Illinois Department of Transportation

Abbreviated Structure Geotechnical Report

Original Report Date: 04/24/2020 **Proposed SN:** Same as Exist. **Route:** FAP 741
Revised Date: **07/09/2021** **Existing SN:** 058-0047,0048 **Section:** (121B-1)BR
Geotechnical Engineer: Brad Hessing **County:** Macon
Structural Engineer: Nick Barnett, David Richter **Contract:** 74860

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

The existing dual structures carrying IL 105 (William Street) over Lake Decatur (058-0047 EB and 058-0048 WB) will both undergo superstructure replacement as well as partial substructure replacement (abuts.). The existing vaulted abutments will be replaced with integral abutments supported by H-piles driven to rock. The existing pile-supported hammerhead piers (2 at each bridge) will be re-used. The structure length for each (back-to-back abutments) will increase from 345'-5" (exist.) to 365'-4" (proposed). The proposed superstructure consists of 46' web plate girders. A copy of the TSL is attached.

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 boring data consists of 4 borings, all drilled in 1966 and along the center between the two bridges: B-1 at the West Abutment; B-4 at Pier 1; B-3 at Pier 2; B-2 at the East Abutment. B-1 was drilled through very hard cemented clay loam till and into apparent shale bedrock; all others terminated in 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:

Settlement is not an issue.

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 slope stability issues anticipated by inspection.

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 Information for the Existing Piers

	Pier 1	Pier 2	Comments
Surveyed Ground Elevation (ft)	597.6	600.9	Per HLR
Theoretical "Raw" Total Scour Depths (ft) (Contraction Scour + Local Scour) from Hydraulics	Q100: 30.1 Q200: 32.16	Q100: 30.1 Q200: 32.16	Per HLR
Adjusted Scour Depths (ft)	Q100: 22.5 Q200: 22.7	Q100: 18.7 Q200: 18.9	Per FGU Analyses and Scour Spreadsheet
Adjusted Scour Elevations (ft)	Q100: 575.1 Q200: 574.9	Q100: 582.2 Q200: 582.0	Per FGU Analyses and Scour Spreadsheet
Footing Elevation (ft)	596.61	598.86	Per HLR (and newer survey)
Average Pile Tip Elevation (ft)	574.3	578.3	Per Pile Driving Records
Pile Embedment below Scour Elevations (ft)	Q100: 0.8 Q200: 0.6	Q100: 3.9 Q200: 3.7	OK if treated as a *Pinned* Condition, per Bridge Planning

Based on the scour information above, the Design Scour Elevation Table is as follows:

DESIGN SCOUR ELEVATION TABLE

Event/Limit State	*Design Scour Elevations (ft.)*				
	W. Abut.	*Pier 1*	*Pier 2*	*E. Abut.*	*Item 113*
Q100	*618.86*	*575.1*	*582.2*	*620.04*	*5*
Q200	*618.86*	*574.9*	*582.0*	*620.04*	
Design	*618.86*	*575.1*	*582.2*	*620.04*	

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:

SPZ = 1
S_{DS} = 0.280g
S_{D1} = 0.15g
Site Class D

Liquefaction is not an issue here.

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 Foundation Treatment Recommendation for the new integral abutments will consist of **Steel H-piles** driven to their Maximum Nominal Bearing into apparent rock. Based on **assuming an average Qu of 1.5 tsf within the 10' critical depth material immediately beneath the proposed abutments**, the following piles in the table below appear to be feasible according to the Integral Abutment Feasibility Spreadsheet. Accordingly, the Pile Design Table is as follows:

Location, Boring	Pile Type	Nominal Required Bearing	Factored Resistance Available	Estimated Length
West Abutment, B-1	HP 12 x 63	497	273	62
	HP 12 x 74	589	324	64
	HP 12 x 84	664	365	65
	HP 14 x 73	578	318	62
	HP 14 x 89	705	388	64
East Abutment, B-2	HP 12 x 63	497	273	61
	HP 12 x 74	589	324	63
	HP 12 x 84	664	365	64
	HP 14 x 73	578	318	61
	HP 14 x 89	705	388	63

Test Piles: Drive a total of two (2) Test Piles, one at West Abutment and one at East Abutment. They can be on the same side (stage). Test piles are required due to driving through hard till and presence of "Apparent" bedrock in only one boring (B-1 at West Abutment).

Pile Shoes: As a precautionary measure, Pile Shoes are recommended due to presence of "rocks and pebbles" in the boring logs. It is unsure if these materials are cobbles, thus the recommendation for shoes.

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

Not required. The existing piers are to be re-used and no additional construction will be required.

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

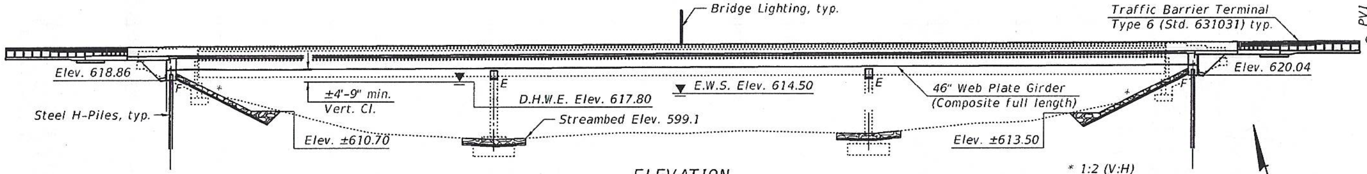
Although staged construction will be carried out using crossovers, both structures share abutments. Since the existing vault slabs appear to be structural, soil retention will not be required for the existing structure, however it will be required for the new backfill behind the proposed abutments to support Stage II Traffic and to prevent backfill from spilling out prior to the construction of the approach slab. Based on our analyses, ***Temporary Sheet Piling*** is feasible and should be used. Since the sheeting will be completely in existing embankment fill, **we recommend the Designer use the Temporary Sheet Pile Design Charts and assume an average N-Value of 5 (modeling it as granular) for the entire embedded portion.**

ATTACHMENTS

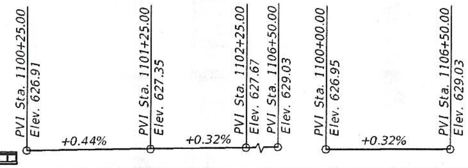
- Approved TSL
- Boring Logs
- Seismic Site Class Determination Spreadsheet
- Integral Abutment Feasibility Spreadsheet
- Pile Length Spreadsheets

Benchmark: Chiseled square on southeast corner of wingwall on southest corner of structure 058-0047, Station 1106+27, 21.1 ft. rt. of ℄ E.B. lanes, Elevation 630.701.

Existing Structure: The existing structures 058-0047 and 058-0048 were constructed in 1970 and 1971 respectively as SBI 10/FAS 540, Sections 12B-1 and 12B-2. The existing bridges are continuous steel plate girder superstructures supported by vaulted abutments and hammerhead piers. The abutments and piers are supported on steel piles. The existing superstructure and abutments are to be removed and replace utilizing cross-overs.



ELEVATION



PROFILE GRADE (Along EB PGL)

PROFILE GRADE (Along WB PGL)

Aluminum rail and rail post to be salvage for future use.

Notes:
Up to ¼" may be ground off the bridge deck and the bridge approach slabs.
The profile grade shows the final elevations after grinding.
The Lighting location to be determined by the district during design phase.

LOADING HL-93

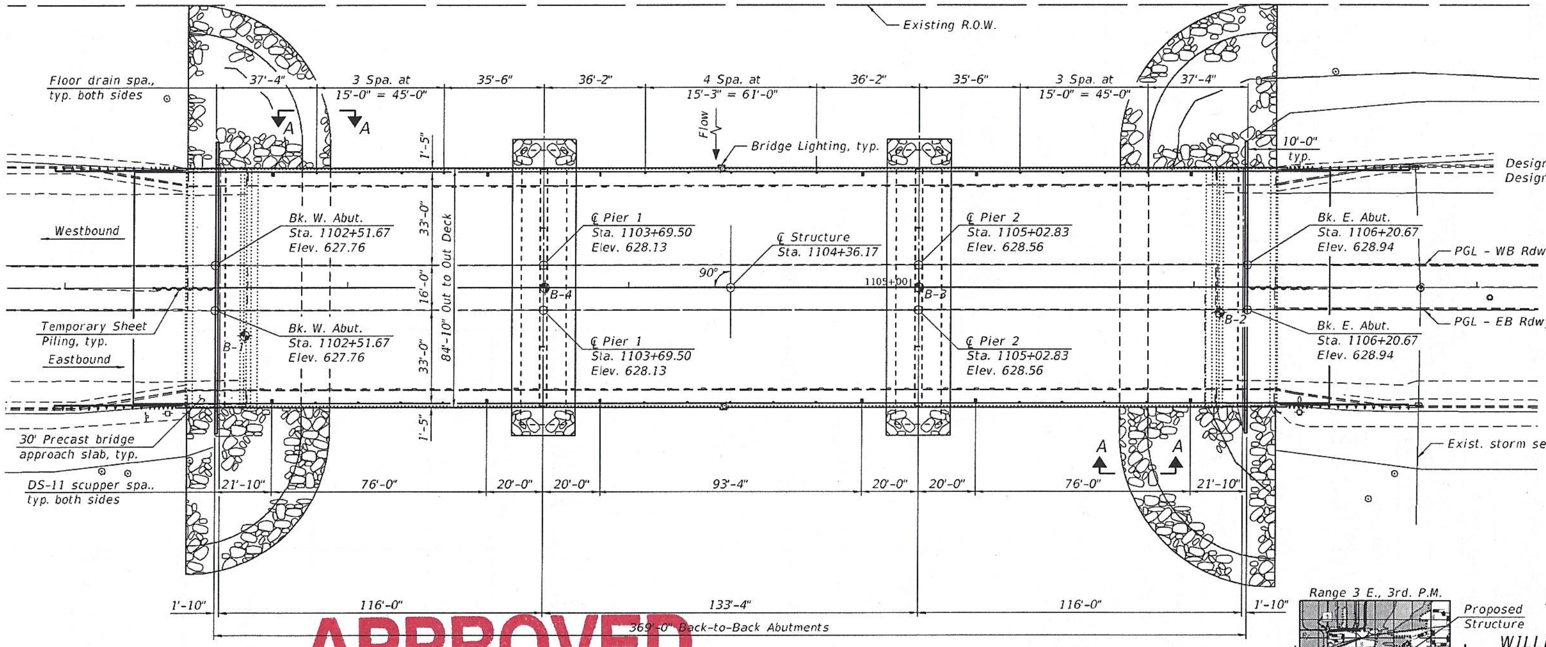
DESIGN SPECIFICATIONS
2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

EXISTING FIELD UNITS
f'c = 3,500 psi (Substructure)
fy = 40,000 psi (Reinforcement)

FIELD UNITS
f'c = 4,000 psi (Superstructure)
f'c = 3,500 psi (Substructure)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)
All structural steel shall be metallized.

SEISMIC DATA
(Abutments)
Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.154g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.280g
Soil Site Class = D



Existing R.O.W.
Floor drain spa., typ. both sides
37'-4"
3 Spa. at 15'-0" = 45'-0"
35'-6"
36'-2"
4 Spa. at 15'-3" = 61'-0"
36'-2"
35'-6"
3 Spa. at 15'-0" = 45'-0"
37'-4"
Flow
Bridge Lighting, typ.
10'-0" typ.
1'-5"
Westbound
Bk. W. Abut. Sta. 1102+51.67 Elev. 627.76
33'-0"
16'-0"
33'-0"
84'-10" Out to Out Deck
℄ Pier 1 Sta. 1103+69.50 Elev. 628.13
℄ Structure Sta. 1104+36.17
90°
℄ Pier 2 Sta. 1105+02.83 Elev. 628.56
Bk. E. Abut. Sta. 1106+20.67 Elev. 628.94
PGL - WB Rdwy.
1105+00
B-4
B-3
B-2
B-1
PGL - EB Rdwy.
Temporary Sheet Piling, typ.
Eastbound
Bk. W. Abut. Sta. 1102+51.67 Elev. 627.76
℄ Pier 1 Sta. 1103+69.50 Elev. 628.13
℄ Pier 2 Sta. 1105+02.83 Elev. 628.56
Bk. E. Abut. Sta. 1106+20.67 Elev. 628.94
30' Precast bridge approach slab, typ.
Exist. storm sewer
DS-11 scupper spa., typ. both sides
21'-10"
76'-0"
20'-0"
20'-0"
93'-4"
20'-0"
20'-0"
76'-0"
21'-10"
1'-10"
116'-0"
133'-4"
116'-0"
1'-10"
369'-0" Back-to-Back Abutments
Indicates boring location
Existing R.O.W.

APPROVED

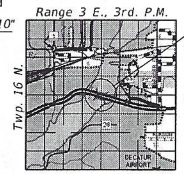
AUG 11 2020

AS A BASIS FOR PREPARATION OF DETAILED PLANS

PLAN

HIGHWAY CLASSIFICATION
Rte. F.A.P. - Rte. 741 (E.B.)
Functional Class: Minor Arterial
ADT: 6300 (2022); 7100 (2042)
ADTT: 625 (2022); 704 (2042)
DHV: 993 (2042)
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
One-Way Traffic

HIGHWAY CLASSIFICATION
Rte. F.A.P. - Rte. 741 (W.B.)
Functional Class: Minor Arterial
ADT: 6200 (2022); 7000 (2042)
ADTT: 600 (2022); 677 (2042)
DHV: 952 (2042)
Design Speed: 50 m.p.h.
Posted Speed: 40 m.p.h.
One-Way Traffic



LOCATION SKETCH

GENERAL PLAN & ELEVATION
ILLINOIS ROUTE 105
WILLIAM STREET OVER LAKE DECATUR
F.A.P. RTE. 741 - SEC. (12B-1)BR
MACON COUNTY
STATION 1104+36.17
STRUCTURE NO. 058-0047 - EASTBOUND
STRUCTURE NO. 058-0048 - WESTBOUND

MODEL: 0000000-74596-TSL-001
FILE NAME: pw:\\planroom.dot.illinois.gov:PWIDOT\Documents\IDOT Offices\Bureau of Bridges and Structures\Projects\0580047\CADD Plans\0580047-74596.dgn

DESIGNED -	NICHOLAS R. BARNETT
CHECKED -	NEPHTALI RIVERA-MARTINEZ
DRAWN -	DENNIS A. POP
CHECKED -	N.R.B. / N.R.M.

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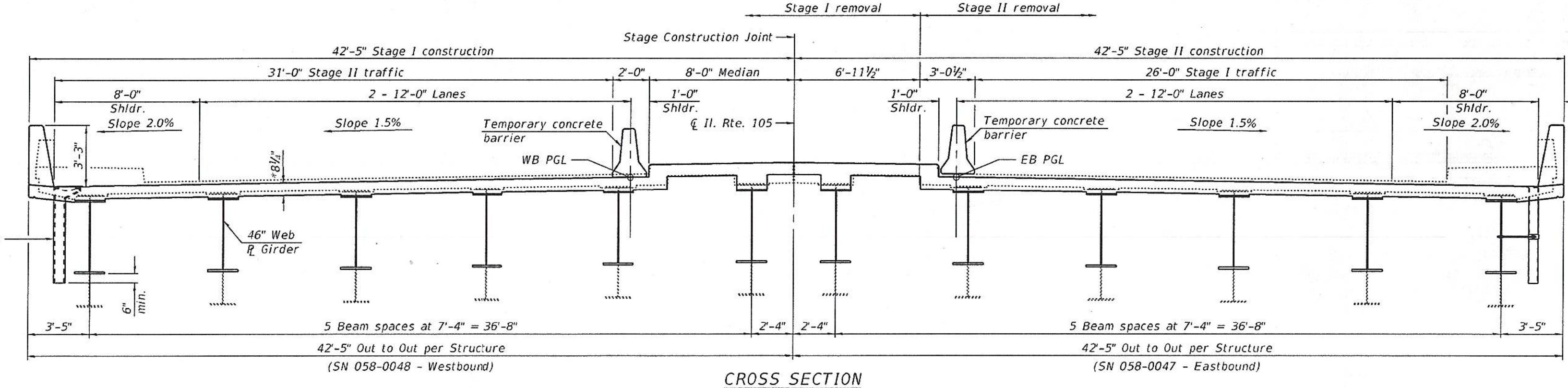
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
741	(12B-1)BR	MACON		
		CONTRACT NO. 74596		
		ILLINOIS FED. AID PROJECT		

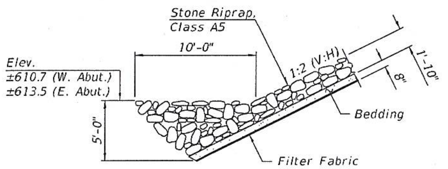


Stage I removal
Stage II removal
Stage Construction Joint
42'-5" Stage I construction
42'-5" Stage II construction
31'-0" Stage II traffic
2'-0"
8'-0" Median
6'-11½"
3'-0½"
26'-0" Stage I traffic
8'-0" Shldr. Slope 2.0%
2 - 12'-0" Lanes
Slope 1.5%
Temporary concrete barrier
1'-0" Shldr.
℄ Il. Rte. 105
1'-0" Shldr.
Temporary concrete barrier
2 - 12'-0" Lanes
Slope 1.5%
8'-0" Shldr. Slope 2.0%
1'-5"
3'-3"
*8¼"
WB PGL
EB PGL
**
46" Web ℞ Girder
6" min.
3'-5"
5 Beam spaces at 7'-4" = 36'-8"
2'-4"
2'-4"
5 Beam spaces at 7'-4" = 36'-8"
3'-5"
42'-5" Out to Out per Structure (SN 058-0048 - Westbound)
42'-5" Out to Out per Structure (SN 058-0047 - Eastbound)

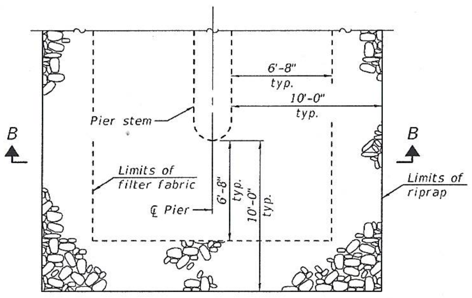
CROSS SECTION

* Prior to grinding.

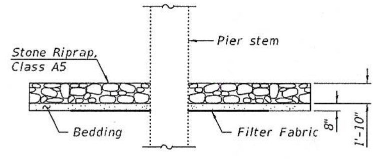
** DS-11 drainage scupper or 6" Ø floor drain (See Plan for locations and spacing).



SECTION A-A



PLAN



SECTION B-B

WATERWAY INFORMATION

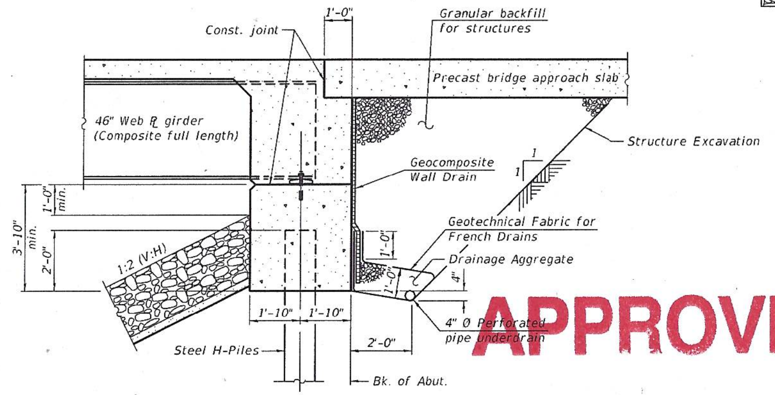
Drainage Area = 814.4 sq. mi.
Existing Overtopping Elev. = 624.6 @ Sta. 1092+50
Proposed Overtopping Elev. = 624.6 @ Sta. 1092+50

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	15500	3760	3760	615.8	0.26	0.26	616.1	616.1
Design	50	23400	4410	4410	617.8	0.42	0.42	618.2	618.2
Base	100	26800	4740	4740	618.8	0.47	0.47	619.3	619.3
Scour Check	200	30100	4980	4980	619.5	0.53	0.53	620.0	620.0
Max. Calc.	500	34800	5250	5250	620.6	0.61	0.61	621.2	621.2

10 year velocity through existing bridge = 4.1 ft./s
10 year velocity through proposed bridge = 4.1 ft./s

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) W. Abut.	Pier 1	Pier 2	E. Abut.	Item 113
Q100	618.86	575.1	582.2	620.04	5
Q200	618.86	574.9	582.0	620.04	
Design	618.86	575.1	582.2	620.04	



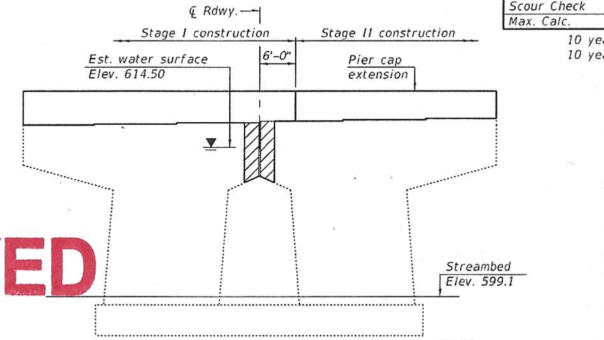
1'-0"
Granular backfill for structures
Const. joint
Precast bridge approach slab
46" Web ℞ girder (Composite full length)
Structure Excavation
Geocomposite Wall Drain
1
1
1'-0" min.
3'-10" min.
2'-0"
1:2 (V:H)
Geotechnical Fabric for French Drains
1'-0"
Drainage Aggregate
4"
1'-10"
1'-10"
4" Ø Perforated pipe underdrain
2'-0"
Steel H-Piles
Bk. of Abut.

SECTION THRU INTEGRAL ABUTMENT

APPROVED

AUG 11 2020

AS A BASIS FOR PREPARATION OF DETAILED PLANS



PIER SKETCH

Existing pier caps to be made continuous. Details to be developed during design phase.

Concrete Removal

DETAILS
ILLINOIS ROUTE 105
WILLIAM STREET OVER LAKE DECATUR
F.A.P. RTE. 741 - SEC. (12B-1)BR
MACON COUNTY
STATION 1106+27.00
STRUCTURE NO. 058-0047 - EASTBOUND
STRUCTURE NO. 058-0048 - WESTBOUND

MODEL: 0000000-74596-TSL-002
FILE NAME: pw:\\plpwm.dot.illinois.gov:PWIDOT\Documents\IDOT Offices\Bureau of Bridges and Structures\Projects\0580047\CADD Plans\0580047-74596.dgn

DESIGNED -	NICHOLAS R. BARNETT
CHECKED -	NEPHTALI RIVERA-MARTINEZ
DRAWN -	DENNIS A. POP
CHECKED -	N.R.B. / N.R.M.

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
741	(12B-1)BR	MACON		
		CONTRACT NO. 74596		

ILLINOIS | FED. AID PROJECT

FORM NO. S. D. 137 REV. 9-60

Sh. 1 of 4 Sh.

BRIDGE FOUNDATION BORING LOG

PROJECT

ROUTE FAS 540

SEC. 12 BR

COUNTY MACON

Boring No. 1

Station 1102+64

Offset 17' Rt.

BRIDGE 3 SPAN ACROSS LAKE DECATUR

STA. 1104+36.17

Date 7-18-66

Bored By BAKER

Checked By CWK

Surface Water El. —

Groundwater El. at Completion —

After — Hours —

Elevation	N	Qu t/s.f.	w (%)
Ground Surface * 603.7			
0	**Shelby tube Data		
VERY SOFT BLACK SAND LOAM TO SILTY CLAY LAKE SEDIMENT (ORGANIC)	**	0	38
	**	0	33
600.7	**	0	40
-5			
SOFT - LOOSE DARK GRAY SILT LOAM TO SAND LOAM ALLUVIUM	1	0.5B	21
596.2			
	6	—	—
-10			
	6	—	—
LOOSE TO MEDIUM GRAY SAND WITH SOME GRAVEL			
	8	—	—
-15			
	22	—	—
	14	—	—
LENSE OF BROWN - GRAY CLAY LOAM TILL -20			
	23	—	—

Elevation	N	Qu t/s.f.	w (%)
	15	—	—
-25 MEDIUM GRAY FINE TO COARSE SAND WITH SOME PEBBLES			
	23	—	—
	23	—	—
574.2			
-30			
	70	NF 10.9+	7.
VERY HARD GRAY CEMENTED CLAY LOAM TILL			
	100 5"	12+E	—
-35			
HARD GRAY SILT LOAM APPEARANCE OF SHALE ROCK 564.7	100 9"	NF 10.9+	—
564.2 LIMIT OF BORING			
-40			
** SHELBY TUBE DATA			
* NOTE: GROUND SURFACE IS LAKE BOTTOM, BORING THROUGH 9½ FEET OF LAKE WATER			
-45			

– Standard Penetration Test – lows per foot to drive 2" .D. Split Spoon Sampler 12" with 0# hammer falling 30".

Qu – Unconfined Compressive Strength – t/sf

w – Water Content – percentage of oven dry weight – %.

Type failure:
B – Bulge Failure
S – Shear Failure
E – Estimated Value
P – Penetrometer

18

BRIDGE FOUNDATION BORING LOG

PROJECT

ROUTE FAS 540

SEC. 12 BR

COUNTY MACON

Boring No. 2

Station 1106+09

Offset 9' Rt.

BRIDGE 3 SPAN ACROSS LAKE DECATUR

STA. 1104+36.17

Date 7-21-66

Bored By BAKER

Checked By CWK

Surface Water El. —

Groundwater El. at Completion —

After — Hours —

Elevation	N	Qu t/s.f.	w (%)
Ground Surface * 605.7 (0)			
VERY SOFT LAKE SEDIMENT	0	no sample	
603.7			
	2	0.6B	32
MEDIUM DARK GRAY - BLACK SILTY CLAY LOAM ALLUVIUM (-5)			
	2	0.6B	25
598.7			
VERY LOOSE TO LOOSE DARK GRAY SAND LOAM & SAND WITH ROCKS	3	—	—
(-10)			
	6	—	—
594.2			
LOOSE GRAY SAND	6	—	—
591.2			
(-15) VERY DENSE COARSE GRAY SAND LOAM TILL	61	—	—
589.2			
HARD GRAY SANDY CLAY LOAM TO CLAY LOAM TILL	60	8.9S	8
(-20)			
	63	9+E	7

Elevation	N	Qu t/s.f.	w (%)
HARD GRAY CLAY LOAM TILL			
582.2	73	9+E	7
LIMIT OF BORING			
(-25)			
(-30)			
(-35)			
(-40)			
(-45)			

* NOTE: GROUND SURFACE IS LAKE BOTTOM, BORING THROUGH 7½ FEET OF LAKE WATER

N – Standard Penetration Test – Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with

Qu – Unconfined Compressive Strength – t/sf

w – Water Content – percentage

Type failure:
B – Bulge Failure
S – Shear Failure

BRIDGE FOUNDATION BORING LOG

PROJECT
ROUTE FAS 540
SEC. 12 BR
COUNTY MACON
Boring No. 3
Station 1105+03
Offset C

BRIDGE 3 SPAN OVER LAKE DECATUR
STA. 1104+36.17

Date 7-25-66
Bored By BAKER
Checked By CWK

Surface Water El. —
Groundwater El. at Completion —
After — Hours —

Elevation	N	Qu t/s.f.	w (%)
Ground Surface * 603.4	0		
VERY SOFT LAKE SEDIMENT			
602.1	0	—	58
SOFT TO MEDIUM DARK GRAY SILTY CLAY LOAM TO CLAY LOAM ALLUVIUM	2	0.8B	28
-5			
	2	0.8B	23
595.6			
VERY LOOSE DARK BROWN SANDY CLAY LOAM WITH WOOD FRAGMENTS			
-10	2	—	—
592.6			
	1	—	—
VERY LOOSE TO MEDIUM COARSE GRAY SAND WITH SOME GRAVEL			
-15			
	8	—	—
	16	—	—
583.6			
-20			
VERY HARD GRAY CEMENTED CLAY LOAM TILL			
	93	NF 11.5+	7

Elevation	N	Qu t/s.f.	w (%)
VERY HARD GRAY CEMENTED CLAY LOAM TILL			
-25	100 8"	10+E	—
575.6	100 9"	9.8S	7
LIMIT OF BORING			
-30			
-35			
-40			
-45			

* NOTE: GROUND SURFACE IS LAKE BOTTOM, BORING THROUGH 9.7 FEET OF LAKE WATER

-Standard Penetration Test- lows per foot to drive 2" .D. Split Spoon Sampler 12" with 30# hammer falling 30".

Qu - Unconfined Compressive Strength - t/sf

w - Water Content - percentage

Type failure:
B - Bulge Failure
S - Shear Failure
E - Estimated Value

18

BRIDGE FOUNDATION BORING LOG

PROJECT
ROUTE FAS 540
SEC. 12 BR
COUNTY MACON
Boring No. 4
Station 1103+70
Offset C

BRIDGE 3 SPAN OVER LAKE DECATUR
STA. 1104+36.17

Date 7-26-66
Bored By BAKER
Checked By CWK

Surface Water El. —
Groundwater El. at Completion —
After — Hours —

Elevation	N	Qu t/s.f.	w (%)
Ground Surface * 601.2			
601.2	0	—	—
VERY SOFT BLACK SILTY CLAY LAKE SEDIMENT (OLD RIVER CHANNEL)			
594.2			
VERY LOOSE SAND WITH GRAVEL	1	—	—
590.7			
	13	—	—
MEDIUM GRAY SAND & GRAVEL	29	—	—
583.2			
MEDIUM FINE GRAY SAND	27	—	—
	15	—	—
MEDIUM GRAY SAND WITH PEBBLES			
576.2	88	—	—
VERY HARD GRAY CEMENTED CLAY LOAM TILL	100 9"	12+E	7
	100 6"	12+E	7
566.7	100 6"	9.1+S	8
LIMIT OF BORING			

* NOTE: GROUND SURFACE IS LAKE BOTTOM, BORING THROUGH 12 FEET OF LAKE WATER

-Standard Penetration Test- ows per foot to drive 2" D. Split Spoon Sampler 12" with 0# hammer falling 30".

Qu - Unconfined Compressive Strength - t/sf

w - Water Content - percentage of oven dry weight - %.

Type failure:
B - Bulge Failure
S - Shear Failure
E - Estimated Value
P - Penetrometer

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Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE=====

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	618.86	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-1	
Top of Boring Elev.	628	ft.
Approximate Fixity Elev.	612.86	ft.

Individual Site Class Definition:

N (bar):	16	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	31	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	2.14	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
9.2	603.7	24.30	15	1.00	B
12.2	600.7	3.00	1	0.50	B
16.7	596.2	4.50		0.50	B
21.2	591.7	4.50	6		B
23.7	589.2	2.50	8		B
26.2	586.7	2.50	22		B
28.7	584.2	2.50	14		B
31.2	581.7	2.50	23		B
33.7	579.2	2.50	15		B
38.7	574.2	5.00	23		B
41.2	571.7	2.50	70	10.90	B
45.2	567.7	4.00	100	12.00	B
48.2	564.7	3.00	100	11.00	B
100.0	512.9	51.80	120	15.00	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	596.9	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-4	
Top of Boring Elev.	601.2	ft.
Approximate Fixity Elev.	590.9	ft.

Individual Site Class Definition:

N (bar):	57	(Blows/ft.)	Soil Site Class C <----Controls
N_{ch} (bar):	17	(Blows/ft.)	Soil Site Class D
s_u (bar):	5	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	596.9	4.30	1	0.50	B
	594.2	2.70	1	0.50	B
0.2	590.7	3.50	1		B
7.7	583.2	7.50	21		B
14.7	576.2	7.00	21		B
24.2	566.7	9.50	100	10.00	B
100.0	490.9	75.80	100	10.00	B

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	599.1	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-3	
Top of Boring Elev.	603.4	ft.
Approximate Fixity Elev.	593.1	ft.

Individual Site Class Definition:

N (bar):	44	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	NA	(Blows/ft.)	NA
s_u (bar):	5	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	602.1	1.30	1		B
	599.1	3.00	2	0.80	B
	595.6	3.50	2	0.80	B
0.5	592.6	3.00	2		B
9.5	583.6	9.00	8		B
17.5	575.6	8.00	100	10.00	B
100.0	493.1	82.50	100	10.00	B

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	620.04	ft.
Pile or Shaft Dia.	12	inches
Boring Number	B-2	
Top of Boring Elev.	629	ft.
Approximate Fixity Elev.	614.04	ft.

Individual Site Class Definition:

N (bar):	12	(Blows/ft.)	Soil Site Class E
N_{ch} (bar):	NA	(Blows/ft.)	NA
s_u (bar):	2.54	(ksf)	Soil Site Class C <----Controls

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
8.3	605.7	23.30	10	1.00	B
10.3	603.7	2.00	1	0.50	B
15.3	598.7	5.00	2	0.60	B
19.8	594.2	4.50	4		B
22.8	591.2	3.00	6		B
24.8	589.2	2.00	61		B
31.8	582.2	7.00	66	9.00	B
100.0	514.0	68.20	66	9.00	B

Global Site Class Definition: Substructures 1 through 4

N (bar):	32	(Blows/ft.)	Soil Site Class D <----Controls
N_{ch} (bar):	25	(Blows/ft.)	Soil Site Class D
s_u (bar):	3.71	(ksf)	Soil Site Class C

Illinois Department of Transportation

INTEGRAL ABUTMENT FEASIBILITY ANALYSIS

Modified 10/30/17

GENERAL DATA

STRUCTURE NUMBER	058-0047/0048		TOTAL STRUCTURE LENGTH	369.00	FT
STRUCTURE TYPE	MULTI-SPAN		NUMBER OF SPANS	3	
STRUCTURE SKEW	0	DEGREES	END SPAN LENGTH	116.00	FT
SUPER. DATA IN REFERENCE TO SUB. DATA	ABUT 1		ADJACENT INTERIOR SPAN LENGTH	133.33	FT

SUPERSTRUCTURE POSITIVE MOMENT REGION DATA (END OR MAIN SPAN)

BEAM TYPE	PLATE GIRDER	
TOP FLANGE WIDTH	16.00	IN
TOP FLANGE THICKNESS	1.00	IN
WEB DEPTH	46.00	IN
WEB THICKNESS	0.50	IN
BOTTOM FLANGE WIDTH	16.00	IN
BOTTOM FLANGE THICKNESS	1.25	IN
BEAM SPACING PERP. TO CL	7.33	FT
SLAB THICKNESS	8.00	IN
SLAB F'C	4.00	KSI

SUPERSTRUCTURE POSITIVE MOMENT REGION DATA (ADJACENT SPAN)

TOP FLANGE WIDTH	16.00	IN
TOP FLANGE THICKNESS	1.00	IN
WEB DEPTH	46.00	IN
WEB THICKNESS	0.50	IN
BOTTOM FLANGE WIDTH	16.00	IN
BOTTOM FLANGE THICKNESS	1.25	IN
BEAM SPACING PERP. TO CL	7.33	FT
SLAB THICKNESS	8.00	IN
SLAB F'C	4.00	KSI

ABUTMENT #1 DATA

ABUTMENT NAME	West	
ABUTMENT REFERENCE BORING	B-1	
BOTTOM OF ABUTMENT ELEVATION	618.52	FT
ESTIMATED NUMBER OF PILES AT ABUT.	12	
PILE SPACING PERP. TO CL	7.3333	FT

ABUTMENT #2 DATA

ABUTMENT NAME	East	
ABUTMENT REFERENCE BORING	B-2	
BOTTOM OF ABUTMENT ELEVATION	619.69	FT
ESTIMATED NUMBER OF PILES AT ABUT.	12	
PILE SPACING PERP. TO CL	7.3333	FT

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #1

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
608.52	10.00	1.5		

10.00 FT = TOTAL DEPTH ENTERED

SOIL DATA FOR 10 FT BENEATH BOTTOM OF ABUTMENT #2

BOT. OF LAYER ELEV. (FT)	*LAYER THICKNESS (FT)*	*UNCONFINED COMPRESSIVE STRENGTH (TSF)*	*N S.P.T. VALUE (BLOWS/12 IN.)*	*Qu EQUIV. FOR N VALUE (TSF)*
609.69	10.00	1.5		

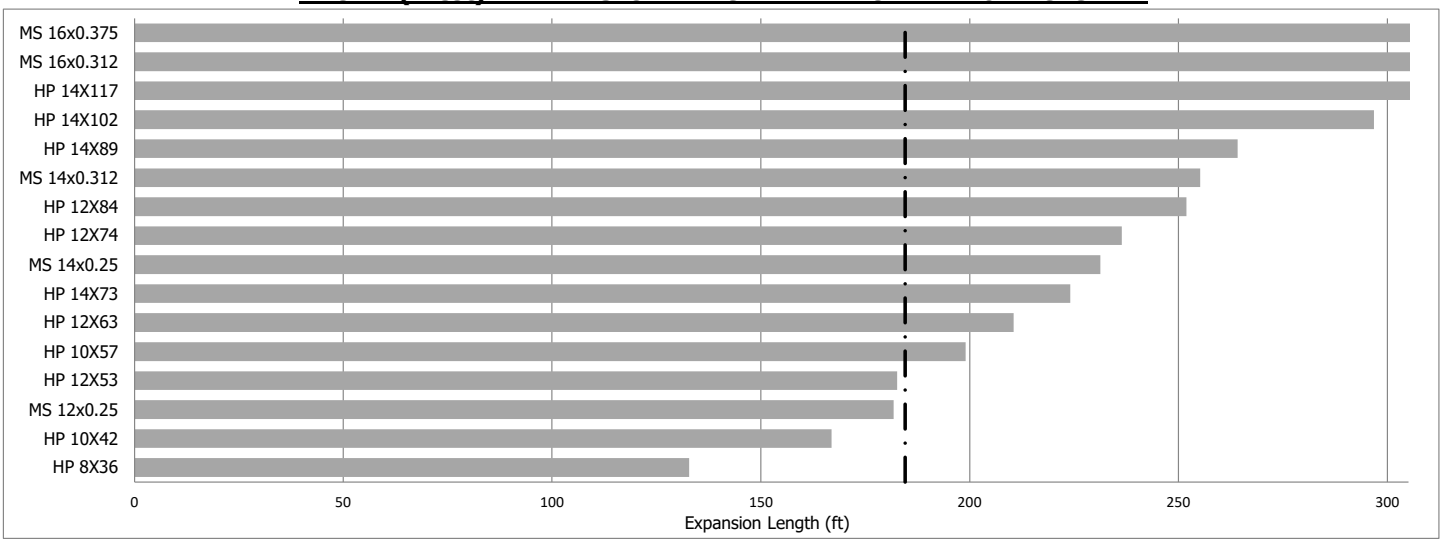
10.00 FT = TOTAL DEPTH ENTERED

WEIGHTED AVERAGE Qu FOR ABUTMENT #1	1.50	TSF	WEIGHTED AVERAGE Qu FOR ABUTMENT #2	1.50	TSF
PILE STIFFNESS MODIFIER FOR ABUTMENT #1 = 1/(1.45-[0.3*1.5])	1.00		PILE STIFFNESS MODIFIER FOR ABUTMENT #2 = 1/(1.45-[0.3*1.5])	1.00	

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #1 = [1*12*0+1*12*369]/[1*12+1*12] = 184.50 FT

DISTANCE TO CENTROID OF STIFFNESS FROM ABUTMENT #2 = [1*12*0+1*12*369]/[1*12+1*12] = 184.50 FT

ABUT 1 (West) - EXPANSION LENGTH LIMIT CHART - 0 DEG. SKEW



— · — · — = *Estimated expansion length for the indicated abutment. Piles with an expansion length greater than this are suitable for consideration.*
(Note: The same size pile should be used at both abutments.)

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== B-02
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 622.04 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 620.04 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 4000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 102.60 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 311.89 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 116.96 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
664 KIPS	**664** KIPS	**365** KIPS	**64** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area========= 0.171 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
605.74	14.30	1.00			41.7		***50.5***	60.4		61.8	50	0	0	28	16
598.74	7.00	0.60			13.2	8.8	***67.9***	19.1	1.4	81.6	68	0	0	37	23
589.24	9.50		5	Fine Sand	3.3	13.1	176.0	4.8	2.1	***103.5***	103	0	0	57	33
582.24	7.00		60	Hard Till	24.5	117.8	279.0	35.6	19.1	***151.8***	152	0	0	83	40
564.24	18.00		100	Hard Till	159.1	196.3	372.7	230.5	31.9	***371.7***	372	0	0	204	58
563.24	1.00			Shale	51.1	130.9	***423.8***	74.0	21.3	445.7	424	0	0	233	58.8
562.24	1.00			Shale	51.1	130.9	***474.8***	74.0	21.3	519.7	475	0	0	261	59.8
561.24	1.00			Shale	51.1	130.9	***525.9***	74.0	21.3	593.7	526	0	0	289	60.8
560.24	1.00			Shale	51.1	130.9	***577.0***	74.0	21.3	667.8	577	0	0	317	61.8
559.24	1.00			Shale	51.1	130.9	***628.0***	74.0	21.3	741.8	628	0	0	345	62.8
558.24	1.00			Shale	51.1	130.9	***679.1***	74.0	21.3	815.8	~~679~~	~~0~~	~~0~~	~~374~~	~~63.8~~
557.24	1.00			Shale	51.1	130.9	***730.2***	74.0	21.3	889.8	~~730~~	~~0~~	~~0~~	~~402~~	~~64.8~~
556.24	1.00			Shale	51.1	130.9	***781.3***	74.0	21.3	963.8	~~781~~	~~0~~	~~0~~	~~430~~	~~65.8~~
555.24	1.00			Shale	51.1	130.9	***832.3***	74.0	21.3	1037.8	~~832~~	~~0~~	~~0~~	~~458~~	~~66.8~~
554.24	1.00			Shale	51.1	130.9	***883.4***	74.0	21.3	1111.9	~~883~~	~~0~~	~~0~~	~~486~~	~~67.8~~
553.24	1.00			Shale	51.1	130.9	***934.5***	74.0	21.3	1185.9	~~934~~	~~0~~	~~0~~	~~514~~	~~68.8~~
552.24	1.00			Shale	51.1	130.9	***985.6***	74.0	21.3	1259.9	~~986~~	~~0~~	~~0~~	~~542~~	~~69.8~~
551.24	1.00			Shale	51.1	130.9	***1036.6***	74.0	21.3	1333.9	~~1037~~	~~0~~	~~0~~	~~570~~	~~70.8~~
550.24	1.00			Shale	51.1	130.9	***1087.7***	74.0	21.3	1407.9	~~1088~~	~~0~~	~~0~~	~~598~~	~~71.8~~
549.24	1.00			Shale	51.1	130.9	***1138.8***	74.0	21.3	1481.9	~~1139~~	~~0~~	~~0~~	~~626~~	~~72.8~~
548.24	1.00			Shale		130.9			21.3						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== B-01
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 620.86 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 618.86 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 4000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 102.60 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 311.89 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 116.96 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
664 KIPS	**664** KIPS	**365** KIPS	**65** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 84
Plugged Pile Perimeter========== 4.100 FT. Unplugged Pile Perimeter========== 5.942 FT.
Plugged Pile End Bearing Area========== 1.051 SQFT. Unplugged Pile End Bearing Area========= 0.171 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
603.66	15.20	1.00			44.3		***51.6***	64.2		65.4	52	0	0	28	17
596.16	7.50	0.50			12.0	7.4	***74.6***	17.4	1.2	84.5	75	0	0	41	25
585.16	11.00		7	Medium Sand	5.8	18.3	114.4	8.3	3.0	***98.4***	98	0	0	54	36
574.16	11.00		20	Medium Sand	16.4	52.4	215.9	23.8	8.5	***136.0***	136	0	0	75	47
569.16	5.00		70	Hard Till	22.9	137.4	297.7	33.2	22.3	***178.8***	179	0	0	98	52
564.16	5.00		100	Hard Till	44.2	196.3	276.4	64.0	31.9	***232.2***	232	0	0	128	57
563.16	1.00			Shale	51.1	130.9	327.5	74.0	21.3	***306.2***	306	0	0	168	57.7
562.16	1.00			Shale	51.1	130.9	***378.6***	74.0	21.3	380.2	379	0	0	208	58.7
561.16	1.00			Shale	51.1	130.9	***429.6***	74.0	21.3	454.2	430	0	0	236	59.7
560.16	1.00			Shale	51.1	130.9	***480.7***	74.0	21.3	528.2	481	0	0	264	60.7
559.16	1.00			Shale	51.1	130.9	***531.8***	74.0	21.3	602.3	532	0	0	292	61.7
558.16	1.00			Shale	51.1	130.9	***582.9***	74.0	21.3	676.3	583	0	0	321	62.7
557.16	1.00			Shale	51.1	130.9	***633.9***	74.0	21.3	750.3	634	0	0	349	63.7
556.16	1.00			Shale	51.1	130.9	***685.0***	74.0	21.3	824.3	~~685~~	~~0~~	~~0~~	~~377~~	~~64.7~~
555.16	1.00			Shale	51.1	130.9	***736.1***	74.0	21.3	898.3	~~736~~	~~0~~	~~0~~	~~405~~	~~65.7~~
554.16	1.00			Shale	51.1	130.9	***787.2***	74.0	21.3	972.3	~~787~~	~~0~~	~~0~~	~~433~~	~~66.7~~
553.16	1.00			Shale	51.1	130.9	***838.2***	74.0	21.3	1046.4	~~838~~	~~0~~	~~0~~	~~461~~	~~67.7~~
552.16	1.00			Shale	51.1	130.9	***889.3***	74.0	21.3	1120.4	~~889~~	~~0~~	~~0~~	~~489~~	~~68.7~~
551.16	1.00			Shale	51.1	130.9	***940.4***	74.0	21.3	1194.4	~~940~~	~~0~~	~~0~~	~~517~~	~~69.7~~
550.16	1.00			Shale	51.1	130.9	***991.5***	74.0	21.3	1268.4	~~991~~	~~0~~	~~0~~	~~545~~	~~70.7~~
549.16	1.00			Shale		130.9			21.3						