



Original Report Date: <u>04/05/2018</u>	Proposed SN: <u>060-2052</u>	Route: <u>IL Route 157 (FAS 770)</u>
Revised Date: <u>04/27/2018</u>	Existing SN: <u>060-2454</u>	Section: <u>66-BR</u>
Geotechnical Engineer: <u>Doris D. González</u>		County: <u>Madison</u>
Structural Engineer: <u>Al-Barrae R. Shebib</u>		Contract: <u>76F18</u>

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing):

The existing structure (SN 060-2454) carries IL-157 over a tributary to Silver Creek. It is composed by a reinforced concrete slab bridge with two culvert extensions on the east and west side, and it will be removed and replaced with a new box culvert (SN 060-2052). The proposed structure consists of a cast in place box culvert with two 10 ft by 10 ft barrels and a 15 degree skew; upstream and downstream invert elevations are 518.75 ft and 518.50 ft, respectively. The downstream SE and SW wingwalls parallel to the road (note that $L > 16$ ft based on the skew, Design Height, and 2:1 geometry) can either be horizontal cantilever wings with Drilled Soldier Pile extensions (just like the original TSL) or they can entirely be Drilled Soldier Pile wings (as per the TSL in Exhibit 1). Per the TSL (Exhibit 1), the upstream NE wing ($L > 16$ ft again based on geometry) will be a horizontal cantilever with a Drilled Soldier Pile Wall extension; the NW wing will be a horizontal cantilever (no extension needed). Sheet piling was initially considered for wing extensions; however, due to the high N-values and the hard clays that were encountered, sheeting does not appear feasible. Another feasible alternative, in lieu of soldier pile wingwall extensions, would be to modify the wingwall geometry to accommodate shorter lengths and allow for the use of horizontal cantilevers. As requested by both the Bridge Planning Unit and the In-house Design Unit on 03/29/2018, the FGU evaluated the feasibility of using shorter wingwalls lengths (16 ft for the NE wingwall and 17.75 ft for the SE and SW wingwalls). Even though the proposed length of the South section wingwalls is greater than 16 ft, horizontal cantilever wingwalls could still be feasible by using a special design, according to the In-house Design Unit. The use of a 1:1.75 slope for the NE wingwall and a 1:1.5 slope for both the SE and SW wingwalls are geotechnically adequate, based on our Slope Stability Analyses.

Should drilled soldier pile wingwall extensions be used, please contact the SGR author during the design phase to provide a Geotechnical Design Memorandum involving the geotechnical design of the extensions. As shown on the Plan and Profile provided by the Planning Unit (Exhibit 2), no significant change in grade is anticipated.

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot):

Two boring logs were provided by IDOT District 8. These borings were taken on August 1st, 2017 using a 3.25 in hollow stem auger and an automatic hammer. The borings were denominated SB-1 and SB-2, located towards the N and S wingwalls respectively. Both borings were drilled to approximately 40 ft below ground surface, with samples taken every 2.5 ft. Below the Asphalt Concrete and Portland Cement Concrete, down to an elevation of approximately 520 ft, brown silt loam and silty clay loam layers were found, with Unconfined Compressive Strength (Q_u) values ranging from 1.0 to 2.17 tsf, N-values ranging from 4 to 8 and moisture content values between 20 and 28%. At an elevation of approximately 520 ft, a 2.5 ft layer of clay loam and sandy clay with trace gravel was found, with a Q_u of 0.61 tsf, N-value of 4 and moisture content values ranging from 20 to 28%. Below that weak layer, at an elevation of approximately 518 ft, both boring logs show brown to gray clay with trace gravel down to the end of the borings. Q_u values for this layer were ranging from 2.74 to 9.9 tsf; N-values ranging from 15 to 57; and moisture content values ranging from 10 to 16%. Boring SB-1 shows interbedded layers of gray weathered limestone (1 ft thick) and gray sand with gravel (1 ft thick) between the clay layers. Groundwater was encountered at elevations of 506.5 ft and 511.4 ft in borings SB-1 and SB-2 respectively. Bedrock was not encountered. Atterberg Limit Tests and Grain Size Analyses were performed on some samples. Refer to Boring Logs (Exhibit 3) and Subsurface Profile Plot (Exhibit 4) for more details regarding the subsurface exploration.

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary:

The existing grade will be maintained, but a maximum of 13 ft of fill will be required, for the new box culvert south approach roadway (Refer to Exhibit 1). Settlement is expected to be less than 0.5 in; therefore, no further testing or ground improvement treatments are expected to be necessary.

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary:

As per Typical Sections Diagram (Exhibit 5), the proposed roadway embankment slope is 4H:1V. Since the existing grade will be maintained, no slope stability problems are expected to occur. The computed factor of safety for the side slope of the new portion of the roadway is greater than 1.5, as required by the 2017 Geotechnical Manual.

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations:

As per All Bridge Designers Memo 14.2, design scour elevations for box culverts are no longer required.

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable:

As per page 3-2 of 2017 Culvert Manual, box culverts are not designed for seismic effects.

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary factored unit side and tip resistance values shall be indicated when drilled shafts are proposed:

The soils below the bottom of the proposed structure provide adequate conditions that make feasible cast in place culvert construction, as well as precast construction.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat:

No cofferdams appear to be required for this construction. The contractor should be prepared to provide stream diversion methods to allow for construction of the proposed culvert.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns:

Traffic will be maintained using a detour route; therefore, no Temporary Soil Retention System (TSRS) will be required. Should stage construction be implemented or if an open excavation is not feasible, TSRS will be required. All excavations must be performed in accordance to local and federal regulations.

Exhibit 1 – TSL Draft

Benchmark BM 157-26: RR spike driven 1' above the ground on the north side of PP located 31' south of the center of IL 140, 77' east of the center of IL 157, and 36' west of the center of Wolf Avenue in Hamel. Approximate Lat. & Long.: N38°50'20"; 89°50'40"

Existing Structure: SN 060-2454 was built in 1921 as a single span reinforced concrete slab bridge supported on reinforced concrete vertical abutments. The original bridge length is 24'-0" end to end slab with no skew, and widened at unknown date with 12'x8' reinforced concrete culvert extensions on the east and west sides of the bridge with total out-to-out width of 45'-0".

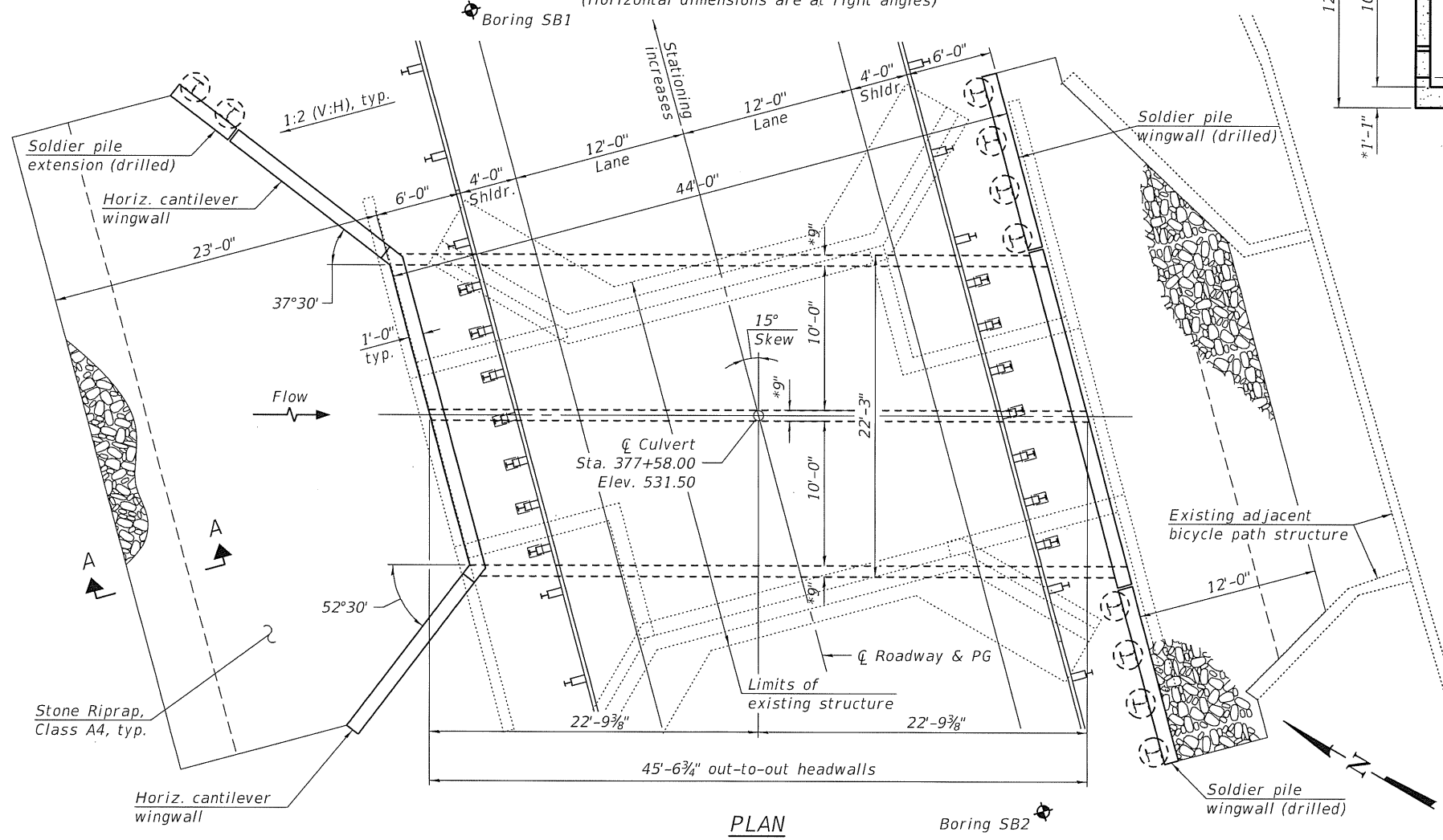
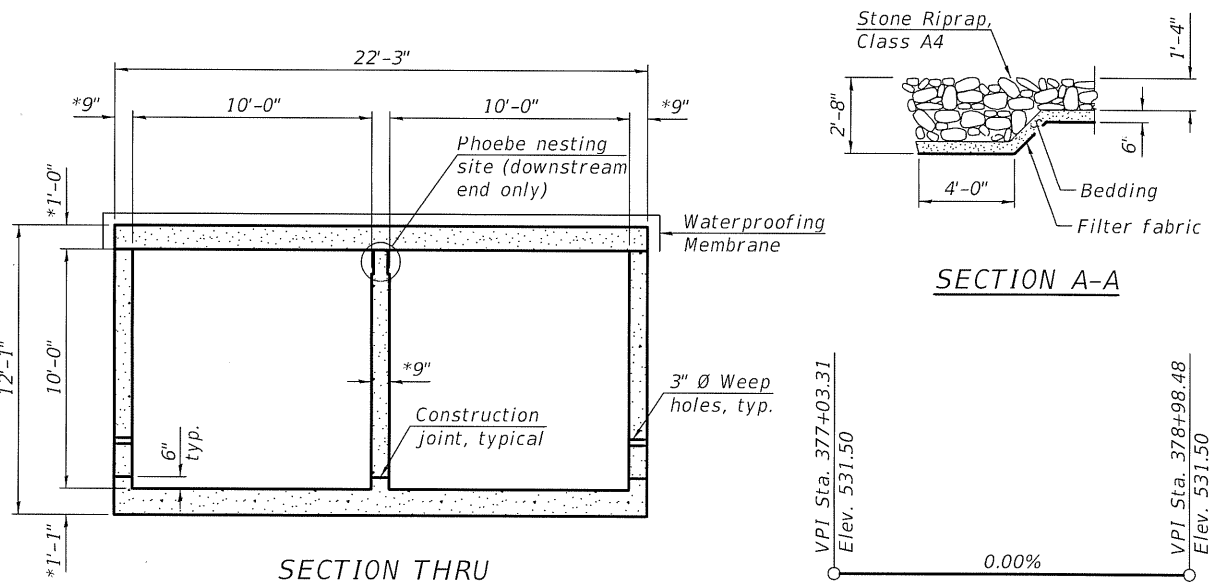
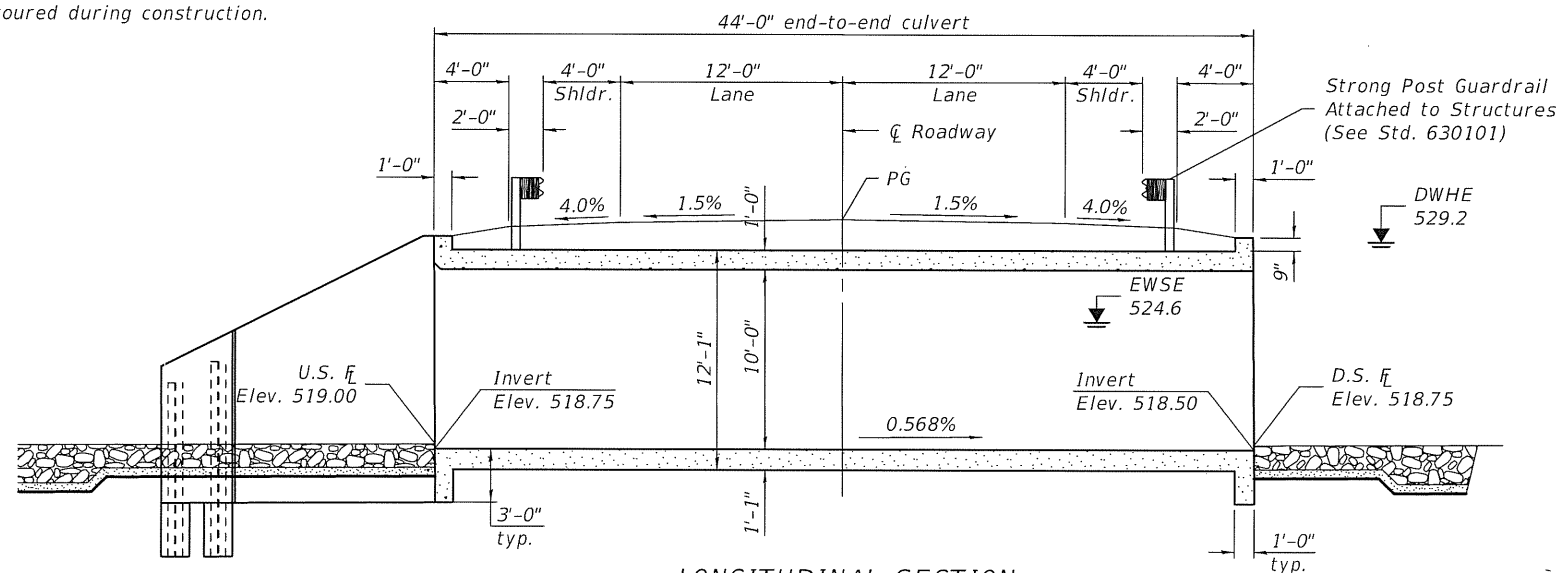
Traffic to be detoured during construction.

No salvage.

WATERWAY INFORMATION

Drainage Area = 2.06 sq. mi.		Existing Overtopping Elev. 530.4 ft. @ Sta. 378+00.00							
		Proposed Overtopping Elev. 531.4 ft. @ Sta. 378+00.00							
Flood	Freq. Yr.	Discharge C.F.S.	Opening Ft ²		Natural H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
Design	10	630	94	166	527.3	0.9	0.6	528.2	527.9
Base	50	1020	96	200	529.2	1.9	1.2	531.1	530.4
Exist. Overtopping	100	1200	96	200	529.9	2.4	1.6	532.3	531.5
Prop. Overtopping	35	950	96	--	528.9	1.7	--	530.6	--
Scour Check	100	1200	--	200	529.9	--	1.6	--	531.5
Max. Calc.	200	1380	96	200	530.5	2.8	1.8	533.3	532.3
	500	1630	96	200	531.3	2.2	2.0	533.5	533.3

10 year outlet velocity from existing structure = 6.7 ft./sec.
10 year outlet velocity from proposed structure = 3.8 ft./sec.

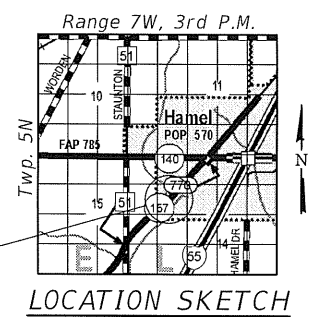


DESIGN SPECIFICATIONS
2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

HIGHWAY CLASSIFICATION
F.A.S. Rte. 770 - IL Rte.157
Functional Class: Major Collector
ADT: 2550 (2018); 2900 (2038)
ADTT: 6.5% (2018/38)
DHV: 250 (2018)
Design Speed: 50 m.p.h.
Posted Speed: 35 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

DESIGN STRESSES
FIELD UNITS
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

LOADING HL-93
Allow 50#/sq. ft. for future wearing surface.



GENERAL PLAN & ELEVATION
IL RTE. 157 OVER
TRIBUTARY TO SILVER CREEK
F.A.S. RTE. 770, SEC. 66-BR
MADISON COUNTY
STATION 377+58.00
STRUCTURE NO. 060-2052

MODEL: 0602052-76F18-TSL-001
FILE NAME: pw:\IL084EBID\INTEG...Illinois.gov\PWIDOT\Documents\IDOT_Offices\Bureau of Bridges and Structures\Projects\0602052\CADD_Plans\0602052-76F18.dgn

DESIGNED	-	AL-BARRAE R. SHEBIB
CHECKED	-	HAREEM I. DAR
DRAWN	-	IAN J. ANDREWS / M.B.M.
CHECKED	-	RICHARD J. CHAPUT

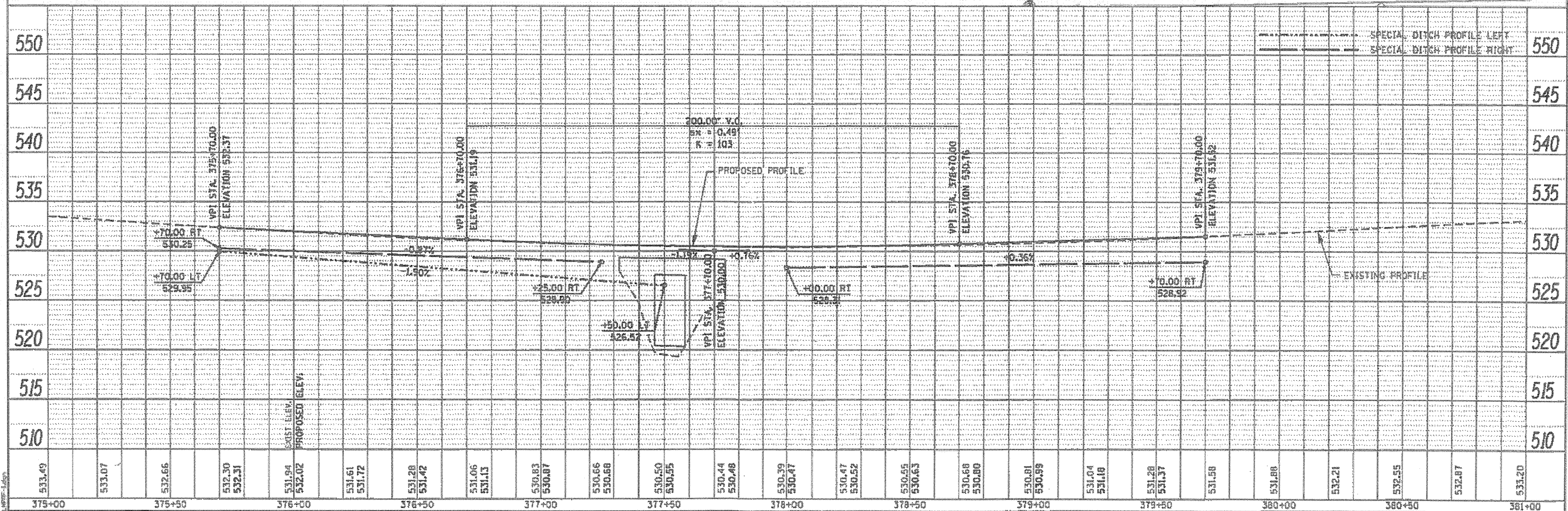
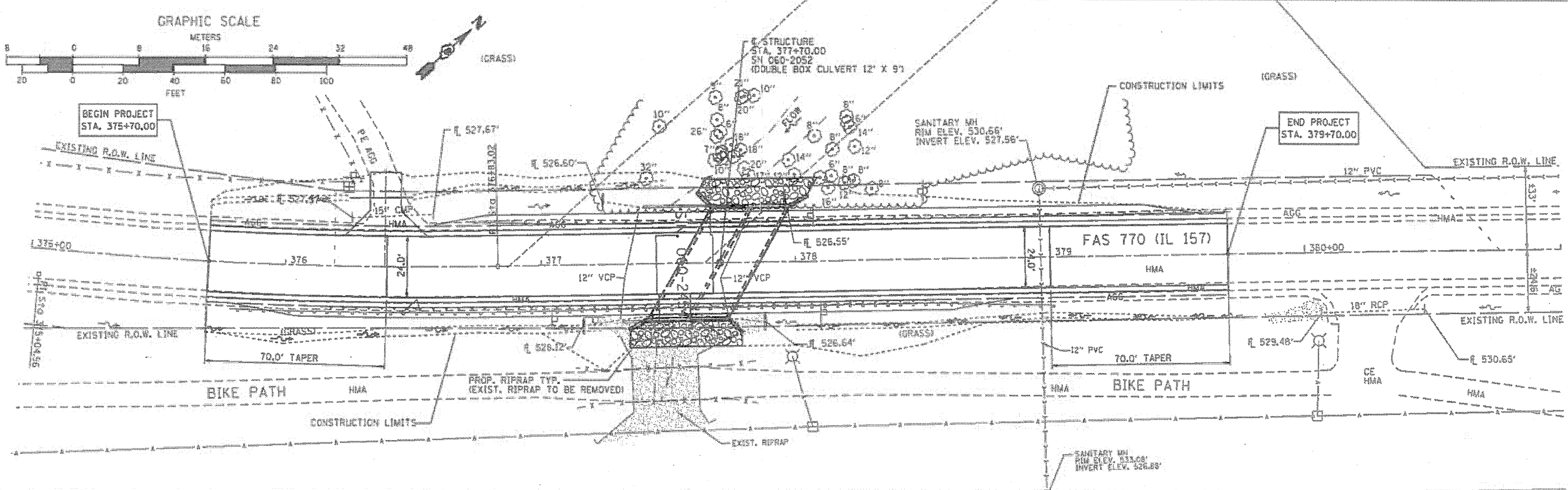
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 1 SHEETS

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
770	66-BR	MADISON		
ILLINOIS FED. AID PROJECT			CONTRACT NO. 76F18	

Exhibit 2 – Plan and Profile



DATE	
BY	
REVISION	
FLAIR	
NOTE BOOK	
NO.	

DATE	
BY	
REVISION	
PROFILE	
NOTE BOOK	
NO.	

533.49	533.07	532.66	532.30	532.31	531.94	531.61	531.72	531.28	531.42	531.06	531.13	530.83	530.87	530.66	530.68	530.50	530.55	530.44	530.48	530.39	530.47	530.47	530.52	530.55	530.63	530.68	530.80	530.81	530.89	531.04	531.10	531.28	531.37	531.58	531.88	532.21	532.55	532.87	533.20
375+00	375+50	376+00	376+50	377+00	377+50	378+00	378+50	379+00	379+50	380+00	380+50	381+00																											



USER NAME	DESIGNED	REVISION
FILE NAME	CHECKED	REVISION
PLDT SCALE	DRAWN	REVISION
PLDT DATE	CHECKED	REVISION

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PLAN AND PROFILE
IL 157 OVER TRIBUTARY TO SILVER CREEK
SCALE: 1" = 20'
SHEET NO. 1 OF 1 SHEETS
STA. 375+70.00 TO STA. 379+70.00

F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
770	15-08274-00-BR	MADISON	XX	X

Exhibit 3 – Boring Logs



Illinois Department of Transportation

Division of Highways Illinois Department of Transportation

SOIL BORING LOG

Date 8/1/17

ROUTE FAS 770 DESCRIPTION IL 157 over Silver Creek Tributary LOGGED BY AE (TSI)

SECTION 66-BR LOCATION NW 1/4, SEC. 14, TWP. 6N, RNG. 7W, 3 PM

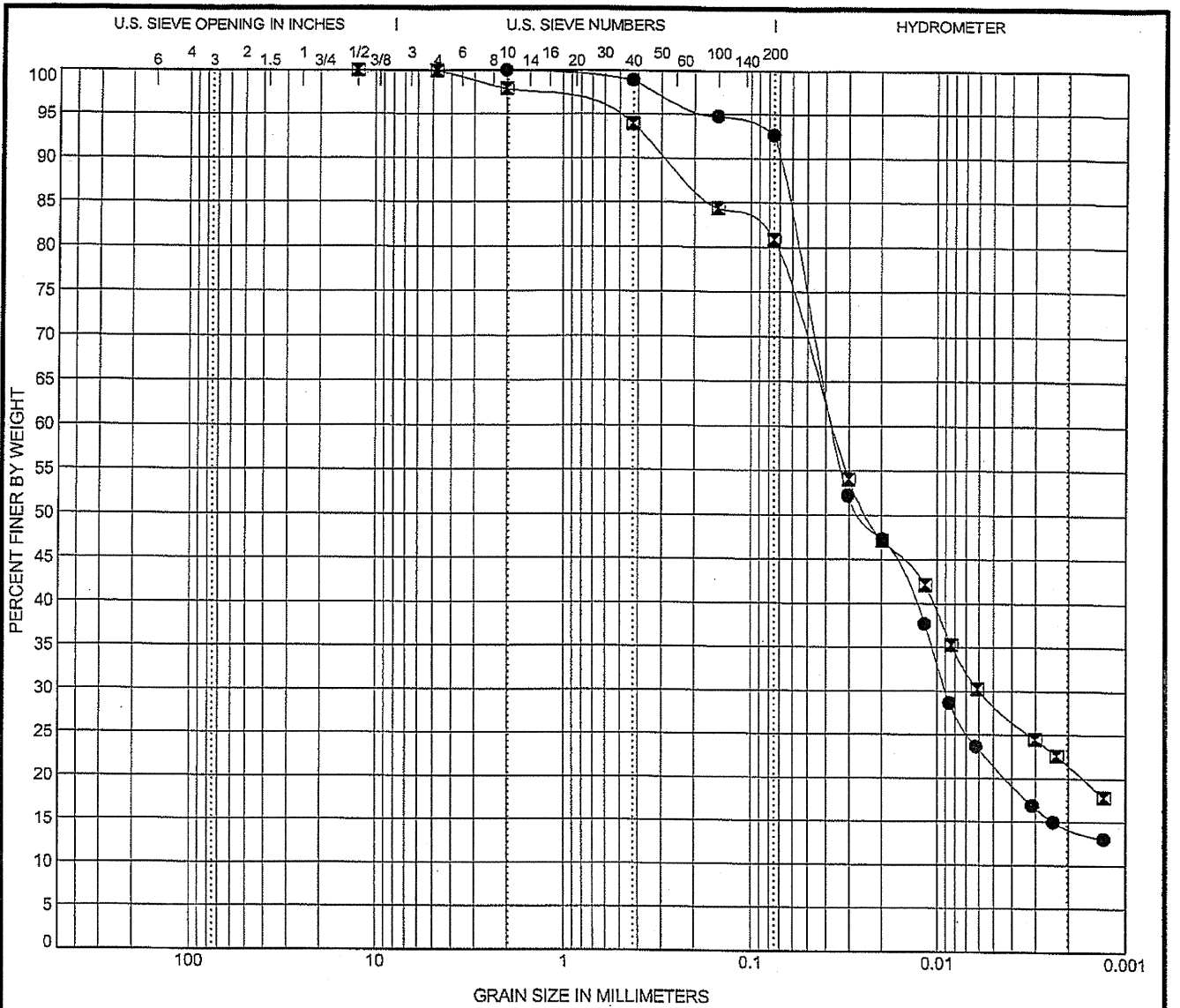
COUNTY Madison DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 060-2454 (E) / 060-2052 (P) Station 377+70

BORING NO. SB-1 West End Station 378+06 Offset 12.00ft Left Ground Surface Elev. 530.5 ft

Table with columns: DEPTH, BLOW S, UCS Qu, MOIST, Surface Water Elev., Stream Bed Elev., Groundwater Elev., First Encounter, Upon Completion, After Hrs., DEPTH, BLOW S, UCS Qu, MOIST. Rows describe soil layers like Asphaltic Concrete, Dark Brown Silt LOAM, Dark Brown Silty Clay LOAM, Brown and Gray Clay LOAM, Brown and Gray CLAY with Trace Gravel, and 1" Sand Seam.

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)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification	Classification	LL	PL	PI	Cc	Cu		
● SB-1 4.00	A-4 (6) SILTY LOAM	30.0	22.9	7.1				
☒ SB-1 6.50	A-6 (14) SILTY CLAY LOAM	36.0	16.7	19.3				
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● SB-1 4.00	2	0.036	0.009		0.0	7.4	78.2	14.4
☒ SB-1 6.50	12.5	0.037	0.006		2.1	17.0	59.5	21.4

GRAIN_SIZE_IDH_3-18-11_060-2454.GPJ_IL_DOT.GDT 8/15/17



Illinois Department of Transportation
 Division of Highways
 Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAS 770
 Section: 66-BR
 County: Madison

8/15/2017 10:52:36 AM

EV0000

Illinois Department of Transportation

Version 8.30.004

INPUT - s:\materials geotechnical unit\gint\projects\madison\structures\060-2454.gpj Sv Readings table Library: s:\materials geotechnical unit\gint\library.glb

PointID.Depth, SB-1, 4

Reading	Soil Tare	Percent Finer
2	0	100
0.425	0.555	98.90599
0.15	2.083	94.80003
0.075	1.097	92.63763

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Illinois Department of Transportation

Version 8.30.004

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PointID:Depth:SB-1, 6.5

Reading	Soil Tare	Percent Finer
12.5	0	100
4.75	0.2	99.94904
2	8.1	97.88535
0.425	2.055	93.93347
0.15	4.966	84.38359
0.075	1.823	80.87786



Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 8/1/17

ROUTE FAS 770 DESCRIPTION IL 157 over Silver Creek Tributary LOGGED BY AE (TSI)

SECTION 66-BR LOCATION NW 1/4, SEC. 14, TWP. 6N, RNG. 7W, 3 PM

COUNTY Madison DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 060-2454 (E) / 060-2052 (P)
Station 377+70

BORING NO. SB-2 East End
Station 377+21
Offset 12.00ft Right
Ground Surface Elev. 530.9 ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	_____	ft
Stream Bed Elev.	_____	ft
Groundwater Elev.:		
First Encounter	<u>511.4</u>	ft
Upon Completion	<u>**</u>	ft
After _____ Hrs.	<u>**</u>	ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Asphaltic Concrete & Portland Cement Concrete	50/1"	-	6	Brown and Gray CLAY with Trace Gravel (continued)	8		
528.4	-	-			14	9.90	10
Brown Silty CLAY	3				14	S	
526.4	3	1.00	23		7		
Dark Brown Silty Clay LOAM A-6(12) See Class @ 6.5 ft	3	S			9	8.13	10
Trace Gravel	3				12	S	
	4	1.23	21		-25		
	4	B			9		
	4	2.17	20		11	8.02	10
520.4	4	B			14	S	
Gray Sandy CLAY with Trace Gravel	1				8		
	2	0.61	28		9	8.09	10
	2	B			11	S	
517.9					-30		
Brown and Gray CLAY with Trace Gravel	2				6		
	8	2.74	11		15	6.91	11
	14	B			16	S	
Gray	9				9		
	16	6.26	9		7	4.50	13
	20	B			8	P	
					8		
	7				6		
	11	4.50	12		8	4.50	14
	14	P			11	B	
					6		
					10	7.98	12
					12	S	
					490.9	-40	

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 8/1/17

ROUTE FAS 770 DESCRIPTION IL 157 over Silver Creek Tributary LOGGED BY AE (TSi)

SECTION 66-BR LOCATION NW 1/4, SEC. 14, TWP. 6N, RNG. 7W, 3 PM

COUNTY Madison DRILLING METHOD 3.25" HSA HAMMER TYPE Automatic

STRUCT. NO. 060-2454 (E) /
060-2052 (P)
Station 377+70

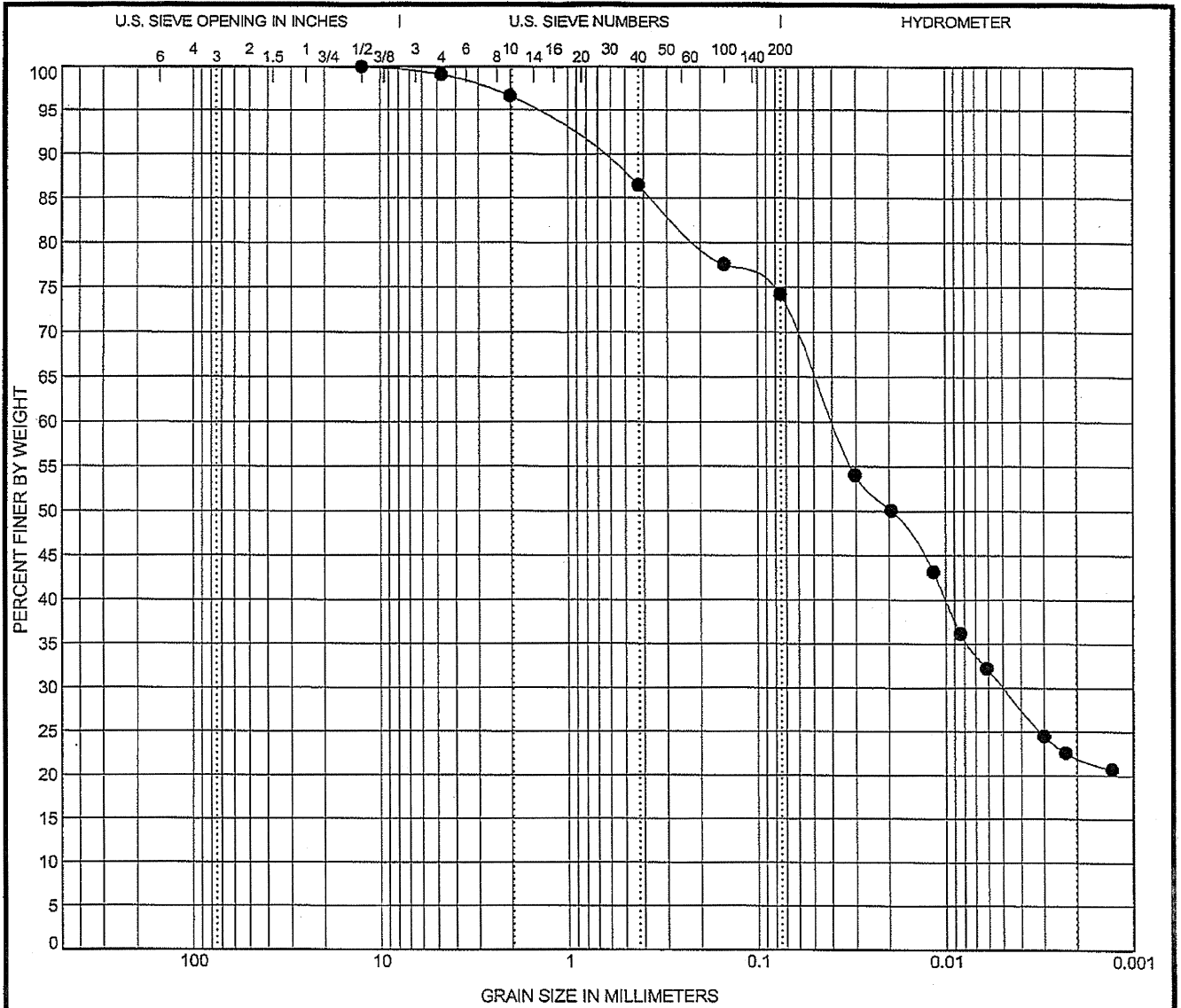
BORING NO. SB-2 East End
Station 377+21
Offset 12.00ft Right
Ground Surface Elev. 530.9 ft

D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)

Surface Water Elev.	_____	ft
Stream Bed Elev.	_____	ft
Groundwater Elev.:		
First Encounter	<u>511.4</u>	ft ▼
Upon Completion	<u>**</u>	ft
After _____ Hrs.	<u>**</u>	ft

<p>END OF BORING</p> <p>** Hole Filled Upon Completion</p>	<p>-45</p> <p>-50</p> <p>-55</p> <p>-60</p>			
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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)



COBBLES	GRAVEL	SAND		SILT	CLAY
		coarse	fine		

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● SB-2 6.50	A-6 (12) SILTY CLAY LOAM	34.9	17.0	17.9		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● SB-2 6.50	12.5	0.04	0.005		3.4	22.4	52.1	22.1

GRAIN_SIZE_IDH_3-18-11 060-2454.GPJ IL_DOT.GDT 8/15/17



Illinois Department of Transportation
 Division of Highways
 Illinois Department of Transportation

IDH GRAIN SIZE DISTRIBUTION

Route: FAS 770
 Section: 66-BR
 County: Madison

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Illinois Department of Transportation

Version 8.30.004

INPUT - s:\materials\geotechnical unit\gint\projects\madison\structures\060-2454.gpj Sv Readings table Library: s:\materials\geotechnical unit\gint\library.glb

PointID,Depth, SB-2, 6.5

Reading	Soil Tare	Percent Finer
12.5	0	100
4.75	3.2	99.11284
2	9	96.61769
0.425	5.351	86.45889
0.15	4.686	77.5626
0.075	1.755	74.23076

Exhibit 4 – Subsurface Profile Plot

**SN 060-2052 Box Culvert - IL 157 Over Tributary to Silver Creek, Located in the NW 1/4 of
Sec. 14, Township 5N, Range 7W of the 3 P.M.**

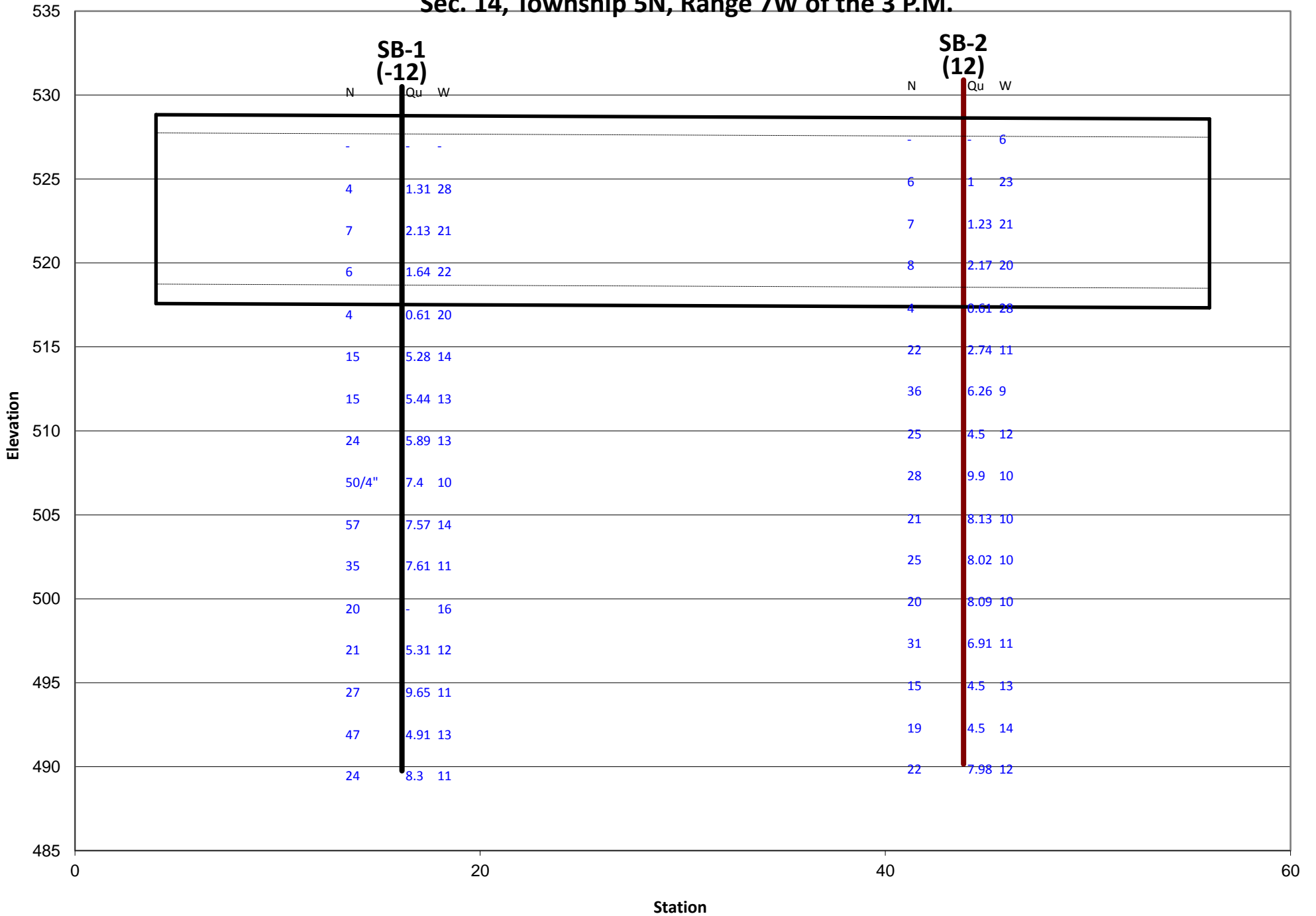
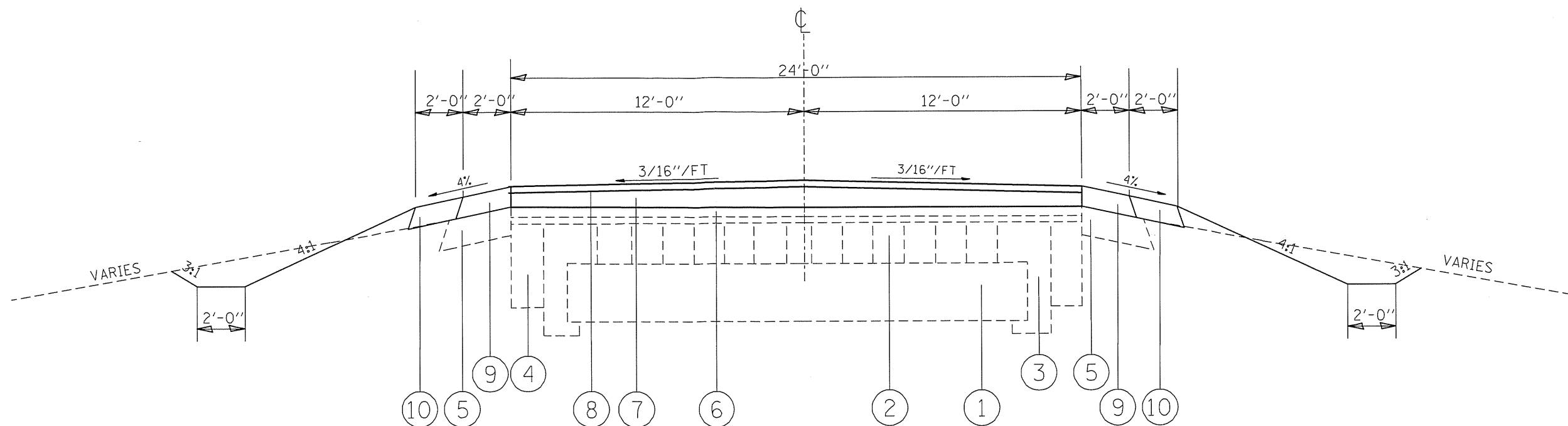


Exhibit 5 – Typical Sections Diagram



APPROACH ROADWAY TYPICAL

LEGEND

- ① EXISTING CONCRETE BASE, 8"
- ② EXISTING BRICK PAVEMENT, 2 1/4'
- ③ EXISTING CONCRETE RETAINER, 1'-3"
- ④ EXISTING PC CONCRETE BASE COURSE, 8"
- ⑤ EXISTING HMA SHOULDER
- ⑥ EXISTING HMA RESURFACING, VARIES
- ⑦ PROPOSED HMA BINDER COURSE, VARIES
- ⑧ PROPOSED HMA SURFACE COURSE, 1 1/2'
- ⑨ PROPOSED HMA SHOULDER
- ⑩ PROPOSED AGGREGATE SHOULDER

NOTE: EXISTING AND PROPOSED GUARDRAIL NOT SHOWN

FILE NAME =	USER NAME = manntm	DESIGNED - -	REVISED - -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	EXISTING TYPICAL SECTIONS	F.A.S. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.	
ph:\L884EBIDINTEG\Illinois.gov\PWJ00T\Documents\DOT Offices\District 8\Projects\0875\DRAWING\GAsheets\0876J12-ah-typica	Documents\DOT Offices\District 8\Projects\0875\DRAWING\GAsheets\0876J12-ah-typica	CHECKED - -	REVISED - -			770	66-BR6IRS-5	MADISON	1	1	
PLOT SCALE = 100.0000' / 1"	DATE - -	REVIS	REVIS			IL	CONTRACT NO. 76J12				
PLOT DATE = 8/15/2017	DATE - -	REVIS	REVIS			8890	ILLINOIS FED. AID PROJECT				

SHEET NO. 1 OF 1 SHEETS STA. _____ TO STA. _____