

STRUCTURE GEOTECHNICAL REPORT

068-2508

Existing SN: 068-0016


IL 16 over Tributary to the South Fork of the Sangamon River

Route: FAP 325
Section: 18(B-2,B-3)
Montgomery County

D-96-522-05
Contract # 72984

Prepared By: Luke Murphy, PE
IDOT Region 4 District 6
Geotechnical Unit
217-782-6709

Checked By: LTM

Approved By: 
Luke Murphy, P.E.
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Lic. #062-071192

Date: August 14, 2019
Revised: February 17, 2023

Date: 2/17/2023

Prepared For: Mary Coobme Bloxdorf
Fehr-Graham
Consultants

Attachments: Structure Plans
Subsurface Profile

Boring Logs
Special Provisions

This Report has been prepared based on a "Approved" Structure Plans dated January 20, 2023. Contact the author if there are any questions regarding this Report or if there are modifications to structure location, size, geometry, or vertical alignment.

Electronic copies of boring logs are available upon request for inclusion in the plans. Calculations are also available upon request.

This Report has been prepared according to AASHTO Standard Specifications for Highway Bridges 9th Edition 2020 and the 2023 IDOT BBS Bridge Manual.

Project Description and Proposed Structure Information

This project consists of the removal of the existing 26 ft single span bridge on closed abutments and replacing it with a triple 8'Hx12'W box culvert. Work will be performed under stage construction.

Proposed horizontal cantilever wingwalls are approximately 13.5 ft long and 9.5 ft high. There is approximately 1ft of fill above the culvert. An approximate 1.5 ft change in roadway grade is proposed.

Existing Structure and Site Investigation

The existing single span bridge was constructed in 1923.

The existing structure is located in level terrain, and the primary area land use is cultivated fields. The approach roadway is at or near grade. No existing settlement or stability problems were observed.

The channel banks are approximately 5ft and near 2V:1H slopes with no evidence of sloughing.

Rip rap has been placed under the bridge and along the banks where ditches outlet into the stream.

New borings were advanced on the existing driving lanes at the northwest and southeast corners. Borings were advanced to 25± ft below streambed by the District 6 drill crew according to AASHTO T 206 and the IDOT Geotechnical Manual.

Boring data indicates approximately 2 ft of clay loam over 13 ±ft of sand over clay loam till. Borings on roadways are filled to prevent a hazard immediately after drilling. As a result, no 24-hour water elevation observations were made. The boring data indicates groundwater was encountered at 655.0 ft corresponding to the top of sand.

Geotechnical Evaluation

Settlement. There is a minor change in grade. Empirical settlement calculations estimate a settlement of less than 1 inch beneath the box. Settlement is not anticipated to be a problem.

Slope Stability. The stability of a 1:1 temporary construction slope has been analyzed including excavation to elevation 658 ft. The resulting factor-of-safety is 2.7. No stability issues are anticipated.

Seismic Considerations. Seismic events are not a significant design consideration for culverts. No analysis is required.

Scour. A 100 year scour estimate has not been calculated for the proposed culvert. The design scour elevation should correspond to the bottom of toe wall elevation. Based on available information, the upstream design scour elevation is 656.15 ft, and the downstream design scour elevation is 655.85 ft. These elevations may be adjusted during final design.

Mining Activity. ISGS records indicate no mining beneath the proposed structure.

Foundation Evaluation

Culvert Barrel. A pre-cast culvert is feasible at this site. If the pre-cast alternative is selected, cast-in-place headwalls should be included. No ground improvement is required

Wingwalls. Originally the design called for horizontal cantilevered wingwalls for both the up and downstream ends of the culvert. Due to complications acquiring Right of Way on the downstream end of the box culvert, other wingwall types have been explored on the downstream end.

Soil Properties for Analysis: The table below contains soil properties to be used for embedment and section modulus analysis of a sheet or soldier pile wall.

Elevation		Soil Type	γ (pcf)	Undrained				Drained			
Top	Bottom			C (psf)	φ	Ka	Kp	C (psf)	φ	Ka	Kp
668.88	663.5	Silty Clay	120	1000		1	1		26	0.36	3.31
663.5	655.5	Clay Loam	120	700		1	1		26	0.36	3.31
655.5	650	Fine Sand	110		29	0.32	3.97		29	0.32	3.97
650	641	Sandy Gravel	125		32	0.28	4.76		32	0.28	4.76
641	-	Clay Loam Till	130	7200		1	1	500	28	0.33	3.66

The borings showed very consistent stratigraphy with similar blow counts and unconfined compressive strengths. The cohesion (C) was taken from field Rimac results. The undrained phi angle of the Fine Sand and Sandy Gravel were taken from Wolfe 1989 and FDOT 2012. The drained phi angle of cohesive soils was based on Table 4-6 of USACE EM 1110-2-2906. Ka's and Kp's were calculated using Coulomb and assuming the wall friction angle is equal to a third of the angle of internal friction.

The effective cohesion of the Clay Loam Till was assumed as 500 psf. As taken from MnDOT Report MN/RC 2018-32 the effective cohesion could be approximately 10% of the undrained cohesion. Given the high unconfined compressive strengths of this layer, ranging from 7.2 to 10 tsf, it is believed this soil would retain cohesion in the drained condition.

Using the soil properties from the Table above, the below table of earth pressures was derived. These represent the factored values per foot of wall. The active and passive values will need multiplied by the appropriate widths for the analyses. This would be equal to the pile spacing for active and the smaller of 3 times the pile width or the pile spacing for passive.

Elevation	σ'va	σ'vp	LL Surcharge	σ'h (undrained) Factored per foot						σ'h (drained) Factored per foot					
				active		passive		net (-active)		active		passive		net (-active)	
				top	bottom	top	bottom	top	bottom	top	bottom	top	bottom	top	bottom
668.88	0		240	105				-105		151.2				-151.2	
663.5	645.6		240	347.1				-347.1		499.82				-499.82	
655.63	1590	0	240	701.25		1050		348.75		1009.8		0		-1009.8	
655.5	1597.49	7.49	240	704.06	901.2	1055.62	22.3	351.56	-878.9	1013.84	901.2	18.59	22.3	-995.25	-878.9
650	1859.29	269.29	240	1026.86	898.5	801.81	961.37	-225.05	62.87	1026.86	898.5	801.81	961.37	-225.05	62.87
641	2422.69	832.69	240	1135.13	1013.51	2972.7	11424.52	1837.57	10410.99	1135.13	1013.51	2972.7	5030.74	1837.57	4017.23
635	2828.29	1238.29	240	1165.61		11728.72		10563.09		1165.61		6144.11		4978.5	

From the Allpile User's Manual, the below table of soil properties used specifically for lateral analysis was compiled and should be used by the Consultant.

Elevation		Soil Type	K (pci)	e50 (%)
Top	Bottom			
668.88	663.5	Silty Clay	100	1
663.5	655.5	Clay Loam	70	1.5
655.5	650	Fine Sand	20	-
650	641	Sandy Gravel	60	-
641	-	Clay Loam Till	2000	0.4

Preliminary Feasibility Analyses: Preliminary Analyses using an internal spreadsheet was conducted for the purpose of determining feasibility.

Cantilevered Sheet Pile Wall: The preliminary analysis for a cantilevered sheet pile wall showed a minimum section modulus of 30 cubic inches per foot, not accounting for corrosion, and a tip elevation of 628 would be required, with the limiting case being the drained condition. The tip elevation would be 13 feet into Clay Loam Till with blow counts ranging from 31 to 66 and Qu's ranging from 7.2 to 10 tsf. It is anticipated that driving sheet pile this deep into this layer would prove difficult at best and have a high probability to damage the sheet pile. A cantilevered sheet pile wall is not recommended. Technically anchors could be used to reduce the tip elevation and section modulus, however the anchors would have to extend underneath the road, which is not recommended unless other wall types are economically not feasible.

Cantilevered Soldier Pile Wall: A cantilevered soldier pile could be used. Using the soil properties from this memo and an internal spreadsheet the below table documents the tip elevation, minimum section modulus (not accounting for corrosion), and acceptable structural shapes, which can be refined further by Structural Engineer.

Pile Spacing	Tip Elevation	Minimum Section Modulus	Acceptable Shapes
3.5'	637	87.2	HP 14x73 or above
3.75'	637	87.2	
4'	637	110.6	HP 14x89 or above
4.25'	636	110.6	
4.5'	636	110.6	
5'	635	110.6	
5.5'	634	130.4	
6'	634	130.4	HP 14x102 or above
6.5'	633	152.3	HP 14x117 or above
7'	632	152.3	
7.5'	633	152.3	

A drivability analysis, using BBS 147 demonstrated that the piles could be driven to the desired tip elevations without issue, however it is believed that the analysis does not adequately model the Till's, shear strength and stiffness, as the till can have unconfined compressive strengths in excess of 9 tsf. Given this, even though the boring shows sandy soils, complicating the drilling process, the soldier piles should be set in drilled shafts extending to the calculated tip elevations.

T-Type: T-Type and other wall types better suited for "Fill" situations were eliminated as installing them close to the edge of pavement would require additional temporary retention, making a "Cut" type of wall, sheet or soldier pile, economically more ideal.

Final Recommendation(s): Our recommendation for the final configuration of the downstream end would be a cantilevered soldier pile wall with the soldier piles being set in drilled shafts, utilizing only readily available HP Sections. If more detailed analysis precludes the use of a cantilevered soldier pile wall, utilizing readily available HP Sections, we would recommend a cantilevered soldier pile with a larger W section. The upstream end should utilize horizontal cantilevered wingwalls.

Construction Considerations

Stage Construction. This project will be constructed under stage construction.

Temporary Soil Retention. Temporary retention will be required to facilitate stage construction. The estimated maximum retained height is 11 ft. A preliminary analysis indicates a cantilevered sheet pile wall is feasible. If the final design shows a sheet pile tip elevation below 644 ft, a dense sand layer may prevent adequate embedment. In that case, use the Temporary Soil Retention System.

The designer has indicated a 1H: 1V slope on the backfill area above stage I construction. The granular culvert backfill should be wrapped with geotextile to prevent rock loss, a detail is attached. No additional retention methods are required.

Excavation. Existing abutments should be removed to 2 ft below the proposed culvert barrel and should be backfilled with Rockfill-Foundation. The special provision is attached.

Backfill. Backfill should consist of Granular Culvert Backfill. The special provision is attached. A detail showing pay limits should be included. Pay limits include the temporary excavation limits in a section along the roadway and from edge of shoulder to edge of shoulder in a section along the culvert.

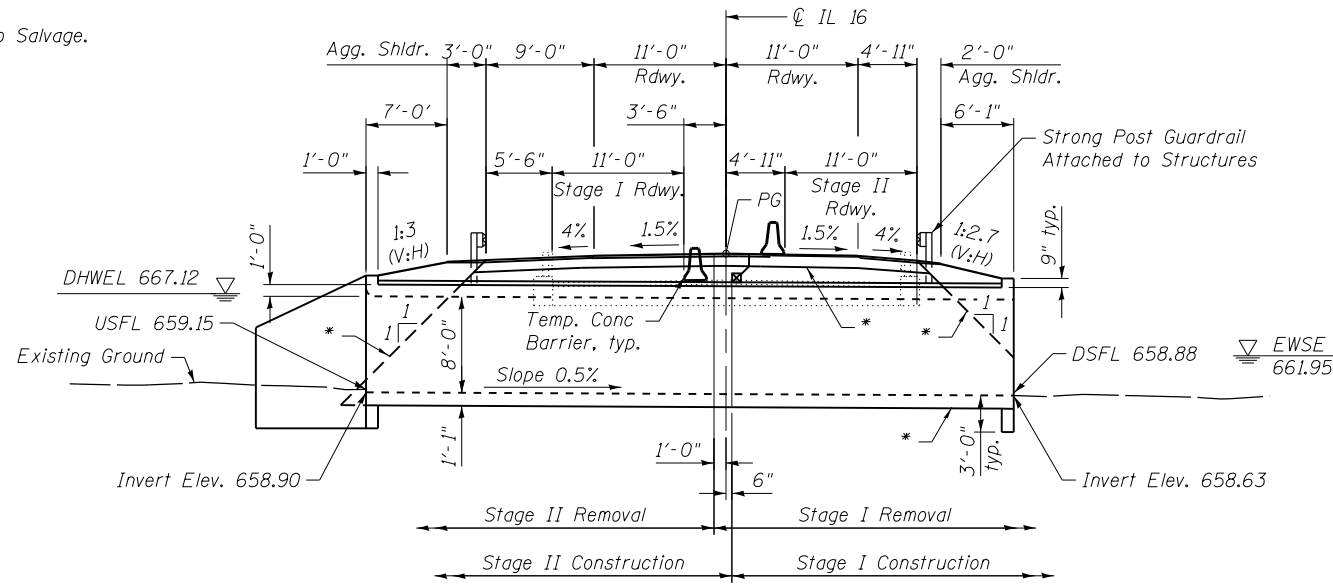
Ground Improvement. No ground improvement is necessary below the culvert barrel or below wingwalls.

Drilled Soldier Piles. The borings indicate Cohesionless Soils below the groundwater table will be present. The Contractor should anticipate the challenges of drilling in Cohesionless Soils below the groundwater table.

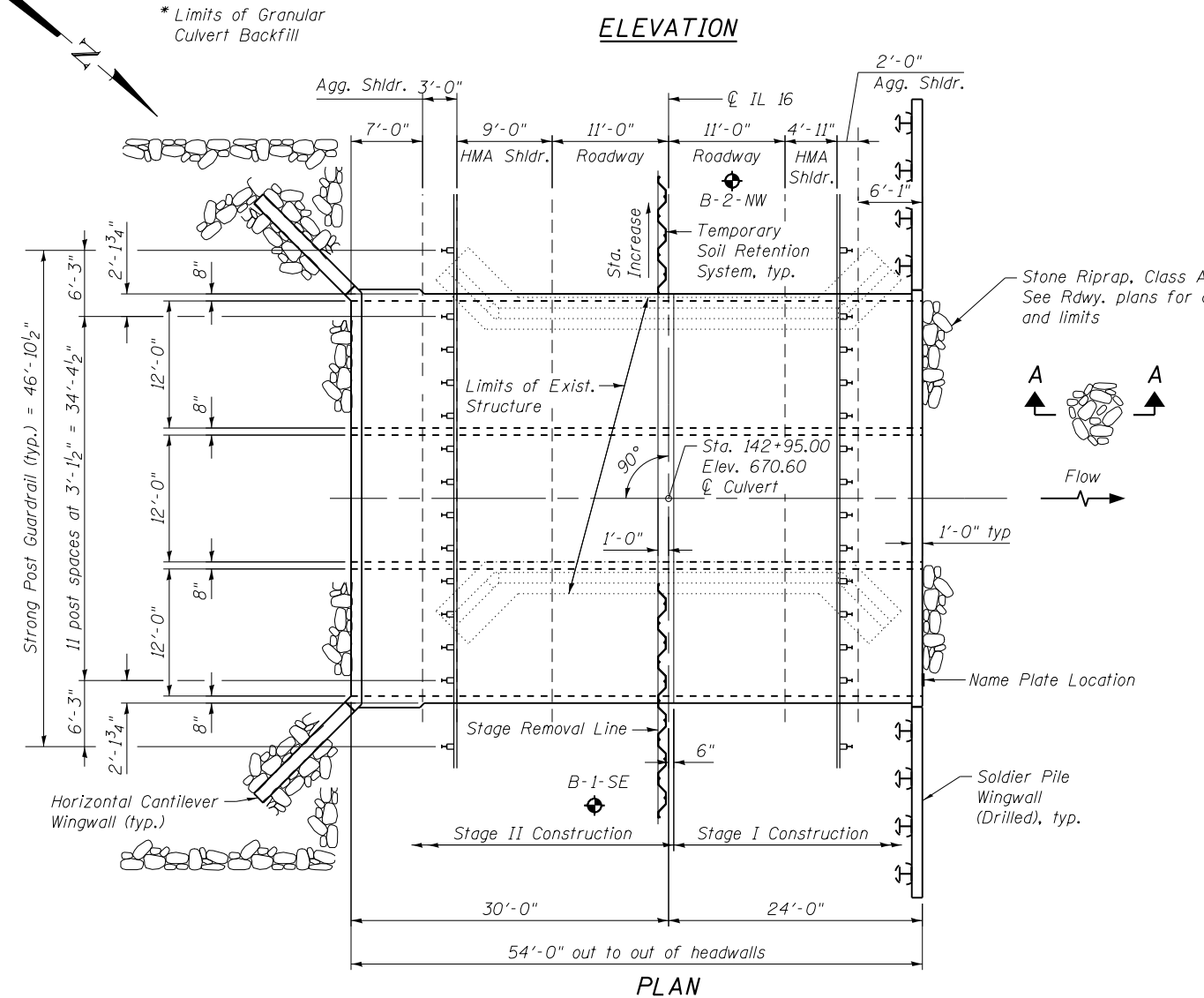
Benchmark: Chiseled square on top N.W. wingwall SN 068-0016, Elev. 668.47

Existing Structure: SN 068-0016 at Sta. 143+00 was built in 1923 as SBI 16, Section 18.
The HMA overlay was replaced in 1973 and in 2002 the bridge rail was replaced. The Structure is a single span concrete deck slab on closed abutments, 26'-0" bk. to bk. of abutments and 32'-2" out to out deck, no skew.
Stage construction will be utilized to maintain 1 lane of traffic.

No Salvage.



ELEVATION



PLAN

INDEX OF SHEETS

1. General Plan
2. Stage Construction Details
3. Temporary Concrete Barrier for Stage Construction
- 4-5. Culvert Details
6. Bar Splicer Assembly and Mechanical Splicer Details
- 7-8. North Wingwall Details
9. Boring Logs

GENERAL NOTES

Layout of slope protection system may be varied to suit ground conditions in the field as directed by the Engineer.
Excavation behind existing abutment walls shall be performed to balance front and back soil pressure before removing the existing superstructure. The Contractor shall sawcut the upper portion of the existing abutment at the stage removal line before Stage I removal to ensure the remaining portion will not be prematurely damaged.

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

$f'_c = 3,500$ psi
 $f_y = 60,000$ psi (Reinforcement)
 $f_y = 36,000$ psi (Soldier Piles)

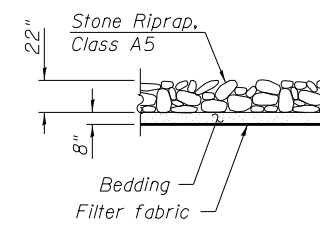
WATERWAY INFORMATION

Drainage Area = 1.9 sq. mi. Exist. Overtopping Elev. 668.52 ft. @ Sta. 143+00.00
Prop. Overtopping Elev. 669.11 ft. @ Sta. 137+00.00

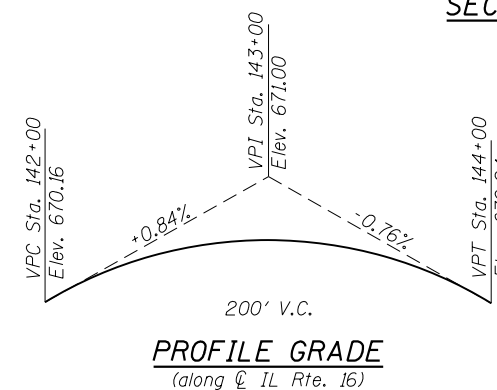
Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft.		Head - Ft.		Headwater El.		
			Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	
Design	10	640	124	240	665.88	1.2	0.6	667.11	666.48
Base	50	1080	144/20	290	667.12	1.9	0.7	668.97	667.80
Max. Calc.	100	1280	144/90	290	667.49	2.0	0.8	669.48	668.29
OVT (E)	<50								
OVT (P)	>100								
10 yr velocity thru Existing Structure									6.47 fps
10 yr velocity thru Proposed Structure									4.07 fps

DESIGN SCOUR ELEVATION TABLE

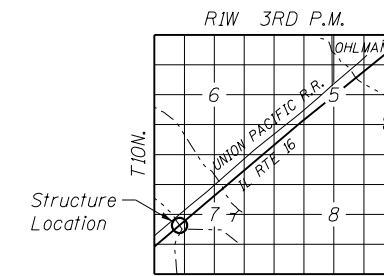
Design Scour Elevation (ft.)	Upstream	Downstream
	656.15	655.85



SECTION A-A



PROFILE GRADE (along IL Rte. 16)



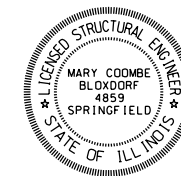
LOCATION SKETCH

TOTAL BILL OF MATERIAL

ITEM	UNIT	TOTAL
Removal of Existing Structures No. 2	Each	1
Reinforcement Bars	Pound	39,740
Bar Splicers	Each	160
Name Plates	Each	1
Concrete Box Culverts	Cu. Yd.	243.2
Granular Culvert Backfill	Cu. Yd.	158
Temporary Soil Retention System	Sq. Ft.	381
Membrane Waterproofing System for Buried Structures	Sq. Yd.	235
Geocomposite Wall Drain	Sq. Yd.	251
Strong Post Guardrail Attached to Culvert	Foot	94
Furnishing Soldier Piles (HP Section)	Foot	250
Drilling and Setting Soldier Piles (in soil)	Cu. Ft.	740
Untreated Timber Lagging	Sq. Ft.	402
Stud Shear Connectors	Each	104

STATION 142+95.00
BUILT 20__ BY
STATE OF ILLINOIS
F.A.P. RTE. 325 SEC. 18(B-2, B-3)
LOADING HL-93
STR. NO. 068-2508

NAME PLATE
See Std. 515001



ILLINOIS STRUCTURAL NO. 4859
EXPIRES 11/30/24
DATE: / /

GENERAL PLAN
IL 16 OVER TRIBUTARY TO THE
SOUTH FORK OF THE SANGAMON RIVER
FAP 325 SECTION 18(B-2, B-3)
MONTGOMERY COUNTY
STATION 142+95.00
STRUCTURE NO. 068-2508

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ENGINEERING & ENVIRONMENTAL
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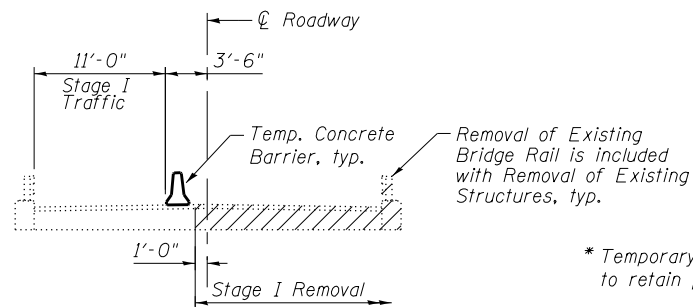
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
SN 068-2508

SHEET 1 OF 9 SHEETS

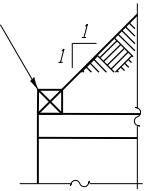
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325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	113
CONTRACT NO. 72984			ILLINOIS FED. AID PROJECT	

FEHR GRAHAM PROJECT NUMBER: 10005-2



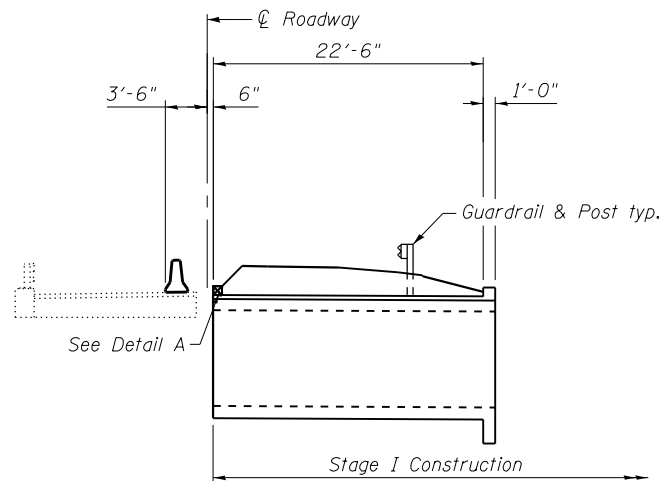
STAGE I REMOVAL

* Temporary blocking at Stage Line to retain proposed backfill

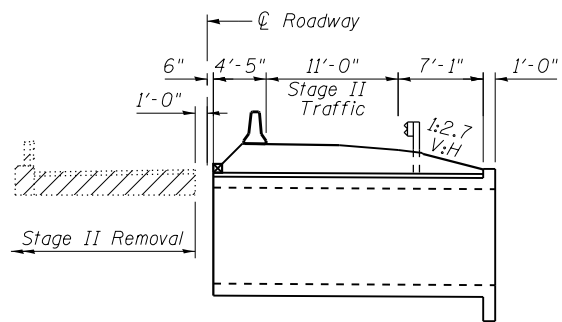


DETAIL A
(at Stage I Construction)

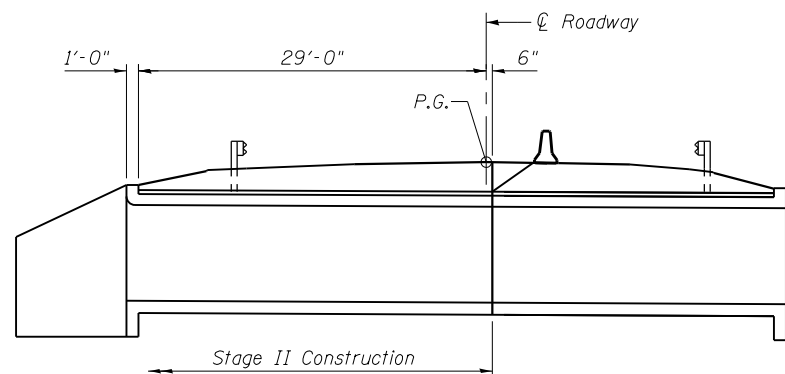
* The Contractor shall submit the design calculations and details for the temporary blocking for review and approval by the Engineer. Cost included in Temporary Soil Retention System.



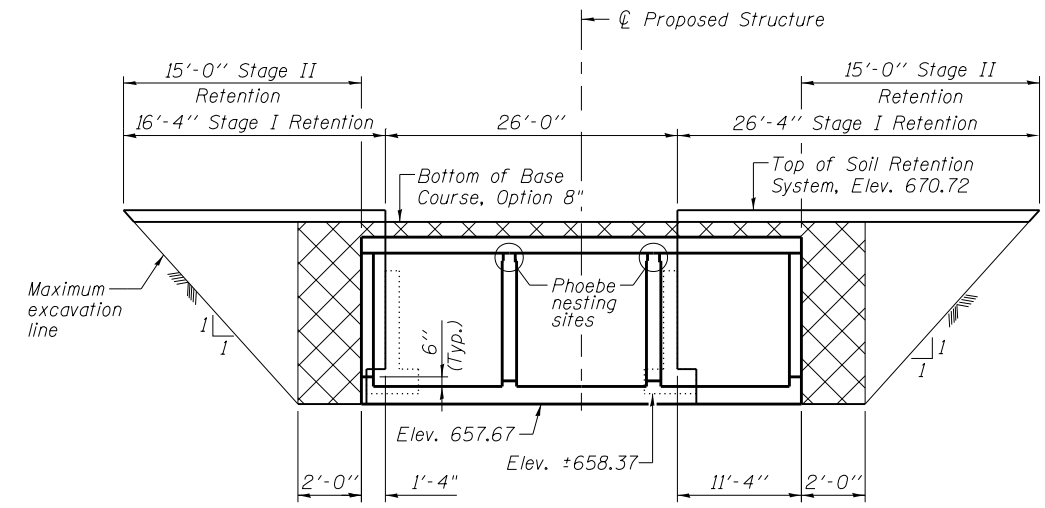
STAGE I CONSTRUCTION



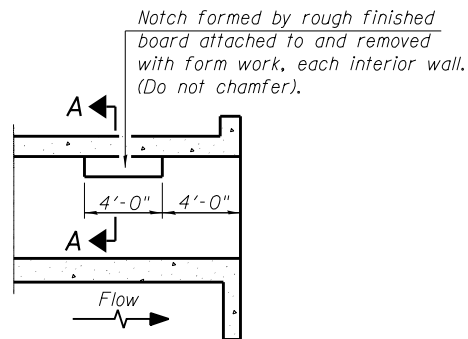
STAGE II REMOVAL



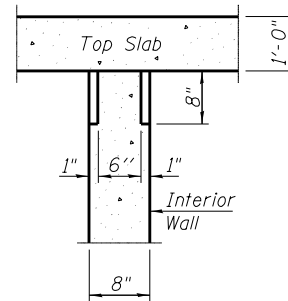
STAGE II CONSTRUCTION



TEMPORARY SOIL RETENTION SYSTEM



LONGITUDINAL SECTION



SECTION A-A

PHOEBE NESTING SITE DETAILS
(Downstream End Only)

Notes:
 Cross hatched area indicates Granular Culvert Backfill. See Special Provisions.
 A cantilevered sheet piling design does not appear feasible and additional members or other retention systems may be necessary. The Contractor shall submit a temporary soil retention system design including plan details and calculations for review and acceptance by the Engineer.
 All staging cross sections are looking West.
 For quantity of Temporary Concrete Barrier, see roadway plans.
 Hatched area indicates Removal of Existing Structures.

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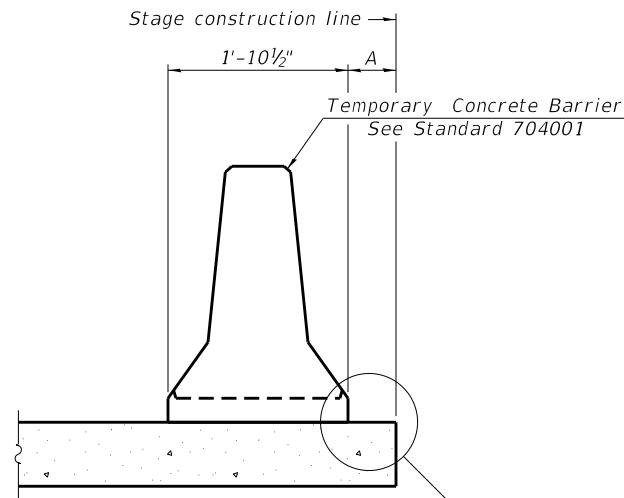
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STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

STAGE CONSTRUCTION DETAILS
 STRUCTURE NO. 068-2508

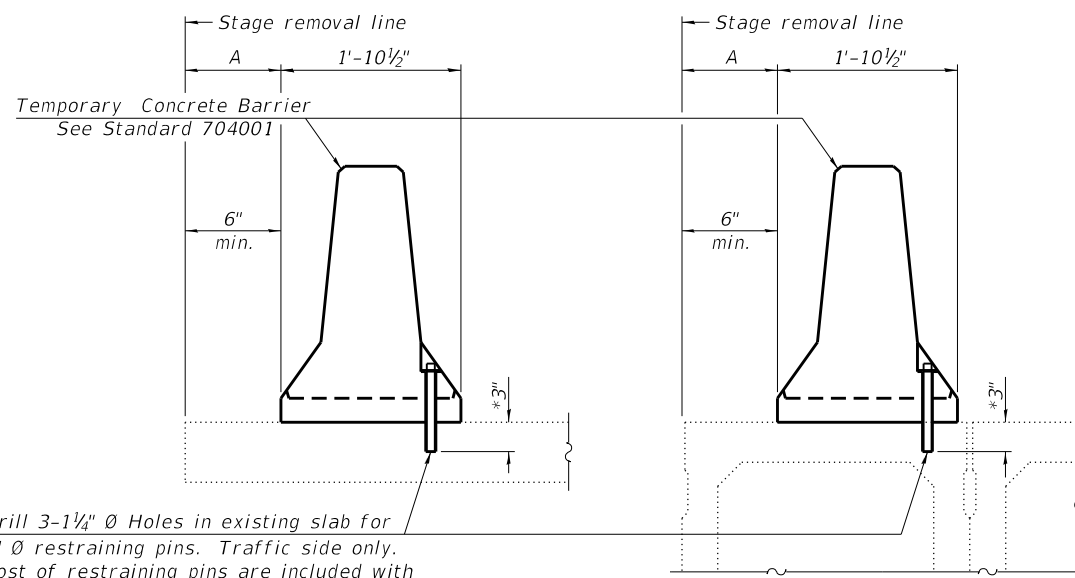
SHEET 2 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	114
				CONTRACT NO. 72984
ILLINOIS FED. AID PROJECT				



When "A" is 3'-1" or less, the temporary concrete barrier shall be restrained to the new slab according to Detail I, II or III. No restraint is required when "A" is greater than 3'-1".

NEW SLAB OR NEW DECK BEAM

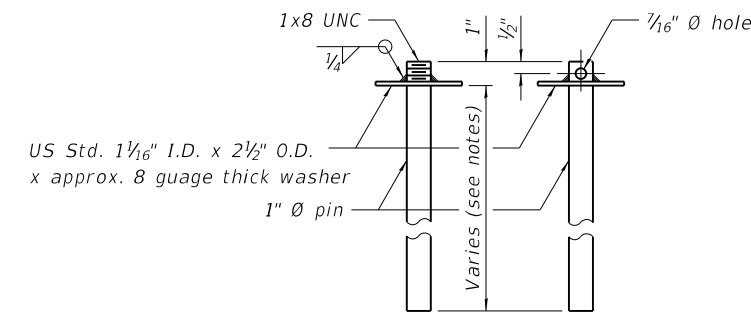


Drill 3-1/4" Ø Holes in existing slab for 1" Ø restraining pins. Traffic side only. Cost of restraining pins are included with Temporary Concrete Barrier. No restraint is required when "A" is greater than 3'-1".

EXISTING SLAB

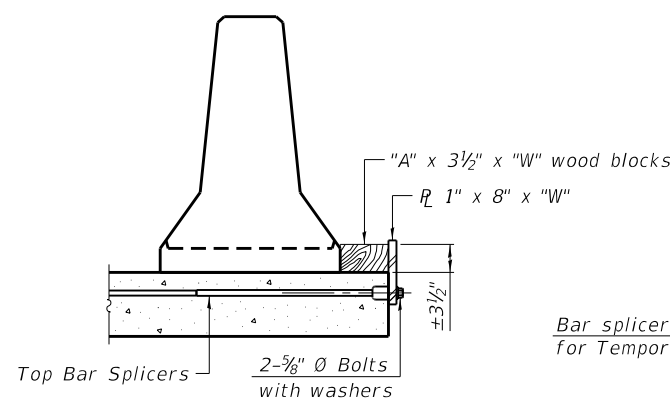
* When hot-mix asphalt wearing surface is present, embedment shall be 3" plus the wearing surface depth.

EXISTING DECK BEAM



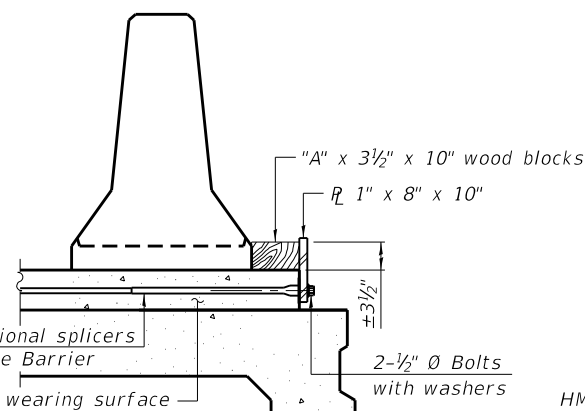
RESTRAINING PIN

SECTIONS THRU SLAB OR DECK BEAM

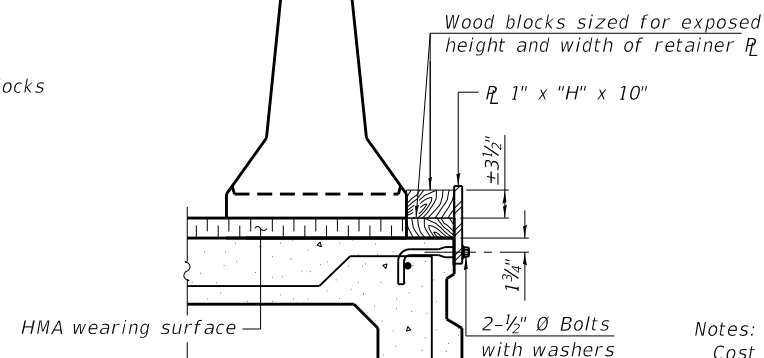


DETAIL I

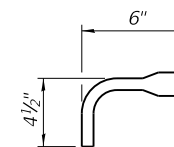
Bar splicers and additional splicers for Temporary Concrete Barrier



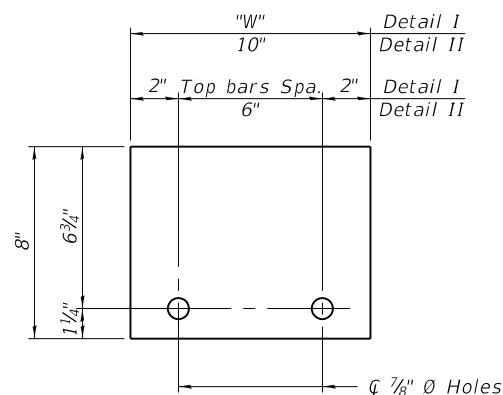
DETAIL II



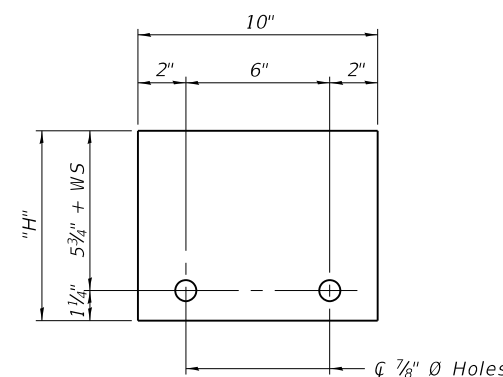
DETAIL III



BAR SPLICER FOR #4 BAR - DETAIL III



STEEL RETAINER R 1" x 8" x "W"
(Detail I and II)



STEEL RETAINER R 1" x "H" x 10"
(Detail III)

Notes:
 Cost of retainer assembly is included with Temporary Concrete Barrier.
 A retainer assembly shall be located at the approximate \bar{C} of each temporary concrete barrier.
 The retainer plate shall not be removed until the concrete on the adjacent stage is ready to be poured. For Detail III applications the retainer plate shall not be removed until just prior to placing the adjacent beam.
 When the 'A' dimension is less than 1 1/2', the wood block shall be omitted and the barrier shall be placed in direct contact with the steel retainer plate. For deck beam applications the minimum required 'A' distance is 6' to accommodate the shear key clamping device.

Detail I - Installation for a new bridge deck or bridge slab.
 Detail II - Installation for a new deck beam with an initial concrete wearing surface. Additional bar splicers shall be provided at 6'-0" centers and paired with the bar splicers of the concrete wearing surface reinforcement to accommodate the installation of the retainer assemblies. The cost of the additional bar splicers is included with the concrete wearing surface.
 Detail III - Installation for a new deck beam with no initial wearing surface or with an initial hot-mix asphalt (HMA) wearing surface present. The deck beam directly beneath the temporary concrete barrier shall be fabricated with bar splicer inserts in the side of the beam, as detailed, to accommodate the installation of the retainer assemblies. A pair of bar splicers, 6' apart, shall be placed at 6'-0" centers along the length of the beam. The cost of the bar splicers is included with the deck beam.

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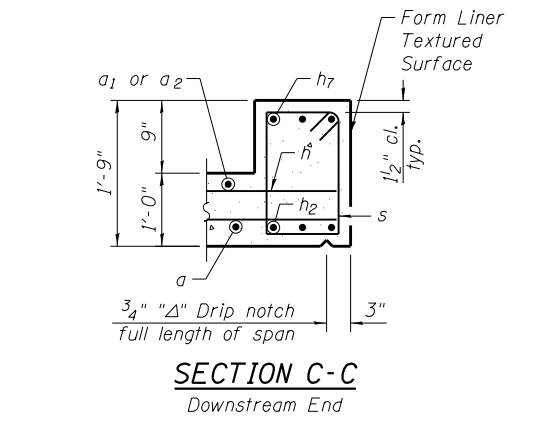
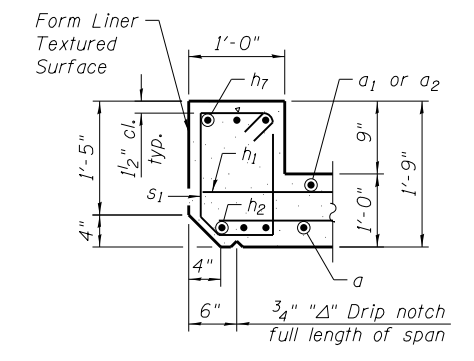
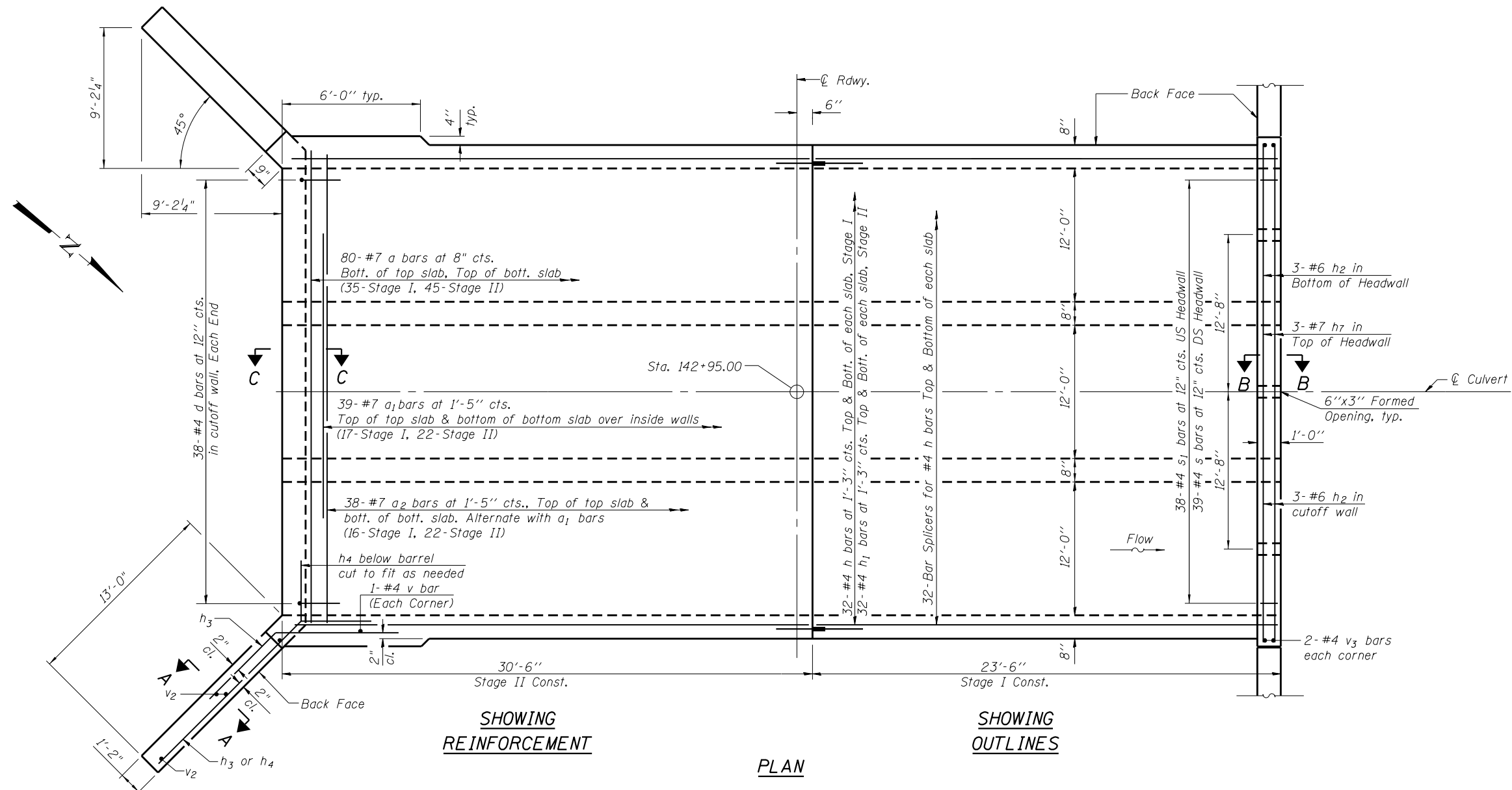
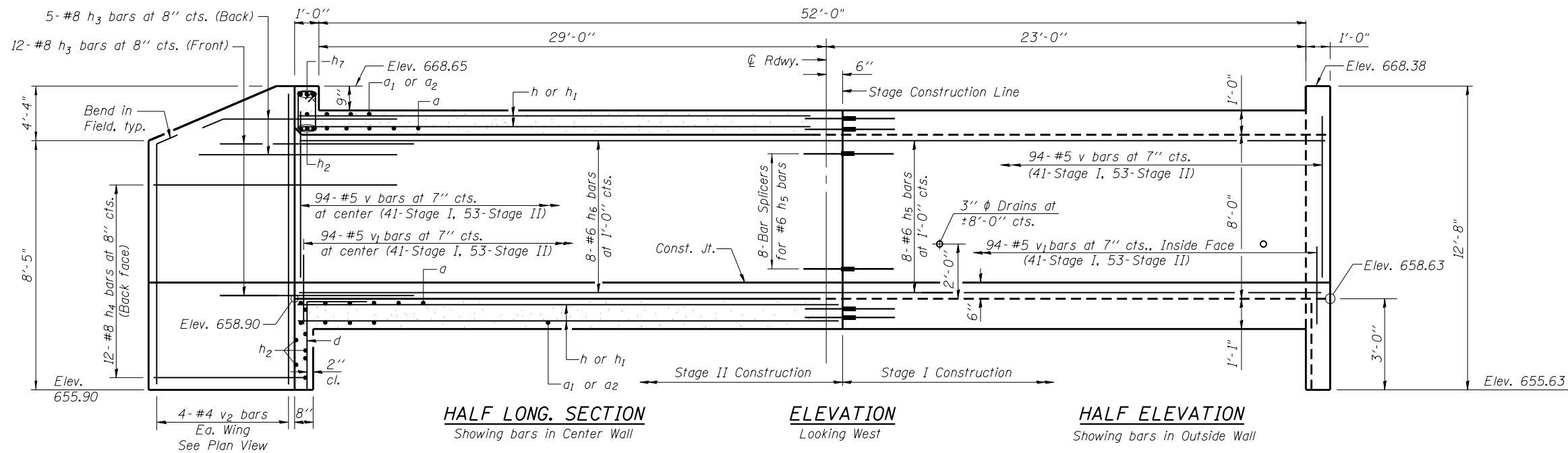
STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

TEMPORARY CONCRETE BARRIER FOR STAGE CONSTRUCTION
 STRUCTURE NO. 068-2508

SHEET 3 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	115
				CONTRACT NO. 72984
ILLINOIS FED. AID PROJECT				

FEHR GRAHAM PROJECT NUMBER: 10005-2



Note:
See sheet 5 of 9 for Sec. A-A,
bar details and Bill of Material.

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FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL
ILLINOIS DESIGN FIRM NO. 184-003525

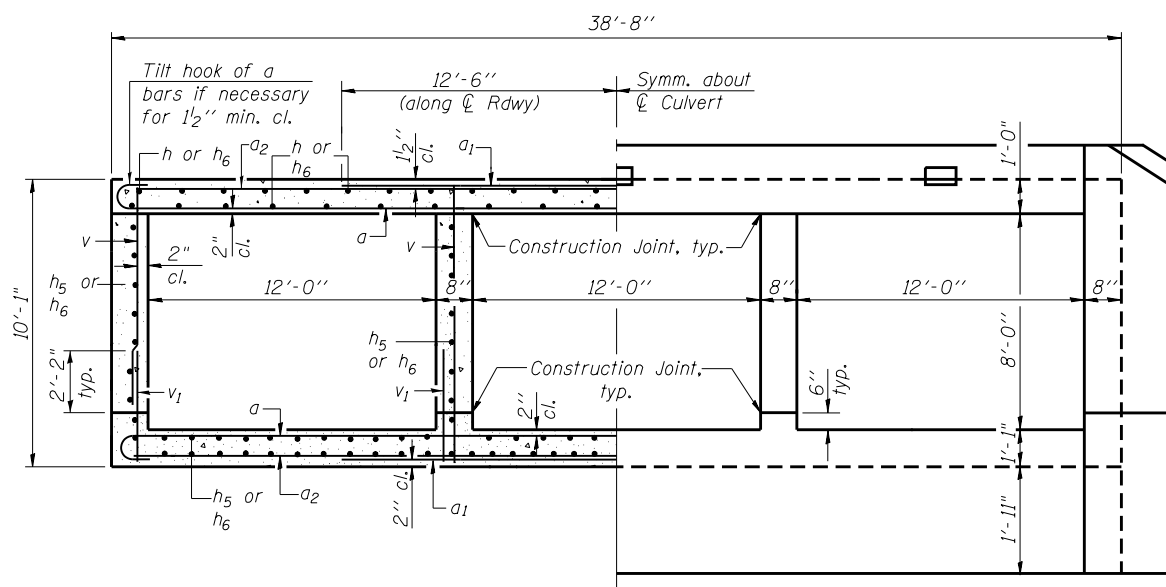
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CULVERT DETAILS
STRUCTURE NO. 068-2508

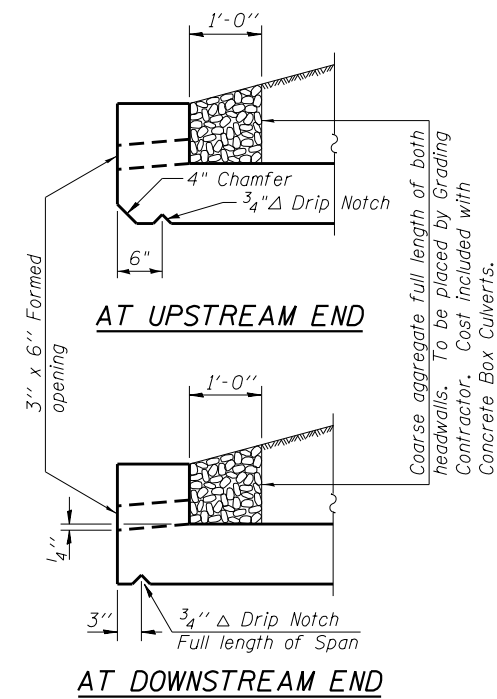
SHEET 4 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	116
CONTRACT NO. 72984				
ILLINOIS FED. AID PROJECT				



HALF SECTION
THRU BARREL

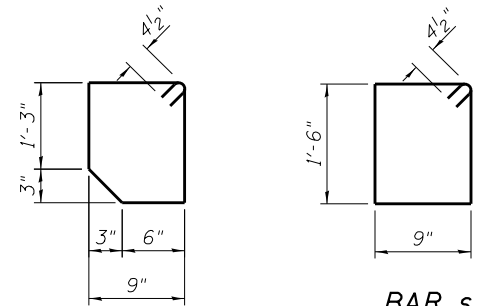
HALF END ELEVATION



AT UPSTREAM END

AT DOWNSTREAM END

DRAIN DETAIL



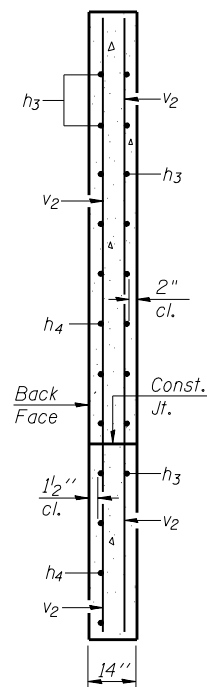
BAR s₁

BAR s

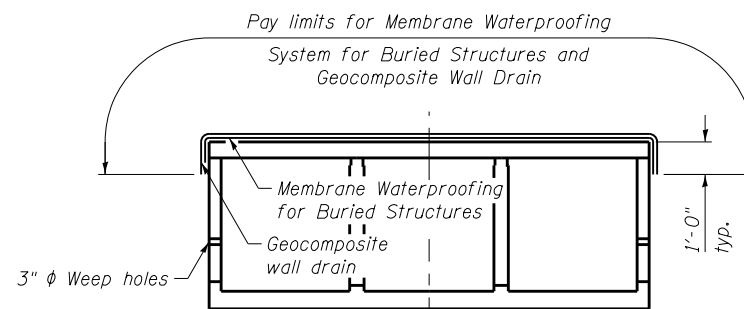
Notes:
A distance of half the length of the wingwall but not less than six feet of the barrel shall be poured monolithically with the wingwalls.

BILL OF MATERIAL

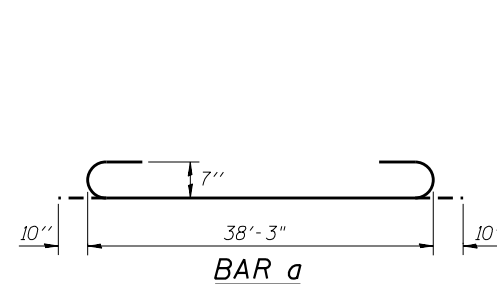
Bar	No.	Size	Length	Shape
a	160	#7	39'-11"	U
a ₁	78	#7	25'-0"	—
a ₂	76	#7	38'-3"	—
d	76	#4	4'-5"	L
h	128	#4	23'-2"	—
h ₁	128	#4	30'-2"	—
h ₂	12	#6	38'-3"	—
h ₃	34	#8	8'-0"	L
h ₄	24	#8	16'-0"	L
h ₅	32	#6	23'-2"	—
h ₆	32	#6	30'-2"	—
h ₇	6	#7	38'-3"	—
h ₈	52	#5	17'-8"	—
s	39	#4	5'-3"	□
s ₁	38	#4	5'-4"	□
v	380	#5	8'-2"	—
v ₁	376	#5	3'-4"	—
v ₂	8	#4	12'-5"	—
v ₃	80	#4	12'-5"	—
Concrete Box Culverts			Cu. Yd.	243.2
Reinforcement Bars			Pound	39,740
Membrane Waterproofing System for Buried Structures			Sq. Yd.	235
Furnishing Soldier Piles (HP Section)			Foot	250
Drilling and Setting Soldier Piles (In soil)			Cu. Ft.	740
Untreated Timber Lagging			Sq. Ft.	402
Geocomposite Wall Drain			Sq. Yd.	251
Stud Shear Connectors			Each	104
Bar Splicers			Each	160



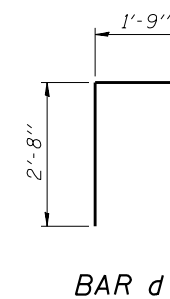
SECTION A-A



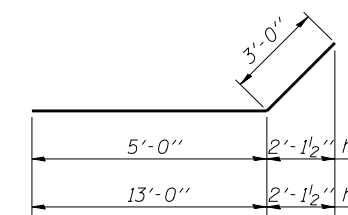
MEMBRANE WATERPROOFING



BAR a



BAR d



BARs h₃ & h₄

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FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL
ILLINOIS DESIGN FIRM NO. IB4-003525

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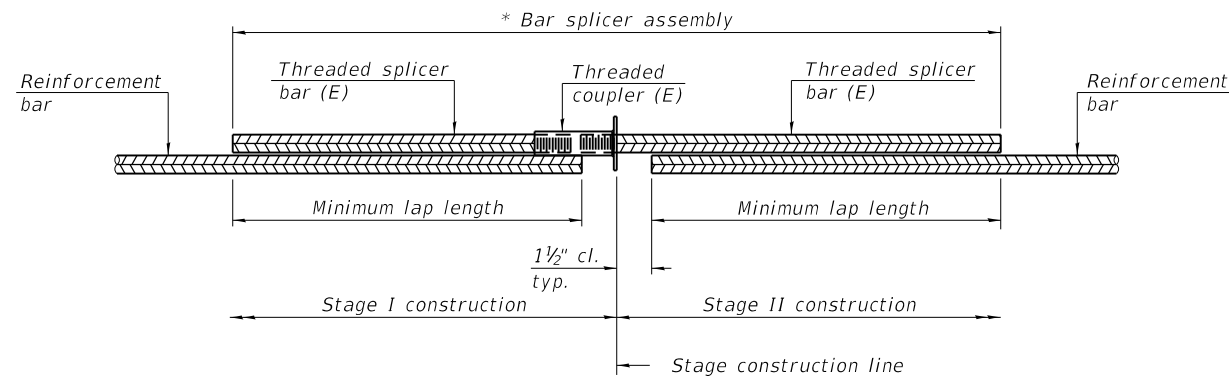
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

CULVERT DETAILS
STRUCTURE NO. 068-2508

SHEET 5 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	117
			CONTRACT NO. 72984	
ILLINOIS FED. AID PROJECT				

FEHR GRAHAM PROJECT NUMBER: 10005-2

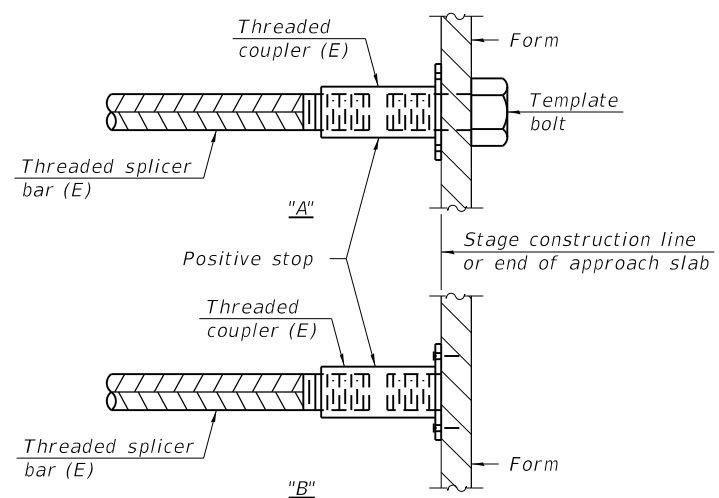


STANDARD BAR SPLICER ASSEMBLY PLAN
 (All components shall be provided from one supplier)

Threaded splicer bar length = min. lap length + 1 1/2" + thread length

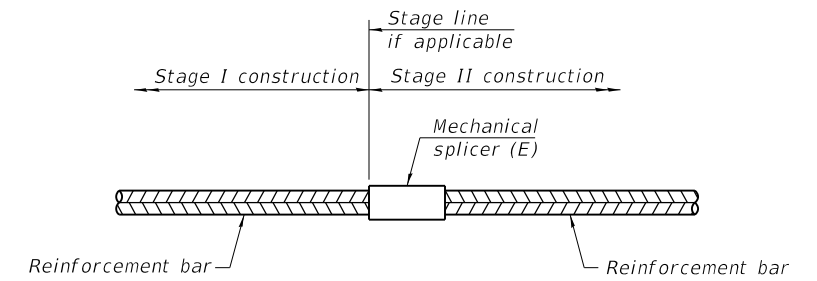
* Epoxy not required on Bar Splicer Assembly components used in conjunction with black bars.

Location	Bar size	No. assemblies required	Minimum lap length
Top Slab	#4	64	1'-5"
Bottom Slab	#4	64	1'-5"
Walls	#6	32	2'-11"



INSTALLATION AND SETTING METHODS

"A" : Set bar splicer assembly by means of a template bolt.
 "B" : Set bar splicer assembly by nailing to wood forms or cementing to steel forms.
 (E) : Indicates epoxy coating.



STANDARD MECHANICAL SPLICER

Location	Bar size	No. assemblies required

Notes:
 Splicer bars shall be deformed with threaded ends and have a minimum 60 ksi yield strength.
 All reinforcement shall be lapped and tied to the splicer bars.
 Bar splicer assemblies shall be epoxy coated according to the requirements for reinforcement bars. See Section 508 of the Standard Specifications.
 See approved list of bar splicer assemblies and mechanical splicers for alternatives.

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BSD-1

1-1-2020



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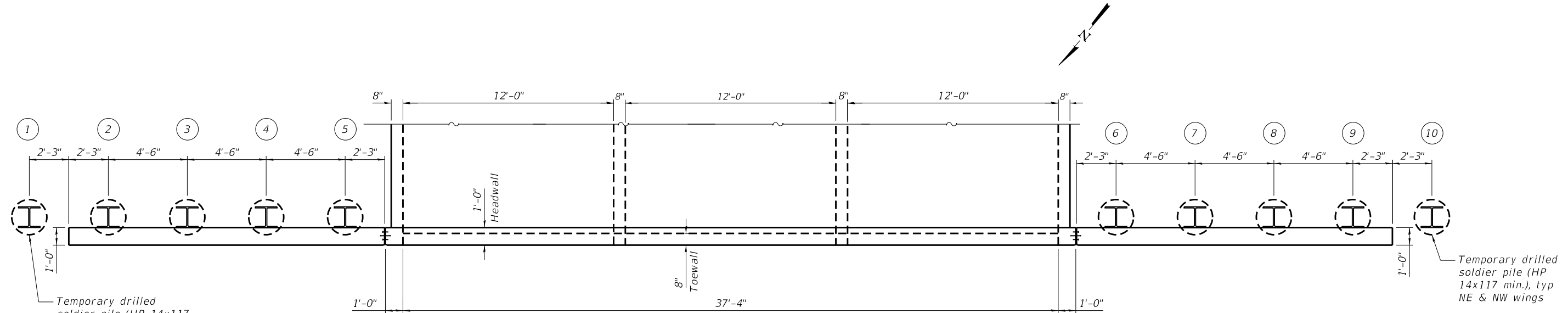
STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

BAR SPLICER ASSEMBLY AND MECHANICAL SPLICER DETAILS
 STRUCTURE NO. 068-2508

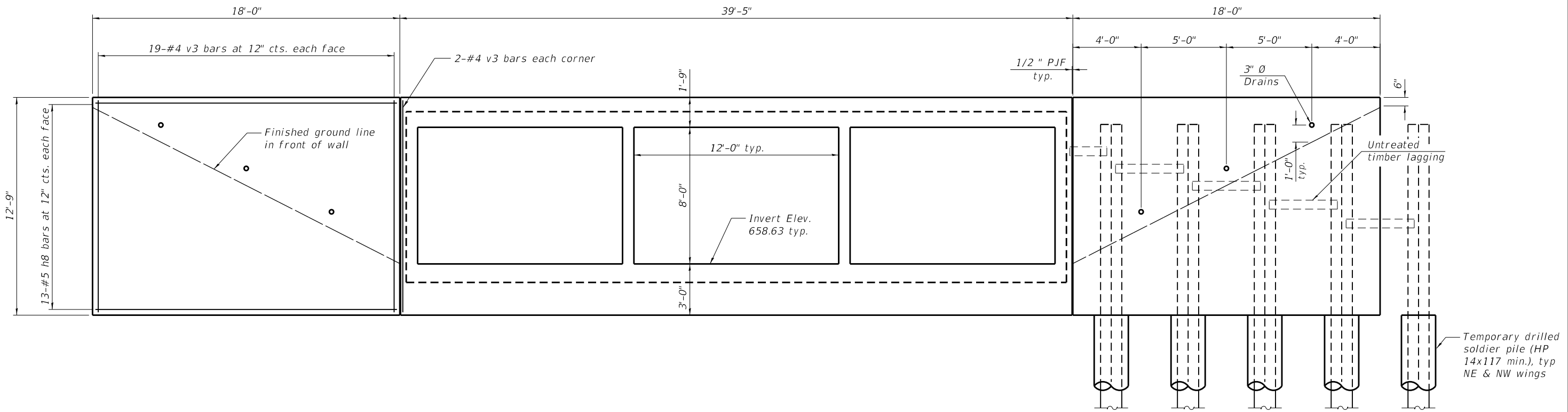
SHEET 6 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	118
			CONTRACT NO. 72984	
ILLINOIS FED. AID PROJECT				

FEHR GRAHAM PROJECT NUMBER: 10005-2



PLAN



SHOWING WINGWALL REINF.

ELEVATION

SHOWING PILES

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FEHR GRAHAM
 ENGINEERING & ENVIRONMENTAL
 ILLINOIS DESIGN FIRM NO. IB4-003525

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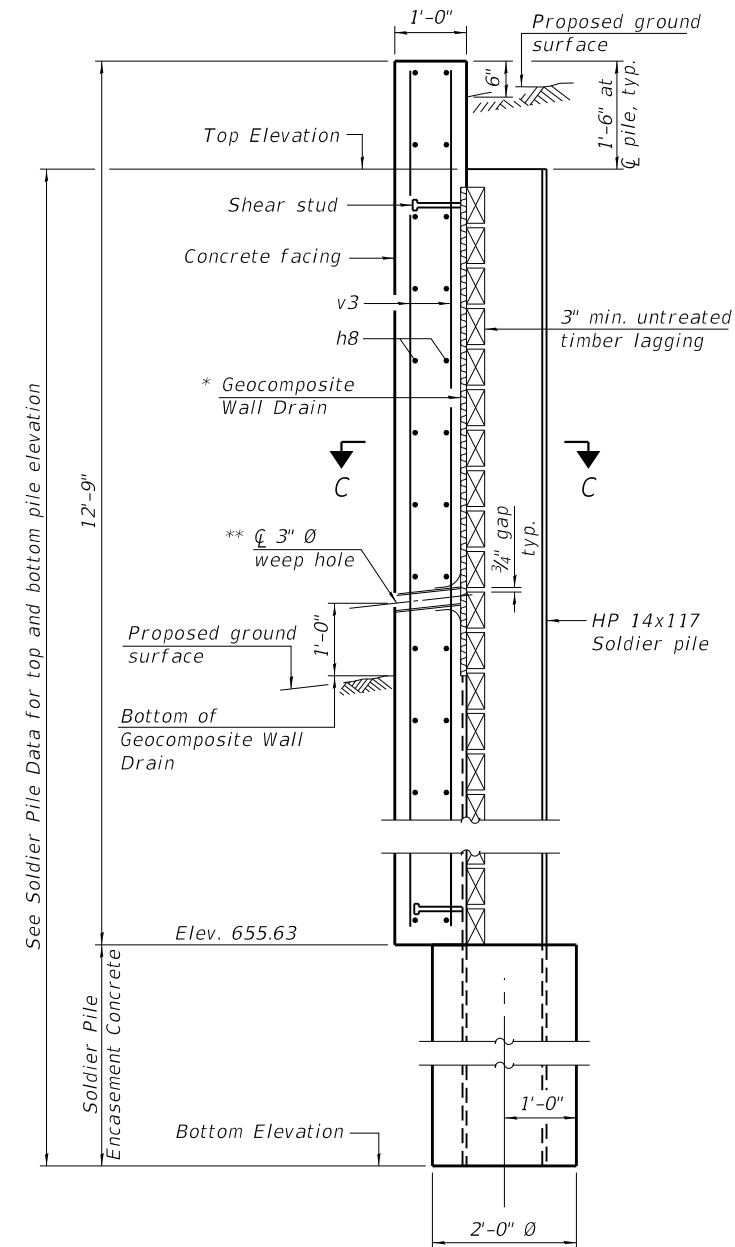
STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

NORTH WINGWALL DETAILS
 STRUCTURE NO. 068-2508

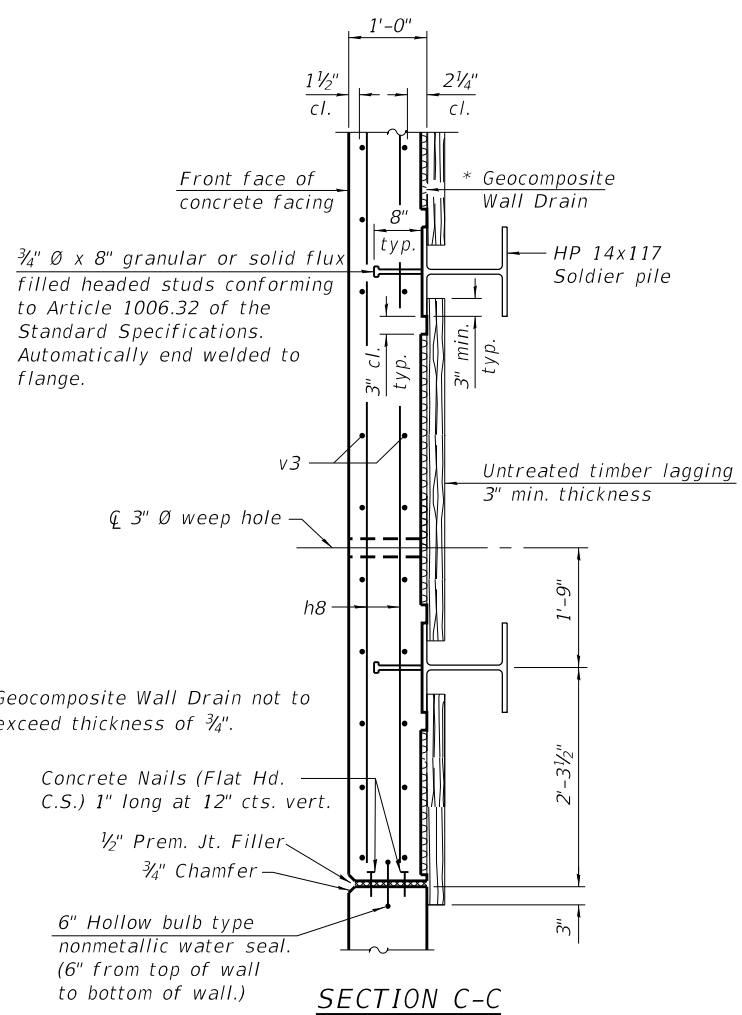
SHEET 7 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	119
CONTRACT NO. 72984				
ILLINOIS FED. AID PROJECT				

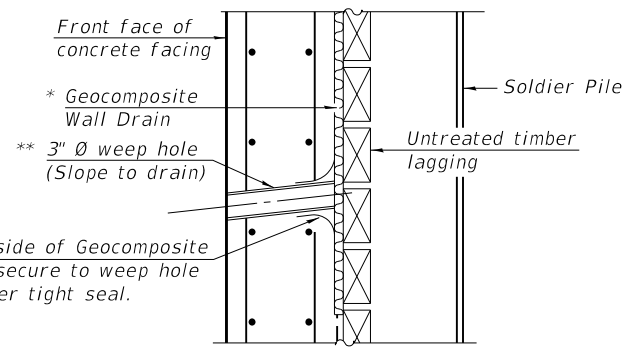
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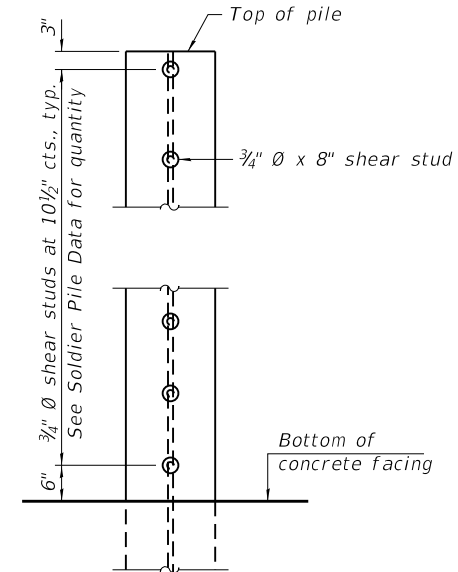
SECTION A-A



SECTION C-C



WEEP HOLE DRAIN DETAIL



SHEAR STUD DETAIL

** Cost of the weep hole drain and connection to the Geocomposite Wall Drain are included in the cost of Concrete Box Culverts.

SOLDIER PILE WINGWALL CONSTRUCTION SEQUENCE

1. Construct concrete box culvert.
2. Drill soldier piles (may be completed prior to completing construction of box culvert).
3. Install timber lagging.
4. Place and compact backfill behind wingwall to top of timber lagging.
5. Install shear stud connectors.
6. Place reinforcement and form concrete wall face.
7. Cast concrete wingwall facing.
8. Remove temporary soldier pile and timber lagging outside limits of the wingwall.
9. Place remainder of backfill to proposed ground surface elevations on both sides of wall (backfill front side of wall as much as possible before backfilling is completed).

Notes:
 The temporary soldier pile is required to facilitate backfilling of the wingwall prior to casting the concrete face. The temporary soldier pile shall conform to the construction requirements for permanent soldier piles except material for the temporary soldier pile may be new or used. After the concrete face has been allowed to cure, the temporary soldier pile shall be removed 2 ft below streambed along with the adjacent timber lagging. Cost of removing and disposing temporary soldier pile and timber lagging shall be included in the cost of Concrete Box Culverts.
 In order to minimize excessive deflection and/or stresses in the soldier piles, compaction equipment used within 4 ft of the back face of the timber lagging shall be limited to lightweight mechanical tampers, rollers, or vibratory systems.
 The Contractor is responsible for the design and performance of the timber lagging using no less than a 3 inch nominal rough-sawn thickness and timber with a minimum allowable bending stress of 1000 psi.

SOLDIER PILE DATA

Soldier Pile	Pile Size	Top Elevation	Bottom Elevation	Total Height (Ft.)	Number of Shear Studs
1	HP 14x117 min.	666.88	635.63	31'-3"	
2	HP 14x117	666.88	635.63	31'-3"	13
3	HP 14x117	666.88	635.63	31'-3"	13
4	HP 14x117	666.88	635.63	31'-3"	13
5	HP 14x117	666.88	635.63	31'-3"	13
6	HP 14x117	666.88	635.63	31'-3"	13
7	HP 14x117	666.88	635.63	31'-3"	13
8	HP 14x117	666.88	635.63	31'-3"	13
9	HP 14x117	666.88	635.63	31'-3"	13
10	HP 14x117 min.	666.88	635.63	31'-3"	

SP-ZS-DETAILS

2-17-2017



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STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

NORTH WINGWALL DETAILS
 STRUCTURE NO. 068-2508

SHEET 8 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	120
CONTRACT NO. 72984				

ILLINOIS FED. AID PROJECT

FEHR GRAHAM PROJECT NUMBER: 10005-2



Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Page 1 of 1

Date 10/28/10

ROUTE FAP 325 DESCRIPTION Culvert carrying IL 16 over Trib to S. Fork of Sangamon River LOGGED BY M. Tappan

SECTION 18(B-2, B-3) LOCATION SW 1/4, SEC. 7, TWP. 10N, RNG. 1W, 3 PM

COUNTY Montgomery DRILLING METHOD HSA HAMMER TYPE 140# Auto

STRUCT. NO. 068-2508
Station 142+95
BORING NO. 1-SE
Station 142+66
Offset 7.0R LT
Ground Surface Elev. 669.0 ft

DEPTH (ft)	BULGE (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)
0											
1											
2	1.1										
2	B										
663.50											
0											
1	0.7										
2	B										
641.50											
0											
1	0.6										
1	B										
658.00											
0											
1	0.9										
2	B										
656.00											
0											
2											
3											
634.00											
0											
2											
3											
634.00											
0											
2											
7											
6											
-20											

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)

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Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Page 1 of 1

Date 10/28/10

ROUTE FAP 325 DESCRIPTION Culvert carrying IL 16 over Trib to S. Fork of Sangamon River LOGGED BY M. Tappan

SECTION 18(B-2, B-3) LOCATION SW 1/4, SEC. 7, TWP. 10N, RNG. 1W, 3 PM

COUNTY Montgomery DRILLING METHOD HSA HAMMER TYPE 140# Auto

STRUCT. NO. 068-2508
Station 142+95
BORING NO. 2-NW
Station 143+25
Offset 6.0R RT
Ground Surface Elev. 669.0 ft

DEPTH (ft)	BULGE (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)	W.O.P. (ft)	W.O.H. (ft)
0											
1											
2	0.9										
2	B										
663.50											
0											
2	0.6										
2	B										
661.00											
0											
1	0.9										
2	B										
641.00											
0											
1	0.5										
1	B										
655.50											
0											
1											
3											
634.00											
0											
2											
4											
6											
8											
7											
-20											

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)

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

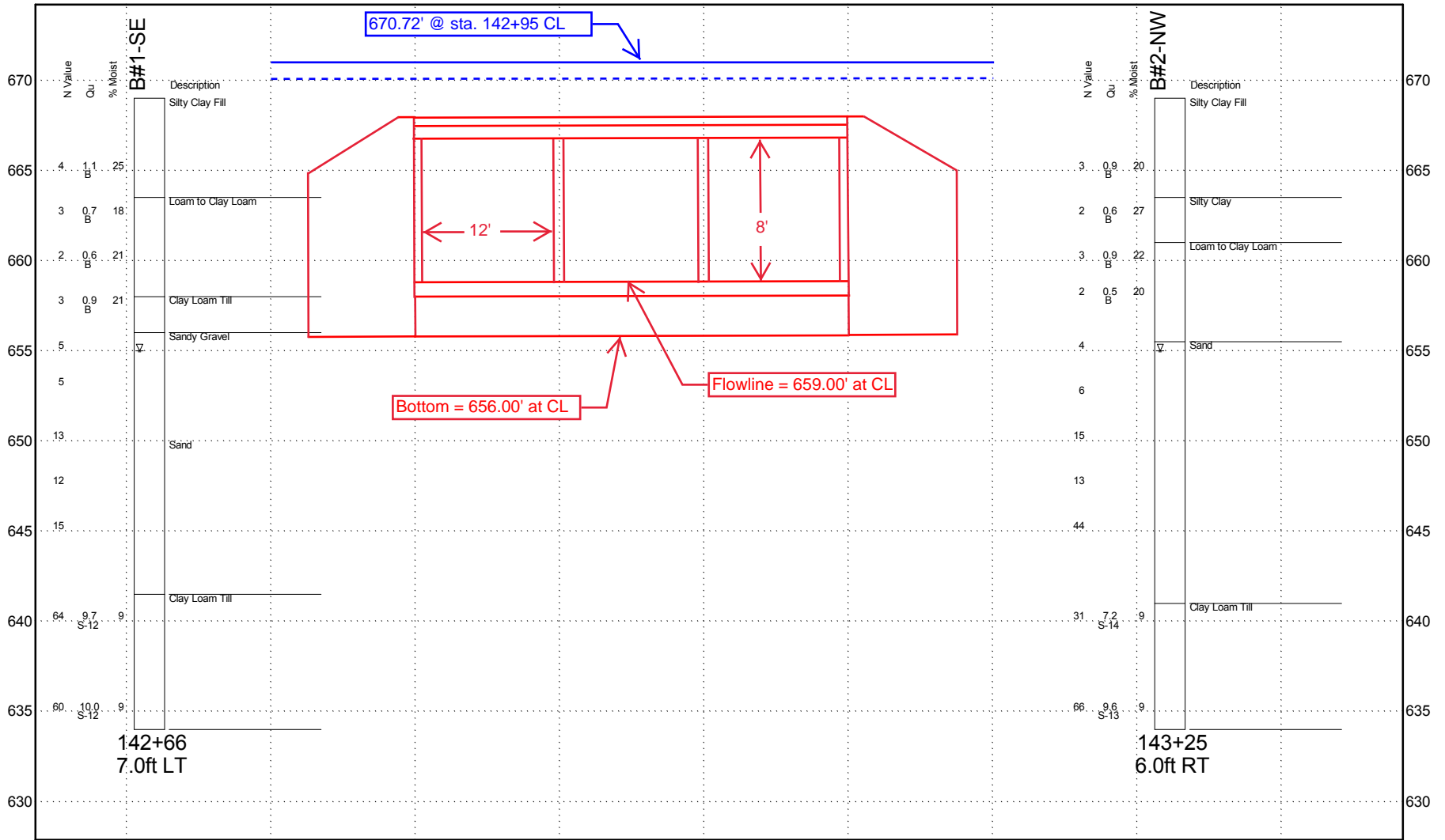
BORING LOGS
STRUCTURE NO. 068-2508

SHEET 9 OF 9 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
325	18(B-2, B-3); 16(CR)	MONTGOMERY	142	121
			CONTRACT NO. 72984	
ILLINOIS FED. AID PROJECT				

FEHR GRAHAM PROJECT NUMBER: 10005-2

Structure Number 068-0508 Culvert carrying IL 16 over Trib to S. Fork of Sangamon River
 Located in the SW 1/4 of Section 7, Township 10N, Range 1W of the 3 P.M.



NOT TO HORIZONTAL SCALE

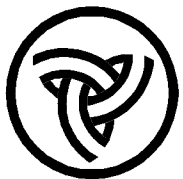
VARIATIONS IN SUBSURFACE
 CONDITIONS MAY EXIST
 BETWEEN BORINGS

Groundwater
 First Encounter
 Completion
 after (refer to log) hours

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

SUBSURFACE DATA PROFILE

Route: FAP 325
 Section: 18(B-2, B-3)
 County: Montgomery



Illinois Department
 of Transportation
 Division of Highways
 IDOT

SUBSURFACE DATA PROFILE 068-0508 IL 16 OVER TRIB TO SOUTH FORK OF SANGAMON RIVER.GPJ D6TEMPLT.GDT 8/13/19

SUBSURFACE DATA PROFILE 068-0508 IL 16 OVER TRIB TO SOUTH FORK OF SANGAMON RIVER.GPJ D6TEMPLT.GDT 8/13/19



SOIL BORING LOG

Date 10/28/10

ROUTE FAP 325 DESCRIPTION Culvert carrying IL 16 over Trib to S. Fork of Sangamon River LOGGED BY M. Tappan

SECTION 18(B-2, B-3) LOCATION SW 1/4, SEC. 7, TWP. 10N, RNG. 1W, 3 PM

COUNTY Montgomery DRILLING METHOD _____ HSA _____ HAMMER TYPE 140# Auto

STRUCT. NO. 068-0508
Station 142+95

BORING NO. 1-SE
Station 142+66
Offset 7.0ft LT
Ground Surface Elev. 669.0 ft

DEPTH H (ft)	BLOW S /6"	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev. _____ ft	Stream Bed Elev. _____ ft	DEPTH H (ft)	BLOW S /6"	UCS Qu (tsf)	MOIST T (%)
				660.5	659.4				
				Groundwater Elev.:					
				▽ First Encounter _____ ft					
				▽ Upon Completion _____ ft					
				▽ After _____ Hrs. _____ ft					
				Washed					
				Gray Wet Med SANDY GRAVEL			2		
				FREE WATER (continued)			6		
				Gray Coarse SANDY GRAVEL			6		
				Washed			7		
	1						6		
	2	1.1	25				9		
	-5	B				-25			
				663.50					
				Brown and Gray Moist LOAM to CLAY LOAM					
	0								
	1	0.7	18						
	2	B							
				641.50					
				Gray Moist CLAY LOAM (Till)			7		
	0			Washed			21	9.7	9
	1	0.6	21				43	S-12	
	-10	B				-30			
				658.00					
				Brown and Olive Gray Moist CLAY LOAM (Till)					
	0								
	1	0.9	21						
	2	B							
				656.00					
				Gray Wet Med SANDY GRAVEL					
	0			FREE WATER			7		
	2						21	10.0	9
	3						39	S-12	
	-15								
				634.00		-35			
	0			Boring Complete					
	2								
	3								
	2								
	7								
	6								
	-20					-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)

GRANULAR CULVERT BACKFILL 6M6 10/15/13

This work consists of backfilling box culverts or three-sided structures with granular materials. This work shall be performed at locations shown on the plans or as directed by the Engineer.

Backfilling shall be performed according to Article 502.10. The backfill material shall meet the requirements of Article 1004.05, except the gradation shall be CA-06 or CA-10. This work satisfies select granular backfill (porous granular material) requirements of ASTM C 1577.

Granular Culvert Backfill will be measured for payment in cubic yards compacted in place. Additional material required to backfill excavation outside the limits shown on the plans will not be measured for payment. This work shall be paid for at the contract unit price per cubic yard for GRANULAR CULVERT BACKFILL.

ROCKFILL - FOUNDATION 6M10 6/15/17

This work consists of constructing a layer of rockfill below culverts or spread footings having unstable or unsuitable soil conditions. When shown on the plans, the rockfill limits and thickness shall be confirmed by the Engineer prior to excavating below the theoretical top of rockfill line.

Rockfill materials shall meet the requirements of Article 1005.01 of the Standard Specifications. The gradation of rockfill shall be primary crusher run. The maximum dimension shall be 8 inches. Rockfill may contain broken pavement or rock excavation as defined in Article 205.04 and with the approval of the Engineer.

Materials shall meet the requirements of the following Articles of the Standard Specifications:

Bedding or Capping Material 1003.04 or 1004.05

The method of rockfill placement shall be approved by the Engineer. Rockfill shall be capped according to application as shown below:

Spread Footing	4 to 6 inches CA-6
Cast-In-Place Box Culverts	4 to 6 inches CA-7 or CA-11
Pre-Cast Box Culverts	Porous Granular Bedding Material (Article 540.02)
Pre-Cast Pipe Culverts	Coarse or Fine Aggregate Bedding (Article 542.04)

Excavation shall be performed according to Section 202 of the Standard Specifications.

In spread footing applications, the CA-6 cap shall be compacted to the satisfaction of the Engineer. No compaction of rockfill is required for culvert applications.

This work will be measured and paid for at the contract unit price per ton for ROCKFILL - FOUNDATION. The contract price for ROCKFILL-FOUNDATION shall include excavation, aggregate materials, aggregate material placement, and placement of excavated materials within right-of-way or disposal off right-of-way. *Excavation will not be measured or paid for separately or as part of EARTH EXCAVATION.* For precast concrete box culverts, porous granular bedding material and the excavation volume required for bedding will be paid for according to Article 540.08. For pipe culverts, the aggregate bedding material and excavation volume required for the aggregate bedding material will be paid for according to Article 542.11.