

Original Report Date: <u>10/29/20</u>	Proposed SN: <u>017-2015.</u>	Route: <u>FAP 332</u>
Revised Date: <u>3/8/21</u>	Existing SN: <u>017-0022</u>	Section: <u>20B-1</u>
Geotechnical Engineer: <u>Bill Kramer</u>		County: <u>Crawford</u>
Structural Engineer: <u>Nephtali Rivera-Martinez</u>		Contract: <u>74755</u>

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): A 55' long cast in place 10' x 8' double box culvert with horizontal wings 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): Existing Structure: Structure No. 017-0022 was originally constructed in 1921 under S.B.I. Route 1, Section 20 at station 912+23. The superstructure consists of a single span, 11-½" thick reinforced concrete slab bridge with a 4" thick concrete wearing surface supported on closed abutments with wingwalls on spread footings at the north and south. On 1960, the structure was widened under S.B.I. Route 1, Section 20-BY-1. The structure was expanded from 20' wide to 46'-4" wide and the wingwalls were removed and replaced. One lane of traffic will be maintained utilizing stage construction. Existing boring data consists very hard cemented clay loam till.

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: No increase in grade or widening is planned so by inspection, settlement is anticipated to near zero and thus not an issue to address.

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: No increase in grade or widening is planned so by inspection, slope stability is anticipated to have a factor of safety of above 1.5 (which is the minimum required).

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: Scour is not required to be calculated at box culverts due to their cutoff wall and CIP bottom slab protection to the foundation soils. In addition, rip rap is being placed at the inlet and outlet ends of the box to arrest any local scour holes that might develop in these locations.

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: Liquefaction is not an issue at this location due to the consistent cohesive soils which are unable to liquefy. Buried structures are not required to be designed for seismic loading and thus no seismic data is required for the TSL plan.

Confirm feasibility of the proposed foundation or wall type and provide design parameters. 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 foundation treatment at the wings and the box consists of the standard process of excavating down to the bottom of slab or wing/cutoff wall and pour the first sequence of box concrete. No working platform, removal and replacement or other ground improvement is necessary at this location. The wing length appears to be short enough to use horizontal cantilever wing which we recommend. Precast alternate is not allowed according to the district preference on the structure report. Looking at the soils at the site and loading on the new box, we don't see any problem with allowing a precast box alternative.

Calculate the estimated water surface elevation and determine the need for Cofferdams (Type 1 or 2), and seal coat: The estimated water surface elevation (EWSE) is 482.4 ft. according to the district hydraulic group. The soils are cohesive so water diversion (which is incidental to box construction) is very feasible, and the wing type is expected to be horizontal cantilever, we see no need for any cofferdam.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: Staged construction will be carried out using stage construction. Our unit believes at temporary sheeting piling design will work and should be shown on the TSL. During final plans development, our unit should be contacted to determine the required section modulus and tip elevation to be shown on the contract plans. The existing footing should have sufficient bearing capacity (at least 5 ksf. factored) to support the temporary stage construction loadings (factored) which are indicated to be around 4 ksf. due to that addition of a new 14" concrete slab to strengthen the deck during stage construction.

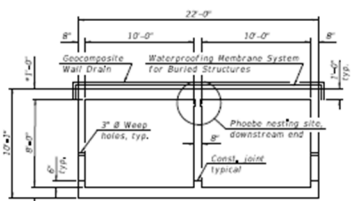
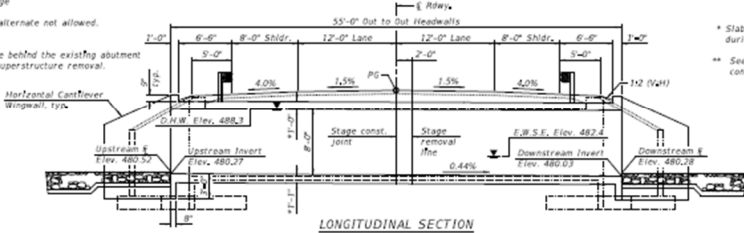
Bench Mark BH 408 - Chiseled square on northwest wingwall of SN 017-0022
 Station 912+37.8, Offset 24.2 Left, Elevation = 490.56.

Existing Structure: Structure No. 017-0022 was originally constructed in 1921 under S.B.J. Route 1, Section 20 at Station 912+23. The superstructure consists of a single span, 11½" thick reinforced concrete slab bridge with a 4" thick concrete wearing surface supported on closed abutments with wingwalls on spread footings at the north and south. In 1960 the structure was widened under S.B.J. Route 1, Section 20-87-1. The structure was expanded from 20'-0" wide to 46'-4" wide and the wingwalls were removed and replaced. One lane of traffic will be maintained utilizing stage construction.

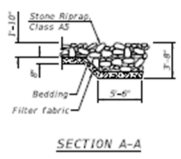
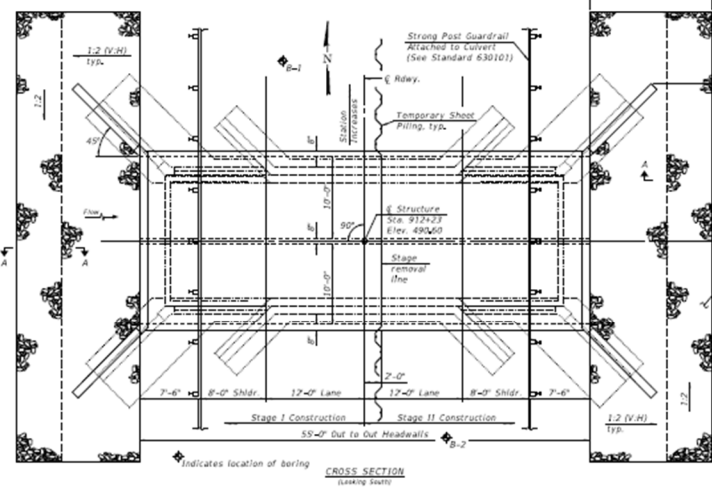
No Salvage

Precast alternate not allowed.

Note: Excavate behind the existing abutment prior to superstructure removal.



* Slab thickness may be refined during final design.
 ** See sheet 2 of 2 for stage construction details.

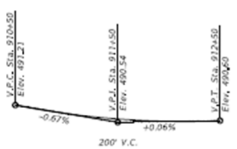


DESIGN STRESSES
 FIELD UNITS
 $f_c = 3,500$ psi (Concrete)
 $f_y = 60,000$ psi (Reinforcement)

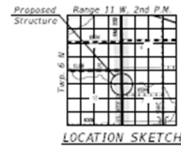
LOADING HL-93
 Allow 50w/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS
 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

HIGHWAY CLASSIFICATION
 F.A.P. Rte. 332 - IL Rte. 1
 Functional Class: Other Principal Arterial
 ADT: 4,450 (2021); 5,400 (2041)
 ADT: 801 (2021); 972 (2041)
 DNV: 490 (2021); 594 (2041)
 Design Speed: 60 mph
 Posted Speed: 55 mph
 Two-Way Traffic
 Directional Distribution: 50/50



GENERAL PLAN & ELEVATION
 IL RTE. 1 OVER UNNAMED CREEK
 F.A.P. RTE. 332 - SECTION 20B-1
 CRAWFORD COUNTY
 STATION 912+23
 STRUCTURE NO. 017-2015



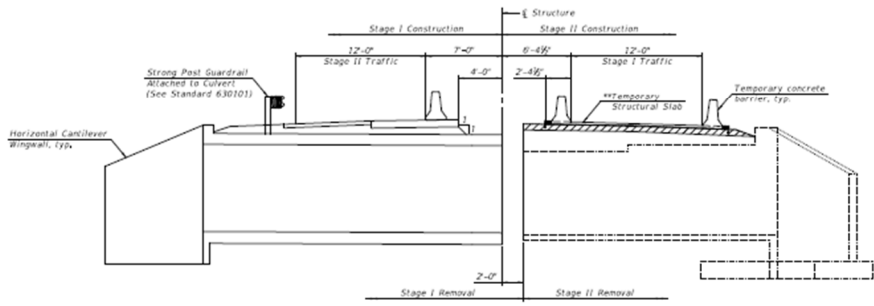
DESIGNED BY	WIPITALE ENGINEERING INC.
CHECKED BY	BRENDA PAGAN-BEJERSON
DRAWN BY	JENNIFER A. POFF
CHECKED BY	

312921 - 12/16/24 PH

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
20B	332A	UNAPPROVED	1
CONTRACT NO. 24755			11-3-1



Existing HMA surface to be removed before placing temporary slab.

** Temporary structural slab shall be designed to carry 100% of the dead and live load of stage I traffic. Thickness to be determined during final design.

WATERWAY INFORMATION

Drainage Area = 1.1 Sq. Mi. Existing Overlapping Elev. 490.6 ft. at Sta. 912+50
 Proposed Overlapping Elev. 490.6 ft. at Sta. 912+50

Flood	Freq. yr.	Q	Opening Ft.		Nat. H.W.B.	Head Ft.		Headwater Ft.
			Exist.	Prop.		Exist.	Prop.	
Design	50	893	102	160	488.3	1.2	0.5	489.5
Base	100	1060	102	160	488.3	1.8	0.8	490.1
Overlapping (Exist.)	100	1117	102	160	488.5	2.1	-	490.6
Scour Design Check	200	1234	102	160	488.6	2.2	1.3	490.8
Overlapping (Prop.)	310	1236	-	160	488.7	-	1.9	490.6
Max. side	500	1480	102	160	489.0	2.1	1.9	491.1

10-year outlet velocity from existing structure = 5.8 fps
 10-year outlet velocity from proposed structure = 3.6 fps

DETAILS
 IL RTE. 1 OVER UNNAMED CREEK
 F.A.P. RTE. 332 - SECTION 20B-1
 CRAWFORD COUNTY
 STATION 912+23
 STRUCTURE NO. 017-2015

DESIGNED BY	WIPITALE ENGINEERING INC.
CHECKED BY	BRENDA PAGAN-BEJERSON
DRAWN BY	JENNIFER A. POFF
CHECKED BY	

312921 - 12/16/24 PH

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
20B	332A	UNAPPROVED	2
CONTRACT NO. 24755			11-3-1



Illinois Department of Transportation
 Division of Highways
 IDOT

SOIL BORING LOG

Page 1 of 1

Date 7/15/19

ROUTE FAP 332 (IL 1) DESCRIPTION Abutment LOGGED BY E. Sandschafer

SECTION 20B-1 LOCATION IL 1 over Unnamed Stream, SEC. 12, TWP. 6N, RNG. 12W, 2 PM

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

STRUCT. NO. 017-0022 (E)
017-2015 (P)
 Station 912+23

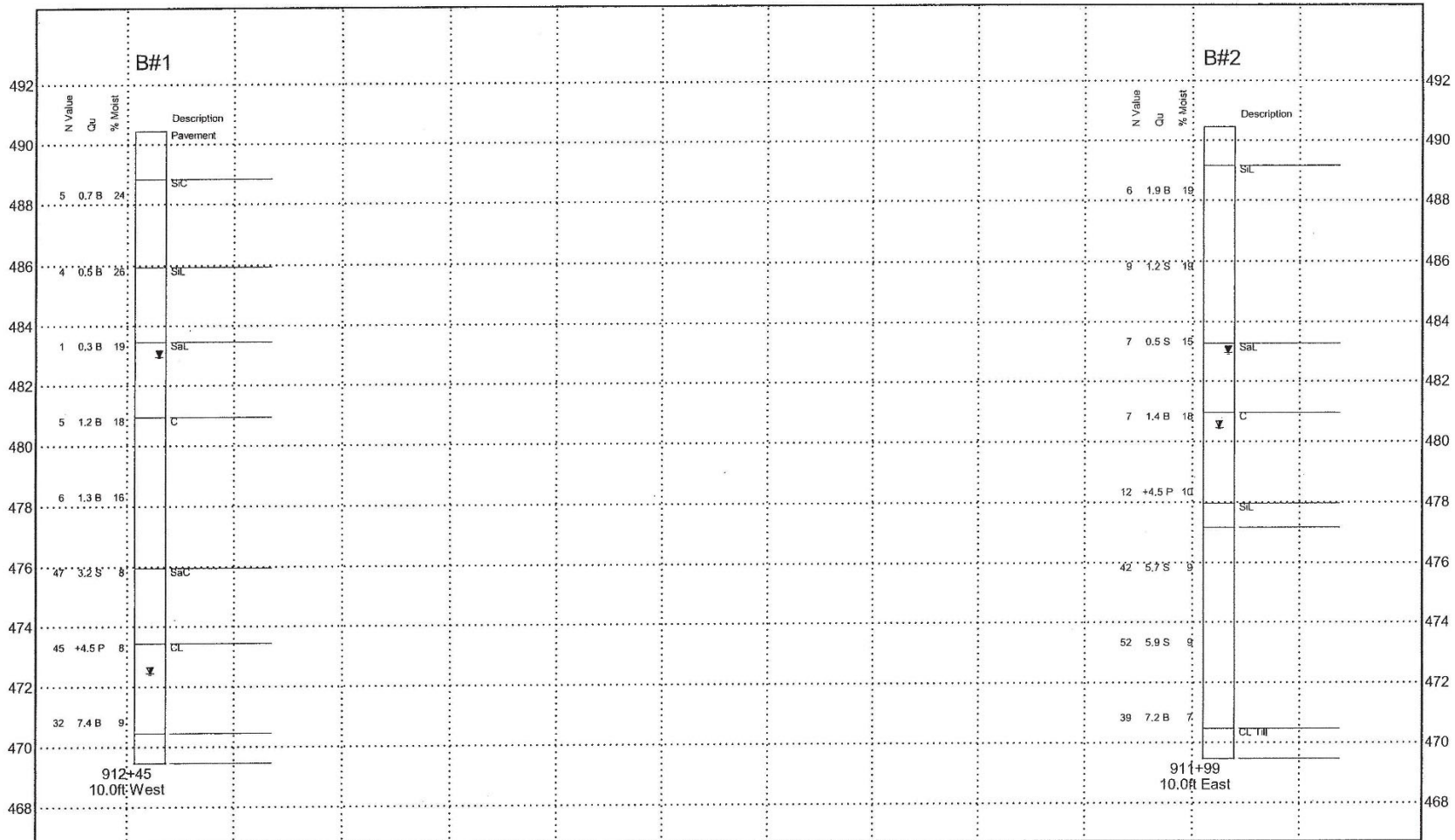
BORING NO. 2 (South)
 Station 911+99
 Offset 10.0ft East
 Ground Surface Elev. 490.46

DEPTH H (ft)	BLOW S /6"	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev.		DEPTH H (ft)	BLOW S /6"	UCS Qu (tsf)	MOIST T (%)
				ft	ft				
				481.68	ft				
				481.66	ft				
				Groundwater Elev.:					
				▽ First Encounter	Dry	ft			
				▽ Upon Completion	480.5	ft			
				▽ After 24 Hrs.	483.0	ft			
6-1/8" Asphalt over 9-1/2" Concrete				Grey			19	7.2	7
489.16					469.46		20	B	
Grey, SILTY LOAM				Extent of exploration.					
Stiff, moist	3			Benchmark: BM 408 Cut square on top of NW wingwall of Str. No. 017-0022, Sta. 912+35, 24' LT.					
	3	1.9	19						
	3	B							
	3								
	3	1.2	19						
	6	S							
483.26									
Medium, moist, grey, SANDY LOAM	5								
	4	0.5	15						
	3	S							
480.96									
Stiff, moist, brown, CLAY	2								
	3	1.4	18						
	4	B							
	2								
477.96									
Very soft, moist, brown, SILTY LOAM	2	+4.5	10						
	10	P							
477.16									
Hard, moist, brown, CLAY LOAM Till									
	13								
	18	5.7	9						
	24	S							
	12								
	22	5.9	9						
	30	S							
470.46	15								

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, Form 137 (Rev. 8-99)

File Name S:\NEW GEOTECHNICAL\DATA\PROJECTS\CRAWFORD CO (017)017-2015 SOIL 2019 BOX CULVERT.GPJ Data Template D7.GDT Date Printed 7/18/19 Latitude N 38.981280 Longitude W 87.684715 Datum Job Number

Structure Number 017-0022 (E) 017-2015 (P) Abutment
 Located in the IL 1 over Unnamed Stream of Section 12, Township 6N, Range 12W of the 2 P.M.



NOT TO HORIZONTAL SCALE

VARIATIONS IN SUBSURFACE
 CONDITIONS MAY EXIST
 BETWEEN BORINGS

SUBSURFACE DATA PROFILE

Route: FAP 332 (IL 1)
 Section: 20B-1
 County: Crawford



Groundwater
 First Encounter
 Completion
 after (refer to log) hours

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

TEST FENCE 2 017-2015 SOIL 2019 BOX CULVERT.GPJ D7.GDT 7/18/19

TEST FENCE 2 017-2015 SOIL 2019 BOX CULVERT.GPJ D7.GDT 7/18/19



SOIL PROPERTIES BELOW EXCAVATION LIMIT

STRUCTURE ===== 017-2015
SUBSTRUCTURE & REFERENCE BORING === B#1

RETAINED HEIGHT (FT)	LAYER THICKNESS (FT)	SPT N-VALUE (BPF)	UNCONFINED COMPRESSIVE STRENGTH Qu (TSF)
10	2		1.3
ROUND TO NEAREST 0.25	2.5		3.2
	1		4.4
	1		4.4
	1		4.4
	1		4.4
	1		4.4
	1		4.4

COHESIVE CHARTS CONTROL USING AN EMBEDMENT D, 7.50 FT
AND REQUIRES A SECTION MODUL, 6.00 IN.² IFT

Clear Input

Print

DEPTH BELOW EXCAV. (FT)	SPLIT LAYER N	SPLIT AT DEPTH (FT)	SPLIT Qu (TSF)	AVG. N ABOVE DEPTH (BPF)	AVG. 50% N (BPF)	REQ'D CHART DEPTH (FT)	AVG. N IN UPPER 33% (BPF)	REQ'D CHART W/ AMP. (IN.² IFT)	RATIO LOWER MOL UPPER 1/3 N	AVG. Qu ABOVE DEPTH (TSF)	AVG. 50% Qu (TSF)	REQ'D CHART DEPTH (FT)	AVG. Qu IN UPPER 33% (TSF)	REQ'D CHART W/ AMP. (IN.² IFT)	RATIO OF UPPER MOL LOWER 1/3 Qu
0.50	0.5	13	1.3	13.00			13.00		1.00	1.30			1.30		1.00
1.00	0.5	13	1.3	13.00			13.00		1.00	1.30			1.30		1.00
1.50	0.5	13	1.3	13.00	13.00	44.62	13.00		1.00	1.30	1.30	7.60	1.30		1.00
2.00	0.5	13	1.3	13.00	13.00	44.62	13.00		1.00	1.30	1.30	7.60	1.30		1.00
2.31	0.313	32	3.2	15.57	13.00	44.62	13.00		1.00	1.56	1.30	7.60	1.30		1.00
2.63	0.313	32	3.2	17.52	13.00	44.62	13.00		1.00	1.75	1.30	7.60	1.30		1.00
2.94	0.313	32	3.2	19.06	13.00	44.62	13.00		1.00	1.91	1.30	7.60	1.30		1.00
3.25	0.313	32	3.2	20.31	13.00	44.62	13.00		1.00	2.03	1.30	7.60	1.30		1.00
3.56	0.313	32	3.2	21.33	13.00	44.62	13.00		1.00	2.13	1.30	7.60	1.30		1.00
3.88	0.313	32	3.2	22.19	13.00	44.62	13.00		1.00	2.22	1.30	7.60	1.30		1.00
4.19	0.313	32	3.2	22.93	13.85	44.62	13.00		1.00	2.29	1.39	7.60	1.30		1.00
4.50	0.313	32	3.2	23.56	15.11	44.33	13.00		1.00	2.36	1.51	7.60	1.30		1.00
4.83	0.125	44	4.4	24.11	15.57	43.94	13.00		1.00	2.41	1.56	7.60	1.30		1.00
4.75	0.125	44	4.4	24.63	16.00	43.81	13.00		1.00	2.46	1.60	7.60	1.30		1.00
4.88	0.125	44	4.4	25.13	16.41	43.69	13.00		1.00	2.51	1.64	7.60	1.30		1.00
5.00	0.125	44	4.4	25.60	16.80	43.68	13.00		1.00	2.56	1.68	7.60	1.30		1.00
5.13	0.125	44	4.4	26.05	17.17	43.48	13.00		1.00	2.60	1.72	7.60	1.30		1.00
5.25	0.125	44	4.4	26.48	17.52	43.39	13.00		1.00	2.65	1.75	7.60	1.30		1.00
5.38	0.125	44	4.4	26.88	17.86	43.30	13.00		1.00	2.69	1.79	7.60	1.30		1.00
5.50	0.125	44	4.4	27.27	18.18	43.22	13.00		1.00	2.73	1.82	7.60	1.30		1.00
5.63	0.125	44	4.4	27.64	18.49	43.14	13.00		1.00	2.76	1.85	7.60	1.30		1.00
5.75	0.125	44	4.4	28.00	18.78	43.07	13.00		1.00	2.80	1.88	7.60	1.30		1.00
5.88	0.125	44	4.4	28.34	19.06	43.00	13.00		1.00	2.83	1.91	7.60	1.30		1.00
6.00	0.125	44	4.4	28.67	19.33	42.94	13.00		1.00	2.87	1.93	7.60	1.30		1.00
6.13	0.125	44	4.4	28.98	19.59	42.88	13.39	1.06	1.06	2.90	1.96	7.60	1.34	1.06	1.06
6.25	0.125	44	4.4	29.28	19.84	42.83	13.76	1.12	1.12	2.93	1.98	7.60	1.38	1.12	1.12
6.38	0.125	44	4.4	29.57	20.08	42.78	14.12	1.17	1.17	2.96	2.01	7.60	1.41	1.17	1.17
6.50	0.125	44	4.4	29.85	20.31	42.73	14.46	1.22	1.22	2.98	2.03	7.60	1.45	1.22	1.22
6.63	0.125	44	4.4	30.11	20.53	42.68	14.79	1.28	1.28	3.01	2.05	7.60	1.48	1.28	1.28
6.75	0.125	44	4.4	30.37	20.74	42.64	15.11	1.32	1.32	3.04	2.07	7.60	1.51	1.32	1.32
6.88	0.125	44	4.4	30.62	20.95	42.60	15.42	1.37	1.37	3.06	2.09	7.60	1.54	1.37	1.37
7.00	0.125	44	4.4	30.86	21.14	42.56	15.71	1.42	1.42	3.09	2.11	7.60	1.57	1.42	1.42
7.13	0.125	44	4.4	31.09	21.33	42.52	16.00	1.46	1.46	3.11	2.13	7.60	1.60	1.46	1.46
7.25	0.125	44	4.4	31.31	21.52	42.49	16.28	1.50	1.50	3.13	2.15	7.60	1.63	1.50	1.50
7.38	0.125	44	4.4	31.53	21.69	42.46	16.54	1.54	1.54	3.15	2.17	7.60	1.65	1.54	1.54
7.50	0.125	44	4.4	31.73	21.87	42.43	16.80	1.58	1.58	3.17	2.19	7.50	1.68	1.58	1.58
7.63	0.125	44	4.4	31.93	22.03	42.40	17.05	1.62	1.62	3.19	2.20	7.50	1.70	6.00	1.62
7.75	0.125	44	4.4	32.13	22.19	42.37	17.29	1.66	1.66	3.21	2.22	7.50	1.73	6.00	1.66

CANTILEVER PILE WALL ANALYSIS

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

Modified on 4/16/12

RUN STRIP OR EMBANKMENT SURCHARGE IMPORT

ELEV. OF RETAINED GROUND SURFACE =====	100.00 FT.	RETAINED HEIGHT FROM TOP OF WALL TO DREDGE LINE
ELEV. OF DREDGE LINE EXCAVATION =====	90.00 FT.	=====> 10.00 FT.
ELEV. OF WATER TABLE (FRONT OF WALL) =====	90.00 FT.	DEPTH OF EMBEDMENT BELOW DREDGE LINE WITH NO F.S.
WATER TABLE DIFFERENCE (BEHIND WALL) =====	0.00 FT.	=====> 3.90 FT.
FACTOR OF SAFETY (INCREASE IN EMBED.) =====	20 %	DEPTH OF EMBEDMENT BELOW DREDGE LINE WITH F.S.
WALL FRICTION ANGLE (FOR GRANULAR) =====	0.0 DEG.	=====> 4.68 FT.
FORESLOPE BETA ANGLE =====	0.0 DEG.	
BACKSLOPE BETA ANGLE =====	0.0 DEG.	
VERT. HEIGHT TO TOP OF BACKSLOPE =====	0.00 FT.	
ALLOW. BENDING STRESS FACTOR =====	0.66 (NORMALLY .55Fy OR .66Fy FOR TEMP.)	
GRADE STEEL OF PILING (YIELD STRENGTH) =====	50.0 KSI (Fy)	
SURCH. LOAD OF EMBANK., STRIP, OR BOTH =====	0 (0=NONE, 1=EMBANKMENT, 2=STRIP, 3=BOTH)	
UNIFORM SURFACE SURCHARGE BEHIND WALL =====	0.25 KSF.	
MIN. EFFECTIVE OVERBURDEN PRESS. COEF. =====	0.25 (AASHTO 5.6.2)	

LAYER THICK.	COHES. INTER.	S.P.T. BLOWS	FRICT. ANGLE	UNIT WEIGHT	BUOYANT UNIT WT.	COULOMB'S ACTIVE & PASSIVE	HYDRO. PRESS.	EXTERNAL SURCHAR.	RETAINED SOIL PRESS. AT TOP & AT BOT.	EFF. WIDTH	SUM TOTAL PRESS. AT TOP & AT BOT. OF EACH LAYER		
(FT)	(KSF)	(N)	(DEG)	(PCF)	(PCF)	(Ka) (Kp)	(KIP/FT)	(KIP/FT)	(KIP/FT)	(FT)			
1	2.0	0.00	7	29.9	114.3	114.3	0.33	-	0.084	0.160	1.0	0.084	0.160
2	2.0	0.00	7	29.9	114.3	114.3	0.33	-	0.160	0.237	1.0	0.160	0.237
3	2.0	0.00	7	29.9	114.3	114.3	0.33	-	0.237	0.313	1.0	0.237	0.313
4	2.0	0.00	7	29.9	114.3	114.3	0.33	-	0.313	0.390	1.0	0.313	0.390
5	2.0	0.00	7	29.9	114.3	114.3	0.33	-	0.390	0.466	1.0	0.390	0.466
6	2.5	1.30	7	0.0	120.3	57.9	0.25Min.	1.00	-2.252	-2.360	1.0	-2.252	-2.360
7	2.5	3.20	9	0.0	122.5	60.1	0.25Min.	1.00	-6.160	-6.273	1.0	-6.160	-6.273
8	2.5	4.50	11	0.0	124.2	61.8	0.25Min.	1.00	-8.873	-8.989	1.0	-8.873	-8.989
9	2.5	4.50	13	0.0	125.7	63.3	0.25Min.	1.00	-8.989	-9.107	1.0	-8.989	-9.107
10	2.5	0.00	15	32.9	126.9	64.5	0.30	3.38	-1.464	-1.962	1.0	-1.464	-1.962
11	2.5	0.00	17	33.5	128.0	65.6	0.29	3.46	-2.038	-2.559	1.0	-2.038	-2.559
12	1.0	0.00	19	34.0	129.0	66.6	0.28	3.54	-2.645	-2.862	1.0	-2.645	-2.862
13	1.0	0.00	21	34.5	129.9	67.5	0.28	3.61	-2.948	-3.173	1.0	-2.948	-3.173
14	1.0	0.00	23	34.9	130.8	68.4	0.27	3.68	-3.260	-3.493	1.0	-3.260	-3.493
15	1.0	0.00	25	35.4	131.5	69.1	0.27	3.75	-3.581	-3.821	1.0	-3.581	-3.821

SUMMARY OF FINAL RESULTS:

UNBALANCED SHEAR AT TIP =====	-11.683 KIPS
MAX. MOMENT IN PILING (PER EFF.) =====	12.2205 KIP-FT.
REQUIRED TIP ELEV. W / NO F.S. =====	86.1003 FT.
REQUIRED TIP ELEV. W / F.S. =====	85.3204 FT.
REQUIRED PILE SECTION MODULUS =====	4.44 IN ³

