Bridge Preliminary Design Report
Addendum

SR-823 over Norfolk Southern Tracks & US-23
SCI-823-1601

SCI-823-10.13
PID No. 79977

Prepared for

Ohio Department of Transportation

May 2011

CH2MHILL

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1. Introduction

Per the agreed upon scope of services, CH2M HILL was tasked with addressing all review comments pertaining to the Preliminary Bridge Design Reports that were submitted to ODOT in November 2007. This addendum addresses two review comments in particular that required additional engineering investigation by CH2M HILL. One review comment was related to studying the lengths of the three bridges crossing the Norfolk Southern Tracks and confirming that the proposed bridges were ending at a location in which the cost of supporting the roadway on an MSE wall was more expensive than supporting the roadway with a bridge. The second review comment was related to investigating the feasibility and cost associated with supporting the proposed bridge piers on drilled shafts rather than steel H-piles as was originally proposed in the Preliminary Bridge Design Report.

2. Design Requirements / Specifications

All structural design on this project has been done in accordance with both the AASHTO Standard Design Specifications (LFD) and the 2004 ODOT Bridge Design Manual (LFD). Per an email received from ODOT on October 14, 2010, LFD will continue to be used on this project. Specifically, the guidelines for seismic design loading in section 301.4.3 of the ODOT BDM have been followed. As such no seismic design loading has been included in the design or analysis of the proposed drilled shafts which are discussed in this document. All design criteria as stated in the Bridge Preliminary Design Report remains accurate.

3. MSE Wall / Bridge Length Optimization Study

In order to study the optimal location to end the bridge and use an MSE wall to support the abutments, CH2M HILL assumed the cost of MSE wall's to be $135 per square foot. This assumed unit wall cost was considered to be a conservative value as ODOT had provided CH2M HILL with unit wall costs of $95 per square foot for wall heights less than or equal to 30' and $135 per square foot for wall heights greater than 30'. These two assumed unit prices were supplied to CH2M HILL by ODOT in an e-mail received on July 12, 2010. It was assumed that the unit prices included excavation, embankment, concrete leveling pads, precast panels and straps, drainage conduit, granular backfill, concrete coping cap on top of wall, and sealing of concrete surfaces. Due to the fact that the SR-823 profile has a downgrade of -3.0%, CH2M HILL determined by inspection that increasing the length of the rear end span is not desirable. That decision is based on the fact that lengthening the rear end span of the bridge will increase bridge length and bridge cost, and it will also increase both the required wall height and wall cost of MSE Wall 6.

In order to investigate the economical impacts of lengthening the forward end span and adjusting the location of MSE Wall 3, CH2M HILL calculated both the Total Initial Unit Cost of Bridge and Total Unit Cost of Bridge Including Life Cycle Cost. Those unit costs were $10,274 per linear foot of bridge and $18,311 per linear foot of bridge respectively. Next, CH2M HILL calculated the reduction in wall area that would be provided if the forward end span was lengthened by 33.33' thus reducing the maximum wall height by 1' (due to the -3.0% downgrade of the roadway profile). Lowering the top of MSE Wall 3 by 1' results in a reduction of total wall area by approximately 188 SF, and the total cost of MSE Wall 3 would be reduced by approximately $25,400 (188 SF x $135/SF). However, the bridge length

would need to be lengthened by 33.33' in order to achieve that 1' wall height reduction, and the total initial cost of the bridge would increase by $342,400 (33.33' x $10,274 / LF) while the total cost of the bridge including life cycle would increase by $610,300 (33.33' x $18,311 / LF). Therefore, it was concluded that it was not cost effective to increase the length of the forward end span, and that the location of the forward abutment and MSE Wall 3 would remain as originally proposed in the November 2007 Preliminary Bridge Design Report. Detailed cost estimates and sketches that were created to derive the above mentioned unit costs can be found in the "MSE Wall / Bridge Cost Comparison Study" attachment.

4. Drilled Shaft Pier Foundation Study

The feasibility and cost of supporting the piers on drilled shafts was performed as part of this Preliminary Bridge Design Report Addendum. The cost and constructability of drilled shaft supported piers was then compared to that of pile supported piers. Two drilled shaft supported pier options were investigated. The first option was a 5-shaft option and the second option was a 4-shaft option. The 5-shaft option consists of 54" diameter drilled shafts in soil connected to 48" diameter drilled shafts in bedrock. The length of the 48" diameter drilled shaft in bedrock will be approximately 13.5'. The 5-shaft option places one drilled shaft directly below each pier column. The 4-shaft option consists of 60" diameter drilled shafts in soil connected to 54" diameter drilled shafts in bedrock. The length of the 54" diameter drilled shaft in bedrock will be approximately 13.5'. The 4-shaft option places 4 drilled shafts below a cap beam which then supports the 5 pier columns. The size of the steel piles that were originally proposed in the Preliminary Bridge Design Report was HP 12x53, and the estimated length of those piles was 15' at Pier 1 and 25' at Pier 2. Essentially six factors were considered when determining the recommended foundation support for the piers. Those six factors were redundancy, the need for temporary shoring, the effect on the NSRR, the effect on U.S. 23, cost, and the need for additional rock cores being required. A comparison matrix of those 6 factors is shown in Table 1.

Table 1: Foundation System Comparison

	Pile Option	5-Shaft Option	4-Shaft Option
Redundancy	Yes	Yes	Yes
Temporary Shoring	Yes	Minimal	Minimal
Effect on NSRR	Greatest due to shoring and potential for tiebacks	Reduced, but some shoring required	Minimal, may be possible to eliminate shoring
Effect on U.S. 23	Greatest due to shoring and size of footing	Reduced, but some shoring required	Minimal, may be possible to eliminate shoring
Cost *	$217,000	$218,000	$273,000
Additional Rock Cores Required	No	Yes	Yes

*The cost provided represents the estimated cost associated with constructing Pier 2 only.

The difference in estimated cost for supporting the two piers on 5 drilled shafts as opposed to steel H-piles is negligible. However, the 5-shaft option does minimize impacts on both the Norfolk Southern railroad and U.S. 23. Furthermore, the 5-shaft option requires minimal temporary shoring. Due to these reasons and the negligible cost difference between the pile option and the 5-shaft option, CH2M HILL recommends that each pier be supported on 5 drilled shafts (one drilled shaft below each pier column).

5. Cost Estimate

Table 2: Opinion of Probable Construction Cost

	Updated costs for bridge proposed in the November 2007 Preliminary Design Report (123'-144.83'-97.42')
Bridge Cost (initial)	$2,640,503
Bridge Life Cycle Cost	$2,935,520
Bridge Cost (initial plus life cycle)	$5,576,023
Wall Cost (1)	$1,189,543
Total Cost	$6,765,565

(1) Cost shown is Combined Cost of MSE Walls 3 & 6.

The updated cost for the bridge and MSE Walls 3 & 6 is presented in Table 2. The updated detailed bridge cost estimate is included as an attachment to this addendum. CH2M HILL established all unit prices for the cost estimate by using ODOT's online CMS portal and then working with ODOT estimating staff to verify all estimated unit prices. All comments and revisions that were received from ODOT estimating staff were incorporated into the unit prices.

6. Recommendations:

Based upon the studies and cost estimates completed it is recommended that:

1. The preferred alternative recommended in the November 2007 Bridge Preliminary Design Report not be changed. It is recommended that the preferred alternative remain a three span steel plate girder bridge with spans of 123'-144.83'-97.42'.
2. The deep foundations recommendation be revised from steel H-piles to five drilled shafts socketed into rock.
3. Additional rock cores be taken at both pier locations in order to complete final drilled shaft design.

SCI-823-1601: SR-823 OVER US-23 & NSRR -- COST SUMMARY OF ORIGINALLY PROPOSED BRIDGE (123' - 144.83' - 97.42')

Total Length of Originally Proposed Bridge (Along Ramp BL) = 365.25'

COSTS FOR BRIDGE PAY ITEMS THAT VARY WITH BRIDGE LENGTH

	Description	Unit Cost	Unit	Quantity	Cost
BRIDGE SUPERSTRUCTURE	QC/QA Concrete, Class QSC2, Superstructure (Parapet):	$540.00	CY	117.4	$63,396
	QC/QA Concrete, Class QSC2, Superstructure:	$550.00	CY	699.5	$384,725
	Epoxy Coated Reinforcing Steel (superstructure):	$1.10	LB	232,817	$256,099
	Structural Steel Members, Level 5:	$1.50	LB	800,000	$1,200,000
	Subtotal of Costs That Vary With Bridge Length				$1,904,220
	Structure Incidental Cost (Note 1)			16%	$304,675
	Contingency			20%	$441,779
	Total Cost For Pay Items That Vary With Bridge Length				**$2,650,674**
	Unit Cost For Bridge Pay Items That Vary With Bridge Length ($/ft)				*$7,257*

COSTS FOR BRIDGE PAY ITEMS THAT ARE NOT DEPENDENT UPON BRIDGE LENGTH

	Description	Unit Cost	Unit	Quantity	Cost
APPROACH SLAB	QC/QA Concrete, Class QSC2, Superstructure (Approach Slab), (T=17"), As Per Plan	$225.00	SY	440	$99,000
ABUTMENTS	QC/QA Concrete, Class QSC1, Substructure:	$570.00	CY	316	$180,120
	Epoxy Coated Reinforcing Steel (substructure):	$1.10	LB	28,440	$31,284
	Steel Piles HP12x53, Furnished:	$25.00	FT	2500	$62,500
	Steel Piles HP12x53, Driven:	$13.00	FT	2300	$29,900
	Steel Piles HP14x73, Furnished:	$35.00	FT	0	$0
	Steel Piles HP14x73, Driven:	$13.00	FT	0	$0
	Subtotal of Costs That Are Not Dependent Upon Bridge Length				$402,804
	Structure Incidental Cost (Note 1)			16%	$64,449
	Contingency			20%	$93,451
	Total Cost For Pay Items That Are Not Dependent Upon Bridge Length				**$560,704**

COSTS FOR BRIDGE PAY ITEMS THAT MAY VARY WITH BRIDGE LENGTH

	Description	Unit Cost	Unit	Quantity	Cost
PIER 1	QC/QA Concrete, Class QSC1, Substructure:	$570.00	CY	189.9	$108,243
	Epoxy Coated Reinforcing Steel (substructure):	$1.10	LB	23737.5	$26,111
	Steel Piles HP12x53, Furnished:	$25.00	FT	880	$22,000
	Steel Piles HP12x53, Driven:	$13.00	FT	660	$8,580
	Steel Piles HP14x73, Furnished:	$35.00	FT	0	$0
	Steel Piles HP14x73, Driven:	$13.00	FT	0	$0
	Cofferdams and Excavation Bracing:	$15.00	SF	4540	$68,100
	Subtotal of Pier 1 Cost				$233,034
	Structure Incidental Cost (Note 1)			16%	$37,285
	Contingency			20%	$54,064
	Total Cost for Pier 1				**$324,383**
PIER 2	QC/QA Concrete, Class QSC1, Substructure:	$570.00	CY	153.2	$87,324
	Epoxy Coated Reinforcing Steel (substructure):	$1.10	LB	19150	$21,065
	Steel Piles HP12x53, Furnished:	$25.00	FT	1320	$33,000
	Steel Piles HP12x53, Driven:	$13.00	FT	1100	$14,300
	Steel Piles HP14x73, Furnished:	$35.00	FT	0	$0
	Steel Piles HP14x73, Driven:	$13.00	FT	0	$0
	Cofferdams and Excavation Bracing:	$15.00	SF	0	$0
	Subtotal of Pier 2 Cost				$155,689
	Structure Incidental Cost (Note 1)			16%	$24,910
	Contingency			20%	$36,120
	Total Cost for Pier 2				**$216,719**
	Total Cost For Pay Items That May Vary With Bridge Length				**$541,102**
	Approximate Cost of Each Additional Pier (If Required To Accommodate New Bridge Length)				*$270,551*

LIFE CYCLE COSTS FOR BRIDGE, ITEMS THAT VARY WITH BRIDGE LENGTH

	Description	Unit Cost	Unit	Quantity	Cost
	Structural Expansion Joint Including Elastomeric Strip Seal:	$375.00	FT	132	$49,500
	Paint weathering steel plate girders (prep, prime, intermediate, final coats):	$14.00	SF	91,078	$1,275,092
	Superplasticized Dense Concrete Overlay Using Hydrodemolition:	$95.00	SY	5,142	$488,490
	Full Depth Repair:	$23.61	SF	2,314	$54,634
	Portions of Structure Removed, As Per Plan (for deck removal):	$15.00	SF	24,239	$363,585
	QC/QA Concrete, Class QSC2, Superstructure (Parapet):	$540.00	CY	117.4	$63,396
	QC/QA Concrete, Class QSC2, Superstructure:	$550.00	SY	699.5	$384,725
	Epoxy Coated Reinforcing Steel (superstructure):	$1.10	LB	232,817	$256,099
	Total Life Cycle Cost for Originally Proposed Bridge				**$2,935,521**
	Unit Cost For Bridge Life Cycle Costs That Vary With Bridge Length ($/ft)				*$8,037*

CH2MHILL

SUBJECT SCI-823-1601
SR-823 OVER NSRR & US-23
BRIDGE VS MSE WALL STUDY

BY DGS

SHEET NO. 2 of

DATE

PROJECT NO.

TOTAL INITIAL UNIT COST OF BRIDGE = $\frac{\$2,650,674 + \$560,704 + \$541,102}{365.25'} = \$10,274/LF$

TOTAL UNIT COST OF BRIDGE INCLUDING LIFE CYCLY COST = $\frac{\$2,650,674 + \$560,704 + \$541,102 + \$2,935,521}{365.25}$

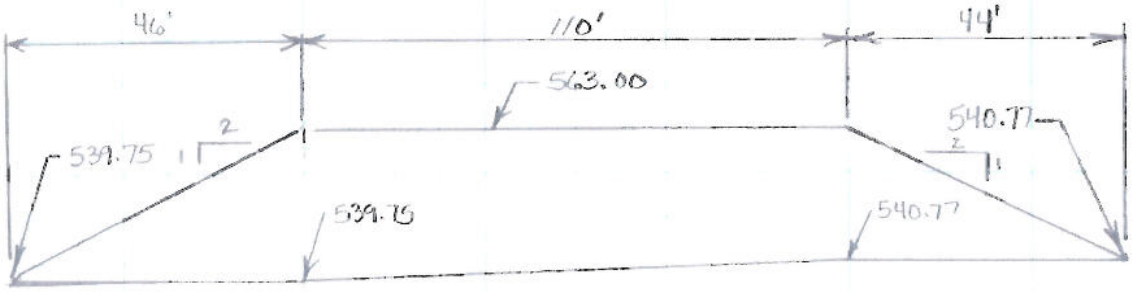
$= \$18,311/LF$

- REAR ABUTMENT W/ MSE WALL 6:

SR-823 PROFILE HAS A DOWNGRADE OF -3.0% (IN DIRECTION OF STATIONING). BY INSPECTION IT IS APPARENT THAT INCREASING THE LENGTH OF SPAN 1 IS NOT DESIRABLE. BECAUSE DOING SO WILL INCREASE BRIDGE LENGTH & BRIDGE COST AND AT THE SAME TIME INCREASE BOTH HEIGHT & COST OF MSE WALL 6.

- FWD. ABUTMENT W/ MSE WALL 3:

ORIGINALLY PROPOSED ELEV. OF WALL 3:



APPROX. WALL AREA = $\frac{1}{2}\left(46' \times (563.00 - 539.75)\right) = 534.8\ FT^2$

$\frac{(563 - 539.75) + (563 - 540.77)}{2}(110') = 2501.4\ FT^2$

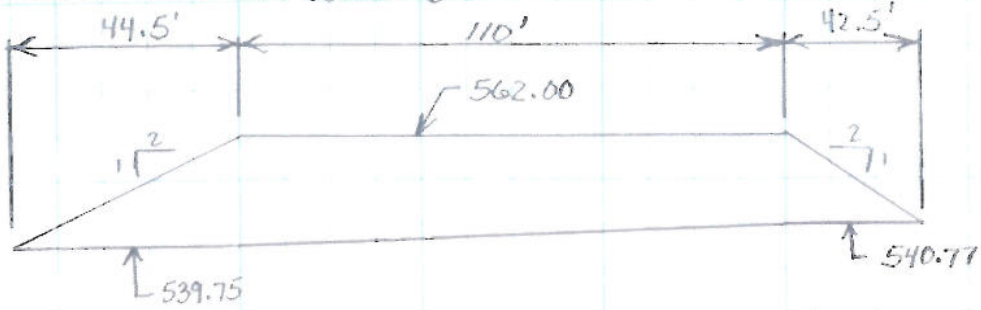
$\frac{1}{2}\left(44' \times (563.00 - 540.77)\right) = 489.1\ FT^2$

TOTAL APPROX. WALL AREA = $3525.3\ FT^2$

THE 3% DOWNGRADE MEANS THAT IF BRIDGE IS LENGTHENED BY 33.33' THE TOP OF WALL WOULD BE 1' LOWER. SEE NEXT SHEET FOR REVISED WALL ELEV. & CORRESPONDING REDUCTION IN WALL AREA.

- FWD. ABUTMENT W/ MSE WALL 3 (cont.):

REVISED ELEV. OF WALL 3:



APPROX. WALL AREA = $\frac{1}{2}(44.5' \times (562 - 539.75))$ = 495.1 FT²

$\frac{(562-539.75)+(562-540.77)}{2}(110')$ = 2391.4 FT²

$\frac{1}{2}(42.5' \times (562 - 540.77))$ = 451.1 FT²

TOTAL APPROX. WALL AREA = 3337.6 FT²

∴ INCREASING BRIDGE LENGTH BY 33.33' WOULD RESULT IN APPROXIMATELY 187.7 FT² (3525.3 - 3337.6) REDUCTION IN WALL AREA.

CONSERVATIVELY ASSUME WALL COST = $135/SF

WALL PRICE WOULD DECREASE BY $25,400

HOWEVER BRIDGE BID PRICE WOULD INCREASE BY:

(SEE SHEET 2)
$10,274/LF x 33.33' = $342,400

& BRIDGE COST INCLUDING LIFE CYCLE WOULD INCREASE BY:

(SEE SHEET 2)
$18,311/LF x 33.33' = $610,300

CONCLUDE THAT IT IS NOT COST EFFECTIVE TO INCREASE THE LENGTH OF SPAN 3. LEAVE MSE WALL 3 & FWD. ABUTMENT AT ORIGINALLY PROPOSED LOCATION.

SCI-823-1601: SR-823 over NSRR and U.S. 23
DETAILED COST ESTIMATE

Alternative A: 365.25' Bridge (123'-144.83'-97.42') proposed in Bridge Preliminary Design Report (Nov. 2007) with pile supported piers
Alternative B: 365.25' Bridge (123'-144.83'-97.42') with Each Pier Column Supported by Drilled Shaft. A Total of Five Drilled Shafts per Pier.
Alternative C: 365.25' Bridge (123'-144.83'-97.42') using a Grade Beam and Four Drilled Shafts at each Pier.

Description	Unit Cost	Unit	Alternative A		**Alternative B**		Alternative C	
			Quantity	Cost	**Quantity**	**Cost**	Quantity	Cost
QC/QA Concrete, Class QSC2, Superstructure (Parapet):	$540.00	CY	117.4	$63,396	**117.4**	**$63,396**	117.4	$63,396
QC/QA Concrete, Class QSC2, Superstructure:	$550.00	CY	699.5	$384,725	**699.5**	**$384,725**	699.5	$384,725
QC/QA Concrete, Class QSC2, Superstructure (Approach Slab), (T=17"), As Per Plan	$225.00	SY	440	$99,000	**440**	**$99,000**	440	$99,000
QC/QA Concrete, Class QSC1, Substructure:	$570.00	CY	659.1	$375,687	**543.1**	**$309,567**	695.8	$396,606
Epoxy Coated Reinforcing Steel (superstructure):	$1.10	LB	232,817	$256,099	**232,817**	**$256,099**	232,817	$256,099
Epoxy Coated Reinforcing Steel (substructure):	$1.10	LB	71,328	$78,461	**56,828**	**$62,511**	75,915	$83,507
Structural Steel Members, Level 5:	$1.50	LB	800,000	$1,200,000	**800,000**	**$1,200,000**	800,000	$1,200,000
Steel Piles HP12x53, Furnished:	$25.00	FT	4,700	$117,500	**2,500**	**$62,500**	2,500	$62,500
Steel Piles HP12x53, Driven:	$13.00	FT	4,060	$52,780	**2,300**	**$29,900**	2,300	$29,900
Steel Piles HP14x73, Furnished:	$35.00	FT		$0		**$0**		$0
Steel Piles HP14x73, Driven:	$13.00	FT		$0		**$0**		$0
Drilled Shafts, 42" Diameter, Above Bedrock:	$230.00	FT		$0		**$0**		$0
Drilled Shafts, 48" Diameter, Above Bedrock:	$286.00	FT		$0		**$0**		$0
Drilled Shafts, 54" Diameter, Above Bedrock:	$377.00	FT		$0	**265**	**$99,905**		$0
Drilled Shafts, 60" Diameter, Above Bedrock:	$400.00	FT		$0		**$0**	212	$84,800
Drilled Shafts, 66" Diameter, Above Bedrock:	$782.00	FT		$0		**$0**		$0
Drilled Shafts, 72" Diameter, Above Bedrock:	$670.00	FT		$0		**$0**		$0
Drilled Shafts, 78" Diameter, Above Bedrock:	$670.00	FT		$0		**$0**		$0
Drilled Shafts, 84" Diameter, Above Bedrock, As per Plan:	$985.00	FT		$0		**$0**		$0
Drilled Shafts, 42" Diameter, Into Bedrock:	$416.00	FT		$0		**$0**		$0
Drilled Shafts, 48" Diameter, Into Bedrock:	$540.00	FT		$0	**135**	**$72,900**		$0
Drilled Shafts, 54" Diameter, Into Bedrock:	$616.00	FT		$0		**$0**	108	$66,528
Drilled Shafts, 60" Diameter, Into Bedrock:	$746.00	FT		$0		**$0**		$0
Drilled Shafts, 66" Diameter, Into Bedrock:	$1,190.00	FT		$0		**$0**		$0
Drilled Shafts, 72" Diameter, Into Bedrock:	$1,634.00	FT		$0		**$0**		$0
Drilled Shafts, 78" Diameter, Into Bedrock:	$2,300.00	FT		$0		**$0**		$0
Drilled Shafts, 84" Diameter, Into Bedrock:	$2,900.00	FT		$0		**$0**		$0
Cofferdams and Excavation Bracing:	$15.00	SF	4,540	$68,100		**$0**		$0
Structure Incidental Cost (Note 1)	16%			$0		**$0**		$0
Contingency	20%			$0		**$0**		$0
TOTAL INITIAL BRIDGE COST				**$2,695,748**		**$2,640,503**		**$2,727,060**
LIFE CYCLE COSTS:								
Structural Expansion Joint Including Elastomeric Strip Seal:	$375.00	FT	132	$49,500	**132**	**$49,500**	132	$49,500
Paint weathering steel plate girders (prep, prime, intermediate, final coats):	$14.00	SF	91,078	$1,275,092	**91,078**	**$1,275,092**	91,078	$1,275,092
Superplasticized Dense Concrete Overlay Using Hydrodemolition:	$95.00	SY	5,142	$488,490	**5,142**	**$488,490**	5,142	$488,490
Full Depth Repair:	$23.61	SF	2,314	$54,634	**2,314**	**$54,634**	2,314	$54,634
Portions of Structure Removed, As Per Plan (for deck removal):	$15.00	SF	24,239	$363,585	**24,239**	**$363,585**	24,239	$363,585
QC/QA Concrete, Class QSC2, Superstructure (Parapet):	$540.00	CY	117.4	$63,396	**117.4**	**$63,396**	117.4	$63,396
QC/QA Concrete, Class QSC2, Superstructure:	$550.00	SY	699.5	$384,725	**699.5**	**$384,725**	699.5	$384,725
Epoxy Coated Reinforcing Steel (superstructure):	$1.10	LB	232,817	$256,099	**232,817**	**$256,099**	232,817	$256,099
TOTAL LIFE CYCLE COST				**$2,935,520**		**$2,935,520**		**$2,935,520**
TOTAL RELATIVE OWNERSHIP COST				**$5,631,268**		**$5,576,023**		**$5,662,580**
MSE WALL 3								
MSE Wall (wall height greater than 30 ft)	$135.00	SF		$0	**0**	**$0**	0	$0
MSE Wall (wall height less than or equal to 30 ft)	$95.00	SF	3,667	$348,365	**3,667**	**$348,365**	3,667	$348,365
Ground Improvement	$257,000	LUMP	1	$257,000	**1**	**$257,000**	1	$257,000
Contigency	15%			$90,805		**$90,805**		$90,805
TOTAL COST OF MSE WALL 3				**$696,170**		**$696,170**		**$696,170**
MSE WALL 6								
MSE Wall (wall height greater than 30 ft)	$135.00	SF		$0	**0**	**$0**	0	$0
MSE Wall (wall height less than or equal to 30 ft)	$95.00	SF	4,516	$429,020	**4,516**	**$429,020**	4,516	$429,020
Contigency	15%			$64,353		**$64,353**		$64,353
TOTAL COST OF MSE WALL 6				**$493,373**		**$493,373**		**$493,373**
TOTAL RELATIVE OWNERSHIP COST OF BRIDGE PLUS COST OF MSE WALLS 3 & 6				**$6,820,810**		**$6,765,565**		**$6,852,123**

Notes:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill & drainage pipe, sealing of concrete surfaces, falsework bents, bearings, (minor) temporary shoring, crushed aggregate slope protection, pile driving equipment mobilization, shear connectors, settlement platforms, expansion joints, joint sealers, and joint fillers costs.

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June 18, 2008

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Bridges and Structures
Norfolk Southern Corporation
1200 Peachtree St.
Atlanta, GA 30309

Lucasville, OH **SR 823/US 23 Interchange Bridges over Norfolk Southern**
ODOT Project SCI-823-10.13, PID 79977
MP N-618.49 **File BR0086615 / 117-29408**

Dear Ms. Moore:

On June 5, 2008, a site visit was made to the location of the three proposed SR 823/US 23 interchange bridges over the Norfolk Southern double main tracks north of Lucasville, OH. The following are comments made using the plans provided on May 22, 2008. Our comments are as follows:

1. Within the project limits along the railroad, there are no visible railroad utilities, the pole line has been removed, and there are no advertising billboards present on railroad property.

2. At the location of the Ramp "B" overhead bridge, Railroad Station 580+50, there is currently a private grade crossing. This crossing has a 16-foot wide, timber and asphalt type surface. The asphalt has generally been removed in the area of the track, and replaced by ballast. The crossing has a post and chain closure on the east side of the tracks secured by a non-railroad lock. There is a note indicating that the existing drive is to be removed. This crossing should be removed as part of the project once construction begins.

3. Near the grade crossing under proposed Ramp "B", the main track drainage is along the east side of the track. This ditch catches water draining along the farm road, toward the crossing. After the crossing is removed, the ditch along the tracks should be improved by the removal of the old roadway, and the ditch should be continuous.

4. Proposed Channel No. 2, which is south of the Ramp "B" area, is shown as a new ditch from Fairgrounds Road curving under the Ramp "B" structure and flowing into the existing Norfolk Southern ditch near Railroad Station 582+00. This water would then flow north toward the existing concrete culvert under the railroad at Railroad Station 585+70. There is no improvement shown for the existing railroad ditch between Railroad Station 582+00 and 585+70. Since this is additional water, drainage computations should

be provided to verify that the ditch and culvert can accept this additional water and still meet the Norfolk Southern's 100-year storm requirements. Improvements made to this ditch should be constructed such that it would not need to be relocated for the installation of the proposed future track shown on the east side of the existing mainline tracks.

5. The existing culvert under the tracks at Railroad Station 585+70 also is shown as accepting water from proposed Channel No. 3. This drainage would need to be analyzed, along with the flows from the existing ditch (including the added flows from proposed Channel No. 2), to verify that the culvert can handle this additional drainage and that it will handle the 100-year storm with both ditches flowing through this culvert.

6. The existing box culvert at Railroad Station 585+70 is currently clean and free of debris.

7. The proposed new drainage structure and associated ditches along the tracks at Railroad Station 587+70 will need to be designed for the 100-year storm; it should be verified that the ditches on each side of the tracks are designed so that water stays within the rip-rapped areas of the ditch.

8. North of the location of the Ramp "C" overhead bridge, Railroad Station 591+25, there is currently a private grade crossing. This crossing has a 16-foot wide, timber and asphalt type surface. The asphalt has generally been removed in the area of the track and replaced by ballast. The crossing has a steel gate closure on the east side of the tracks secured by a non-railroad lock. There is a note indicating that the existing drive is to be removed. This crossing should be removed as part of the project once construction begins, and the drainage ditch along the east side improved to eliminate the existing water ponding near the crossing.

9. All bridge vertical clearances are greater than the 23' minimum but there are no minimum horizontal clearances indicated. For the curved steel ramp girders the plans include erection plans and sequencing for the girders. The final sections are shown being placed over the tracks with craned located adjacent to the tracks.

10. The plans include an Erection Sequence Plan which assumes crane types, capacities, and lifting locations. These erection plans are not shown for construction, but as a guide for the contractor. The selected contractor's erection plans will need to be reviewed and approved by Norfolk Southern before proceeding with the erection.

11. As the plans become further developed, they will need to be reviewed for conformance to current Norfolk Southern criteria. The plans are currently at the Stage 1 Submission level.

Site photographs were taken during this site visit, and have been placed on the CD that accompanies this report.

If you have further questions or need additional information, please call me at 770-452-0797.

Sincerely yours,

STV Incorporated

George T. Zimmerman, P.E.
Project Manager

Enclosures

CH2MHILL

DESIGNER RESPONSE TO REVIEW COMMENTS

BY: Wolpert Jirschele Sherk

DATE: 8/31/2010

Portsmouth Bypass – Stage I Comments

PROJECT: **SCI-823-10.13: Portsmouth Bypass; PID 79977**

PROJ. NO: 408549.08.ST.CM

REVIEWER: **Comments by NSRR (STV/Ralph Whitehead Associates),Letter dated June 18, 2008**

PHASE: Preliminary Design

Step 8 – Major PDP

Comment No.	Review Comment	Designer Response
	SR 823/US23 Interchange Bridges over Norfolk Southern	
1	Within the project limits along the railroad, there are no visible railroad utilities, the pole line has been removed, and there are no advertising billboards present on railroad property.	Acknowledged.
2	At the location of the Ramp "B" overhead bridge, Railroad Station 580+50, there is currently a private grade crossing. This crossing has a 16-foot wide, timber and asphalt type surface. The asphalt has generally been removed in the area of the track and replaced by ballast. The crossing has a post and chain closure on the east side of the tracks secured by a non-railroad lock. There is a note indicating the existing drive is to be removed. This crossing should be removed as part of the project once construction begins.	The intent of the work associated with the roadway improvements is to only remove the access point to US 23 NB. Any additional removal of the existing drive should be discussed with ODOT.
3	Near the grade crossing under proposed Ramp "B", the main track drainage is along the east side of the track. This ditch catches water draining along the farm road, toward the crossing. After the crossing is removed, the ditch along the tracks should be improved by the removal of the old roadway, and the ditch should be continuous.	The intent of the work associated with the roadway improvements is to only remove the access point to US 23 NB. Any additional removal of the existing drive should be discussed with ODOT.

CH2MHILL

DESIGNER RESPONSE TO REVIEW COMMENTS

BY: Wolpert Jirschele Sherk

DATE: 8/31/2010

Portsmouth Bypass – Stage I Comments

PROJECT: **SCI-823-10.13: Portsmouth Bypass; PID 79977**

PROJ. NO: 408549.08.ST.CM

REVIEWER: **Comments by NSRR (STV/Ralph Whitehead Associates),Letter dated June 18, 2008**

PHASE: Preliminary Design

Step 8 – Major PDP

Comment No.	Review Comment	Designer Response
4	Proposed Channel No. 2, which is south of the Ramp "B" area, is shown as a new ditch from Fairgrounds Road curving under the Ramp "B" structure and flowing into the existing Norfolk Southern ditch near Railroad Station 582+00. This water would then flow north toward the existing concrete culvert under the railroad at Railroad Station 585+70. There is no improvement shown for the existing railroad ditch between Railroad Station 582+00 and 585+70. Since this is additional water, drainage computations should be provided to verify that the ditch and culvert can accept this additional water and still meet the Norfolk Southern's 100-year storm requirements. Improvements made to this ditch should be constructed such that it would not need to be relocated for the installation of the proposed future track shown on the east side of the existing mainline tracks.	Acknowledged. Ditch grading from STA. 582+00 to 585+70 will be coordinated with Norfolk Southern Railway and revised in the next stage of the project. Calculations for the new drainage patterns were performed for the existing culvert and the 100-year storm requirements were met. The installation of the dual 48" culverts under the NFSS at STA. 587+62 removes a significant amount of flow from the existing culvert.
5	The existing culvert under the tracks at Railroad Station 585+70 also is shown as accepting water from proposed Channel No. 3. This drainage would need to be analyzed, along with the flows from the existing ditch (including the added flows from proposed Channel No. 2), to verify that the culvert can handle this additional drainage and that it will handle the 100-year storm with both ditches flowing through this culvert.	Calculations for the new drainage patterns were performed for the existing culvert and the 100-year storm requirements were met. The installation of the dual 48" culverts under the NFSS at STA. 587+62 removes a significant amount of flow from the existing culvert.

CH2MHILL

DESIGNER RESPONSE TO REVIEW COMMENTS

BY: Wolpert Jirschele Sherk

DATE: 8/31/2010

Portsmouth Bypass – Stage I Comments

PROJECT: **SCI-823-10.13: Portsmouth Bypass; PID 79977**

PROJ. NO: 408549.08.ST.CM

REVIEWER: **Comments by NSRR (STV/Ralph Whitehead Associates),Letter dated June 18, 2008**

PHASE: Preliminary Design

Step 8 – Major PDP

Comment No.	Review Comment	Designer Response
6	The existing box culvert at Railroad Station 585+70 is currently clean and free of debris.	Acknowledged.
7	The proposed new drainage structure and associated ditches along the tracks at Railroad Station 587+70 will need to be designed for the 100-year storm; it should be verified that the ditches on each side of the tracks are designed so that water stays within the rip-rapped areas of the ditch.	Calculations for the new drainage patterns were performed and the dual 48" culverts at STA. 587+62 meet the 100-year storm requirements.
8	North of the location of the Ramp "C" overhead bridge, Railroad Station 591+25, there is currently a private grade crossing. This crossing has a 16-foot wide, timber and asphalt type surface. The asphalt has generally been removed in the area of the track and replaced by ballast. The crossing has a steel gate closure on the east side of the tracks secured by a non-railroad lock. There is a note indicating the existing drive is to be removed. This crossing should be removed as part of the project once construction begins, and the drainage ditch along the east side improved to eliminate the existing water ponding near the crossing.	The intent of the work associated with the roadway improvements is to only remove the access point to US 23 NB. Any additional removal of the existing drive should be discussed with ODOT.
9	All bridge vertical clearances are greater than the 23' minimum but there are no minimum horizontal clearances indicated. For the curved steel ramp girders the plans include erection plans and sequencing for the girders. The final sections are shown being placed over the tracks with cranes located adjacent to the tracks.	The actual horizontal clearances are shown as 25'-0" (minimum) on sheets 833 and 846 for the Ramp B and C bridges. The actual horizontal clearances are shown as 25'-6" and 25'-10" on sheet 841 for the SR 823 bridge.

CH2MHILL

DESIGNER RESPONSE TO REVIEW COMMENTS

BY: Wolpert Jirschele Sherk

DATE: 8/31/2010

Portsmouth Bypass – Stage I Comments

PROJECT: **SCI-823-10.13: Portsmouth Bypass; PID 79977**

PROJ. NO: 408549.08.ST.CM

REVIEWER: **Comments by NSRR (STV/Ralph Whitehead Associates),Letter dated June 18, 2008**

PHASE: Preliminary Design

Step 8 – Major PDP

Comment No.	Review Comment	Designer Response
10	The plans include an Erection Sequence Plan which assumes crane types, capacities, and lifting locations. These erection plans are not shown for construction, but as guide for the contactor. The selected contractor's erection plans will need to be reviewed and approved by Norfolk Southern before proceeding with the erection.	Acknowledged.
11	As the plans become further developed, they will need to be reviewed for conformance to current Norfolk Southern criteria. The plans are currently at the Stage 1 Submission level.	Acknowledged.

-----Original Message-----
From: Wyatt, Dave [mailto:dave.wyatt@nscorp.com]
Sent: Tuesday, June 05, 2007 8:39 AM
To: Thompson, Shawn/COL
Subject: RE: RR Minimum Clearances - Portsmouth Bypass Project, OH

Shawn:

As discussed, your interpretation is somewhat confused. The T portion of the cap can not be any closer to the track than 10'-0" if bottom portion os less than 23'-0" above top of rail.

Thanks,

David Wyatt
System Engineer Public Improvements
Norfolk Southern Corporation
1200 Peachtree Street, N.E.
Atlanta, Georgia 30309

Telephone: 404/529-1641
Cell Phone: 404/245-2596
Fax: 404/527-2769
e-mail: dave.wyatt@nscorp.com

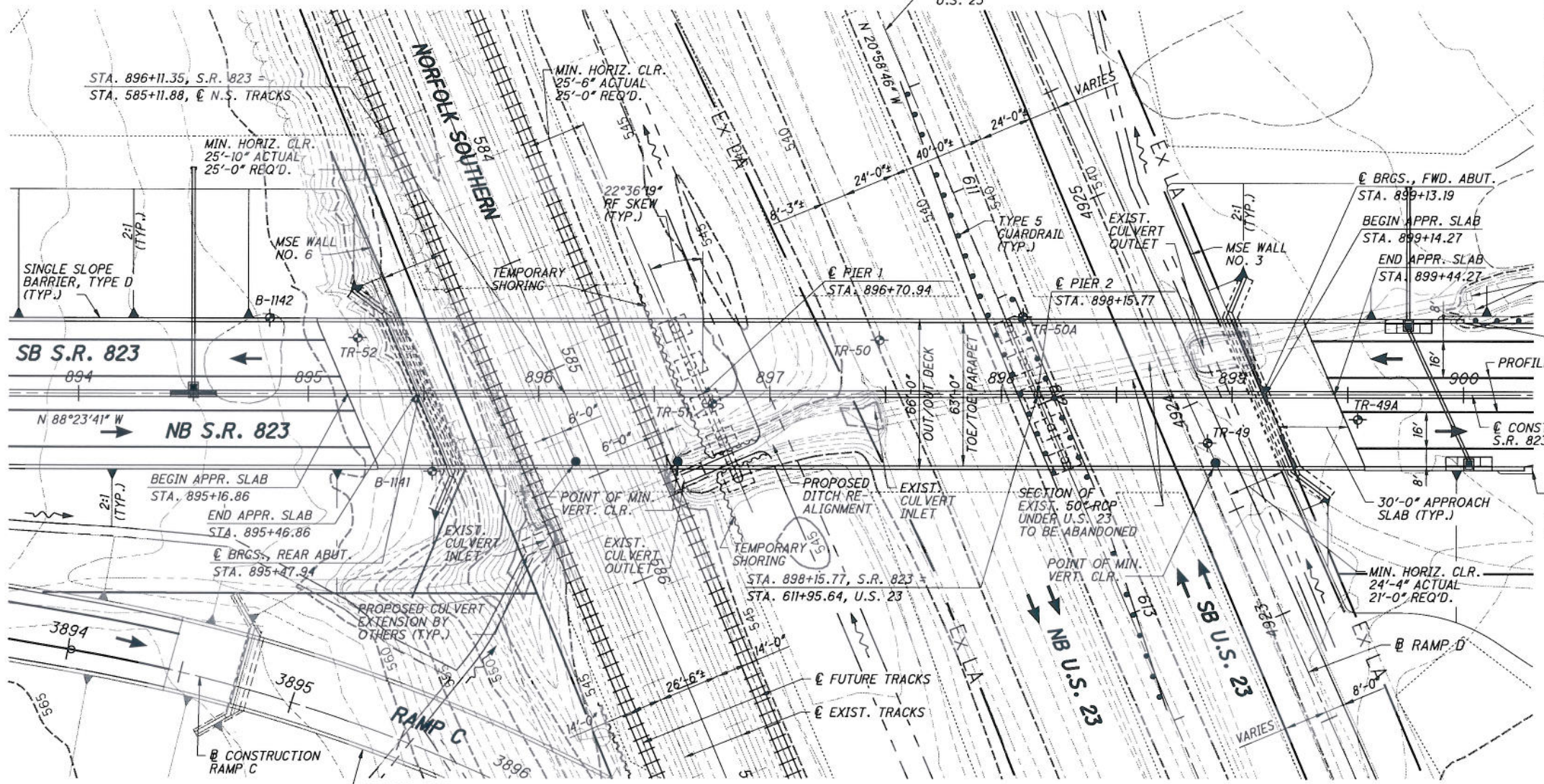
-----Original Message-----
From: Shawn.Thompson@CH2M.com [mailto:Shawn.Thompson@CH2M.com]
Sent: Friday, April 13, 2007 4:01 PM
To: Wyatt, Dave
Cc: steve.jirschele@ch2m.com; jrcox@transystems.com; mdweeks@transystems.com; robert.miller@ch2m.com; Richard.Behrendt@dot.state.oh.us
Subject: RR Minimum Clearances - Portsmouth Bypass Project, OH

David,
Good afternoon. I hope you are doing well. Attached is a .pdf drawing showing our interpretation of your criteria for clearances at the US-23/SR-823 Interchange, as we understand them. Both Norfolk Southern and ODOT have clearance requirements. We will use the most conservative requirement, in the event of conflicts or differences between the two agencies.

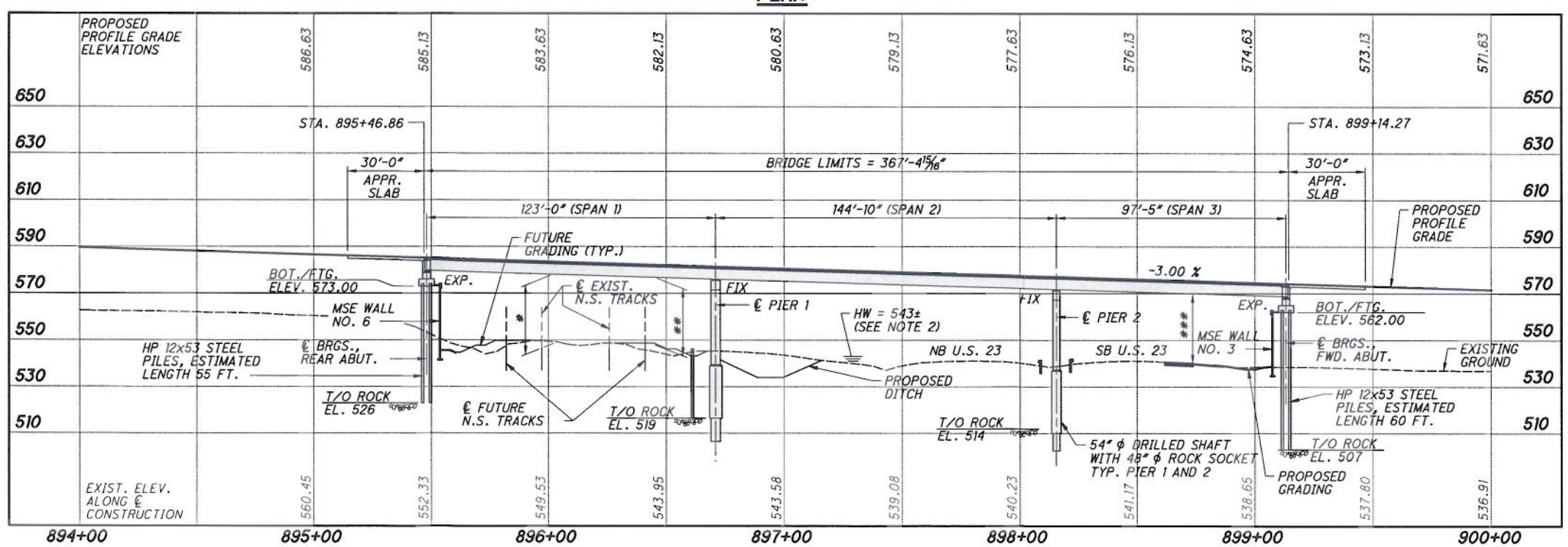
One thing of note is the location of the T-type pier. Our understanding is that as long as the pier stem is a minimum of 22'-0" from the centerline of the track and 10'-0" high, the pier cap can extend inside of the 22'-0" clearance envelope. Again, due to the two new tracks and the curvature of the ramps, our goal is to shorten the span lengths as much as possible.

At your earliest convenience, please provide a response re: acceptance of our clearance understanding.

Thanks David. Have a great weekend.
Shawn



PLAN



* MIN. VERT. CLR. 26'-9" ACTUAL 23'-5 1/8" REQ'D.

** MIN. VERT. CLR. 26'-9" ACTUAL 23'-6 1/2" REQ'D.

*** MIN. VERT. CLR. 28'-4" ACTUAL 17'-0" REQ'D.

PROFILE ALONG PROFILE GRADE LINE, S.R. 823

BENCHMARKS

TRAFFIC DATA

CURRENT ADT (2010) = 8900
DESIGN ADT (2030) = 13000
DESIGN ADTT (2030) = 1820

LEGEND

INDICATES BORING LOCATION

NOTES:

1. EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.
2. HIGHWATER (HW) ELEV. 543± IS THE 100 YEAR SCIOTO RIVER BACKWATER ELEVATION AS DETERMINED BY FEMA.
3. MEDIAN GUARDRAIL AT PIER 2 TO BE IN ACCORDANCE WITH STANDARD DRAWING GR-6.2, DESIGN A.

PROPOSED STRUCTURE

TYPE: THREE-SPAN COMPOSITE STEEL PLATE GIRDERS (WEATHERING ASTM A709, GR 50W) WITH REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS BEHIND MSE WALLS WITH CAP AND COLUMN PIERS

LENGTH OF SPAN: 123'-0", 144'-10", 97'-5" C-C BEARINGS, MEASURED ALONG ℄ CONSTRUCTION

ROADWAY: 30'-1 1/8" TOE/TOE BARRIERS (RB)
30'-1 1/8" TOE/TOE BARRIERS (LB)

SIDEWALK: NONE

DESIGN LOADING: HS25 (CASE II) AND THE ALTERNATE MILITARY LOADING, FWS = 60 LB/FT²

SKEW: 22°36'19" RIGHT FORWARD

WEARING SURFACE: MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (30'-0" LONG)

ALIGNMENT: TANGENT

CROWN: 0.016 FT/FT

LATITUDE: N 38°53'32"

LONGITUDE: W 82°59'58"

DESIGN AGENCY
CH2MHILL.
1103 SCHROCK ROAD, SUITE 400
COLUMBUS, OHIO 43229

DESIGNED	DRAWN	REVIEWED	DATE
DGS	JBA	VKN	04/11
CHECKED	REVISED	STRUCTURE FILE NUMBER	
SKT	SCJ/DGS	7306792	

SCIOTO COUNTY
STA. 895+46.86
TO STA. 899+14.27

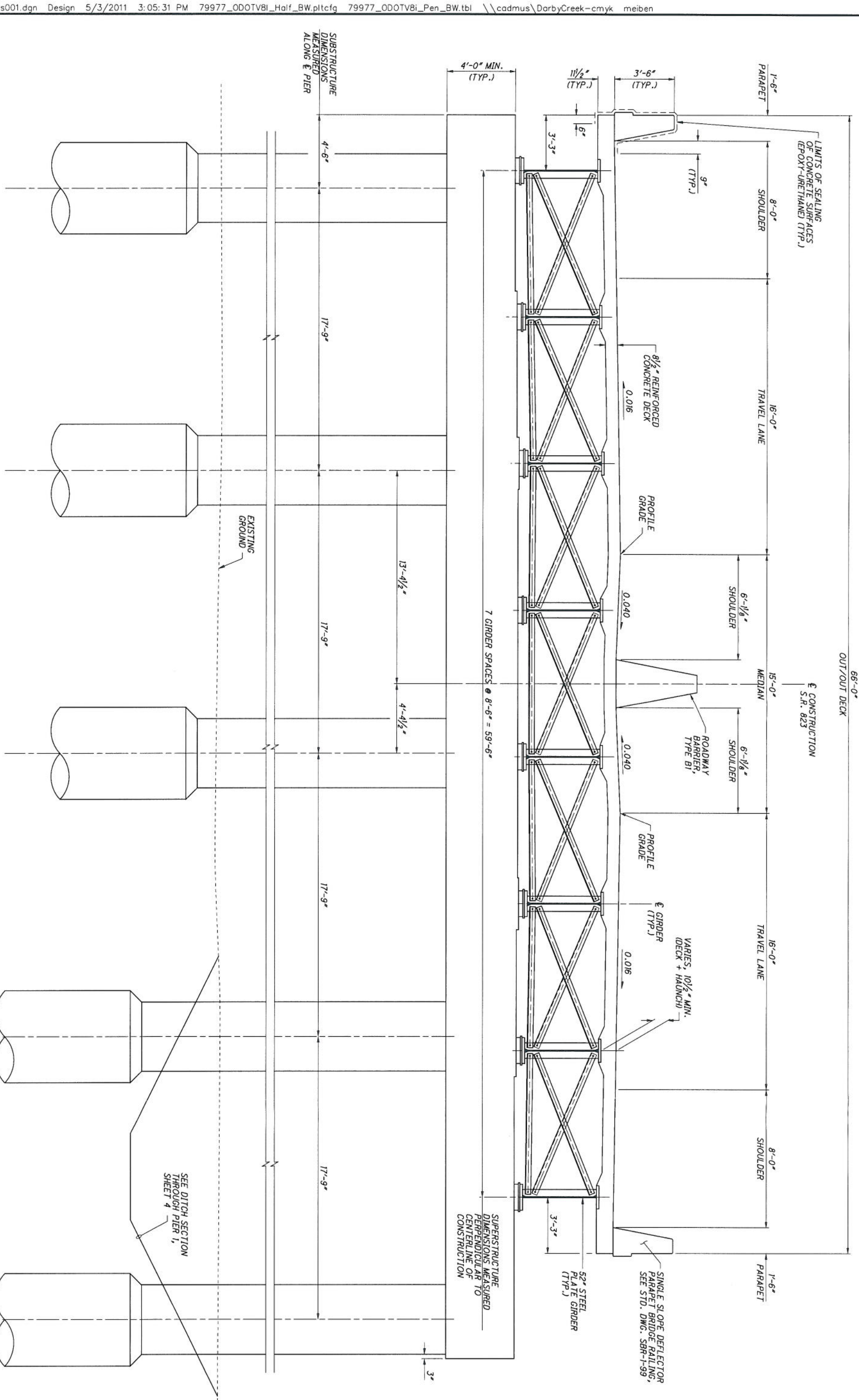
SITE PLAN

BRIDGE NO. SCI-823-1601
S.R. 823 OVER NORFOLK SOUTHERN & U.S. 23

SCI-823-10.13
PID 79977

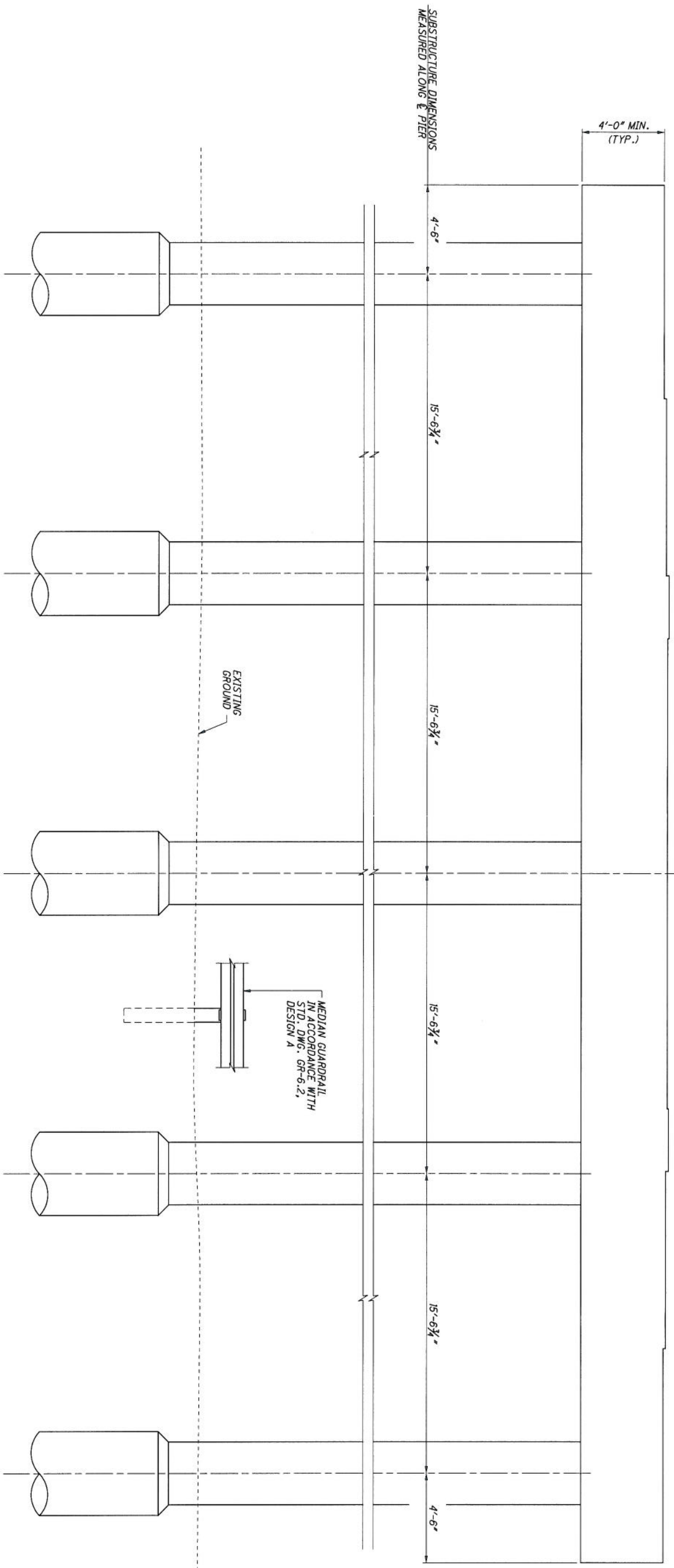
1 / 5

841



TYPICAL TRANSVERSE SECTION AND PIER 1

842	2/5	SCI-823-10.13 PID 79977	PIER 1 ELEVATION & TYPICAL TRANSVERSE SECTION BRIDGE NO. SCI-823-1601 S.R. 823 OVER NORFOLK SOUTHERN & U.S. 23	DESIGNED DGS CHECKED SKT	DRAWN JBA REVISED SCJ/DGS	REVIEWED VKN DATE 04/11 STRUCTURE FILE NUMBER 7306792	DESIGN AGENCY CH2MHILL. 1103 SCHROCK ROAD, SUITE 400 COLUMBUS, OHIO 43229



PIER 2 ELEVATION

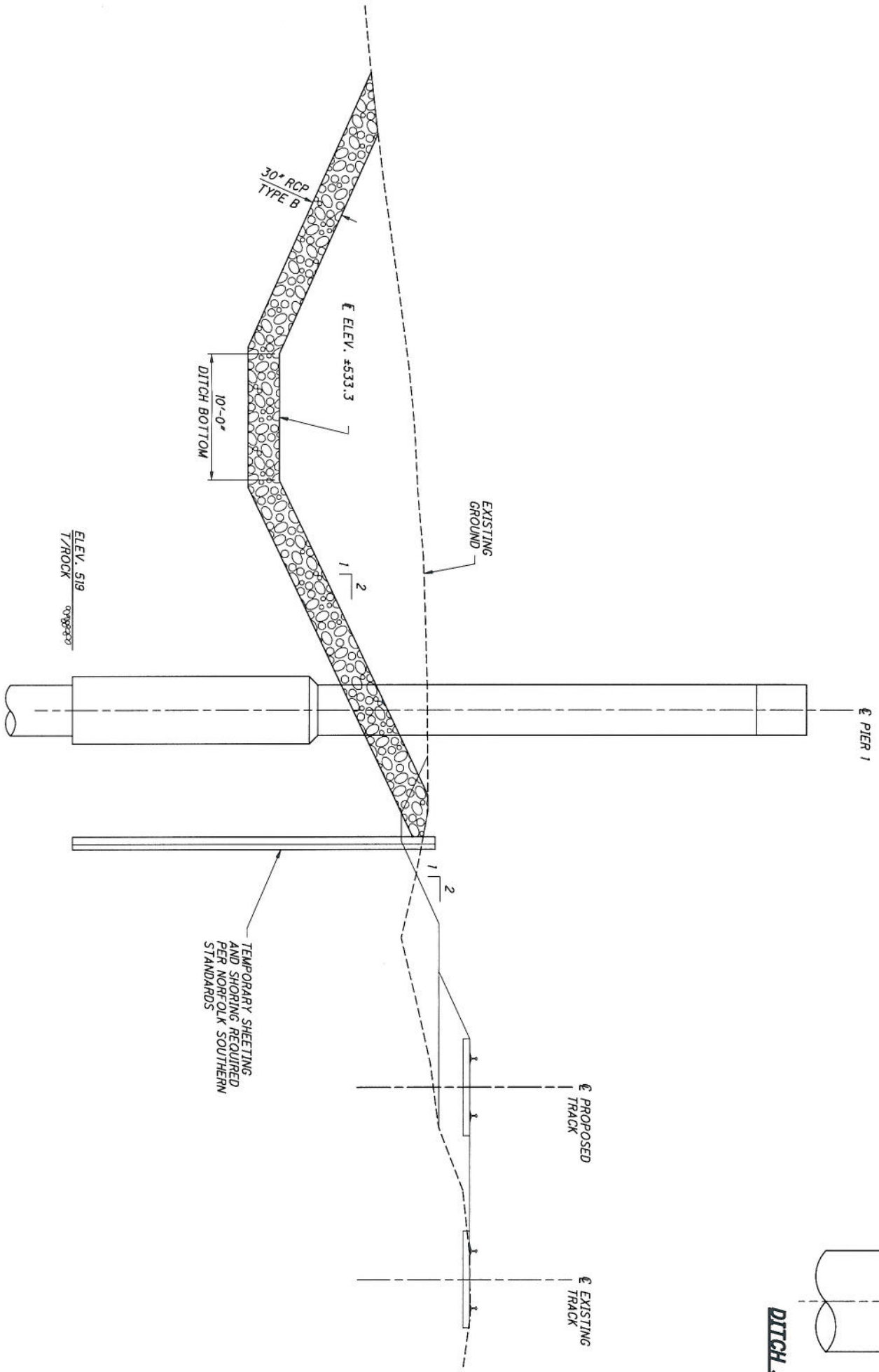
PIER 2 ELEVATION

BRIDGE NO. SCI-823-1601

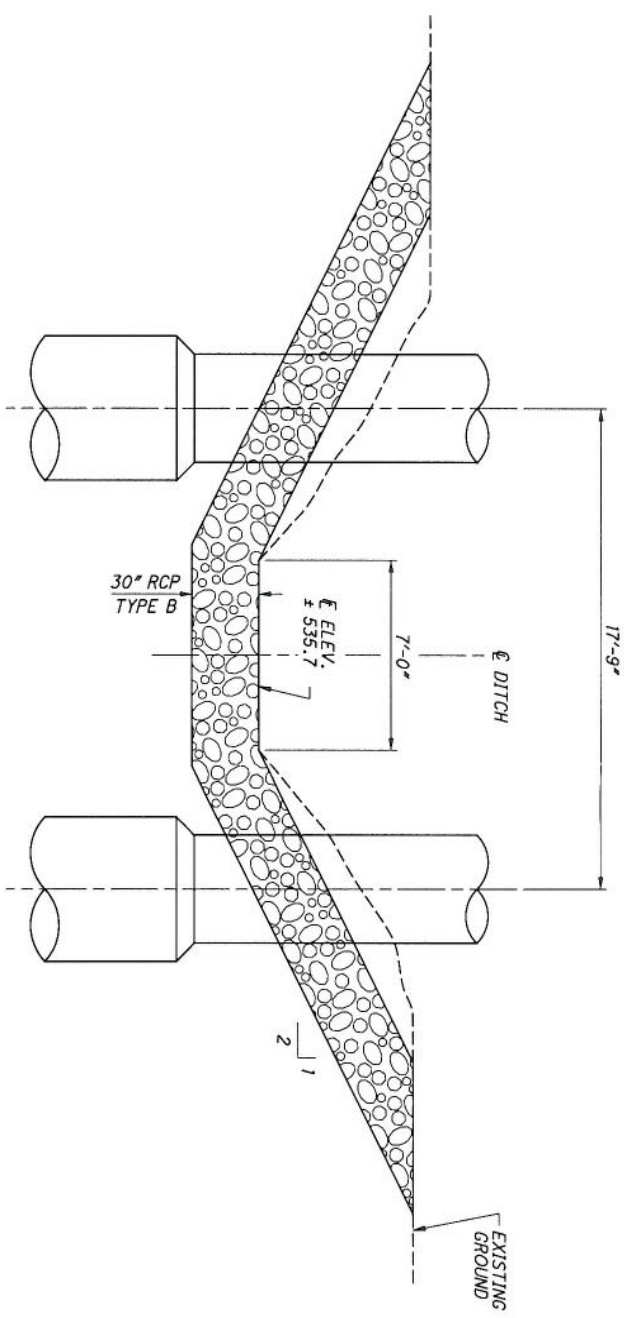
S.R. 823 OVER NORFOLK SOUTHERN & U.S. 23

DESIGNED	DRAWN	REVIEWED	DATE
DGS	JBA	VKN	04/11
CHECKED	REVISED	STRUCTURE FILE NUMBER	
SKT	SCJ/DGS	7306792	

DESIGN AGENCY
CH2MHILL.
1103 SCHROCK ROAD, SUITE 400
COLUMBUS, OHIO 43229



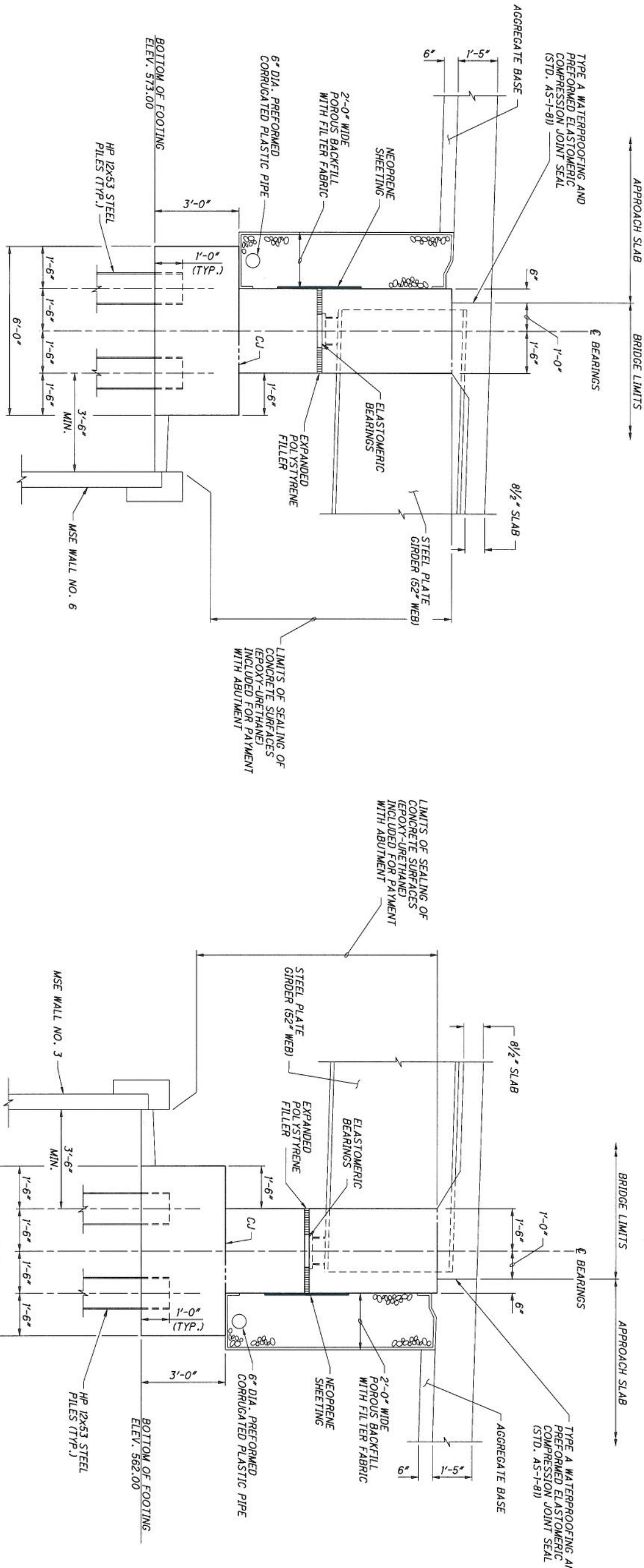
SECTION AT PIER 1 LOOKING NORTH



DITCH SECTION THROUGH PIER 1

844	4/5	SCI-823-10.13 PID 79977	SUBSTRUCTURE DETAILS BRIDGE NO. SCI-823-1601 S.R. 823 OVER NORFOLK SOUTHERN & U.S. 23	DESIGNED DGS	DRAWN JBA	REVIEWED VKN DATE 04/11	DESIGN AGENCY CH2MHILL. 1103 SCHROCK ROAD, SUITE 400 COLUMBUS, OHIO 43229
				CHECKED SKT	REVISED SCJ/DGS	STRUCTURE FILE NUMBER 7306792	

REAR ABUTMENT SECTION



FORWARD ABUTMENT SECTION

845	5/5	SCI-823-10.13 PID 79977	ABUTMENT SECTION BRIDGE NO. SCI-823-1601 S.R. 823 OVER NORFOLK SOUTHERN & U.S. 23	DESIGNED DGS CHECKED SKT	DRAWN JBA REVISED SCJ/DGS	REVIEWED VKN DATE 04/11 STRUCTURE FILE NUMBER 7306792	DESIGN AGENCY CH2MHILL. 1103 SCHROCK ROAD, SUITE 400 COLUMBUS, OHIO 43229