STRUCTURE GEOTECHNICAL REPORT

Proposed Structure No. 058-0137

Existing SN: 058-0029

IL Route 148 over Mosquito Creek
FAP Route 714 (IL 148)
Section (128BR-1) B-1
Macon County
Sta. 382+15.80

P-97-019-09
Contract No. 74368

May 12, 2020 (revised)
February 7, 2020

Prepared By: Scott A. Kassel, P.E.
IDOT Region 4 District 7
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Approved by: Bradly Hessing, P.E.
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Foundation & Geotechnical Unit
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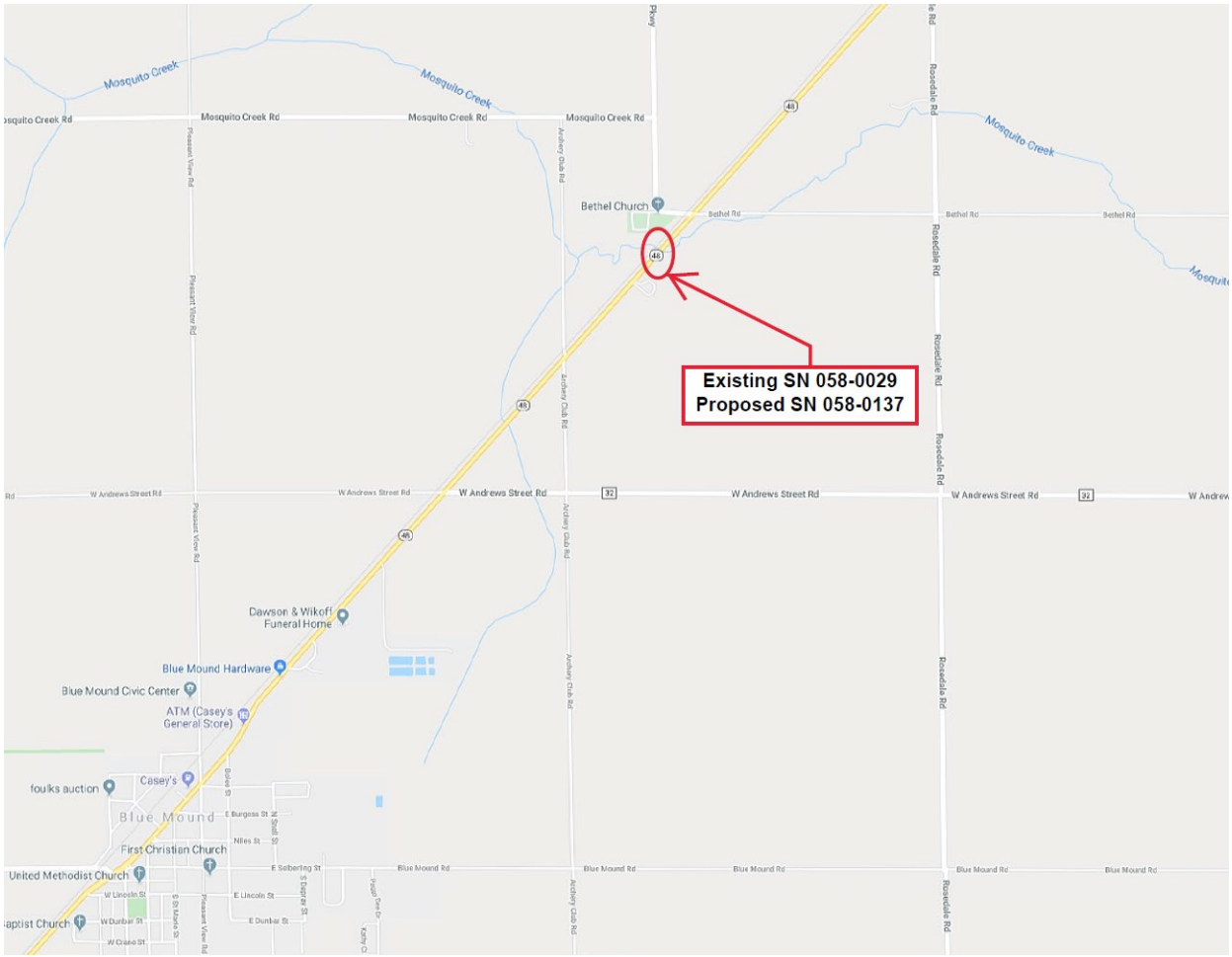
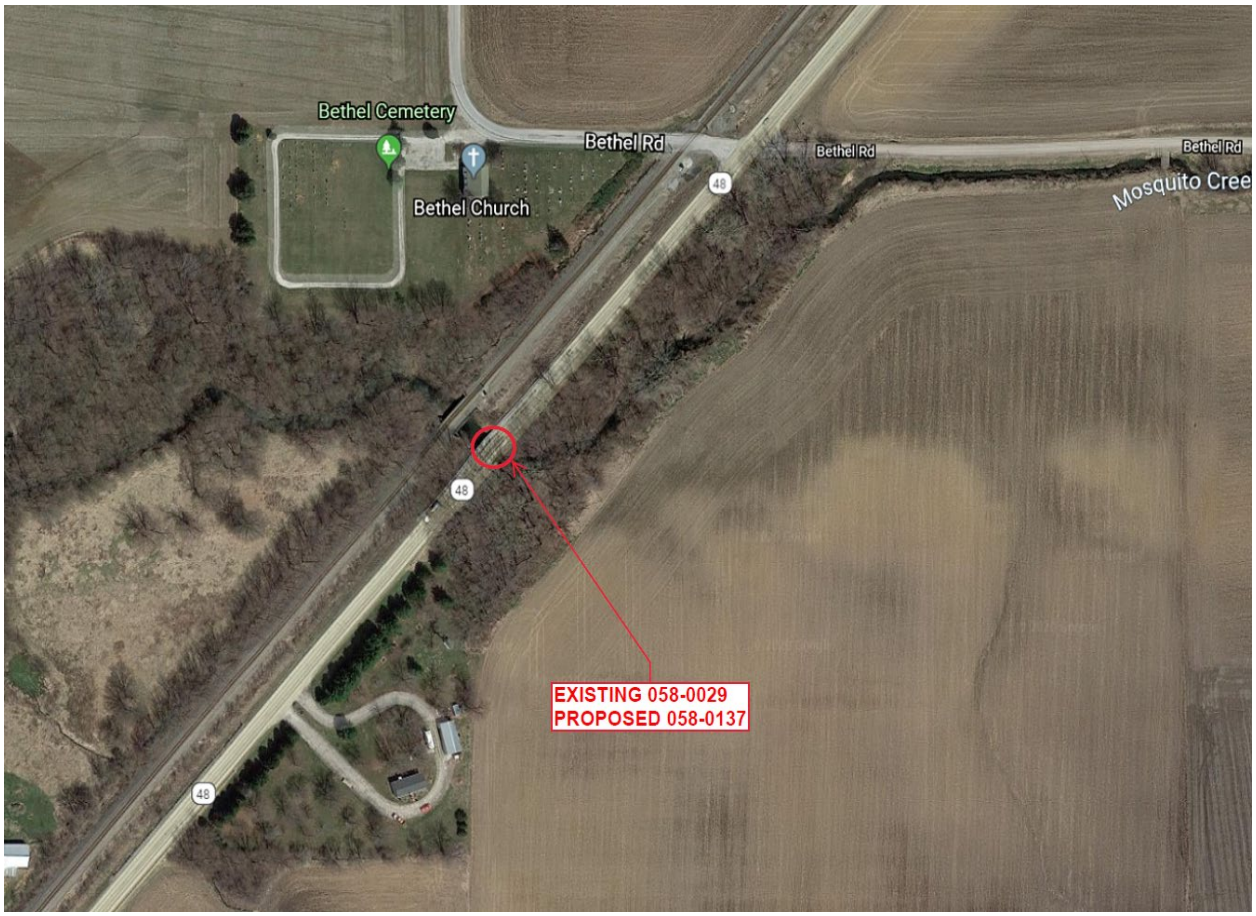
Prepared For: Illinois Department of Transportation
Bureau of Bridges and Structures
Bridge Planning Unit and
Bridge Design Section

Attachments: Boring Logs
Subsurface Data Profile Plot
Slope Stability Analysis
Approved TSL
IDOT Static Method of
Estimating Pile Lengths

1. Project Description and Scope

This project consists of complete replacement of existing structure 058-0029 with proposed structure 058-0137. The existing structure consists of a single span, deck beam bridge. It measures 52 ft 9-⅛ in total length (back to back abutments) and a clear width of 35 ft-4 in (out to out deck) and is set at a zero-degree skew. The proposed structure will consist of a single span concrete deck on steel beams supported on integral abutments and will also be set at a zero-degree skew. The planned length is 84 ft-8 in (back to back abutments) and planned width of 42 ft-10 in (out to out deck). According to the BCR, replacement has been recommended due to the excessive leaking at the keyways and 30 plus years of deck beam service. The location of the existing and proposed structure is at IL 48 over Mosquito Creek in Macon County. Specifically, this is in the Northwest ¼ of the Southeast ¼, Section 28, Township 15N, Range 1E. The maps below show the location of the structure to be approximately 1½ miles Northeast of Blue Mound.





2. Subsurface Conditions

Generalized subsurface conditions, based on borings B-1 and B-2, mainly consist of a mixture of Clay and Silty Clay overlaying a Sandy Loam and Sandy Clay Loam (Till). The hard glacial (Till) unconfined compressive strengths (Q_u) range from 3.93 – 11.52 tsf with SPT (N Value) ranging from 21 to 100 blows per 12" of penetration. Boring B-1 was advanced to auger refusal at elevation 565.77 feet.

Groundwater was first encountered at elevations of 581.8 feet in boring B-1 and 579.8 feet in boring B-2 at the time of field exploration. Upon completion of drilling, the groundwater was measured at an elevation 589.3 feet in both borings. When checked 24 hours after drilling, groundwater in both borings was measured at an elevation of 592.3 feet. These observations represent groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions.

3. Settlement

Approximately 1½ feet of fill will be placed at the north and south abutments. The soil profile is composed of medium to hard, cohesive soils. It is estimated that less than 1-in of settlement should occur in the cohesive portion of the existing soils. Most of this settlement, if any, will likely occur in the top 5 feet below the ground surface. Remedial methods used to accelerate or limit settlement should not be necessary.

4. Slope Stability

Due to lengthening of the structure, soil will be excavated to a distance approximately 42' behind the existing north and south abutments, to the proposed north and south abutment locations. A 1:2 (V:H) cut slope will be constructed in front of the proposed north and south abutments. The estimated slope stability factor of safety for the new slopes at the abutments is 5.9, which exceeds the minimum requirement of 1.7 for cut slopes. Therefore, there is no stability concern at either slope wall and remedial measures are not necessary.

5. Scour

Based on pictures and descriptions in the BCR, there is no scour concern at the existing abutments. Pictures in the BCR do not indicate that any of the substructure footings have been undermined by scour. There is no documented history of scour or erosion occurring at the existing substructure. The proposed bridge opening will be

widened, and the abutments will be protected by a 1:2 (V:H) riprap slope. Based upon the new substructure configuration, the Q100, the Q200, Design and the Check Scour Elevations for both abutments are to be set at the bottom of abutment elevation.

Event/Limit State	Design Scour Elevations (ft.)		
	North Abutment	South Abutment	Item 113
Q100	600.68	600.68	8
Q200	600.68	600.68	
Design	600.68	600.68	
Check	600.68	600.68	

6. Seismic Considerations

Based on the proposed structure location and boring data, we recommend that the seismic data to be shown on the TSL as follows:

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.114
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.227
Soil Site Class = C

There is a granular layer shown in boring B-1 at approximate elevation 581 feet, which is submerged by the water table. Liquefaction is not probable due to the location of this sand layer, its relation to the water table, and due to the stiff cohesive soils in the

profile. The design of this structure will not likely be impacted by seismic considerations.

7. Foundation Recommendations

Preliminary maximum factored loads, provided by the structure designer, are estimated to be approximately 1277 kips vertical at the abutments. The draft TS&L proposes an integral abutment substructure system for this structure. Driven piling is the preferred foundation for integral abutments, therefore drilled shafts and spread footings were not evaluated as alternatives to driven pile foundations.

Piles: Based on the "*Integral Abutment Feasibility Analysis*", it appears that friction H-piles or steel shell piles are feasible. The analysis included steel H-piles, 14" metal shell piles and 16" metal shell piles. H-pile lengths are very difficult to predict when bedrock is not encountered in the boring logs, therefore metal shell piles were the preferred pile type at this location. However, based upon the hard till conditions and our analysis, it would be difficult for metal shell piles to be driven into the hard till material without incurring damage to the pile. Therefore, it is recommended that steel H-piles driven to their maximum nominal bearing be used. Because of the limitations of the drill rig and crew, the borings were only able to be advanced to an auger refusal depth of 41 feet without encountering rock. A review of steel H-pile driving records from structures constructed in the vicinity of this structure indicate that H-piles can be successfully driven into hard till conditions without encountering bedrock. The Pile Design Table (below) lists steel H-Piles, their maximum nominal required bearings, and the corresponding factored resistances. Pile capacities on the pile data sheets were calculated assuming no pre-coring thorough the existing embankment material and the hard till material extended to the maximum depth of the pile. Since settlement at the embankments under the weight of new fill should be minimal, we do not feel that pre-coring is necessary. Lateral loading to the piles should not be a concern in this situation. A structure with pile configurations as shown on the TSL should not require a lateral load pile analysis.

Pile Design Table for Steel H-Piles
SN: 058-0137

Pile Location	Pile Size	Maximum Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length* (Ft)
North Abutment Boring B-1	HP 12x53	419	230	50
	HP 12x63	497	273	56
	HP 12x74	589	324	67
South Abutment Boring B-2	HP 12x53	419	230	48
	HP 12x63	497	273	54
	HP 12x74	589	324	62

*Estimated pile length is based on assuming the pile embedment depth: 2.0 ft., bottom of abutment elevation: 600.68 ft, and ground elevation at beginning of pile driving: 600.68 ft.

One test pile should be driven at the North Abutment to verify the estimated lengths determined in design.

8. Construction Considerations:

Stage Construction: The new structure will be built under staged construction. Based on the design charts, "Temporary Sheet Piling" appears only to be feasible at the North Abutment. A Temporary Soil Retention System will be required to be used on the South Abutment.

EWSE/Cofferdams: The estimated water surface elevation (EWSE) is approximately 593 feet. The bottom of abutment elevation is 601 feet. Therefore, there is no need for cofferdams.

Illinois Department of Transportation
Division of Highways
IDOT

SOIL BORING LOG

Date 8/30/18

ROUTE FAP 714 **DESCRIPTION** Abutments **LOGGED BY** E. Sandschafer

SECTION (12BR-1)B-1 **LOCATION** Mosquito Creek, **SEC.** 14, **TWP.** 15N, **RNG.** 1E, 3rd **PM**,
Latitude N 39.723321, **Longitude** W 89.097798

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

STRUCT. NO. 058-0029 (E) 058-0137 (P)
Station 382+20.8 (E) 382+15.8 (P)

BORING NO. 1 North Abutment (North)
Station 382+77.8
Offset 10.0 ft East
Ground Surface Elev. 606.77 ft

Surface Water Elev. 591.40 ft
Stream Bed Elev. 591.02 ft

Groundwater Elev.:
First Encounter 581.8 ft ▼
Upon Completion 589.3 ft ▽
After 24 **Hrs.** 592.3 ft ▼

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				9" Asphalt Pavement. 606.02
				9" Concrete Pavement. 605.27
				Moist, dark grey, CLAY with Silt.
-5	3			*Stiff, with organics.*
	3 4	1.3 B	31	
	3			
	3 4	1.2 B	29	
				597.27
-10	2			Medium, moist, dark grey, SILTY CLAY.
	2 3	1.0 B	28	
	1			
	2 3	2.1 B	28	593.67
				Very stiff, moist, dark grey, CLAY.
				592.27 ▽
-15	1			Medium, moist, dark grey, SILTY CLAY.
	2 2	0.7 B	28	
				589.77
	1			Medium, moist, grey, SILTY CLAY LOAM. ▽
	2 2	0.9 B	25	
-20	0			
	1 1	0.6 B	25	Medium, moist, grey, SILTY CLAY LOAM. *(continued)*
				584.77
	0			Medium, moist, grey, SANDY LOAM with Silt.
	1 1	0.5 B	22	
				Soft, wet.
-25	1			▼
	4 8	0.3 B	21	
				580.87
				Grey, GRAVELLY SAND.
				579.77
	10			Very stiff, moist, grey, SANDY CLAY LOAM. 579.27 / 578.77
	10 11	2.9 B	9	SANDY LOAM with gravel
				SANDY CLAY LOAM TILL
-30	20			
	31 50 5-3/4	6.9 S	8	Hard, moist, grey.
				Very dense, augers locked in place.
-35	42			
	50 5-1/4"	6.9 S	6	
	50 4-1/2			
-40	50			

SOIL BORING 058-0029 SOIL 2018.GPJ IL_DOT.GDT 2/6/20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
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
IDOT

SOIL BORING LOG

Date 8/30/18

ROUTE FAP 714 **DESCRIPTION** Abutments **LOGGED BY** E. Sandschafer

SECTION (12BR-1)B-1 **LOCATION** Mosquito Creek, **SEC.** 14, **TWP.** 15N, **RNG.** 1E, 3rd **PM**,
Latitude N 39.723321, **Longitude** W 89.097798

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Station 382+20.8 (E) 382+15.8 (P)

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Station 382+77.8
Offset 10.0 ft East
Ground Surface Elev. 606.77 ft

Surface Water Elev. 591.40 ft
Stream Bed Elev. 591.02 ft

Groundwater Elev.:
First Encounter 581.8 ft
Upon Completion 589.3 ft
After 24 **Hrs.** 592.3 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
565.77	5-5/8" 50 4-3/16" 50 3-5/8	NT	5
Extent of exploration. Benchmark: BM 100 brass disk in NE Headwall of Str. No. 058-0029, Sta. 382+46, 18.6' RT. End of Boring			
-45			
-50			
-55			
-60			

SOIL BORING 058-0029 SOIL 2018.GPJ IL_DOT.GDT 2/6/20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
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
IDOT

SOIL BORING LOG

Date 8/30/18

ROUTE FAP 714 **DESCRIPTION** Abutments **LOGGED BY** E. Sandschafer

SECTION (12BR-1)B-1 **LOCATION** Mosquito Creek, **SEC.** 14, **TWP.** 15N, **RNG.** 1E, 3rd **PM**,
Latitude N 39.723206, **Longitude** W 89.098092

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

STRUCT. NO. 058-0029 (E) 058-0137 (P)
Station 382+20.8 (E) 382+15.8 (P)

BORING NO. 2 South Abutment (South)
Station 381+74.8
Offset 8.0 ft west
Ground Surface Elev. 606.78 ft

Surface Water Elev. 591.40 ft
Stream Bed Elev. 591.02 ft

Groundwater Elev.:
First Encounter 579.8 ft ▼
Upon Completion 589.3 ft ▽
After 24 **Hrs.** 592.3 ft ▽

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				9" Asphalt Pavement. 606.03
				6" Concrete Pavement. 605.53
				Brown SILTY CLAY
-5	2			*Medium,moist dark grey.*
	3 2	0.6 B	27	
	1			*Stiff.*
	1 2	1.4 B	32	
-10	1			*With organics.*
	2 2	1.2 S	35	
	1			
	2 4	1.4 B	25	
-15	1			*Soft.*
	2 3	1.6 B	28	*Grey.*
	1			
	1 2	0.4 B	33	
-20	1			587.28
	1 1	1.2 B	28	Stiff, moist, grey, SILTY CLAY LOAM *(continued)*
				584.78
	0			Soft, moist, grey, SANDY LOAM
	1 1	0.3 B	22	
-25	5			*Very soft*
	8 14	0.2 S	15	
				579.78 ▼
	12			Very stiff, moist, grey, SANDY
	10 13	3.9 S	8	CLAY LOAM TILL
-30	29			*Hard, sample reassembled for testing.*
	50 5-15/16"	11.5 S	7	
	50 4-1/8"			
-35	40			*Poor sample condition. Sample reassembled for testing.*
	50 5-5/8"	5.7 S	6	
	50 4-3/8"			
-40	50			*Sample reassembled for testing.*

SOIL BORING 058-0029 SOIL 2018.GPJ IL_DOT.GDT 2/6/20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
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
IDOT

SOIL BORING LOG

Date 8/30/18

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BORING NO. 2 South Abutment (South)
Station 381+74.8
Offset 8.0 ft west
Ground Surface Elev. 606.78 ft

Surface Water Elev. 591.40 ft
Stream Bed Elev. 591.02 ft

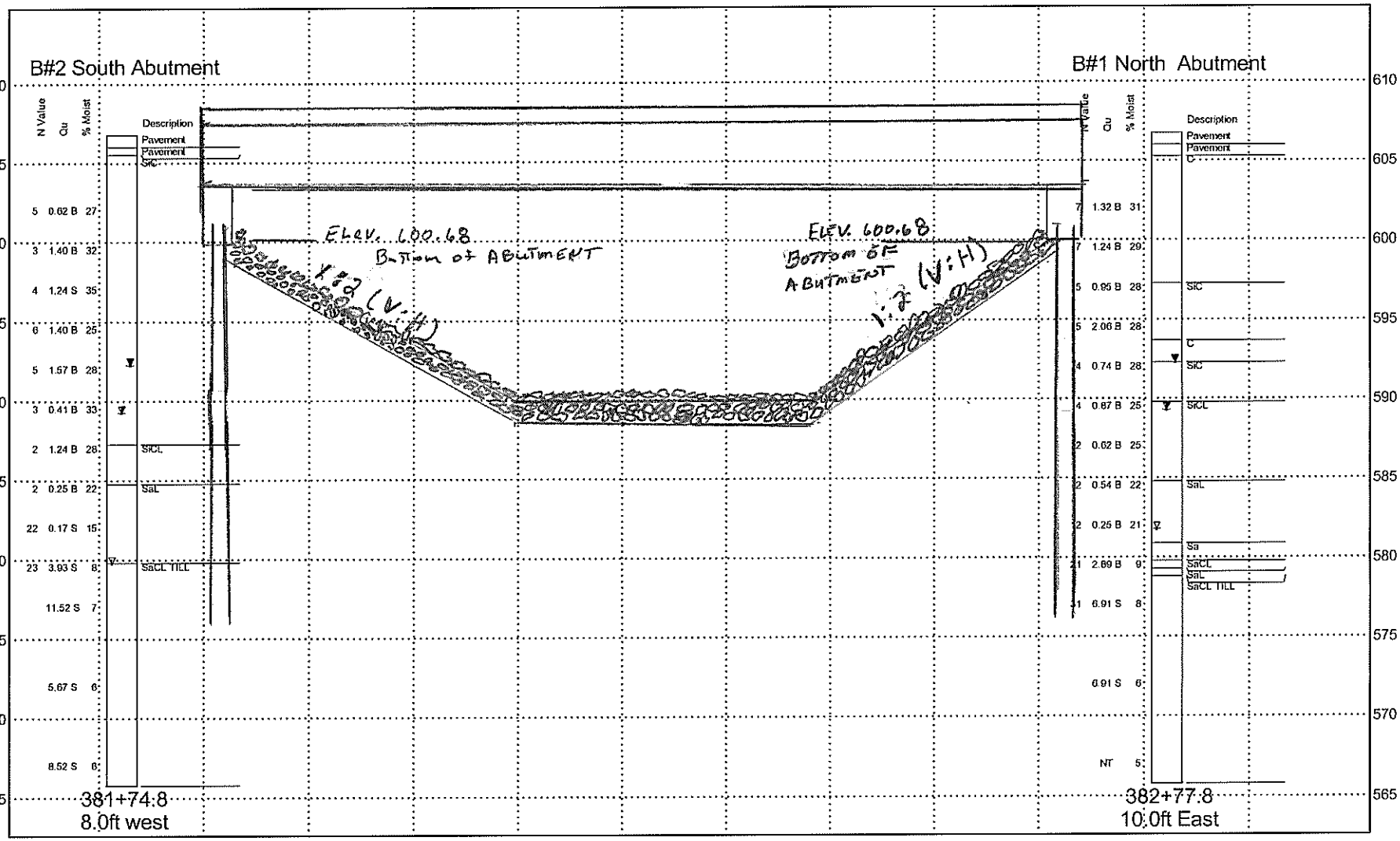
Groundwater Elev.:
First Encounter 579.8 ft
Upon Completion 589.3 ft
After 24 **Hrs.** 592.3 ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
565.78	4-1/2" 50 4-1/4"	8.5 S	6
Extent of exploration.	50 3-1/2"		
Benchmark: BM 100 brass disk in NE Headwall of Str. No. 058-0029, Sta. 382+46, 18.6' RT.			
End of Boring			
-45			
-50			
-55			
-60			

SOIL BORING 058-0029 SOIL 2018.GPJ IL_DOT.GDT 2/6/20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Structure Number 058-0029 (E) 058-0137 (P) Abutments
Located in the Mosquito Creek of Section 14, Township 15N, Range 1E of the 3 P.M.



NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways
IDOT

VARIATIONS IN SUBSURFACE CONDITIONS MAY EXIST BETWEEN BORINGS

Groundwater
▽ First Encounter
▼ Completion
▼ after (refer to log) hours

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

SUBSURFACE DATA PROFILE

Route: FAP 714
Section: (12BR-1)B-1
County: Macon

SUBSURFACE DATA PROFILE 058-0029 SOIL 2018.GPJ D7.GDT 2/6/20

SUBSURFACE DATA PROFILE 058-0029 SOIL 2018.GPJ D7.GDT 2/6/20

Slide Analysis Information

Abutment

Project Summary

File Name:	Abutment.slmd
Last saved with Slide version:	8.013
Project Title:	SN 058-0137 Mosquito Creek
Analysis:	Slope Stability for Abutments
Author:	Scott Kassel, P.E.
Company:	IDOT District 7
Date Created:	February 6, 2020

Analysis Options

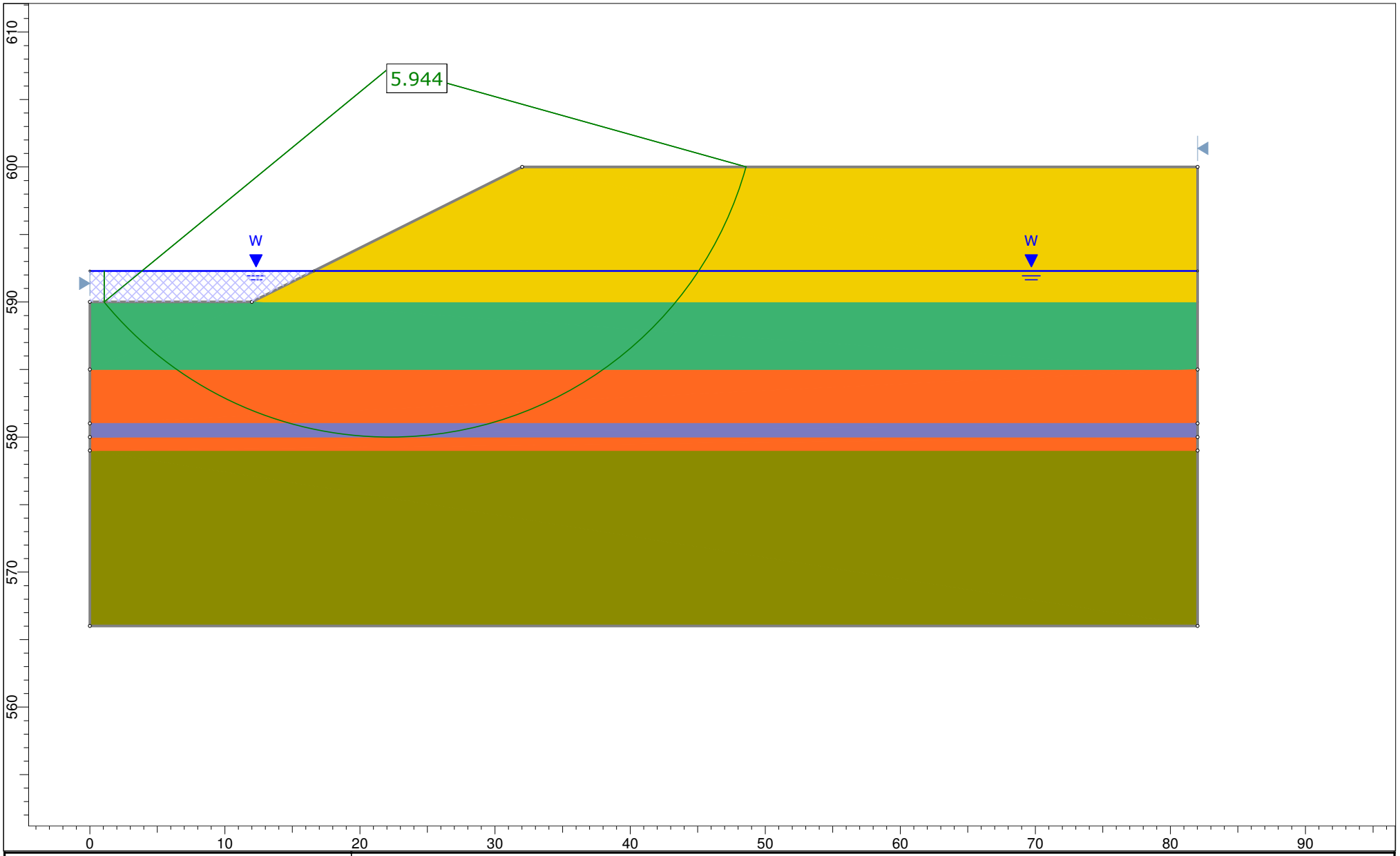
Slices Type:	Vertical

Analysis Methods Used
Bishop simplified
Janbu simplified

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Materials

Property	Embankment	Silty Clay Loam	Sandy Loam	Gravelly Sand	Till
Color					
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	125	120	110	120	106
Cohesion [psf]	1800	1500	1000	0	2000
Friction Angle [°]	0	0	0	26	0
Water Surface	Water Table	Water Table	Water Table	Water Table	Water Table
Hu Value	1	1	1	1	1
Unsat. Shear Strength Phi b [°]	0	0	0	0	0
Unsat. Shear Strength Air Entry Value [psf]	0	0	0	0	0



rocscience	Project	SN 058-0137 Mosquito Creek		
	Analysis Description	Slope Stability for Abutments		
	Drawn By	Scott Kassel, P.E.	Scale 1:118	Company IDOT District 7
	Date	February 6, 2020		File Name Abutment.slmd

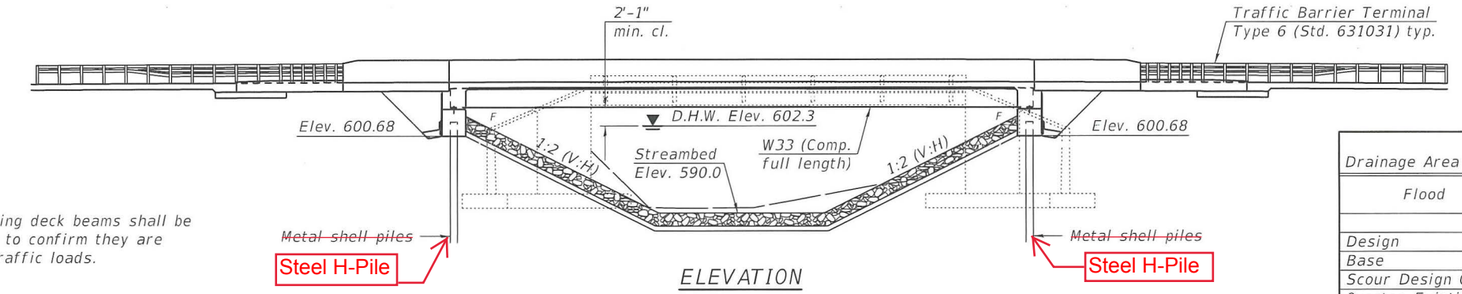
SLIDEINTERPRET 8.013

Benchmark: Brass disk in NE wingwall of SN 058-0029; Elev. 606.90, Sta. 382+46, Offset 18.6' Rt.

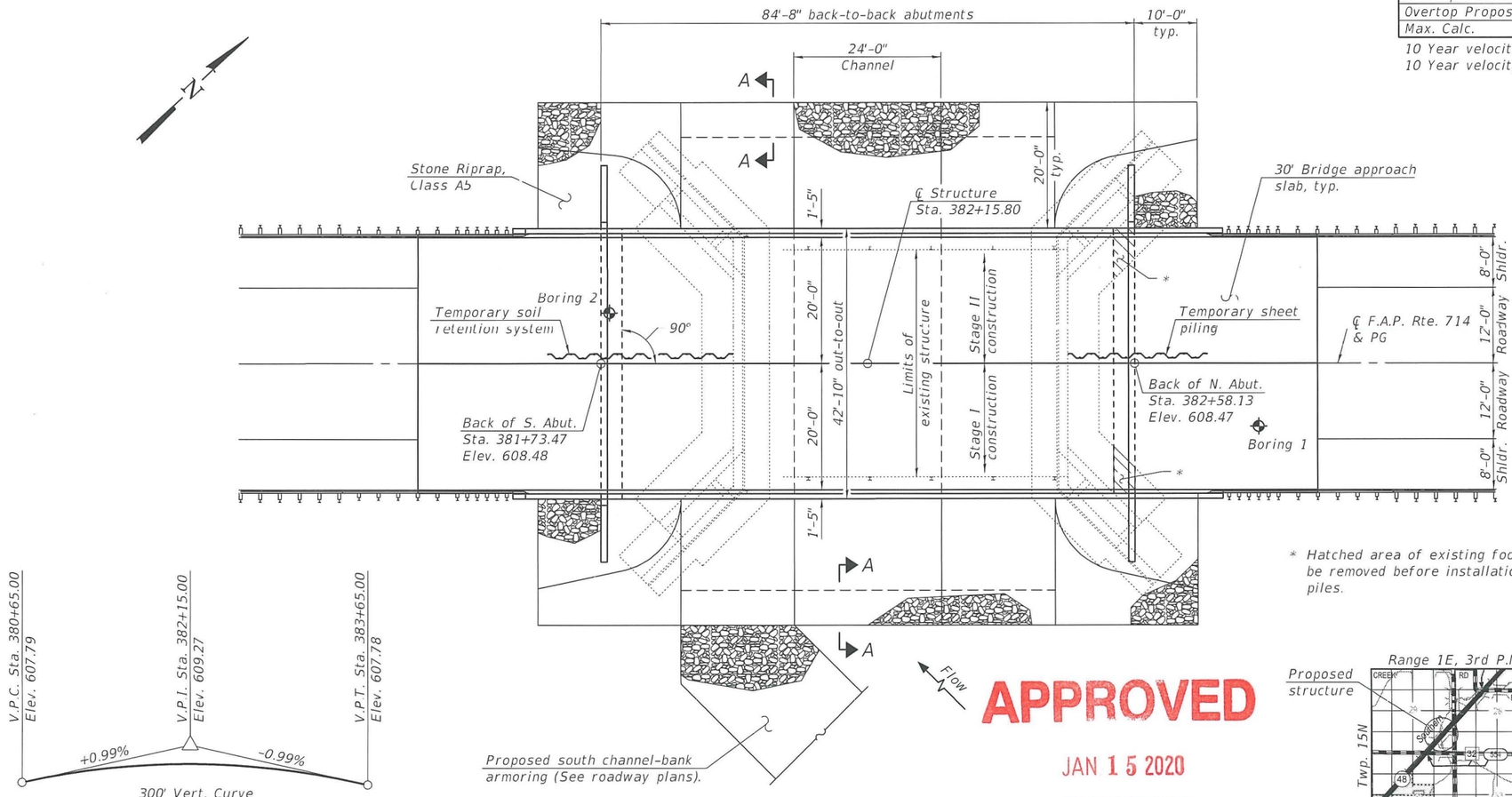
Existing Structure: Structure No. 058-0029 was originally constructed in 1928 as F.A.P. Route 714, Section 128-8. The original structure was a single span, 52'-9½" reinforced concrete deck girder superstructure supported on closed abutments with wingwalls on untreated timber pile foundation. In 1951, the structure was widened from 22 ft. to 36 ft. with new concrete wingwalls as Section 128-B-1; S.B.I. Route 48. In 1983, the concrete deck girder superstructure was removed and replaced with PPC deck beams and a bituminous wearing surface overlying a waterproofing membrane system as Section 128 BR-1. Existing structure will be removed and replaced utilizing stage construction.

No salvage.

Note:
The condition of the existing deck beams shall be verified during final design to confirm they are capable of carrying stage traffic loads.



ELEVATION



PLAN

* Hatched area of existing footing to be removed before installation of piles.

PROFILE GRADE
(Along ℄ F.A.P. Rte. 714)

APPROVED
JAN 15 2020
AS A BASIS FOR PREPARATION OF DETAILED PLANS

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.)		
	S. Abut.	N. Abut.	Item 113
Q100	600.68	600.68	8
Q200	600.68	600.68	
Design	600.68	600.68	
Check	600.68	600.68	

WATERWAY INFORMATION

Drainage Area = 12.4 sq. mi.
Existing Overtopping Elev. = 606.74 at Sta. 381+00
Proposed Overtopping Elev. = 606.87 at Sta. 385+50

Flood	Freq. Yr.	Q C.F.S.	Opening Ft²		Nat.	Head - Ft.		Headwater El.	
			Exist.	Prop.	H.W.E.	Exist.	Prop.	Exist.	Prop.
	10	1720	397	495	600.9	0.3	0.2	601.2	601.1
Design	50	2820	468	594	602.3	0.5	0.3	602.8	602.6
Base	100	3310	497	636	602.9	0.5	0.3	603.4	603.2
Scour Design Check	200	3830	527	682	603.5	0.6	0.3	604.1	603.8
Overtop Existing	N/A	-	-	-	-	-	-	-	-
Overtop Proposed	N/A	-	-	-	-	-	-	-	-
Max. Calc.	500	4540	566	743	604.3	1.2	0.8	605.5	605.1

10 Year velocity through existing structure = 4.3 ft./sec.
10 Year velocity through proposed structure = 3.5 ft./sec.

DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement)
fy – 50,000 psi (M270 Grade 50)

HIGHWAY CLASSIFICATION

IL Rte. 48 - F.A.P. Rte. 714
Functional Class: Minor Arterial
ADT: 5,200 (2020); 6,200 (2040)
ADTT: 750 (2020); 894 (2040)
DHV: 572 (2020); 682 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

LOADING HL-93

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

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.114
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.227
Soil Site Class = C

LOCATION SKETCH

GENERAL PLAN & ELEVATION
ILLINOIS ROUTE 48 OVER MOSQUITO CREEK
F.A.P. RTE. 714 - SEC. (128BR-1)B-1
MACON COUNTY
STATION 382+15.80
STRUCTURE NO. 058-0137

DESIGNED -	JUSTIN T. BELUE
CHECKED -	RICHARD J. CHAPUT
DRAWN -	MICHAEL B. MOSSMAN
CHECKED -	J.T.B. / R.J.C.

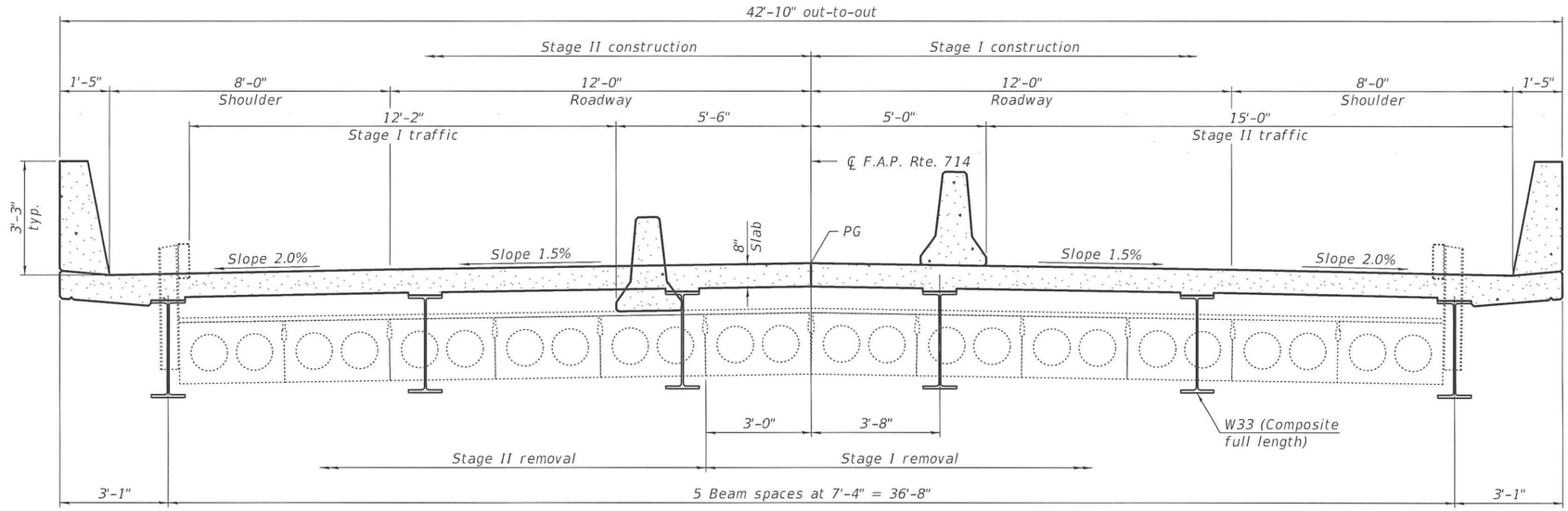
1/14/2020 - 3:50:59 PM

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

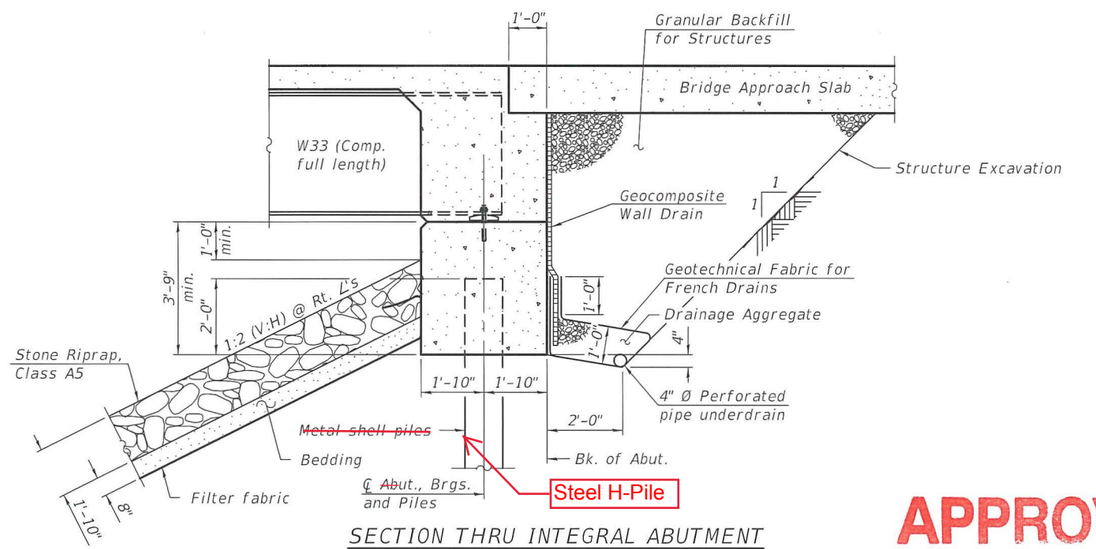
SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
714	(128BR-1)B-1	MACON	---	---
		CONTRACT NO. 74368		
	ILLINOIS FED. AID PROJECT			

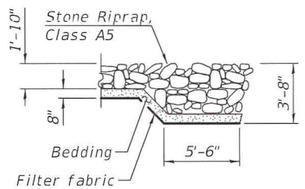
MODEL: 0580137-74368-TSL-001
FILE NAME: pw:\\planroom.dot.illinois.gov:PWIDOT\Documents\IDOT Offices\Bureau of Bridges and Structures\Projects\0580137\CADD Plans\0580137-74368.dgn



CROSS SECTION
(Looking North)



SECTION THRU INTEGRAL ABUTMENT



SECTION A-A

APPROVED

JAN 15 2020

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

DETAILS
ILLINOIS ROUTE 48 OVER MOSQUITO CREEK
F.A.P. RTE. 714 - SEC. (128BR-1)B-1
MACON COUNTY
STATION 382+15.80
STRUCTURE NO. 058-0137

DESIGNED -	JUSTIN T. BELUE
CHECKED -	RICHARD J. CHAPUT
DRAWN -	MICHAEL B. MOSSMAN
CHECKED -	J.T.B. / R.J.C.

1/14/2020 - 3:51:48 PM

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
714	(128BR-1)B-1	MACON	--	--
		CONTRACT NO. 74368		
	ILLINOIS FED. AID PROJECT			

MODEL: 0580137-74368-TSL-002
FILE NAME: pw:\\planroom.dot.illinois.gov:PWIDOT\Documents\IDOT Offices\Bureau of Bridges and Structures\Projects\0580137\CALD Plans\0580137-74368.dgn

Pile Design Table for North Abutment utilizing Boring #B-1

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls		
82	45	21
376	207	23
Metal Shell 14"Φ w/.25" walls		
101	55	21
Metal Shell 14"Φ w/.312" walls		
101	55	21
497	273	23
Metal Shell 16"Φ w/.312" walls		
120	66	21
634	349	23
Metal Shell 16"Φ w/.375" walls		
120	66	21
634	349	23
Steel HP 8 X 36		
130	71	31
171	94	36
208	114	41
241	132	46
266	147	51

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42		
161	88	31
212	117	36
259	142	41
305	168	46
Steel HP 10 X 57		
114	63	26
167	92	31
218	120	36
265	146	41
312	172	46
357	197	51
390	214	56
422	232	61
Steel HP 12 X 53		
130	72	26
193	106	31
254	140	36
310	170	41
365	201	46
Steel HP 12 X 63		
135	75	26
199	109	31
261	143	36
317	174	41
374	205	46
430	237	51
486	268	56
Steel HP 12 X 74		
140	77	26
204	112	31
266	146	36
323	177	41
379	209	46
436	240	51
493	271	56
538	296	61
577	317	66

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84		
145	80	26
209	115	31
271	149	36
328	180	41
385	212	46
442	243	51
499	274	56
547	301	61
586	323	66
626	344	71
Steel HP 14 X 73		
160	88	26
235	129	31
309	170	36
376	207	41
442	243	46
509	280	51
576	317	56
Steel HP 14 X 89		
135	74	23
167	92	26
243	134	31
317	174	36
384	211	41
452	248	46
519	286	51
587	323	56
654	360	61
Steel HP 14 X 102		
140	77	23
173	95	26
249	137	31
323	177	36
390	215	41
458	252	46
526	289	51
593	326	56
661	363	61
723	398	66
769	423	71
Steel HP 14 X 117		
145	80	23
180	99	26
256	141	31
330	182	36
399	219	41
467	257	46
535	294	51
603	332	56
671	369	61
734	403	66
780	429	71
Precast 14"x 14"		
128	70	21

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== North Abutment
REFERENCE BORING ========== B-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 602.68 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 600.68 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 ========== 1277 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 238.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 89.45 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
418 KIPS	**365** KIPS	**201** KIPS	**46** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 53
Plugged Pile Perimeter========== 3.967 FT. Unplugged Pile Perimeter========== 5.800 FT.
Plugged Pile End Bearing Area========== 0.983 SQFT. Unplugged Pile End Bearing Area========= 0.108 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.)
599.28	1.40	1.20			4.6		18.3	6.7		***8.2***	8	0	0	4	3
596.78	2.50	1.00			7.0	13.8	40.5	10.3	1.5	***20.1***	20	0	0	11	6
594.28	2.50	2.10			11.9	28.9	***33.1***	17.4	3.2	35.4	33	0	0	18	8
591.78	2.50	0.70			5.2	9.6	***41.1***	7.6	1.1	43.4	41	0	0	23	11
589.28	2.50	0.90			6.5	12.4	***43.5***	9.5	1.4	52.4	43	0	0	24	13
586.78	2.50	0.60			4.6	8.3	***46.6***	6.7	0.9	58.9	47	0	0	26	16
584.28	2.50	0.50			3.9	6.9	***47.7***	5.7	0.8	64.2	48	0	0	26	18
581.78	2.50	0.30			2.4	4.1	86.0	3.5	0.5	***71.7***	72	0	0	39	21
579.28	2.50	2.90			14.8	40.0	209.7	21.7	4.4	***105.2***	105	0	0	58	23
576.78	2.50		81	Hard Till	14.4	148.8	259.0	21.1	16.3	***130.1***	130	0	0	72	26
571.78	5.00		100	Hard Till	42.7	183.7	301.7	62.5	20.1	***192.6***	193	0	0	106	31
566.78	5.00		100	Hard Till	42.7	183.7	333.4	62.5	20.1	***253.9***	254	0	0	140	36
561.78	5.00		94	Hard Till	38.0	172.7	371.5	55.6	18.9	***309.5***	310	0	0	170	41
556.78	5.00		94	Hard Till	38.0	172.7	409.5	55.6	18.9	***365.1***	365	0	0	201	46
551.78	5.00		94	Hard Till	38.0	172.7	447.5	55.6	18.9	***420.7***	~~421~~	~~0~~	~~0~~	~~231~~	~~51~~
546.78	5.00		94	Hard Till	38.0	172.7	485.5	55.6	18.9	***476.3***	~~476~~	~~0~~	~~0~~	~~262~~	~~56~~
541.78	5.00		94	Hard Till	38.0	172.7	***523.6***	55.6	18.9	531.9	~~524~~	~~0~~	~~0~~	~~288~~	~~61~~
536.78	5.00		94	Hard Till	38.0	172.7	***561.6***	55.6	18.9	587.5	~~562~~	~~0~~	~~0~~	~~309~~	~~66~~
531.78	5.00		94	Hard Till	38.0	172.7	***599.6***	55.6	18.9	643.1	~~600~~	~~0~~	~~0~~	~~330~~	~~71~~
526.78	5.00		94	Hard Till		172.7			18.9						

Pile Design Table for South Abutment utilizing Boring #B-2

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls		
144	79	21
Metal Shell 14"Φ w/.25" walls		
69	38	18
185	102	21
Metal Shell 14"Φ w/.312" walls		
69	38	18
185	102	21
Metal Shell 16"Φ w/.312" walls		
79	43	18
230	127	21
Metal Shell 16"Φ w/.375" walls		
79	43	18
230	127	21
751	413	23
Steel HP 8 X 36		
147	81	33
189	104	38
231	127	43
264	145	48

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42		
130	71	28
182	100	33
234	129	38
287	158	43
Steel HP 10 X 57		
136	75	28
189	104	33
241	133	38
294	162	43
347	191	48
392	216	53
429	236	58
Steel HP 12 X 53		
156	86	28
218	120	33
281	154	38
343	189	43
406	223	48
Steel HP 12 X 63		
162	89	28
225	124	33
288	159	38
352	193	43
415	228	48
479	263	53
Steel HP 12 X 74		
103	57	23
167	92	28
230	127	33
294	162	38
358	197	43
421	232	48
485	267	53
548	302	58

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84		
107	59	23
171	94	28
235	129	33
299	164	38
363	200	43
427	235	48
491	270	53
555	305	58
602	331	63
Steel HP 14 X 73		
116	64	23
191	105	28
266	146	33
341	188	38
416	229	43
492	270	48
567	312	53
Steel HP 14 X 89		
123	67	23
198	109	28
274	151	33
350	193	38
426	234	43
502	276	48
577	318	53
653	359	58
Steel HP 14 X 102		
128	70	23
204	112	28
280	154	33
356	196	38
432	238	43
508	280	48
584	321	53
660	363	58
737	405	63
Steel HP 14 X 117		
134	74	23
211	116	28
288	158	33
365	201	38
441	243	43
518	285	48
595	327	53
671	369	58
748	411	63
Precast 14"x 14"		
88	48	18
235	129	21

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== South Abutment
REFERENCE BORING ========== B-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 602.68 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 600.68 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 ========== 1277 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 42.83 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 238.52 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 89.45 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
497 KIPS	**479** KIPS	**263** KIPS	**53** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 63
Plugged Pile Perimeter========== 4.000 FT. Unplugged Pile Perimeter========== 5.883 FT.
Plugged Pile End Bearing Area========== 1.000 SQFT. Unplugged Pile End Bearing Area========= 0.128 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.)
599.28	1.40	1.40			5.1		22.0	7.6		***9.7***	10	0	0	5	3
596.78	2.50	1.20			8.2	16.8	32.9	12.1	2.1	***22.1***	22	0	0	12	6
594.28	2.50	1.40			9.2	19.6	44.9	13.5	2.5	***36.0***	36	0	0	20	8
591.78	2.50	1.60			10.1	22.4	***38.2***	14.8	2.9	48.6	38	0	0	21	11
589.28	2.50	0.40			3.2	5.6	***52.5***	4.7	0.7	54.7	53	0	0	29	13
586.78	2.50	1.20			8.2	16.8	***48.1***	12.1	2.1	65.1	48	0	0	26	16
584.28	2.50	0.30			2.4	4.2	***49.1***	3.6	0.5	68.5	49	0	0	27	18
581.78	2.50	0.20			1.6	2.8	91.0	2.4	0.4	***76.1***	76	0	0	42	21
579.28	2.50		23	Hard Till	2.5	43.0	237.3	3.7	5.5	***98.1***	98	0	0	54	23
574.28	5.00		100	Hard Till	43.1	186.8	280.4	63.4	23.9	***161.6***	162	0	0	89	28
569.28	5.00		100	Hard Till	43.1	186.8	323.6	63.4	23.9	***225.0***	225	0	0	124	33
564.28	5.00		100	Hard Till	43.1	186.8	366.7	63.4	23.9	***288.4***	288	0	0	159	38
559.28	5.00		100	Hard Till	43.1	186.8	409.8	63.4	23.9	***351.8***	352	0	0	193	43
554.28	5.00		100	Hard Till	43.1	186.8	452.9	63.4	23.9	***415.2***	415	0	0	228	48
549.28	5.00		100	Hard Till	43.1	186.8	496.0	63.4	23.9	***478.6***	479	0	0	263	53
544.28	5.00		100	Hard Till	43.1	186.8	***539.1***	63.4	23.9	542.0	~~539~~	~~0~~	~~0~~	~~297~~	~~58~~
539.28	5.00		100	Hard Till	43.1	186.8	***582.2***	63.4	23.9	605.4	~~582~~	~~0~~	~~0~~	~~320~~	~~63~~
534.28	5.00		100	Hard Till		186.8			23.9						