STRUCTURE GEOTECHNICAL REPORT

Proposed SN 083-7102
Existing SN 083-7067

US Route 45 over Unnamed Stream
FAP Route 881
Section 32B-2
Saline County

PTB 157 - Item 46
Contract No. 78501
Job No. D-99-061-15

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Project Description and Scope

This project involves the complete replacement of an existing structure near the intersection of US Route 45 and TR 184 (Feazel Road) carrying traffic over an unnamed stream, located in Saline County. The project site is located in Section 28, Range 6E, Township 9S, in the 3rd Principal Meridian, about 1.5 miles southwest of the US 45 and IL 34 Junction. A *Location Map* is presented in Exhibit A.

The existing culvert on US Route 45, SN 083-7067, was constructed in 1921. It is a double barrel 8' span x 5' rise concrete box culvert with parallel wing walls. The culvert measures 31'-4" long, with no skew. In 2013 the north headwall was stabilized using steel piles.

Per the preliminary Type, Size & Location Plan (TSL), the proposed structure on US Route 45, SN 083-7102, is a double barrel concrete box culvert with horizontal cantilever wing walls. The proposed structure will be 45'-6" long out to out headwalls, with no skew. The maximum fill height will be approximately 3.1 feet above the proposed culvert.

The structure is adjacent to the intersection of US 45 and Feazel Road. Both roads are on a horizontal tangent alignment and on a vertically tangent section of roadway. Guardrail will be provided at each end the culvert. It is anticipated that the adjacent proposed culvert carrying Feazel Road over Pankey Branch, SN 083-2018, will be constructed as part of the same contract. The southeast wing wall of SN 083-7102 will intersect with the northwest wing wall of SN 083-2018. Traffic on US 45 will be maintained utilizing stage construction, while Feazel Road will be closed during construction of SN 083-2018. The new structure is to be designed following LRFD Bridge Design Specifications.

See *Preliminary TSL* attached in Exhibit B for further information about the proposed structures.

Field Exploration

Subsurface Exploration and Testing

The site is located in a rural area on the south edge of Harrisburg, IL with a wooded area located at the northwest quadrant, farm fields located to the south, and commercial buildings with gravel parking lots located to the north. Drainage from an unnamed stream flows from north to south beneath US Route 45 where it intersects Pankey Branch, and then flows west to east beneath Feazel Road. Overhead power lines cross US Route 45 at this location, running parallel to and just west of Feazel Road.

The subsurface investigation consisted of two borings (1-S and 2-S) drilled by IDOT District 9 personnel in October 2019. 1-S was west of the proposed culvert and within the north lane of US 45; 2-S was drilled just east of the proposed culvert within the south lane of US 45. Boring locations can be found in Exhibit B.

Beginning at the ground surface, standard penetration tests (SPT) were conducted every 2.5 feet according to AASHTO T 206, using a Hollow Stem Auger. Borings 1-S and 2-S were terminated in stiff clay at depths of approximately 30 feet.

Subsurface Conditions

While drilling, groundwater was encountered at an elevation of 344.8 with surface water elevation at 366.4.

Layers of silty clay loam, silty loam and clay are present down to elevation 344.3 where the borings were terminated. These cohesive layers have Qu values ranging from 0.1 tsf to 2.7 tsf.

Further descriptions of the soil conditions encountered in the borings are presented in the *Soil Borings* attached in Exhibit D and the *Subsurface Data Profile* in Exhibit C.

Geotechnical Evaluations

Settlement

No significant roadway profile change is expected at this structure. The proposed culvert on US 45 (SN 083-7102) will be extended outside the limits of the existing culvert, which will increase pressure at the culvert ends due to the new culvert and fill weight.

The amount of differential settlement expected on the currently unloaded soils ranges from 1.08 inches to 0.85 inches (Boring 2-S and 1-S respectively), assuming the soil will be removed down to an elevation of 362 and replaced with Rock Fill – Foundation in order to allow for the desired removal and replacement of unsuitable material. Refer to Ground Improvement recommendations within the Construction Considerations section of this report.

Slope Stability

Preliminary stability analyses using Bishop's method were performed for both structures. According to AASHTO LRFD 11.6.2.3, the required resistance factor for slope stability is 0.65 which is equivalent to factor of safety of 1.54. SN 083-7102 used a 10.7' high 1:1 temporary excavation end slope model which rendered factor of safety of 2.79. Slope stability analyses are presented in Exhibit F. No slope stability problems are expected.

Seismic Considerations

Per the IDOT Culvert Manual and Article 3.10.1 of the AASHTO LRFD Bridge Design Specifications, buried structures are not designed for seismic effects. The wing walls are considered part of the buried structures and therefore are not designed for seismic loading either.

Scour

Per IDOT All Bridge Designer Memorandum 14.2, the Design Scour Elevation table is not required for closed bottom box culverts.

Mining Activity

A review of the Illinois State Geological Survey (ISGS) "Directory of Coal Mines in Illinois" for Saline County indicates that mining activity has been present near the project

location. The nearest coal mine point is approximately 0.3 miles southwest of the structure location.

Foundation Recommendations

Culvert Barrels

A 3-sided structure is not desired at this location due to the the estimated differential settlement.

A cast in place culvert appears to be the most appropriate construction option for the given site conditions and due to the need for cast in place wing walls and head walls. The precast option is not recommended due to the staging requirements of SN 083-7102 and the amount of anticipated differential settlement.

With the large foundation footprint of the box culvert, along with the Rock Fill – Foundation material being placed beneath the culvert, the allowable bearing capacity at the base of foundation was found to be more than adequate for resisting estimated pressures.

Wing Walls

Per the 2017 IDOT Culvert Manual, horizontal cantilever wing walls are the most economical and preferred wall type for most cast in place concrete box culverts, with a proposed wall length limited to 16 feet. The Preliminary TSL plans indicate all wall lengths are under 16 feet.

Hydraulics

Class A4 Stone Riprap shall be provided at each end of the culvert as a scour countermeasure. The Estimated Water Surface Elevation (EWSE) during construction is 366.5.

Construction Considerations

Cofferdams

Considering the EWSE of 366.5, the structure can be constructed using conventional methods of water diversion determined by the Contractor.

Stage Construction

In order to maintain traffic along US 45, stage construction shall be utilized on SN 083-7102. Temporary Sheet Piling is proposed to retain existing soil along the stage line adjacent to the existing and proposed culverts. A 1:1 slope will be provided between the existing roadway and stage removal line. A geotextile retaining wall will retain the proposed roadway during construction.

Temporary Soil Retention

Temporary sheet piling appears to be a suitable option to retain excavation and backfill areas during construction along US 45. Using a retained height of 11 feet, it's estimated that a minimum section modulus of 8.05 in^3/ft be used with a minimum embedment of 8.25 ft.

Excavation

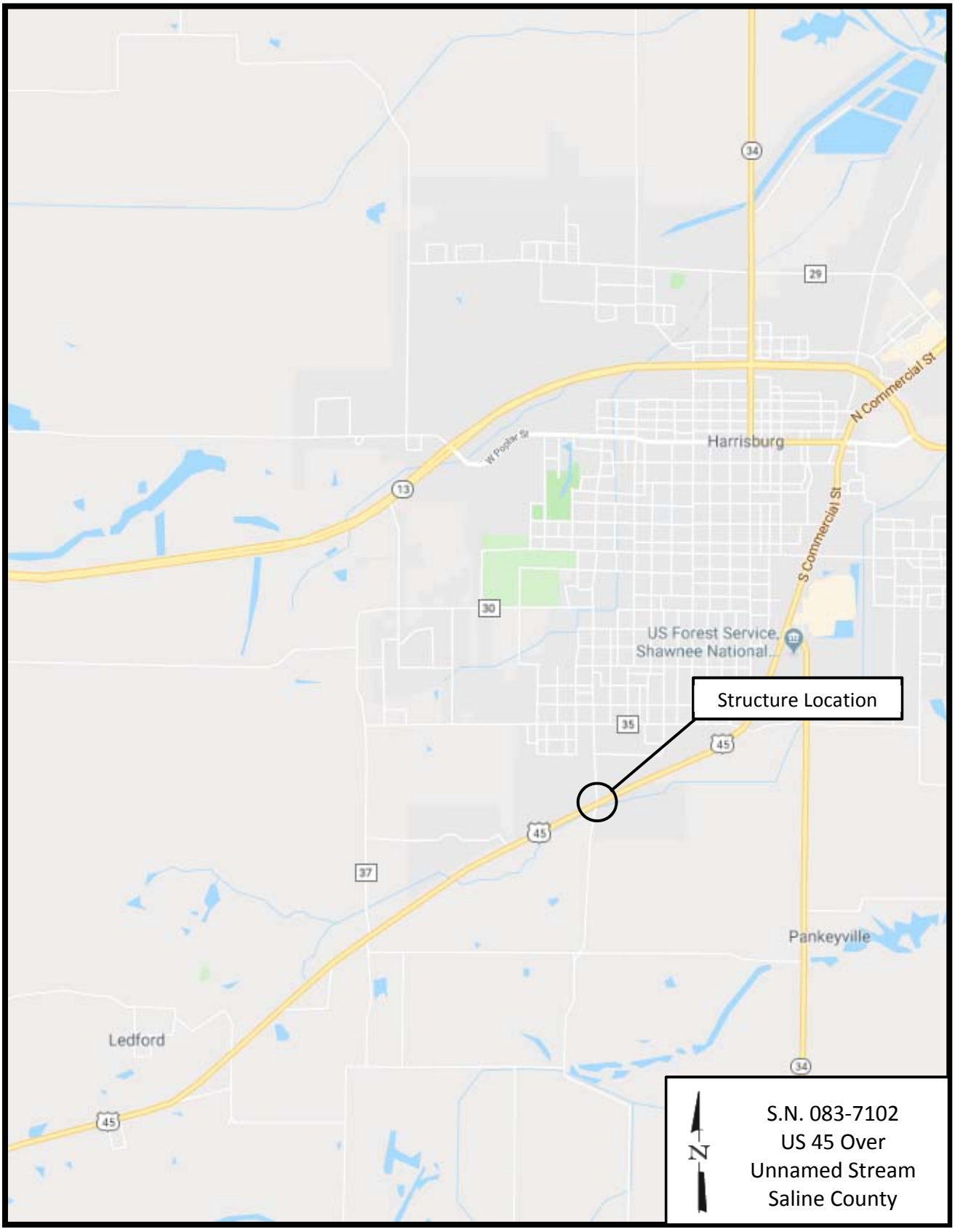
A 1:1.5 temporary excavation slope for construction clearance has an adequate factor of safety. The factor of safety is limited to 1:1.5 slopes and any steeper slopes are not recommended.

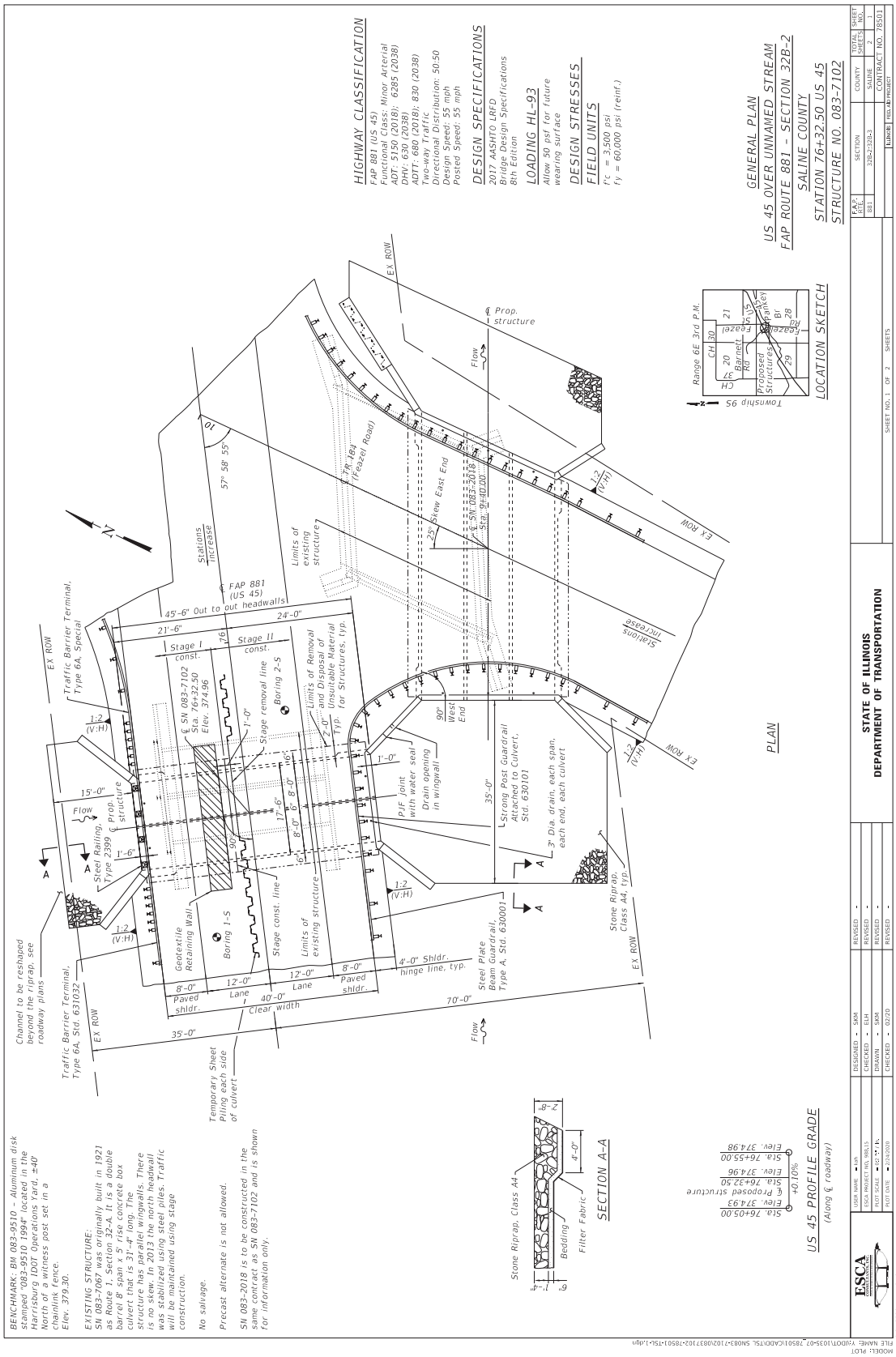
Ground Improvement

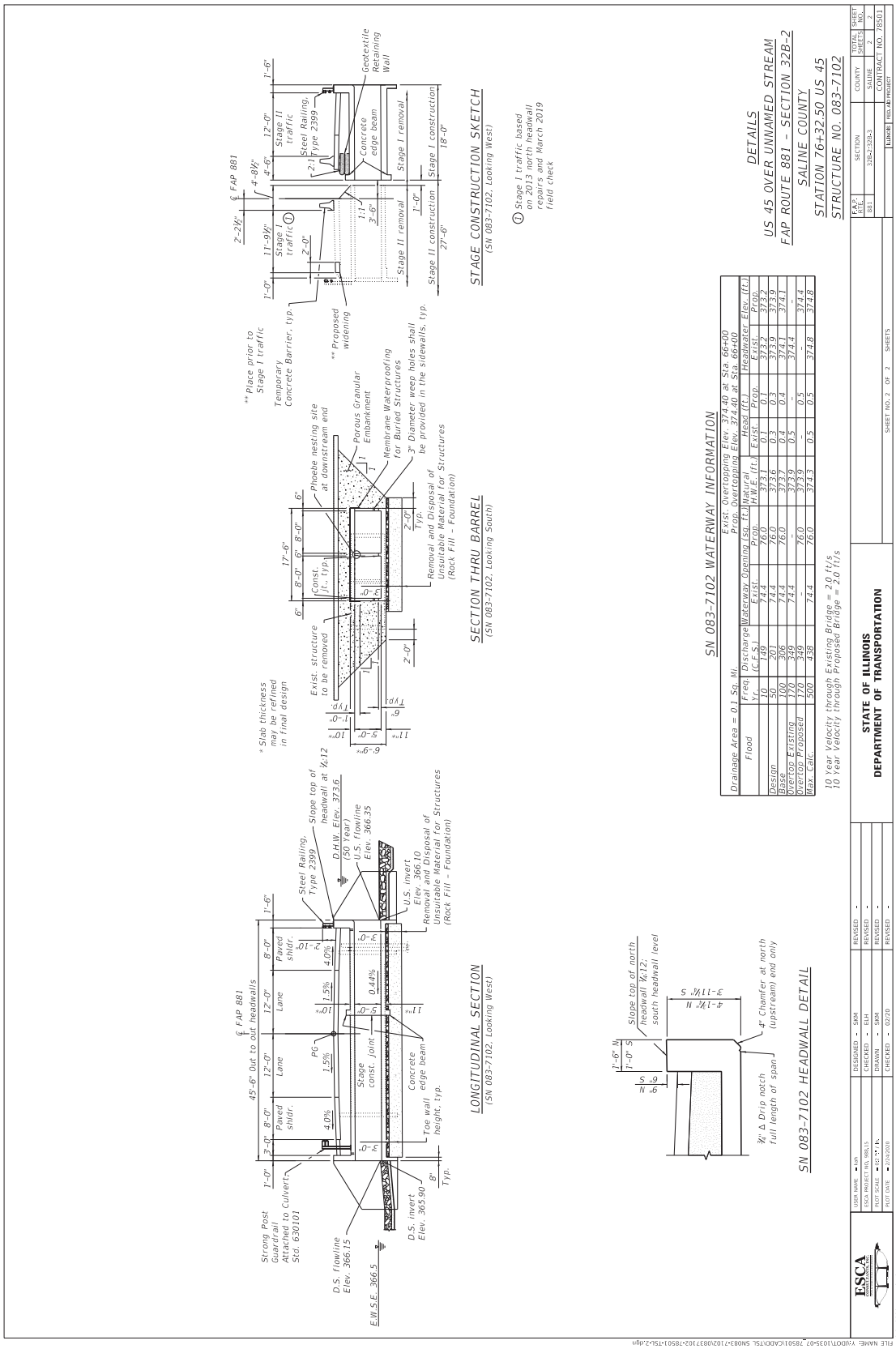
Since SN 083-7102 will primarily be supported on pre-loaded soil with only the culvert ends on currently unloaded soil, the bottom slab is considered rigid enough to not cause major structural issues due to differential settlement. To mitigate the potential differential settlement, it's recommended to provide 3 feet of removal of unsuitable material and replacement with Rock Fill – Foundation beneath the proposed slab.

Limitations

The recommendations provided herein are for the exclusive use of IDOT and ESCA Consultants, Inc. They are specific only to the project described, and are based on subsurface information obtained at boring locations within the bridge area, our understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. Lin Engineering, Ltd. should be contacted if conditions encountered during construction are not consistent with those described.

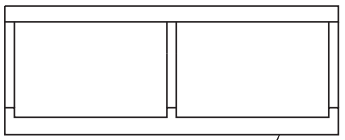

Harrisburg
N Commercial St
S Commercial St
W Poplar St
US Forest Service, Shawnee National...
Structure Location
Pankeyville
Ledford
34
29
13
30
35
45
37
S.N. 083-7102
US 45 Over
Unnamed Stream
Saline County
N


HIGHWAY CLASSIFICATION
FAP 881 (US 45)
Functional Class: Minor Arterial
ADT: 5150 (2018); 6285 (2038)
DHV: 630 (2038)
ADTT: 660 (2018); 830 (2038)
Two-way Traffic
Directional Distribution: 50-50
Design Speed: 55 mph
Posted Speed: 55 mph
DESIGN SPECIFICATIONS
2017 AASHTO LRFD
Bridge Design Specifications
8th Edition
LOADING HL-93
Allow 50 psf for future wearing surface
DESIGN STRESSES
FIELD UNITS
f'c = 3,500 psi
fy = 60,000 psi (reinf.)
GENERAL PLAN
US 45 OVER UNNAMED STREAM
FAP ROUTE 881 - SECTION 32B-2
SALINE COUNTY
STATION 76+32.50 US 45
STRUCTURE NO. 083-7102
LOCATION SKETCH
PLAN
US 45 PROFILE GRADE
(Along ℄ roadway)
SECTION A-A
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
ESCA
SHEET NO. 1 OF 2 SHEETS
CONTRACT NO. 78501
BENCHMARK: BM 083-9510 - Aluminum disk stamped "083-9510 1994" located in the Harrisburg IDOT Operations Yard, ±40' North of a witness post set in a chainlink fence. Elev. 379.30.
EXISTING STRUCTURE:
SN 083-7067 was originally built in 1921 and rebuilt in 1947. It is a double barrel 8' span x 5' rise concrete box culvert that is 31'-4" long. The structure has parallel wingwalls. There is no skew. In 2013 the north headwall was stabilized using steel piles. Traffic will be maintained using stage construction.
No salvage.
Precast alternate is not allowed.
SN 083-2018 is to be constructed in the same contract as SN 083-7102 and is shown for information only.
Channel to be reshaped beyond the riprap, see roadway plans
Traffic Barrier Terminal, Type 6A, Std. 631032
Temporary Sheet Piling each side of culvert
Geotextile Retaining Wall
Boring 1-S
Stage const. line
Limits of existing structure
Steel Plate Beam Guardrail, Type A, Std. 630001
Stone Riprap, Class A4, typ.
Strong Post Guardrail Attached to Culvert, Std. 630101
2" Dia. drain, each span, each end, each culvert
P.I.F. joint with water seal
Drain opening in wingwall
Limits of Removal and Disposal of Unsuitable Material for Structures, typ.
Stage removal line
Boring 2-S
Stage I const.
Stage II const.
Traffic Barrier Terminal, Type 6A, Special
Steel Railing, Type 2399
Prop. ℄ structure
FAP 881 (US 45)
45'-6" Out to out headwalls
Stations increase
Skew East End
℄ SN 083-2018 Sta. 29+40.00
℄ SN 083-7102 Sta. 76+32.50 Elev. 374.96
57° 58' 55"
25°
90°
Flow
EX ROW
TR 164 (Frazel Road)
Township 9S
Range 6E 3rd P.M.
Proposed Structures
Barnett Rd
Frazel
Sta. 76+05.00 Elev. 374.93
℄ Proposed Structure +0.10%
Sta. 76+32.50 Elev. 374.96
Sta. 76+55.00 Elev. 374.98
Bedding
Filter Fabric
Stone Riprap, Class A4


LONGITUDINAL SECTION
(SN 083-7102, Looking West)
SECTION THRU BARREL
(SN 083-7102, Looking South)
STAGE CONSTRUCTION SKETCH
(SN 083-7102, Looking West)
SN 083-7102 HEADWALL DETAIL
SN 083-7102 WATERWAY INFORMATION
Exist. Overtopping Elev. 374.40 at Sta. 66+00
Prop. Overtopping Elev. 374.40 at Sta. 66+00
Drainage Area = 0.1 Sq. Mi.
Flood | Freq. | Discharge | Waterway Opening (sq. ft.) Natural | Headwater Elev. (ft.)
Exist. | Prop. | Exist. | Prop.
Design | 50 | 201 | 74.4 | 76.0 | 373.6 | 373.7 | 0.3 | 0.3 | 373.9 | 373.9
Base | 100 | 306 | 74.4 | 76.0 | 373.7 | 374.1 | 0.4 | 0.4 | 374.1 | 374.1
Overtop Existing | 170 | 349 | 74.4 | 76.0 | 373.9 | 374.4 | 0.5 | 0.5 | 374.4 | 374.4
Overtop Proposed | 170 | 349 | 74.4 | 76.0 | 373.9 | 374.4 | 0.5 | 0.5 | 374.4 | 374.4
Max. Calc. | 500 | 438 | 74.4 | 76.0 | 374.3 | 374.8 | 0.5 | 0.5 | 374.8 | 374.8
10 Year Velocity through Existing Bridge = 2.0 ft/s
10 Year Velocity through Proposed Bridge = 2.0 ft/s
DETAILS
US 45 OVER UNNAMED STREAM
FAP ROUTE 881 - SECTION 32B-2
SALINE COUNTY
STATION 76+32.50 US 45
STRUCTURE NO. 083-7102
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
SHEET NO. 2 OF 2 SHEETS
F.A.P. RTE. 881
SECTION 32B-2STBG-3
COUNTY SALINE
TOTAL SHEETS 2
CONTRACT NO. 78501
ILLINOIS FED. AID PROJECT
ESCA
USER NAME: = lah
ESCA PROJECT NO. 19B115
PLOT SCALE: = 100.00 ' / in.
PLOT DATE: = 2/24/2020
DESIGNED - SKM
CHECKED - ELH
DRAWN - SKM
CHECKED - DZ/ZD
REVISED -
2/24/2020 7:48:42 AM
MODEL: PLOT
FILE NAME: Y:\DOT\1035-07_78501\CADD\TSL SN083-7102\083-7102-78501-TSL-2.dgn

Boring No: 1-S
Station: 76+55
Offset: 9.0ft RT
Ground Surface: 374.8'

		N	Qu	W%
Cored Pavement, 8 in. HMA over 9 in. Concrete	373.3			
Stiff Brown, V. Moist Silty Clay Loam	371.3	4	1.4B	21
		WOH	0.1B	32
V. Soft Brown, V. Moist Silty Clay Loam	366.3	2	0.1B	30
		5	1.2B	25
		5	1.9B	26
		7	1.4B	24
Stiff Grey, Moist Clay	358.8			
Stiff Brownish Grey, Moist Silty Clay Loam	356.3	6	1.0B	22
Soft Brownish Grey, Moist Silty Clay Loam	353.8	6	0.4B	23
		3	1.4B	21
Stiff Tannish Brown, Moist Silty Loam	348.8	13	1.3B	16
Stiff Brown and Grey, Moist Silty Clay Loam	346.3	8	1.2S	26
		6	0.9S	37
Stiff Grey, Moist Clay	344.8			



Boring No: 2-S
Station: 76+14
Offset: 9.0ft LT
Ground Surface: 374.8'

		N	Qu	W%
Cored Pavement, 7 in. HMA over 9 in. Concrete	373.3			
Soft Brown, Moist Silty Clay Loam		WOH	0.4B	24
Stiff Brownish Grey, Moist Silty Clay Loam	368.3	4	0.4B	32
M. Stiff Greyish Brown w/ Specks of Dark Brown, Moist Silty Clay Loam	365.8	6	1.2B	25
Stiff Greyish Brown with Specks of dark brown, Moist Silty Clay Loam	363.3	6	0.8B	26
V. Stiff Greyish Brown with specks of Grey, Moist Clay to Clay Loam	360.8	7	1.8B	27
Soft Brownish Grey, V. Moist Clay Loam	358.3	3	2.7B	24
M. Stiff Brownish Grey, Moist Silty Clay Loam	355.8	5	0.4B	27
Soft Brownish Grey, Moist Silty Clay Loam	350.8	3	0.9B	22
Stiff Brownish Grey, Moist Silty Clay Loam	348.3	5	0.6B	22
V. Stiff Brownish Grey, Moist Clay	345.8	4	0.4B	26
	344.3	9	1.2B	25
		9	2.4B	27

Legend

▽ Ground Water at Completion

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 10/1/19

ROUTE US 45 **DESCRIPTION** Double barrel 8'x5' box culvert/stream **LOGGED BY** L. Estel

SECTION 32B-3;32B-2 **LOCATION** Near Feazel St S of Harrisburg, **SEC.** 28, **TWP.** 9S, **RNG.** 6E, **PM**

COUNTY Saline **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lbs

STRUCT. NO. 083-7067
Station 70+32

BORING NO. 1-S
Station 76+55
Offset 9.0ft RT
Ground Surface Elev. 374.8 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 366.4 ft

Groundwater Elev.:
▽ **First Encounter** 344.8 ft
▼ **Upon Completion** 344.8 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Cored Pavement, 8 in. HMA over 9 in. CONCRETE
373.30				
	1			Stiff Brown, V. Moist SILTY CLAY LOAM
	2	1.4	21	
	2	B		
371.30				
	WOH			V. Soft Brown, V. Moist SILTY CLAY LOAM
	WOH	0.1	32	
-5	WOH	B		
	WOH			
	WOH	0.1	30	
	2	B		
366.30				
	2			Stiff Grey, Moist CLAY
	2	1.2	25	
-10	3	B		
	1			
	2	1.9	26	
	3	B		
	1			
	4	1.4	24	
-15	3	B		
358.80				
	1			Stiff Brownish Grey, Moist SILTY CLAY LOAM
	3	1.0	22	
	3	B		
356.30				
	1			Soft Brownish Grey, Moist SILTY CLAY LOAM
	3	0.4	23	
-20	3	B		
				Soft Brownish Grey, Moist SILTY CLAY LOAM *(continued)*
353.80				
	WOH			Stiff Tannish Brown, Moist SILTY LOAM
	WOH	1.4	21	
	3	B		
	3			
	7	1.3	16	
-25	6	B		
348.80				
	1			Stiff Brown and Grey, Moist SILTY CLAY LOAM
	3	1.2	26	
	5	S		
346.30				
	1			Stiff Grey, Moist CLAY
	3	0.9	37	
▽▼ 344.80 -30	3	S		
				Bottom of hole @ 30.0 ft
				Ground surface elevation calculated from Contract 78501 plan sheets
				To convert "N" values to "N60", multipy by 1.5
-35				
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
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)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\SALINE\083-7067.GPJ Data Template D6TEMPLT.GDT Date Printed 10/23/19
Latitude Longitude Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 10/1/19

ROUTE US 45 **DESCRIPTION** Double barrel 8'x5' box culvert/stream **LOGGED BY** L. Estel

SECTION 32B-3;32B-2 **LOCATION** Near Feazel St S of Harrisburg, **SEC.** 28, **TWP.** 9S, **RNG.** 6E, **PM**

COUNTY Saline **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lbs

STRUCT. NO. 083-7067
Station 70+32

BORING NO. 2-S
Station 76+14
Offset 9.0ft LT
Ground Surface Elev. 374.8 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 366.4 ft

Groundwater Elev.:
▽ **First Encounter** 344.8 ft
▼ **Upon Completion** 344.8 ft
▼ **After** ____ **Hrs.** ____ ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
Cored Pavement, 7 in. HMA over 9 in. CONCRETE			
373.30			
Soft Brown, Moist SILTY CLAY LOAM	WOH		
	WOH	0.4	24
	WOH	B	
	1		
-5	2	0.4	32
	2	B	
368.30			
Stiff Brownish Grey, Moist SILTY CLAY LOAM	1		
	2	1.2	25
	4	B	
365.80			
M. Stiff Greyish Brown with specks of dark Brown, Moist SILTY CLAY LOAM	1		
-10	3	0.8	26
	3	B	
363.30			
Stiff Greyish Brown with specks of dark Brown, Moist SILTY CLAY LOAM	1		
	3	1.8	27
	4	B	
360.80			
V. Stiff Greyish Brown with specks of Grey, Moist CLAY TO CLAY LOAM	WOH		
-15	1	2.7	24
	2	B	
358.30			
Soft Brownish Grey, V. Moist CLAY LOAM	1		
	2	0.4	27
	3	B	
355.80			
M. Stiff Brownish Grey, Moist SILTY CLAY LOAM	WOH		
-20	1	0.9	22
M. Stiff Brownish Grey, Moist SILTY CLAY LOAM *(continued)*	2	B	
	1		
	2	0.6	22
	3	B	
350.80			
Soft Brownish Grey, Moist SILTY CLAY LOAM	1		
-25	1	0.4	26
	3	B	
348.30			
Stiff Brownish Grey, Moist SILTY CLAY LOAM	1		
	4	1.2	25
	5	B	
345.80			
V. Stiff Brownish Grey, Moist CLAY	1		
▽▼ -30	4	2.4	27
344.30	5	B	
Bottom of hole @ 30.5 ft			
Ground surface elevation calculated from Contract 78501 plan sheets			
To convert "N" values to "N60", multiply by 1.5			
-35			
-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
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)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\SALINE\083-7067.GPJ Data Template D6TEMPLT.GDT Date Printed 10/23/19
Latitude Longitude Datum NAD83 Job Number

Illinois Department of Transportation

COHESIVE SOIL SETTLEMENT ESTIMATE

LOCATION AND BORING USED ==== Boring 1-S
TYPE OF SURCHARGE ========== 2 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) == 8.4 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ========== 75.6 PCF
- NEW EMBANKMENT FILL HEIGHT ========== 9.9 FT
- PROPOSED WIDTH AT TOP ========== 45.5 FT
- PROPOSED WIDTH AT BOTTOM ========== 45.5 FT (which is a 0.0:1 slope)

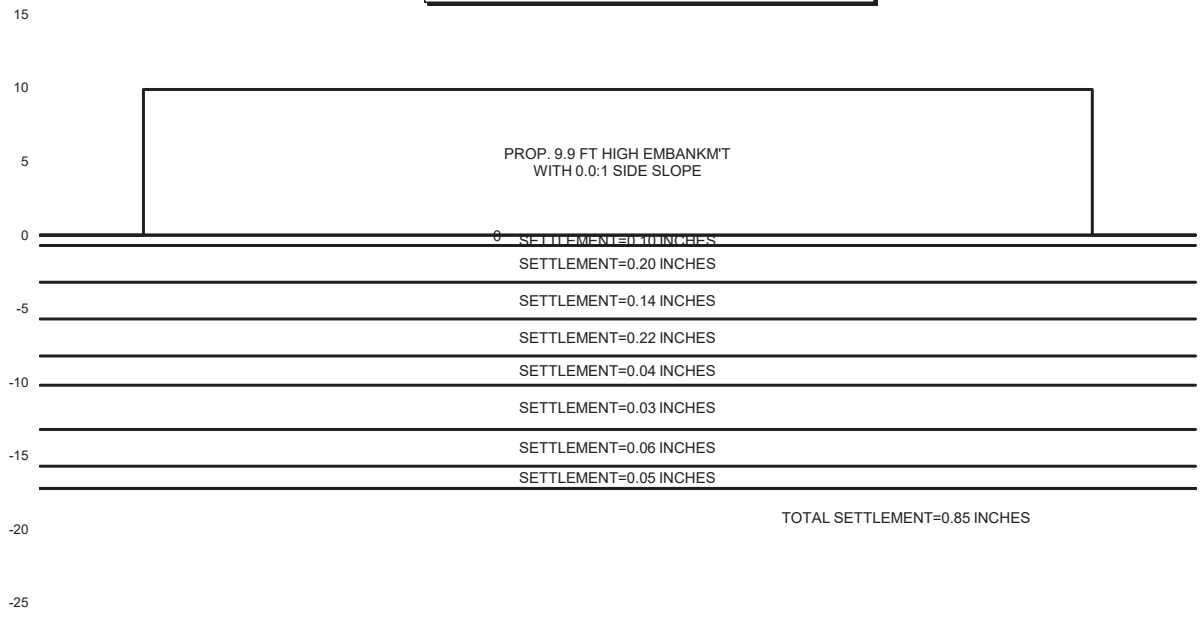
EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ========== 0 PCF
- EXISTING EMBANKMENT HEIGHT ========== 0 FT
- EXISTING WIDTH AT TOP ========== 0 FT
- EXISTING WIDTH AT BASE ========== 0 FT (which is a 0.0:1 slope)

ASSUMPTIONS:
Soil Deposit is Normally Consolidated
Cohesive Layers are Saturated
Soils have a Low Sensitivity
Liquid Limit (LL)=Moist. Content (MC%)
Initial Void Ratio (Eo)=2.7*(MC%)/100
Comp. Index (Cc)=0.009*(LL-10)
Neglecting Granular & Secondary Settlem't

LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
0.7	129.1	1.90	26	0.045	0.741	0.702	0.144	0.116	**0.10**
2.5	125.4	1.40	24	0.247	0.708	0.648	0.126	0.150	**0.20**
2.5	121.5	1.00	22	0.556	0.656	0.594	0.108	0.200	**0.14**
2.5	111.4	0.40	23	0.847	0.607	0.621	0.117	0.436	**0.22**
2.0	125.4	1.40	21	1.062	0.565	0.567	0.099	0.150	**0.04**
3.0	124.6	1.30	16	1.218	0.522	0.432	0.054	0.160	**0.03**
2.5	123.6	1.20	26	1.388	0.479	0.702	0.144	0.171	**0.06**
1.5	120.3	0.90	37	1.508	0.450	0.999	0.243	0.219	**0.05**

TOTAL SETTLEMENT UNDER CENTER OF CONTINUOUS EMBANKMENT = 0.85 IN.

EMBANKMENT AND SOIL PROFILE



Illinois Department of Transportation

COHESIVE SOIL SETTLEMENT ESTIMATE

LOCATION AND BORING USED ==== Boring 2-S
TYPE OF SURCHARGE ========== 2 (1=2:1 bridge cone, 2=continuous embank., 3=rectangular surch.)
DEPTH TO WATER TABLE (below top of existing embankment) == 8.4 FT

NEW EMBANKMENT:
- NEW EMBANKMENT FILL UNIT WEIGHT ========== 75.6 PCF
- NEW EMBANKMENT FILL HEIGHT ========== 9.9 FT
- PROPOSED WIDTH AT TOP ========== 45.5 FT
- PROPOSED WIDTH AT BOTTOM ========== 45.5 FT (which is a 0.0:1 slope)

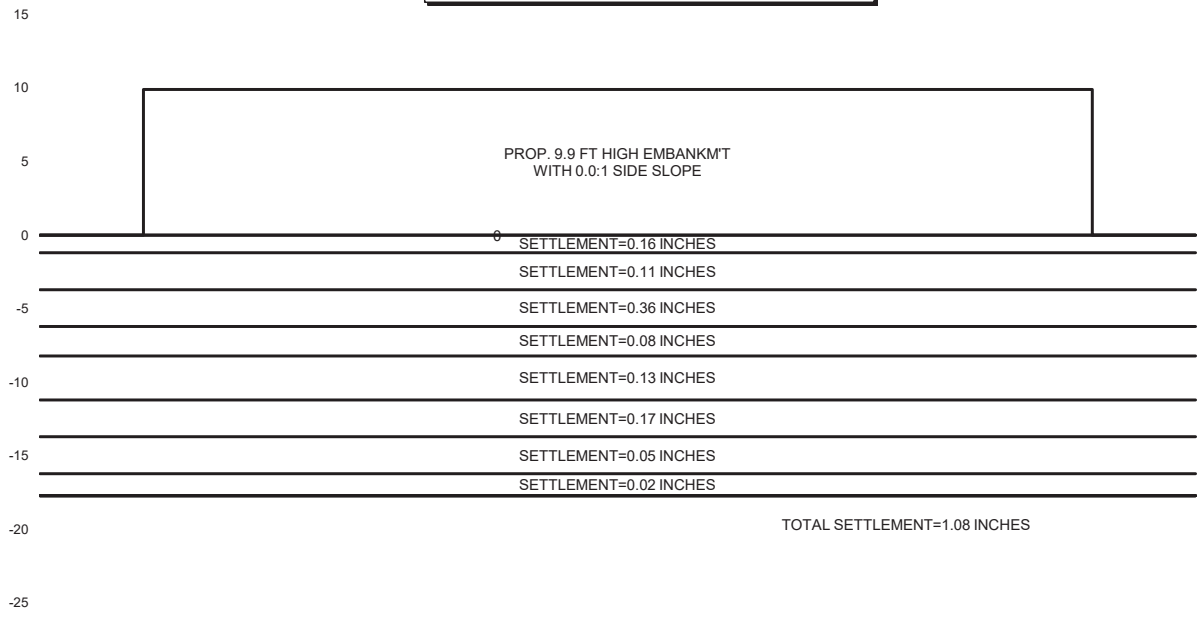
EXISTING EMBANKMENT (IF ANY):
- EXISTING EMBANKMENT UNIT WEIGHT ========== 0 PCF
- EXISTING EMBANKMENT HEIGHT ========== 0 FT
- EXISTING WIDTH AT TOP ========== 0 FT
- EXISTING WIDTH AT BASE ========== 0 FT (which is a 0.0:1 slope)

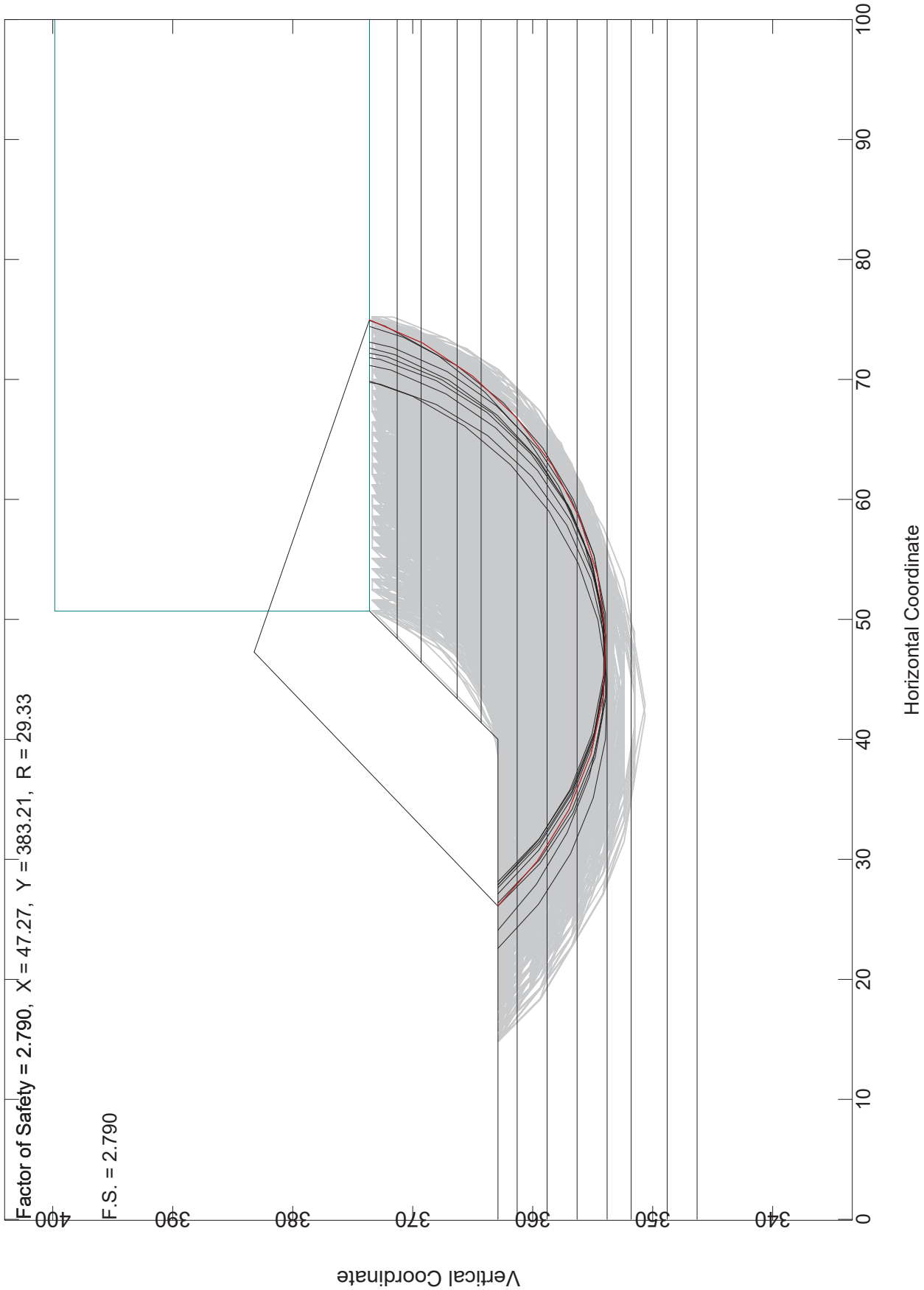
ASSUMPTIONS:
Soil Deposit is Normally Consolidated
Cohesive Layers are Saturated
Soils have a Low Sensitivity
Liquid Limit (LL)=Moist. Content (MC%)
Initial Void Ratio (Eo)=2.7*(MC%)/100
Comp. Index (Cc)=0.009*(LL-10)
Neglecting Granular & Secondary Settlem't

LAYER THICK (FT)	*TOTAL UNIT WT. (PCF)*	*UNCONF. COMP. STRENGTH (Qu) (TSF)*	*MOIST. CONTENT (%)*	*EXISTING PRESSURE (KSF)*	*PRESSURE INCREASE (KSF)*	*INITIAL VOID RATIO*	*COMPRESSION INDEX (Cc)*	*Qu CORRECTION FACTOR*	*LAYER SETTLEMENT (IN.)*
1.2	128.5	1.80	27	0.077	0.736	0.729	0.153	0.121	**0.16**
2.5	133.5	2.70	24	0.321	0.697	0.648	0.126	0.100	**0.11**
2.5	111.4	0.40	27	0.627	0.646	0.729	0.153	0.436	**0.36**
2.0	120.3	0.90	22	0.887	0.602	0.594	0.108	0.219	**0.08**
3.0	115.7	0.60	22	1.099	0.556	0.594	0.108	0.309	**0.13**
2.5	111.4	0.40	26	1.241	0.510	0.702	0.144	0.436	**0.17**
2.5	123.6	1.20	25	1.378	0.471	0.675	0.135	0.171	**0.05**
1.5	132	2.40	27	1.507	0.443	0.729	0.153	0.100	**0.02**

TOTAL SETTLEMENT UNDER CENTER OF CONTINUOUS EMBANKMENT = 1.08 IN.

EMBANKMENT AND SOIL PROFILE




Factor of Safety = 2.790, X = 47.27, Y = 383.21, R = 29.33
F.S. = 2.790
Vertical Coordinate
Horizontal Coordinate
400
390
380
370
360
350
340
0
10
20
30
40
50
60
70
80
90
100