SCI-823-0.00

PID No. 19415

S.R. 823 OVER BLUE RUN (CR -29)

STRUCTURE TYPE STUDY SUBMITTAL

Prepared for:
OHIO DEPARTMENT OF TRANSPORTATION
DISTRICT 9
650 EASTERN AVE.
CHILLICOTHE, OHIO 45601

MARCH 28, 2006

Prepared by:

TRANSYSTEMS CORPORATION

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BRIDGE TYPE STUDY NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of new left and right overpass structures that will carry the proposed S.R. 823 bypass over Blue Run (CR-29). As requested by the Scope of Services, a Structure Type Study report is to be submitted before any plan development. The purpose of this report is to investigate various span arrangements and superstructure and substructure types in order to determine the most appropriate and economical structure type that will meet the project requirements. An initial Structure Type Study report dated 7/15/2005 was submitted to the Department and comments, dated 9/1/2005, were in turn received by Transystems Corporation. However, since these dates, the entire project has experienced a change in profile – the original project profile presented in the Preferred Alternative Verification Report (PAVR) submitted July 2005 has been altered and the revised profile has been approved by the Department. The revised profile lowers the elevations of the proposed S.R. 823 Mainline over Blue Run Road from the elevations specified in the July 2005 PAVR. Built-up embankments are therefore lowered which permits shortening of the span lengths with the use of 2:1 embankment slopes. Due to the possibility of shortening the spans, bridge types for the proposed S.R. 823 Mainline over Blue Run Road were reevaluated. This follow-up Structure Type Study presents the results of these reevaluations as well as alternative bridge types that are investigated in accordance with the 9/1/2005 ODOT comments. As a result, six (6) alternatives for construction of the proposed S.R. 823 Mainline over Blue Run Road are evaluated in this study and are designated as Alternatives 1, 1A, 2, 2A, 3, and 4. Each of these alternatives is evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, constructability, and maintenance of traffic. Discussion of these alternatives is presented later in this report.

2. Design Criteria

The proposed structure types are designed according to the most current version of the Ohio Department of Transportation Bridge Design Manual and the 2002 AASHTO Standard Specifications for Highway Bridges, 17th Edition. Horizontal clearances (clear zone width and horizontal sight distance) are based on the Ohio Department of Transportation Location and Design Manual, Volume One – Roadway Design.

3. Subsurface Conditions and Foundation Recommendation

DLZ Ohio, Inc. performed the subsurface exploration for the proposed bridge and prepared the Preliminary Bridge Foundation Recommendations which were presented in Section 3 and Appendix E of the original 7/15/2005 Structure Type Study report. Updated boring logs for the four test borings (TR-7, TR-8, TR-9 and TR-10) and preliminary MSE wall evaluations – performed by DLZ Ohio, Inc. – accompany this modified/updated Structure Type Study Report. The preliminary evaluations reveal that MSE walls can be used at the rear and forward abutment locations for single span alternatives as long as the naturally occurring soils beneath the proposed MSE walls are overexcavated to top of rock and replaced with compacted,granular fill. Refer to the preliminary MSE wall evaluation report for more details and information.

4. Roadway

The purpose of this project is to construct a new bypass state route around the town of Portsmouth Ohio. The proposed alignment will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with US 52 just east of the town to another interchange with US 23 north of the town in Valley Township. Each of the proposed bridge sections will consist of two 12'-0" travel lanes with 6'-0" median shoulders and 12'-0" outside shoulders. Each bridge deck width will be 45'-0" out-to-out with 1'-6" inside and outside straight face deflector parapets. Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives considered. The existing Blue Run (CR-29) will remain on its current horizontal and vertical alignment.

Vertical and Horizontal Design - Since these twin structures' vertical alignment were dictated by the overall vertical design of the new bypass profile, clearance was not a critical issue. More than 15'-0" of preferred vertical clearance could be provided for all the alternatives considered for this study. In accordance with the L&D manual, Volume 1, a minimum horizontal clear zone width of 15'-0" from edge of traveled way to face of obstruction and a minimum horizontal sight distance of approximately 25'-0" from centerline of inside lane to sight obstruction has to be maintained. The proposed substructure layout for each alternative in this updated Structure Type Study report exceeds these minimum horizontal clearances. An existing creek ditch, which parallels the road, will be maintained on the east side of Blue Run.

Drainage Design - The collection of storm water runoff will be addressed off the bridge. The type of drainage system will be investigated as part of the preliminary design.

Utilities - No utilities will be placed on the bridge. However, lighting and ITS conduits will be provided as necessary.

Maintenance of Traffic - While the new bridge is under construction, traffic will be maintained on the existing road. It is anticipated that there will be limited closures during construction of the new structure.

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a tangent alignment across the entire length of both the left and right structures. The proposed mainline profile for each bridge is located on the inside edge of pavement which is 11'-0" from the centerline survey and construction S.R. 823. The left and right profiles are within a 1200' vertical curve with PVI at Station 576+00.00, g_1 = -2.60% and g_2 = 4.00%. The horizontal and vertical geometry for all alternatives considered are the same. Embankment slopes will be a maximum 2:1 in order to minimize right-of-way impacts.

Structure: As per the Scope of Services, we investigated several bridge types and alternatives as part of the type study. A total of six (6) alternatives were considered and are outlined in the Structure Type Alternative Table below:

STRUCTURE TYPE ALTERNATIVE TABLE				
Structure Type Alternative	**1**	**1A**	**2**	**2A**
Structure Type Description	Tangent,continuous Steel Plate Girders A709 Gr. 50W	Tangent,continuous Steel Plate Girders A709 Gr. 50W	Tangent,Prestressed Concrete Girders Modified AASHTO Type 4 (60")	Tangent,Prestressed Concrete Girders Modified AASHTO Type 4 (66")
Proposed Beam Spacing	4 Spaces @ 9'-6" per Bridge	3 Spaces @ 12'-8" per Bridge	4 Spaces @ 9'-6" per Bridge	3 Spaces @ 12'-8" per Bridge
No. of Spans	3	3	3	3
Abutment Type	Semi-integral Type with 2:1 spill-through slopes	Semi-integral Type with 2:1 spill-through slopes	Semi-integral Type with 2:1 spill-through slopes	Semi-integral Type with 2:1 spill-through slopes
No. of Piers	2	2	2	2
Pier Type	T-type	T-type	T-type	T-type
Substructure Orientation	18°00'00" RF	18°00'00" RF	18°00'00" RF	18°00'00" RF
Approximate Bridge Length	260'	260'	260'	260'
Approximate Structure Depth				
Slab	8.75"	9.75"	8.75"	9.75"
Haunch	2"	2"	2"	2"
Beam	43.00"	52.625"	60"	66"
Total	53.75" (4.479')	64.375" (5.365')	70.75" (5.896')	77.75" (6.479')

STRUCTURE TYPE ALTERNATIVE TABLE (CONT.)		
Structure Type Alternative	**3**	**4**
Structure Type Description	Tangent, Steel Plate Girders A709 Gr. 50W	Tangent,Prestressed Concrete Girders Modified AASHTO Type 4 (72")
Proposed Beam Spacing	4 Spaces @ 9'-6" per Bridge	4 Spaces @ 9'-6" per Bridge
No. of Spans	1	1
Abutment Type	Semi-integral Type behind MSE Wall	Semi-integral Type behind MSE Wall
No. of Piers	No Piers (single span)	No Piers (single span)
Pier Type	n/a	n/a
Substructure Orientation	18°00'00" RF	18°00'00" RF
Approximate Bridge Length	104'-9"±	104'-9"±
Approx. Structure Depth		
Slab	8.75"	8.75"
Haunch	2"	2"
Beam	49.00"	72"
Total	59.75" (4.979')	82.75" (6.896')

Alternative Discussion:

Alternative 1

Alternative 1 is a continuous steel plate girder bridge. The height of the built-up embankment on the east side of Blue Run Road (for the Rear Abutment of the Mainline), the creek location, as well as the clear zone width and horizontal sight distances for Blue Run Road help dictate the substructure unit locations and respective span lengths. Clear zone width of 15' minimum and horizontal sight distance of 20' from edge of Blue Run Road (edge of traveled way) to sight obstruction (i.e., approximately 25' from centerline of inside lane to sight obstruction) are used to ensure proper placement of Pier 2. To minimize disruption of the creek and its bed, sufficient horizontal clearance between the edge of the creek bed and the toe of the Pier 1 footing is used to help establish the position of Pier 1. When these obstructions are considered along with the built-up embankment and the end span-to-middle span ratios of ODOT BDM 205.6, three spans with lengths of 80'-0", 100'-0", and 80'-0" center-to-center of bearing are defined (0.80 end span-to-middle span ratio).

Because the bearing-to-bearing length of this bridge is 260'-0" (< 400' total length) and skew is 18°00'00" right forward, the use of semi-integral abutments is deemed permissible. The semi-integral rear and forward abutments will both be supported by steel H-piles driven to bedrock and positioned on built-up embankments with 2:1 spill-through slopes. Straight wingwalls will be provided. Abutment and wingwall details will follow ODOT Standard Drawings.

Both Piers 1 and 2 will be T-type piers supported on spread footings founded on bedrock. Footing dimensions will need to be established using an allowable bearing capacity of 10 TSF (refer to Appendix E – Subsurface Investigation and Preliminary Foundation Recommendations).

The superstructure for both the left and right bridge of this alternative consists of 5-continuous welded steel plate girders, Grade 50W, with 41" deep webs spaced at 9'-6" on center. This satisfies the HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf. Each bridge width is 42'-0" from toe-to-toe of parapets with an overall bridge deck width of 45'-0". Deck thickness, including a 1" monolithic wearing surface, is 8 ¾".

The initial bridge construction cost for Alternative 1 is estimated to be $2,960,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,976,000, resulting in a total estimated ownership cost of $4,936,000 in year 2008 dollars.

Alternative 1A

Alternative 1A is identical to Alternative 1 except that the superstructures for the left and right bridges consist of 4-continuous steel plate girders, Grade 50W, with 50" deep webs spaced at 12'-8" on center. Note that eliminating a girder line in this manner permits greater structural participation of the reinforced concrete deck. Deck thickness, including a 1" monolithic wearing surface, is 9 ¾".

The initial bridge construction cost for Alternative 1A is estimated to be $2,930,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,961,000, resulting in a total estimated ownership cost of $4,891,000 in year 2008 dollars.

__Alternative 2__

Alternative 2 is also identical to Alternative 1 except that the superstructures for the left and right bridges consist of 5-60" deep Modified AASHTO Type 4 prestressed concrete I-beams spaced at 9'-6" on center. The 80'-0" end spans are measured from centerline bearing abutment to centerline pier and the 100'-0" interior span is measured from centerline pier to centerline pier.

The initial bridge construction cost for Alternative 2 is estimated to be $3,300,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,185,000, resulting in a total estimated ownership cost of $4,485,000 in year 2008 dollars.

__Alternative 2A__

Alternative 2A is identical to Alternative 2 except that the superstructures for the left and right bridges consist of 4-66" deep Modified AASHTO Type 4 prestressed concrete I-beams spaced at 12'-8" on center.

The initial bridge construction cost for Alternative 2A is estimated to be $3,260,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,235,000, resulting in a total estimated ownership cost of $4,495,000 in year 2008 dollars.

__Alternative 3__

This single span alternative is investigated in response to ODOT's 9/1/2005 comments to the original 7/15/2005 Structure Type Study. Alternative 3 is a single span steel plate girder bridge with a span length of 104'-9"± center-to-center of bearings and an 18°00'00" right forward skew. Semi-integral abutments are used at the rear and forward abutment locations and are positioned on steel H-piles behind MSE walls. The H-piles are driven to bedrock. The position of the forward MSE wall satisfies the clear zone width requirements from the edge of traveled way of Blue Run Road as well as horizontal sight distance requirements from the centerline of inside lane of Blue Run Road. Preliminary evaluations demonstrating that MSE walls can be utilized at the proposed locations are included as an addendum to this updated Structure Type Study report. The superstructures for both the left and right bridges of this alternative consist of 5-welded steel plate girders, Grade 50W, with 46" deep webs spaced at 9'-6" on center. This satisfies the HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf. Each bridge width is 42'-0" from toe-to-toe of parapets with an overall bridge deck width of 45'-0". Deck thickness, including a 1" monolithic wearing surface, is 8 ¾".

The initial bridge construction cost for Alternative 3 is estimated to be $2,520,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $856,000, resulting in a total estimated ownership cost of $3,376,000 in year 2008 dollars.

__Alternative 4__

Alternative 4 is identical to Alternative 3 except that the superstructures for the left and right bridges consist of 5-72" deep Modified AASHTO Type 4 prestressed concrete I-beams spaced at 9'-6" on center.

The initial bridge construction cost for Alternative 4 is estimated to be $2,650,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $516,000, resulting in a total estimated ownership cost of $3,166,000 in year 2008 dollars.

6. Recommendations:

Based upon the above information and discussions, Transystems Corporation recommends **Structure Type Alternative 4 (Single Span, 72" deep Modified AASHTO Type 4 prestressed concrete I-beams with semi-integral abutments behind MSE walls)** for the Bridge. (See Appendix B for the Site Plan and Structure Details).

The recommendation of Alternative 4 is based on the following items:

1. This Alternative appears to be economical from a construction standpoint (i.e., low initial construction costs);

2. Lowest life-cycle maintenance costs;

3. Lowest total ownership costs.

APPENDIX A

Cost Comparison Summary

TRANSYSTEMS CORPORATION

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY

By: JRC — Date: 3/17/2006
Checked: MLS — Date: 3/28/2006

ALTERNATIVE COST SUMMARY

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Subtotal Superstructure Cost	Subtotal Substructure Cost	Structure Incidental Cost (16%)	Structure Contingency Cost (20%)	Total Alternative Cost	Life Cycle Maintenance Cost	Total Relative Ownership Cost
1	3	80' - 100' - 80'	260.00	5 Steel Girders /per BRIDGE	41" Web Grade 50W	$1,441,000	$683,000	$339,800	$492,800	$2,960,000	$1,976,000	$4,936,000
2	3	80' - 100' - 80'	260.00	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$1,624,000	$758,000	$381,100	$552,600	$3,320,000	$1,185,000	$4,505,000
1A	3	80' - 100' - 80'	260.00	4 Steel Girders /per BRIDGE	50" Web Grade 50W	$1,428,000	$680,000	$337,300	$489,100	$2,930,000	$1,961,000	$4,891,000
2A	3	80' - 100' - 80'	260.00	4 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (66")	$1,595,000	$756,000	$376,200	$545,400	$3,270,000	$1,235,000	$4,505,000
3	1	105'	105.00	5 Steel Girders /per BRIDGE	46" Web Grade 50W	$725,000	$1,085,000	$289,600	$419,900 2,100,000	$2,520,000	$856,000	$3,376,000
4	1	105'	105.00	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$758,000	$1,160,000	$306,900	$445,000 2,225,000	$2,670,000	$516,000	$3,186,000

NOTES:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill, sealing of concrete surfaces, structural steel painting, bearings, and crushed aggregate slope protection costs.
2. Estimated construction cost does not include existing structure removal (if any), which should be quantified seperately, if required.

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STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: JRC Date: 3/17/2006
Checked: MLS Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
1	1	80' - 100' - 80'	260	262	867	$511,300	$217,400	$82,500	5 Steel Girders /per BRIDGE	41" Web Grade 50W	540,800	$629,600	**$1,441,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.9	3.3	44.7
Right Bridge	0.73	45.00	32.9	3.3	44.7

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$590.00

Based on parapet and slab percentages of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
Level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.33	Curved Girders

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2003	Annual Escalation	Year 2008	
Strip Seal Expansion Joints	1.00	$863.00	3.5%	$1,097.98	2001 Price

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S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: JRC
Checked: MLS

Date: 3/17/2006
Date: 3/28/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Subtotal Substructure Cost
1	3	80' - 100' - 80'	5 Steel Girders /per BRIDGE	41" Web Grade 50W	$301,400	$68,600	$218,800	$35,900	$58,400	**$683,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile/Spread Footing)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	122	$421.00	3.5%	$483.00	$58,930
Stem	280	$421.00	3.5%	$483.00	$135,240
Footings	222	$421.00	3.5%	$483.00	$107,230
Total Cost	624				$301,400

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	101	$421.00	3.5%	$483.00	$48,800

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

	Number of Piles		Total Pile Length
Alt. 1	68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support
Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

MSE Abutment Unit Cost ($/sq. ft.):

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1		$54.00	3.5%	$62.00

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

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S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - QUANTITY CALCULATIONS

By: JRC Date: 3/17/2006
Checked: MLS Date: 3/28/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr Ftg)	43	4	4.75	19.00	817	3.5	32.5	16.00		1820	15	4	25.00		1500	4137
Pier 2 (Spr Ftg)	43	4	4.75	19.00	817	3.5	35	16.00		1960	15	4	25.00		1500	4277
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1634**					**3780**					**3000**	**8414**
Total (Cu.Yd.)					**61**					**140**					**111**	**312**
			Qty x 2 (L/R)		**122**					**280**					**222**	**624**

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footin	Volume	
Rear Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Fwd. Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Total (Cu.Ft.)					**1561**					**1490**					**1703**	**4754**
Total (Cu.Yd.)					**58**					**55**					**63**	**176**
			Qty x 2 (L/R)		**116**					**110**					**126**	**352**

Wingwall Quantities

Abut Location	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volume
		Width	Height	Area	Volume	Width	Height	Area	Length	Volume	Width	Depth	Area	# Footin	Volume	
Rear Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Fwd. Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Total (Cu.Ft.)					**1120**					**350**					**1260**	**2730**
Total (Cu.Yd.)					**41**					**13**					**47**	**101**

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length (Feet)
Rear Abut.	0	0	0	0	140	0	1	17	800.0	761.9	40.0	680
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	17	806	797	11.0	187
TotaL								**34**				**867**
							Qty x 2 (L/R)	**68**				**1734**

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								**0**				**0**

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	208	10	80	166400
Span 2	208	10	100	208000
Span 3	208	10	80	166400
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
TotaL				540800

total steel weight per girder (lb.) =	16640
Total Span length (ft.)=	260.00
Weight Per ft. =	64

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: JRC
Checked: MLS

Date: 3/17/2006
Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
2	3	80' - 100' - 80'	260.00	262.00	866	$510,900	$217,200	$82,500	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$813,200	$1,624,000	0%	**$1,624,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.8	3.3	44.6
Right Bridge	0.73	45.00	32.8	3.3	44.6

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$590.00

Based on parapet and slab percentages of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Prestressed Concrete Girders
Unit Costs:

AASHTO Type IV Beams	Year 2005		Annual Escalation	Year 2008		No. Required	
Type 4 I-Beams	$16,000	ea.	3.5%	$17,740	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,000	ea.	16	$32,000
Abutment Diaphragms	$1,200	ea.	3.5%	$1,330	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,330	ea.	40	$53,200
Modified Type 4 I-Beams (60")	$250	per ft	3.5%	$280	ea.	2600	$728,000
						TOTAL =	**$813,200**

Construction Complexity Factor
Percent of Superstructure = 0% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Modular Expansion Joints (2001 Price)	1.00	$863.00	3.5%	$1,097.98

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: JRC Date: 3/17/2006
Checked: MLS Date: 3/28/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Additional Crane Cost	Subtotal Substructure Cost
2	3	80' - 100' - 80'	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$301,400	$68,600	$218,800	$35,900	$58,400	$75,000	**$758,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	136	$421.00	3.5%	$483.00	$65,690
Stem	266	$421.00	3.5%	$483.00	$128,480
Footings	222	$421.00	3.5%	$483.00	$107,230
Total Cost	624				$301,400

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	101	$421.00	3.5%	$483.00	$48,800

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

MSE Abutment Unit Cost ($/sq. ft.):

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1		$54.00	3.5%	$62.00

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

Number of Piles		Total Pile Length
68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 2 - QUANTITY CALCULATIONS

By: JRC
Checked: MLS

Date: 3/19/2006
Date: 3/28/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr Ftg)	43	4.5	4.75	21.38	919	3.5	31	16.00		1736	15	4	25.00		1500	4155
Pier 2 (Spr Ftg)	43	4.5	4.75	21.38	919	3.5	33.3	16.00		1865	15	4	25.00		1500	4284
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					1838					3601					3000	8439
Total (Cu.Yd.)					68					133					111	313
			Qty x 2 (L/R)		136					266					222	626

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length (Feet)
Rear Abut.	0	0	0	0	140	0	1	17	800.0	761.9	40.0	680
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	17	806	797	11.0	187
TotaL								34				867
							Qty x 2 (L/R)	68				1734

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footi	Volume	
Rear Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Fwd. Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Total (Cu.Ft.)					1916					1135					1703	4754
Total (Cu.Yd.)					71					42					63	176
			Qty x 2 (L/R)		142					84					126	352

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Wingwall Quantities

Abut Location	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volume
		Width	Height	Area	Volume	Width	Height	Area	Length	Volume	Width	Depth	Area	# Footi	Volume	
Rear Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Fwd. Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Total (Cu.Ft.)					1120					350					1260	2730
Total (Cu.Yd.)					41					13					47	101

Superstructure P/S Concrete Quantities

Location	Type of girder	# Girders	Span Length (ft.)	Total Length (ft.)	Spacing Int.	No. of Int in span	Number of Int Diap. 1 location	Total No. in Span
Span 1	MOD TYPE 4 60	10	80	800	26.67	1	8	8
Span 2	MOD TYPE 4 60	10	100	1000	33.33	3	8	24
Span 3	MOD TYPE 4 60	10	80	800	26.67	1	8	8
Span 4		0	0	0	0.00	3	0	0
Span 5		0	0	0	0.00	3	0	0
Span 6		0	0	0	0.00	3	0	0
Span 7		0	0	0	0.00	3	0	0
Span 8		0	0	0	0.00	3	0	0
Span 9		0	0	0	0.00	3	0	0
					Total			40
TotaL	MOD TYPE 4 60	30		2600				

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1A - SUPERSTRUCTURE

By: JRC   Date: 3/19/2006
Checked: MLS   Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
1A	3	80' - 100' - 80'	260	262	946	$556,200	$237,200	$82,500	4 Steel Girders /per BRIDGE	50" Web Grade 50W	474,240	$552,100	**$1,428,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.81	45.00	36.6	3.7	48.7
Right Bridge	0.81	45.00	36.6	3.7	48.7

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$588.00

Based on parapet and slab percentages of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
Level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.33	Curved Girders

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft.   Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2003	Annual Escalation	Year 2008	
Strip Seal Expansion Joints	1.00	$863.00	3.5%	$1,097.98	2001 Price

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1A - SUBSTRUCTURE

By: JRC — Date: 6/25/2005
Checked: MLS — Date: 7/1/2005

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Subtotal Substructure Cost
1A	3	80' - 100' - 80'	4 Steel Girders /per BRIDGE	50" Web Grade 50W	$298,500	$68,000	$218,800	$35,900	$58,400	**$680,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile/Spread Footing)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	122	$421.00	3.5%	$483.00	$58,930
Stem	274	$421.00	3.5%	$483.00	$132,340
Footings	222	$421.00	3.5%	$483.00	$107,230
Total Cost	618				$298,500

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	101	$421.00	3.5%	$483.00	$48,800

Epoxy Coated Reinforcing Steel Unit Cost ($/lb):

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

MSE Abutment Unit Cost ($/sq. ft.):

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1		$54.00	3.5%	$62.00

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

	Number of Piles		Total Pile Length
Alt. 1	68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1A - QUANTITY CALCULATIONS

By: JRC
Checked: MLS

Date: 3/19/2006
Date: 3/28/2006

Pier Quantities

Pier Locat	Length	Cap				Stem					Footing					Total Volu
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1 (Spr	43	4	4.75	19.00	817	3.5	31.75	16.00		1778	15	4	25.00		1500	4095
Pier 2 (Spr	43	4	4.75	19.00	817	3.5	34.25	16.00		1918	15	4	25.00		1500	4235
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					1634					3696					3000	8330
Total (Cu.Yd.)					61					137					111	309
			Qty x 2 (L/R)		122					274					222	618

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length
Rear Abut.	0	0	0	0	140	0	1	*17*	800.0	761.9	40.0	*680*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*17*	806	797	11.0	*187*
TotaL								34				867
							Qty x 2 (L/	68				1734

Abutment Quantities

Abut Loca	Length (feet)	Backwall				Beam Seat					Footing					Total Volu
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*		*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Rear Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Fwd. Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Total (Cu.Ft.)					1561					1490					1703	4754
Total (Cu.Yd.)					58					55					63	176
			Qty x 2 (L/R)		116					110					126	352

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft
Rear Abut.	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 1	0	0	0	0	0	0	1	*0*	0	0	2.0	*0*
Pier 2	0	0	0	0	0	0	1	*0*	0	0	2.0	*0*
Pier 3	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 4	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 5	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 6	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 7	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Fwd. Abut.	0	10	0	0	0	0	1	*0*	0	0	0.0	*0*
Total								0				0

Wingwall Quantities

Abut Loca	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volu
		Width	*Height*	*Area*	*Volume*	*Width*	*Height*	*Area*	*Length*	*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Rear Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Fwd. Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Total (Cu.Ft.)					1120					350					1260	2730
Total (Cu.Yd.)					41					13					47	101

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	228	8	80	145920
Span 2	228	8	100	182400
Span 3	228	8	80	145920
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
TotaL				474240

total steel weight per girder (lb.) = 18240
Total Span length (ft.)= 260.00
Weight Per ft. = 70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2A - SUPERSTRUCTURE

By: JRC
Checked: MLS

Date: 3/19/2006
Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
2A	3	80' - 100' - 80'	260.00	262.00	946	$556,200	$237,200	$82,500	4 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (66")	$719,300	$1,595,000	0%	$1,595,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.81	45.00	36.6	3.7	48.7
Right Bridge	0.81	45.00	36.6	3.7	48.7

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$588.00

Based on parapet and slab percentages of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Prestressed Concrete Girders
Unit Costs:

	Year 2004		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Type 4 I-Beams	$16,000	ea.	3.5%	$18,360	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	16	$33,120
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	30	$41,400
Modified Type 4 I-Beams (66")	$270	per ft.	3.5%	$310	ea.	2080	$644,800
						TOTAL =	$719,320

Construction Complexity Factor
Percent of Superstructure = 0% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Modular Expansion Joints (2001 Price)	1.00	$863.00	3.5%	$1,097.98

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2A - SUBSTRUCTURE

By: JRC Date: 3/19/2006
Checked: MLS Date: 3/28/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Additional Crane Cost	Subtotal Substructure Cost
2A	3	80' - 100' - 80'	4 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (66")	$299,500	$68,200	$218,800	$35,900	$58,400	$75,000	**$756,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	136	$421.00	3.5%	$483.00	$65,690
Stem	262	$421.00	3.5%	$483.00	$126,550
Footings	222	$421.00	3.5%	$483.00	$107,230
Total Cost	620				$299,500

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	101	$421.00	3.5%	$483.00	$48,800

Epoxy Coated Reinforcing Steel Unit Cost ($/lb):

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

MSE Abutment Unit Cost ($/sq. ft.):

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1		$54.00	3.5%	$62.00

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

Number of Piles		Total Pile Length
68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 2A - QUANTITY CALCULATIONS

By: JRC
Checked: MLS

Date: 3/19/2006
Date: 3/28/2006

Pier Quantities

Pier Locat	Length	Cap				Stem					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr	43	4.5	4.75	21.38	919	3.5	30.5	16.00		1708	15	4	25.00		1500	4127
Pier 2 (Spr	43	4.5	4.75	21.38	919	3.5	32.8	16.00		1837	15	4	25.00		1500	4256
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					1838					3545					3000	8383
Total (Cu.Yd.)					68					131					111	310
			Qty x 2 (L/R)		136					262					222	620

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length
Rear Abut.	0	0	0	0	140	0	1	17	800.0	761.9	40.0	680
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	17	806	797	11.0	187
TotaL								34				867
							Qty x 2 (L/	68				1734

Abutment Quantities

Abut Loca	Length (feet)	Backwall				Beam Seat					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Fwd. Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Total (Cu.Ft.)					1916					1135					1703	4754
Total (Cu.Yd.)					71					42					63	176
			Qty x 2 (L/R)		142					84					126	352

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Wingwall Quantities

Abut Loca	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volu
		Width	Height	Area	Volume	Width	Height	Area	Length	Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Fwd. Abut	28	2.5	8	20.00	560	2.5	10	25.00	7	175	6	3	18	1	630	1365
Total (Cu.Ft.)					1120					350					1260	2730
Total (Cu.Yd.)					41					13					47	101

Superstructure P/S Concrete Quantities

Location	Type of girder	# Girders	Span Length	Total Length	Spacing Int.	No. of Int in span	Number of Int Diap. 1	Total No. in Span
Span 1	DD TYPE 4	8	80	640	26.67	1	3	3
Span 2	DD TYPE 4	8	100	800	33.33	3	8	24
Span 3	DD TYPE 4	8	80	640	26.67	1	3	3
Span 4		0	0	0	0.00	3	0	0
Span 5		0	0	0	0.00	3	0	0
Span 6		0	0	0	0.00	3	0	0
Span 7		0	0	0	0.00	3	0	0
Span 8		0	0	0	0.00	3	0	0
Span 9		0	0	0	0.00	3	0	0
					Total			30
TotaL	DD TYPE 4	24		2080				

SCI-823-0.00 - PORTSMOUTH BYPASS
S.R. 823 over Blue Run L/R
STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUPERSTRUCTURE

By: JRC Date: 3/21/2006
Checked: MLS Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
3	1	105'	105	107	354	$208,600	$88,700	$82,500	5 Steel Girders /per BRIDGE	46" Web Grade 50W	296,100	$344,700	$725,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.8	3.3	44.6
Right Bridge	0.73	45.00	32.8	3.3	44.6

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$590.00

Based on parapet and slab percentages
of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
Level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.33	Curved Girders

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2003	Annual Escalation	Year 2008	
Strip Seal Expansion Joints	1.00	$863.00	3.5%	$1,097.98	2001 Price

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUBSTRUCTURE

By: JRC Date: 3/20/2006
Checked: MLS Date: 3/28/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Wall Cost	Subtotal Substructure Cost
3	1	105'	5 Steel Girders /per BRIDGE	46" Web Grade 50W	$0	$0	$170,000	$27,900	$58,400	$828,784	**$1,085,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile/Spread Footing)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Stem	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost	0				$0

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	0	$421.00	3.5%	$483.00	$0

Epoxy Coated Reinforcing Steel Unit Cost ($/lb):

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

MSE Abutment Unit Cost ($/sq. ft.):

Alternative No.	Total Area (sq. ft.)	2005 Unit Cost	Annual Escalation	Year 2008
3	14,960	$50.00	3.5%	$55.40

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

	Number of Piles		Total Pile Length
Alt. 1	68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - QUANTITY CALCULATIONS

By: JRC
Checked: MLS

Date: 3/21/2006
Date: 7/1/2005

Pier Quantities

Pier Locat	Length	Cap				Stem					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00		0	0
Pier 2 (Spr	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00		0	0
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					0					0					0	0
Total (Cu.Yd.)					0					0					0	0
			Qty x 2 (L/R)		0					0					0	0

Abutment Quantities

Abut Loca	Length (feet)	Backwall				Beam Seat					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Fwd. Abut	47.3	3	5.5	16.50	780	3	5.25	15.75		745	6	3	18	1	851	2377
Total (Cu.Ft.)					1561					1490					1703	4754
Total (Cu.Yd.)					58					55					63	176
			Qty x 2 (L/R)		116					110					126	352

Wingwall Quantities

Abut Loca	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volu
		Width	Height	Area	Volume	Width	Height	Area	Length	Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Fwd. Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Total (Cu.Ft.)					0					0					0	0
Total (Cu.Yd.)					0					0					0	0

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length
Rear Abut.	0	0	0	0	140	0	1	17	800.0	761.9	40.0	680
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	17	806	797	11.0	187
TotaL								34				867
							Qty x 2 (L/	68				1734

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	282	10	105	296100
Span 2	0	0	0	0
Span 3	0	0	0	0
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
TotaL				296100

total steel weight per girder (lb.) = 29610
Total Span length (ft.)= 260.00
Weight Per ft. = 114

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 4 - SUPERSTRUCTURE

By: JRC Date: 3/21/2006
Checked: MLS Date: 3/28/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
4	1	105'	105.00	107.00	354	$208,600	$88,700	$82,500	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$378,400	$758,000	0%	$758,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.8	3.3	44.6
Right Bridge	0.73	45.00	32.8	3.3	44.6

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

QC/QA Concrete, Class QSC2
Unit Cost ($/cu. yd):

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$590.00

Based on parapet and slab percentages of total concrete area

Epoxy Coated Reinforcing Steel
Unit Cost ($/lb):
Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

	Year 2004	Annual Escalation	Year 2008
Deck Reinforcing	$0.77	3.5%	$0.88

Prestressed Concrete Girders
Unit Costs:

	Year 2005		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Type 4 I-Beams	$16,000	ea.	3.5%	$17,740	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,000	ea.	0	$0
Abutment Diaphragms	$1,200	ea.	3.5%	$1,330	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,330	ea.	24	$31,920
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	1050	$346,500
						TOTAL =	$378,420

Construction Complexity Factor
Percent of Superstructure = 0% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$144.00	3.5%	$165.00

Expansion Joints
Unit Costs ($/Lin.Ft.):

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Modular Expansion Joints (2001 Price)	1.00	$863.00	3.5%	$1,097.98

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 4 - SUBSTRUCTURE

By: JRC Date: 3/21/2006
Checked: MLS Date: 3/28/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Wall Cost	Additional Crane Cost	Subtotal Substructure Cost
4	1	105'	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$0	$0	$170,000	$27,900	$58,400	$828,784	$75,000	**$1,160,000**

COST SUPPORT CALCULATIONS

Pier QC/QA Concrete, Class QSC1 Cost: (HP-Pile)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Stem	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost	0				$0

Pier QC/QA Concrete, Class QSC1 Cost: (Drilled Shaft)

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
Columns	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	352	$421.00	3.5%	$483.00	$170,000
Wingwalls	0	$421.00	3.5%	$483.00	$0

Epoxy Coated Reinforcing Steel Unit Cost ($/lb):

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

	Year 2004	Annual Escalation	Year 2008
Pier	$0.77	3.5%	$0.88
Abutment	$0.77	3.5%	$0.88

MSE Abutment Unit Cost ($/sq. ft.):

Alternative No.	Total Area (sq. ft.)	Year 2005 Unit Cost	Annual Escalation	Year 2008
4	14,960	$50.00	3.5%	$55.40

Note: MSE wingwall lengths are based on the difference between the maximum bridge length and the length of the alternative being considered.

Pile Foundation Unit Cost ($/ft.): *HP 12X53 Piles, Furnished & Driven*

Number of Piles		Total Pile Length
68	SEE QUANTITY CALCULATIONS	1,734

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

Temporary Shoring and Support Unit Costs ($/sq. ft.):

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$22.50	3.5%	$25.80
Cofferdam	$32.00	3.5%	$36.70

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 4 - QUANTITY CALCULATIONS

By: JRC
Checked: MLS

Date: 3/21/2006
Date: 7/1/2005

Pier Quantities

Pier Locat	Length	Cap				Stem					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr Ftg)				0.00	0					0					0	0
Pier 2 (Spr Ftg)				0.00	0					0					0	0
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					0					0					0	0
Total (Cu.Yd.)					0					0					0	0
			Qty x 2 (L/R)		0					0					0	0

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length
Rear Abut.	0	0	0	0	140	0	1	17	800.0	761.9	40.0	680
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	17	806	797	11.0	187
TotaL								34				867
							Qty x 2 (L/	68				1734

Abutment Quantities

Abut Loca	Length (feet)	Backwall				Beam Seat					Footing					Total Volu
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Fwd. Abut	47.3	3	6.75	20.25	958	3	4	12.00		568	6	3	18	1	851	2377
Total (Cu.Ft.)					1916					1135					1703	4754
Total (Cu.Yd.)					71					42					63	176
			Qty x 2 (L/R)		142					84					126	352

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Wingwall Quantities

Abut Loca	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volu
		Width	Height	Area	Volume	Width	Height	Area	Length	Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Fwd. Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Total (Cu.Ft.)					0					0					0	0
Total (Cu.Yd.)					0					0					0	0

Superstructure P/S Concrete Quantities

Location	Type of girder	# Girders	Span Length	Total Length	Spacing Int.	No. of Int in span	Number of Int Diap. 1	Total No. in Span
Span 1	)D TYPE 4	10	105	1050	26.25			24
Span 2					0.00			0
Span 3					0.00			0
Span 4		0	0	0	0.00			0
Span 5		0	0	0	0.00			0
Span 6		0	0	0	0.00			0
Span 7		0	0	0	0.00			0
Span 8		0	0	0	0.00			0
Span 9		0	0	0	0.00			0
					Total			24
TotaL	)D TYPE 4	10		1050				

By: JRC Date: 3/21/2006
Checked: MLS Date: 3/28/2006

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Structural Steel Painting: Number of Maintenance Cycles	Structural Steel Painting: Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Superstructure Sealing: Number of Maintenance Cycles	Superstructure Sealing: Total Life Cycle Cost	Approach Pavement Resurfacing: Cost Per Cycle	Approach Pavement Resurfacing: Number of Maintenance Cycles	Approach Pavement Resurfacing: Total Life Cycle Cost
1	3	260.00	5 Steel Girders /per BRIDGE	$446,900	2	$893,800	$0	0	$0	$0	0	$0
2	3	260.00	5 Prestressed I-Girders /per BRIDGE	$0	0	$0	$51,600	2	$103,200	$0	0	$0
1A	3	260.00	4 Steel Girders /per BRIDGE	$407,000	2	$814,000	$0	0	$0	$0	0	$0
2A	3	260.00	4 Prestressed I-Girders /per BRIDGE	$0	0	$0	$44,100	2	$88,200	$0	0	$0
3	1	105.00	5 Steel Girders /per BRIDGE	$194,200	2	$388,400	$0	0	$0	$2,600	10	$26,000
4	1	105.00	5 Prestressed I-Girders /per BRIDGE	$0	0	$0	$24,000	2	$48,000	$2,600	10	$26,000

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Bridge Deck Overlay (5): Deck Demo & Chipping	Bridge Deck Overlay (5): Deck Overlay	Bridge Deck Overlay (5): Deck Joint Gland (2)	Bridge Deck Overlay (5): Number of Maintenance Cycles	Bridge Deck Overlay (5): Total Life Cycle Cost	Bridge Redecking (5): Deck Concrete Cost (3)	Bridge Redecking (5): Deck Reinforcing Cost (3)	Bridge Redecking (5): Deck Joint Cost (2)	Bridge Redecking (5): Deck Removal Cost	Bridge Redecking (5): Number of Maintenance Cycles	Bridge Redecking (5): Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	3	260	5 Steel Girders /per BRIDGE	$71,500	$86,700	n/a	1	$158,200	$511,300	$217,400	n/a	$195,200	1	$923,900	$1,976,000	$2,960,000	$4,936,000
2	3	260	5 Prestressed I-Girders /per BRIDGE	$71,500	$86,700	n/a	1	$158,200	$510,900	$217,200	n/a	$195,200	1	$923,300	$1,185,000	$3,320,000	$4,505,000
1A	3	260	4 Steel Girders /per BRIDGE	$71,500	$86,700	n/a	1	$158,200	$556,200	$237,200	n/a	$195,200	1	$988,600	$1,961,000	$2,930,000	$4,891,000
2A	3	260	4 Prestressed I-Girders /per BRIDGE	$71,500	$86,700	n/a	1	$158,200	$556,200	$237,200	n/a	$195,200	1	$988,600	$1,235,000	$3,270,000	$4,505,000
3	1	105	5 Steel Girders /per BRIDGE	$29,200	$35,400	n/a	1	$84,600	$208,600	$88,700	n/a	$79,700	1	$377,000	$856,000	$2,520,000	$3,376,000
4	1	105	5 Prestressed I-Girders /per BRIDGE	$29,200	$35,400	n/a	1	$84,600	$208,600	$88,700	n/a	$79,700	1	$377,000	$516,000	$2,670,000	$3,186,000

Structural Steel Painting:

Structural Steel Area:

Alt. No.	Web Depth (in.)	No. Stringers	Total Span Length (ft.)	Assumed Ave. Bot. Flange Width (in.)	Nominal Exposed Girder Area (sq. ft.)	Secondary Member Allowance	Total Exposed Steel Area (sq. ft.)
1	41	10	260.00	15.75	28,004	20%	33,600
1A	50	8	260.00	15.75	25,623	20%	30,600
3	46	10	105.00	15.75	12,184	20%	14,600

Painting Cost per sq. ft.:

	Year 2005	Annual Escalation	Year 2008
Paint	$12.00	3.5%	$13.30

Superstructure Sealing:

PS Concrete I-Beam Area:

60" Modified AASHTO Type 4

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		34		2	68.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00
Total Exposed Perimeter					174.30 in.

66" Modified AASHTO Type 4

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		40		2	80.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00
Total Exposed Perimeter					186.30 in.

54" AASHTO Type 2

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		23		2	46.00
Upper Fillets	6	6	8.49	2	16.97
Top Flange		8		2	16.00
Total Exposed Perimeter					146.43 in.

72" Modified AASHTO Type 4

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		46		2	92.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00
Total Exposed Perimeter					198.30 in.

PS Concrete Area:

Alt. No.	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)
2	10	262.00	38,056	10%	4,650
2A	8	262.00	32,541	10%	3,980
4	10	107.00	17,682	10%	2,160

Sealing Cost per sq. yd.:

	Year 2005	Annual Escalation	Year 2008
Epoxy-Urethane Sealer	$10.00	3.5%	$11.09

Bridge Redecking:

Bridge Deck Joint Cost per foot:

	Year 2004	Annual Escalation	Year 2008
Structural Expansion Joint Including Elastomeric Strip Seal	$238.00	3.5%	$273.11

	Bridge Width	No. Joints
Alt. 1	94.63	0
Alt. 2	94.63	0
Alt. 1A	94.63	0
Alt. 2A	94.63	0
Alt. 3	94.63	0
Alt. 4	94.63	0

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	23,580	$8.28	$195,200
Alt. 2	23,580	$8.28	$195,200
Alt. 1A	23,580	$8.28	$195,200
Alt. 2A	23,580	$8.28	$195,200
Alt. 3	9,630	$8.28	$79,700
Alt. 4	9,630	$8.28	$79,700

Bridge Deck Overlay (Item 848):

Bridge Deck MSC Overlay Cost per sq. yd.:

	Year 2004	Annual Escalation	Year 2008
Micro Silica Modified Concrete Overlay Using Hydrodemolition (1.25" thick)	$25.58	3.5%	$29.35
Surface Preparation Using Hydrodemolition	$22.65	3.5%	$26.22
Hand Chipping	$37.07	3.5%	$42.54

Bridge Deck MSC Overlay Cost per cu. yd.:

	Year 2004	Annual Escalation	Year 2008
Micro Silica Modified Concrete Overlay (Variable Thickness), Material Only	$144.00	3.5%	$165.24

	Deck Area (3) (sq. ft.)	Deck Area (sq. yd.)	Hand Chipping (sq. yd.)	Variable Thickness Repair (cu. yd.)
Alt. 1	23,580	2,620	66	59
Alt. 2	23,580	2,620	66	59
Alt. 1A	23,580	2,620	66	59
Alt. 2A	23,580	2,620	66	59
Alt. 3	9,630	1,070	27	24
Alt. 4	9,630	1,070	27	24

Assume 25% of deck area requires removal to depth of 4.5"

	Year 2004	Annual Escalation	Year 2008
Bridge Deck Joint Gland Replacement Cc	$59.50	3.5%	$68.26

Elastomeric Strip Seal Gland

Assume gland replacement cost equals 25% of original deck joint construction cost.

NOTES:

1. Life cycle maintenance costs assume a 75-year structure life, and are expressed in present value (2008 construction year) dollars.
2. Bridges are assumed to have semi-integral abutments, therefore no strip seal deck joints will be required.
3. See Superstructure Cost sheet.
4. See Alternative Cost Summary sheet.
5. Assume bridge deck overlay at Year 25 and bridge deck replacement at Year 50. Assume superstructures are painted or sealed on a 25-year recurrence interval. Assume complete bridge replacement at Year 75.
6. Life cycle maintenance cost differences are assumed to be predominately a function of superstructure maintenance costs. Consequently, substructure lifecycle maintenance costs are not included in this analysis.

Approach Pavement Resurfacing:

Resurface Perpetual Asphalt Pavement:
Resurfacing Units Costs:

	Year 2004	Annual Escalation	Year 2008
Pavement Planing, Asphalt Concrete, per sq. yd. (Item 254)	$0.98	3.5%	$1.12
Asphalt Concrete Surface Course, per cu. yd.	$72.00	3.5%	$82.62

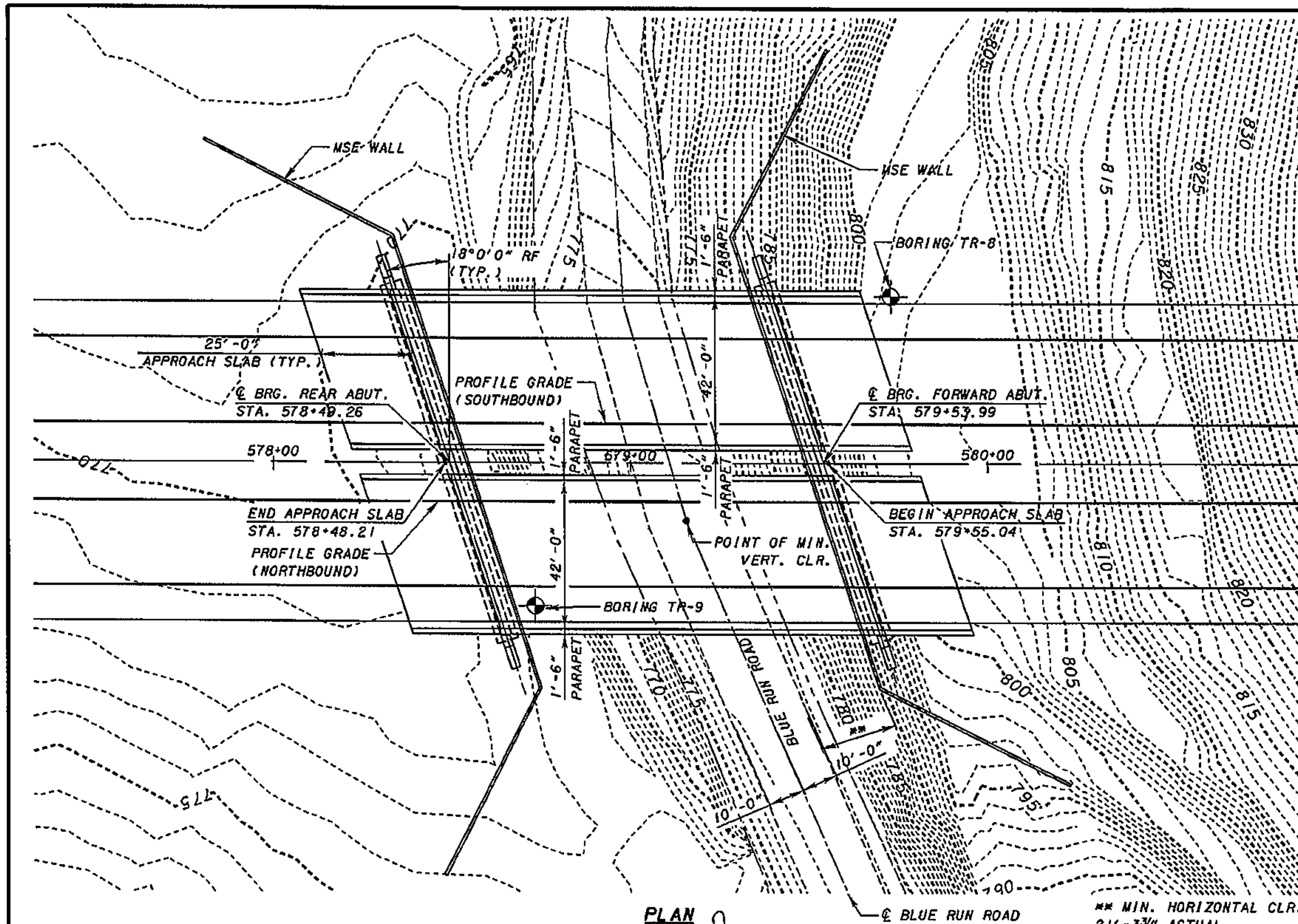
Asphalt Resurfacing Costs:

	Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
Alt. 1	0.0	33.0	0	1.50	0.0
Alt. 2	0.0	33.0	0	1.50	0.0
Alt. 1A	0.0	33.0	0	1.50	0.0
Alt. 2A	0.0	33.0	0	1.50	0.0
Alt. 3	155.0	33.0	568	1.50	23.7
Alt. 4	155.0	33.0	568	1.50	23.7

APPENDIX B

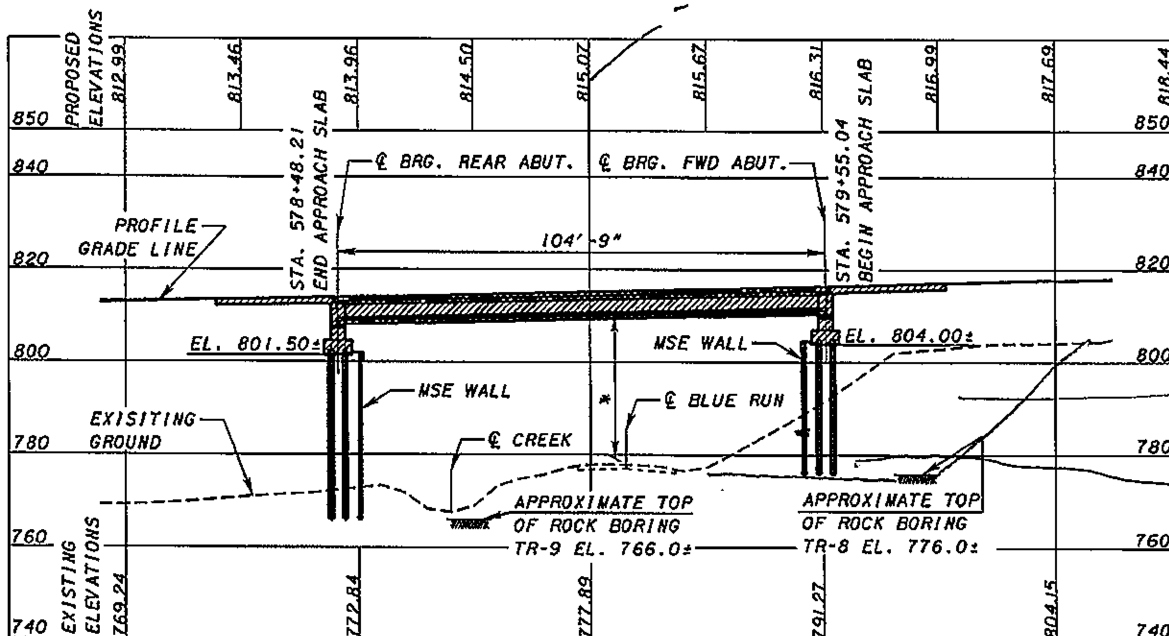
Preferred Alternative Site Plan and Details

TRANSYSTEMS CORPORATION



PLAN

** MIN. HORIZONTAL CLR.
21'-3¾" ACTUAL
20'-0" REQUIRED



ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN. VERT. CLR.
29'-1$\frac{9}{16}$" ACTUAL
14'-6" REQUIRED

FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS		
LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS		
BORING No.	STATION	OFFSET
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.

BENCHMARK 1	BENCHMARK 2
(TO BE PROVIDED LATER)	(TO BE PROVIDED LATER)

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (20XX) = 19,800
CURRENT YEAR ADTT (20XX) = 2,722
DESIGN YEAR ADT (20XX) = 26,000
DESIGN YEAR ADTT (20XX) = 3,640

PROPOSED STRUCTURE

TYPE: SINGLE SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPAN: 104'-9" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS - 60 PSF

SKEW: 18°00'00"

CROWN: 0.016 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC SURFACE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.
2. EARTHWORK LIMITS SHWON ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.
3. THE PROPOSED PROFILE GRADE IS WITHIN BRIDGE LIMITS. SEE ROADWAY PLANS FOR PAVEMENT ELEVATIONS BEYOND BRIDGE LIMITS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 12x53 PILES AND HAVE A MAXIMUM CAPACITY OF 70 TONS PER PILE.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL

inside shoulder
show slope indicators
show vert. curve data
not with concrete
sight distance 25'0" OK (pg 2)
20' to edge of travel lane
Was the excavation taken into account for cost
30'4

TRANSYSTEMS CORPORATION

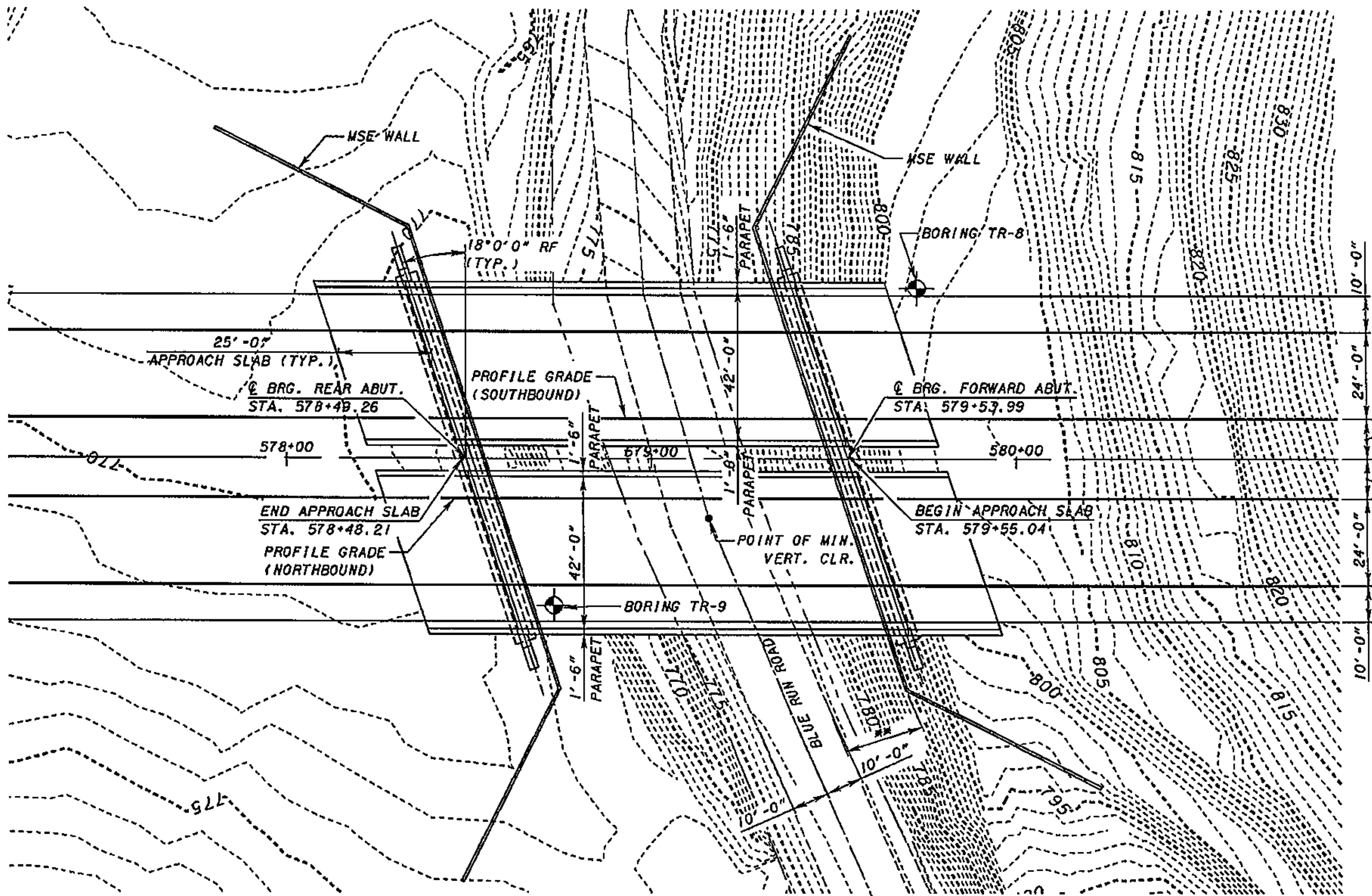
DESIGNED MSL | DRAWN MTN | REVIEWED JRC | DATE 3/29/06

PRELIMINARY SITE PLAN - ALTERNATIVE 4
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

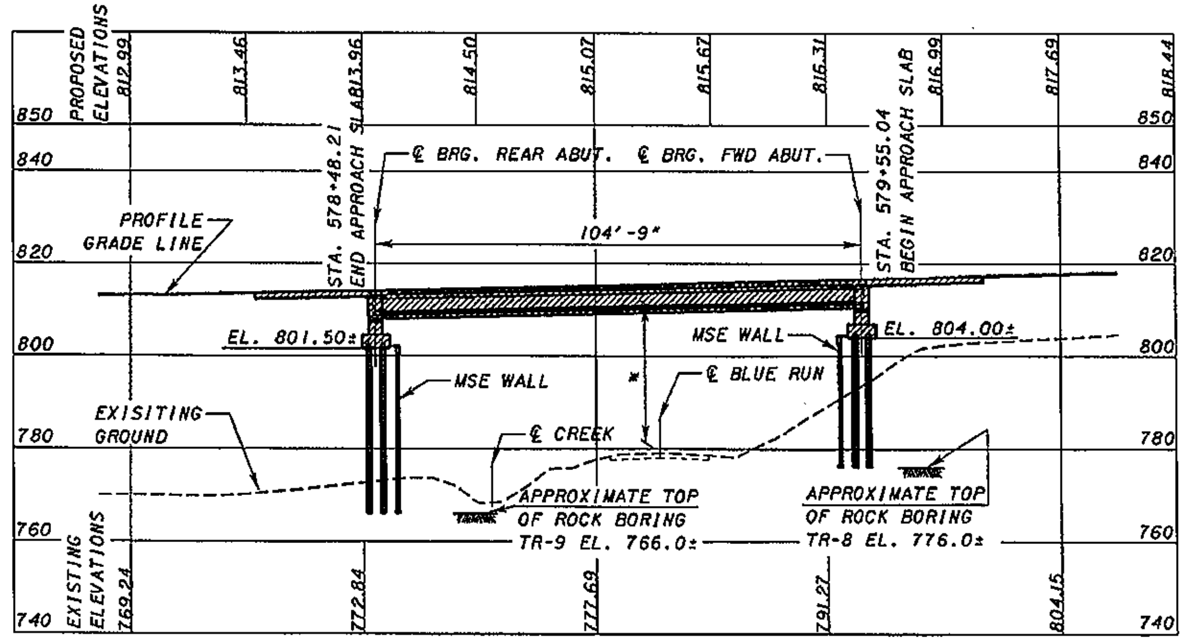
SCIOTO COUNTY
STA. 578+48.21
STA. 579+55.04

SCI-823-0.00
PID 19415

1 / 3



PLAN



ELEVATION ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

* MIN. VERT. CLR.
29'-1$\frac{9}{16}$" ACTUAL
14'-6" REQUIRED

FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS

LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS

BORING No.	STATION	OFFSET
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.

BENCHMARK 1	BENCHMARK 2
(TO BE PROVIDED LATER)	(TO BE PROVIDED LATER)

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (20XX) = 19,800
CURRENT YEAR ADTT (20XX) = 2,722
DESIGN YEAR ADT (20XX) = 26,000
DESIGN YEAR ADTT (20XX) = 3,640

PROPOSED STRUCTURE

TYPE: SINGLE SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.
SPAN: 104'-9" c/c BEARINGS
ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS
LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS = 60 PSF
SKEW: 18°00'00"
CROWN: 0.016 FT/FT
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC SURFACE
APPROACH SLABS: AS-1-81 (25'-0" LONG)
LATITUDE:
LONGITUDE:

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.
2. EARTHWORK LIMITS SHWON ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.
3. THE PROPOSED PROFILE GRADE IS WITHIN BRIDGE LIMITS. SEE ROADWAY PLANS FOR PAVEMENT ELEVATIONS BEYOND BRIDGE LIMITS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 12x53 PILES AND HAVE A MAXIMUM CAPACITY OF 70 TONS PER PILE.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL

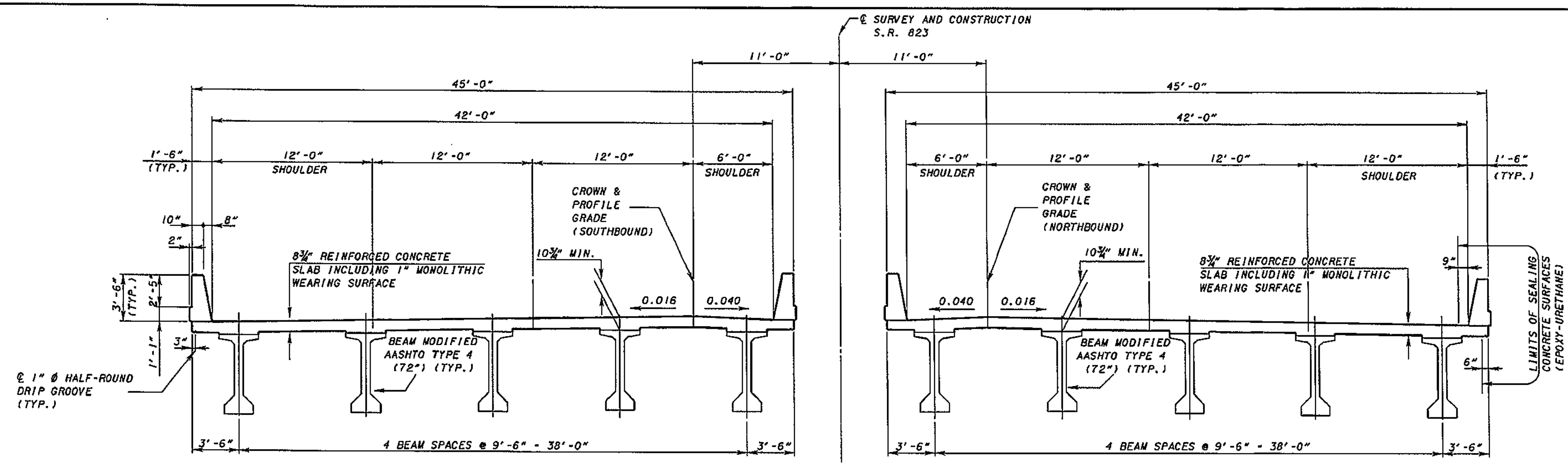
DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN MTN | REVISED | REVIEWED JRC | DATE 3/29/06 | STRUCTURE FILE NUMBER

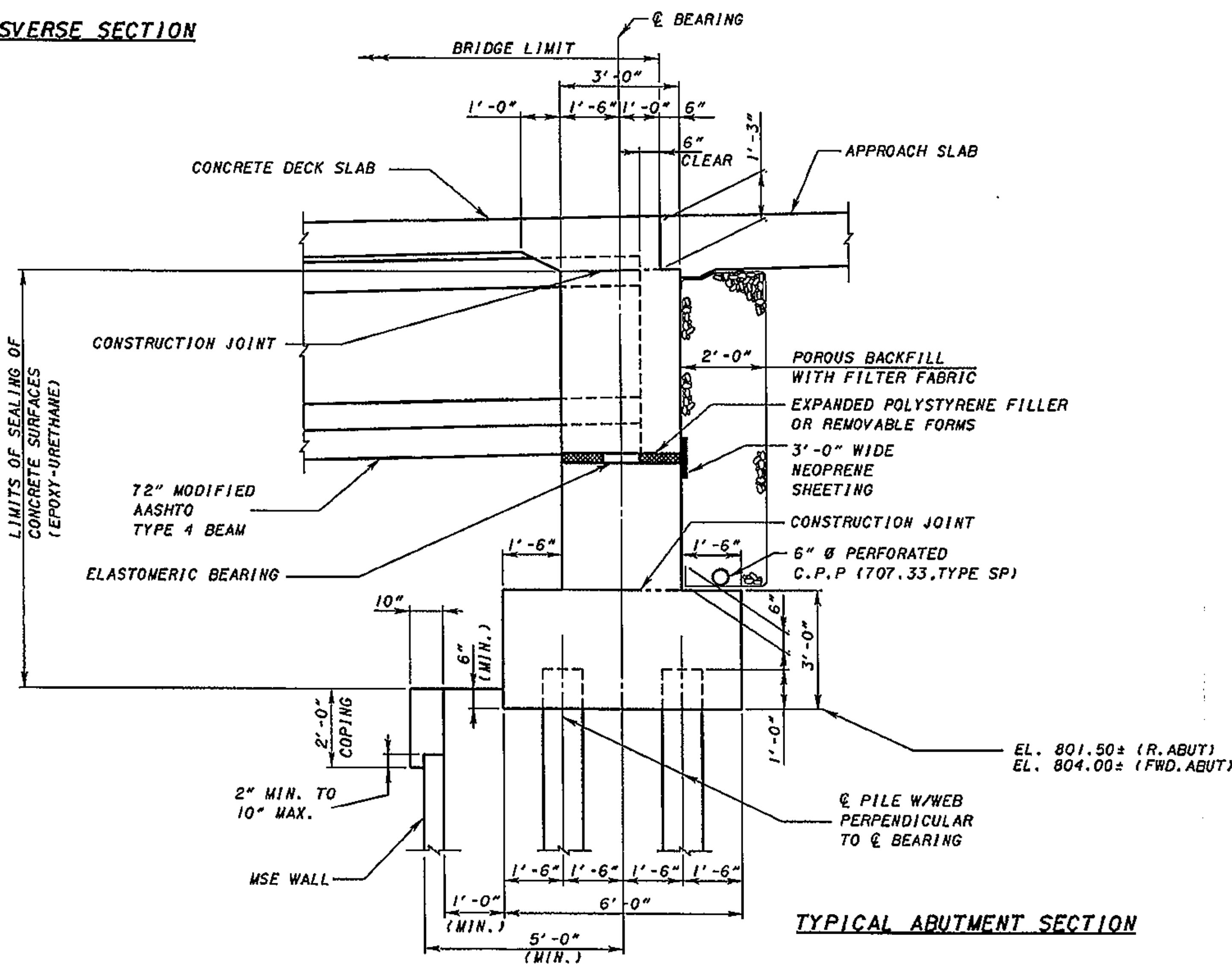
SCIOTO COUNTY
STA. 578+48.21
STA. 579+55.04

PRELIMINARY SITE PLAN- ALTERNATIVE 4
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415



PROPOSED TRANSVERSE SECTION



TYPICAL ABUTMENT SECTION

SUPERSTRUCTURE DEPTH	
ITEM	72" MODIFIED AASHTO TYPE 4 BEAM
SLAB (INCLUDING WEARING SURFACE)	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
GIRDER DEPTH	72"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (INCH)	82.75"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (FEET)	6.896'

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN CAS | REVISED | REVIEWED | DATE 3/29/06 | STRUCTURE FILE NUMBER

TYPICAL TRANSVERSE & ABUTMENT SECTION
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

APPENDIX C

Vertical Clearance Calculations

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By	MSL	Date	03/28/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER BLUE RUN ROAD PID # 19415

Alternative 1 - 5-41" web continuous plate girders Gr. 50W, 3 span — ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	43	3.58
	53.75	4.48

Total Superstructure Depth (ft) = **4.48**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**579+15.77**
Offset Location @ Critical Point	=	**16.426' Right**
Profile Grade Elevation at Critical Point	=	815.44
Adjustment for Cross Slopes to Beam CL	=	-0.09
Top of Deck Elevation @ Critical Point	=	**815.35**
Total Superstructure Depth	=	-4.48
Bottom of Beam Elevation @ Critical Point	=	**810.87**
Approximate Top of Existing Ground @ Critical Point	=	**779.33**
Actual Vertical Clearance	=	***31.55***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	03/28/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER BLUE RUN ROAD PID # 19415

Alternative 1A - 4-50" web continuous plate girders Gr. 50W, 3 span ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9.75	0.81
Haunch:	2	0.17
Girder or Beam Depth:	52.625	4.39
	64.375	5.37

Total Superstructure Depth (ft) = **5.37**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**579+15.77**
Offset Location @ Critical Point	=	**16.426' Right**
Profile Grade Elevation at Critical Point	=	815.44
Adjustment for Cross Slopes to Beam CL	=	-0.09
Top of Deck Elevation @ Critical Point	=	**815.35**
Total Superstructure Depth	=	-5.37
Bottom of Beam Elevation @ Critical Point	=	**809.98**
Approximate Top of Existing Ground @ Critical Point	=	**779.33**
Actual Vertical Clearance	=	***30.66***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	03/28/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER BLUE RUN ROAD PID # 19415

Alternative 2 - 5-60" Modified AASHTO Type 4, 3 Span ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	60	5
	70.75	5.9

Total Superstructure Depth (ft) = **5.90**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**579+15.77**
Offset Location @ Critical Point	=	**16.426' Right**
Profile Grade Elevation at Critical Point	=	815.44
Adjustment for Cross Slopes to Beam CL	=	-0.09
Top of Deck Elevation @ Critical Point	=	**815.35**
Total Superstructure Depth	=	-5.90
Bottom of Beam Elevation @ Critical Point	=	**809.45**
Approximate Top of Existing Ground @ Critical Point	=	**779.33**
Actual Vertical Clearance	=	***30.13***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	03/28/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name *SCI-823-0.00* **Structure**

Description *S.R. 823 OVER BLUE RUN ROAD* **PID #** *19415*

Alternative 2A - 4-66" Modified AASHTO Type 4, 3 Span — ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9.75	0.81
Haunch:	2	0.17
Girder or Beam Depth:	66	5.5
	77.75	6.48

Total Superstructure Depth (ft) = **6.48**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**579+15.77**
Offset Location @ Critical Point	=	**16.426' Right**
Profile Grade Elevation at Critical Point	=	815.44
Adjustment for Cross Slopes to Beam CL	=	-0.09
Top of Deck Elevation @ Critical Point	=	**815.35**
Total Superstructure Depth	=	-6.48
Bottom of Beam Elevation @ Critical Point	=	**808.87**
Approximate Top of Existing Ground @ Critical Point	=	**779.33**
Actual Vertical Clearance	=	***29.55***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	03/28/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER BLUE RUN ROAD PID # 19415

Alternative 3 - 5-46" web continuous plate girders Gr. 50W, 1 Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	49	4.08
	59.75	4.98

Total Superstructure Depth (ft) = **4.98**

Vertical Clearance at Critical Point

Station @ Critical Point = **579+15.77**

Offset Location @ Critical Point = **16.426' Right**

Profile Grade Elevation at Critical Point = 815.44

Adjustment for Cross Slopes to Beam CL = -0.09

Top of Deck Elevation @ Critical Point = **815.35**

Total Superstructure Depth = -4.98

Bottom of Beam Elevation @ Critical Point = **810.37**

Approximate Top of Existing Ground @ Critical Point = **779.33**

Actual Vertical Clearance = ***31.05***

Preferred Vertical Clearance = *15.0*

Required Vertical Clearance = *14.5*

TranSystems Corporation

Made By *MSL*	**Date** *03/28/06*	**Job No.** *P403030064*	
Checked By	**Date**	**Sheet No.**	

VERTICAL CLEARANCE CALCULATIONS

Job Name *SCI-823-0.00* **Structure**

Description *S.R. 823 OVER BLUE RUN ROAD* **PID #** *19415*

Alternative 4 - 5-72" Modified AASHTO Type 4, 1 Span — ***Point Location:* A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	5.426	-0.086816

(5.426 = 16.426 -11 ;16.426 is distance from CL Survey SR 823 to critical pt.)

Total Adjustment = **-0.09**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.75	6.9

Total Superstructure Depth (ft) = **6.90**

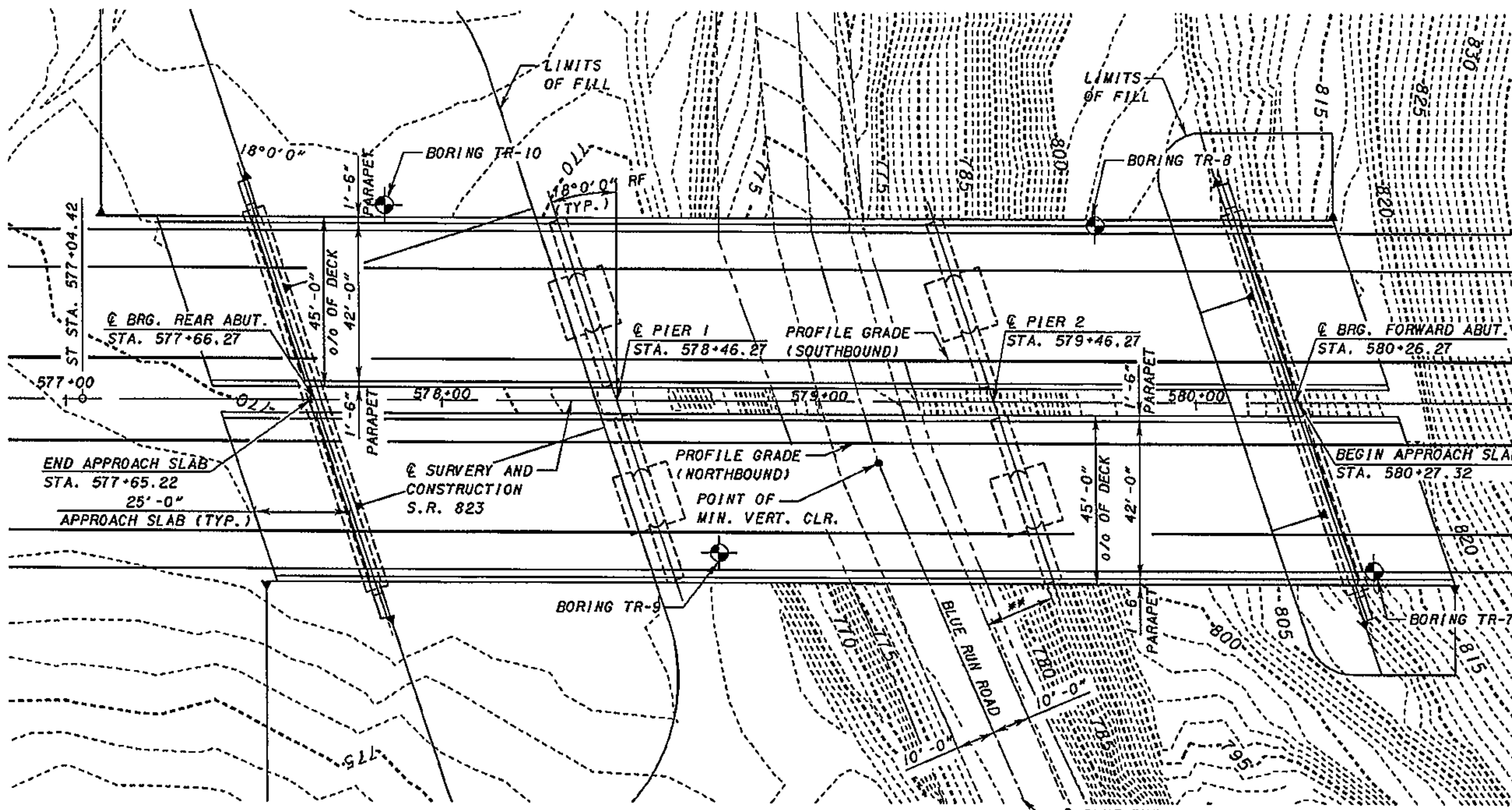
Vertical Clearance at Critical Point

Station @ Critical Point	=	**579+15.77**
Offset Location @ Critical Point	=	**16.426' Right**
Profile Grade Elevation at Critical Point	=	815.44
Adjustment for Cross Slopes to Beam CL	=	-0.09
Top of Deck Elevation @ Critical Point	=	**815.35**
Total Superstructure Depth	=	-6.90
Bottom of Beam Elevation @ Critical Point	=	**808.45**
Approximate Top of Existing Ground @ Critical Point	=	**779.33**
Actual Vertical Clearance	=	***29.13***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

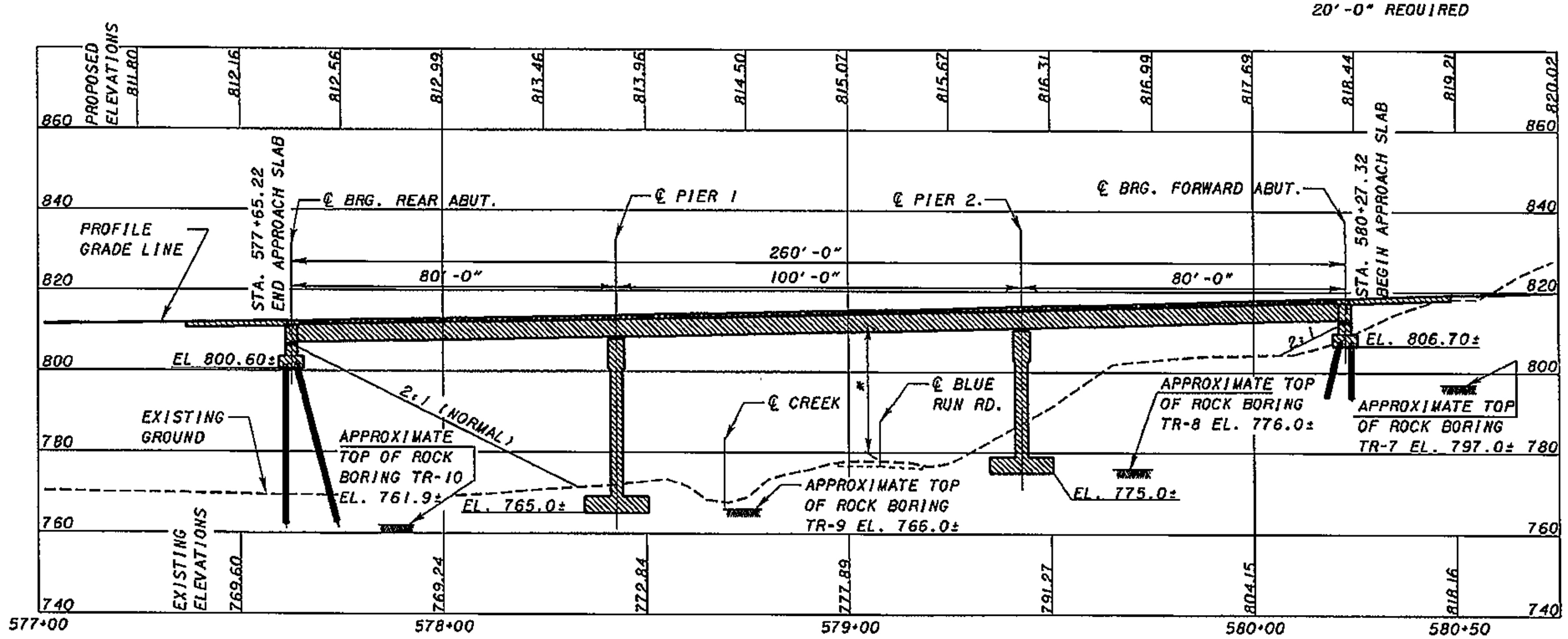
APPENDIX D

Preliminary Structure Site Plan

TRANSYSTEMS CORPORATION

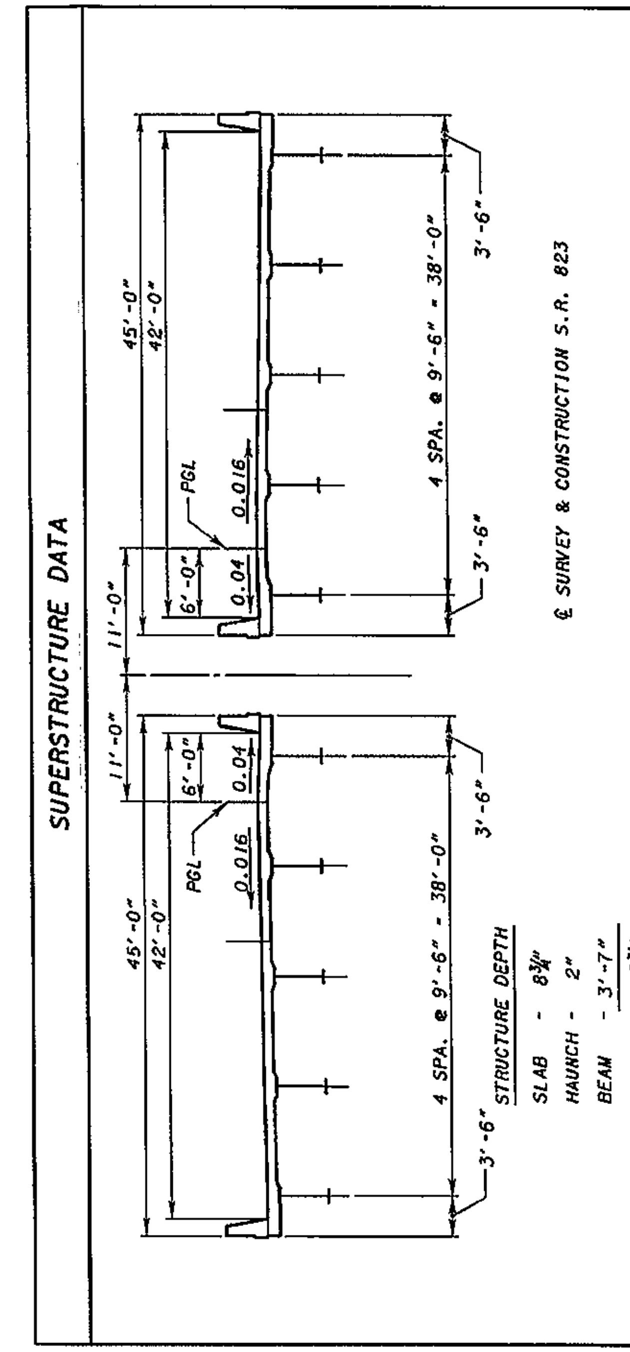


PLAN



ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN. VERT. CLR.
31'-6⅝" ACTUAL
14'-6" REQUIRED



PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPANS: 80'-0", 100'-0", 80'-0" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS - 60 PSF

SKEW: 18°00'00"

CROWN: 0.16 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TRANSYSTEMS CORPORATION

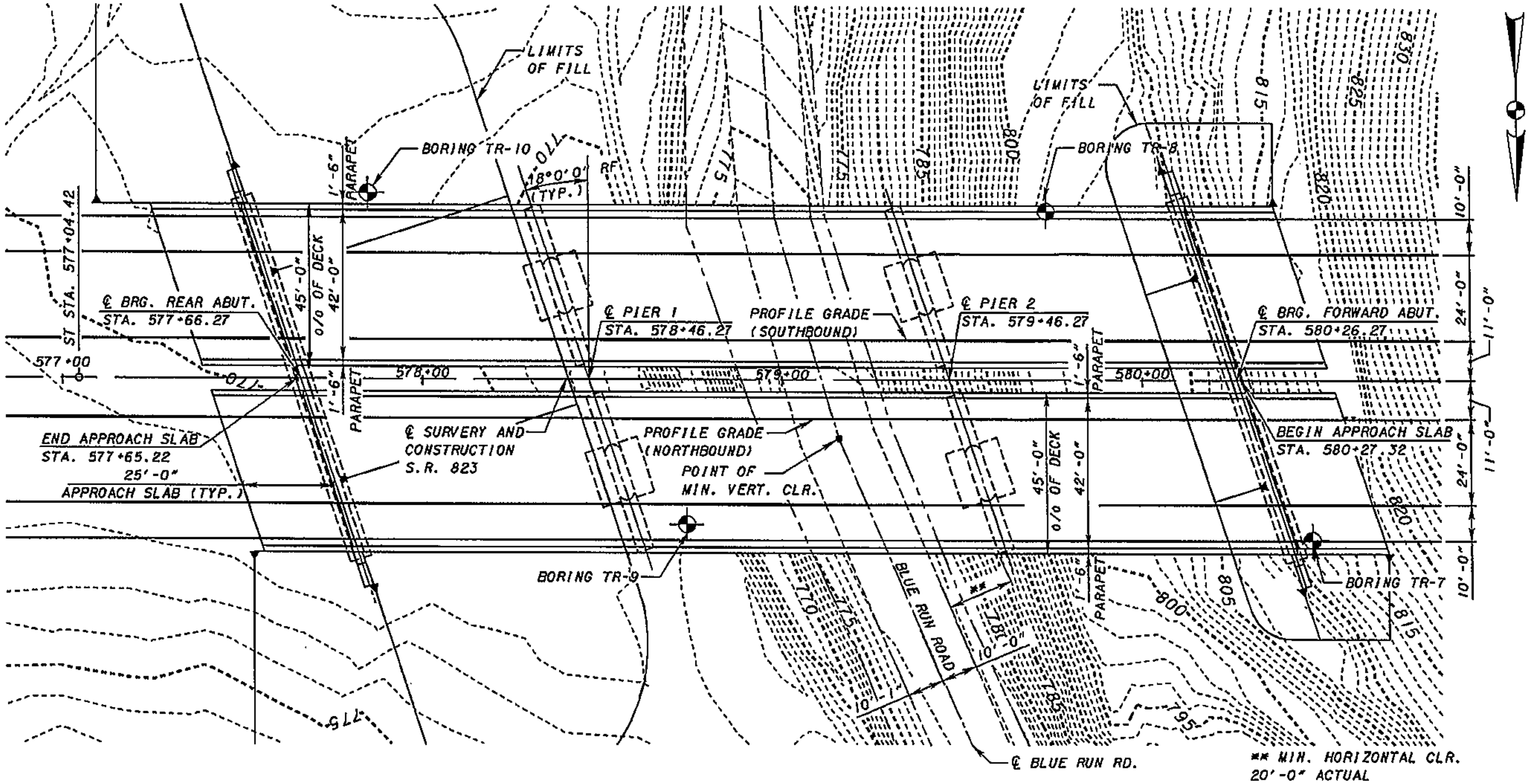
DESIGNED	DRAWN	REVIEWED	DATE
HSL	MTN	JRC	3/29/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY
STA. 577+65.22
STA. 580+27.32

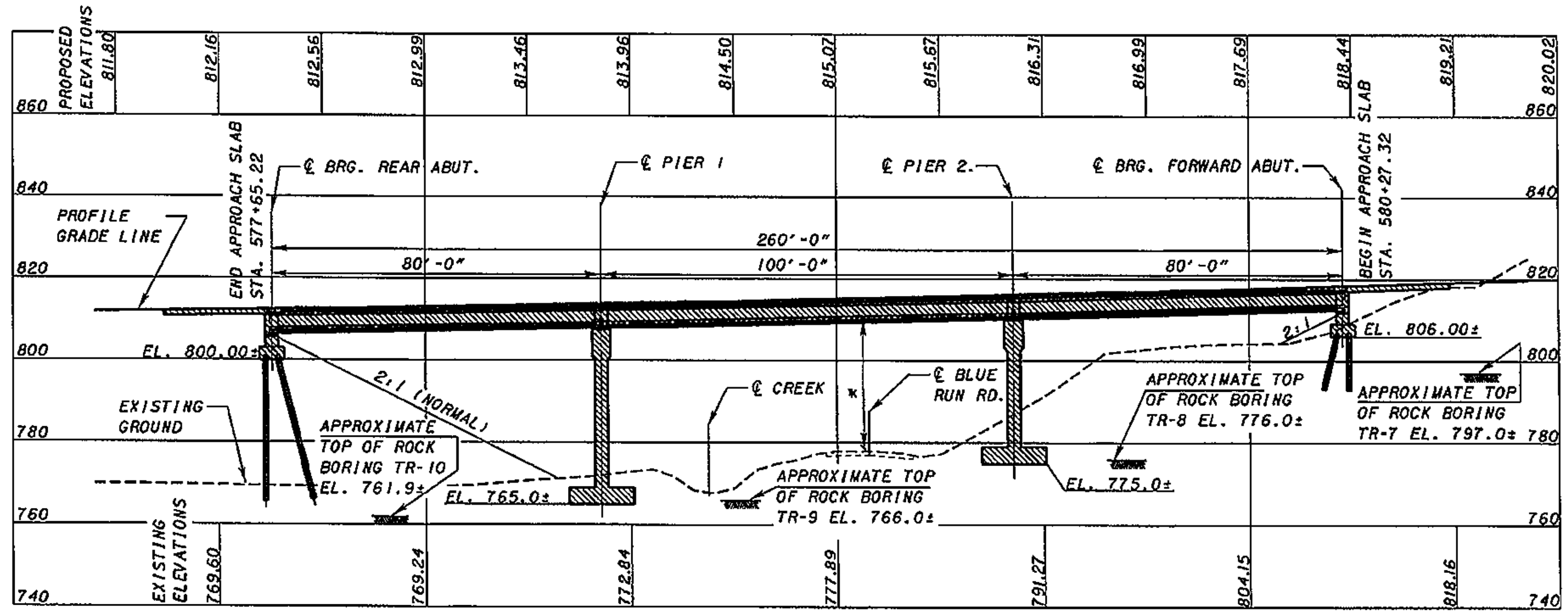
PRELIMINARY SITE PLAN- ALTERNATIVE I
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

1 / 1

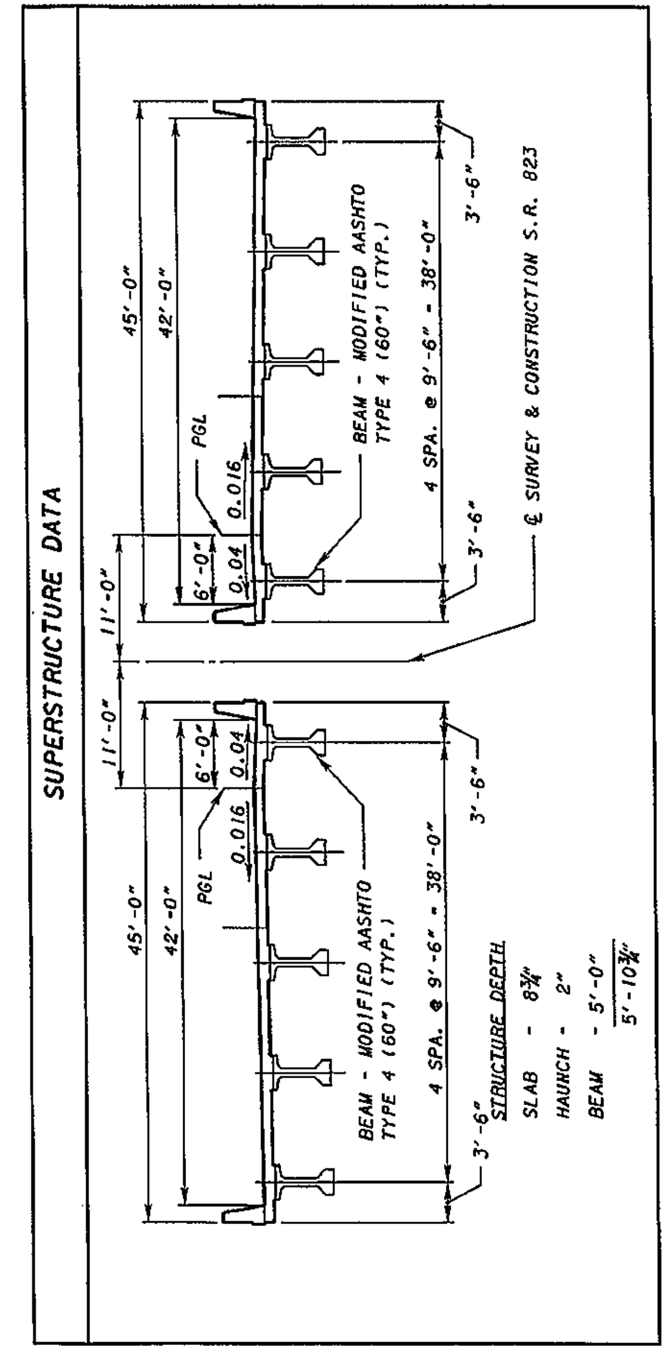


PLAN



ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN. VERT. CLR.
30'-1 9/16" ACTUAL
14'-6" REQUIRED



PROPOSED STRUCTURE

TYPE: 3-SPAN 60" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI- INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPANS: 80'-0", 100'-0", 80'-0" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS - 60 PSF

SKEW: 18°00'00"

CROWN: 0.16 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TRANSYSTEMS CORPORATION

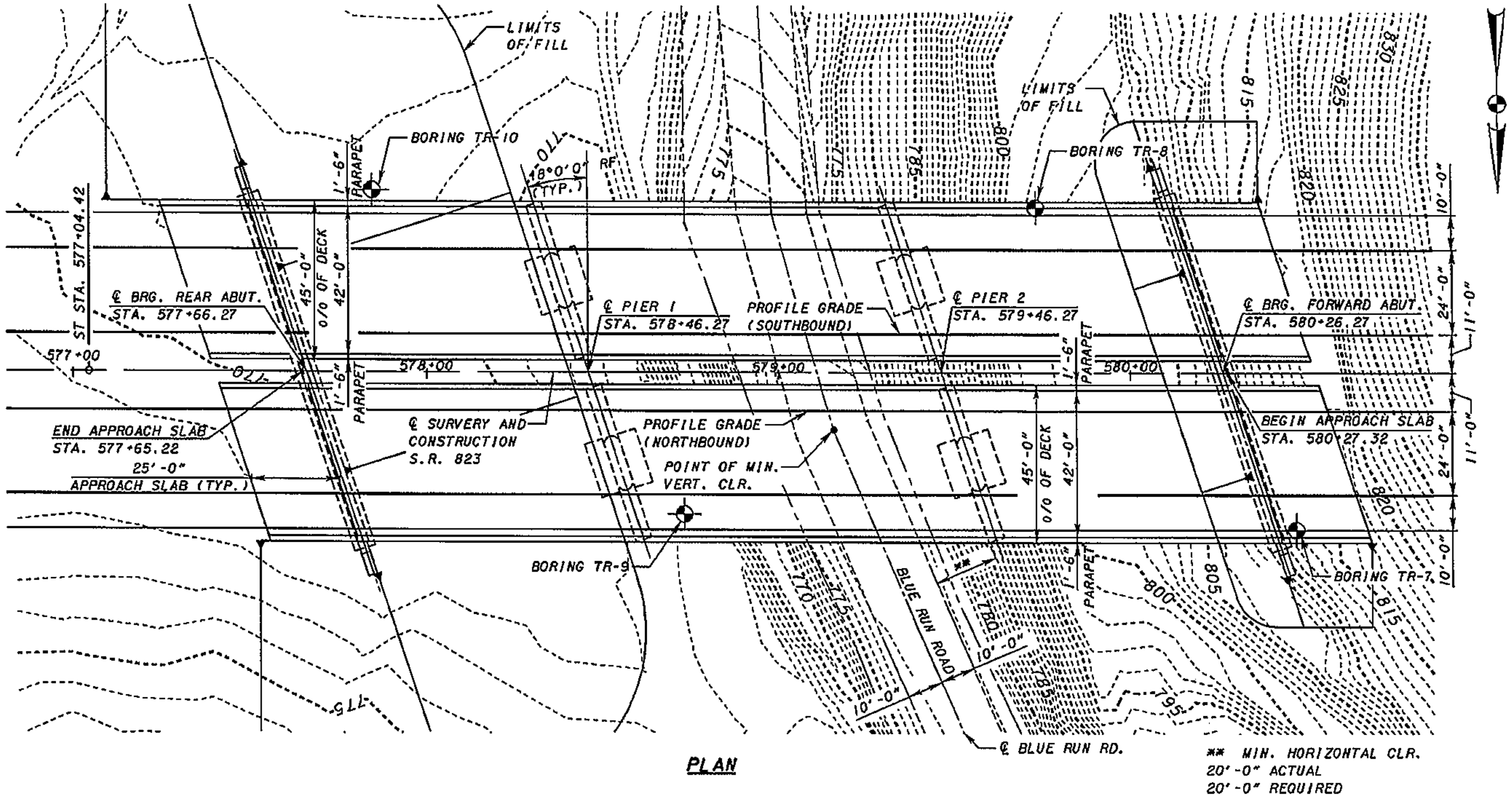
DESIGNED: MSL | DRAWN: MTN | REVIEWED: JRC | DATE: 3/29/06

CHECKED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 577+65.22
STA. 580+27.32

PRELIMINARY SITE PLAN- ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415



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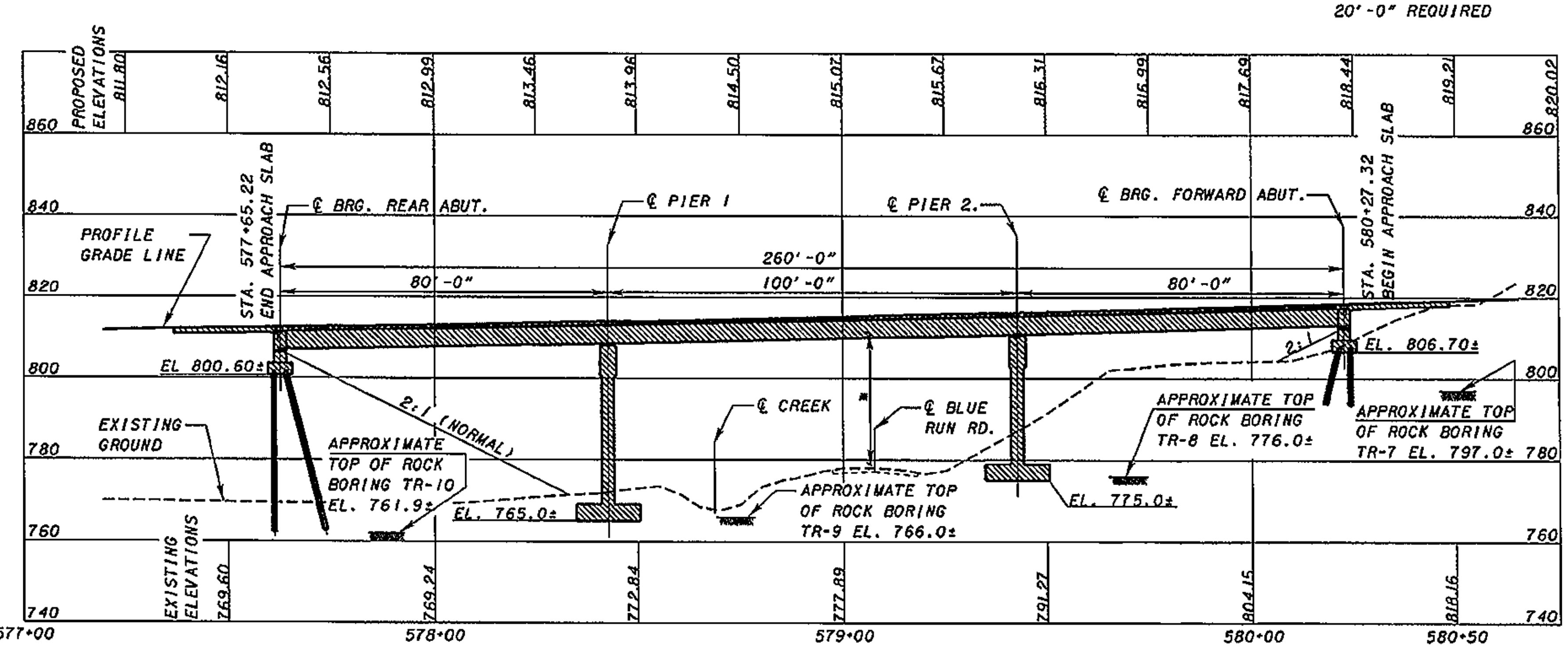
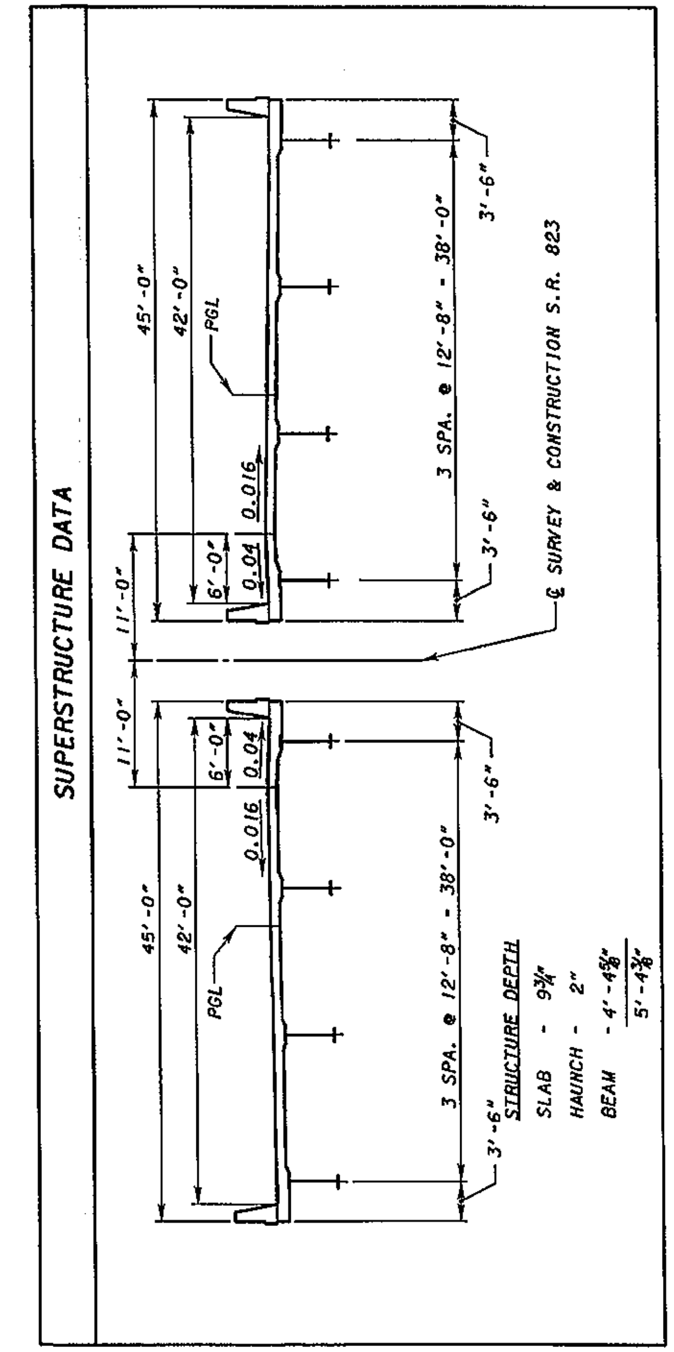


ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN. VERT. CLR.
30'-7 9/16" ACTUAL
14'-6" REQUIRED



PROPOSED STRUCTURE

TYPE: 3- SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS

SPANS: 80'-0", 100'-0", 80'-0" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS - 60 PSF

SKEW: 18°00'00"

CROWN: 0.16 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED: MSL | DRAWN: MTN | REVIEWED: JRC | DATE: 3/29/06

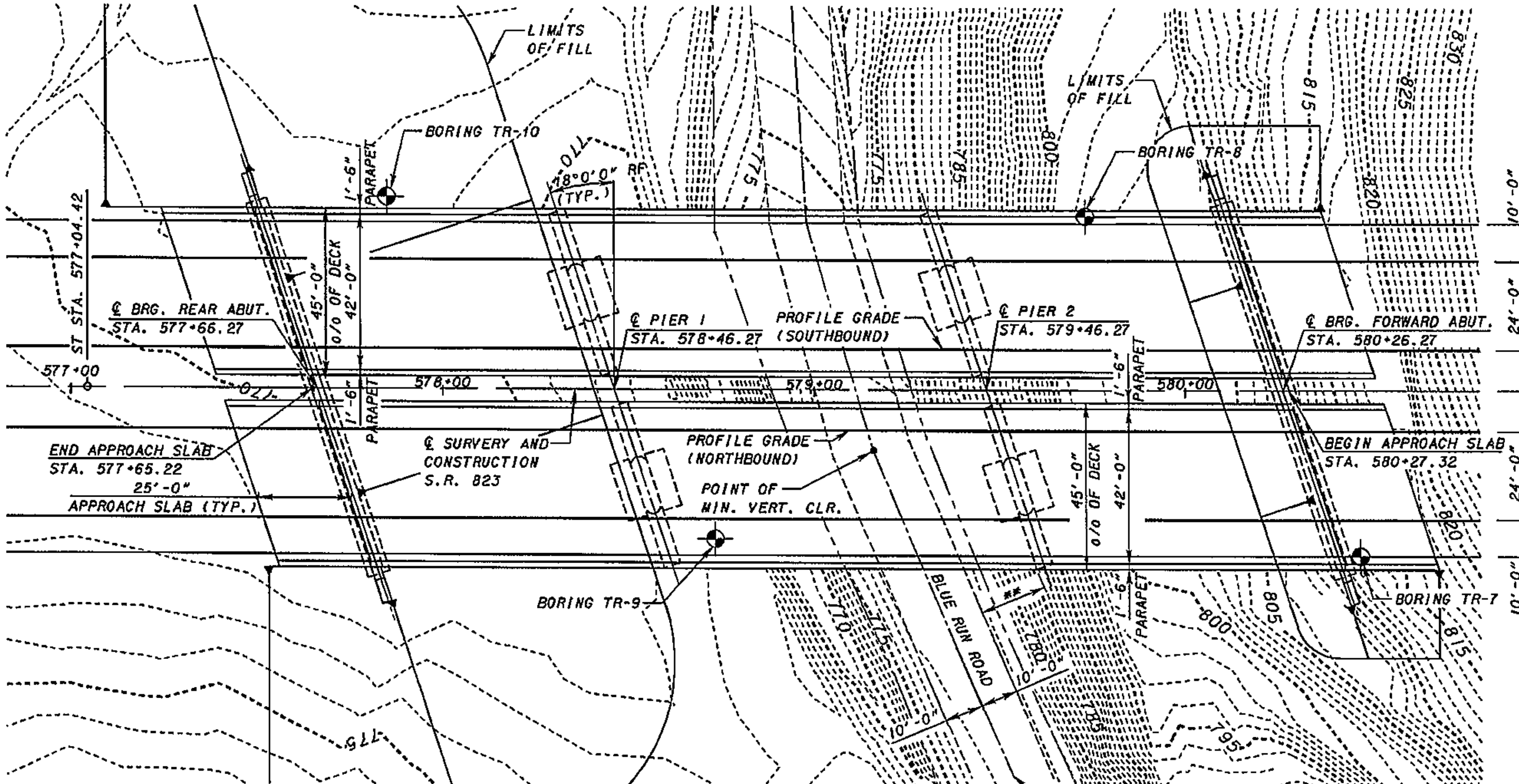
CHECKED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 577+65.22
STA. 580+27.32

PRELIMINARY SITE PLAN- ALTERNATIVE IA
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

1 / 1



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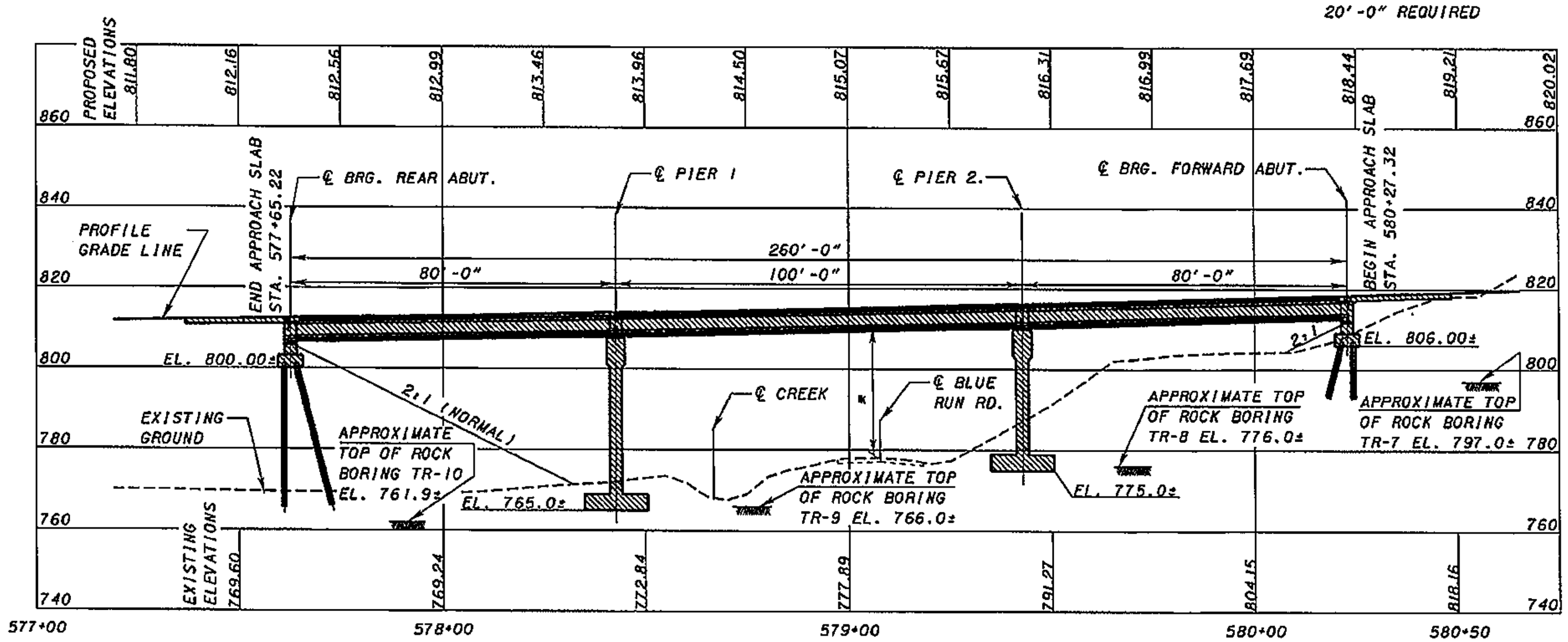
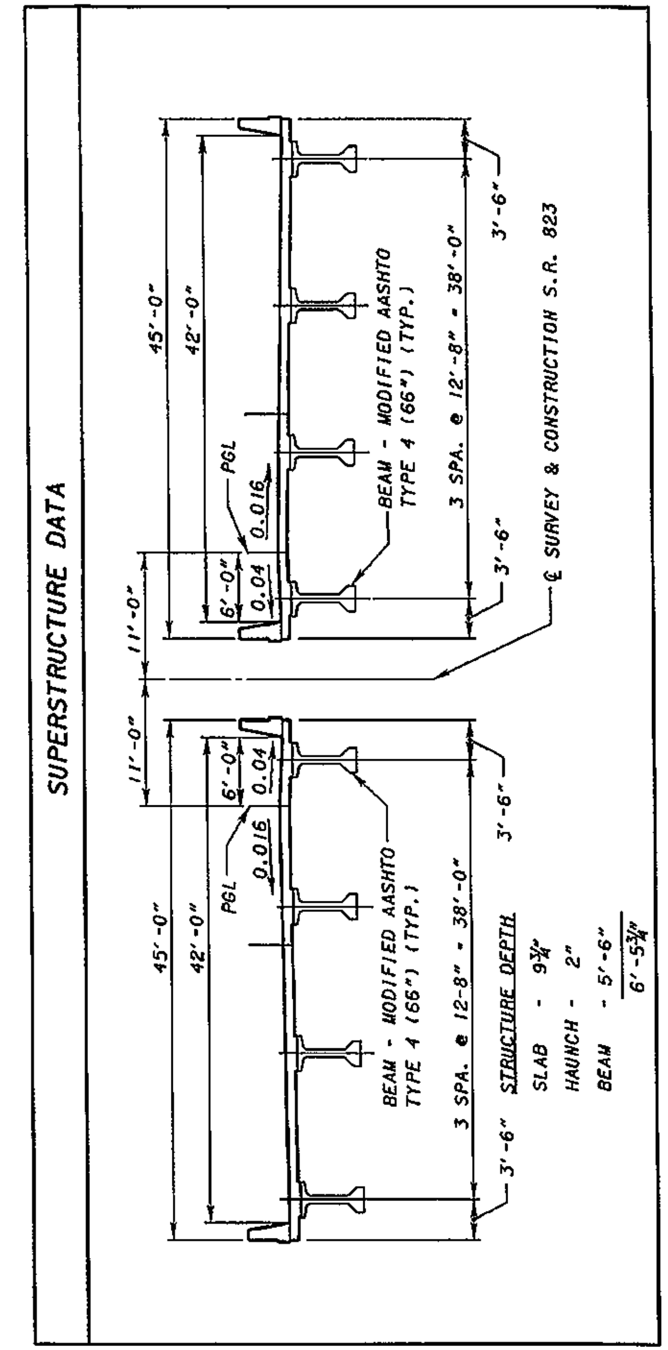


ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN VERT. CLR.
29'-6⅝" ACTUAL
14'-6" REQUIRED



PROPOSED STRUCTURE

TYPE: 3-SPAN 66" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPANS: 80'-0", 100'-0", 80'-0" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS - 60 PSF

SKEW: 18°00'00"

CROWN: 0.16 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

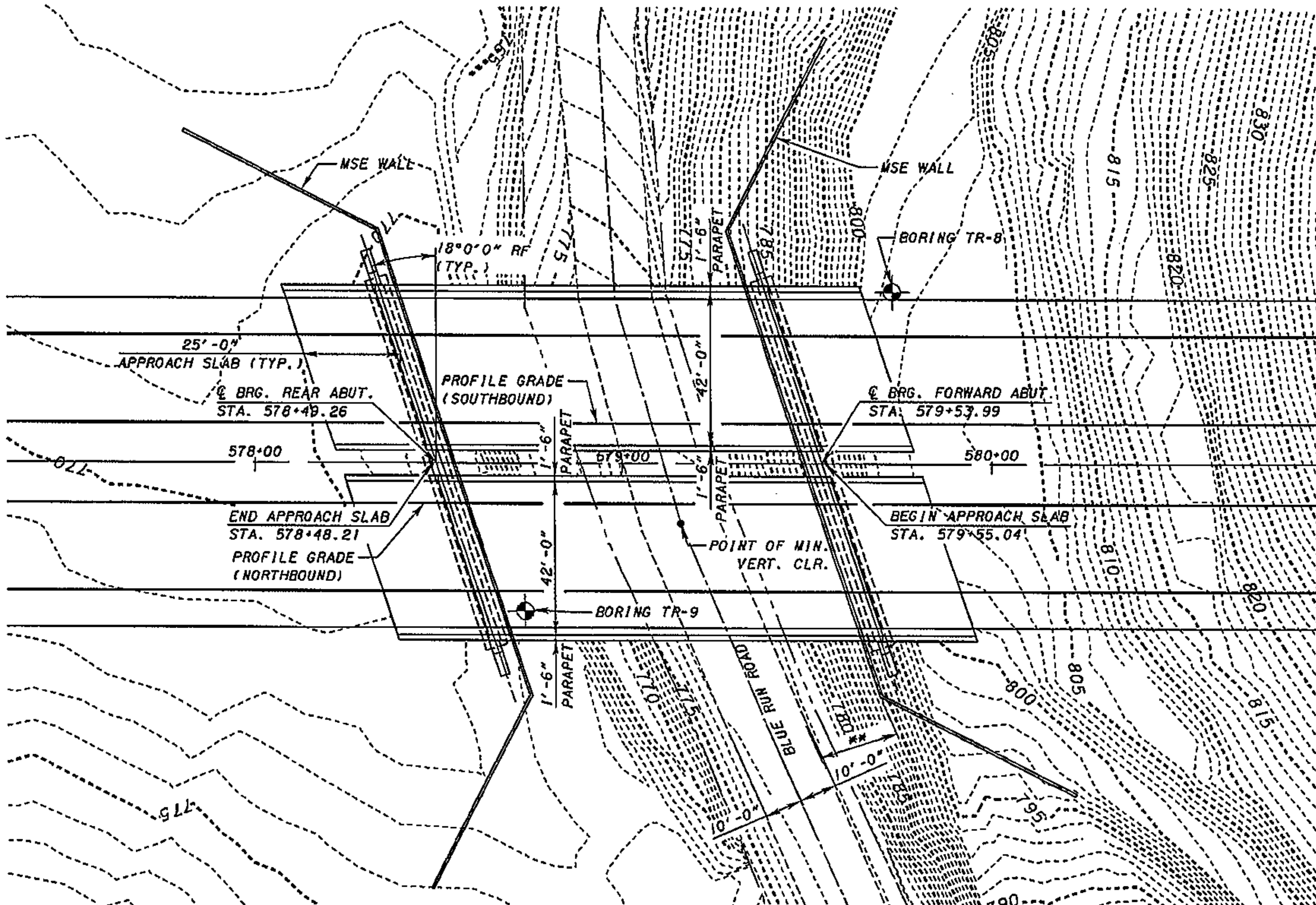
TRANSYSTEMS CORPORATION (DESIGN AGENCY)

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	3/29/06

SCIOTO COUNTY
STA. 577+65.22
STA. 580+27.32

PRELIMINARY SITE PLAN- ALTERNATIVE 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415



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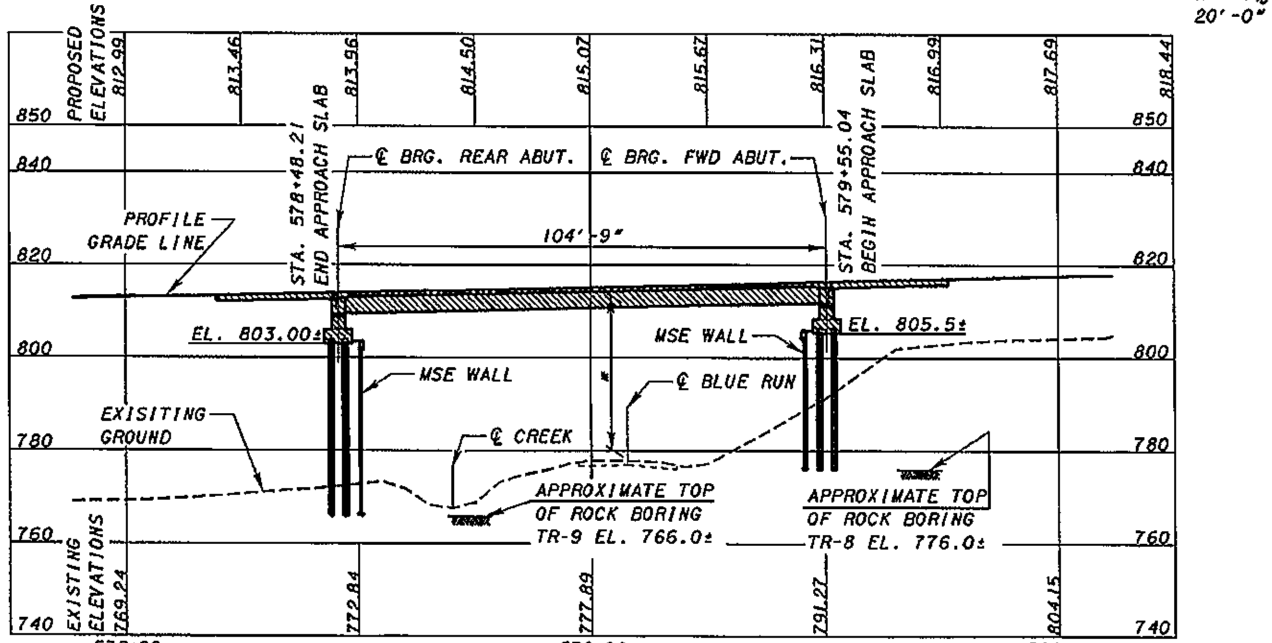
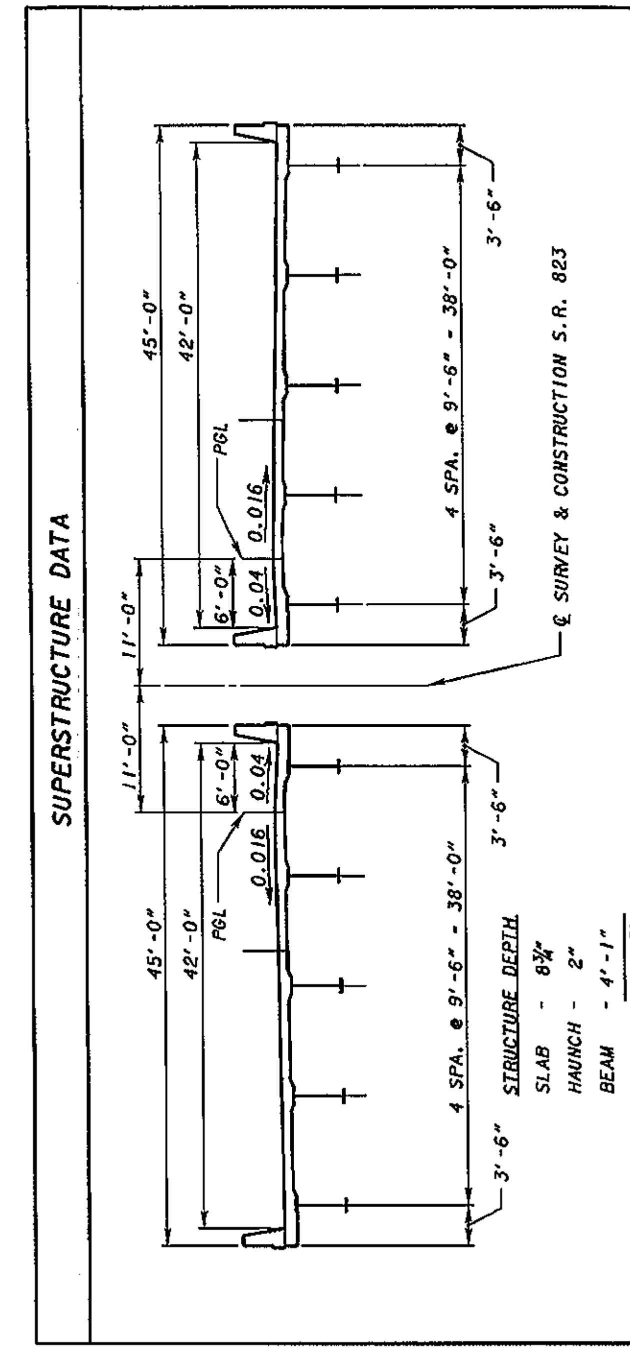


ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* MIN. VERT. CLR.
31'-0⅝" ACTUAL
14'-6" REQUIRED



PROPOSED STRUCTURE

TYPE: SINGLE-SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS

SPAN: 104'-9" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS = 60 PSF

SKEW: 18°00'00"

CROWN: 0.16 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-0" LONG)

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN MTN | REVISED | REVIEWED JRC | DATE 3/29/06 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 578+48.21
STA. 579+55.04

PRELIMINARY SITE PLAN- ALTERNATIVE 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

1 / 1

APPENDIX E

Preliminary Geotechnical Report
& Preliminary MSE Wall Evaluation

TRANSYSTEMS CORPORATION

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April 1, 2005

Mr. Greg Parsons, P.E.
Project Manager
TranSystems Corporation
5747 Perimeter Dr., Suite 240
Dublin, OH 43017

Re: **SCI-823-0.00 over Blue Run Road (C.R. 29)**
Preliminary Structural Foundation Recommendations
Project SCI-823-0.00
DLZ Job No.: 0121-3070.03

Dear Mr. Parsons:

This letter reports the findings of the subsurface exploration and preliminary foundation recommendations for the proposed structure SCI-823-0.00 over Blue Run Road (C.R. 29). It is anticipated that the proposed structure will be a three-span, elevated bridge. The existing grade at the proposed new bridge location ranges between elevations 769 and 775 in the plain east of C.R. 29 and extends as high as elevation 818 on the hill west of C.R. 29. It is anticipated that the SCI-823-0.00 mainline will be located in fill sections on either side of the proposed bridge. Approximately 50 feet of new fill is anticipated at the rear (east) abutment. There will likely be a sidehill fill at the forward (west) abutment, with the fill ranging in thickness from 0 to 15 feet. It is anticipated that the piers will be approximately 35 to 45 feet in height.

The findings and recommendations presented in this report should be considered preliminary. It is understood that the final number and locations of substructure units have not been determined yet. After the substructure unit locations have been established, the results of the borings should be reviewed to determine if additional exploration is needed to finalize the foundation recommendations for the new structure.

Field Exploration

A total of four borings, TR-7, TR-8, TR-9, and TR-10, were drilled at the proposed structure between March 11 and 15, 2005. The borings were drilled to depths ranging from 17.0 to 34.5 feet. The borings were extended into bedrock, which was verified by rock coring. Boring logs and information concerning the drilling procedures are attached.

The boring locations were selected by TranSystems Corporation. Borings TR-7, TR-8, TR-9, and TR-10 are located approximately at Stations 586+00, 585+00, 584+30, and 583+20,

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respectively. The boring locations and the ground surface elevations at the boring locations were estimated from the established topographic mapping for the project and are presented on the attached Boring Logs.

Findings

The following text presents generalized subsurface conditions encountered by the borings. For more detailed information, please refer to the attached Boring Logs.

At the ground surface, the borings encountered one to three inches of topsoil. Beneath the topsoil, all of the borings encountered silt and clay (A-6a) and silty clay (A-6b) to depths ranging from 5.0 to 13.5 feet. Beneath the A-6 soils, a hard clay (A-7-6) layer was encountered in Borings TR-7, TR-8, and TR-9 at depths of 8.5 to 10.0 feet, 13.5 to 16.0 feet, and 6.0 to 7.0 feet, respectively.

Bedrock was encountered in the borings at depths between 5.0 and 16.0 feet and consisted primarily of a moderately to highly weathered soft to medium hard siltstone. Below a depth of 7.1 feet in Boring TR-10, the siltstone was less weathered and medium hard to hard. Recovery of the core samples ranged from 94 to 100 %, and the RQD values ranged from 17 to 87%, with an average RQD of 58%.

Water seepage was detected in Borings TR-9 and TR-10 at a depth of 1.0 feet prior to coring operations. Seepage was not detected in Borings TR-7 and TR-8. At the completion of drilling, water levels ranged from 1.3 to 17.4 feet. The final water levels include drilling water and may not be representative of actual groundwater conditions particularly in Borings TR-7 and TR-8. Groundwater levels may vary seasonably.

Conclusions and Recommendations

Based on the subsurface materials encountered in the borings, spread footing foundations appear to be best suited for support of the proposed structure. Competent bedrock was encountered between depths of 5.0 and 16.0 feet in the borings. At the forward (west) abutment, the amount of fill is expected to vary between zero and 15 feet, due to the sidehill fill. However, approximately 50 feet of additional fill is anticipated at the rear (east) abutment location. Consequently, it is anticipated that spread footings will be founded in fill at the rear (east) abutment. Spread footings will likely be founded in bedrock at Pier 1, in either bedrock or natural soil at Pier 2, and in either fill or bedrock at the forward (west) abutment.

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Spread footings bearing in embankment fill or natural soil may be designed for an allowable bearing capacity of 3000 psf. If spread footings are bearing on bedrock, the footings should be embedded into the bedrock. Recommendations for spread footings on rock are presented in the table below.

Additionally, drilled shafts to rock or pre-bored H-piles into bedrock can also be used to support the structure. If high lateral or uplift loads are anticipated, drilled shafts or H-piles socketed into bedrock may be needed. The actual rock socket lengths will need to be designed based upon actual loading conditions.

The following table summarizes the site conditions and bearing capacity recommendations for foundations on rock.

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Top-of-Rock Elevation* (Feet)	Allowable Bearing Capacity
TR-7	Forward (West) Abutment	810.0	797.0	10 TSF
TR-8	Pier 2	792.0	776.0	10 TSF
TR-9	Pier 1	773.0	766.0	10 TSF
TR-10	Rear (East) Abutment	769.0	761.9	10 TSF

*Existing ground surface elevation was estimated from the established topographic mapping.

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Closing

If you have any questions, please contact our office for clarification.

Sincerely,

DLZ OHIO, INC.

Edward R Hood

Edward R. Hood, P.E.
Geotechnical Engineer

Dorothy A. Adams

~~Dorothy A. Adams, P.E.~~
Senior Geotechnical Engineer

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Site Plan
Boring Logs TR-7, TR-8, TR-9, and TR-10

cc: File

M:\proj\0121\3070.03\Structures\Blue Run CR 29\CR 29 lt04-01-05.doc

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5 foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop hammer, the sampling increment was discontinued. Standard penetration data were recorded and one or more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ size diamond coring tools were used.

In the laboratory all samples were visually classified by a geotechnical engineer. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics tests. The results of these tests are shown on the boring logs.

The boring logs included in the Appendix have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at our laboratory for a period of six months. After this period of time, they will be discarded, unless notified to the contrary by the client.

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.

2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.

3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

   50/n – indicates number of blows (50) to drive a split-barrel sampler a certain number of inches (n) other than the normal 6-inch increment.

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.

5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".

6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.

7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.

8. Sample numbers are designated consecutively, increasing in depth.

9. Soil Description

   a. The following terms are used to describe the relative compactness and consistency of soils:

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	below 2	Easily penetrated by fist
Soft	0.25 – 0.50	2 – 4	Easily penetrated by thumb
Medium Stiff	0.50 – 1.0	4 – 8	Penetrated by thumb with moderate pressure
Stiff	1.0 – 2.0	8 – 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 – 4.0	15 – 30	Readily indented by thumb nail
Hard	over 4.0	over 30	Indented with difficulty by thumb nail

   b. Color – If a soil is a uniform color throughout, the term is single, modified by such adjective as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description	Size	Description	Size
Boulders	Larger than 8"	Sand – Coarse	2.0 mm to 0.42 mm
Cobbles	8" to 3"	– Fine	0.42 mm to 0.074 mm
Gravel – Coarse	3" to ¾"	Silt	0.074 mm to 0.005 mm
– Fine	¾" to 2.0 mm	Clay	smaller than 0.005 mm

d. The main soil component is listed first. The minor components are listed in order of decreasing percentage of particle size.

e. Modifiers to main soil descriptions are indicated as a percentage by weight of particle sizes.

trace	0 to 10%
little	10 to 20%
some	20 to 35%
"and"	35 to 50%

f. Moisture content of **cohesionless soils** (sands and gravels) is described as follows:

Term	Relative Moisture or Appearance
Dry	No moisture present
Damp	Internal moisture, but none to little surface moisture
Moist	Free water on surface
Wet	Voids filled with free water

g. The moisture content of **cohesive soils** (silts and clays) is expressed relative to plastic properties.

Term	Relative Moisture or Appearance
Dry	Powdery
Damp	Moisture content slightly below plastic limit
Moist	Moisture content above plastic limit but below liquid limit
Wet	Moisture content above liquid limit

10. Rock Hardness and Rock Quality Designation

a. The following terms are used to describe the relative hardness of the bedrock.

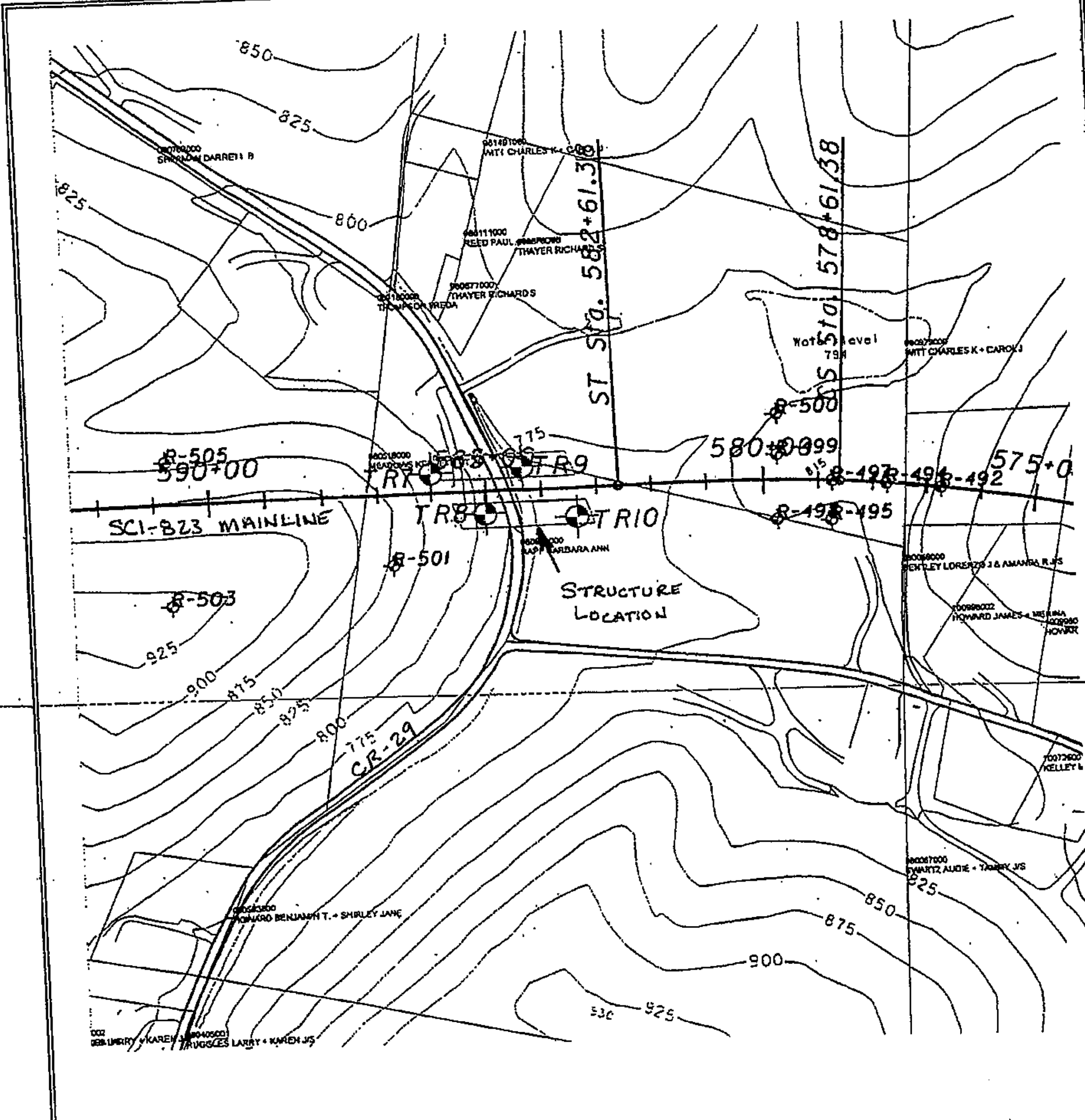
Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed hammer)
Medium Hard	Resists pencil point, but can be scratched with a knife blade. (Breaks easily under single hammer blow, but with crumbly edges.)
Hard	Can be deformed or broken by light to moderate hammer blows. (Breaks under one or two strong hammer blow, but with resistant sharp edges.)
Very Hard	Can be broken only by heavy and in some rocks repeated hammer blows.

b. Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

11. Gradation – when tests are performed, the percentage of each particle size is listed in the appropriate column (defined in Item 9c).

12. When a test is performed to determine the natural moisture content, liquid limit moisture content, or plastic limit moisture content, the moisture content is indicated graphically.

13. The standard penetration (N) value in blows per foot is indicated graphically.



Source: Topographic Mapping provided by TranSystems Corporation, Dated 2004.

NORTH

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SITE PLAN

Blue Run Road

SCI-823 over CR 29

SCI-823-0.00

FIGURE 1.

DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Job No. 0121-3070.03

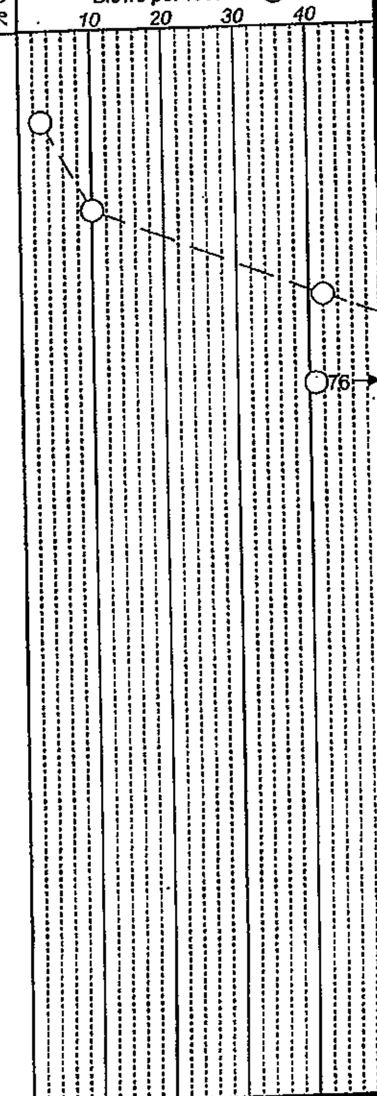
Client: TranSystems, Inc. **Project:** SCI-823-0.00

LOG OF: Boring TR-7 **Location:** SCI-823-0.00 over CR 29 (Forward Abutment) **Date Drilled:** 03/15/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
4.1' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	810.0												
0.2	809.8						Topsoil - 2"						
		1 1 2	5	1		--	Soft brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.						
3.0	807.0	4 5 5	17	2		2.0	Stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; (contains relic rock structure); damp.						
5		8 20 22	18	3		—							
8.5	801.5	18 30 46	12	4		4.5+	Hard light brown CLAY (A-7-6); (decomposed shale); dry.						
10.0	800.0	Core 54"	Rec 52"	RQD 17%	R-1		Soft light brown SILTSTONE; highly weathered, thinly laminated, highly fractured, contains several healed fractures.						
13.0	797.0	Core 120"	Rec 120"	RQD 60%	R-2		Soft to medium hard gray SILTSTONE; highly weathered, thinly laminated, highly fractured, contains several healed fractures. @ 14.7'-15.6',17.3'-17.9', decomposed zone.						
24.5	785.5						Bottom of Boring - 24.5'						

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ├──┤ LL
Blows per foot - ○



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DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Job No. 0121-3070.03

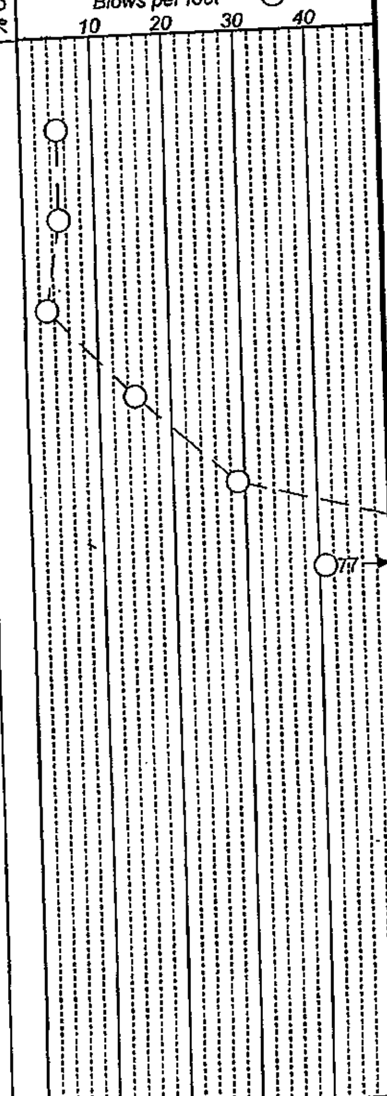
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Date Drilled: 03/11/05 to 03/14/05

LOG OF: Boring TR-8 | Location: SCI-823-0.00 over CR 29 (Pier 2)

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
17.4' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.0	792.0												
0.1	791.9						Topsoil - 1"						
		2 3 2	14	1		2.0	Stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; damp.						
		2 2 3	11	2		1.0							
6.5	785.5	1 1 2	9	3		1.5	Stiff light brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp.						
8.0	784.0	3 7 8	10	4		2.0	Very stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; damp.						
		4 10 19	18	5		3.5							
13.5	778.5	13 31 46	18	6		4.5	Hard brown CLAY (A-7-6), trace fine sand; damp.						
16.0	776.0	Core 114"	Rec 107"	RQD 46%	R-1		Soft light brown SILTSTONE; highly weathered, thinly laminated to thinly bedded, highly fractured.						
20.8	771.2						Soft to medium hard gray SILTSTONE; highly weathered, micaceous, thinly laminated to thinly bedded, highly fractured.						
		Core	Rec	RQD	R-2								

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ├──┤ LL
Blows per foot - ○



DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Job No. 0121-3070.03

Client: TranSystems, Inc.
Project: SCI-823-0.00
Date Drilled: 03/11/05 to 03/14/05

LOG OF: Boring TR-8
Location: SCI-823-0.00 over CR 29 (Pier 2)

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
17.4' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	762.0	120"	120"	81%			Soft to medium hard gray SILTSTONE; highly weathered, micaceous, thinly laminated to thinly bedded, highly fractured.							
34.5	757.5						Bottom of Boring - 34.5'							

35
40
45
50
55

FILE: 0121-3070-03 [4/1/2005 2:23 PM]

DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Job No. 0121-3070.03

Client: TranSystems, Inc.

Project: SCI-823-0.00

Date Drilled: 03/15/05

LOG OF: Boring TR-9

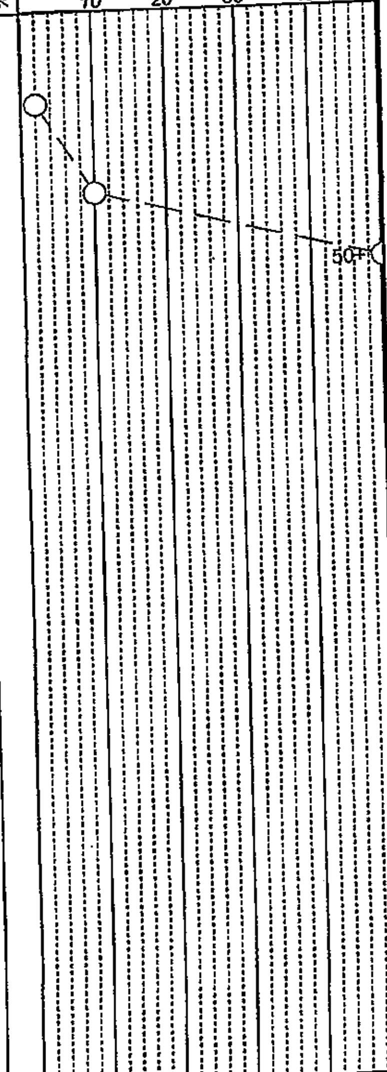
Location: SCI-823-0.00 over CR 29 (Pier 1)

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: 3.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	773.0												
0.3	772.7						Topsoil - 3"						
		WOH WOH 2	7	1		0.25	Soft dark brown SILTY CLAY (A-6b), trace fine to coarse sand; contains shale fragments; moist.						
3.0	770.0	4 5 5	18	2		2.5	Very stiff light brown SILT AND CLAY (A-6a), trace to little fine to coarse sand, trace gravel; damp.						
6.0	767.0	19 50/3	8	3		4.5+	Hard light brown CLAY (A-7-6), trace fine sand; (decomposed shale); dry to damp.						
7.0	766.0	Core 120"	Rec 120"	RQD 83%	R-1		Soft to medium hard gray SILTSTONE; slightly weathered, micaceous, arenaceous, laminated to thinly bedded, moderately fractured, contains high angle healed fractures.						
17.0	756.0						Bottom of Boring - 17.0'						

Depth scale: 5, 10, 15, 20, 25, 30

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ├──┤ LL
Blows per foot - ○
10 20 30 40



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DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

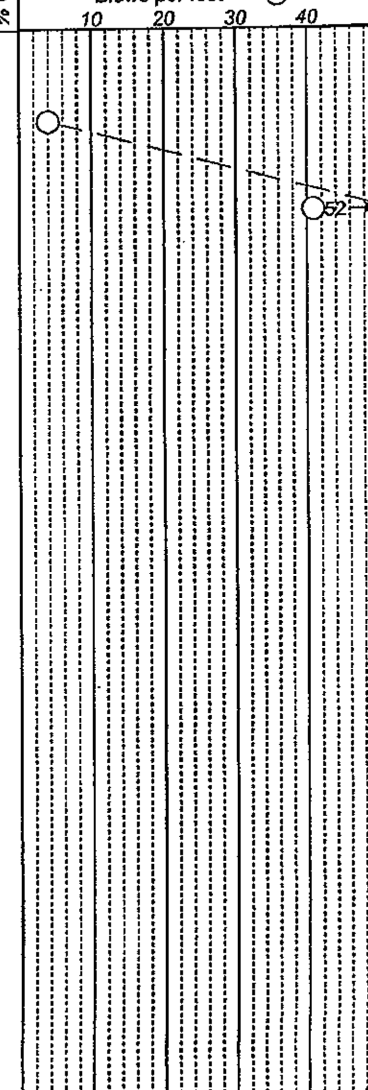
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-10 | Location: SCI-823-0.00 over CR 29 (Rear Abutment) | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: 1.3'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	769.0												
0.3	768.7						Topsoil - 3"						
		1 2 2	8	1		1.0	Medium stiff dark brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; damp to moist.						
3.0	766.0	12 11 41	18	2			Hard light brown SILTY CLAY (A-6b), little gravel, trace fine sand; (decomposed rock); dry to damp.						
5.0	764.0						Soft light brown SILTSTONE; highly weathered, laminated, highly fractured, contains high angle healed fractures.						
7.1	761.9	Core 54"	Rec 54"	RQD 33%	R-1		Medium hard to hard gray SILTSTONE; slightly weathered, micaceous, arenaceous, laminated, moderately fractured.						
10													
15		Core 120"	Rec 120"	RQD 87%	R-2								
19.5	749.5						Bottom of Boring - 19.5'						
20													
25													
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢—⊣ LL
Blows per foot - ○



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March 17, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Preliminary MSE Wall Evaluations**
Blue Run Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0005

Dear Mr. Weeks:

This letter includes the findings of preliminary evaluations of mechanically stabilized earth (MSE) retaining walls on the above-referenced project. The findings included in this letter pertain to the MSE walls at the intersection of proposed 823 and Blue Run Road. The findings of other preliminary MSE wall evaluations will be submitted in separate documents at a later date.

It should be noted that the results of these evaluations are based upon the findings of four preliminary structural borings drilled for the structures. Boring logs for borings TR-7, TR-8, TR-9, and TR-10 are attached. After the bridge design is finalized, it will be necessary to drill additional borings in the area of the proposed MSE walls in accordance with ODOT's specifications for subsurface investigations in order to finalize the MSE wall evaluations.

An MSE retaining wall essentially consists of good quality backfill material with layers of metal or plastic reinforcing that are attached to concrete facing panels. The MSE wall and associated backfill should be constructed in accordance with the specifications of the manufacturer of the MSE wall.

At the time this letter was prepared, it was understood that the plan location of the bridge structure for proposed 823 over Blue Run Road is similar to the location shown on the plan and profile drawings dated 07/09/05. See attached plan and profile drawing. It is understood that the planned structure is being modified as follows: placing MSE walls at approximately stations 578+45 and 579+55 to contain the abutments and hold back the roadway embankment, thus shortening the bridge structure. Furthermore, it is understood that the height of the MSE wall at station 578+45 (Rear Abutment) will be approximately 42 feet high, while the MSE wall at station 579+55 (Forward Abutment) will be approximately 26 feet high.

A preliminary global stability analysis and preliminary bearing capacity analysis were performed for the MSE walls at this bridge location in accordance with ODOT and AASHTO guidelines. The MSE walls were also analyzed for sliding and overturning. At the time this letter was prepared, it was not known what foundation type was to be used at this site to support the bridge abutments. However, the use of MSE walls at this site does not preclude the use of most common foundation types. Once a foundation type has been selected, DLZ should be informed so that the analyses may be revised as necessary.

Preliminary calculations for bearing capacity, sliding and overturning as well as the results of the global stability analyses are attached. Other external and internal stability analyses are required for the design of an MSE wall, but are considered outside the scope of this report. The parameters required to perform the stability analyses are presented below.

In accordance with ODOT guidelines, a unit weight of 120 pcf and a friction angle of 34 degrees were selected for the backfill material in the reinforced zone. Similarly, the fill material used to construct the roadway embankments is assumed to have a unit weight of 120 pcf and a friction angle of 30 degrees. If the embankment fill material or backfill material for the reinforcing zone has properties significantly different from these values, DLZ should be informed so that the analyses may be revised as necessary.

The analyses for the MSE walls at station 578+45 (Rear Abutment) and station 579+55 (Forward Abutment) are presented separately in this letter.

MSE Wall Evaluation at Station 578+45 (Rear Abutment), Boring TR-9

In the area of this proposed MSE wall, boring TR-9 encountered three inches of topsoil at the surface. Below the topsoil layer, soft silty clay (A-6b) was encountered to a depth of 3.0 feet below ground surface. Below 3.0 feet, soil consisting primarily of very stiff sandy silt (A-4a) was encountered to a depth of approximately 7.0 feet below ground surface. Underlying the soil, this boring encountered medium hard, slightly weathered sandstone to the bottom of the boring, at 17.0 feet.

The MSE wall at this location is understood to be approximately 42 feet high. The minimum required embedment depth for this wall is H/10 or 4.2 feet. Preliminary bearing capacity calculations yielded inadequate factors of safety for the wall bearing on the natural soils. Therefore, an undercut of soils to bedrock, backfilled with compacted, granular material was also analyzed. Under this configuration, preliminary calculations for stability and bearing capacity yielded acceptable results. Therefore, it is recommended that the leveling pad be extended into bedrock or the naturally occurring soils be excavated to bedrock and replaced with compacted granular fill to the leveling pad elevation. For stability, preliminary calculations indicate that a minimum reinforcement length of 37 feet is required for the proposed MSE wall at this location.

It should be noted that variations in the topography may be encountered within the proposed footprint of the proposed MSE wall, potentially causing the bedrock elevation to vary significantly. For stability, in areas where compacted granular fill is to be placed on bedrock, benches should be cut into the rock. This will reduce the possibility of sliding at the interface of the compacted granular fill and the bedrock.

It should be noted that the leveling pad for the MSE wall is close to a creek that runs essentially parallel to Blue Run Road. The approximate bedrock elevation under the MSE wall is 767 feet, near the creek bottom. If scour and erosion near the toe of the MSE wall are a concern, then slope protection should be provided.

MSE Wall Evaluation at Station 579+55 (Forward Abutment), Boring TR-8

In the area of this proposed MSE wall, boring TR-8 encountered approximately 1 inch of topsoil. Underlying the topsoil layer, this boring encountered soil consisting primarily of stiff sandy silt (A-4a) to a depth of 6.5 feet below the ground surface. Below 6.5 feet, a stiff to very stiff silt (A-4b) was encountered to a depth of 13.5 feet below the ground surface. Beneath the soil layers, soft decomposed sandstone was encountered to a depth of 16.0 feet below the ground surface. Below 16.0 feet, soft to medium hard, highly weathered sandstone was encountered to the bottom of the boring at 34.5 feet.

The MSE wall at this location is understood to be approximately 26 feet high. The minimum embedment depth for this wall is H/5 or 5.2 feet. Preliminary stability and bearing capacity calculations resulted in inadequate factors of safety for the wall bearing on the natural soils. Therefore, a five-foot deep undercut, backfilled with compacted, granular soil, was then analyzed. However, the drained global stability analysis still resulted in a safety factor below the required minimum. Consequently, analyses were performed assuming overexcavation to the top of bedrock and backfilled with compacted, granular fill. These analyses indicated adequate safety factors for both the undrained and the drained conditions. As a result, it is recommended that the soils beneath the proposed MSE wall be overexcavated to top of rock and replaced with compacted, granular fill. For stability, preliminary calculations indicate that a minimum reinforcement length of 22 feet is required for the proposed MSE wall at this location.

An alternate preliminary design may also be considered for the MSE wall at the forward abutment. Lowering the base of the MSE wall so that it is founded directly on bedrock, or if necessary, on a very thin leveling pad reduces the amount of fill material required to form the leveling pad and the slope in front of the wall. Using this design, the height of the MSE wall will be 30 feet, and the minimum embedment is H/7 or 4.5 feet using a 2:1 slope in front of the wall. The required length of reinforcement will then be 24 feet. In addition, because the wall will be founded on bedrock, stability should be adequate. A drawing illustrating this alternate preliminary design is attached.

It should be anticipated that variations in the topography may be encountered within the footprint of the proposed MSE wall, potentially causing the bedrock elevations to vary significantly. For stability, in areas where compacted granular fill is to be placed on bedrock, benches should be cut into the rock to reduce the possibility of sliding at the interface of the compacted granular fill and the bedrock.

Settlement calculations were not performed for the MSE walls at this site. The MSE walls will bear on compacted granular fill or bedrock resulting in negligible settlement.

Calculations for bearing capacity, overturning and sliding are attached for both the native soil and compacted granular fill foundations. A drawing showing the results of the global stability analyses is also attached. In addition, drawings illustrating the areas of overexcavation and replacement of compacted granular fill for the recommended and alternate preliminary designs are attached.

A summary of soil properties, summary of the results of calculations, and results of global stability analyses are attached.

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our preliminary findings.

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

Arthur (Pete) Nix, P.E.
Geotechnical Division Manager

Encl: As noted

cc: file

sjr

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DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

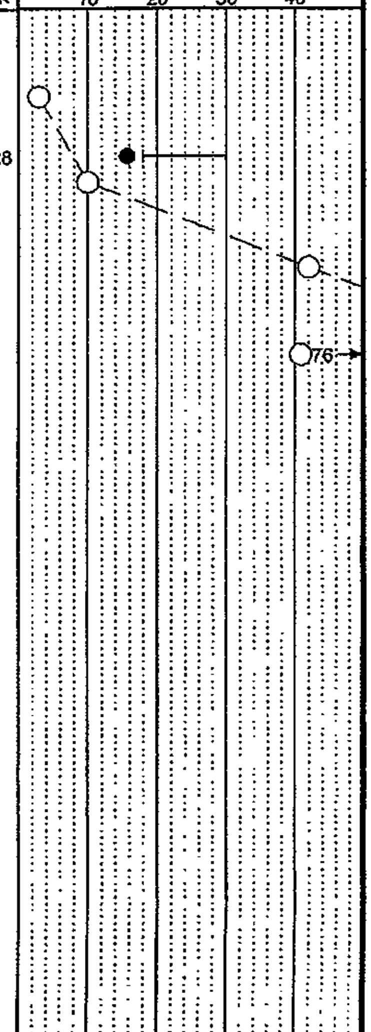
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-7 | Location: SCI-823-0.00 over CR 29 (Forward Abutment) | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
4.1' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	814.3												
0.2	814.1						Topsoil - 2"						
		1 1 2	5	1			Soft dark gray SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; organic; damp.						
3.0	811.3	4 5 5	17	2		2.0	Stiff light brown SILT AND CLAY (A-6a), trace to little fine to coarse sand, trace gravel; (contains relic rock structure); damp.	3	14	--	7	48	28
6.5	807.8	8 20 22	18	3			Soft light brown SANDSTONE; very fine grained; decomposed.						
		18 30 46	12	4		4.5+							
10.0	804.3	Core 54"	Rec 52"	RQD 17%	R-1		Soft light brown SANDSTONE; highly weathered to decomposed, very fine grained, thinly laminated to thinly bedded, highly fractured, contains several healed fractures.						
13.0	801.3						Soft to medium hard gray SANDSTONE; highly weathered, very fine to fine grained, thinly laminated, argillaceoud, highly fractured.						
18.0	796.3	Core 120"	Rec 120"	RQD 60%	R-2		Medium hard gray SANDSTONE; highly to moderately weathered, argillaceous, micacious, thinly laminated to medium bedded, slightly fractured. @ 21.0' to 21.2', Decomposed.						
24.5	789.8						Bottom of Boring - 24.5'						

Depth scale: 5, 15, 20, 25, 30



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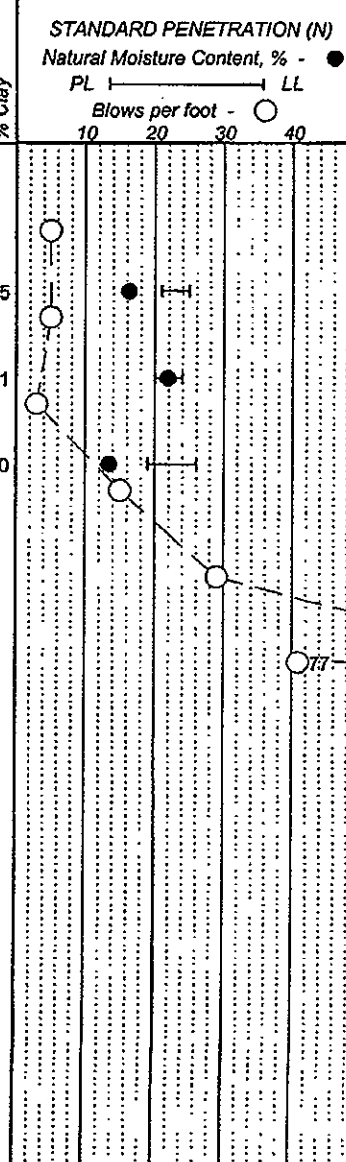
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-8 | Location: SCI-823-0.00 over CR 29 (Pier 2) | Date Drilled: 03/11/05 to 03/14/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
17.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	802.1												
0.1	802.0						Topsoil - 1"						
		2 3 2	14	1		2.0	Stiff dark gray SANDY SILT (A-4a), little fine to coarse sand, little to some gravel, contains organic material; damp.						
5		2 2 3	11	2		1.0		22	10	–	7	46	15
6.5	795.6	1 1 2	9	3		1.5	Stiff to very stiff brown SILT (A-4b), some clay, trace to little fine to coarse sand, trace gravel; moist.	1	11	–	7	60	21
10		3 7 8	10	4		2.0	@ 8.0', Very stiff, light brown, little fine sand, little coarse sand; damp.	5	13	–	12	50	20
		4 10 19	18	5		3.5							
13.5	788.6	13 31 46	18	6		4.5	Soft light brown SANDSTONE; very fine grained, argillaceous, decomposed.						
15													
16.0	786.1						Soft light brown SANDSTONE; highly weathered to decomposed, highly fractured.						
19.3	782.8	Core 114"	Rec 107"	RQD 46%	R-1		Soft to medium hard gray SANDSTONE; very fine grained, highly weathered, micaceous, argillaceous, thinly laminated to thinly bedded, highly fractured, contains ferric bands.						
20													
25													
							@ 27.7' to 27.9', Decomposed Zone.						
30		Core	Rec	RQD	R-2								



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Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-8 | Location: SCI-823-0.00 over CR 29 (Pier 2) | Date Drilled: 03/11/05 to 03/14/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
17.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ├─┤ LL Blows per foot - ○ 10 20 30 40
30	772.1													
30.5	771.6	120"	120"	81%			Soft to medium hard gray SANDSTONE; very fine grained, highly weathered, micaceous, argillaceous, thinly laminated to thinly bedded, highly fractured, contains ferric bands.							
34.5	767.6						Bottom of Boring - 34.5'							
35														
40														
45														
50														
55														
60														

FILE: 0121-3070-03 [3/13/2006 5:23 PM]

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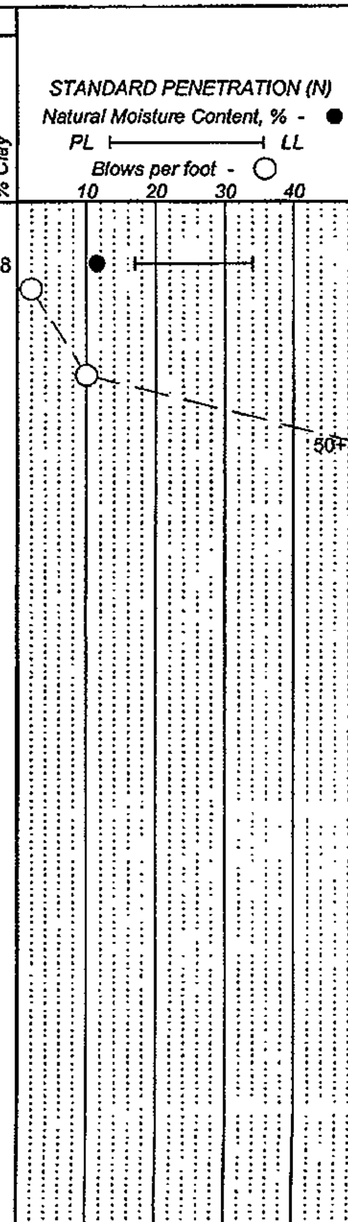
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-9 | Location: SCI-823-0.00 over CR 29 (Pier 1) | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: None (prior to coring)
3.5' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	772.9												
0.3	772.6						Topsoil - 3"						
		WOH WOH 2	7	1		0.25	Soft dark brown SILTY CLAY (A-6b), trace fine to coarse sand; contains shale fragments; moist.	0	5	–	5	52	38
3.0	769.9	4 5 5	18	2		2.5	Very stiff brown SANDY SILT (A-4a), trace clay, trace gravel; damp.						
6.0	766.9	19 50/3	8	3		4.5+	Soft light brown SANDSTONE; decomposed, argillaceous.						
7.0	765.9	Core 120"	Rec 120"	RQD 83%	R-1		Medium hard gray SANDSTONE; slightly weathered, micaceous, argillaceous, massive bedding, slightly fractured. @ 7.0' to 7.3', Broken.						
17.0	755.9						Bottom of Boring - 17.0'						



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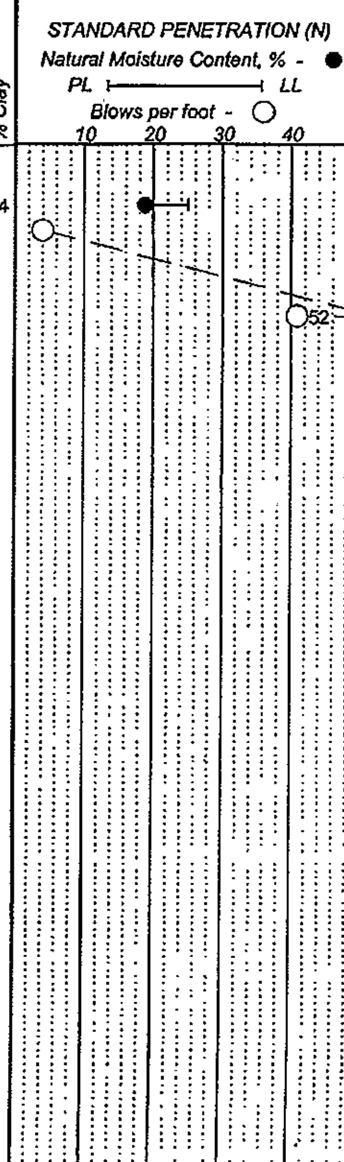
DLZ OHIO INC. • 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 • (614)888-0040

Client: TranSystems, Inc. | *Project:* SCI-823-0.00 | *Job No.* 0121-3070.03

LOG OF: Boring TR-10 | *Location:* SCI-823-0.00 over CR 29 (Rear Abutment) | *Date Drilled:* 03/15/05

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: None (prior to coring)
1.3' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N)
0	768.1													
0.3	767.8						Topsoil - 3"							
		1 2 2	8	1		1.0	Medium stiff dark brown SANDY SILT (A-4a), some gravel, little clay; damp to moist.	29	12	–	7	38	14	
3.0	765.1	12 11 41	18	2			Soft grayish brown SANDSTONE; very fine grained, decomposed.							52
5.0	763.1						Medium hard light brown SANDSTONE; highly weathered, thickly bedded, broken, contains high angle healed fractures.							
7.1	761.0	Core 54"	Rec 54"	RQD 33%	R-1		Medium hard to hard gray SANDSTONE; slightly to moderately weathered, micaceous, argillaceous, massive, moderately to slightly fractured.							
		Core 120"	Rec 120"	RQD 87%	R-2									
19.5	748.6						Bottom of Boring - 19.5'							



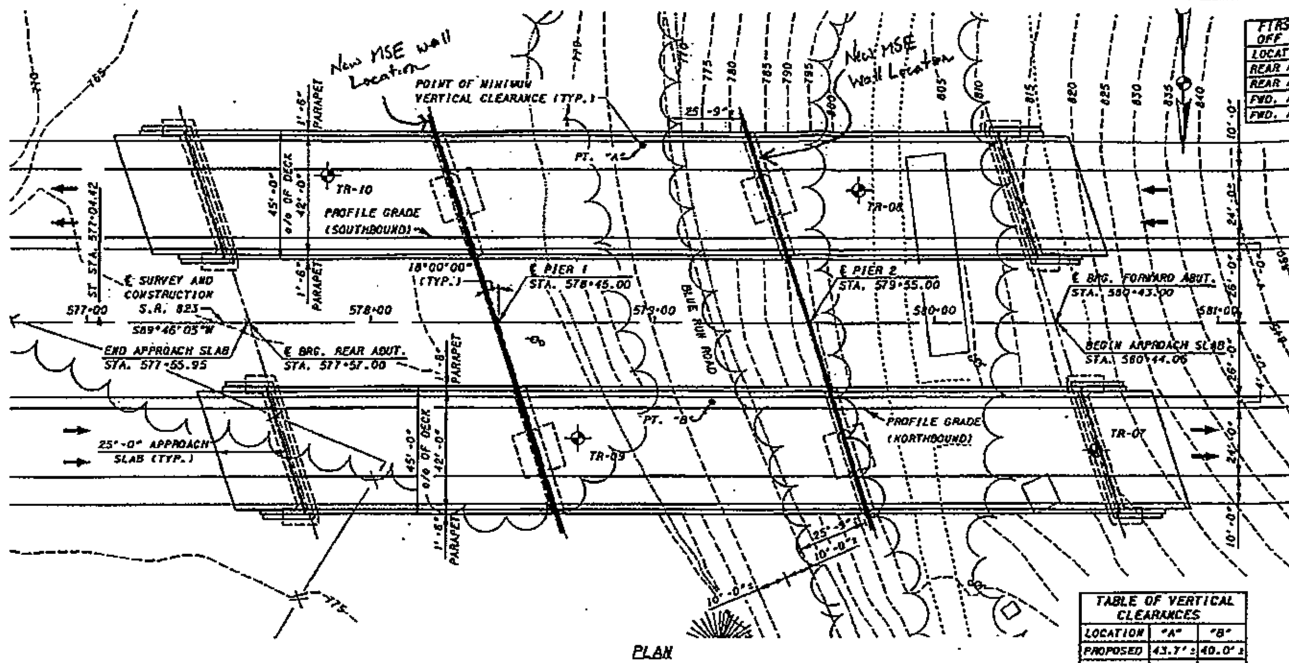
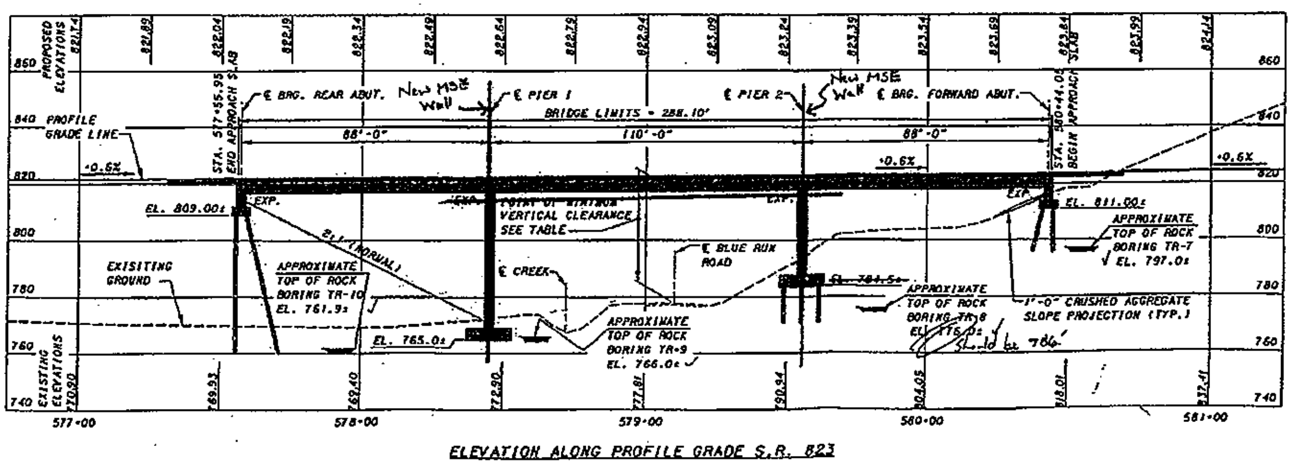


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	43.7'±	40.0'±
REQUIRED	15.0'	15.0'



FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS		
LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS		
BORING No.	STATION	OFFSET
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.

BENCHMARK 1	BENCHMARK 2
(TO BE PROVIDED LATER)	(TO BE PROVIDED LATER)

TRAFFIC DATA

(SR 823)

CURRENT YEAR ADT (2010) = 19,800
CURRENT YEAR ADTT (2030) = 2,722
DESIGN YEAR ADT (2010) = 26,000
DESIGN YEAR ADTT (2030) = 3,640

PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK AND SUBSTRUCTURE UNITS

SPANS: 88'-0", 110'-0", 88'-0" c/c BEARINGS

ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 (CASE I) AND ALTERNATE MILITARY LOADING; FWS = 60 PSF

SKEW: 18°00'00" RF
CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-81 (25'-0" LONG)
LATITUDE:
LONGITUDE:
STRUCTURE FILE NO.

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.
2. EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.
3. THE PROPOSED PROFILE GRADE IS WITHIN BRIDGE LIMITS. SEE ROADWAY PLANS FOR PAVEMENT ELEVATIONS BEYOND BRIDGE LIMITS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 12x53 PILES AND HAVE A MAXIMUM CAPACITY OF 70 TONS PER PILE.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS & L SUBMITTAL.

TranSystems Corporation

DESIGNED BTA | CHECKED | DRAWN RCK | REVIEWED HFF | DATE 7/9/05

SCIOTO COUNTY
STA. 577+55.95

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX

SCI-823-0.00
PID 19415

1/2

Soil Parameters Used in MSE Wall Stability Analyses
Blue Run Road

Zone	Soil Type	Unit Weight (pcf)	Strength Parameters			
			Undrained		Drained	
			c	ϕ	c'	ϕ'
Reinforced Fill	Compacted Granular Fill	120	0	34	0	34
Retained Soil	Compacted Embankment Fill	120	0	30	0	30
Foundation Soil (Rear Abutment) (Boring TR-9)	Stiff to very stiff Sandy Silt	125	2000	0	0	29
Foundation Soil (Rear Abutment)	Compacted Granular Fill	125	0	36	0	36
Foundation Soil (Forward Abutment) (Boring TR-8)	Stiff Sandy Silt / Silt	125	1000	0	0	28
Foundation Soil (Forward Abutment)	Compacted Granular Fill	125	0	36	0	36

MSE Retaining Wall Parameters and Analyses Results
Blue Run Road (Rear Abutment) ***Granular Fill Foundation***

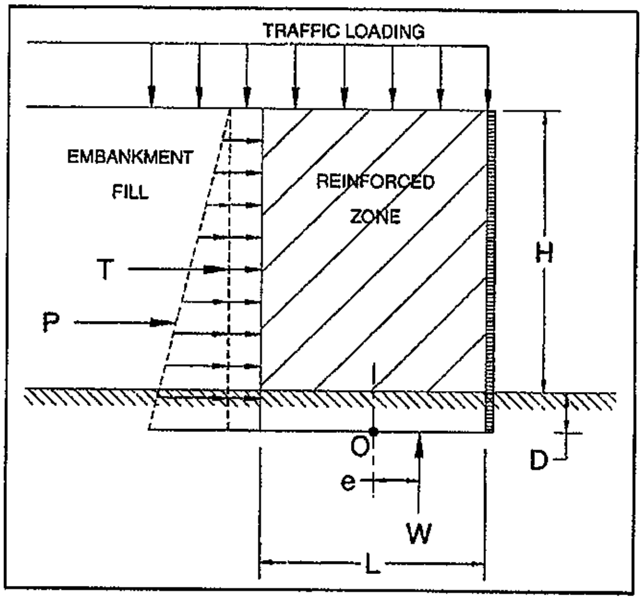
Retained Soil (New Embankment) Unit Weight = 120 pcf Coefficient of Active Earth Pressure (K_a) = 0.33 (Based on $\Phi = 30^{o}$)
Sliding along base of MSE wall Sliding Coefficient (μ)(0.67) = tan 36°(0.67) = 0.49   Use (μ)(0.67) Use (μ)(0.67) =0.55 as a maximum value as per AASHTO, BDM,303.4.1.1
Allowable Bearing Capacity – Undrained Condition q_{all} = 23,036 psf For MSE wall with minimum 37-foot long reinforcing
Allowable Bearing Capacity – Drained Condition q_{all} = 23,036 psf For MSE wall with minimum 37-foot long reinforcing
Global Stability Factor of Safety – Undrained Condition = 2.0 Factor of Safety – Drained Condition =2.1 Factor of Safety – Seismic Condition = 2.0 For MSE wall with 37-foot long reinforcing
Estimated Settlement of MSE volume Total settlement = 0 inches Differential settlement < 1/100
Minimum Length of Reinforcement for External Stability = 37 feet

MSE Retaining Wall Parameters and Analyses Results
Blue Run Road (Forward Abutment) ***Granular Fill-foundation***

Retained Soil (New Embankment) Unit Weight = 120 pcf Coefficient of Active Earth Pressure (K_a) = 0.33 (Based on $\Phi = 30^o$)
Sliding along base of MSE wall Sliding Coefficient (μ)(0.67) = tan 36°(0.67) = 0.49 Use (μ)(0.67) Use (μ)(0.67) =0.55 as a maximum value as per AASHTO, BDM,303.4.1.1
Allowable Bearing Capacity – Undrained Condition q_{all} = 15,058 psf For MSE wall with minimum 22-foot long reinforcing
Allowable Bearing Capacity – Drained Condition q_{all} = 15,058 psf For MSE wall with minimum 22-foot long reinforcing
Global Stability Factor of Safety – Undrained Condition = 1.7 Factor of Safety – Drained Condition = 1.6 Factor of Safety – Seismic Condition = 1.5 For MSE wall with 22-foot long reinforcing
Estimated Settlement of MSE volume Total settlement = 0 inches Differential settlement < 1/100
Minimum Length of Reinforcement for External Stability = 22 feet

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	125	pcf	Unit weight	Foundation soil
c	=	2000	psf	Cohesion	Foundation soil
ϕ	=	0	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	29	deg.	Friction ang.	Foundation soil

Loads and Parameters

q_t	=	240	psf	Traffic loading
L=B	=	36.72	ft	Length of MSE reinforcement
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	4.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	45.9	ft	
H	=	41.7	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	15.3	ft	Moment arm
Γ Wt	=	22.95	ft	Moment arm
B'	=	29.88	ft	
γ'	=	57.6	pcf	
W_t		8,813	lb/ft of wall	Weight from traffic
W_{mse}	=	202,254	lb/ft of wall	Weight from MSE wall

Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 7,064 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 10,522 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 4,209 psf

Factor of Safety = 1.49 **No Good**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 20,620 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 8,248 psf

Factor of Safety = 2.92 **OK**

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	5.14	N_c	27.86
N_q	1.00	N_q	16.44
N_γ	0.00	N_γ	19.34

Eccentricity of Resultant Force

e = 3.42 ft

Kern

e < L/6 = 6.12 ft

DLZ

SUBJECT			
Client TranSystems ODOT D-9	JOB NUMBER	0121-3070.03	
Project SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF	
Item MSE Wall Stability (Rear Abutment)	COMP. BY SJR	DATE	03/16/06
02 - 823 over Blue Run Road (Boring TR-09)	CHECKED BY	DATE	
Natural Soil Foundation			

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=30'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

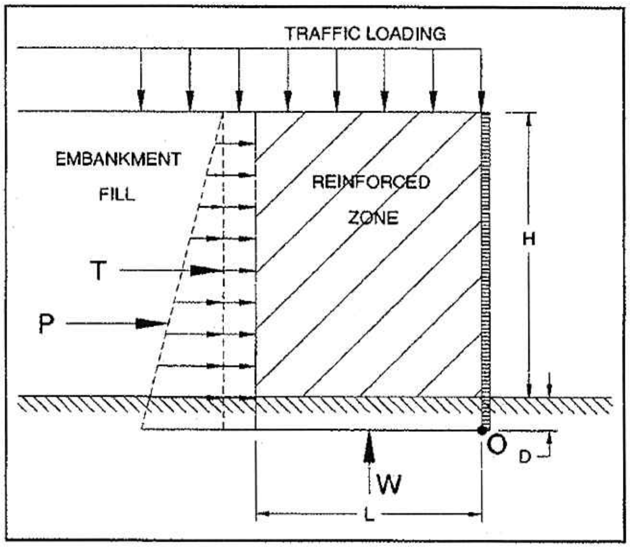
Wall Properties

$H+D$ = 45.9 feet
γ_{mse} = 120 pcf
L = 36.72 feet
L factor = 0.80 Length factor-range (0.7 - 1.0)
ϕ = 30 deg Friction Angle of Embankment Fill

Foundational Soil Properties

c = 2000 psf Cohesion
ϕ' = 29 deg Friction angle
ω_T = 240 psf Traffic loading

RESISTANCE AGAINST SLIDING ALONG BASE



Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 45,350 lbs per foot of wall

Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.37

0.67μ Max. = 0.35 (AASHTO, Bridge Design Manual, 303.4.1.1)

P_r = 70,789 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 73,440 lbs per foot of wall

Use Drained Value

$FS = \frac{P_r}{P_a}$ Calculated FS = **1.56** Required FS = 1.50

Resistance Against Sliding is **OK**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 3,713,379 lb-ft

$\Sigma M_{overturning}$ = 721,667 lb-ft

$$\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$$

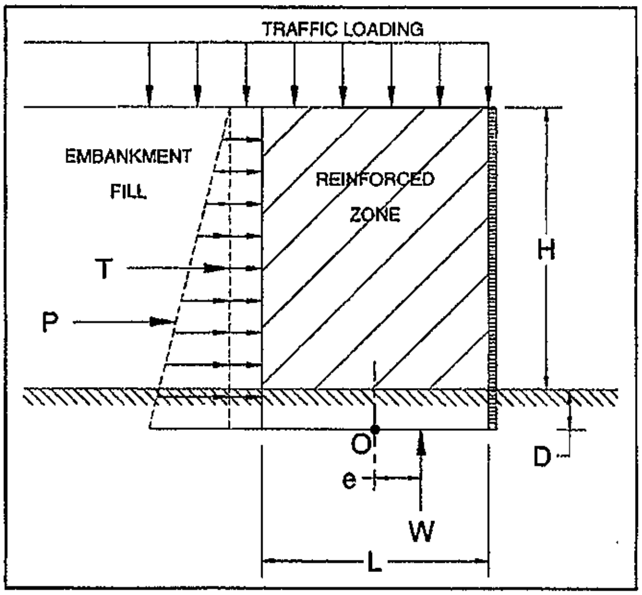
$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturning}}$ Calculated FS = **5.15** Required FS = 2.00

Resistance Against Overturning is **OK**

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	125	pcf	Unit weight	Foundation soil
c	=	0	psf	Cohesion	Foundation soil
ϕ	=	36	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	36	deg.	Friction ang.	Foundation soil

Loads and Parameters

q_t	=	240	psf	Traffic loading
L=B	=	36.72	ft	Length of MSE reinforcement
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	4.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	45.9	ft	
H	=	41.7	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	15.3	ft	Moment arm
Γ Wt	=	22.95	ft	Moment arm
B'	=	29.88	ft	
γ'	=	57.6	pcf	
W_t		8,813	lb/ft of wall	Weight from traffic
W_{mse}	=	202,254	lb/ft of wall	Weight from MSE wall

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	50.59	N_c	50.59
N_q	37.75	N_q	37.75
N_γ	56.31	N_γ	56.31

Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 7,064 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 57,590 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 23,036 psf

Factor of Safety = 8.15 **OK**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 57,590 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 23,036 psf

Factor of Safety = 8.15 **OK**

Eccentricity of Resultant Force

e = 3.42 ft

Kern

e < L/6 = 6.12 ft

DLZ

SUBJECT			
Client	TranSystems ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF
Item	MSE Wall Stability (Rear Abutment)	COMP. BY	SJR DATE 03/16/06
02 - 823 over Blue Run Road (Boring TR-09)		CHECKED BY	DATE
Compacted Granular Fill Foundation			

STABILITY OF MSE WALL

Assumptions:

1. Estimated height of embankment; H=30'
2. It is assumed that the bridge is supported on piles
3. Ground water; Dw=0.0'
4. Traffic loading is neglacted in resisting forces
5.

Wall Properties

H+D	=	45.9	feet
γ_{mse}	=	120	pcf
L	=	36.72	feet
L factor	=	0.80	
ϕ	=	30	deg

Foundational Soil Properties

c	=	0	psf	Cohesion
ϕ'	=	36	deg	Friction angle
ω_T	=	240	psf	Traffic loading

Length factor-range (0.7 - 1.0)

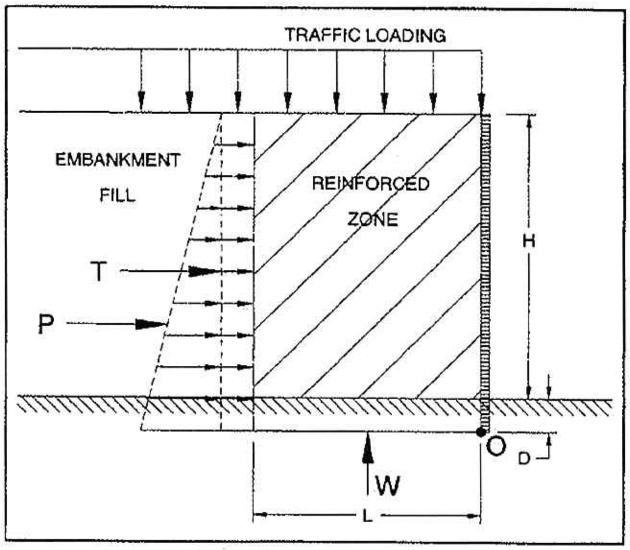
Friction Angle of Embankment Fill

RESISTANCE AGAINST SLIDING ALONG BASE

Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 45,350 lbs per foot of wall



Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.49

0.67μ Max. = 0.55 (AASHTO, Bridge Design Manual, 303.4.1.1)

P_r = 99,104 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 0 lbs per foot of wall

Use Drained Value

$FS = \frac{P_r}{P_a}$ Calculated FS = **2.19** Required FS = 1.50

Resistance Against Sliding is **OK**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 3,713,379 lb-ft

$$\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$$

$\Sigma M_{overturning}$ = 721,667 lb-ft

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

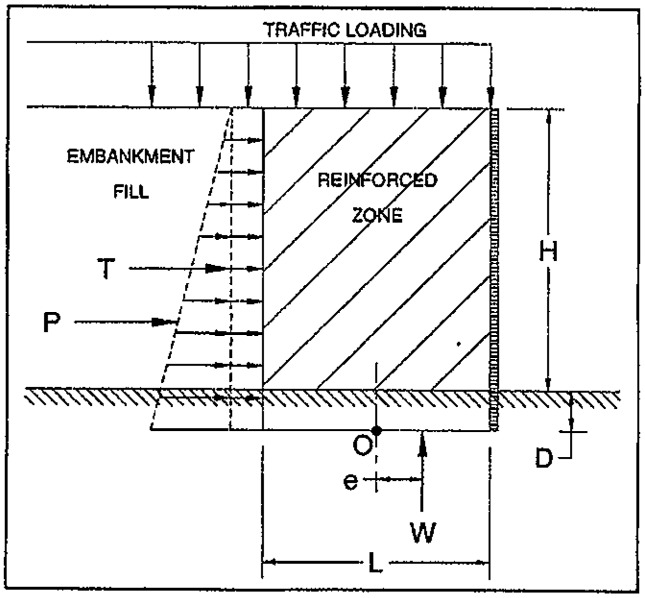
$$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturning}}$$

Calculated FS = **5.15** Required FS = 2.00

Resistance Against Overturning is **OK**

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	125	pcf	Unit weight	Foundation soil
c	=	1000	psf	Cohesion	Foundation soil
ϕ	=	0	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	28	deg.	Friction ang.	Foundation soil

Loads and Parameters

σ'_t	=	240	psf	Traffic loading
L=B	=	21.7	ft	Length of MSE reinforcement
L factor	=	0.7		Length factor-range (0.7 - 1.0)
D	=	5.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	31	ft	
H	=	25.8	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	10.333	ft	Moment arm
Γ Wt	=	15.5	ft	Moment arm
B'	=	16.24	ft	
γ'	=	57.6	pcf	
W_t		5,208	lb/ft of wall	Weight from traffic
W_{mse}	=	80,724	lb/ft of wall	Weight from MSE wall

Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 5,291 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 5,440 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 2,176 psf

Factor of Safety = 1.03 **No Good**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 12,229 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 4,892 psf

Factor of Safety = 2.31 **No Good**

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	5.14	N_c	25.80
N_q	1.00	N_q	14.72
N_γ	0.00	N_γ	16.72

Eccentricity of Resultant Force

e = 2.73 ft

Kern

e < L/6 = 3.62 ft

DLZ

SUBJECT			
Client	TranSystems ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF
Item	MSE Wall Stability (Forward Abutment)	COMP. BY SJR	DATE 03/16/06
02 - 823 over Blue Run Road (Boring TR-08)		CHECKED BY	DATE
Natural Soil Foundation			

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=30'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

Wall Properties

$H+D$ = 31 feet
γ_{mse} = 120 pcf
L = 21.7 feet
L factor = 0.70 Length factor-range (0.7 - 1.0)
ϕ = 30 deg Friction Angle of Embankment Fill

Foundational Soil Properties

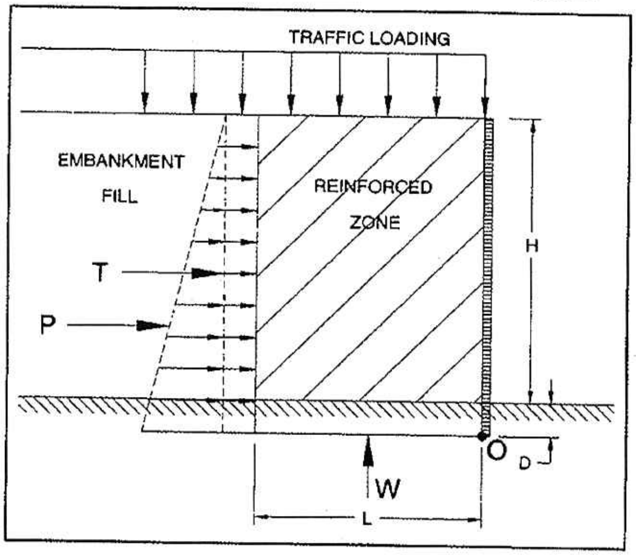
c = 1000 psf Cohesion
ϕ' = 28 deg Friction angle
ω_T = 240 psf Traffic loading

RESISTANCE AGAINST SLIDING ALONG BASE

Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 21,483 lbs per foot of wall



Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.36
0.67μ Max. = 0.35 (AASHTO, Bridge Design Manual, 303.4.1.1)

P_r = 28,253 lbs per foot of wall

Use Undrained Value

$P_r = L(c)$ (Undrained)

P_r = 21,700 lbs per foot of wall

USE THIS VALUE

$FS = \frac{P_r}{P_a}$ Calculated FS = **1.01** Required FS = 1.50 Resistance Against Sliding is **No Good**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 875,855 lb-ft

$$\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$$

$\Sigma M_{overturning}$ = 234,676 lb-ft

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

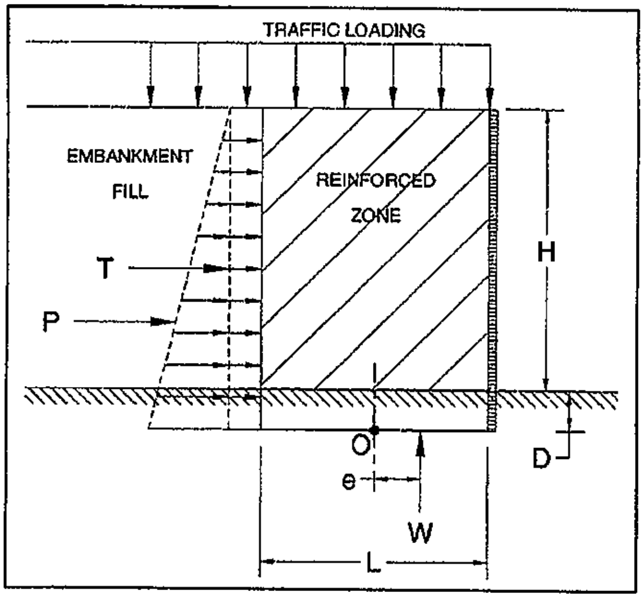
$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturning}}$ Calculated FS = **3.73** Required FS = 2.00 Resistance Against Overturning is **OK**

DLZ

SUBJECT			
Client	TranSystems / ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF
Item	Bearing Capacity MSE Wall (Forward Abutment)	COMP. BY	SJR DATE 3/16/06
	02 - 823 over Blue Run Road (Boring TR-08)	CHECKED BY	DATE
	Compacted Granular Fill Foundation		

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	125	pcf	Unit weight	Foundation soil
c	=	0	psf	Cohesion	Foundation soil
ϕ	=	36	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	36	deg.	Friction ang.	Foundation soil

Loads and Parameters

w_t	=	240	psf	Traffic loading
L=B	=	21.7	ft	Length of MSE reinforcement
L factor	=	0.7		Length factor-range (0.7 - 1.0)
D	=	5.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	31	ft	
H	=	25.8	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	10.333	ft	Moment arm
Γ Wt	=	15.5	ft	Moment arm
B'	=	16.24	ft	
γ'	=	57.6	pcf	
W_t		5,208	lb/ft of wall	Weight from traffic
W_{mse}	=	80,724	lb/ft of wall	Weight from MSE wall

Effective Bearing Pressure

$$\sigma_{v'} = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 5,291 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 37,644 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 15,058 psf

Factor of Safety = 7.11 **OK**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 37,644 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 15,058 psf

Factor of Safety = 7.11 **OK**

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	50.59	N_c	50.59
N_q	37.75	N_q	37.75
N_γ	56.31	N_γ	56.31

Eccentricity of Resultant Force

e = 2.73 ft

Kern

e < L/6 = 3.62 ft

DLZ

SUBJECT			
Client	TranSystems ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF
Item	MSE Wall Stability (Forward Abutment)	COMP. BY	SJR DATE 03/16/06
02 - 823 over Blue Run Road (Boring TR-08)		CHECKED BY	DATE
Compacted Granular Fill Foundation			

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=30'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

Wall Properties

- H+D = 31 feet
- γ_{mse} = 120 pcf
- L = 21.7 feet
- L factor = 0.70 Length factor-range (0.7 - 1.0)
- ϕ = 30 deg Friction Angle of Embankment Fill

Foundational Soil Properties

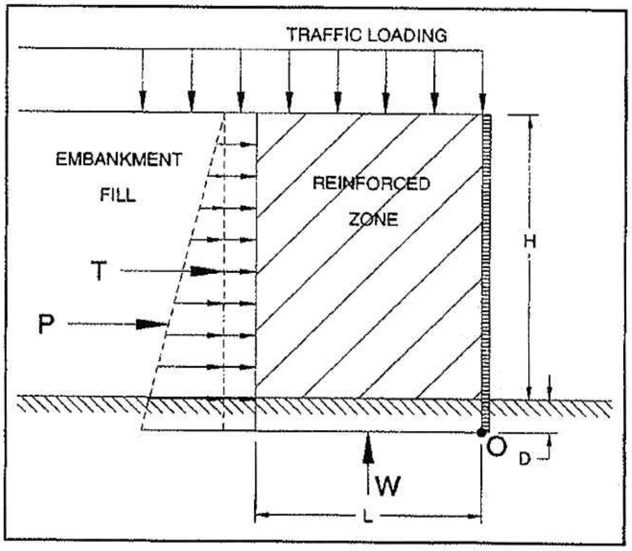
- c = 0 psf Cohesion
- ϕ' = 36 deg Friction angle
- ω_T = 240 psf Traffic loading

RESISTANCE AGAINST SLIDING ALONG BASE

Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 21,483 lbs per foot of wall



Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.49

0.67μ Max. = 0.55 (AASHTO, Bridge Design Manual, 303.4.1.1)

P_r = 39,555 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 0 lbs per foot of wall

Use Drained Value

$FS = \frac{P_r}{P_a}$ Calculated FS = **1.84** Required FS = 1.50

Resistance Against Sliding is **OK**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 875,855 lb-ft

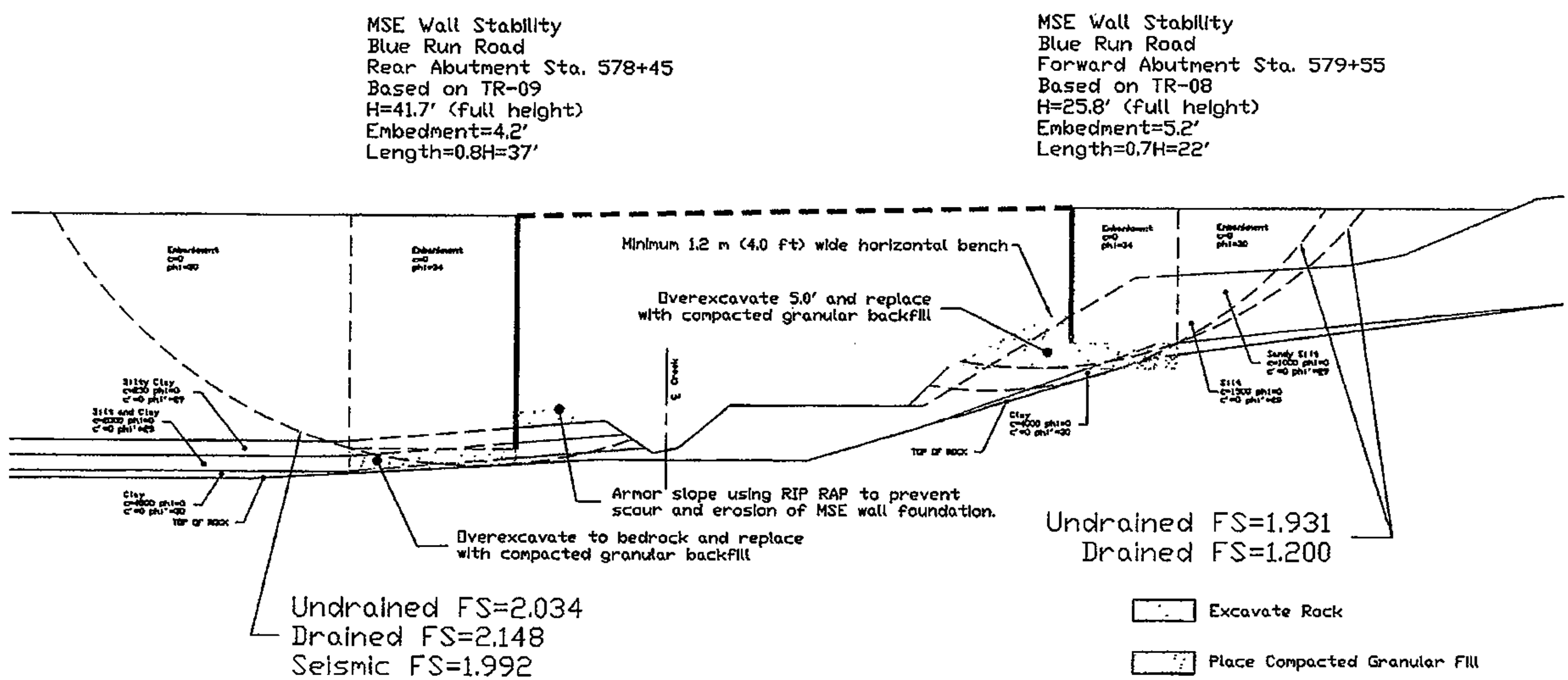
$$\Sigma M_{resisting} = \gamma H L\left(\frac{L}{2}\right)$$

$\Sigma M_{overturning}$ = 234,676 lb-ft

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturning}}$ Calculated FS = **3.73** Required FS = 2.00

Resistance Against Overturning is **OK**



BLUE RUN ROAD
EXCAVATE AND REPLACE WITH GRANULAR FILL

MSE WALL STABILITY ANALYSIS
UNDERCUT TRIAL
SCI-823-0.00

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-14-06

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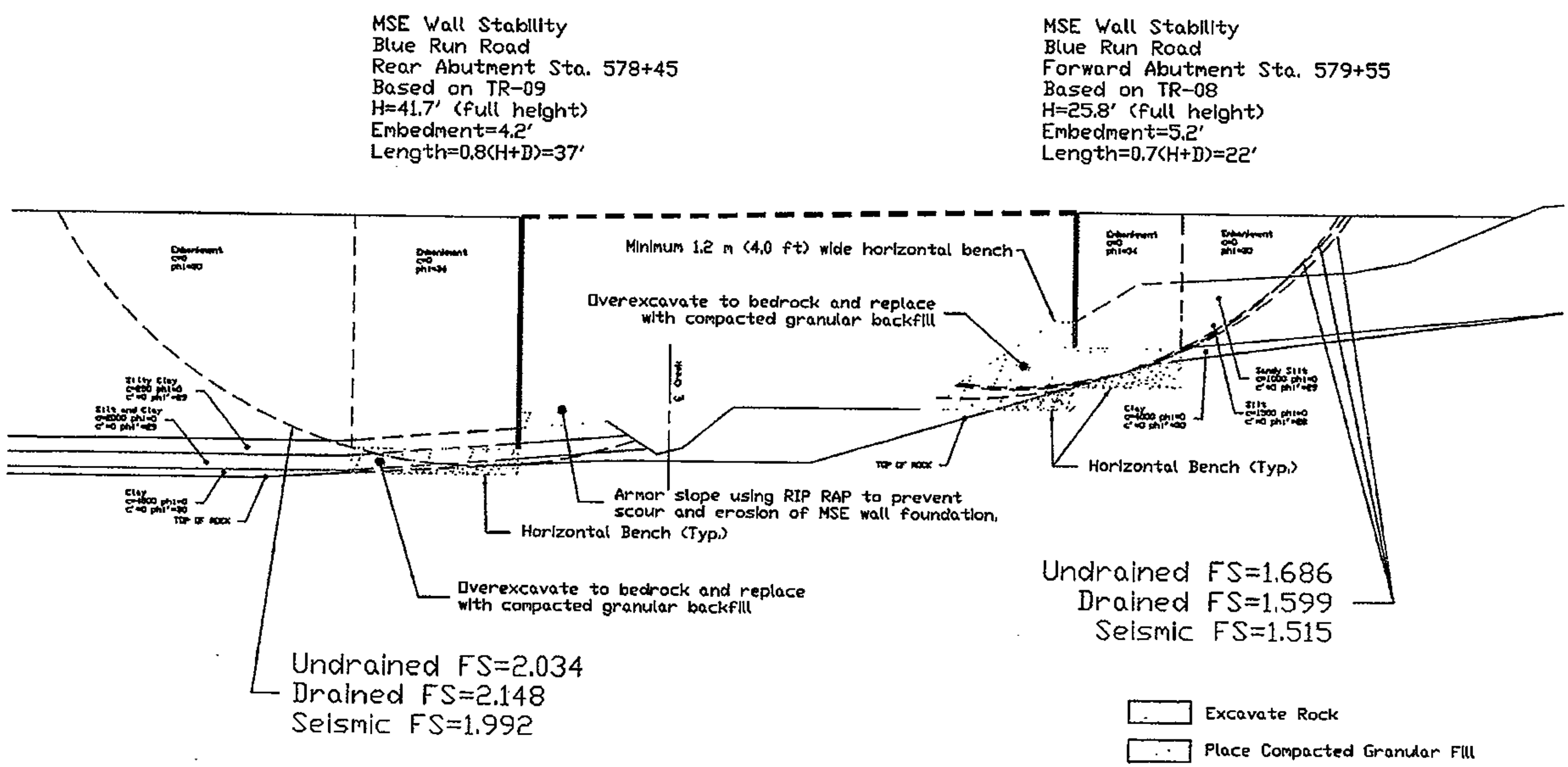

BLUE RUN ROAD
EXCAVATE AND REPLACE WITH GRANULAR FILL

MSE WALL STABILITY ANALYSIS
RECOMMENDED PRELIMINARY DESIGN
SCI-823-0.00

PROJECT NO. 0121-3070.03 | CALC: SJR | DATE 03-14-06

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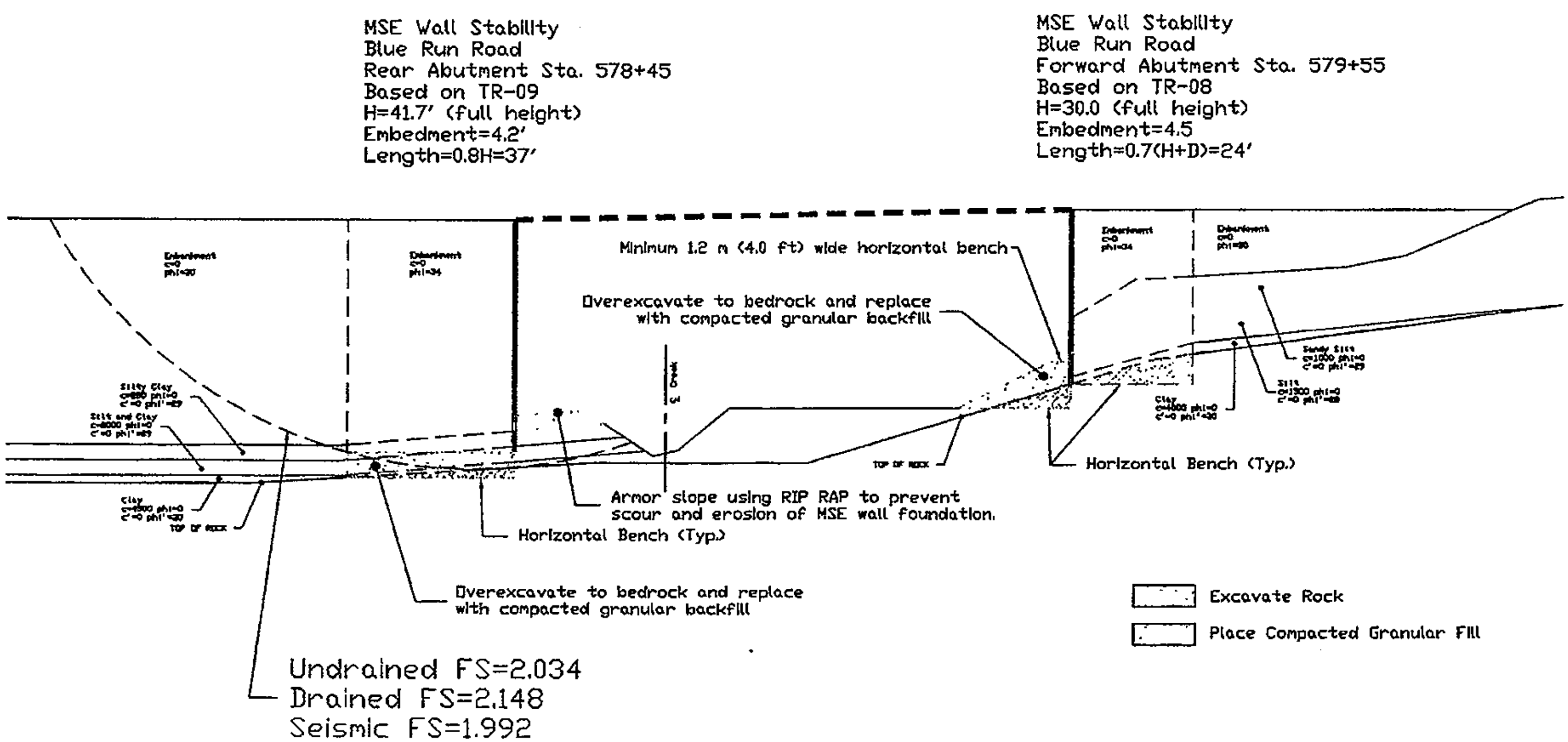

BLUE RUN ROAD
EXCAVATE AND REPLACE WITH GRANULAR FILL

MSE WALL STABILITY ANALYSIS
ALTERNATE PRELIMINARY DESIGN
SCI-823-0.00

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-14-06

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