-12-2013** Complete Drilling **11-12-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55**
Driller **R&J** Logger **F. Bozga** Checked by **DRAFT**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **NA**
At Completion of Drilling: **4.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG SB-03

WEI Job No.: 616-02-04

Client: **Millennia Professional Services of Illinois**
Project: **Mannheim Road over Addison Creek**
Location: **Stone Park, Illinois**

Datum: NAVD 88
Elevation: 635.76 ft
North: 1906044.86 ft
East: 1106628.71 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	12-inch thick ASPHALT					
634.8	Loose to medium dense, brown SANDY GRAVEL --FILL--		1	8 10 8	NP	7
		5	2	2 3 3	NP	12
			3	3 3 2	NP	23
627.8	Very stiff, brown to gray SILTY CLAY, trace gravel	10	4	5 7 11	3.77 B	21
			5	3 6 9	2.95 B	16
		15	6	3 6 10	2.54 B	19
620.3	Medium dense, gray SILTY LOAM, some sand seams		7	10 12 14	NP	15
618.0	Hard. gray SILTY CLAY LOAM, trace gravel	20	8	5 11 18	6.72 B	15
			9	13 19 33	9.68 B	11
		25	10	12 14 18	6.15 B	11
			11	11 28 50/4	6.81 B	11
608.8	Very dense, brown SANDY GRAVEL, some weathered dolostone fragments --WEATHERED BEDROCK--					
607.8	Strong, brown, very poor rock mass quality, thin bedded, moderately weathered DOLOSTONE, up to 4-inch beds, 1- to 4-inch spaced joints, horizontal with less than 0.2-inch infilling, hard joint wall, slightly weathered joints, moderately vuggy, moderately fractured --RUN 1 - RECOVERY= 85%-- --RQD = 7% --	30	1	CORE		
602.8	Boring terminated at 33.00 ft	35				
		40				
		45				
		50				

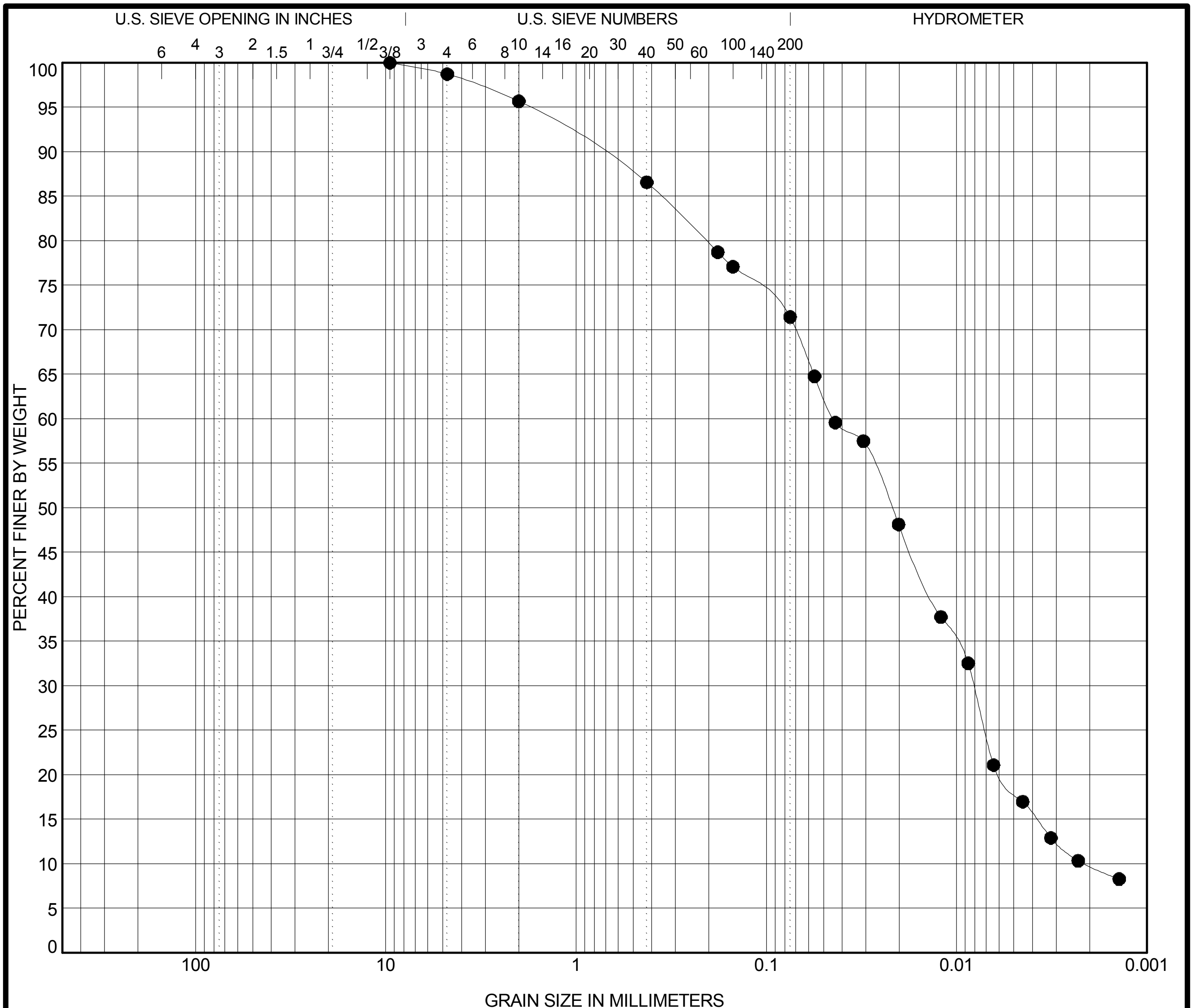
GENERAL NOTES

Begin Drilling **11-12-2013** Complete Drilling **11-14-2013**
Drilling Contractor **Wang Testing Services** Drill Rig **CME-55**
Driller **P/F** Logger **F. Bozga** Checked by **DRAFT**
Drilling Method **2.25" SSA to 10', mud rotary thereafter, boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **3.00 ft**
At Completion of Drilling ▼ **3 (MUD)**
Time After Drilling **NA**
Depth to Water ▼ **NA**
The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	SB-02#7	16.0 ft	**Silty Loam**	22	16	6	0.70	20.93

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-02#7	16.0 ft	9.5	0.044	0.008	0.002	4.3	24.5	61.4	9.8

WEI GRAIN SIZE IDH 6160204.GPJ US LAB.GDT 11/19/13

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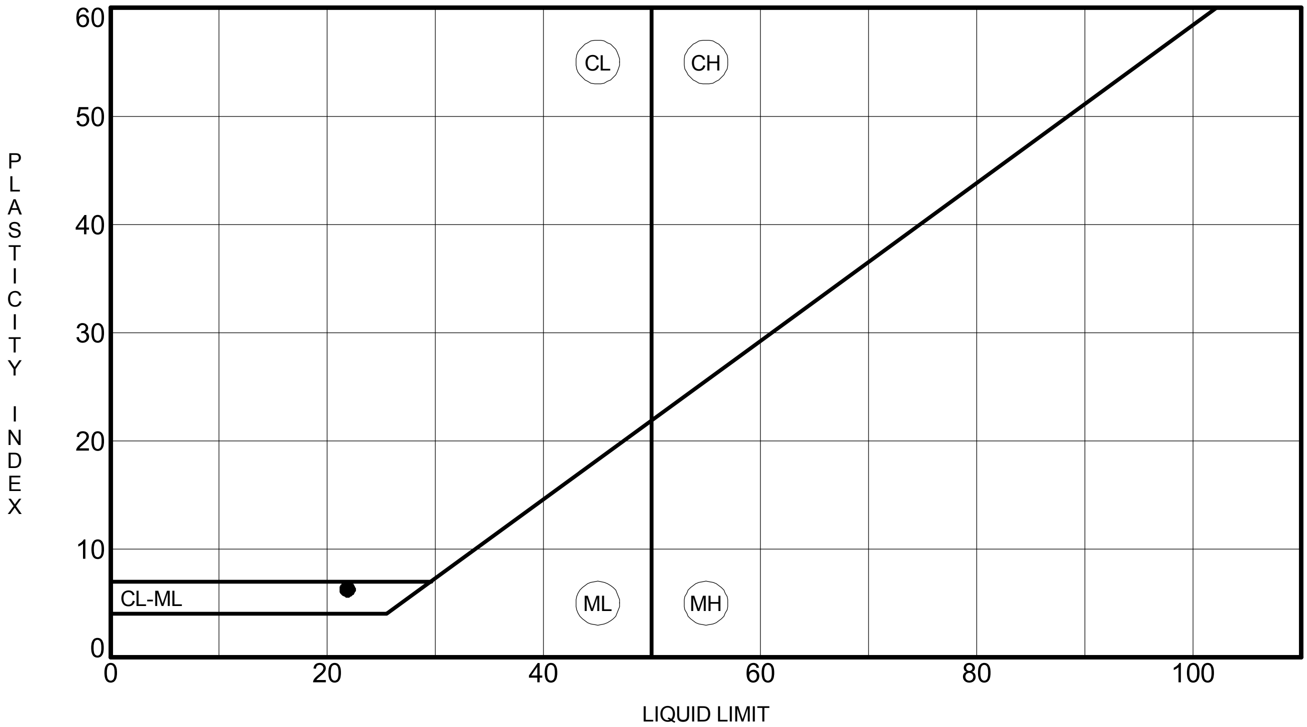
GRAIN SIZE DISTRIBUTION

Project: Mannheim Road over Addison Creek

Location: Stone Park, Illinois

Number: 616-02-04



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	**SB-02#7**	**16.0 ft**	**22**	**16**	**6**	**71**	**Silty Loam**

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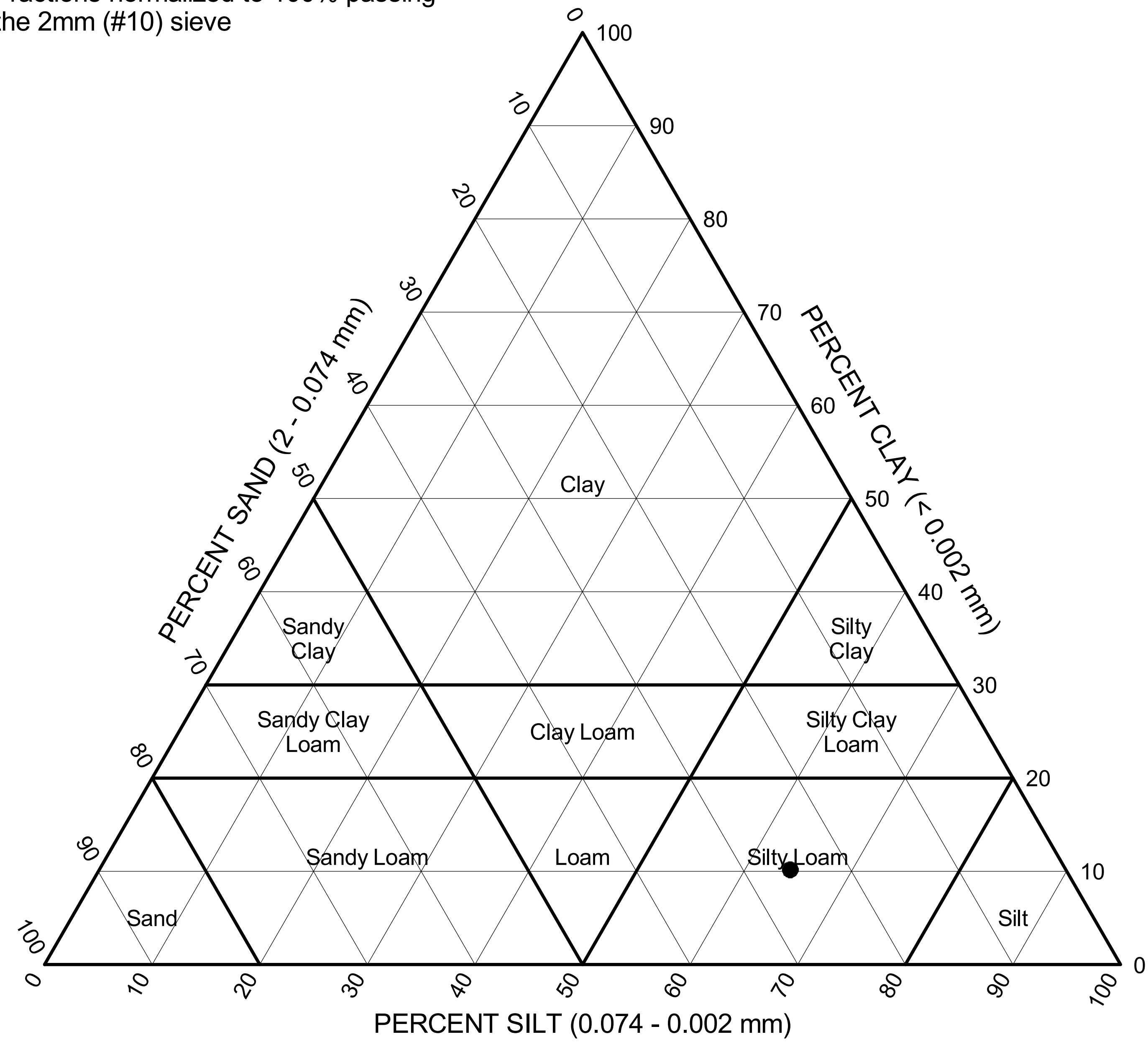
ATTERBERG LIMITS' RESULTS

Project: Mannheim Road over Addison Creek

Location: Stone Park, Illinois

Number: 616-02-04

Fractions normalized to 100% passing the 2mm (#10) sieve



	Sample	Depth (ft)	Sand (%)	Silt (%)	Clay (%)	Classification		
						IL DOT	AASHTO	ASTM
●	SB-02#7	16.0	25.6	64.2	10.2	Silty Loam	A-4 (2)	CL-ML

WEI SINCE 1982

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IDH Textural Classification Chart

Project: Mannheim Road over Addison Creek

Location: Stone Park, Illinois

Number: 616-02-04

APPENDIX C

SEISMIC SITE CLASS DETERMINATION

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

Modified on 12/10/10

PROJECT TITLE===== Millennia Professional Services of Illinois SN 016-1351

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	630.26	ft.
Pile or Shaft Dia.		inches
Boring Number	SB-01B	
Top of Boring Elev.	636.01	ft.

Approximate Fixity Elev. 630.26 ft.

Individual Site Class Definition:

N (bar):	53	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	97	(Blows/ft.)	Soil Site Class C
s_u (bar):	4.42	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	633.0	3.00	12	2.50	B
	630.5	2.50	9	1.50	
2.3	628.0	2.50	5	1.48	B
4.8	625.5	2.50	10	2.46	
7.3	623.0	2.50	23	3.12	
9.8	620.5	2.50	16	2.13	B
12.3	618.0	2.50	48		B
14.8	615.5	2.50	68	6.07	B
16.8	613.5	2.00	100		B
19.8	610.5	3.00	42	8.36	B
21.3	609.0	1.50	100		B
100.0	530.3	78.70	100	5.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	630.26	ft.
Pile or Shaft Dia.		inches
Boring Number	SB-02	
Top of Boring Elev.	636.46	ft.

Approximate Fixity Elev. 630.26 ft.

Individual Site Class Definition:

N (bar):	51	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	98	(Blows/ft.)	Soil Site Class C
s_u (bar):	4.16	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	633.5	3.00	11	2.25	B
	631.0	2.50	6	1.75	B
1.8	628.5	2.50	6	0.82	B
4.3	626.0	2.50	9	2.13	
6.8	623.5	2.50	17	2.79	B
9.3	621.0	2.50	11	1.89	B
11.8	618.5	2.50	58		B
14.3	616.0	2.50	22	6.56	
16.8	613.5	2.50	52	5.00	
19.3	611.0	2.50	41	8.20	B
21.8	608.5	2.50	98		
24.8	605.5	3.00	100		B
100.0	530.3	75.20	100	5.00	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	630.26	ft.
Pile or Shaft Dia.		inches
Boring Number	SB-03	
Top of Boring Elev.	635.76	ft.

Approximate Fixity Elev. 630.26 ft.

Individual Site Class Definition:

N (bar):	49	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	60	(Blows/ft.)	Soil Site Class C <----Controls
s_u (bar):	4.77	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	632.8	3.00	18		B
	630.3	2.50	6		
2.5	627.8	2.50	5		B
5.0	625.3	2.50	18	3.77	
7.5	622.8	2.50	15	2.95	
10.0	620.3	2.50	16	2.54	B
12.3	618.0	2.30	26		B
14.8	615.5	2.50	29	6.72	
17.3	613.0	2.50	52	9.68	
19.8	610.5	2.50	32	6.15	
22.5	607.8	2.70	78	6.81	B
100.0	530.3	77.50	100	5.00	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)		ft.
Pile or Shaft Dia.		inches
Boring Number		
Top of Boring Elev.		ft.

Approximate Fixity Elev. ft.

Individual Site Class Definition:

N (bar):		(Blows/ft.)	NA
N_{ch} (bar):		(Blows/ft.)	NA
s_u (bar):		(ksf)	NA

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Global Site Class Definition: Substructures 1 through 3

N (bar):	51	(Blows/ft.)	Soil Site Class C
N_{ch} (bar):	85	(Blows/ft.)	Soil Site Class C <----Controls
s_u (bar):	4.45	(ksf)	Soil Site Class C

APPENDIX D

Bench Mark: Found square cut in north part of east bridge parapet of Mannheim rd. bridge over Addison Creek. Elev. 637.02.

Existing Structure: S.N. 016-1036 originally constructed in 1924 as a cast-in-place box culvert three cells 10' wide and 4' high and 35'-4" length. The culvert was extended at an unknown date to be 60' long. A second culvert extension in 1964 resulted in a 94'-6" long culvert. In 1969, the center cell of the culvert was removed and dredged to achieve a final middle cell depth of 7'-3" vertical clearance. The culvert was extended to the east in 1974 to become 103'-6" long. Two lanes of traffic shall be maintained for each direction utilizing Stage Construction.

No Salvage

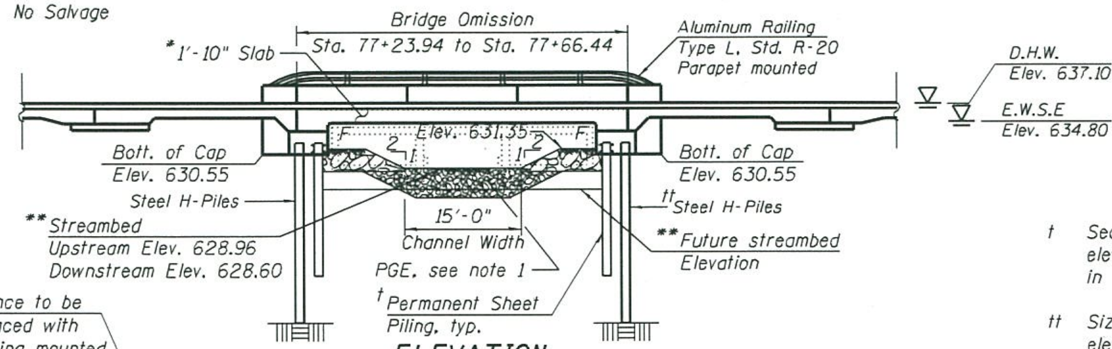
* Slab thickness subject to refinement during the design phase.

** Interim streambed elevation matches existing condition. Future upstream elevation =626.28, future downstream elevation =626.13 per MWRD.

*** Existing sewer is plugged with concrete.

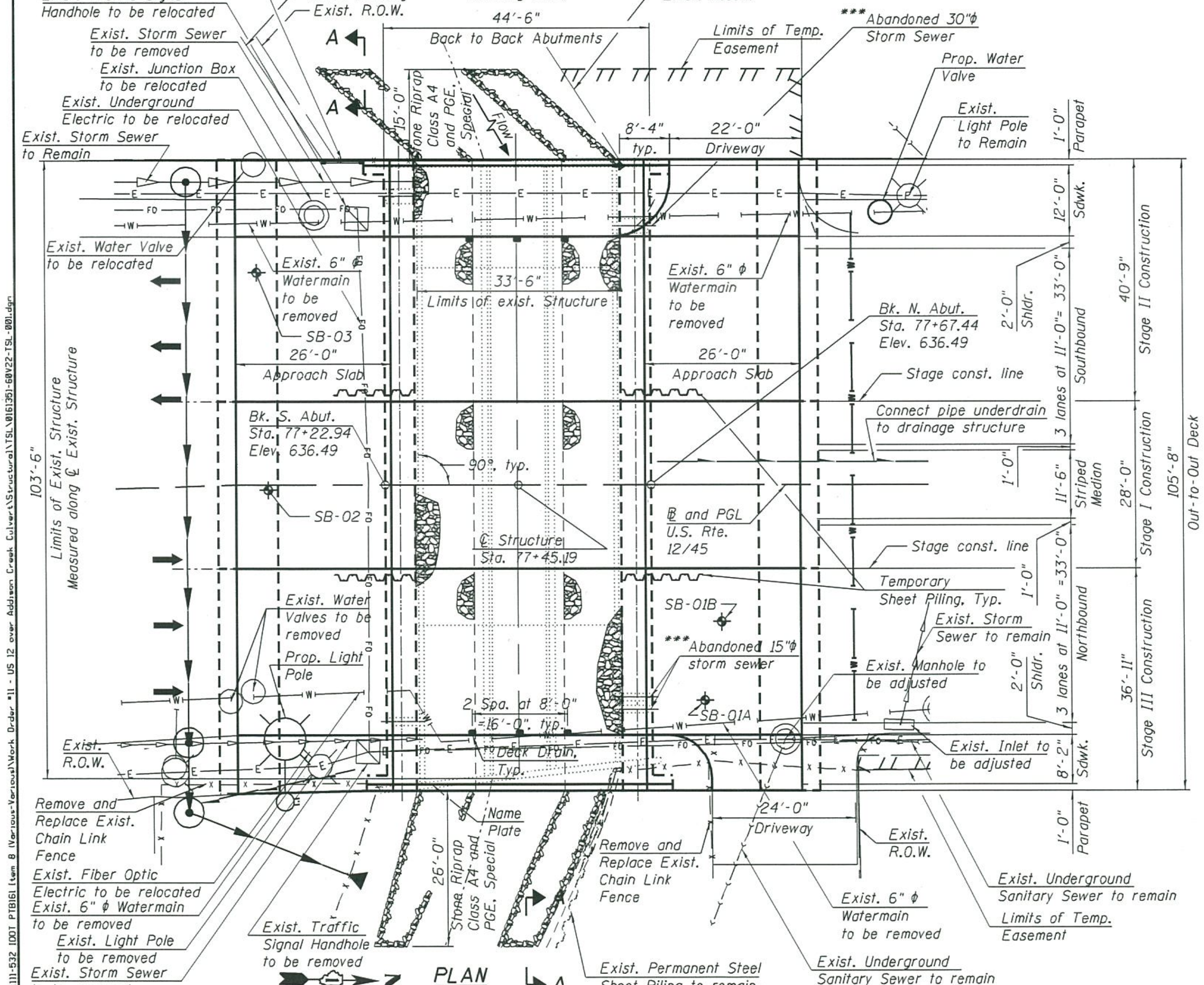
† Section modulus and tip elevation shall be determined in final design.

†† Size, spacing and tip elevations of piles shall be determined during final design.

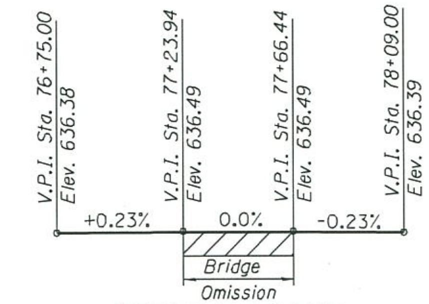


ELEVATION

(Wingwall Sheet Piling not Shown For Clarity)
(Looking West)



PLAN



PROFILE GRADE

(Along ℄ US Rte. 12/45)

HIGHWAY CLASSIFICATION

F.A.P Rte. 330 - US. Rte. 12/45
Functional Class: Other Principal Arterial
ADT: 39,500 (2009); 40,000 (2030)
DHV: 3,200 (Two-Way Traffic)
Directional Distribution 50/50
ADTT: 8%
Design Speed: 35 mph
Posted Speed: 30 mph

LEGEND

- Soil Boring location
- Exist. Water Main
- Exist. Light Pole
- Exist. Underground Electric
- Exist. Water Valve
- Exist. Telephone Line
- Exist. Telephone Junction Box
- Exist. Traffic Signal Handhole
- Exist. Manhole
- Exist. Permanent Steel Sheet Piling
- Exist. Fiber Optic
- Exist. Storm Sewer
- Prop. Storm Sewer
- Prop. Water Main
- Prop. Water Valve
- Prop. Manhole
- Prop. End Section

WATERWAY INFORMATION

Drainage Area = 8.31 sq. mi. Low Grade Elev. = 635.06 at Sta. 83+30 Max. Recorded H.W.E = 637.33

Flood	Freq. Yr.	Discharge-C.F.S		Opening Sq. Ft.		Nat. H.W.E.	Head - Ft.		Headwater El.	
		Exist.	Prop.	Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
	10	494	494	117	143	635.9	1.1	0.3	637.0	636.2
Design	50	774	774	117	143	637.1	1.1	0.4	638.2	637.5
Base	100	863	863	117	143	637.4	1.1	0.4	638.5	637.8
Overtopping										
Max. Calc.	500	1060	1060	117	143	638.2	0.9	0.3	639.1	638.5

10-year velocity through the existing structure = 5.2 fps. 10-year velocity through the proposed structure = 3.6 fps.
2 Year Peak Flow (Q) = 284 C.F.S. Estimated Water Surface Elevation = 634.8

CONSTRUCTION SEQUENCE FOR EACH STAGE CONSTRUCTION

1. Install temporary concrete barriers and temporary sheet piling.
2. Perform pavement removal and Structure Excavation for the approach slab and the abutments construction.
3. Install new permanent sheet piling and H-piles for the abutments.
4. Install shear studs, forms and reinforcement and construct concrete abutments.
5. Remove the existing portions of pavement and structure within limits of the current stage construction.
6. Perform Channel Excavation. Install Porous Granular Embankment, Special and Stone Riprap.
7. Construct deck slab and approach slabs.

APPROVED
JUL 12 2017
AS A BASIS FOR
PREPARATION OF DETAILED PLANS

NOTE

1. For limits of Stone Riprap, Class A4 and Porous Granular Embankmenk, Special, see Sheet 3 of 3.

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)		Item 113
	S. Abut.	N. Abut.	
0100	617.40	617.90	5
Q200	616.30	616.90	
Design	617.40	617.90	
Check	616.30	616.90	

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.061g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.113g
Soil Site Class = C

DESIGN SPECIFICATIONS

2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 and 2016 Interim Revisions.

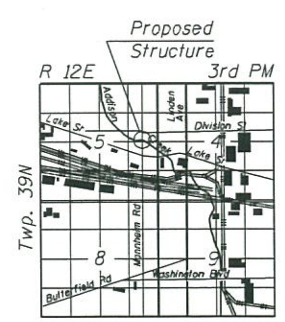
LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

f'_c = 3,500 psi
f'_c = 4,000 psi (Superstructure Concrete)
f_y = 60,000 psi (Reinforcement)
f_y = 50,000 psi (AASHTO M270 Grade 50)



LOCATION SKETCH

GENERAL PLAN
U.S. RTE. 12/45
(MANNHEIM ROAD) OVER
ADDISON CREEK
F.A.P. RTE. 330 - SEC. 464-B
COOK COUNTY
STATION 77+45.19
STRUCTURE NO. 016-1351

HBM ENGINEERING GROUP LLC — 4415 WEST HARRISON ST. SUITE 231 HILLSIDE, IL 60162 PHONE: (708) 236-0900 FAX: (708) 236-0901

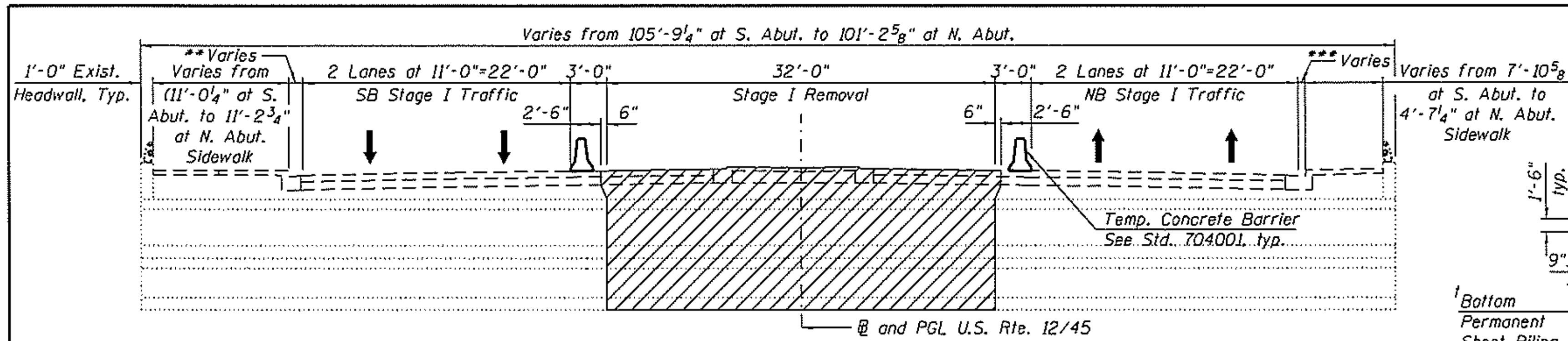
0161351-60V22-TSL-001.dgn	DESIGNED - MI, MA	REVISED	
USER NAME = lisa.buntin	DRAWN - MA, KJD	REVISED	
PLOT SCALE = 24.00 ' / in.	CHECKED - LAB, MI	REVISED	
PLOT DATE = 7/11/2017	DATE - 07/11/2017	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: SHEET 1 OF 3 SHEETS STA. TO STA.

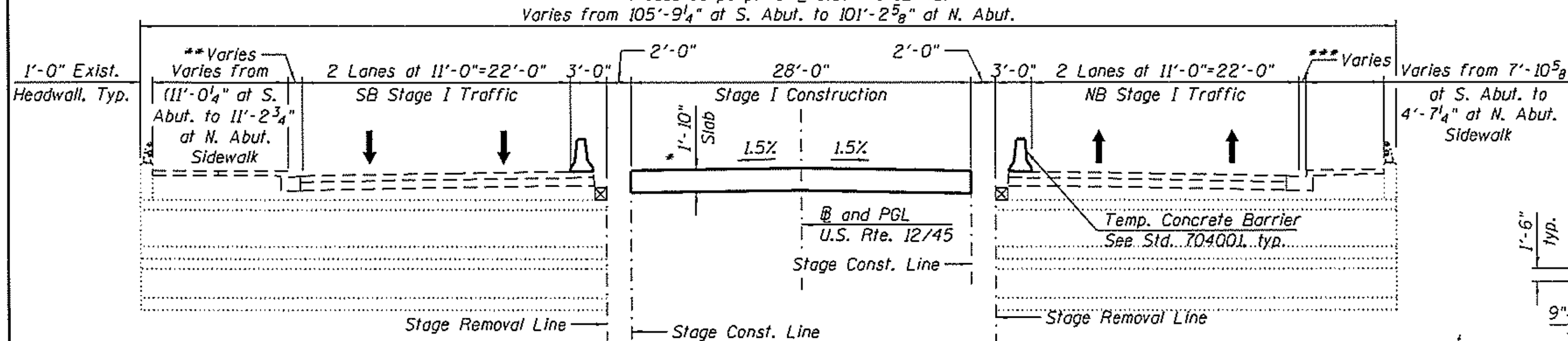
F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
330	464-B	COOK	3	1

CONTRACT NO. 60V22
ILLINOIS FED. AID PROJECT



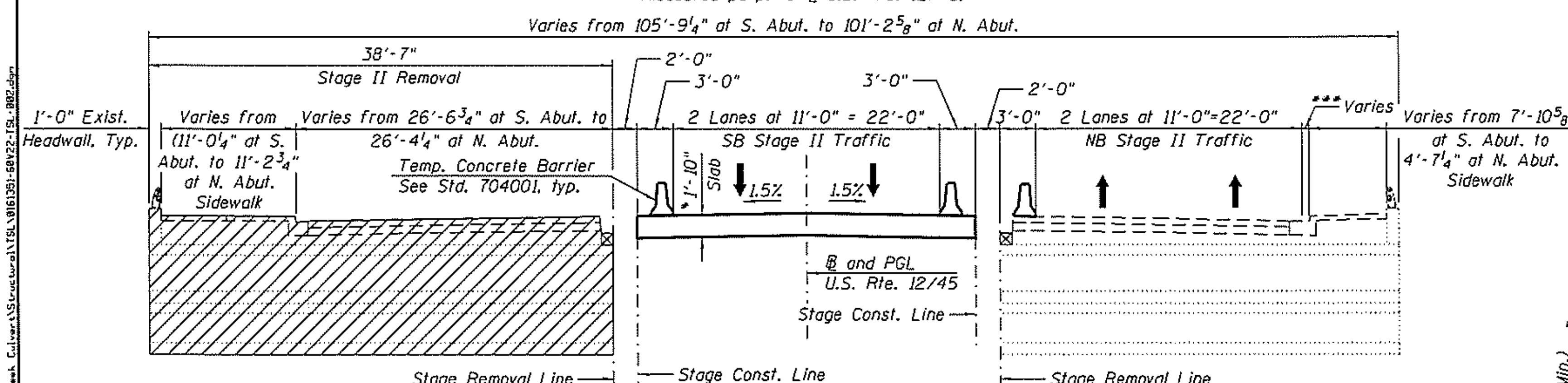
STAGE I REMOVAL

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte 12/45)



STAGE I CONSTRUCTION

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte. 12/45)



STAGE II REMOVAL

(Looking Upstation)
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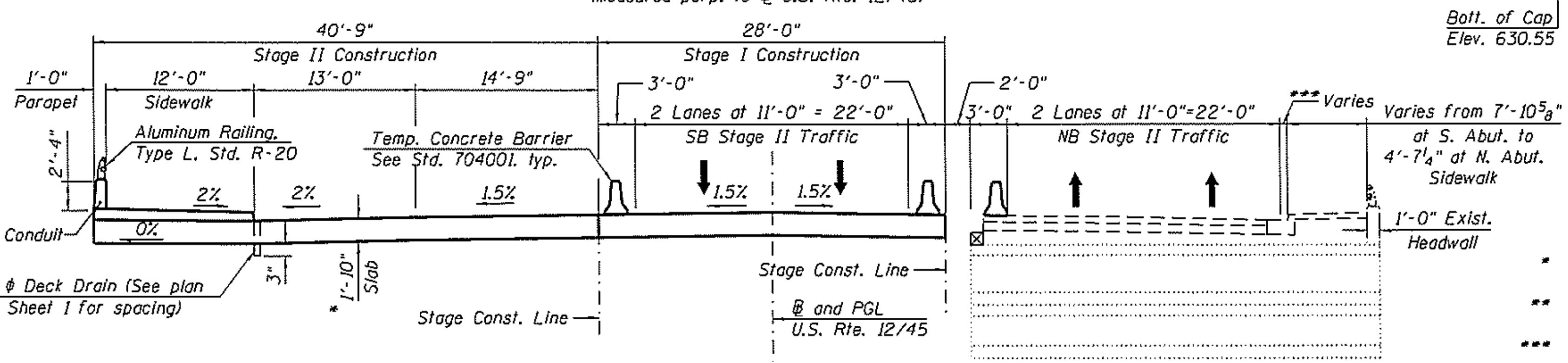
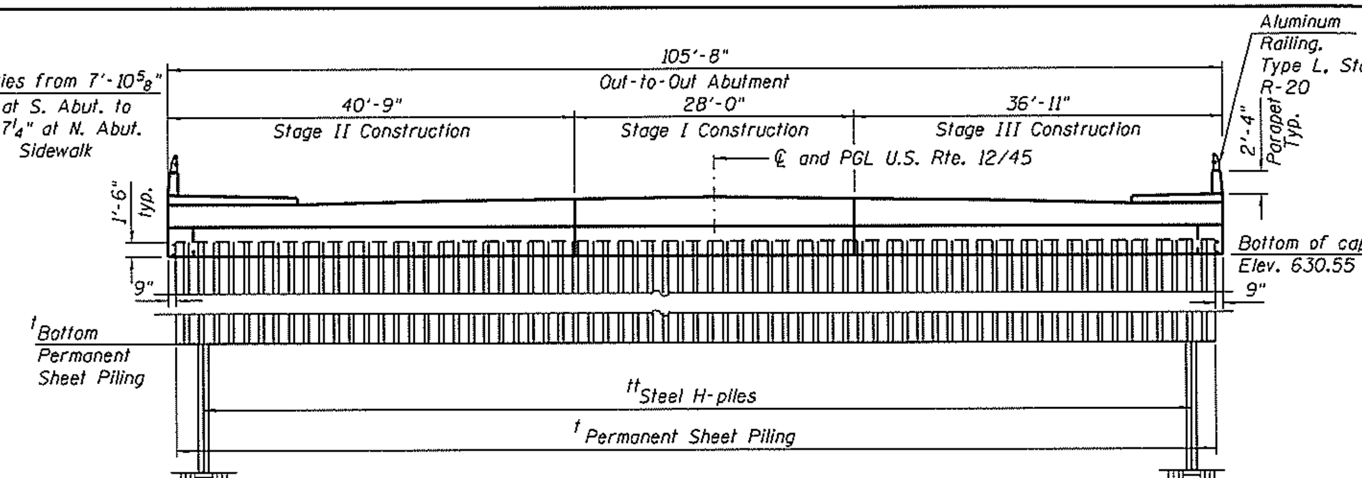


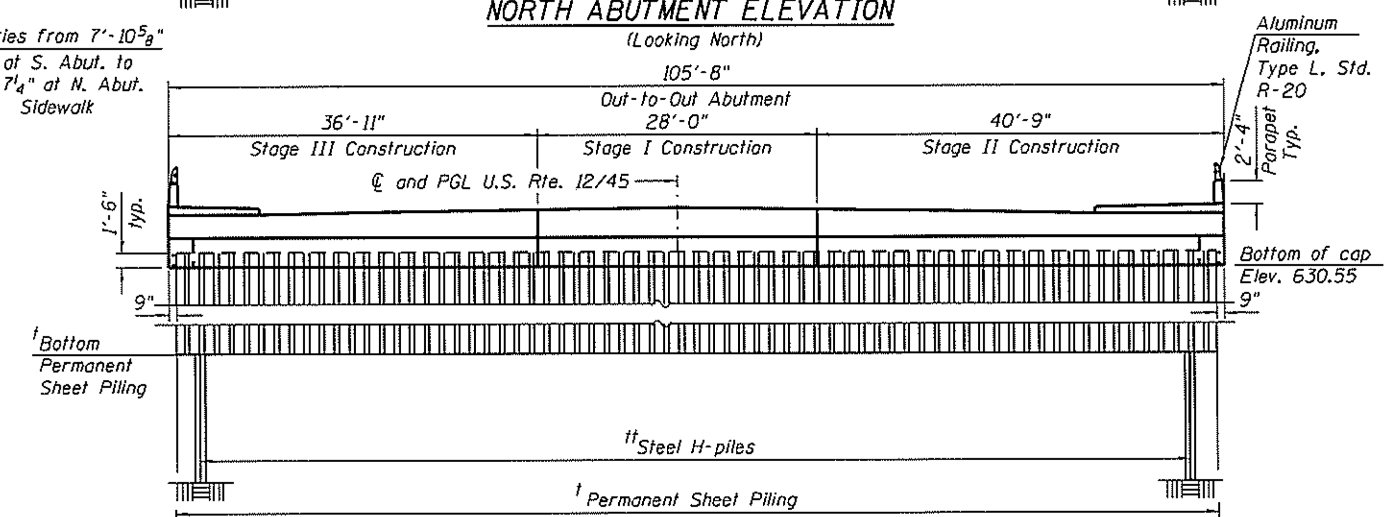
STAGE II CONSTRUCTION

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte. 12/45)



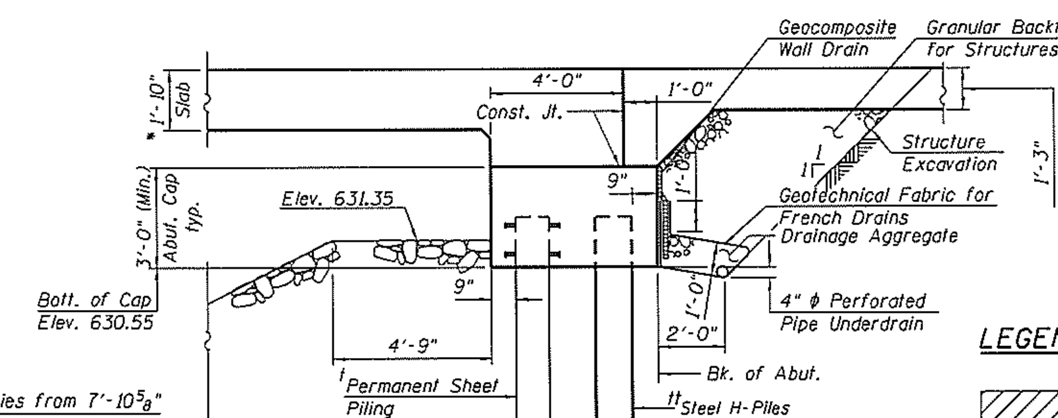
NORTH ABUTMENT ELEVATION

(Looking North)



SOUTH ABUTMENT ELEVATION

(Looking South)



TYPICAL SECTION THRU ABUTMENT

(Wingwall Sheet Piling not Shown For Clarity)
(Horiz. dim. @ Rt. L's)

* Slab thickness subject to refinement during the design phase.
** Varies from 1'-6¾" at S. Abut. to 1'-4¼" at N. Abut.
*** Varies from 1'-3⅝" at S. Abut. to 0½" at N. Abut.
† Section modulus and tip elevation shall be determined in final design.
†† Size, spacing and tip elevations of piles shall be determined during final design.

LEGEND

- Removal of existing structure

DETAILS (SHEET 1 OF 2)
U.S. RTE. 12/45
(MANNHEIM ROAD) OVER
ADDISON CREEK
F.A.P. RTE. 330 - SEC. 464-B
COOK COUNTY
STATION 77+45.19
STRUCTURE NO. 016-1351

HBM ENGINEERING GROUP LLC. CONSULTING & DESIGN INSPECTION & RATING RESEARCH & TESTING
4415 WEST HARRISON ST. SUITE 231 HILLSIDE, IL 60162 PHONE: (708) 236-0900 FAX: (708) 236-0901

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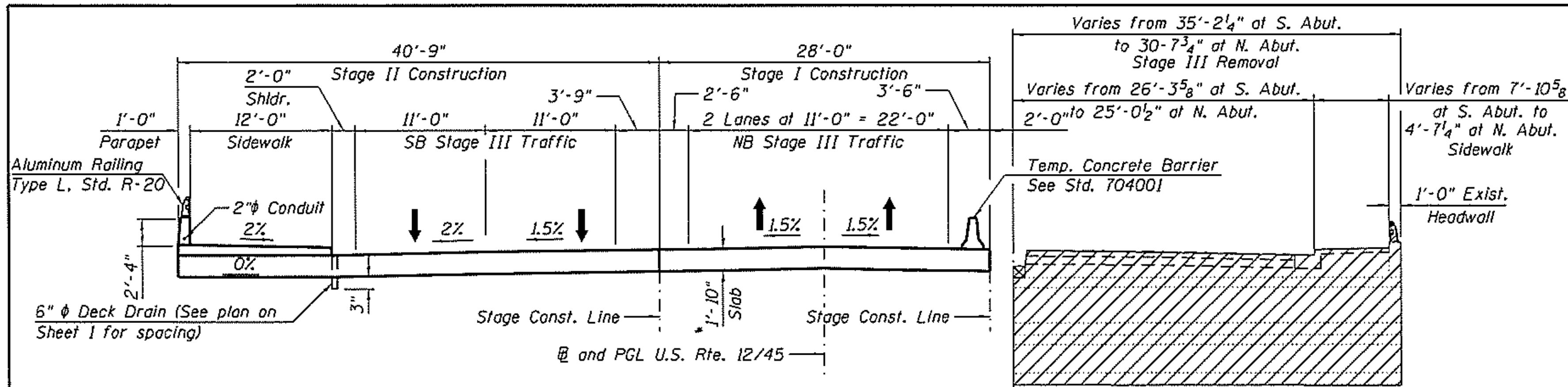
USER NAME = lisa.bunton	DRAWN - MA, KJO	REVISED	
PLOT SCALE = 14.0 '/" / in.	CHECKED - LAB, MI	REVISED	
PLOT DATE = 7/11/2017	DATE - 07/11/2017	REVISED	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

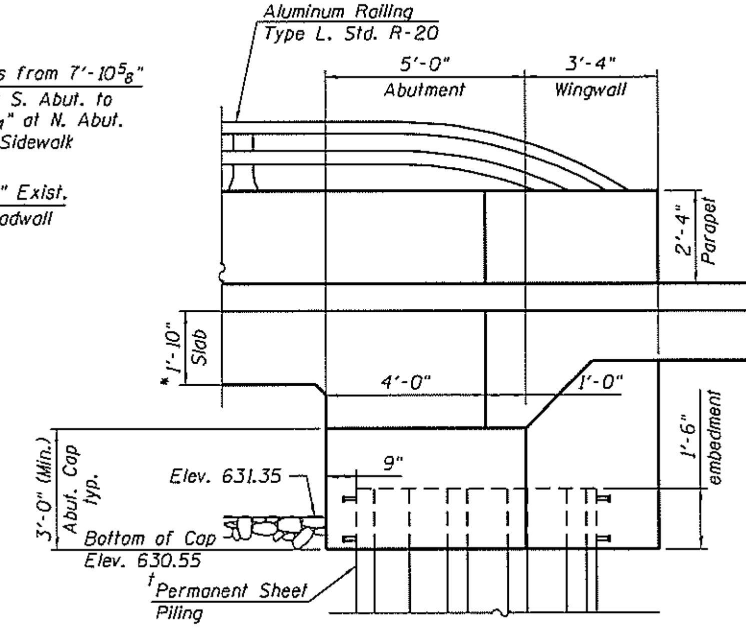
SCALE: | SHEET 2 OF 3 SHEETS | STA. TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
330	464-B	COOK	3	2
		CONTRACT NO. 60V22		
		ILLINOIS FED. AID PROJECT		



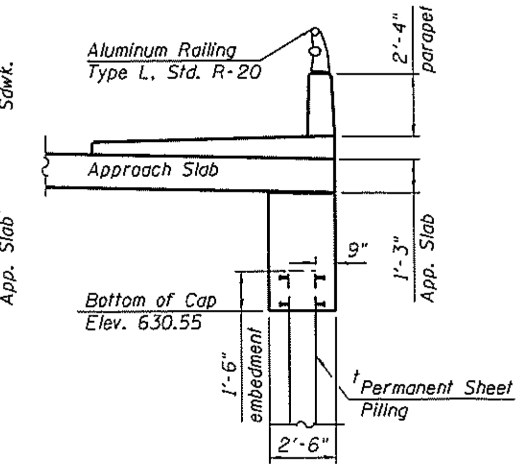
STAGE III REMOVAL

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte 12/45)



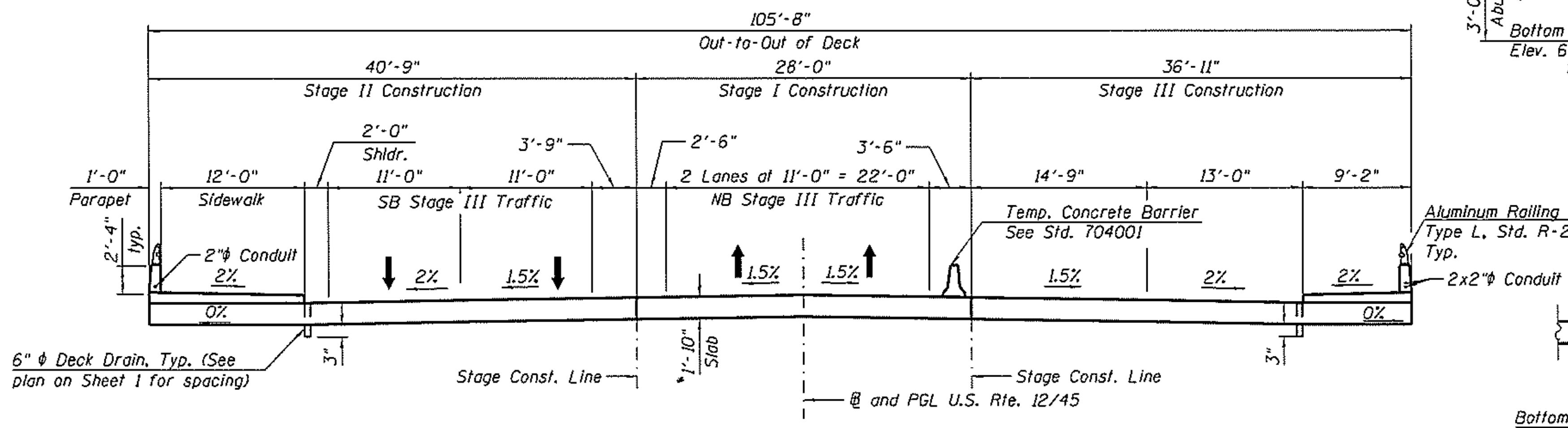
TYPICAL WINGWALL ELEVATION

(Steel H-Piles not shown for clarity)



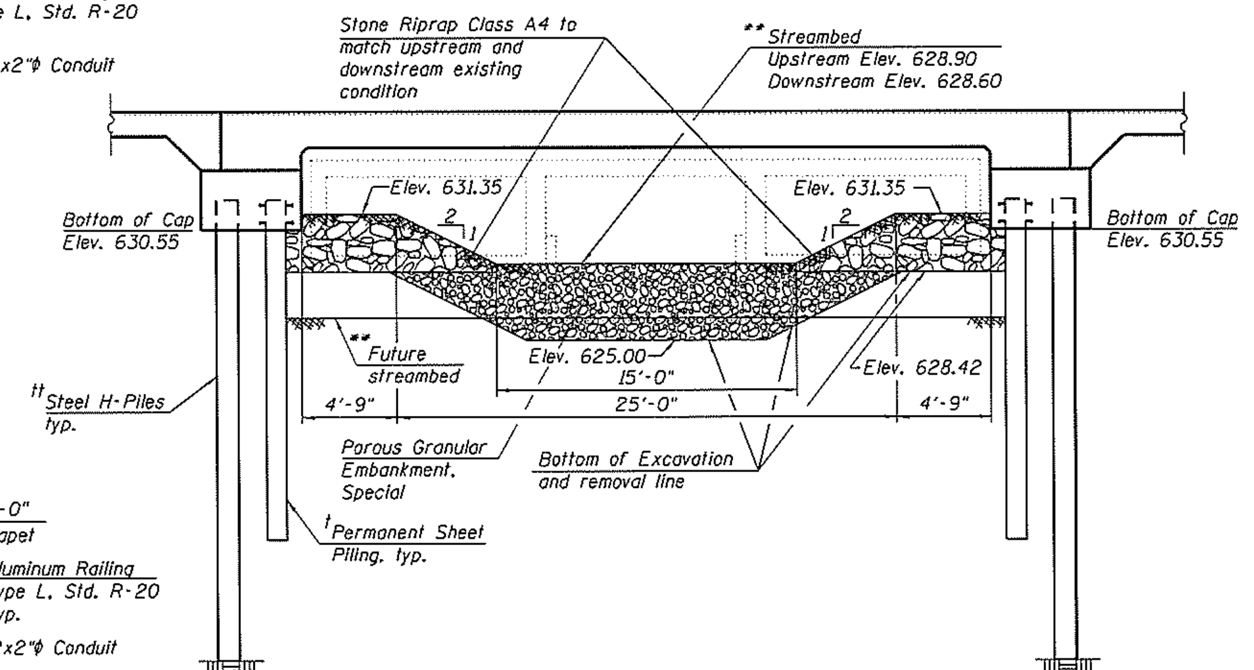
TYPICAL SECTION THRU WINGWALL

(At Approach Slab)

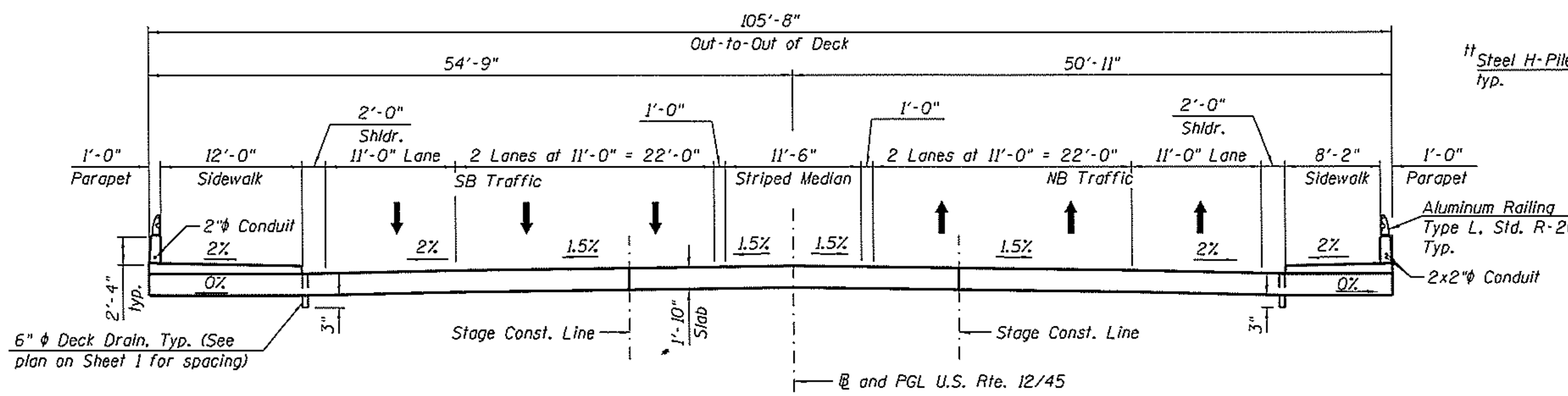


STAGE III CONSTRUCTION

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte 12/45)



TYPICAL BRIDGE SECTION



FINAL CROSS SECTION

(Looking Upstation)
(Measured perp. to ℄ U.S. Rte 12/45)

* Slab thickness subject to refinement during the design phase.

** Interim streambed elevation matches existing condition. Future upstream elevation =626.28, future downstream elevation =626.13 per MWRD.

† Section modulus and tip elevation shall be determined in final design.

†† Size, spacing and tip elevations of piles shall be determined during final design.

LEGEND

- Removal of existing structure

DETAILS (SHEET 2 OF 2)
U.S. RTE. 12/45
(MANNHEIM ROAD) OVER
ADDISON CREEK
F.A.P. RTE. 330 - SEC. 464-B
COOK COUNTY
STATION 77+45.19
STRUCTURE NO. 016-1351