SCI-823-0.00

PID No. 19415

S.R. 823 over Swauger Valley - Minford Road

Structure Type Study Submittal

Prepared for:
Ohio Department of Transportation
District 9
650 Eastern Ave.
Chillicothe, Ohio 45601

April 7, 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 Swauger Valley-Minford Road. 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 raises the elevations of the proposed S.R. 823 Mainline over Swauger Valley-Minford Road from the elevations specified in the July 2005 PAVR. These increases in profile elevation cause an increase in the height of built-up embankments which, in turn, lengthen the bridge spans when considering 2:1 embankment slopes. Due to this span lengthening, bridge types for the proposed S.R. 823 Mainline over Swauger Valley-Minford 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, four (4) alternatives for construction of the proposed S.R. 823 Mainline over Swauger Valley-Minford Road are evaluated in this study and are designated as Alternatives 1, 2, 2A, and 3. 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. Note that Section 3 of the original report points out that per a phone conversation with DLZ Ohio, Inc. on 7/12/2005, it was agreed that an addendum will be submitted during the TS&L stage stating that substructures located in areas of new embankment construction shall be founded on H-piles. Updated boring logs for the four test borings (TR-20, TR-21, TR-22 and TR-23) and preliminary MSE wall evaluations – performed by DLZ Ohio, Inc. – may be found in Appendix E of this current (updated) version of the Structure Type Study Report. The preliminary MSE wall evaluations reveal that MSE walls can be used at the rear and forward abutment locations for Alternatives 1, 2, and 2A (structure types with two spans) as long as the naturally occurring soils beneath the proposed MSE walls are overexcavated to top of rock and replaced with compacted granular fill. Bedrock elevations may vary significantly so it is recommended that where compacted granular fill is placed on bedrock, a level bench is cut into the rock for stability purposes. MSE walls will bear either on compacted granular fill or bedrock. 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 Swauger Valley-Minford Road 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 is provided for all the alternatives considered in this study. In accordance with the L&D manual, Volume 1 and due to the tangent alignment of the existing Swauger Valley-Minford Road (which negates horizontal sight distance issues), a minimum horizontal clear zone width of 23'-0" from edge of traveled way to face of obstruction has to be maintained. The proposed substructure layout for each alternative in this updated Structure Type Study report satisfies this minimum horizontal clearance. An existing creek, which parallels the road, will be maintained on the west side of Swauger Valley-Minford Road.

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 1300' vertical curve with PVI at Station 446+00.00 (PVI elevation = 686.89'), g_1 = -4.50% and g_2 = 2.60%. 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 four (4) alternatives were considered and are outlined in the Structure Type Alternative Table below:

STRUCTURE TYPE ALTERNATIVE TABLE				
Structure Type Alternative	**1**	**2**	**2A**	**3**
Structure Type Description	Tangent,Prestressed Concrete Girders Modified AASHTO Type 4 (72")	Tangent,continuous Steel Plate Girders A709 Gr. 50W	Tangent,continuous Steel Plate Girders A709 Gr. 50W	Tangent,continuous Steel Plate Girders A709 Gr. 50W
Proposed Beam Spacing	4 Spaces @ 9'-6" per Bridge	4 Spaces @ 9'-6" per Bridge	3 Spaces @ 12'-8" per Bridge	4 Spaces @ 9'-6" per Bridge
No. of Spans	2	2	2	3
Abutment Type	Semi-integral Type behind MSE Wall	Semi-integral Type behind MSE Wall	Semi-integral Type behind MSE Wall	Stub Type with 2:1 spill through slopes
No. of Piers	1	1	1	2
Pier Type	T-type	T-type	T-type	T-type
Substructure Orientation	13°00'00" RF	13°00'00" RF	13°00'00" RF	13°00'00" RF
Approximate Bridge Length	200'	200'	200'	440'-6"
Approximate Structure Depth				
Slab	8.75"	8.75"	9.75"	8.75"
Haunch	2"	2"	2"	2"
Beam	72"	45.625"	54.75"	63.875"
Total	82.75" (6.896')	56.375" (4.698')	66.50" (5.542')	74.625" (6.219')

Alternative Discussion:

Alternative 1

This two-span alternative is investigated in response to ODOT's 9/1/2005 comments to the original 7/15/2005 Structure Type Study. The creek location as well as the horizontal clear zone width for Swauger Valley-Minford Road helps dictate the substructure unit locations. A clear zone width of 23'-0" minimum from edge of Swauger Valley-Minford Road (edge of traveled way) to sight obstruction is used to ensure proper placement of the Rear MSE Wall, and thus the Rear Abutment, as well as the Pier. 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 footing and between the edge of the creek bed and the face of the Forward MSE Wall is ensured. When these obstructions and horizontal clearances are considered along with the ODOT comments of 9/1/2005, two spans, each with a length of 100'-0" from centerline bearing of abutment to centerline pier, are defined.

Because MSE Walls are used in conjunction with a bearing-to-bearing length of 200'-0" (< 400' total length) and a skew of 13°00'00" right forward, a semi-integral abutment type is selected for this alternative (refer to Section 204.6.2.1 and Figure 203 of the ODOT Bridge Design Manual). As previously noted, an addendum will be submitted during the TS&L stage stating that substructures located in areas of new embankment construction shall be founded on H-piles (see Section 3 of this report). Consequently, the semi-integral rear and forward abutments will both be supported by steel H-piles driven to bedrock. Straight wingwalls will be provided. Abutment and wingwall details will follow ODOT Standard Drawings.

The single pier of this two-span structure is a T-type pier supported on a spread footing founded on bedrock. A T-type is selected over a cap-and-column type due to the anticipated height of pier which is approximately 60'. The columns of a 60' cap-and-column pier may be considered slender columns and to minimize/eliminate these slenderness effects, the wide and thick stem of a T-type pier is useful. The dimensions of the spread footing will need to be established using an allowable bearing capacity of 15 TSF (refer to Appendix E – Subsurface Investigation and Preliminary Foundation Recommendations).

The superstructures for both the left and right bridges of this alternative consist of 5-72" deep Modified AASHTO Type 4 prestressed concrete I-beams 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 $3,000,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $966,000, resulting in a total estimated ownership cost of $3,966,000 in year 2008 dollars.

Alternative 2

Alternative 2 is identical to Alternative 1 except that the superstructures for the left and right bridges consist of 5-continuous steel plate girders, Grade 50W, with 42" deep webs spaced at 9'-6" on center.

The initial bridge construction cost for Alternative 2 is estimated to be $4,260,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,567,000, resulting in a total estimated ownership cost of $5,827,000 in year 2008 dollars.

Alternative 2A

Alternative 2A is also identical to Alternative 1 except that the superstructures for the left and right bridges consist of 4-continuous steel plate girders, Grade 50W, with 51" 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 2A is estimated to be $4,080,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,562,000, resulting in a total estimated ownership cost of $5,642,000 in year 2008 dollars.

Alternative 3

Alternative 3 is a continuous steel plate girder bridge. The revised project profile causes an increase in the height of built-up embankments on the east and west sides of Swauger Valley-Minford Road (for the Rear and Forward Abutments of the Mainline). The height and length of these embankments (due to the 2:1 slope), the creek location, and the horizontal clear zone width of 23'-0" for Swauger Valley-Minford Road help dictate the substructure unit locations and respective span lengths. When these factors are considered along with the end span-to-middle span ratios of ODOT BDM 205.6, three spans with lengths of 128'-6", 183'-6", and 128'-6" center-to-center bearing are defined (0.70 end span-to-middle span ratio).

The total bearing-to-bearing length of this alternative is 440'-6". Because this length exceeds 400', a conventional abutment such as a stub type abutment is recommended regardless of skew angle (refer to Figure 203 of the ODOT Bridge Design Manual). As previously noted, an addendum will be submitted during the TS&L stage stating that substructures located in areas of new embankment construction shall be founded on H-piles (see Section 3 of this report). The stub type rear and forward abutments positioned on built-up embankments will therefore be supported by steel H-piles driven to bedrock. Straight wingwalls will be provided. Abutment and wingwall details will follow ODOT Standard Drawings.

Piers 1 and 2 of this three-span structure are T-type piers supported on spread footings founded on bedrock. As with Alternatives 1, 2, and 2A, T-type piers are selected to minimize/eliminate column slenderness effects. The dimensions of the spread footings will need to be established using an allowable bearing capacity of 15 TSF (refer to Appendix E – Subsurface Investigation and Preliminary Foundation Recommendations).

The superstructures for both the left and right bridges of this alternative consist of 5-continuous steel plate girders, Grade 50W, with 60" 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 $5,940,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $4,035,000, resulting in a total estimated ownership cost of $9,975,000 in year 2008 dollars.

6. Recommendations:

Based upon the above information and discussions, Transystems Corporation recommends **Structure Type Alternative 1 (Two-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 1 is based on the following items:

1. This Alternative is the most 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 Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	2	100' - 100'	200.00	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$1,519,000	$638,000	$345,100	$500,400	$3,000,000	$966,000	$3,966,000
2	2	100' - 100'	200.00	5 Steel Girders /per BRIDGE	42" Web Grade 50W	$1,382,000	$1,676,000	$489,300	$709,500	$4,260,000	$1,567,000	$5,827,000
2A	2	100' - 100'	200.00	4 Steel Girders /per BRIDGE	51" Web Grade 50W	$1,358,000	$1,572,000	$468,800	$679,800	$4,080,000	$1,562,000	$5,642,000
3	3	128.5'-183.5'-128.5'	440.50	5 Steel Girders /per BRIDGE	60" Web Grade 50W	$3,490,000	$779,000	$683,000	$990,400	$5,940,000	$4,035,000	$9,975,000

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.

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	Approach Roadway Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
1	2	100' - 100'	200.00	202	666	$392,900	$167,000	$99,000	$117,500	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$742,800	$1,519,000	0%	**$1,519,000**

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%	$18,360	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	8	$16,560
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	48	$66,240
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	2000	$660,000
						TOTAL =	**$742,800**

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

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):

Length = 30 ft. Width = 90 ft
Area = 300 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

Approach Roadway

	Quantity		Year 2005	Annual Escalation	Year 2008
Embankment fill	10,000.00	cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	1,500.00	sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	300	ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	150	ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	MSE Abutment & Wingwall Cost	Additional Crane Cost	Subtotal Substructure Cost
1	2	100' - 100'	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$198,000	$45,100	$166,200	$27,200	$126,200	$0	$75,000	**$638,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	114	$421.00	3.5%	$483.00	$55,060
Stem	184	$421.00	3.5%	$483.00	$88,870
Footings	112	$421.00	3.5%	$483.00	$54,100
Total Cost	410				$198,000

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	344	$421.00	3.5%	$483.00	$166,200
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.):

	Total Area (sq. ft.)	Year 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 1	0	$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
64	SEE QUANTITY CALCULATIONS	3,744

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	2008
$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

By: JRC
Checked: MSL

Date: 4/6/2006
Date: 4/7/2006

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	8	36.00	1548	3	51.5	16.00		2472	15	4	25.00		1500	5520
Pier 2																
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1548**					**2472**					**1500**	**5520**
Total (Cu.Yd.)					**57**					**92**					**56**	**204**
			Qty x 2 (L/R)		**114**					**184**					**112**	**408**

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	*16*	693.8	642.0	57.0	*912*
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	*16*	688.8	636	60.0	*960*
TotaL								**32**				**1872**
							Qty x 2 (L/R)	**64**				**3744**

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	46.2	3	6.75	20.25	936	3	4	12.00		554	6	3	18	1	832	2322
Fwd. Abut	46.2	3	6.75	20.25	936	3	4	12.00		554	6	3	18	1	832	2322
Total (Cu.Ft.)					**1871**					**1109**					**1663**	**4643**
Total (Cu.Yd.)					**69**					**41**					**62**	**172**
			Qty x 2 (L/R)		**138**					**82**					**124**	**344**

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 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 72	10	100	1000	33.33			24
Span 2	MOD TYPE 4 72	10	100	1000	33.33			24
Span 3		0	0	0	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			48
TotaL	**MOD TYPE 4 60**	**20**		**2000**				

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
2	2	100' - 100'	200	202	666	$392,900	$167,000	$99,000	$117,500	5 Steel Girders /per BRIDGE	42" Web Grade 50W	520,000	$605,400	**$1,382,000**

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	$0.74	3.5%	$0.85	
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%	$1.38	Curved Girders

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):

Length = 30 ft. Width = 90 ft
Area = 300 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

Approach Roadway

	Quantity	Unit	Year 2005	Annual Escalation	Year 2008
Embankment fill	10,000.00	cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	1,500.00	sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	300	ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	150	ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS
S.R. 823 over Swauger Valley - Minford Road L/R
STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: JRC   Date: 4/6/2006
Checked: MSL   Date: 4/7/2006

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	MSE Abutment & Wingwall Cost	Subtotal Substructure Cost
2	2	100' - 100'	5 Steel Girders /per BRIDGE	42" Web Grade 50W	$196,100	$44,700	$118,800	$19,500	$116,100	$1,181,000	**$1,676,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	102	$421.00	3.5%	$483.00	$49,270
Stem	192	$421.00	3.5%	$483.00	$92,740
Footings	112	$421.00	3.5%	$483.00	$54,100
Total Cost	406				$196,100

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:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	246	$421.00	3.5%	$483.00	$118,800
Wingwalls	0	$421.00	3.5%	$483.00	$0

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

Number of Piles		Total Pile Length
56	SEE QUANTITY CALCULATIONS	3,444

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	2008
$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

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 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 2	19,717	$54.00	3.5%	$59.90

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2 - QUANTITY CALCULATIONS

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	8	32.00	1376	3	54	16.00		2592	15	4	25.00		1500	5468
Pier 2																0
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1376**					**2592**					**1500**	**5468**
Total (Cu.Yd.)					**51**					**96**					**56**	**203**
			Qty x 2 (L/R)		**102**					**192**					**112**	**406**

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	45	3	4.25	12.75	574	3	2.15	6.45		290	6	3	18	1	810	1674
Fwd. Abut	45	3	4.25	12.75	574	3	2	6.00		270	6	3	18	1	810	1654
Total (Cu.Ft.)					**1148**					**560**					**1620**	**3328**
Total (Cu.Yd.)					**43**					**21**					**60**	**123**
			Qty x 2 (L/R)		**86**					**42**					**120**	**246**

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	*14*	696.3	642.0	61.0	*854*
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	*14*	691.3	636	62.0	*868*
TotaL								**28**				**1722**
							Qty x 2 (L/R)	**56**				**3444**

Includes 5' of additional length into rock

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**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		56.8	136	7724.8	
RA Wing (L)		51.22	23	1178.1	
RA Wing (R)		53.65	23	1234.0	
Fwd Abut		53.8	136	7316.8	
FA Wing (L)		48.5	23	1115.5	
FA Wing (R)		49.9	23	1147.7	
Total (Sq.Ft.)				**19717**	

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	260	10	100	260000
Span 2	260	10	100	260000
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				520000

total steel weight per girder (lb.) = 52000
Total Span length (ft.)= 200.00
Weight Per ft. = 260

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2A - SUPERSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
2A	2	100' - 100'	200	202	727	$427,800	$182,400	$99,000	$117,500	4 Steel Girders /per BRIDGE	51" Web Grade 50W	456,000	$530,900	**$1,358,000**

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	$0.74	3.5%	$0.85	
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%	$1.38	Curved Girders

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 90 ft
Area = 300 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

Approach Roadway

	Quantity	Unit	Year 2005	Annual Escalation	Year 2008
Embankment fill	10,000.00	cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	1,500.00	sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	300	ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	150	ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2A - SUBSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	MSE Abutment & Wingwall Cost	Subtotal Substructure Cost
2A	2	100' - 100'	4 Steel Girders /per BRIDGE	51" Web Grade 50W	$195,100	$44,400	$142,300	$23,300	$116,100	$1,050,567	**$1,572,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	102	$421.00	3.5%	$483.00	$49,270
Stem	190	$421.00	3.5%	$483.00	$91,770
Footings	112	$421.00	3.5%	$483.00	$54,100
Total Cost	404				$195,100

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:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	268	$421.00	3.5%	$483.00	$129,400
Wingwalls	27	$421.00	3.5%	$483.00	$12,900

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 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 2A	18,963	$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
56	SEE QUANTITY CALCULATIONS	3,444

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	2008
$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 Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2A - QUANTITY CALCULATIONS

By: JRC
Checked: MSL

Date: 4/6/2006
Date: 4/7/2006

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	8	32.00	1376	3	53.25	16.00		2556	15	4	25.00		1500	5432
Pier 2																
Pier 3																
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1376**					**2556**					**1500**	**5432**
Total (Cu.Yd.)					**51**					**95**					**56**	**201**
				Qty x 2 (L/R)	**102**					**190**					**112**	**402**

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	*14*	695.6	642.0	61.0	*854*
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	*14*	690.6	636	62.0	*868*
TotaL								**28**				**1722**
							Qty x 2 (L/R)	**56**				**3444**

Includes 5' of additional length into rock

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	46.18	3	5	15.00	693	3	2.15	6.45		298	6	3	18	1	831	1822
Fwd. Abut	46.18	3	5	15.00	693	3	2	6.00		277	6	3	18	1	831	1801
Total (Cu.Ft.)					**1385**					**575**					**1662**	**3623**
Total (Cu.Yd.)					**51**					**21**					**62**	**134**
				Qty x 2 (L/R)	**102**					**42**					**124**	**268**

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**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		54.3	136	7385	
RA Wing (L)		50	23	1150	
RA Wing (R)		52.4	23	1205	
Fwd Abut		51.6	136	7018	
FA Wing (L)		47.2	23	1086	
FA Wing (R)		48.7	23	1120	
Total (Sq.Ft.)				**18963**	

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	285	8	100	228000
Span 2	285	8	100	228000
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				456000

total steel weight per girder (lb.) =	28500
Total Span length (ft.)=	200.00
Weight Per ft. =	143

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUPERSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
3	3	128.5'-183.5'-128.5'	440.50	442.00	1461	$861,800	$366,400	$82,500	5 Steel Girders /per BRIDGE	60" Web Grade 50W	1,828,075	$2,128,200	$51,204.68	**$3,490,000**

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	$0.74	3.5%	$0.85	
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%	$1.38	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 2005	Annual Escalation	Year 2008	
Strip Seal Expansion Joints	1.00	$250.00	3.5%	$277.18	2001 Price

Strip Seal Expansion Joints Length 185 ft.

SCI-823-0.00 - PORTSMOUTH BYPASS
S.R. 823 over Swauger Valley - Minford Road L/R
STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUBSTRUCTURE

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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
3	3	128.5'-183.5'-128.5'	5 Steel Girders /per BRIDGE	60" Web Grade 50W	$371,000	$84,500	$182,600	$29,900	$111,100	$0	**$779,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	204	$421.00	3.5%	$483.00	$98,530
Stem	342	$421.00	3.5%	$483.00	$165,190
Footings	222	$421.00	3.5%	$483.00	$107,230
Total Cost	768				$371,000

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	284	$421.00	3.5%	$483.00	$137,200
Wingwalls	94	$421.00	3.5%	$483.00	$45,400

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. 3		$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
64	SEE QUANTITY CALCULATIONS	3,296

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
0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$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

$ -

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Swauger Valley - Minford Road L/R

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

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

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	8	32.00	1376	3	47.5	16.00		2280	15	4	25.00		1500	5156
Pier 2 (Spr Ftg)	43	4	8	32.00	1376	3	48.8	16.00		2342	15	4	25.00		1500	5218
Pier 3																
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					2752					4622					3000	10374
Total (Cu.Yd.)					102					171					111	384
				Qty x 2 (L/R)	204					342					222	768

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	16	699.0	654.0	52.0	832
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	16	687.5	644	51.0	816
TotaL								32				1648
							Qty x 2 (L/R)	64				3296

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	46.18	1.75	6.5	11.38	525	3.75	3	11.25		520	6.25	3	18.75	1	866	1911
Fwd. Abut	46.18	1.75	6.5	11.38	525	3.75	3	11.25		520	6.25	3	18.75	1	866	1911
Total (Cu.Ft.)					1051					1039					1732	3821
Total (Cu.Yd.)					39					38					64	142
				Qty x 2 (L/R)	78					76					128	284

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	25	2.5	8	20.00	500	2.5	10	25.00	7	175	6.25	3	18.75	1	600	1275
Fwd. Abut	25	2.5	8	20.00	500	2.5	10	25.00	7	175	6.25	3	18.75	1	600	1275
Total (Cu.Ft.)					1000					350					1200	2550
Total (Cu.Yd.)					37					13					44	94

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	415	10	129	533275
Span 2	415	10	184	761525
Span 3	415	10	129	533275
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				1828075

total steel weight per girder (lb.) = 53327.5
Total Span length (ft.)= 200.00
Weight Per ft. = 267

By: JRC Date: 4/6/2006
Checked: MSL Date: 4/7/2006

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Structural Steel Painting * Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Sealing Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Approach Pavement Resurfacing Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost
1	2	200.00	5 Prestressed I-Girders /per BRIDGE	$0	0	$0	$44,900	2	$89,800	$4,600	10	$46,000
2	2	200.00	5 Steel Girders /per BRIDGE	$345,800	2	$691,600	$0	0	$0	$4,600	10	$46,000
2A	2	200.00	4 Steel Girders /per BRIDGE	$317,900	2	$635,800	$0	0	$0	$4,600	10	$46,000
3	3	440.50	5 Steel Girders /per BRIDGE	$1,099,900	2	$2,199,800	$0	0	$0	$0	0	$0

* - A709 Weathering Steel; assume no painting

Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Bridge Deck Overlay (5) Deck Demo & Chipping	Deck Overlay	Deck Joint Gland (2)	Number of Maintenance Cycles	Total Life Cycle Cost	Bridge Redecking (5) Deck Concrete Cost (3)	Deck Reinforcing Cost (3)	Deck Joint Cost (2)	Deck Removal Cost	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	2	200	5 Prestressed I-Girders /per BRIDGE	$54,600	$66,200	n/a	1	$120,800	$392,900	$167,000	n/a	$149,000	1	$708,900	**$966,000**	**$3,000,000**	**$3,966,000**
2	2	200	5 Steel Girders /per BRIDGE	$54,600	$66,200	n/a	1	$120,800	$392,900	$167,000	n/a	$149,000	1	$708,900	**$1,567,000**	**$4,260,000**	**$5,827,000**
2A	2	200	4 Steel Girders /per BRIDGE	$54,600	$66,200	n/a	1	$120,800	$427,800	$182,400	n/a	$149,000	1	$759,200	**$1,562,000**	**$4,080,000**	**$5,642,000**
3	3	440.5	5 Steel Girders /per BRIDGE	$120,200	$145,700	$12,819	1	$278,719	$861,800	$366,400	$51,205	$328,300	1	$1,556,500	**$4,035,000**	**$5,940,000**	**$9,975,000**

Structural Steel Painting:

Structural Steel Area:

	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.)
Alt. 2	42	10	200.00	15.40	21,700	20%	26,000
Alt. 2A	51	8	200.00	15.70	19,880	20%	23,900
Alt. 3	60	10	440.50	22.60	68,938	20%	82,700

Painting Cost per sq. ft.:

	Year 2005	Annual Escalation	Year 2008
Prep.	$6.75	3.5%	$7.48
Prime	$1.75	3.5%	$1.94
Intermed.	$1.75	3.5%	$1.94
Finish	$1.75	3.5%	$1.94
Total	$12.00		$13.30

Superstructure Sealing:

PS Concrete I-Beam Area:

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.

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.

PS Concrete Area:

	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)
Alt. 1	10	200.00	33,050	10%	4,040

Sealing Cost per sq. yd.:

	Year 2004	Annual Escalation	Year 2008
Epoxy-Urethane Sealer	$9.68	3.5%	$11.11

Bridge Redecking:

Bridge Deck Joint Cost per foot:

	Year 2005	Annual Escalation	Year 2008
Structural Expansion Joint Including Elastomeric Strip Seal	$250.00	3.5%	$277.18

	Bridge Width	No. Joints
Alt. 1	90.00	0
Alt. 2	90.00	0
Alt. 2A	90.00	0
Alt. 3	90.00	2

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	18,000	$8.28	$149,000
Alt. 2	18,000	$8.28	$149,000
Alt. 2A	18,000	$8.28	$149,000
Alt. 3	39,645	$8.28	$328,300

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	$22.85	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	18,000	2,000	50	45
Alt. 2	18,000	2,000	50	45
Alt. 2A	18,000	2,000	50	45
Alt. 3	39,645	4,405	110	99

Assume 25% of deck area requires removal to depth of 4.5" (3.25" additional removal).

Bridge Deck Joint Gland Replacement Cost per foot:

	Year 2005	Annual Escalation	Year 2008
Elastomeric Strip Seal Gland	$62.50	3.5%	$69.29

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 except for Alt. 3.
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

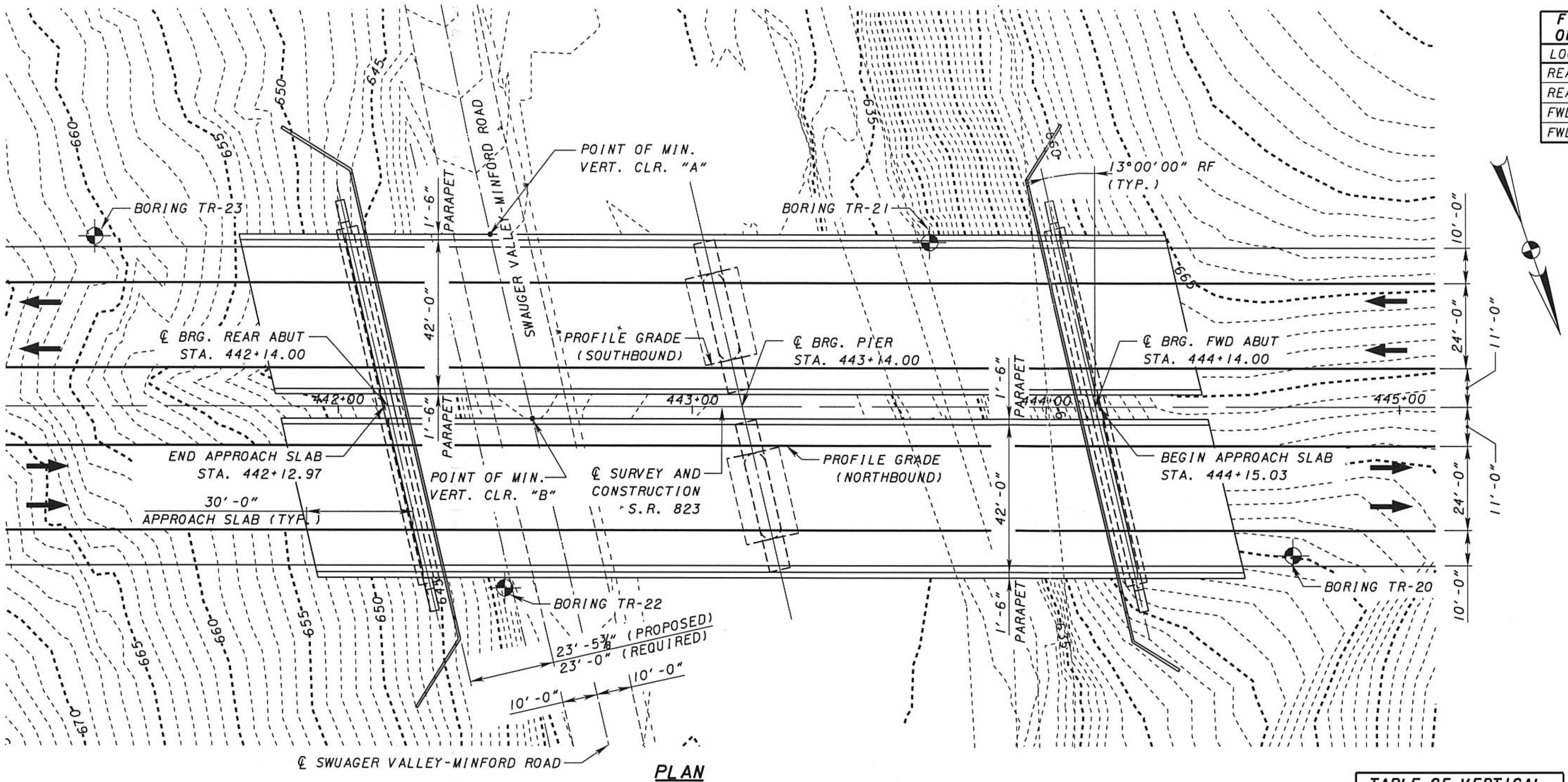
Asphalt Resurfacing Costs:

	Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
Alt. 1	240.5	38.0	1,015	1.50	42.3
Alt. 2	240.5	38.0	1,015	1.50	42.3
Alt. 2A	240.5	38.0	1,015	1.50	42.3

APPENDIX B

Preferred Alternative Site Plan and Details

TRANSYSTEMS CORPORATION



PLAN

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
TR-20	441+30.34	48.07' LT.
TR-21	442+46.93	51.45' RT.
TR-22	443+66.97	46.45' LT.
TR-24	444+69.73	42.09' RT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) = 21,200
DESIGN YEAR ADT (2030) = 31,200
CURRENT YEAR ADTT (2010) = 2,968
DESIGN YEAR ADTT (2030) = 4,368

PROPOSED STRUCTURE

TYPE: 2 SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPANS: 100'-0", 100'-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: 13°00'00" RF

CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT

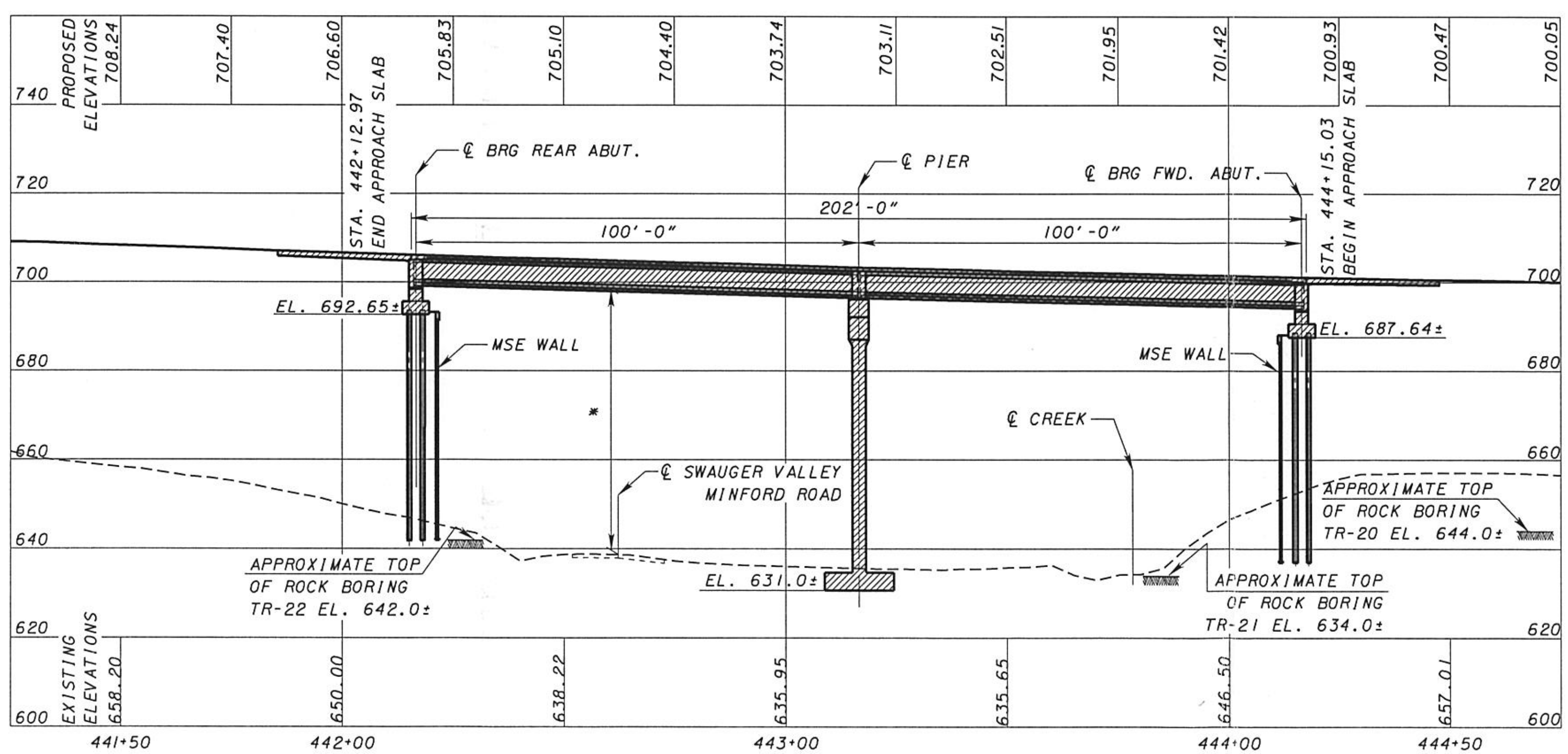
WEARING SURFACE: 1" MONOLITHIC SURFACE

APPROACH SLABS: AS-1-81 (30 FT LONG)

LATITUDE:

LONGITUDE:

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	56.6'±	58.7'±
REQUIRED	14.5'	14.5'



ELEVATION ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

* SEE TABLE OF VERTICAL CLEARANCES

Show profile grade

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

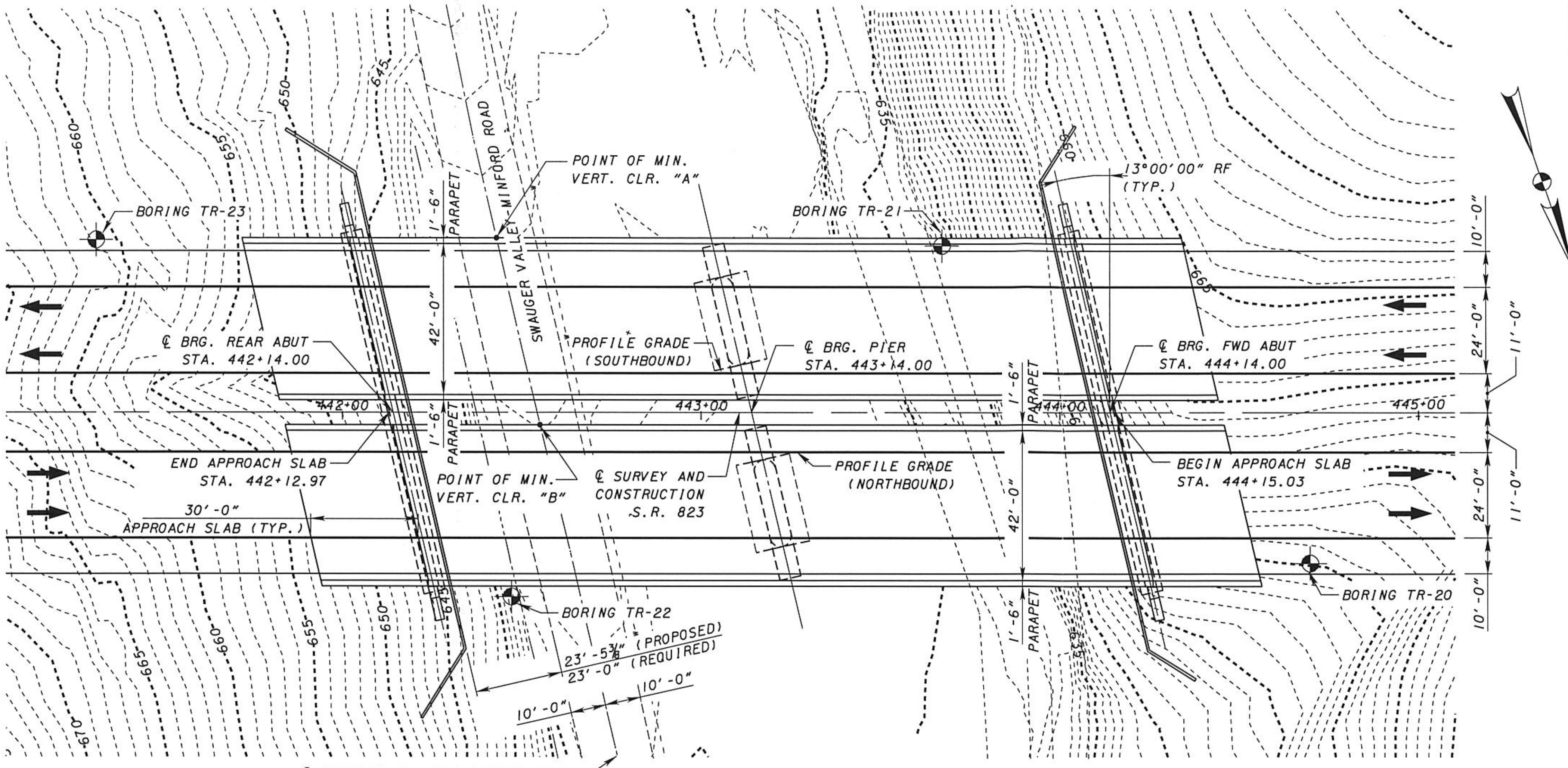
DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN MTN | REVISED | REVIEWED | DATE | STRUCTURE FILE NUMBER

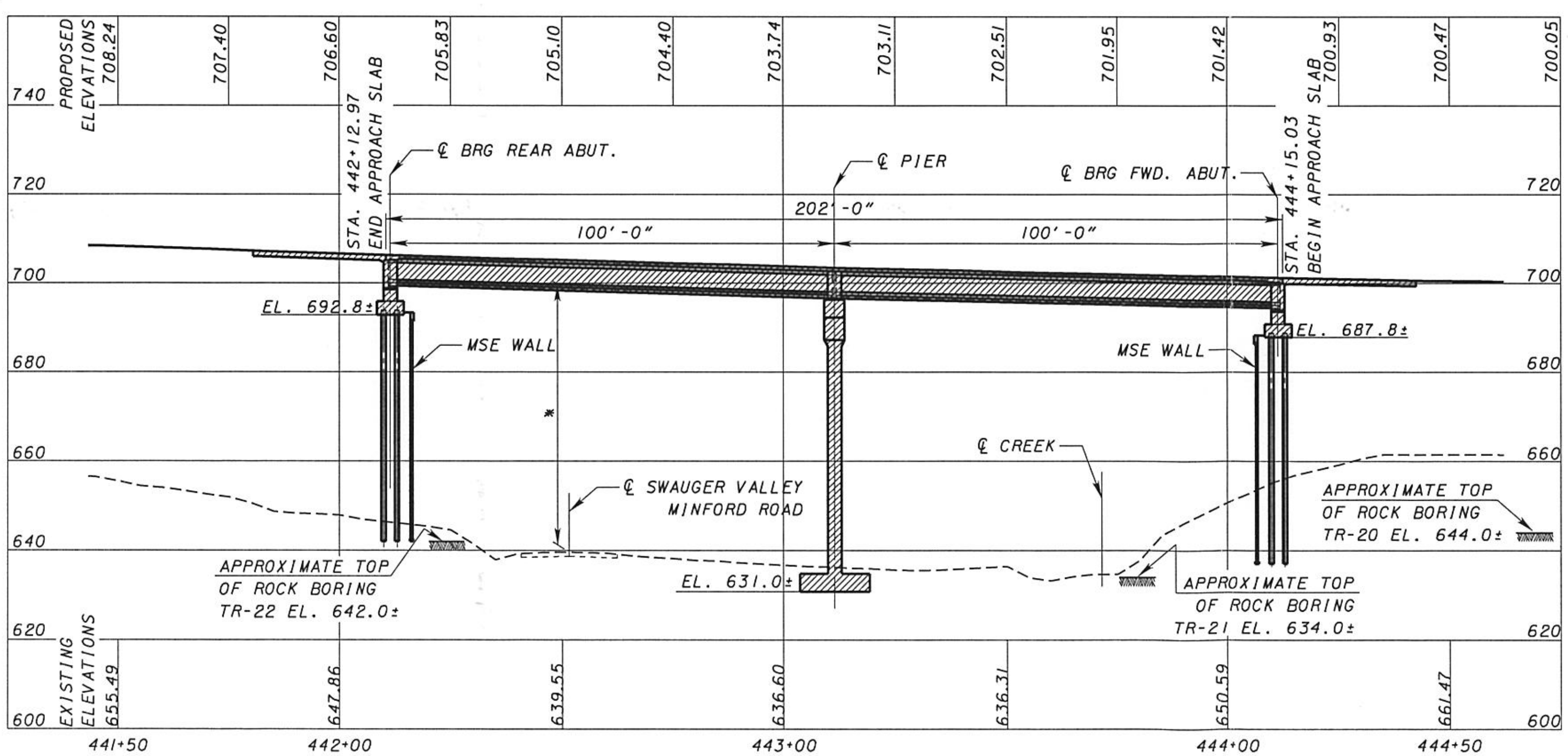
SCIOTO COUNTY
STA. 442+12.97
STA. 444+15.03

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415



PLAN



ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* SEE TABLE OF VERTICAL CLEARANCES

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
TR-20	441+30.34	48.07' LT.
TR-21	442+46.93	51.45' RT.
TR-22	443+66.97	46.45' LT.
TR-24	444+69.73	42.09' RT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) - 21,200
DESIGN YEAR ADT (2030) - 31,200
CURRENT YEAR ADTT (2010) - 2,968
DESIGN YEAR ADTT (2030) - 4,368

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	56.6±	58.7'±
REQUIRED	14.5'	14.5'

PROPOSED STRUCTURE

TYPE: 2 SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS.

SPANS: 100'-0", 100'-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: 13°00'00" RF

CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC SURFACE

APPROACH SLABS: AS-1-81 (30 FT LONG)

LATITUDE:

LONGITUDE:

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

DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN MTN | REVISED | REVIEWED | DATE | STRUCTURE FILE NUMBER

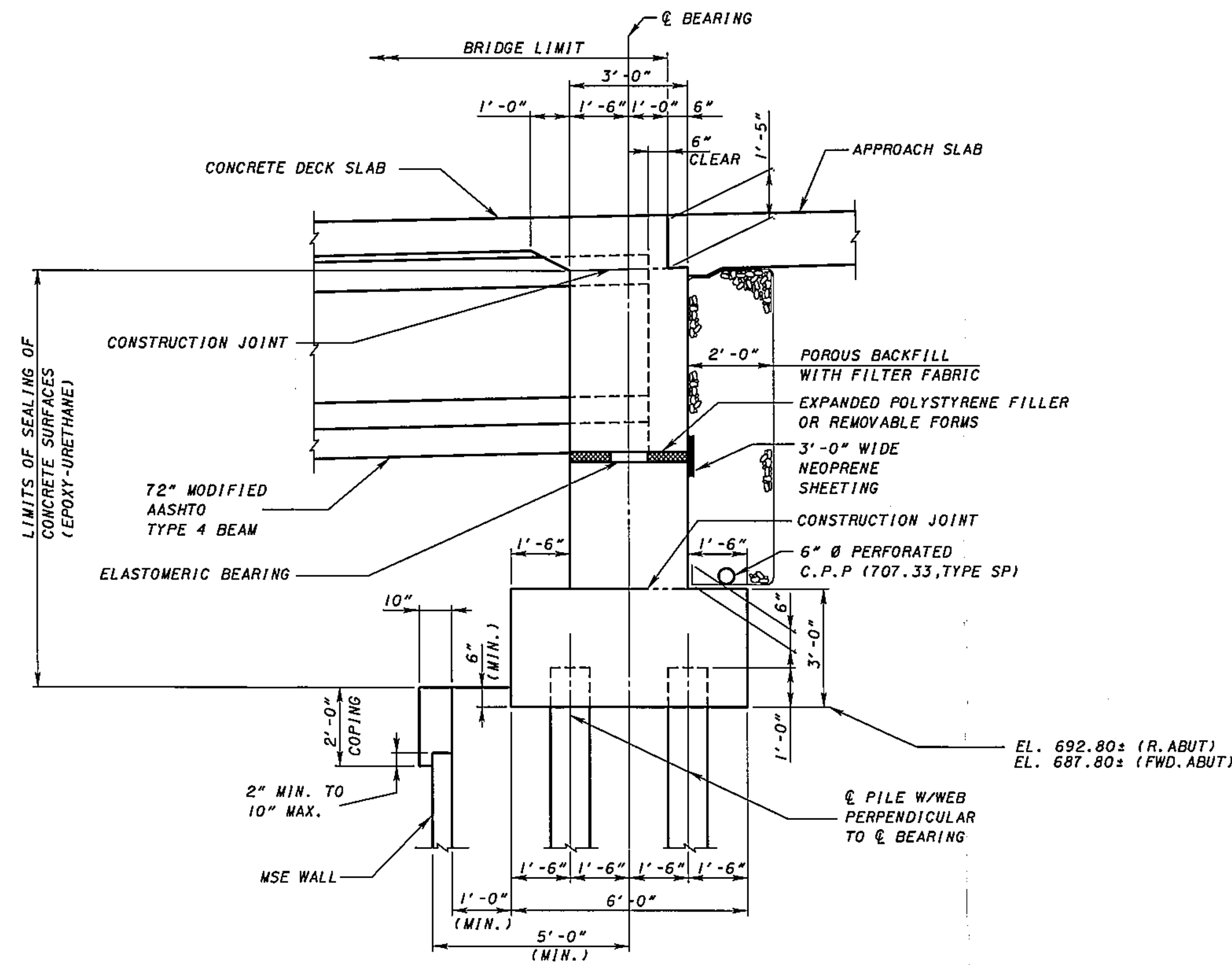
SCIOTO COUNTY
STA. 442+12.97
STA. 444+15.03

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415

2 / 4

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'



TYPICAL ABUTMENT SECTION

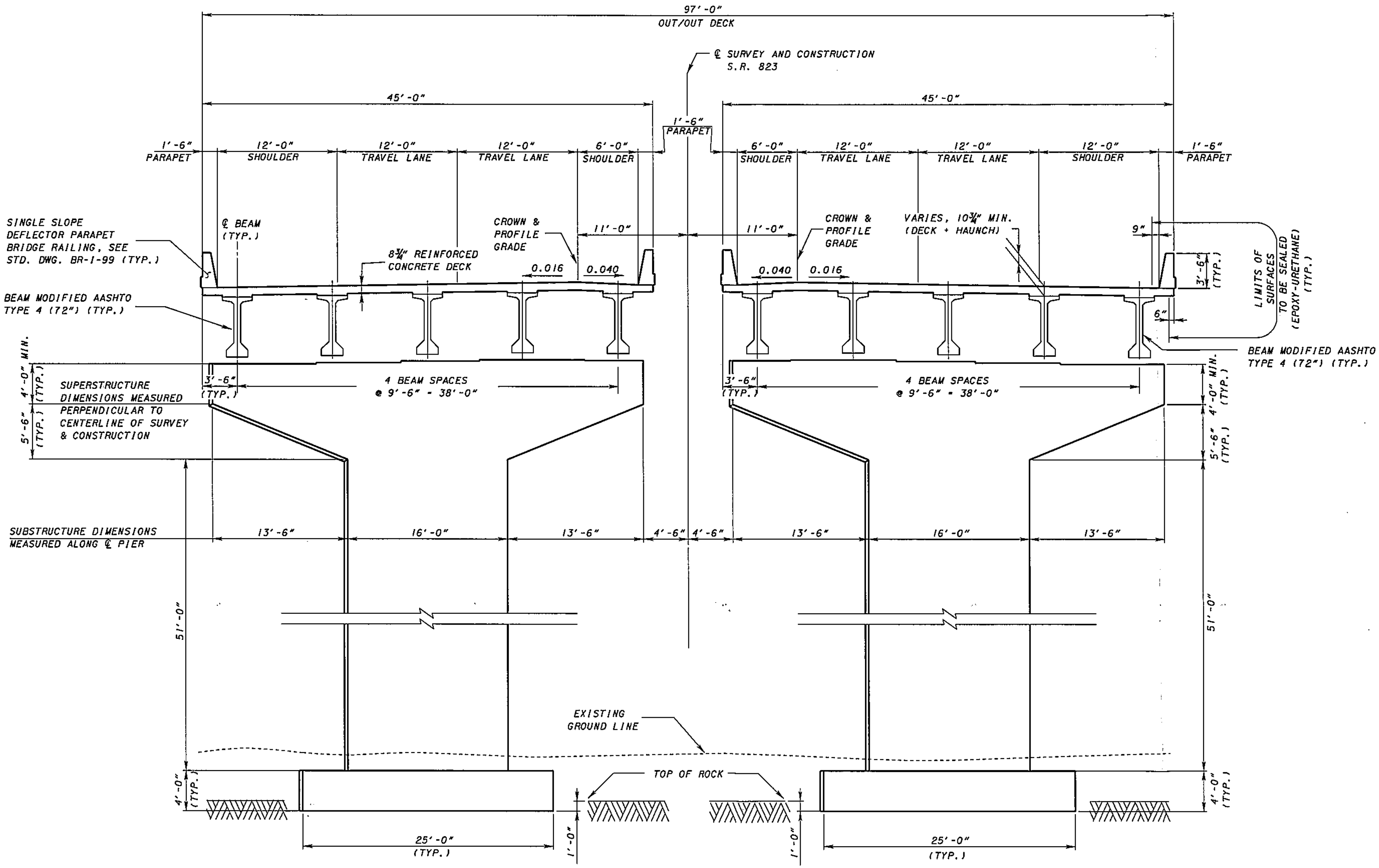
DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED MSL	DRAWN CAS	REVIEWED	DATE
CHECKED	REVISED	STRUCTURE FILE NUMBER	

ABUTMENT DETAILS - ALTERNATE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415

3 / 4



TYPICAL TRANSVERSE SECTION

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED	CHECKED	DRAWN	REVISED	REVIEWED	DATE	STRUCTURE FILE NUMBER
MSL		CAS				

TYPICAL TRANSVERSE SECTION
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-832-0.00
PID 19415

4 / 4

APPENDIX C

Vertical Clearance Calculations

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By	MSL	**Date**	04/07/06	**Job No.**	P403030064
Checked By		**Date**		**Sheet No.**	

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD **PID #** 19415

Alternative 1 - 5-72" Modified AASHTO Type 4 beams, 2-span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	37.5	-0.6
			Total Adjustment =	**-0.60**

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	=	**442+42.7164**
Offset Location @ Critical Point	=	**48.5' Left**
Profile Grade Elevation at Critical Point	=	705.31
Adjustment for Cross Slopes to Beam CL	=	-0.60
Top of Deck Elevation @ Critical Point	=	**704.71**
Total Superstructure Depth	=	-6.90
Bottom of Beam Elevation @ Critical Point	=	**697.81**
Approximate Top of Existing Ground @ Critical Point	=	**641.21**
Actual Vertical Clearance	=	***56.59***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	04/07/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD PID # 19415

Alternative 1 - 5-72" Modified AASHTO Type 4 beams, 2-span | ***Point Location:*** ***B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.04	x	7.5	=	-0.30
				=	0.00
					0
			Total Adjustment	=	**-0.30**

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	=	**442+54.7874**
Offset Location @ Critical Point	=	**3.50' Right**
Profile Grade Elevation at Critical Point	=	704.96
Adjustment for Cross Slopes to Beam CL	=	-0.30
Top of Deck Elevation @ Critical Point	=	**704.66**
Total Superstructure Depth	=	-6.90
Bottom of Beam Elevation @ Critical Point	=	**697.76**
Approximate Top of Existing Ground @ Critical Point	=	**639.06**
Actual Vertical Clearance	=	***58.70***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By MSL Date 04/07/06 Job No. P403030064
Checked By ______ Date ______ Sheet No. ______

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure ______
Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD PID # 19415

Alternative 2 - 5-42" web cont. steel plate girders (A709, Gr. 50W), 2 spans ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	37.5	-0.6

Total Adjustment = **-0.60**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	45.625	3.8
	56.375	4.7

Total Superstructure Depth (ft) = **4.70**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**442+42.7164**
Offset Location @ Critical Point	=	**48.5' Left**
Profile Grade Elevation at Critical Point	=	705.31
Adjustment for Cross Slopes to Beam CL	=	-0.60
Top of Deck Elevation @ Critical Point	=	**704.71**
Total Superstructure Depth	=	-4.70
Bottom of Beam Elevation @ Critical Point	=	**700.01**
Approximate Top of Existing Ground @ Critical Point	=	**641.21**
Actual Vertical Clearance	=	***58.79***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Alternative 2

Made By	MSL	Date	04/07/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD PID # 19415

Alternative 2 - 5-42" web cont. steel plate girders (A709, Gr. 50W), 2 spans ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.04	x	7.5	=	-0.30
				=	0.00
					0
			Total Adjustment	=	**-0.30**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	45.625	3.8
	56.375	4.7

Total Superstructure Depth (ft) = **4.70**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**442+54.7874**
Offset Location @ Critical Point	=	**3.50' Right**
Profile Grade Elevation at Critical Point	=	704.96
Adjustment for Cross Slopes to Beam CL	=	-0.30
Top of Deck Elevation @ Critical Point	=	**704.66**
Total Superstructure Depth	=	-4.70
Bottom of Beam Elevation @ Critical Point	=	**699.96**
Approximate Top of Existing Ground @ Critical Point	=	**639.06**
Actual Vertical Clearance	=	***60.90***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

TRANSYSTEMS CORPORATION

Made By	MSL	Date	04/07/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name	SCI-823-0.00	Structure	
Description	S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD	PID #	19415

Alternative 2A - 4-51" web cont. steel plate girders (A709, Gr. 50W), 2 spans **Point Location: A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	37.5	-0.6

Total Adjustment = **-0.60**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9.75	0.81
Haunch:	2	0.17
Girder or Beam Depth:	54.75	4.56
	66.5	5.54

Total Superstructure Depth (ft) = **5.54**

Vertical Clearance at Critical Point

Station @ Critical Point = 442+42.7164

Offset Location @ Critical Point = 48.5' Left

Profile Grade Elevation at Critical Point = 705.31

Adjustment for Cross Slopes to Beam CL = -0.60

Top of Deck Elevation @ Critical Point = 704.71

Total Superstructure Depth = -5.54

Bottom of Beam Elevation @ Critical Point = 699.17

Approximate Top of Existing Ground @ Critical Point = 641.21

Actual Vertical Clearance = 57.95

Preferred Vertical Clearance = 15.0

Required Vertical Clearance = 14.5

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TRANSYSTEMS CORPORATION

Made By	Alternative 2A MSL	Date	04/07/06	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD **PID #** 19415

Alternative 2A - 4-51" web cont. steel plate girders (A709, Gr. 50W), 2 spans ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.04	x	7.5	=	-0.30
				=	0.00
					0
			Total Adjustment	=	**-0.30**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9.75	0.81
Haunch:	2	0.17
Girder or Beam Depth:	54.75	4.56
	66.5	5.54

Total Superstructure Depth (ft) = **5.54**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**442+54.7874**
Offset Location @ Critical Point	=	**3.50' Right**
Profile Grade Elevation at Critical Point	=	704.96
Adjustment for Cross Slopes to Beam CL	=	-0.30
Top of Deck Elevation @ Critical Point	=	**704.66**
Total Superstructure Depth	=	-5.54
Bottom of Beam Elevation @ Critical Point	=	**699.12**
Approximate Top of Existing Ground @ Critical Point	=	**639.06**
Actual Vertical Clearance	=	***60.06***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

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Alternative 3

TRANSYSTEMS CORPORATION

Made By MSL Date 04/07/06 Job No. P403030064

Checked By Date Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD PID # 19415

Alternative 3 - 5-60" web cont. steel plate girders (A709, Gr. 50W), 3 spans ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.016	x	37.5	-0.6

Total Adjustment = **-0.60**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	63.875	5.32
	74.625	6.22

Total Superstructure Depth (ft) = **6.22**

Vertical Clearance at Critical Point

Station @ Critical Point = 442+42.7164

Offset Location @ Critical Point = 48.5' Left

Profile Grade Elevation at Critical Point = 705.31

Adjustment for Cross Slopes to Beam CL = -0.60

Top of Deck Elevation @ Critical Point = 704.71

Total Superstructure Depth = -6.22

Bottom of Beam Elevation @ Critical Point = 698.49

Approximate Top of Existing Ground @ Critical Point = 641.21

Actual Vertical Clearance = 57.27

Preferred Vertical Clearance = 15.0

Required Vertical Clearance = 14.5

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TRANSYSTEMS CORPORATION

Made By	MSL	Date	04/07/06	Job No.	P403030064
Checked By		Date		Sheet No.	

Alternative 3

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD **PID #** 19415

Alternative 3 - 5-60" web cont. steel plate girders (A709, Gr. 50W), 3 spans ***Point Location:*** ***B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.04	x	7.5	=	-0.30
				=	0.00
					0
			Total Adjustment	=	**-0.30**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.75	0.73		
Haunch:	2	0.17		
Girder or Beam Depth:	63.875	5.32		
	74.625	6.22		
		Total Superstructure Depth (ft)	=	**6.22**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**442+54.7874**
Offset Location @ Critical Point	=	**3.50' Right**
Profile Grade Elevation at Critical Point	=	704.96
Adjustment for Cross Slopes to Beam CL	=	-0.30
Top of Deck Elevation @ Critical Point	=	**704.66**
Total Superstructure Depth	=	-6.22
Bottom of Beam Elevation @ Critical Point	=	**698.44**
Approximate Top of Existing Ground @ Critical Point	=	**639.06**
Actual Vertical Clearance	=	***59.38***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

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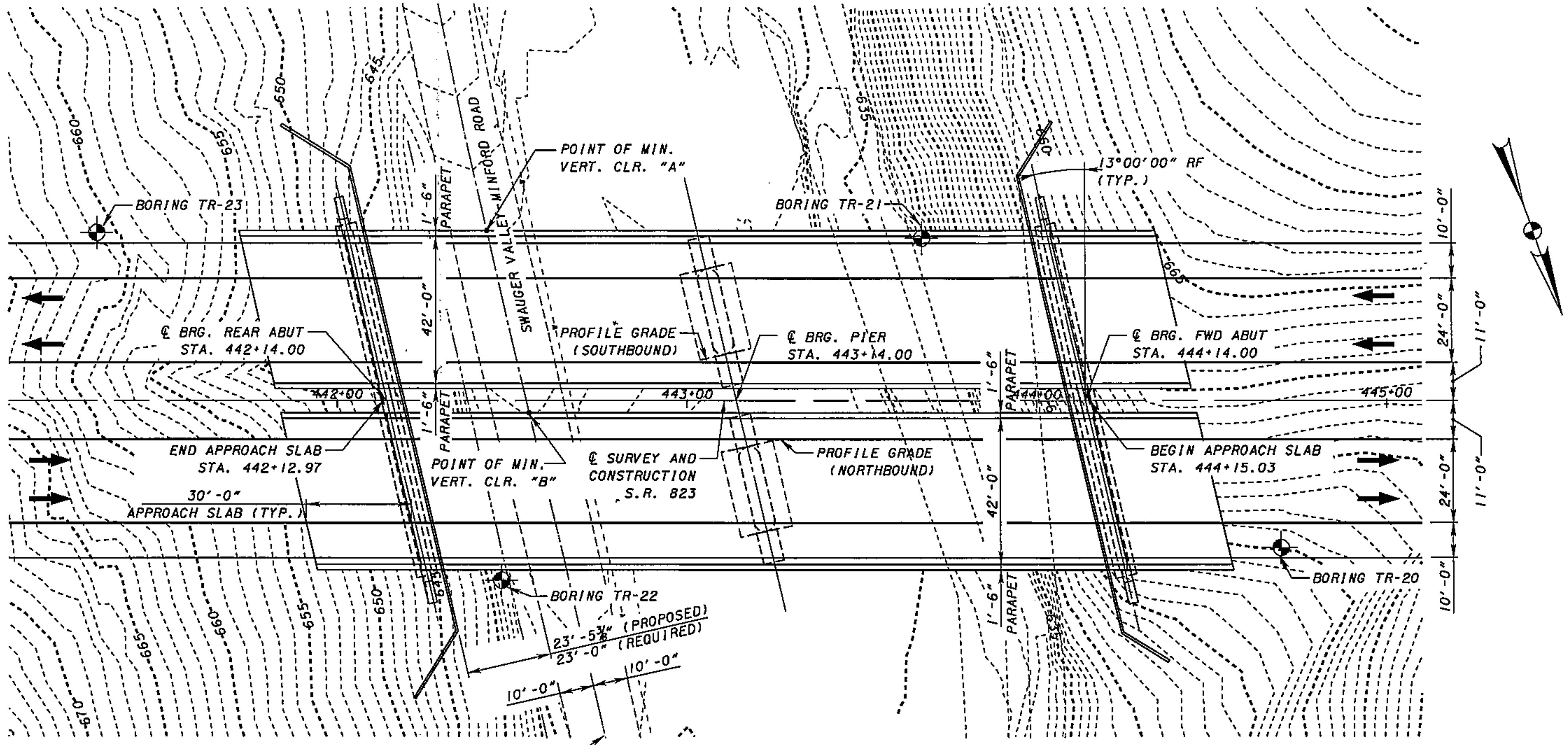
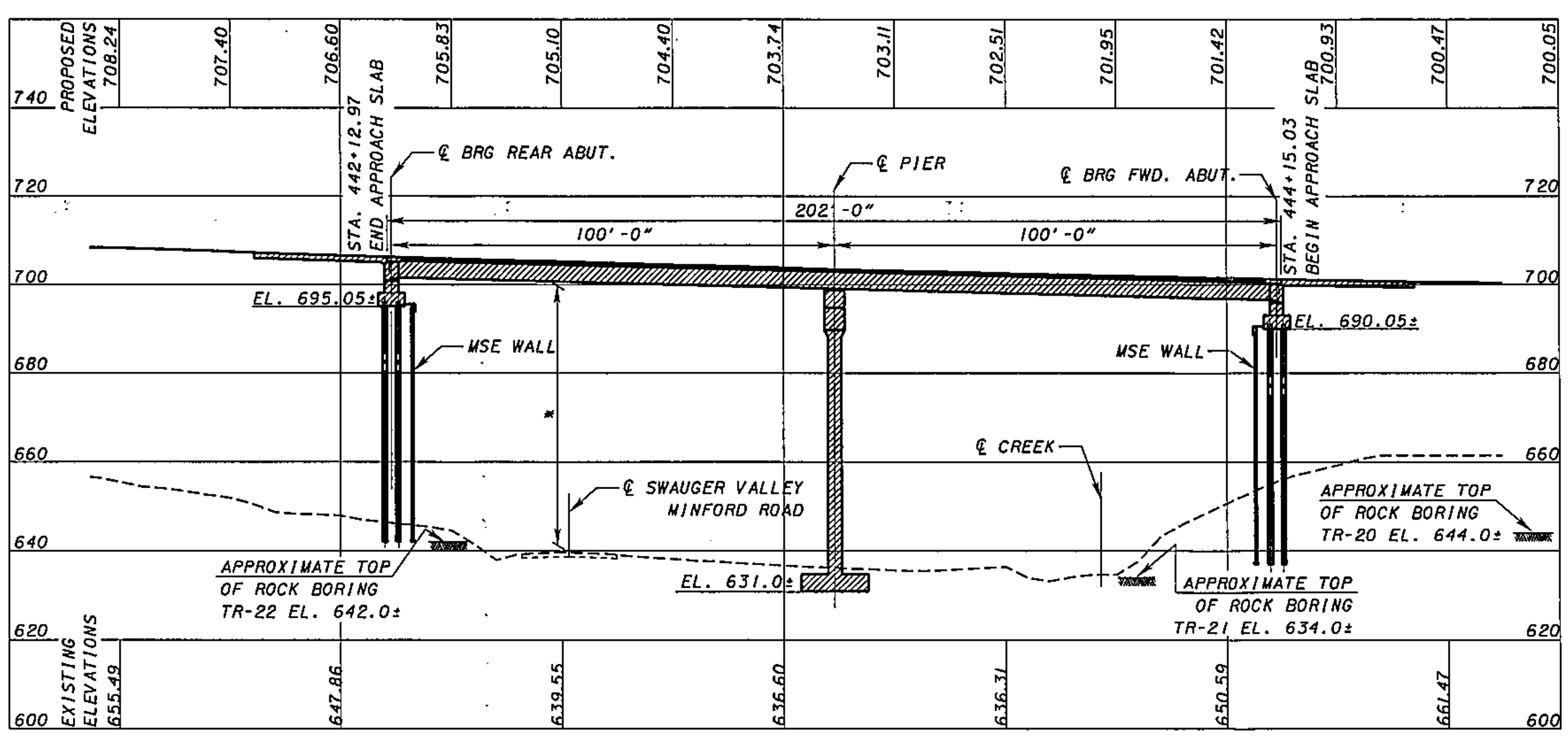
APPENDIX D

Preliminary Structure Site Plan

TRANSYSTEMS CORPORATION



PLAN



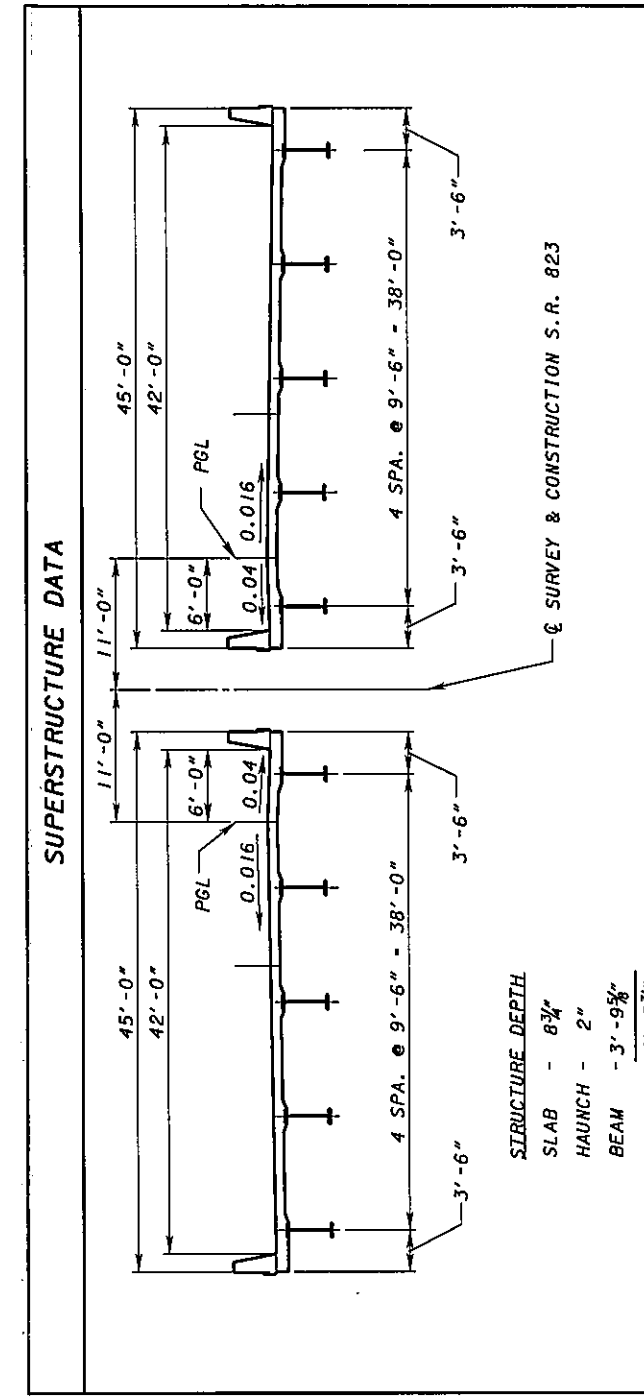
ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* SEE TABLE OF VERTICAL CLEARANCES

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	58.8' ±	60.9' ±
REQUIRED	14.5'	14.5'

SUPERSTRUCTURE DATA



PROPOSED STRUCTURE

TYPE: 2 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS

SPANS: 100'-0", 100'-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: 13°00'00"

CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

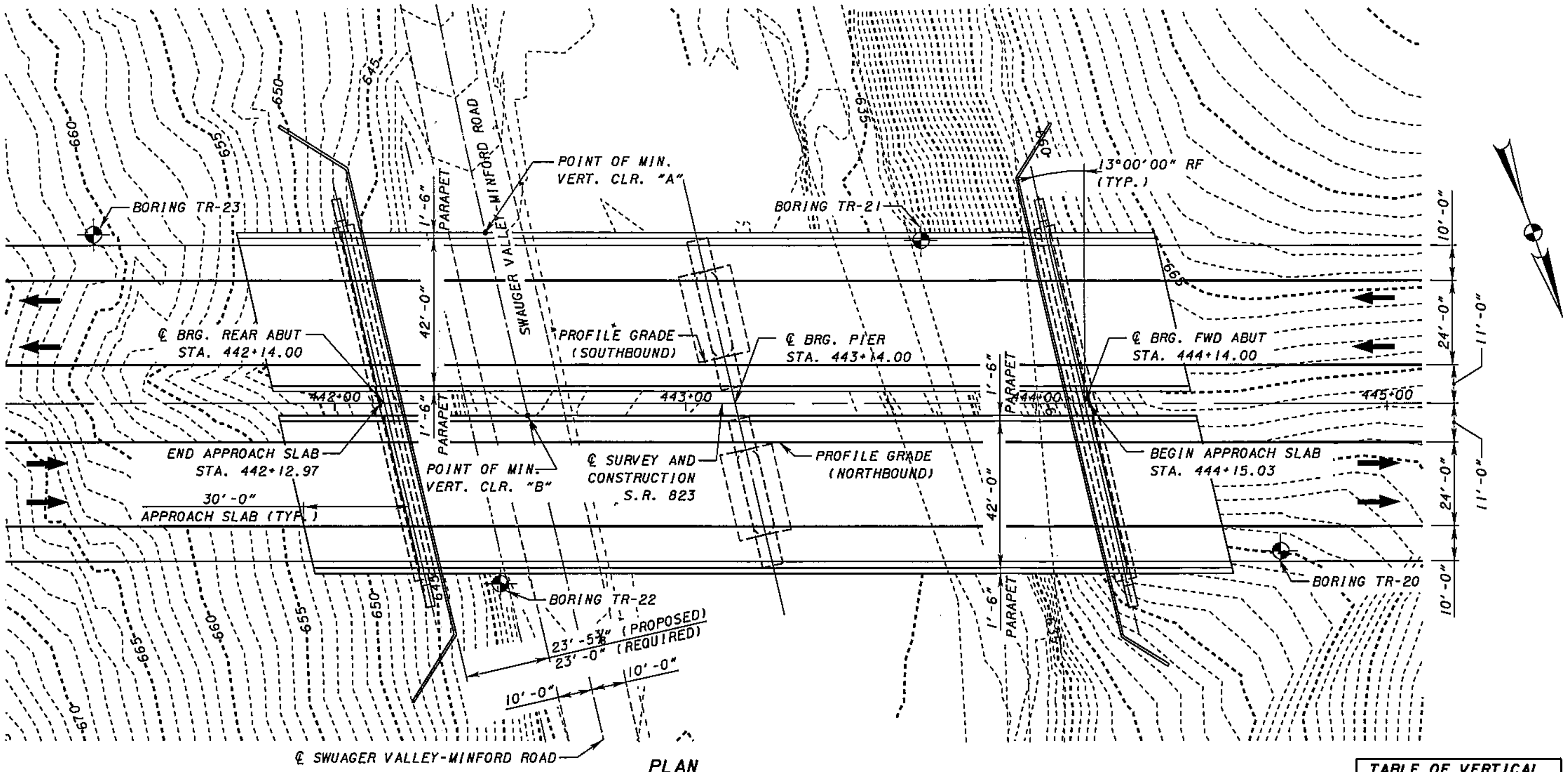
DESIGN AGENCY: TRANSYSTEMS CORPORATION

DESIGNED MSL | DRAWN MTN | REVIEWED | DATE | CHECKED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 442+12.97
STA. 444+15.03

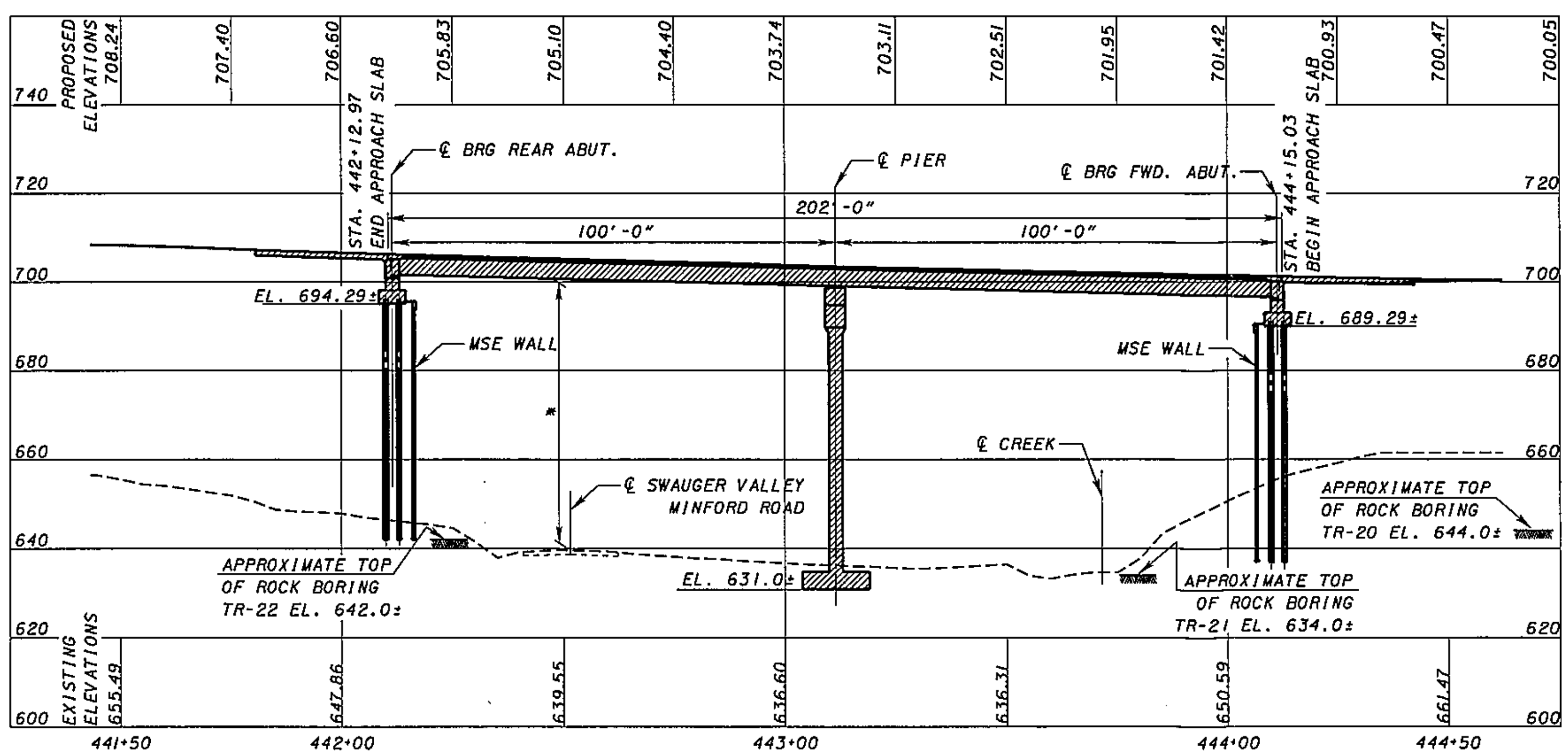
PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415



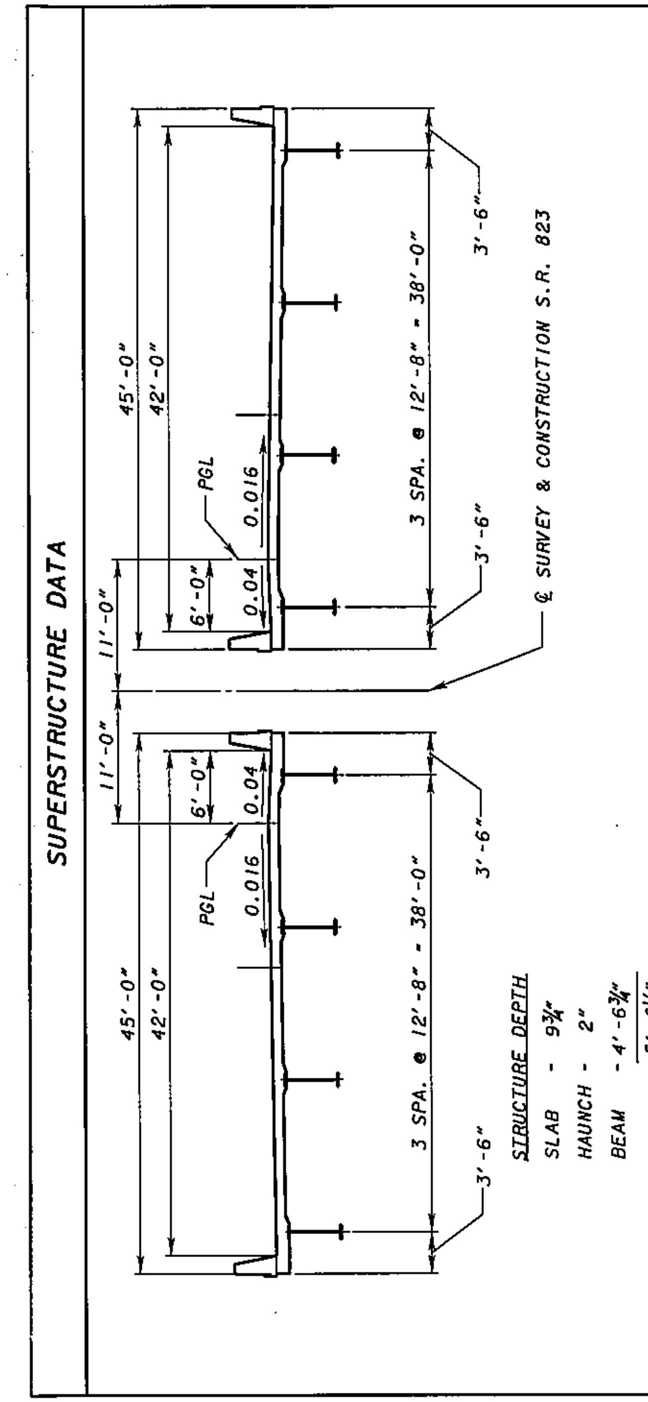
PLAN

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	58.0'±	60.1'±
REQUIRED	14.5'	14.5'



ELEVATION ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

* SEE TABLE OF VERTICAL CLEARANCES



PROPOSED STRUCTURE

TYPE: 2 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS AND T-TYPE PIERS

SPANS: 100'-0", 100'-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: 13°00'00"

CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TRANSYSTEMS CORPORATION

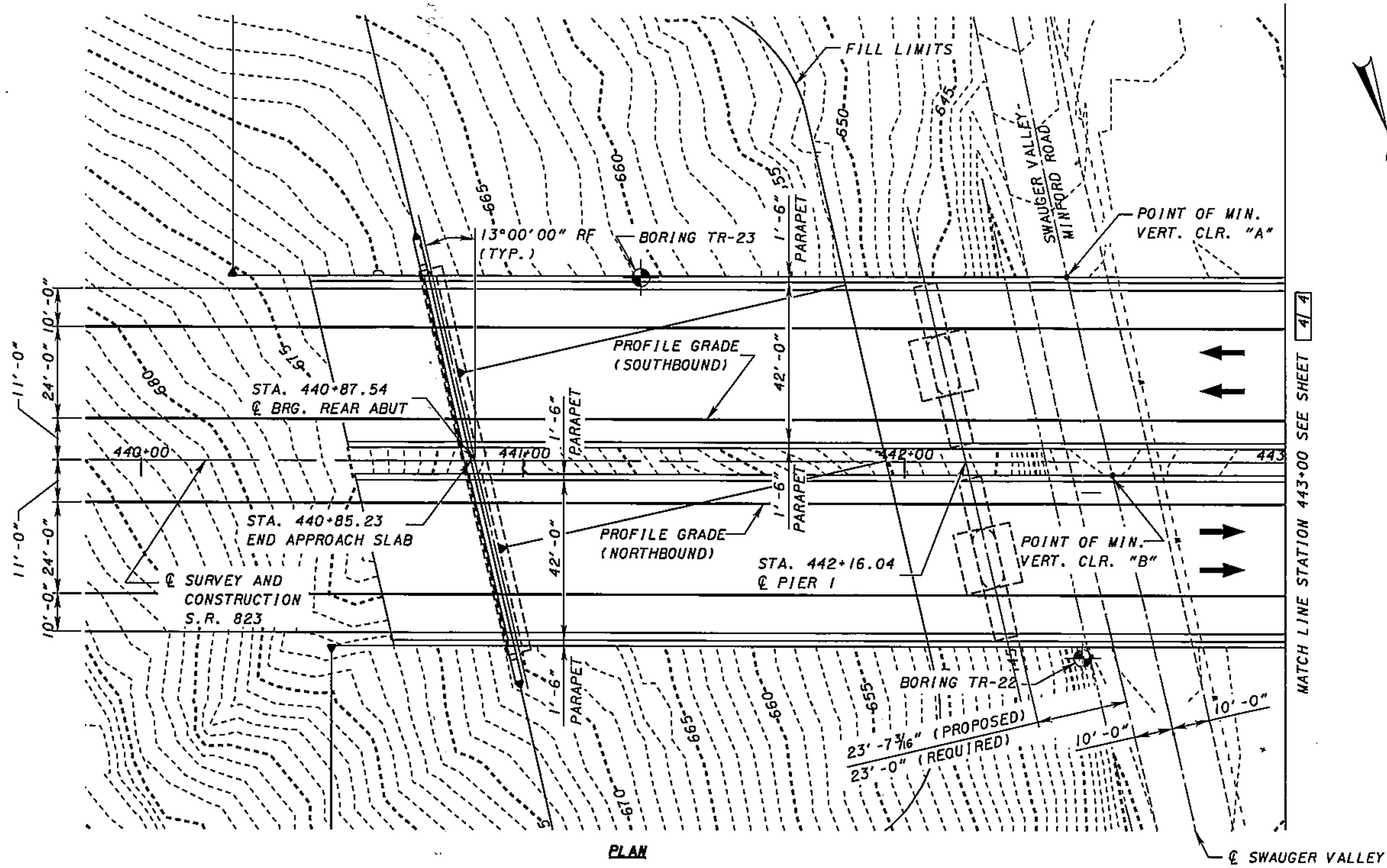
DESIGNED: MSL | CHECKED | DRAWN: MTN | REVISED | REVIEWED | DATE | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 442+12.97
STA. 444+15.03

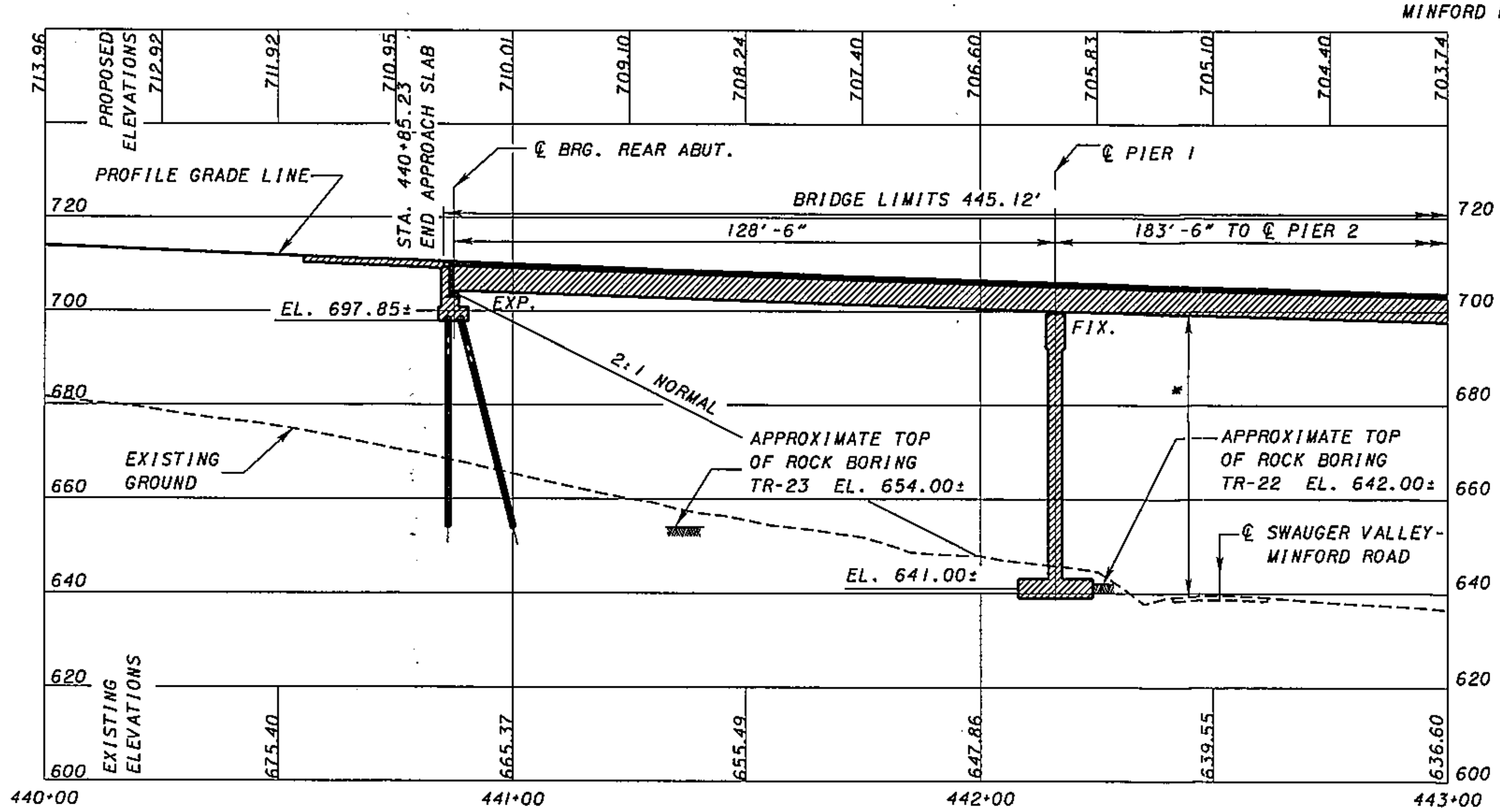
PRELIMINARY SITE PLAN - ALTERNATIVE 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415

2 / 4



PLAN



ELEVATION ALONG PROFILE GRADE LINE LEFT BRIDGE S.R. 823

* SEE TABLE OF VERTICAL CLEARANCES

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
TR-20	441+30.34	48.07' LT.
TR-21	442+46.93	51.45' RT.
TR-22	443+66.97	46.45' LT.
TR-23	444+69.73	42.09' RT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) - 21,200
DESIGN YEAR ADT (2030) - 31,200
CURRENT YEAR ADTT (2010) - 2,968
DESIGN YEAR ADTT (2030) - 4,368

PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINIOUS STEEL PLATE (GIRDER A709) GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB TYPE ABUTMENTS WITH 2:1 SPILL THROUGH SLOPES AND T-TYPE PIERS

SPANS: 128.5', 183.5', 128.5' 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: 13°00'00" RF

CROWN: 0.016 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (30.0' LONG)

LATITUDE:

LONGITUDE:

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	57.3'±	59.4'±
REQUIRED	14.5'	14.5'

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

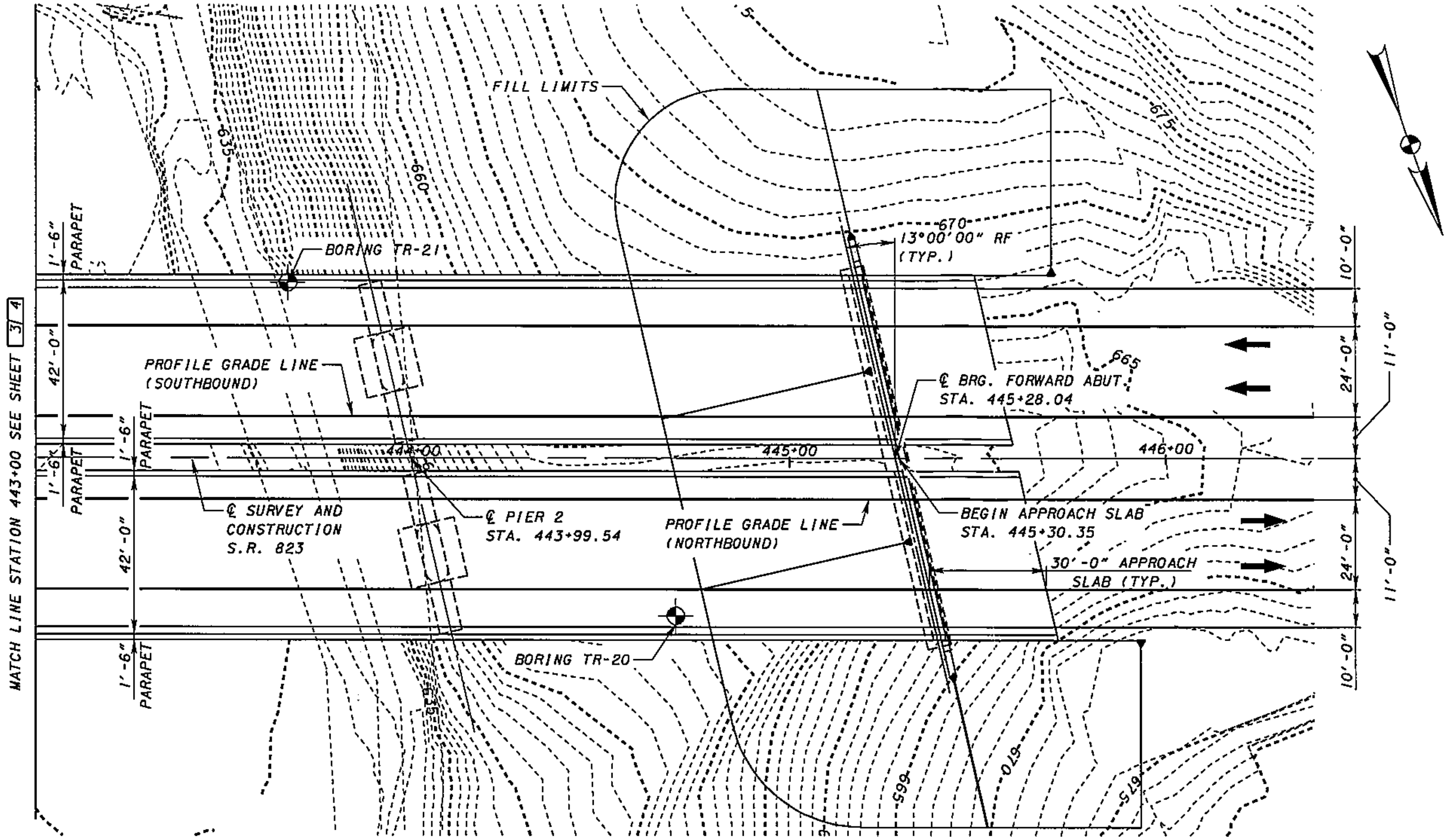
DESIGN AGENCY TRANSYSTEMS CORPORATION

DESIGNED MSL | CHECKED | DRAWN CAS | REVISED | REVIEWED | DATE | STRUCTURE FILE NUMBER

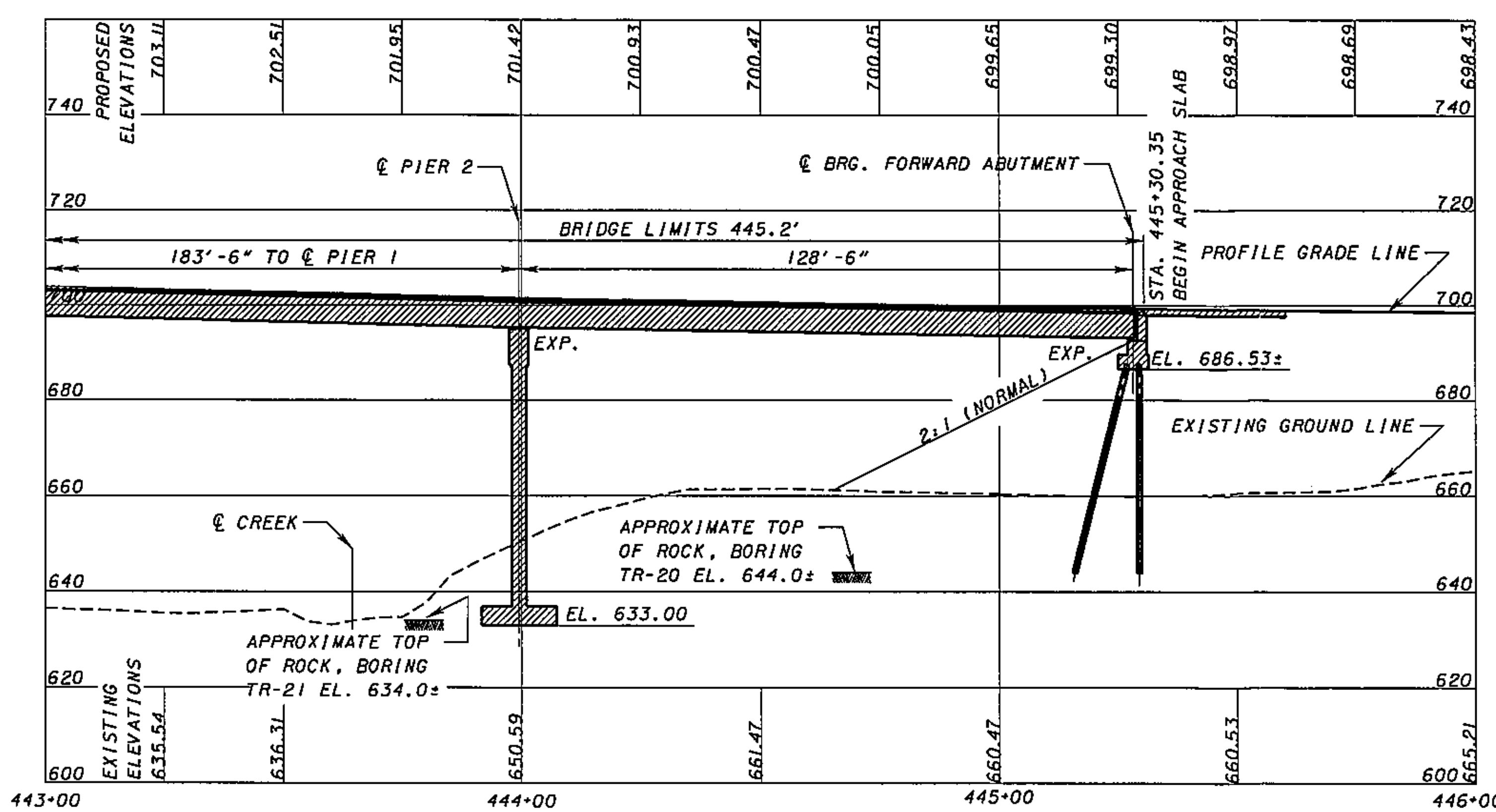
SCIOTO COUNTY
STA. 440+85.23
STA. 445+30.35

PRELIMINARY SITE PLAN - ALTERNATIVE 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

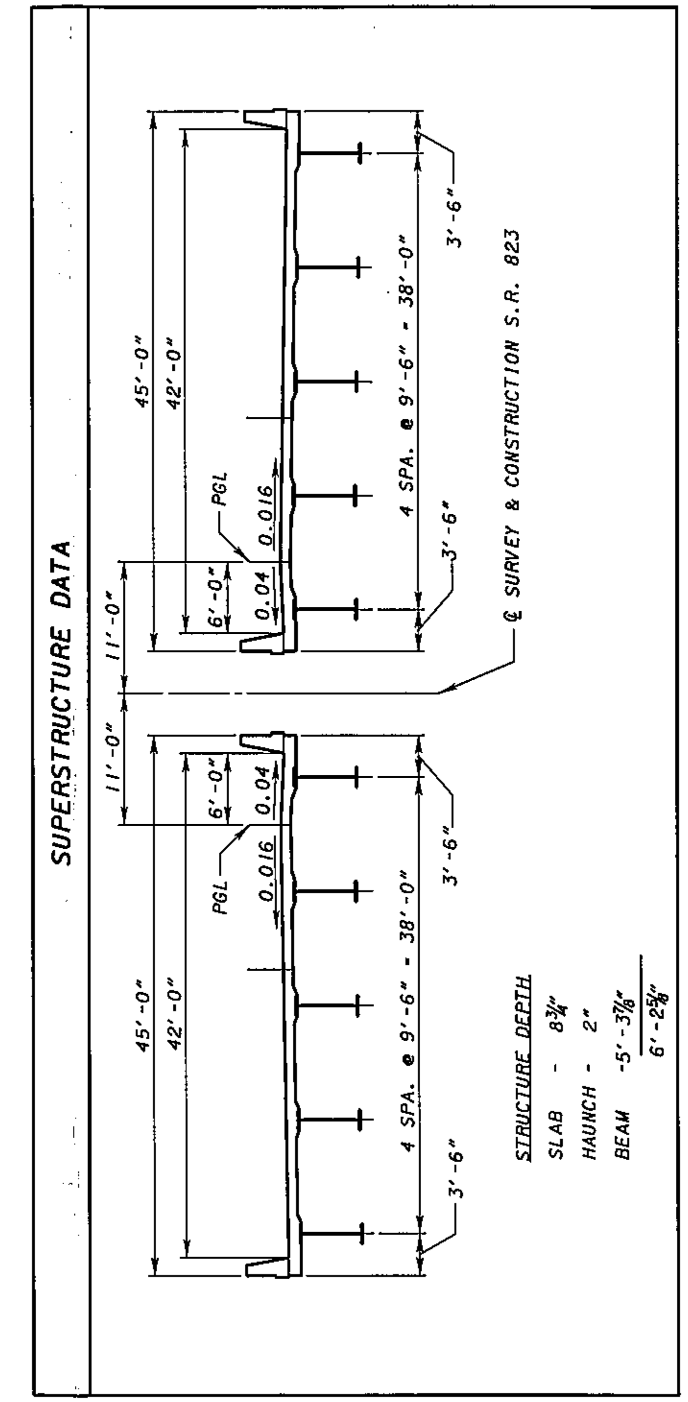
SCI-832-0.00
PID 19415



PLAN



ELEVATION ALONG PROFILE GRADE LINE LEFT BRIDGE S.R. 823



TRANSYSTEMS CORPORATION
DESIGN AGENCY

DESIGNED MSL | DRAWN MTN | REVIEWED | DATE
CHECKED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 440+85.23
STA. 445+30.35

PRELIMINARY SITE PLAN - ALTERNATIVE 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-MINFORD ROAD

SCI-823-0.00
PID 19415

4/4

APPENDIX E

Preliminary Geotechnical Report
& Preliminary MSE Wall Evaluation

TRANSYSTEMS CORPORATION

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PLANNERS • SURVEYORS

March 31, 2005

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

Re: **SCI-823-0.00 over Swauger Valley-Minford Road**
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 on SCI-823-0.00 over Swauger Valley-Minford Rd. It is anticipated that the proposed structure will be a three-span, elevated bridge with embankment fills at both abutment locations. The grade at the proposed locations for the forward and rear abutments varies along the cross section. The embankment fill at the forward abutment is understood to vary from 30 to 20 feet to the left and right of centerline, respectively, while the rear abutment fill embankment varies 20 to 40 feet from left and right of centerline, respectively. It is anticipated that the piers for the structure will be located at elevations similar to those existing at Swauger Valley-Minford Road and will generally be 50 feet in height. Currently, Swauger Valley-Minford Rd. is located along the east side of a stream. Bedrock exposures are evident along the streambed.

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-20 through TR-23, were drilled at the proposed structure between August 3, 2004 and February 24, 2005. The borings were drilled to depths from 20.0 to 24.0 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. 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.

Borings TR-20 and TR-22 encountered 2 and 8 inches of topsoil at the surface. Boring TR-21 was drilled in the stream and consequently encountered no topsoil. Underlying the surficial materials, the borings encountered soft to hard sandy silt (A-4a), very dense sandy silt, and hard silt and clay (A-6a) to depths generally between 3.5 and 7.5 feet where weathered bedrock was encountered. Boring TR-21 encountered bedrock at a depth of 1.5 feet.

Bedrock encountered at the proposed structure location was composed primarily of hard sandstone that was generally slightly fractured to intact. Recovery of the core samples ranged from 87 to 100% and RQD values ranged from 17 to 96% with an average RQD of 83%.

Seepage was not detected in any of the borings except TR-21, which was drilled in a stream. Water levels were not detected prior to coring except in boring TR-21. At completion of drilling, water levels ranged from 0.0 to 6.3 feet. However, the final water levels include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally and should be expected to correspond with the level of the adjacent stream.

Conclusions and Recommendations

Based on existing proposed cross section plans, it would appear that deep foundations would be necessary for the abutments and shallow foundations would be appropriate for the pier foundations. The following is a brief discussion of the recommendations for the substructures.

Due to the large amount of embankment fill, it appears that drilled shafts bearing on bedrock will be the best-suited foundation type for the support of the proposed structural abutments. If high lateral or uplift loads are anticipated, deeper rock sockets may be needed. The actual design lengths or rock sockets will need to be designed based upon actual loading conditions.

Competent bedrock was encountered at shallow depths at the expected pier locations. Therefore, the use of spread footings on rock should be the best-suited foundation type for support of the proposed structure's piers. The footings should be embedded into the bedrock. If an alternative foundation type is required due to lateral or uplift loads, drilled shafts with rock sockets can be utilized.

The following table summarizes the site conditions and foundation recommendations.

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Approximate Bearing Elevation* (Feet)	Recommended Foundation Type	Allowable Bearing Capacity
TR-20	Forward Abutment	649	644	Drilled Shafts	15 TSF
TR-21	Pier	636	634	Spread Footing	15 TSF
TR-22	Pier	646	642	Spread Footing	15 TSF
TR-23	Rear Abutment	662	654	Drilled Shafts	15 TSF

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

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Additionally, since SCI-823-0.00 mainline at the proposed structure location will be founded on some fill, the slopes should be evaluated to ensure that adequate stability of the backslope is achieved. If the backslope should experience instability, then the abutments may also experience instability.

Closing

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

Sincerely,

DLZ OHIO, INC.

Richard Hessler
Geotechnical Engineer

Arthur (Pete) Nix, P.E.
Senior Geotechnical Engineer

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Site Plan
Boring Logs TR-20, TR-21, TR-22, TR-23

cc: File

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 soils 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

Terms	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 - 1.00	4 - 8	Penetrated by thumb w/ moderate effort
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 ODOT Classification System. Soil particle size definitions are as follows:

Description	Size	Description	Size
Boulders	Larger than 8"	Sand-Coarse	2.00 mm. to 0.42 mm.
Cobbles	8" to 3"	-Fine	0.42 mm. to 0.074 mm.
Gravel-Coarse	3" to 3/4"	Silt	0.074 mm. to 0.005 mm.
-Fine	3/4" to 2.00" 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. 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

g. 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

10. Rock hardness and rock quality description.

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

Term	Description
Very Soft	Difficult to indent with thumb nails; resembles hard soil but has rock structure
Soft	Resists indentation with thumb nail but can be abraded and pierced to a shallow depth by a pencil point.
Medium Hard	Resists pencil point, but can be scratched with a knife blade.
Hard	Can be deformed or broken by light to moderate hammer blows.
Very Hard	Can be broken only by heavy blows, and in some rocks, by 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.

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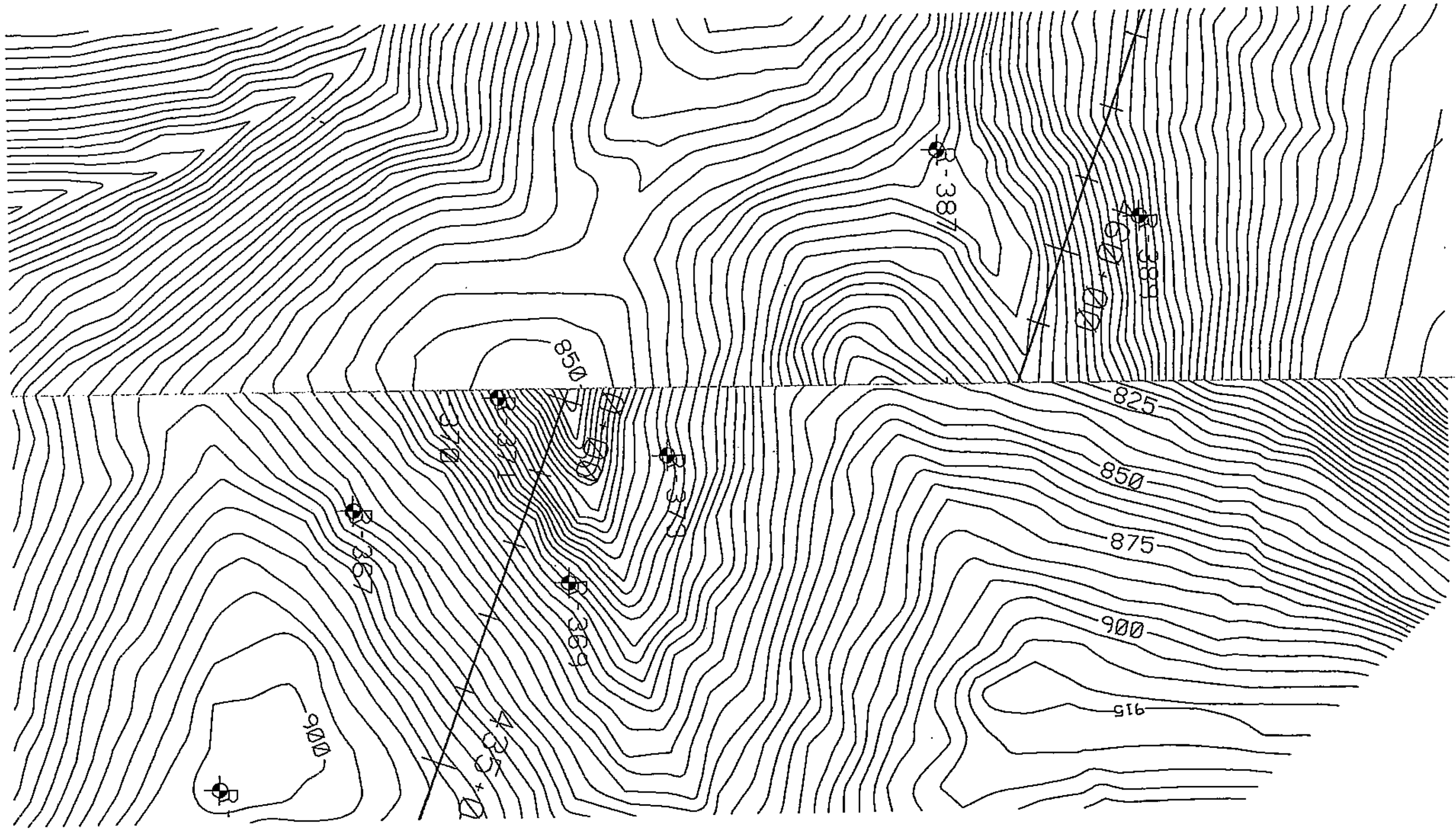


SCI-823-Ø.ØØ	SITE PLAN SCI-823-Ø.ØØ OVER SWAUGER VALLEY-MINFORD RD	DRAWN BY RJH CHECKED PPP	HORIZONTAL SCALE IN FEET (0, 50, 100, 200)

1/1

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

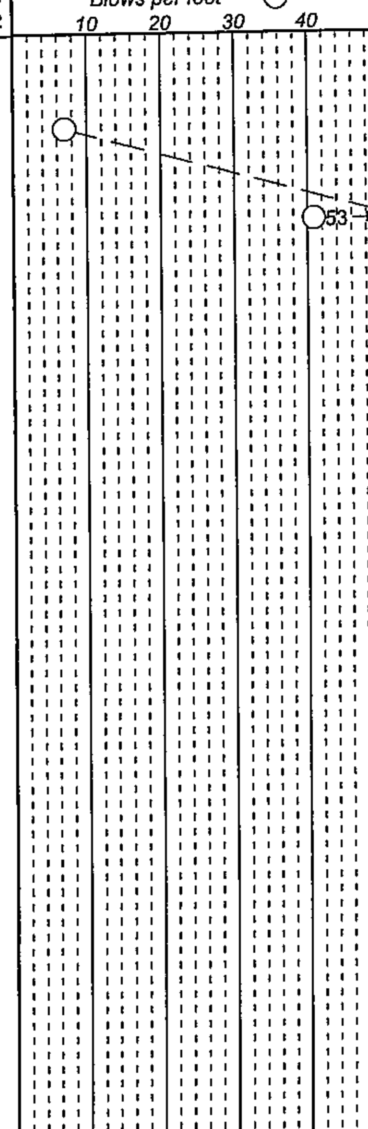
Client: TranSystems, Inc. **Project:** SCI-823-0.00 **Job No.** 0121-3070.03

LOG OF: Boring TR-20 **Location:** Station 450+20, 40' Right **Date Drilled:** 8/4/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 6.3' (inside hollowstem augers after coring)

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
	649.0												
0.2	648.8						Topsoil - 2"						
		3 3 4	18	1		--	Soft to medium stiff brown and gray SILT AND CLAY (A-6a), some fine to coarse sand, little gravel; moist.						
4.5	644.5	1 3 50/3	15	2		--	Gray SANDSTONE fragments.						
5.0	644.0	Core 96"	Rec 91"	RQD 88%	R-1		Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black lamination. @ 5.0' - 5.3'; broken. @ 9.3'-9.5', clay seam, possible core loss.						
		Core 84"	Rec 84"	RQD 86%	R-2		@ 13.9'; irregular vertical fracture.						
20.0	629.0						Bottom of Boring - 20.0'						

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



FILE: 0121-3 [3/31/2005 12:32 PM]

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-21 | Location: Station 449+20, 50' Left | Date Drilled: 8/3/04

WATER OBSERVATIONS: Water seepage at: 0.0' (2" Water above stream bed)
Water level at completion: 0.0' (2" Water above stream bed)

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	636.0						Gray GRAVEL (A-1-a); wet.							
1.5	634.5	Core 114"	Rec 114"	RQD 70%	R-1		Hard brown SANDSTONE; fine grained. @ 3.3'-3.4', clay seam.							
3.6	632.4						Hard gray SANDSTONE; fine grained, slightly micaceous, argillaceous, occasional black laminae. @ 15.5'; interbedded siltstone and sandstone.							
		Core 108"	Rec 108"	RQD 93%	R-2									
16.3	619.7						Hard gray SILTSTONE; slightly micaceous, arenaceous.							
20.0	616.0						Bottom of Boring - 20.0'							

Natural Moisture Content, % - ●
PL ├──┤ LL
Blows per foot - ○
Scale: 10, 20, 30, 40

Depth scale: 0, 5, 10, 15, 20, 25, 30

FILE: 0121-3 [3/31/2005 12:32 PM]

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

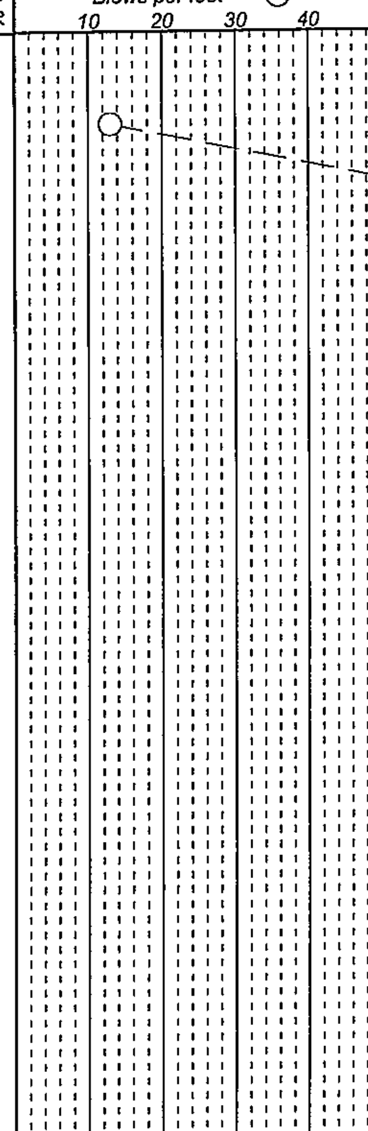
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-22 | Location: Station 447+90, 55' Right | Date Drilled: 2/24/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 4.5' (inside hollowstem augers after coring)

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	646.0						Topsoil - 8"						
0.8	645.2	3 6 7	18	1		1.25	Stiff brown SANDY SILT (A-4a), trace gravel; organic; moist.						
2.8	643.2	26 50/4	10	2A 2B			Very dense brown SANDY SILT (A-4a), trace gravel; organic; moist.						
3.5	642.5						Weathered SANDSTONE, brown.						
4.0	642.0	Core 120"	Rec 120"	RQD 84%	R-1		Soft brown SANDSTONE; fine grained, moderately weathered, slightly micaceous, moderately fractured. @ 5.2'-5.7',7.1'-7.3',8.7'-8.9' very soft, highly weathered. @ 6.1', gray, medium hard. @ 10.9'-11.0', iron stained horizontal fractures. @ 12.0' - 12.8', siltstone.						
14.0	632.0	Core 120"	Rec 120"	RQD 96%	R-2		Hard gray SANDSTONE; fine grained, slightly weathered, slightly micaceous, slightly fractured. @ 14.7'-15.3', very soft SILTSTONE, highly weathered, gray and brown. @ 19.3'-19.4', irregular vertical fracture. @ 19.6', 1/2" clay filled fracture. @ 23.2'-23.5', siltstone.						
24.0	622.0						Bottom of Boring - 24.0'						

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

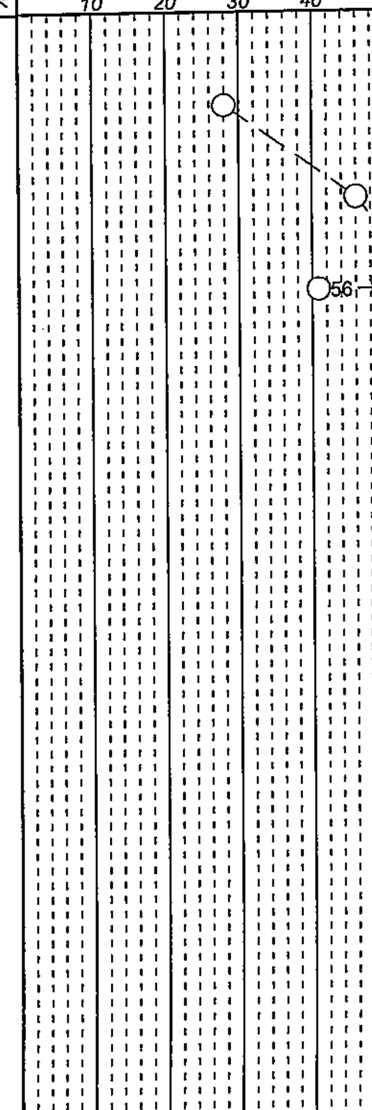
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-23 | Location: Station 446+90, 48' Left | Date Drilled: 8/9/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 2.0'

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	662.0						Hard brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; damp.						
		6 13 15	17	1		4.5+							
5		11 26 20	17	2		4.5+							
		11 16 40	16	3		4.5+	@ 6.0'; contains rust stains.						
7.5	654.5	Core 30"	Rec 26"	RQD 17%	R-1		Soft brown SANDSTONE; highly weathered.						
10.0	652.0						Hard gray SANDSTONE; slightly micaceous.						
							@ 12.9' - 13.6'; brown.						
15		Core 120"	Rec 120"	RQD 84%	R-2								
20.0	642.0						Bottom of Boring - 20.0'						
25													
30													

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



FILE: 0121-31 [3/31/2005 12:32 PM]

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March 14, 2006

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

Re: **Preliminary MSE Wall Evaluations**
Swauger Valley- Minford Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document #0003

Dear Mr. Weeks:

This letter includes the findings of a preliminary evaluation of mechanically stabilized earth (MSE) retaining walls on the above-mentioned project. The findings included in this letter pertain to the MSE walls at the crossing of proposed 823 and Swauger Valley – Minford 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 analyses are based upon the results of three preliminary structural borings drilled for the structures. Boring logs for borings TR-20, TR-21, and TR-23 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.

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 crossing Swauger Valley – Minford Road is similar to the plan location shown on the plan and profile drawings dated 07/12/05. See attached plan and profile drawing. It is understood that the planned structure is being modified as follows; placing MSE walls at stations 442+04 and 444+14 to contain the abutments and hold back the roadway embankment, thus shortening the bridge to a two-span structure. Furthermore, it is understood that the height of the MSE wall at station 442+04 (Rear Abutment) will be approximately 58 feet high. It is also understood that the MSE wall at station 444+14 (Forward Abutment) will be approximately 46 feet high.

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A preliminary global stability analysis and preliminary bearing capacity analysis was 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 report was prepared, it was not known what foundation type was to be used at this site to support the bridge abutments. The use of MSE walls at this site does not preclude the use of most common foundation types.

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 was selected for the backfill material in the reinforced zone. Similarly, the fill material used to construct the 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 442+04 (Rear Abutment) and station 444+14 (Forward Abutment) will be presented separately in this letter.

MSE Wall Evaluation at Station 442+04 (Rear Abutment), Boring TR-23

In the area of the proposed MSE wall, boring TR-23 encountered soil consisting primarily of hard Silt and Clay (A-6a) from the ground surface to a depth of approximately 7.5 feet. Underlying the soil, this boring encountered soft, highly weathered sandstone to a depth of 10.0 feet. At a depth of 10.0 feet, a hard, slightly weathered sandstone was encountered to the bottom of the boring, at 20.0 feet.

The MSE wall at this location is understood to be approximately 58 feet high. The minimum required embedment depth for this wall is H/10 or 5.8 feet. Since this depth is only slightly above the bedrock surface, it is recommended that the leveling pad be extended to bedrock or soil be excavated to bedrock and replaced with compacted granular fill to the leveling pad elevation. In addition, because the wall will be founded on or near bedrock, stability should be adequate. For stability, preliminary calculations have shown that a minimum reinforcement length of 51.5 feet must be used for the proposed MSE wall at this location.

It should be noted that variations in the topography will be encountered within the proposed footprint of the proposed MSE wall, causing the bedrock elevation to vary significantly. If soft soils are encountered while excavating for the MSE wall leveling pad, these soils should be removed and replaced with compacted granular fill. In areas where compacted granular fill is to be placed on bedrock, a level bench must be cut into the rock to place the fill for stability purposes.

MSE Wall Evaluation at Station 444+14 (Forward Abutment), Boring TR-20

In the area of the proposed MSE wall, boring TR-20 encountered approximately 2 inches of topsoil. Underlying the topsoil layer, this boring encountered soil consisting primarily of soft to medium stiff Silt and Clay (A-6a), to a depth of 4.5 feet below the ground surface. At a depth of 5.0 feet, hard, slightly weathered sandstone was encountered to the bottom of the boring at 20.0 feet. However, the topographic mapping of the site indicates a thicker soil cover, as much as 19 feet over the bedrock surface. Consequently, to be conservative, this thicker soil cover was assumed in the MSE wall stability analyses.

The MSE wall at this location is understood to be approximately 46 feet high. The minimum embedment depth for this wall is H/7 or 6.5 feet.

The undrained stability analyses with this minimum embedment resulted in inadequate safety factors. A five-foot deep undercut, backfilled with compacted, granular soil, was then analyzed, but the undrained stability analyses 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 rock and replaced with compacted, granular fill. It should be anticipated that variations in the topography will be encountered within the footprint of the proposed MSE wall, causing the bedrock elevations to vary significantly. In areas where compacted granular fill is to be placed on bedrock, a level bench must be cut into the rock to place the fill for stability purposes. A minimum reinforcing length of 0.8H or 42 feet is required for global stability.

It should be noted that the foundation leveling pad of the MSE wall at the forward abutment is in close proximity to a creek, which is running essentially parallel to Swauger Valley – Minford Road. The approximate elevation of bedrock under the MSE wall is 637 feet, which is near the bottom of the creek. If scour and erosion near the TOE of the MSE wall are a concern, then slope protection should be provided with riprap.

Settlement calculations are not necessary 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 along with a drawing illustrating the areas of overexcavation and replacement of granular fill.

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

M:\proj\0121\3070.03\Stability Analyses\Documents\MSE Wall letters\05 Swauger Valley - Minford Road\MSE Wall Findings - Swauger Valley - Minford Road 03-13-06 SJR.doc

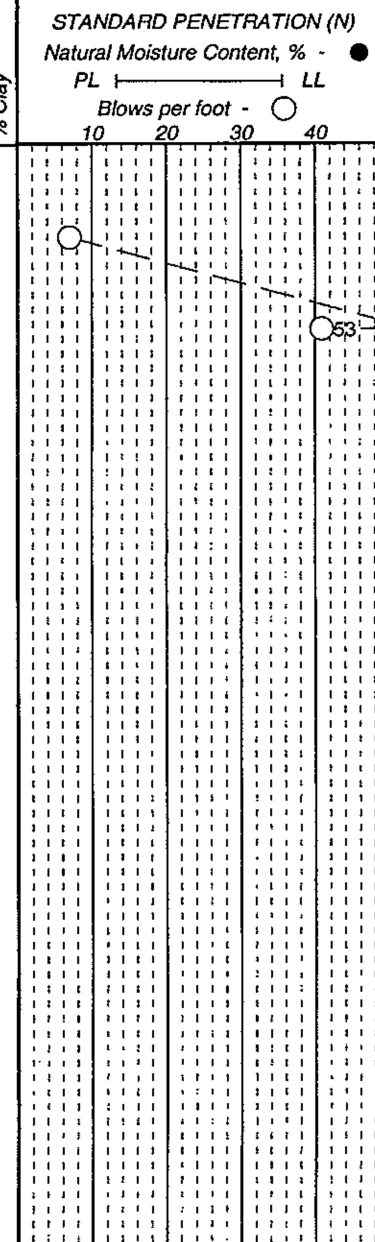
DLZ OHIO INC. • 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 • (614)888-0040

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

LOG OF: Boring TR-20 | *Location:* | *Date Drilled:* 8/4/04

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
0.2	650.0 / 649.8						Topsoil - 2"						
		3 3 4	18	1		0.5	Medium stiff brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; contains sandstone fragments; moist.						
5.0	645.0	1 3 50/3	15	2									
		Core 96"	Rec 91"	RQD 88%	R-1		Hard gray SANDSTONE; very fine to fine grained, slightly weathered, micaceous, massively bedded, slightly fractured. @ 5.0' to 5.3', broken. @ 9.3' to 9.5', broken zone, possible [illegible]s.						
		Core 84"	Rec 84"	RQD 86%	R-2		@ 13.9' to 14.5', high angle fracture with reddish brown discoloration.						
20.0	630.0						Bottom of Boring - 20.0'						

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 6.3' (includes drilling water)



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FILE: 0121-3070-03 | 3/14/2006 11:05 AM |

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-21 | *Location:* | *Date Drilled:* 8/3/04

WATER OBSERVATIONS: Water seepage at: 0.0'
Water level at completion: 0.0' (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
0 – 1.5							Gray GRAVEL (A-1-a); wet. (Auger sample - boring drilled in stream bed)							
1.5 – 20.0		Core 114"	Rec 114"	RQD 70%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly weathered, micaceous, argillaceous, massively bedded, slightly fractured. @ 1.5' to 3.9', brown, highly weathered, highly fractured to broken. @ 3.3' to 3.4', clay filled fracture.							
		Core 108"	Rec 108"	RQD 93%	R-2		@ 15.5' to 16.3', transition to siltstone.							
20.0							Bottom of Boring - 20.0'							

DRAFT

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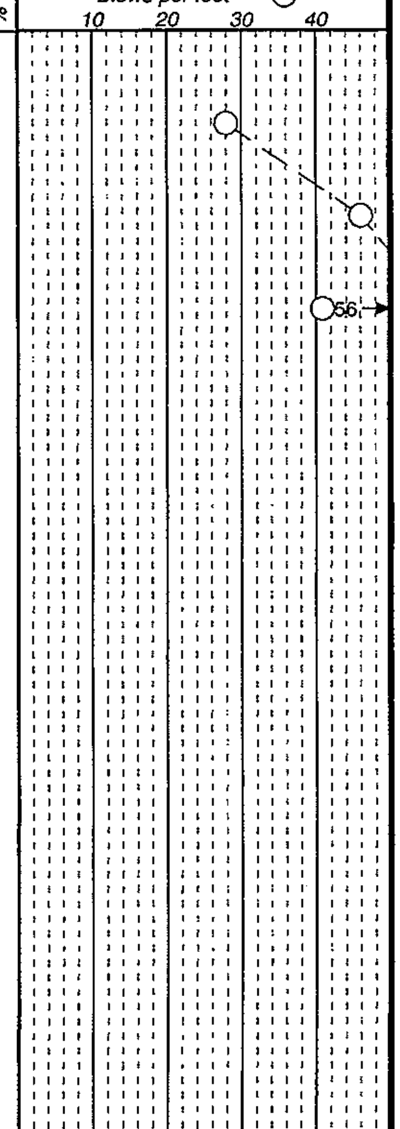
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-23 | Location: | Date Drilled: 8/9/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 2.0' (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
0	661.0						Hard brown SILT AND CLAY (A-6a), some fine to coarse sand, trace gravel; contains sandstone fragments; damp.						
		6 13 15	17	1		4.5+							
5		11 26 20	17	2		4.5							
		11 16 40	16	3		4.5+							
7.5	653.5	Core 30"	Rec 26"	RQD 17%	R-1		Soft brown SANDSTONE; fine grained, decomposed.						
10.0	651.0						Hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, slightly fractured. @ 12.3',13.5', weathered fractures. @ 12.9' to 13.6', brown.						
15		Core 120"	Rec 120"	RQD 84%	R-2								
20.0	641.0						Bottom of Boring - 20.0'						
25													
30													

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



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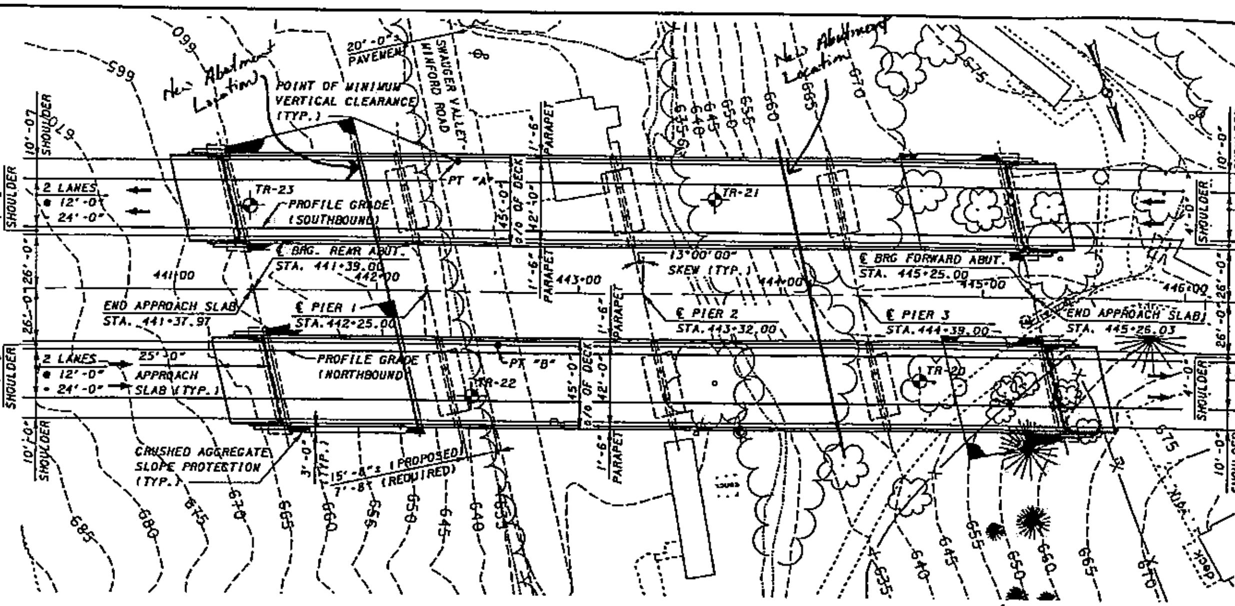


PLAN

⌖ DENOTES SOIL BORING LOCATION

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
TR-20	441+30.34	48.07' LT.
TR-21	442+46.93	51.45' RT.
TR-22	443+66.97	46.45' LT.
TR-23	444+69.73	42.09' RT.

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

TRAFFIC DATA

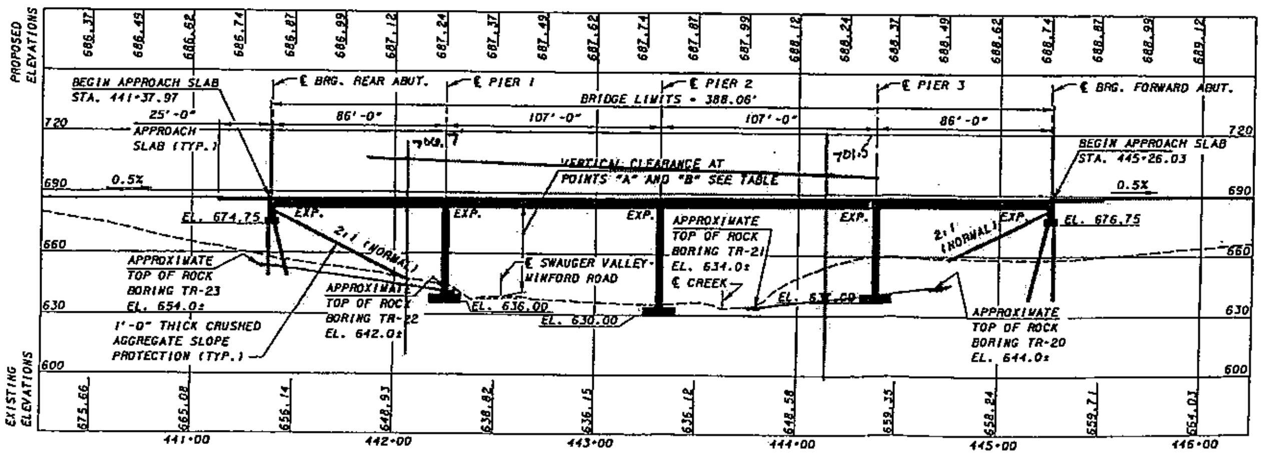
(SR 823)

CURRENT YEAR ADT (2010) = 21,200
DESIGN YEAR ADT (2030) = 31,200
CURRENT YEAR ADTT (2010) = 2,968
DESIGN YEAR ADTT (2030) = 4,368

PROPOSED STRUCTURE

TYPE: 4 SPAN CONTINUOUS STEEL PLATE GIRDERS A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED ON REINFORCED CONCRETE SUBSTRUCTURE UNITS.
SPANS: 86'-0", 107'-0", 107'-0", 86'-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: 13°00'00" (RIGHT FORWARD)
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. :

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	40.7'±	44.7'±
REQUIRED	15.0'	15.0'



ELEVATION ALONG PROFILE GRADE S.R. 823

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 IN THE TS & L SUBMITTAL

TRANSYSTEMS CORPORATION

DESIGNED BTA | DRAWN RCK | REVIEWED HFF | DATE 07/12/05
CHECKED RER | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 441+37.97
STA. 445+26.03

PRELIMINARY SITE PLAN - ALTERNATIVE 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SWAUGER VALLEY-WINFORD ROAD

SCI-823-0.00
PID 19415

1 / 2

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 03/10/06
	05 - 823 over Swauger Valley - Minford Rd	CHECKED BY	DATE

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

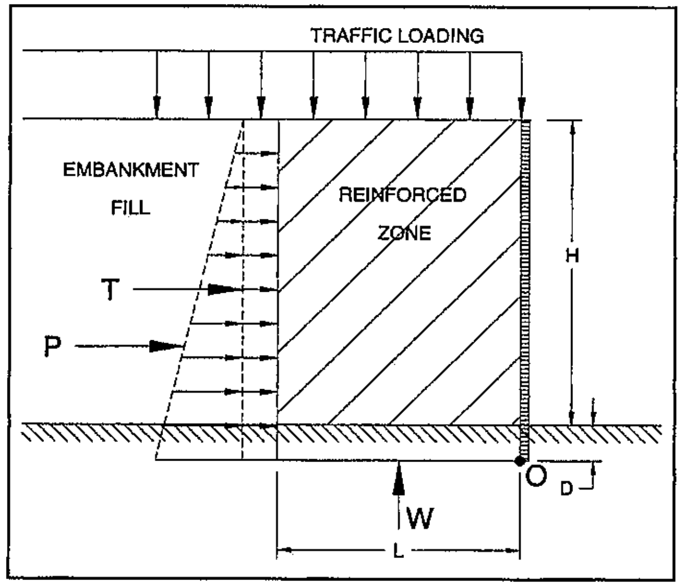
Wall Properties

H+D = 64.4 feet
γ_{mse} = 120 pcf
L = 51.52 feet
L factor = 0.80

Foundational Soil Properties

c = 4500 psf cohesion
ϕ' = 29 deg friction angle
ω_T = 240 psf traffic loading
Length factor-range (0.7 - 1.0)

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 = 0.35

P_a = 92,504 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 = 139,351 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 231,840 lbs per foot of wall

Use Drained Value

$FS = \frac{P_r}{P_a}$ Calculated FS = **1.51** 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

$\Sigma M_{resisting}$ = 10,256,255 lb-ft

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

$\Sigma M_{overturning}$ = 2,043,819 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 = **5.02** Required FS = 2.00

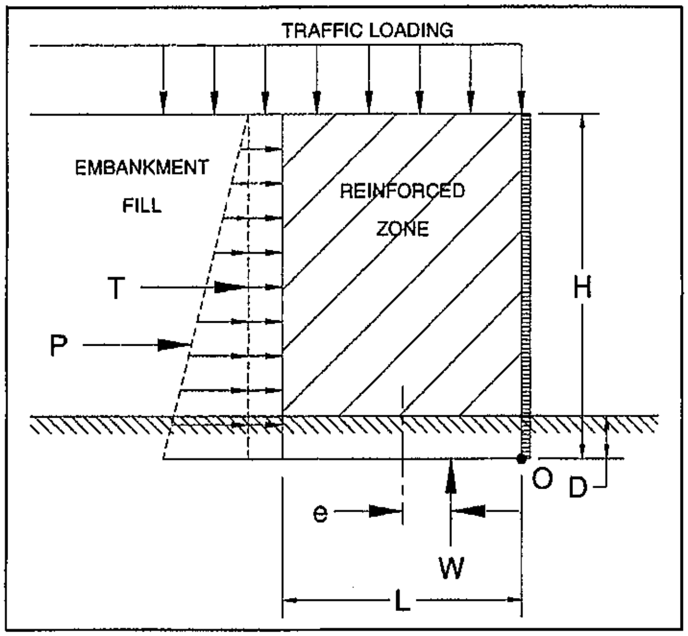
Resistance Against Overturning is **OK**

DLZ

SUBJECT			
Client	TranSystems / ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00	SHEET NO.	OF
Item	Bearing Capacity (Rear Abutment)	COMP. BY SJR	DATE 3/10/06
05 - 823 over Swauger Valley - Minford Road		CHECKED BY	DATE

BEARING CAPACITY OF A MSE WALL *(non-coped)*

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



Soil Properties

γ_{MSE}	=	120	pcf	unit weight	mse fill
γ_{FDN}	=	120	pcf	unit weight	foundation soil
c	=	4500	psf	cohesion	undrained
ϕ	=	0	deg.	friction ang.	undrained
c'	=	0	psf	cohesion	drained
ϕ'	=	29	deg.	friction ang.	drained

Loads and Parameters

ωt	=	240	psf	traffic loading
L=B	=	51.52	ft	length of mse block
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	5.8	ft	embedment depth
Dw	=	0	ft	groundwater depth
H+D	=	64.4	ft	
H	=	58.6	ft	height of wall
Ka	=	0.35		
Γ Pa	=	21.467	ft	moment arm
Γ Wt	=	32.2	ft	moment arm
B'	=	40.60	ft	
γ'	=	57.6	pcf	
W_t	=	12,365	lb/ft of wall	
W_{mse}	=	362,289	lb/ft of wall	

Effective Bearing Pressure

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

σ_v = 9,228 psf

Ultimate undrained bearing capacity, q_{ult}

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

q_{ULT} = 23,464 psf

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

q_{ALL} = 9,386 psf

Factor of Safety = **2.54** 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} = 28,106 psf

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

q_{ALL} = 11,242 psf

Factor of Safety = **3.05** 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 = 5.46 ft

Kern

e < L/6 = 8.59 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 03/10/06
05 - 823 over Swauger Valley - Minford Road		CHECKED BY	DATE

TR-20 Native Soil Foundation

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=46.0'
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

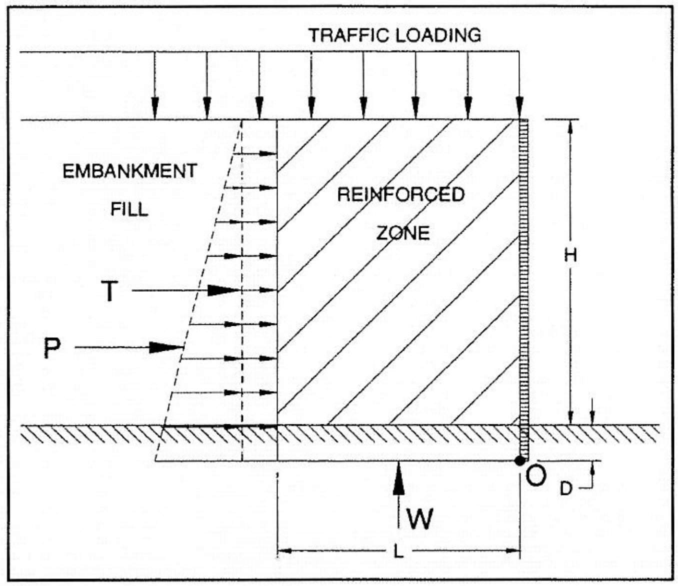
Wall Properties			Foundational Soil Properties			
H+D =	52.5	feet	c =	500	psf	cohesion
γ_{mse} =	120	pcf	ϕ' =	29	deg	friction angle
L =	42	feet	ω_T =	240	psf	traffic loading
L factor =	0.80		Length factor-range (0.7 - 1.0)			

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 = 0.35

P_a = 62,291 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 = 92,610 lbs per foot of wall

Use Undrained Value

$P_r = L(c)$ (Undrained)

P_r = 21,000 lbs per foot of wall

USE THIS VALUE

$FS = \frac{P_r}{P_a}$

	Calculated	Required
	FS = **0.34**	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

$\Sigma M_{resisting}$ = 5,556,600 lb-ft

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

$\Sigma M_{overturning}$ = 1,128,684 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	Required
	FS = **4.92**	FS = 2.00

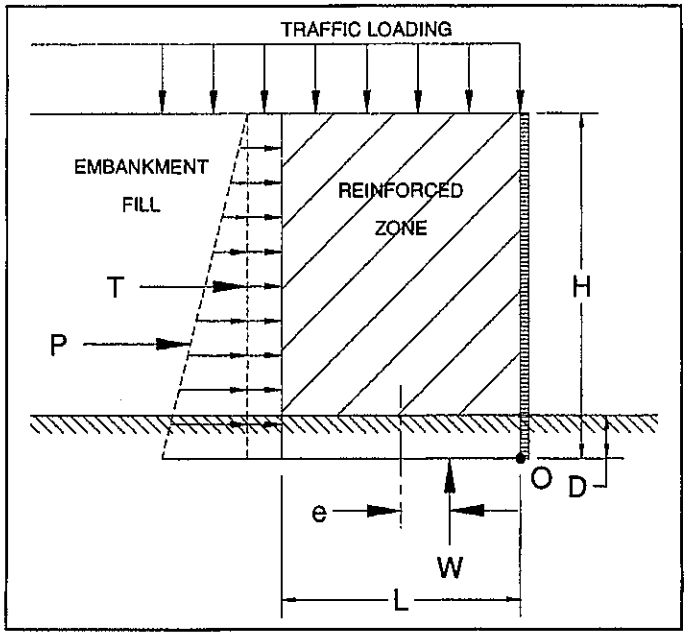
Resistance Against Overturning is **OK**

SUBJECT			
Client	TranSystems / ODOT D-9	JOB NUMBER	0121-3070.03
Project	SCI 823-0.00	SHEET NO.	OF
Item	Bearing Capacity (Forward Abutment)	COMP. BY SJR	DATE 3/10/06
05 - 823 over Swauger Valley - Minford Raod		CHECKED BY	DATE

Boring TR-20 Native Soil Foundations

BEARING CAPACITY OF A MSE WALL *(non-coped)*

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



Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$ σ_v = 7,407 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$ q_{ULT} = 2,944 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$ q_{ALL} = 1,178 psf

Factor of Safety = **0.40** 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} = 24,346 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$ q_{ALL}' = 9,738 psf

Factor of Safety = **3.29** OK

Soil Properties

γ_{MSE}	=	120	pcf	unit weight	mse fill
γ_{FDN}	=	125	pcf	unit weight	foundation soil
c	=	500	psf	cohesion	undrained
ϕ	=	0	deg.	friction ang.	undrained
c'	=	0	psf	cohesion	drained
ϕ'	=	29	deg.	friction ang.	drained

Loads and Parameters

ωt	=	240	psf	traffic loading
L=B	=	42	ft	length of mse block
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	6.5	ft	embedment depth
Dw	=	0	ft	groundwater depth
H+D	=	52.5	ft	
H	=	46	ft	height of wall
Ka	=	0.35		
Γ Pa	=	17.5	ft	moment arm
Γ Wt	=	26.25	ft	moment arm
B'	=	32.66	ft	
γ'	=	57.6	pcf	
W_t	=	10,080	lb/ft of wall	
W_{mse}	=	231,840	lb/ft of wall	

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 = 4.67 ft

Kern

e < L/6 = 7.00 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 03/08/06
05 - 823 over Swauger Valley-Minford Rd TR-20		CHECKED BY	DATE

Granular Fill Foundation

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=46'
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	=	52.5	feet
γ_{mse}	=	120	pcf
L	=	42	feet
L factor	=	0.80	

Foundational Soil Properties

c	=	0	psf	cohesion
ϕ'	=	36	deg	friction angle
ω_T	=	240	psf	traffic loading

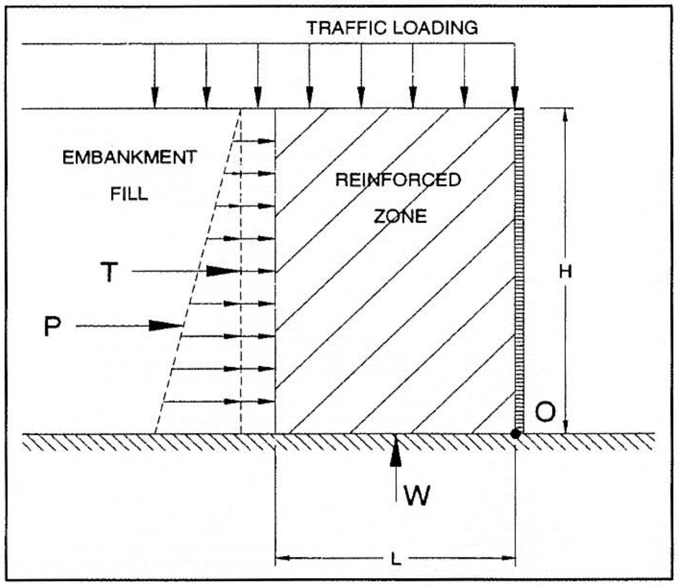
Length factor-range (0.7 - 1.0)

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 = 0.26

P_a = 46,274 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 = 129,654 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 = **2.80** 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

$\Sigma M_{resisting}$ = 5,556,600 lb-ft $\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$

$\Sigma M_{overturning}$ = 838,451 lb-ft $\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$

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

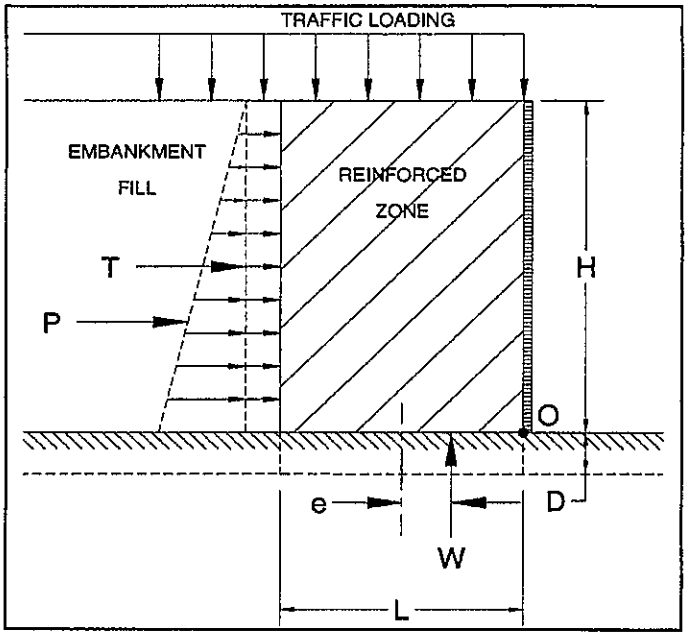
Calculated FS = **6.63** Required FS = 2.00

Resistance Against Overturning is **OK**

DLZ	SUBJECT	Client TranSystems	JOB NUMBER	0121-3070.03		
		Project SCI 823-0.00	SHEET NO.		OF	
		Item Bearing Capacity (Forward Abutment)	COMP. BY	SJR	DATE	3/8/06
		05 - 823 over Swauger Valley-Minford Rd TR-20	CHECKED BY		DATE	
		Granular Fill Foundation				

BEARING CAPACITY OF A MSE WALL *(non-coped)*

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



Soil Properties

γ_{MSE}	=	120	pcf	unit weight	mse fill
γ_{FDN}	=	125	pcf	unit weight	foundation soil
c	=	0	psf	cohesion	undrained
ϕ	=	36	deg.	friction ang.	undrained
c'	=	0	psf	cohesion	drained
ϕ'	=	36	deg.	friction ang.	drained

Loads and Parameters

ωt	=	240	psf	traffic loading
L=B	=	42	ft	length of mse block
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	6.5	ft	embedment depth
Dw	=	0	ft	groundwater depth
H+D	=	52.5	ft	
H	=	46	ft	height of wall
Ka	=	0.26		
Γ Pa	=	17.5	ft	moment arm
Γ Wt	=	26.25	ft	moment arm
B'	=	35.06	ft	
γ'	=	57.6	pcf	
W_t	=	10,080	lb/ft of wall	
W_{mse}	=	231,840	lb/ft of wall	

Effective Bearing Pressure

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

σ_v = 6,900 psf

Ultimate undrained bearing capacity, q_{ult}

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

q_{ULT} = 70,991 psf

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

q_{ALL} = 28,396 psf

Factor of Safety = **10.29** 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} = 70,991 psf

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

q_{ALL} = 28,396 psf

Factor of Safety = **10.29** 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.	56.31	N.	56.31

Eccentricity of Resultant Force

e = 3.47 ft

Kern

e < L/6 = 7.00 ft

Soil Parameters Used in MSE Wall Stability Analyses
Swauger Valley – Minford Road

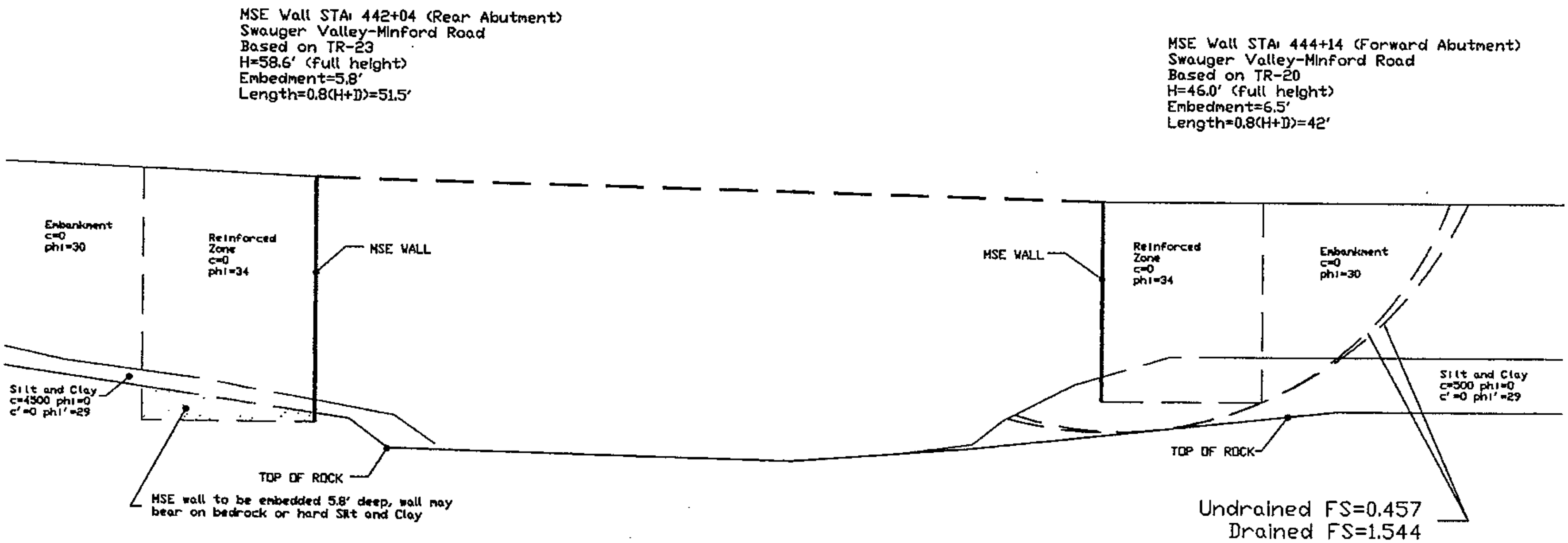
Zone	Soil Type	Unit Weight (pcf)	Strength Parameters			
			Undrained		Drained	
			c	ϕ	c'	ϕ'
Reinforced Fill	Compacted Granular Fill	120	0	34	0	34
Retained Soil	Compacted Embankment Fill	120	0	30	0	30
Foundation Soil (Rear Abutment) (Boring TR-23)	Soft to Medium stiff Silt and Clay	125	4500	0	0	29
Foundation Soil (Rear Abutment)	Compacted Granular Fill	125	0	36	0	36
Foundation Soil (Forward Abutment) (Boring TR-20)	Medium stiff Silt and Clay	125	500	0	0	29
Foundation Soil (Forward Abutment)	Compacted Granular Fill	125	0	36	0	36

MSE Retaining Wall Parameters and Analyses Results
Swauger Valley – Minford Road (Rear Abutment) ***Soil foundation***

Retained Soil (New Embankment) Unit Weight = 120 pcf Coefficient of Active Earth Pressure (K_a) = 0.33 (Based on $\Phi = 30^{\circ}$)
Sliding along base of MSE wall Sliding Coefficient (μ)(0.67) = tan 29°(0.67) = 0.37 Use (μ)(0.67) Use (μ)(0.67) =0.35 as a maximum value as per AASHTO, BDM,303.4.1.1
Allowable Bearing Capacity – Undrained Condition q_{all} = 9,386 psf For MSE wall with minimum 51.5-foot long reinforcing
Allowable Bearing Capacity – Drained Condition q_{all} = 11,242 psf For MSE wall with minimum 51.5-foot long reinforcing
Global Stability Factor of Safety – Undrained Condition > 1.5 (Bearing on Bedrock) Factor of Safety – Drained Condition > 1.5 (Bearing on Bedrock) Factor of Safety – Seismic Condition > 1.1 (Bearing on Bedrock) For MSE wall with 51.5-foot long reinforcing
Estimated Settlement of MSE volume Total settlement = 0 inches Differential settlement < 1/100
Minimum Length of Reinforcement for External Stability = 51.5 feet

MSE Retaining Wall Parameters and Analyses Results
Swauger Valley – Minford 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 $\Phi = 30^{\circ}$)
Sliding along base of MSE wall Sliding Coefficient (μ)(0.67) = tan 36º(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} = 28,396 psf For MSE wall with minimum 42-foot long reinforcing
Allowable Bearing Capacity – Drained Condition q_{all} = 28,396 psf For MSE wall with minimum 42-foot long reinforcing
Global Stability Factor of Safety – Undrained Condition = 1.5 Factor of Safety – Drained Condition = 1.8 Factor of Safety – Seismic Condition = 1.7 For MSE wall with 42-foot long reinforcing
Estimated Settlement of MSE volume Total settlement = 0 inches Differential settlement < 1/100
Minimum Length of Reinforcement for External Stability = 42 feet



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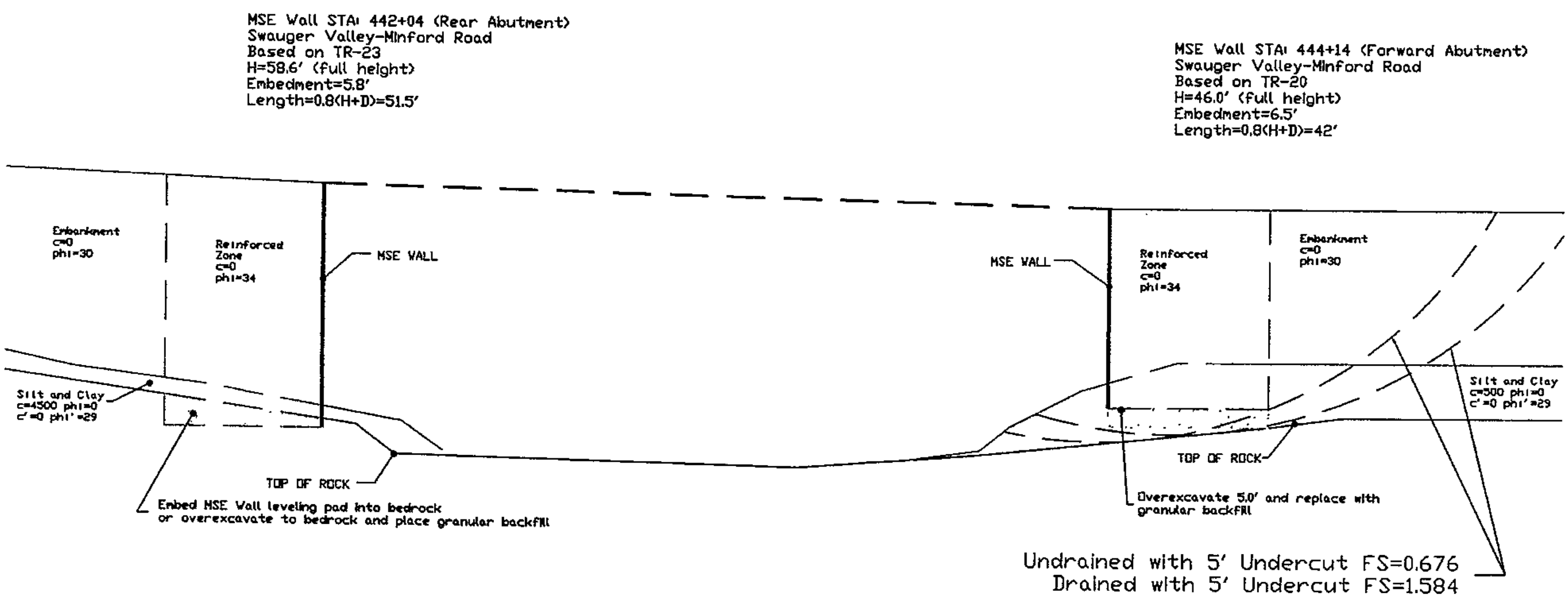
SWAUGER VALLEY-MINFORD ROAD
DRAINED AND UNDRAINED ANALYSIS
BASED ON BORINGS TR-20 & TR-23

MSE WALL STABILITY ANALYSIS
INITIAL TRIAL
SCI-823-0.00

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-10-06



SWAUGER VALLEY-MINFORD 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 03-10-06

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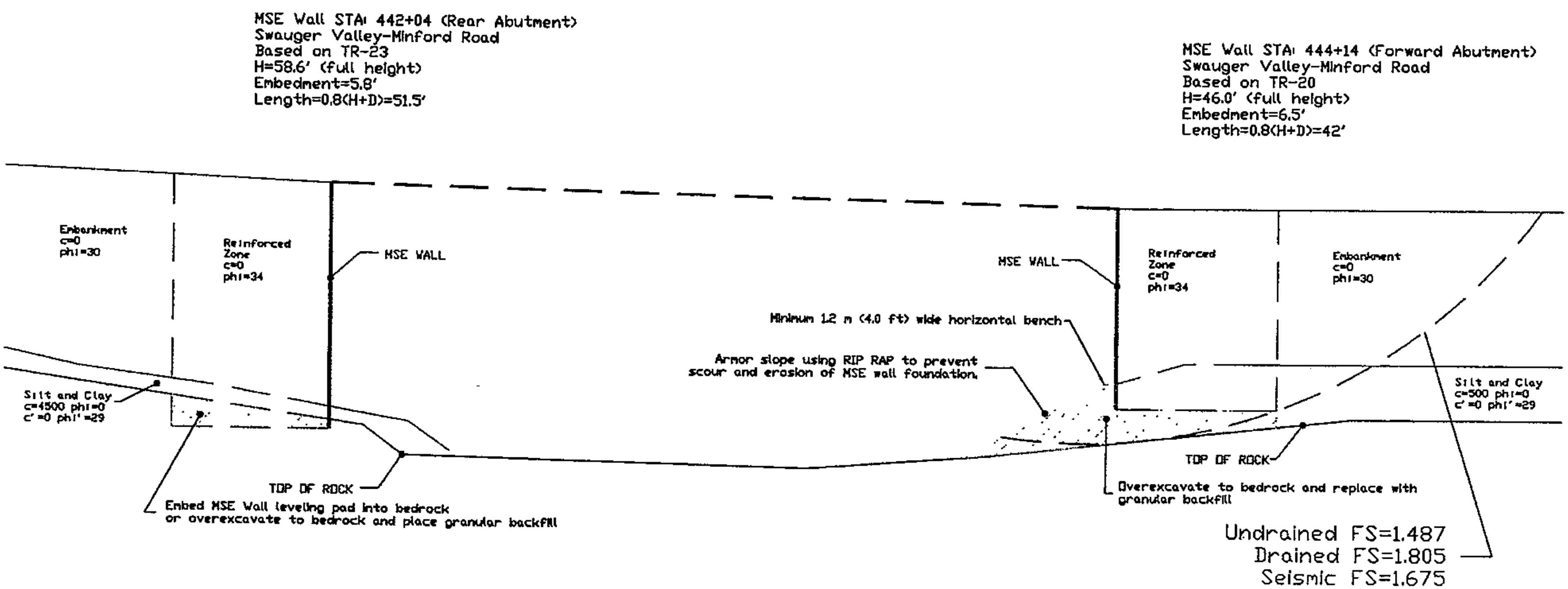

SWAUGER VALLEY-MINFORD ROAD
EXCAVATE AND REPLACE WITH GRANULAR FILL

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

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-10-06

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