TRANSYSTEMS CORPORATION

DUE DATE ?

STRUCTURAL ENGINEERING

MAY 0 1 2006

WJK ☐	SM ☐	TJK ☐	JEM ☐
JAC ☐	RZ ☐	AW ☐	☐
MT ☐	DAG ☐	JCR ☐	☐
AD ☐	SS ☐	JS ☐	FILE ☐

April 28, 2006

Mr. Jawdat Siddiqi, PE
Office of Structural Engineering
Ohio Department of Transportation
1980 W. Broad Street
Columbus, Ohio 43223

SUBJECT: Structure Type Study Resubmission
Shumway Hollow Road over CSXT Railroad
SCI-823-0.00 Portsmouth Bypass
PID#19415

Dear Mr. Siddiqi:

Submitted for review and comment are two (2) copies of the revised Structure Type Study report for the proposed Shumway Hollow Road over CSXT Railroad. The initial report was included with the Preferred Alternative Verification Review (PAVR) submission in July 2005 and comments from Mr. Jeff Crace, dated 8/25/06, were provided to TranSystems.

Subsequent to the PAVR submission, a series of studies have been conducted to reduce fill heights over the drainage structures and minimize earthwork costs. As a result, the profile grade of SR 823 has been modified along most of the project length and the median width has been decreased from a 60' depressed section to a narrow median with concrete barrier. The profile of Shumway Hollow Road has been altered as well as carrying an additional turn lane on the bridge. The initial alternatives have been revised to reflect these modifications and to incorporate the 8/25/06 review comments, including the evaluation of MSE abutment walls. Additional alternatives have been developed and are included.

Please don't hesitate to call me if there are any questions.

Sincerely,

Michael D. Weeks by JRC

Michael D. Weeks, P.E., P.S.
Project Manager

Cc: D. Norris, P.E.(1 copy)

5747 Perimeter Drive, Suite 240 • Dublin, Ohio 43017 • Phone: (614) 336-8480 • Fax: (614) 336-8540

SCI-823-0.00

PID No. 19415

SHUMWAY HOLLOW ROAD OVER CSXT

RAILROAD

STRUCTURE TYPE STUDY SUBMITTAL

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

APRIL 28, 2006

Prepared by:

TRANSYSTEMS CORPORATION

TABLE OF CONTENTS

BRIDGE TYPE STUDY NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of a new overpass structure that will carry the proposed relocated Shumway Hollow Road over CSXT Railroad tracks (and railroad right-of-way) at the proposed Airport Interchange. 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 8/25/2005, were in turn received by Transystems Corporation. However, since these dates, the entire SCI-823-0.00 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. With regards to the proposed relocated Shumway Hollow Road crossing over the CSXT Railroad, the profile grade has been revised/updated to a constant downward grade of 1.00% (as compared to the original downward profile grade of 3.35% followed by a 30' vertical curve with PVI at Station 38+00.00). Due to this change in profile, vertical and horizontal clearances had to be recomputed to ensure CSXT requirements for overhead structures were satisfied. These clearance requirements, when considered with the 8/25/2005 ODOT comments, resulted in a reevaluation of the bridge types for the proposed Shumway Hollow Road crossing over the CSXT Railroad. This follow-up Structure Type Study presents the outcomes of these reevaluations. Three (3) alternatives for construction were evaluated and are designated within this study as Alternatives 1, 2, and 3. Each alternative 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 and vertical clearances are based on the CSXT standard clearances for overhead structures published in the 2005 CSX Public Project Information Manual (last updated 12/07/2005).

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. An updated Preliminary Bridge Foundation Recommendation report by DLZ Ohio, Inc., updated boring logs for the two test borings (TR-27 and TR-28), 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. Note that DLZ recommends spread footings or drilled shafts as foundation types for the proposed abutments. Driven H-piles are not recommended due to the depth of overburden/fill that needs to be placed on the existing railroad rock cuts – the resulting depth of fill would provide insufficient lateral stability for driven H-piles.

Although test borings TR-27 and TR-28 were drilled above the railroad grade and approximately 85' west of the proposed rear MSE wall location and 45' east of the proposed forward MSE wall location, respectively, the soil profiles used for the preliminary MSE wall evaluations are based on the findings of these test borings. Note that soil types and thicknesses at the proposed wall locations will need to be confirmed with additional borings prior to final MSE wall analysis. For now, however, preliminary evaluations reveal that MSE walls can be used at the rear and forward abutment locations – based on the test borings and visibly exposed rock in the rock cuts, it is assumed that the MSE wall leveling pads are resting on high quality soil and/or bedrock (settlement and bearing capacity are consequently non-issues) and global stability analyses reveal stable wall systems. 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 of this bypass route 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. As part of this project, the existing Shumway Hollow Road is relocated along its entire length. The proposed bridge that carries the relocated Shumway Hollow Road over the CSXT Railroad consists of four 12'-0" travel lanes (one eastbound through lane, one eastbound left turn lane, one westbound through lane, and one westbound right turn lane) with one 8'-0" and one 10'-0" outside shoulder. Total bridge deck width is 69'-0" out-to-out with 1'-6" outside straight face deflector parapets. Required vertical and horizontal clearances, in accordance with CSXT standards, have been provided over the railroad for all alternatives considered. The existing S.R. 335 will remain on its current horizontal and vertical alignment.

Vertical and Horizontal Design - Since this structure's vertical alignment is dictated by the intersection of the relocated Shumway Hollow Road with the existing S.R. 335 and the vertical clearance over CSXT railroad tracks, clearance was considered to be critical at this structure location. CSXT standard clearances for overhead structures are:

(1) a minimum vertical clearance of 23'-0" from top of high rail to lowest point of overhead structure in the horizontal clearance area; and,
(2) a horizontal clearance of 25'-0" measured perpendicular from centerline of track to face of pier or abutment (or wall). This 25'-0" distance applies to railroad tracks with ditches.

More than 23'-0" of vertical clearance is provided for all the alternatives considered in this study and the 25'-0" horizontal clearance described above is provided for each alternative as well. However, the horizontal positioning of abutments and MSE walls is truly dictated by the limits of the CSXT Railroad right-of-way – all proposed bridge elements must be located outside the railroad right-of-way. Positioning of the abutments and MSE walls for each alternative not only provides the 25'-0" of horizontal clearance, but also clears the railroad right-of-way and thus clears the ditches that run parallel to the CSXT tracks. Locating the abutments and MSE walls in this manner prevents any infringement on the railroad right-of-way and eliminates any construction on or near the railroad ditches and tracks.

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. It is anticipated that the two railroad ditches will not be required to carry any surface water discharge.

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

Maintenance of Traffic – Rail traffic will be maintained on the tracks while the new bridge is under construction. It is anticipated that there will be no track 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 the structure. The proposed profile is located on the centerline of the relocated Shumway Hollow Road which, at the proposed crossing over the CSXT Railroad, is along a sloping grade of -1.00%. This sloping grade changes to -2.84% at Station 38+30.27. Due to the intersection with the existing S.R. 335 which is just east of the proposed crossing, the superelevations of the rear (west) approach and bridge deck must be transitioned so that the cross-slope of Shumway Hollow Road matches the existing longitudinal grade of S.R. 335 at the intersection. Details that display the superelevation transition along Shumway Hollow Road over the CSXT Railroad are presented in Appendix B of this report. Please note that the horizontal geometry, vertical geometry, and superelevation transition details for all alternatives considered are the same.

Structure: As per the Scope of Services, we investigated several bridge types and alternatives as part of the type study. A total of three (3) alternatives were considered and are outlined in the Structure Type Alternative Table below:

STRUCTURE TYPE ALTERNATIVE TABLE			
Structure Type Alternative	**1**	**2**	**3**
Structure Type Description	Tangent, Prestressed Concrete Girders Modified AASHTO Type 4 (72")	Tangent, Steel Plate Girders A709, Gr. 50W	Tangent, Prestressed Concrete Girders Modified AASHTO Type 4 (72")
Proposed Beam Spacing	8 Spaces @ 8'-0"	6 Spaces @ 10'-4"	7 Spaces @ 9'-0"
No. of Spans	1	1	1
Abutment Type	Semi-Integral Type on spread footing	Semi-Integral Type on spread footing	Semi-Integral Type on spread footing
No. of Piers	none	none	none
Pier Type	N/A	N/A	N/A
Substructure Orientation	0°00'00"	0°00'00"	0°00'00"
Approximate Bridge Length	119'-6"	119'-6"	110'-4"
Approx. Structure Depth			
Slab	8.50"	9.00"	8.50"
Haunch	2"	2"	2"
Beam	72"	53.625"	72"
Total	82.50" (6.875')	64.625" (5.385')	82.50" (6.875')

Alternative Discussion:

Alternative 1

This single span alternative is investigated in response to the updated project profile and to ODOT's 8/25/2005 comments to the original 7/15/2005 Structure Type Study. The CSXT Railroad right-of-way helps dictate the substructure unit locations. As mentioned earlier, 25'-0" of horizontal clearance is required between centerline of track to face of substructure unit, however, the substructure units must also clear the railroad right-of-way to prevent any infringement on railroad property (which includes the ditches alongside the railroad tracks). When proper clearance is considered along with the ODOT comments of 8/25/2005, a single span with a bearing-to-bearing length of 119'-6" is required. This span length is shorter than that proposed in the original 7/15/2005 Structure Type Study. The rear abutment and rear MSE wall have been moved closer to, yet maintain sufficient clearance with, the railroad tracks and right-of-way whereas the forward abutment remains in its originally proposed position, thus allowing it to be supported on a spread footing embedded in bedrock. Because MSE walls are used in conjunction with a bearing-to-bearing length of 119'-6" (< 400' total length) and no skew ($0^{o}00'00"$), 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 with the semi-integral forward abutment, the semi-integral rear abutment will be supported on a spread footing. However, the rear abutment footing will bear directly on the engineered fill placed behind the MSE wall. During the TS&L stage, footing dimensions at the forward abutment location will be evaluated with respect to the allowable bearing capacity recommended by DLZ Ohio, Inc. (see Appendix E) whereas rear abutment footing dimensions will be proportioned according to ODOT BDM Section 204.6.2.1 which specifies a maximum allowable bearing pressure of 4 ksf for spread footing abutments placed on MSE wall embankments. Straight wingwalls will be provided at both abutments and all abutment and wingwall details will follow ODOT Standard Drawings.

The superstructure for this alternative consists of 9-72" deep Modified AASHTO Type 4 prestressed concrete I-beams spaced at 8'-0" on center. This satisfies the HS-25 and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf. Furthermore, by using 9 beams, each with a release strength (f'_{ci}) of 5,000 psi and 28-day strength (f'_{c}) of 7,000 psi, the service level stress requirements of AASHTO 9.15.2.1 and 9.15.2.2 are satisfied. Bridge width is 66'-0" from toe-to-toe of parapets with an overall bridge deck width of 69'-0". Deck thickness, including a 1" monolithic wearing surface, is 8½".

The initial bridge construction cost for Alternative 1 is estimated to be $1,700,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $405,000, resulting in a total estimated ownership cost of $2,105,000 in year 2008 dollars.

Alternative 2

Alternative 2 is identical to Alternative 1 except that the superstructure consists of 7-steel plate girders, Grade 50W, with 50" deep webs spaced at 10'-4" on center. Note that eliminating two girder lines permits greater structural participation of the reinforced concrete deck. Deck thickness, including a 1" monolithic wearing surface, is 9".

The initial bridge construction cost for Alternative 2 is estimated to be $1,580,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $724,000, resulting in a total estimated ownership cost of $2,304,000 in year 2008 dollars.

Alternative 3

Alternative 3 is another single span option that is investigated in response to ODOT's 8/25/2005 comments to the original 7/15/2005 Structure Type Study. This alternative provides a shorter single span length than Alternatives 1 and 2. The rear abutment and rear MSE wall locations are the same as those in Alternatives 1 and 2, however, the forward abutment is moved closer to the east edge of the railroad right-of-way through the use of an MSE wall. The forward MSE wall is positioned so that the required 25'-0" of horizontal clearance from the centerline of track is satisfied and that all bridge elements (including the MSE wall) are outside, or clear, the railroad right-of-way. The forward MSE wall allows the forward abutment to be positioned off the east rock cut, placed on engineered fill, and supported by a spread footing that bears directly on the fill. By repositioning the forward abutment in this manner, the single span bearing-to-bearing length is reduced to 110'-4". However, to ensure the forward MSE wall has proper stability, reinforcing straps of sufficient length must be placed behind and connected to the wall panels. To accomplish this, a significant quantity of rock must be excavated along the east rock cut. This quantity of excavated rock will exceed that required for the spread footing abutments of Alternatives 1 and 2 and will consequently increase the initial bridge construction costs of Alternative 3. Furthermore, considering the proximity of the railroad right-of-way with this rock excavation reveals that more complex construction logistics will be necessary for Alternative 3.

Because MSE walls are used in conjunction with a bearing-to-bearing length of 110'-4" (< 400' total length) and no skew ($0^{o}00'00"$), a semi-integral abutment type is selected for this alternative. As with the semi-integral forward abutment, the semi-integral rear abutment will be supported on a spread footing. Dimensions for these spread footings will be evaluated according to ODOT BDM Section 204.6.2.1 which specifies a maximum allowable bearing pressure of 4 ksf for spread footing abutments placed on MSE wall embankments. Straight wingwalls will be provided at both abutments and all abutment and wingwall details will follow ODOT Standard Drawings.

The superstructure for this alternative consists of 8-72" deep Modified AASHTO Type 4 prestressed concrete I-beams spaced at 9'-0" on center. This satisfies the HS-25 and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf. Using 8 beams, each with a bearing-to-bearing length of 110'-4", a release strength (f'_{ci}) of 5,000 psi, and 28-day strength (f'_c) of 7,000 psi, will also satisfy the service level stress requirements of AASHTO 9.15.2.1 and 9.15.2.2. As with Alternatives 1 and 2, bridge width is 66'-0" from toe-to-toe of parapets with an overall bridge deck width of 69'-0". A 9'-0" center-to-center beam spacing permits a total deck thickness of 8½", which includes a 1" monolithic wearing surface.

The initial bridge construction cost for Alternative 3 is estimated to be $1,740,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $369,000, resulting in a total estimated ownership cost of $2,109,000 in year 2008 dollars.

6. Recommendations

Based upon the above information and discussions, Transystems Corporation recommends **Structure Type Alternative 1 (Single Span, 72" Modified AASHTO Type 4 prestressed concrete I-beams with semi-integral rear abutment behind MSE wall and semi-integral forward abutment on spread footing)** for the bridge (see Appendix B for the Site Plan and Structure Details).

Although Alternatives 1 and 3 provide similar total estimated ownership costs, Alternative 1 is preferred, and thus recommended, based on the following items:

1. Alternative 1 offers lower initial construction costs, less rock excavation, and less complex construction methods. Alternative 1 is more economical from a construction standpoint;

2. Alternative 1 provides lower life-cycle maintenance costs;

3. Alternative 1 does provide lower total ownership costs than Alternative 3.

slightly lower maintenance cost

APPENDIX A
Cost Comparison Summary

TRANSYSTEMS CORPORATION

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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	1	119.5'	119.50	9 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$713,000	$508,000	$195,400	$283,300	$1,700,000	$405,000	$2,105,000
2	1	119.5'	119.50	7 Steel Girders /per BRIDGE	50" Web Grade 50W	$697,000	$436,000	$181,300	$262,900	$1,580,000	$724,000	$2,304,000
3	1	110'-4"	110.33	8 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$631,000	$621,000	$200,300	$290,500	$1,740,000	$369,000	$2,109,000

?

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

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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	1	119.5'	119.50	121	279	$162,700	$70,000	$91,900	$0	9 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$388,000	$713,000	0%	**$713,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	2	4.26	8.52

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.71	69.00	48.9	4.9	62.3

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 =			$583.00

Based on parapet and slab percentages of total concrete area

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

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

Prestressed Concrete Girders
Unit Costs:

	Year 2005		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Type 4 I-Beams	$16,000	ea.	3.5%	$18,360	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	0	$0
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	24	$33,120
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	1076	$354,915
						TOTAL =	**$388,035**

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 = 69 ft Length = 30 ft. Width = 98 ft
Area = 230 sq. yd. Area = 327 sq. yd.

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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 Cost	Additional Crane Cost	Subtotal Substructure Cost
1	1	119.5'	9 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$0	$0	$174,400	$28,600	$0	$230,100	$75,000	**$508,000**

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	0	$421.00	3.5%	$483.00	$0
Stem	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost	0				$0

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	314	$421.00	3.5%	$483.00	$151,700
Wingwalls	47	$421.00	3.5%	$483.00	$22,700

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

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

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

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

Number of Piles		Total Pile Length
0	SEE QUANTITY CALCULATIONS	0

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: $ -

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

	Total Area (sq. ft.)	Year 2005 Unit Cost	Annual Escalation	Year 2008
Rear Abut.	4,153	$50.00	3.5%	$55.40

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

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

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

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 1 - QUANTITY CALCULATIONS

By: JRC
Checked: MSL

Date: 4/25/2006
Date: 4/27/2006

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)	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00		0	0
Pier 2															
Pier 3															0
Pier 4															0
Pier 5															0
Pier 6															0
Pier 7															0
Total (Cu.Ft.)					**0**				**0**					**0**	**0**
Total (Cu.Yd.)					**0**				**0**					**0**	**0**
		Qty			**0**				**0**					**0**	**0**

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	*0*	0.0	0.0	0.0	*0*
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	*0*	0	0	0.0	*0*
TotaL								**0**				**0**
							Qty	**0**				**0**

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	69	3	6	18.00	1242	3	2	6.00		414	6	3	18	1	1242	2898
Fwd. Abut	79	3	6	18.00	1422	3	11.5	34.50		2726	6	3	18	1	1422	5570
Total (Cu.Ft.)					**2664**					**3140**					**2664**	**8468**
Total (Cu.Yd.)					**99**					**116**					**99**	**314**
		Qty			**99**					**116**					**99**	**314**

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		25.1	101	2535.1	
RA Wing (L)		20.2	40	808.0	
RA Wing (R)		20.25	40	810.0	
Fwd Abut		0	0	0.0	
FA Wing (L)		0	0	0.0	
FA Wing (R)		0	0	0.0	
Total (Sq.Ft.)				**4153**	

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	9	120	1076	39.83			24
Span 2		0	0	0	0.00			0
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			24
TotaL	**MOD TYPE 4 60**	**9**		**1076**				

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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 Roadway Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
2	1	119.5'	120	121	293	$170,700	$73,600	$91,900	$0	7 Steel Girders /per BRIDGE	50" Web Grade 50W	309,505	$360,300	**$697,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	2	4.26	8.52

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
	0.75	69.00	51.8	5.2	65.4

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 =			$582.00

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 = 69 ft Length = 30 ft. Width = 98 ft
Area = 230 sq. yd. Area = 327 sq. yd.

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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 Cost	Subtotal Substructure Cost
2	1	119.5'	7 Steel Girders /per BRIDGE	50" Web Grade 50W	$0	$0	$166,600	$27,300	$0	$242,500	**$436,000**

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	0	$421.00	3.5%	$483.00	$0
Stem	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost	0				$0

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	300	$421.00	3.5%	$483.00	$144,900
Wingwalls	45	$421.00	3.5%	$483.00	$21,700

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
Rear Abut.	4,377	$50.00	3.5%	$55.40

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

Number of Piles		Total Pile Length
0	SEE QUANTITY CALCULATIONS	0

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

Shumway Hollow Road over CSX Railroad

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

By: JRC
Checked: MSL

Date: 4/25/2006
Date: 4/27/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1	0	0	0	0.00	0	0	0	0.00		0	0	0	0.00		0	0
Pier 2																0
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**0**					**0**					**0**	**0**
Total (Cu.Yd.)					**0**					**0**					**0**	**0**
			Qty		**0**					**0**					**0**	**0**

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	69	3	4.2	12.60	869	3	2	6.00		414	6	3	18	1	1242	2525
Fwd. Abut	79	3	4.2	12.60	995	3	13.3	39.90		3152	6	3	18	1	1422	5570
Total (Cu.Ft.)					**1865**					**3566**					**2664**	**8095**
Total (Cu.Yd.)					**69**					**132**					**99**	**300**
			Qty		**69**					**132**					**99**	**300**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		26.7	101	2696.7	
RA Wing (L)		21	40	840.0	
RA Wing (R)		21	40	840.0	
Fwd Abut		0	0	0.0	
FA Wing (L)		0	0	0.0	
FA Wing (R)		0	0	0.0	
Total (Sq.Ft.)				**4377**	

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	*0*	0.0	0.0	0.0	*0*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	0.0	*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	0.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
TotaL								**0**				**0**
							Qty	**0**				**0**

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**

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	370	7	120	309505
Span 2	0	0	0	0
Span 3	0	0	0	0
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
TotaL				309505

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 3 - SUPERSTRUCTURE

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

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 Roadway Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
3	1	110'-4"	110.33	112	258	$150,400	$64,700	$91,900	$0	8 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$323,500	$631,000	0%	**$631,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	2	4.26	8.52

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.71	69.00	48.9	4.9	62.3

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 =			$583.00

Based on parapet and slab percentages of total concrete area

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

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

Prestressed Concrete Girders
Unit Costs:

	Year 2005		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Type 4 I-Beams	$16,000	ea.	3.5%	$18,360	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	0	$0
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	24	$33,120
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	880	$290,400
						TOTAL =	**$323,520**

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 = 69 ft
Area = 230 sq. yd.

Length = 30 ft. Width = 98 ft
Area = 327 sq. yd.

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 3 - SUBSTRUCTURE

By: JRC
Checked: MSL

Date: 4/25/2006
Date: 4/27/2006

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 Cost	Additional Crane Cost	Additional Crane Cost	Subtotal Substructure Cost
3	1	110'-4"	8 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$0	$0	$120,500	$19,800	$0	$351,500	$75,000	$54,223	**$621,000**

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	0	$421.00	3.5%	$483.00	$0
Stem	0	$421.00	3.5%	$483.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total Cost	0				$0

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	217	$421.00	3.5%	$483.00	$104,800
Wingwalls	33	$421.00	3.5%	$483.00	$15,700

Epoxy Coated Reinforcing Steel

Unit Cost ($/lb):

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

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

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

Number of Piles		Total Pile Length
0	SEE QUANTITY CALCULATIONS	0

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

13%

Rock Excavation Unit Cost

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Rock Excavation	65	3.5%	$74.60

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

	Total Area (sq. ft.)	Year 2005 Unit Cost	Annual Escalation	Year 2008
Rear & Fwd.Abut.	6,345	$50.00	3.5%	$55.40

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

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

Shumway Hollow Road over CSX Railroad

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 3 - QUANTITY CALCULATIONS

By: JRC
Checked: MSL

Date: 4/25/2006
Date: 4/27/2006

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)	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0
Pier 2														
Pier 3														0
Pier 4														0
Pier 5														0
Pier 6														0
Pier 7														0
Total (Cu.Ft.)					**0**				**0**				**0**	**0**
Total (Cu.Yd.)					**0**				**0**				**0**	**0**
			Qty		**0**				**0**				**0**	**0**

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	*0*	0.0	0.0	0.0	*0*
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	*0*	0	0	0.0	*0*
TotaL								**0**				**0**
							Qty	**0**				**0**

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	69	3	6	18.00	1242	3	2	6.00		414	6	3	18	1	1242	2898
Fwd. Abut	70.5	3	6	18.00	1269	3	2	6.00		423	6	3	18	1	1269	2961
Total (Cu.Ft.)					**2511**					**837**					**2511**	**5859**
Total (Cu.Yd.)					**93**					**31**					**93**	**217**
			Qty		**93**					**31**					**93**	**217**

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		25.1	101	2535.1	
RA Wing (L)		20.2	40	808.0	
RA Wing (R)		20.25	40	810.0	
Fwd Abut		15.9	101	1605.9	
FA Wing (L)		15	20	300.0	
FA Wing (R)		14.3	20	286.0	
Total (Sq.Ft.)				**6345**	

Rock Excavation

Abut Location		Wall			
		Height	*Depth*	*Length*	*Vol.*
Fwd Abut		15	12.5	86.0	597.22
FA Wing (L)		10	12.5	14.0	64.815
FA Wing (R)		10	12.5	14.0	64.815
Total (Cu. Ft.)					**727**

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	8	110	880	36.67			24
Span 2		0	0	0	0.00			0
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			24
TotaL	**MOD TYPE 4 60**	**8**		**880**				

SCI-823-0.00 - PORTSMOUTH BYPASS
Shumway Hollow Road over CSX Railroad
STRUCTURE TYPE STUDY - LIFE CYCLE COSTS

By: JRC Date: 4/25/2006
Checked: MSL Date: 4/27/2006

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Structural Steel Painting: Number of Maintenance Cycles	Structural Steel Painting: Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Superstructure Sealing: Number of Maintenance Cycles	Superstructure Sealing: Total Life Cycle Cost
1	1	119.50	9 Prestressed I-Girders /per BRIDGE	$0	0	$0	$24,100	2	$48,200
2	1	119.50	7 Steel Girders /per BRIDGE	$178,200	2	$356,400	$0	0	$0
3	1	110.33	8 Prestressed I-Girders /per BRIDGE	$0	0	$0	$19,800	2	$39,600

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	1	119.5	9 Prestressed I-Girders /per BRIDGE	$25,000	$30,300	n/a	1	$55,300	$162,700	$70,000	n/a	$68,300	1	$301,000	**$405,000**	**$1,700,000**	**$2,105,000**
2	1	119.5	7 Steel Girders /per BRIDGE	$25,000	$30,300	n/a	1	$55,300	$170,700	$73,600	n/a	$68,300	1	$312,600	**$724,000**	**$1,580,000**	**$2,304,000**
3	1	110.33	8 Prestressed I-Girders /per BRIDGE	$23,100	$28,000	n/a	1	$51,100	$150,400	$64,700	n/a	$63,000	1	$278,100	**$369,000**	**$1,740,000**	**$2,109,000**

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	50	7	119.50	20.00	11,153	20%	13,400

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	9	119.50	17,773	10%	2,170
Alt. 3	8	110.33	14,586	10%	1,780

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

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	8,246	$8.28	$68,300
Alt. 2	8,246	$8.28	$68,300
Alt. 3	7,613	$8.28	$63,000

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.:

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	8,246	916	23	21
Alt. 2	8,246	916	23	21
Alt. 3	7,613	846	21	19

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 litecycle 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

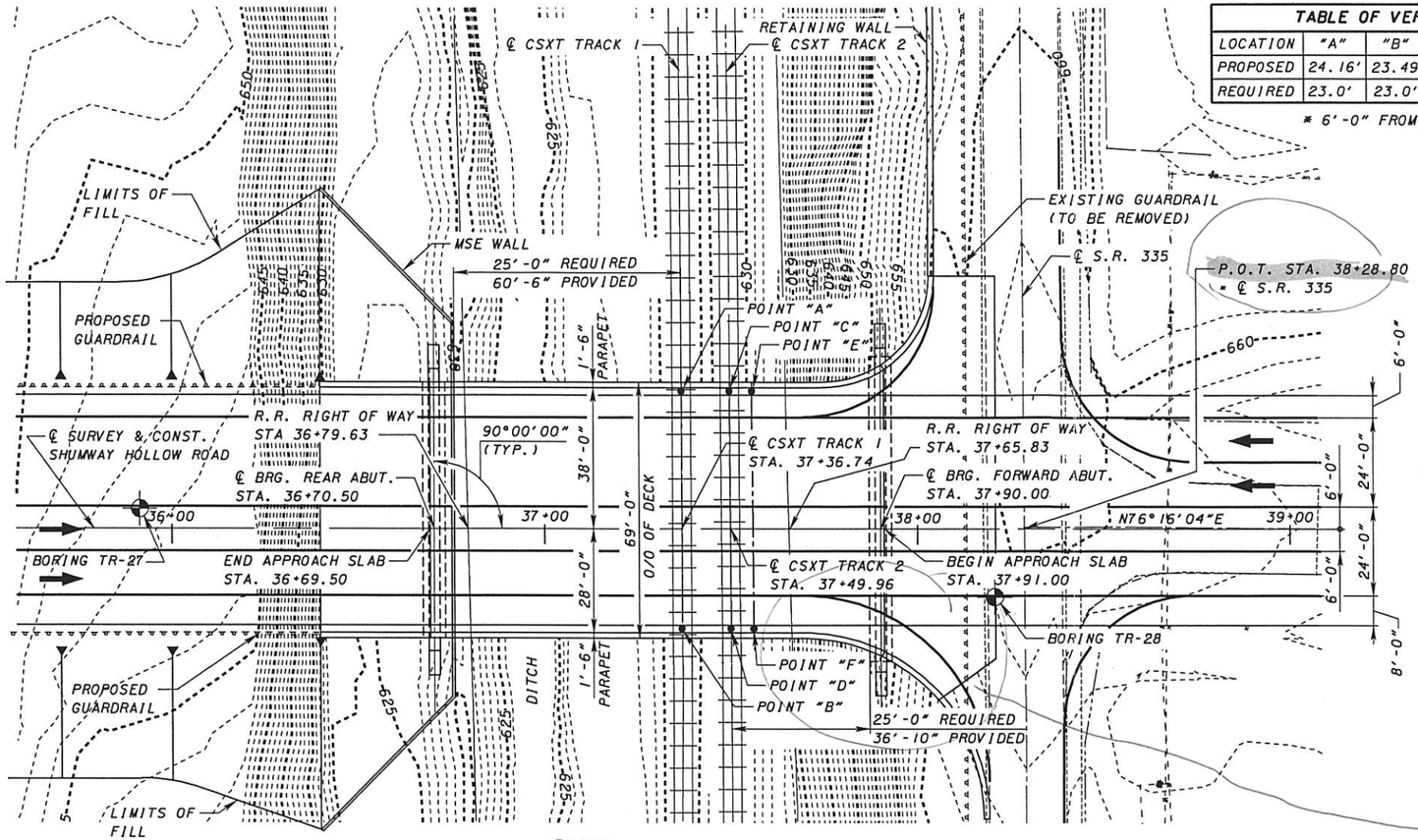
Asphalt Resurfacing Costs:

Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
0.0	0.0	0	1.50	0.0

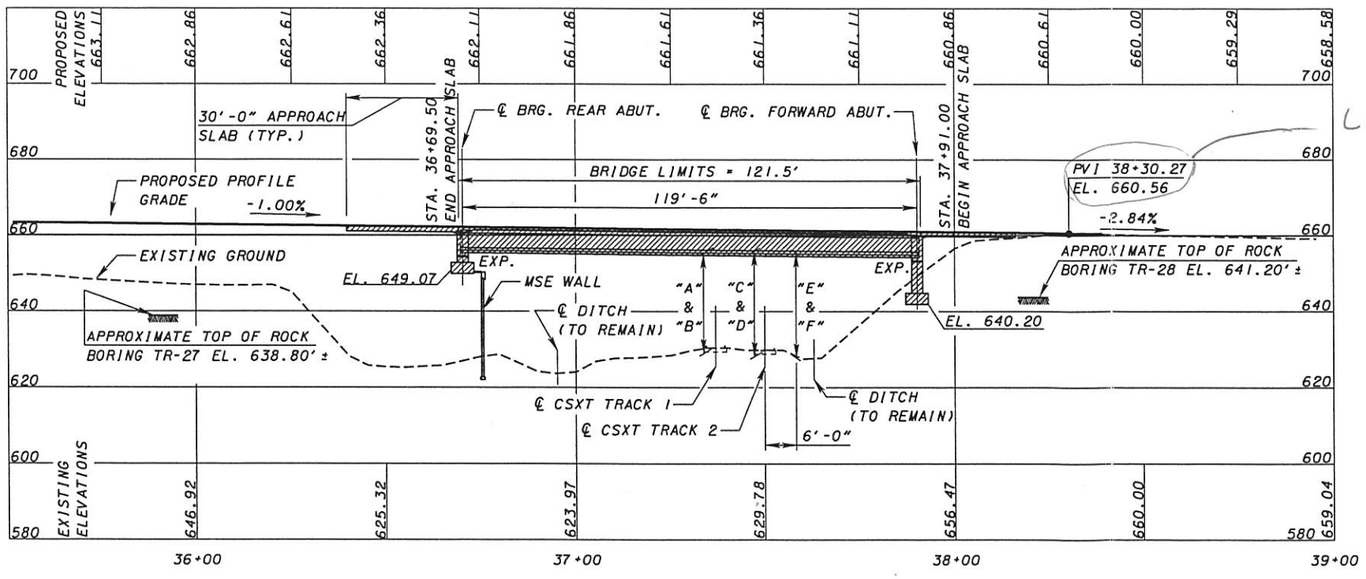
APPENDIX B

Preferred Alternative Site Plan and Details

TRANSYSTEMS CORPORATION



PLAN



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION SHUMWAY HOLLOW ROAD

TABLE OF VERTICAL CLEARANCES						
LOCATION	"A"	"B"	"C"	"D"	"E"*	"F"*
PROPOSED	24.16'	23.49'	24.30'	23.52'	25.58'	24.91'
REQUIRED	23.0'	23.0'	23.0'	23.0'	23.0'	23.0'

* 6'-0" FROM ℄ CSXT TRACK 2

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-27	35+91.27	5.31' LT.
TR-28	38+20.74	18.43' RT.

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

TRAFFIC DATA

(SHUMWAY HOLLOW ROAD)
CURRENT YEAR ADT (2010) - 3,800
DESIGN YEAR ADT (2030) - 7,800
CURRENT YEAR ADTT (2010) - 228
DESIGN YEAR ADTT (2030) - 468

PROPOSED STRUCTURE

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

SPANS: 119'-6" C/C BEARINGS

ROADWAY: 66'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS = 60 PSF

SKEW: NONE

CROWN: VARIES

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

no semi-integral

Length of curve

Horizontal curve

1 of 3

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:

REAR AND FORWARD ABUTMENTS SHALL BE ON SPREAD FOOTINGS. USE ALLOWABLE BEARING CAPACITY OF 4 KSF AT REAR ABUTMENT, 30 KSF AT FORWARD ABUTMENT.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING THE TS&L SUBMITTAL

DESIGN AGENT: TRANSYSTEMS CORPORATION, 250 EAST FIFTH ROSE WAY, SUITE 300, CINCINNATI, OHIO 45202

DESIGNED	DRAWN	REVIEWED	DATE
MSL	NTN	JRC	04/27/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

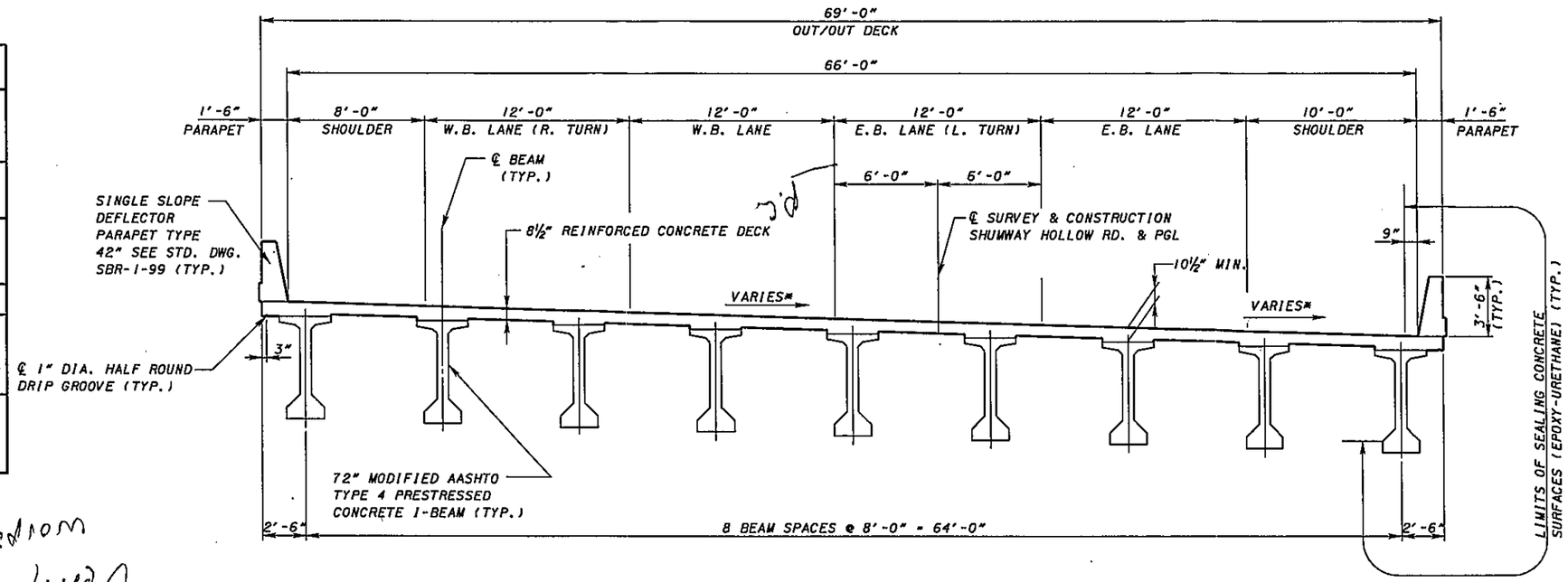
SCIOTO COUNTY
STA. 36+69.50
STA. 37+91.00

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

1 / 3

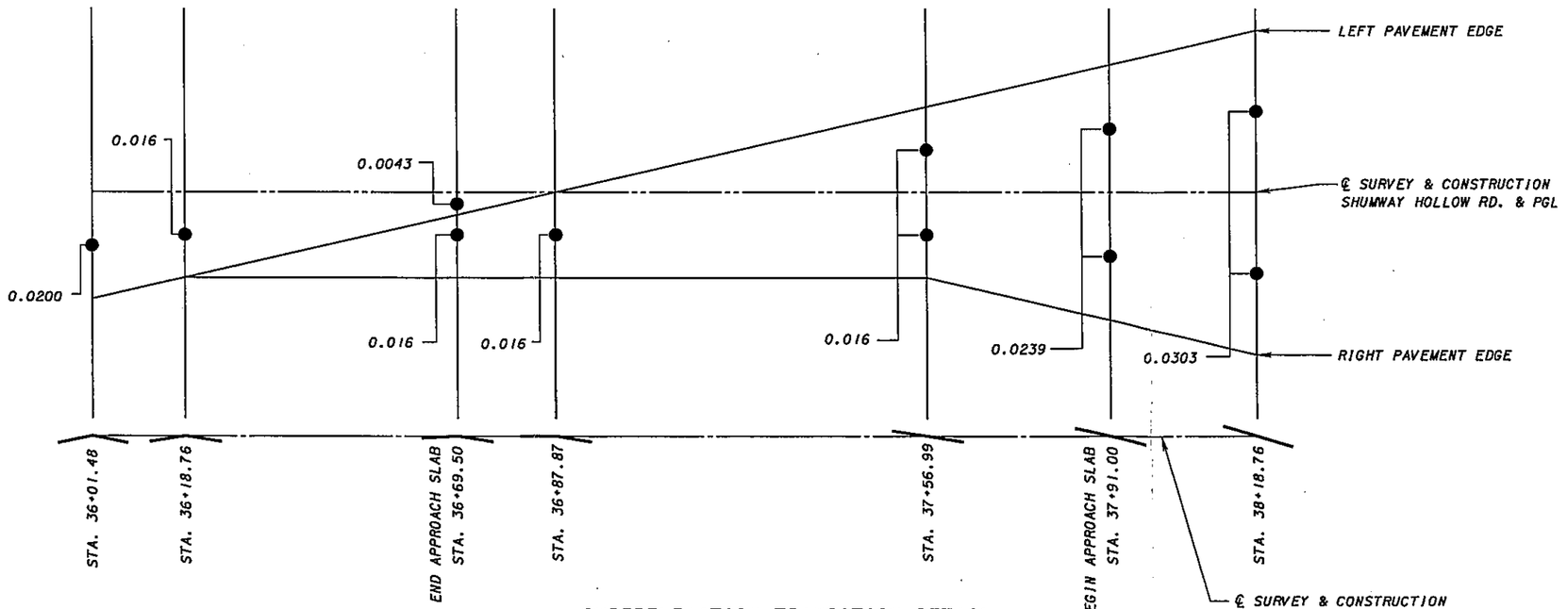
SUPERSTRUCTURE DEPTH	
ITEM	72" MODIFIED AASHTO TYPE 4 BEAM
SLAB (INCLUDING WEARING SURFACE)	8.5"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
GIRDER DEPTH	72"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER (INCH)	82.5"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER (FEET)	6.875'



* SEE BELOW FOR SUPERELEVATION TRANSITION DETAIL

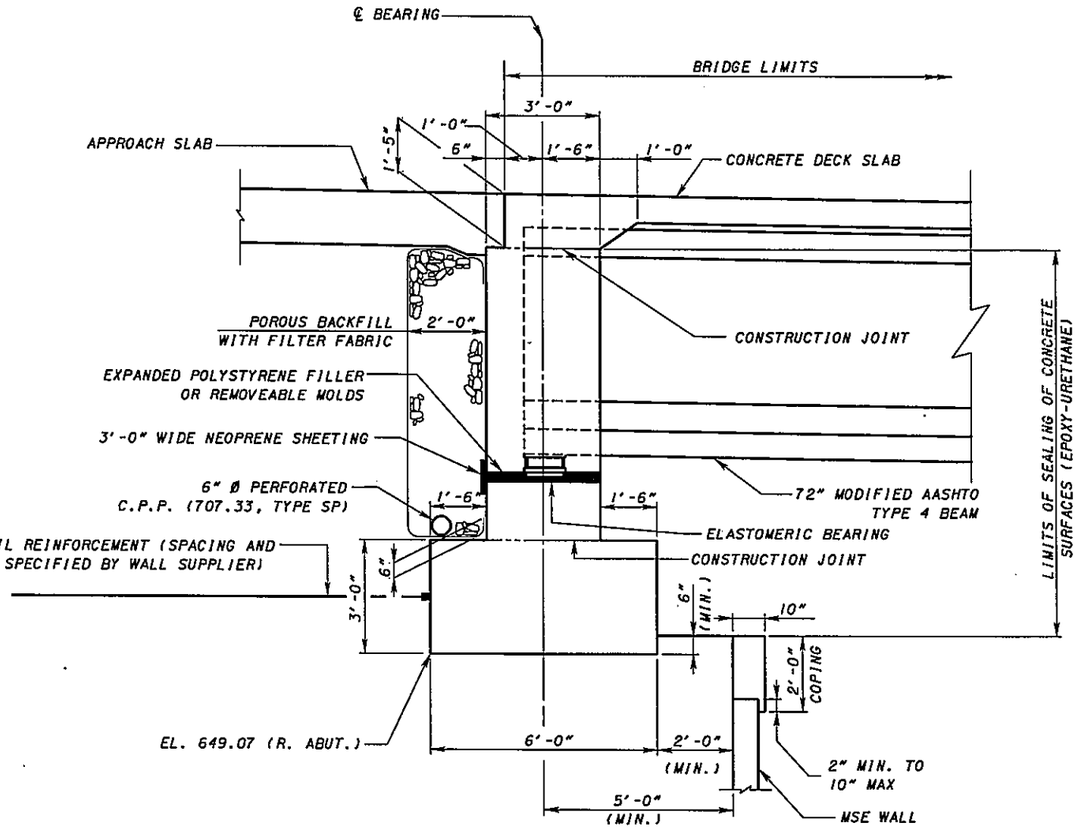
TYPICAL TRANSVERSE SECTION

Weight deck + hardware
working of deck

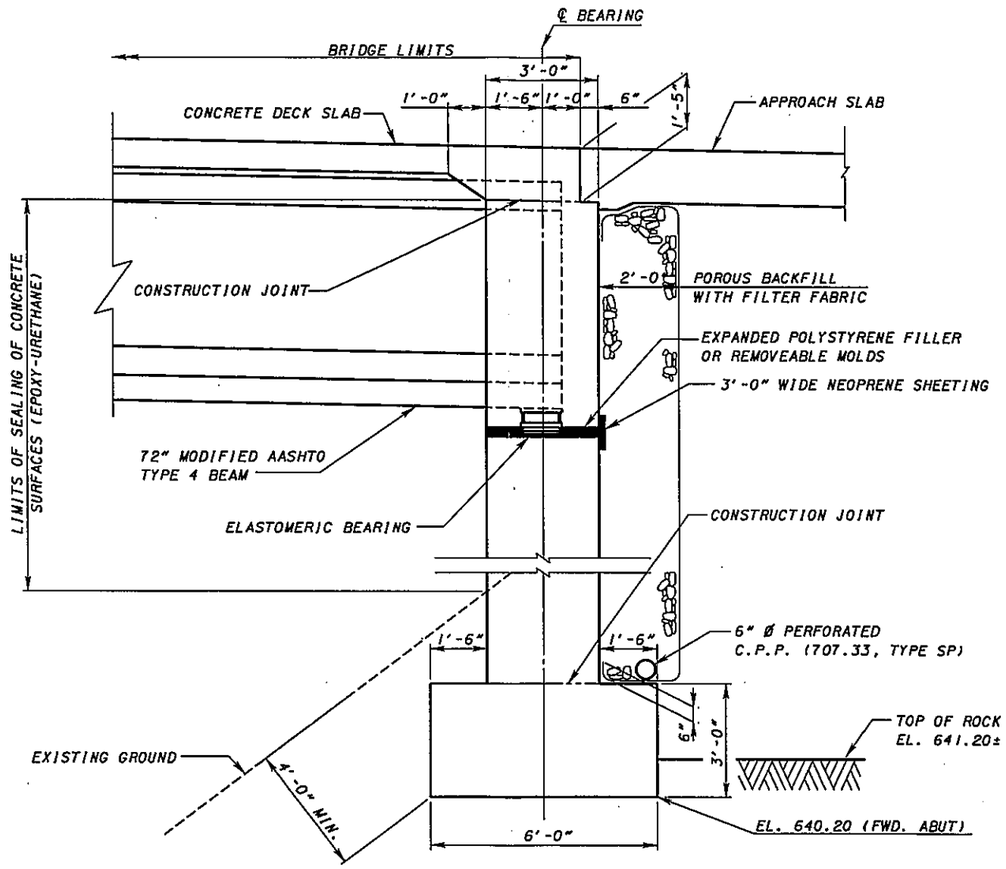


SUPERELEVATION TRANSITION DETAIL

DESIGN AGENCY: TRANSYSTEMS CORPORATION
DESIGNED MSL | DRAWN MTN | CHECKED MSL | REVISED
REVISED JRC 04/27/06 | DATE | STRUCTURE FILE NUMBER
TRANSVERSE SECTION - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAIL ROAD
SCI-823-0.00
PID 19415
2 / 3



REAR ABUTMENT SECTION



FORWARD ABUTMENT SECTION

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED	DRAWN	REVIEWED	DATE
MSL	CAS	JRC	04/27/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

ABUTMENT DETAILS - ALTERNATIVE I
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAIL ROAD

SCI-823-0.00
PID 19415

3 | 3

APPENDIX C

Vertical Clearance Calculations

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0113	x	37	0.4181
			Total Adjustment =	**0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.66**
Offset Location @ Critical Point	=	**37' LEFT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	0.42
Top of Deck Elevation @ Critical Point	=	**661.92**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**655.04**
Approximate Top of Existing Ground @ Critical Point	=	**630.88**
Actual Vertical Clearance	=	***24.16***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: B**

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	27	=	-0.43
				=	0.00
					0
			Total Adjustment	=	**-0.43**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.78**
Offset Location @ Critical Point	=	**27' RIGHT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	-0.43
Top of Deck Elevation @ Critical Point	=	**661.07**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.19**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***23.49***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | ***Point Location: C***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.01435	x	37	0.53095
			Total Adjustment =	**0.53**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+49.79**
Offset Location @ Critical Point	=	**37' LEFT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	0.53
Top of Deck Elevation @ Critical Point	=	**661.89**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**655.01**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***24.30***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | ***Point Location: D***

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	27	=	-0.43
				=	0.00
					0
			Total Adjustment	=	**-0.43**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+50.10**
Offset Location @ Critical Point	=	**27' RIGHT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	-0.43
Top of Deck Elevation @ Critical Point	=	**660.93**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.05**
Approximate Top of Existing Ground @ Critical Point	=	**630.53**
Actual Vertical Clearance	=	***23.52***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064

Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

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

Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | ***Point Location: E***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0157	x	37	0.5809
			Total Adjustment =	**0.58**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+55.79**
Offset Location @ Critical Point	=	**37' LEFT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	0.58
Top of Deck Elevation @ Critical Point	=	**661.88**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**655.00**
Approximate Top of Existing Ground @ Critical Point	=	**629.42**
Actual Vertical Clearance	=	***25.58***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 1 - 9-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: F**

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.016	x	27	=	-0.43
				=	0.00
					0
			Total Adjustment	=	**-0.43**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+56.10**
Offset Location @ Critical Point	=	**27' RIGHT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	-0.43
Top of Deck Elevation @ Critical Point	=	**660.87**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**653.99**
Approximate Top of Existing Ground @ Critical Point	=	**629.08**
Actual Vertical Clearance	=	***24.91***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064

Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

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

Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0113	x	36	0.4068
			Total Adjustment =	**0.41**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	9	0.75	
Haunch:	2	0.17	
Girder or Beam Depth:	53.625	4.47	
	64.625	5.39	
		Total Superstructure Depth (ft) =	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.66**
Offset Location @ Critical Point	=	**36' LEFT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	0.41
Top of Deck Elevation @ Critical Point	=	**661.91**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**656.52**
Approximate Top of Existing Ground @ Critical Point	=	**630.88**
Actual Vertical Clearance	=	***25.64***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	26	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	53.625	4.47		
	64.625	5.39		
		Total Superstructure Depth (ft)	=	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.78**
Offset Location @ Critical Point	=	**26' RIGHT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**661.08**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**655.69**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***24.99***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | ***Point Location: C***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.01435	x	36	0.5166
			Total Adjustment =	**0.52**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	9	0.75	
Haunch:	2	0.17	
Girder or Beam Depth:	53.625	4.47	
	64.625	5.39	
		Total Superstructure Depth (ft) =	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+49.79**
Offset Location @ Critical Point	=	**36' LEFT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	0.52
Top of Deck Elevation @ Critical Point	=	**661.88**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**656.49**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***25.78***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | ***Point Location: D***

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	26	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	53.625	4.47		
	64.625	5.39		
		Total Superstructure Depth (ft)	=	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+50.10**
Offset Location @ Critical Point	=	**26' RIGHT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**660.94**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**655.55**
Approximate Top of Existing Ground @ Critical Point	=	**630.53**
Actual Vertical Clearance	=	***25.02***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | ***Point Location: E***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0157	x	36	0.5652
			Total Adjustment =	**0.57**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	9	0.75	
Haunch:	2	0.17	
Girder or Beam Depth:	53.625	4.47	
	64.625	5.39	
		Total Superstructure Depth (ft) =	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+55.79**
Offset Location @ Critical Point	=	**36' LEFT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	0.57
Top of Deck Elevation @ Critical Point	=	**661.87**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**656.48**
Approximate Top of Existing Ground @ Critical Point	=	**629.42**
Actual Vertical Clearance	=	***27.05***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 2 - 7-53.625" Steel Girders, 1 span | **Point Location: F**

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	26	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	53.625	4.47		
	64.625	5.39		
		Total Superstructure Depth (ft)	=	**5.39**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+56.10**
Offset Location @ Critical Point	=	**26' RIGHT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**660.88**
Total Superstructure Depth	=	-5.39
Bottom of Beam Elevation @ Critical Point	=	**655.49**
Approximate Top of Existing Ground @ Critical Point	=	**629.08**
Actual Vertical Clearance	=	***26.41***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0113	x	36.5	0.41245
			Total Adjustment =	**0.41**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	8.5	0.71	
Haunch:	2	0.17	
Girder or Beam Depth:	72	6	
	82.5	6.88	
		Total Superstructure Depth (ft) =	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.66**
Offset Location @ Critical Point	=	**36.5' LEFT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	0.41
Top of Deck Elevation @ Critical Point	=	**661.91**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**655.03**
Approximate Top of Existing Ground @ Critical Point	=	**630.88**
Actual Vertical Clearance	=	***24.16***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description Shumway Hollow RD. over CSXT R.R. **PID #** 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	26.5	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+36.78**
Offset Location @ Critical Point	=	**26.5' RIGHT**
Profile Grade Elevation at Critical Point	=	661.50
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**661.08**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.20**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***23.50***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: C**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.01435	x	36.5	0.523775
			Total Adjustment =	**0.52**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	8.5	0.71	
Haunch:	2	0.17	
Girder or Beam Depth:	72	6	
	82.5	6.88	
		Total Superstructure Depth (ft) =	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+49.79**
Offset Location @ Critical Point	=	**36.5' LEFT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	0.52
Top of Deck Elevation @ Critical Point	=	**661.88**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**655.00**
Approximate Top of Existing Ground @ Critical Point	=	**630.71**
Actual Vertical Clearance	=	***24.30***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | ***Point Location: D***

Adjstment for Cross Slope

Comment	Grade		Offset		
Profile grade line to critical pt.:	-0.016	x	26.5	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+50.10**
Offset Location @ Critical Point	=	**26.5' RIGHT**
Profile Grade Elevation at Critical Point	=	661.36
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**660.94**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.06**
Approximate Top of Existing Ground @ Critical Point	=	**630.53**
Actual Vertical Clearance	=	***23.53***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: E**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	0.0157	x	36.5	0.57305
			Total Adjustment =	**0.57**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+55.79**
Offset Location @ Critical Point	=	**36.5' LEFT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	0.57
Top of Deck Elevation @ Critical Point	=	**661.87**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.99**
Approximate Top of Existing Ground @ Critical Point	=	**629.42**
Actual Vertical Clearance	=	***25.57***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

TRANSYSTEMS CORPORATION

Made By MTN Date 04/18/06 Job No. P403030064
Checked By MSL Date 04/27/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description Shumway Hollow RD. over CSXT R.R. PID # 19415

Alternative 3 - 8-72" Type 4 Modified Prestressed I-Beams, 1 span | **Point Location: F**

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.016	x	26.5	=	-0.42
				=	0.00
					0
			Total Adjustment	=	**-0.42**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
		Total Superstructure Depth (ft)	=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**37+56.10**
Offset Location @ Critical Point	=	**26.5' RIGHT**
Profile Grade Elevation at Critical Point	=	661.30
Adjustment for Cross Slopes to Beam CL	=	-0.42
Top of Deck Elevation @ Critical Point	=	**660.88**
Total Superstructure Depth	=	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.00**
Approximate Top of Existing Ground @ Critical Point	=	**629.08**
Actual Vertical Clearance	=	***24.92***
Preferred Vertical Clearance	=	*23.0*
Required Vertical Clearance	=	*23.0*

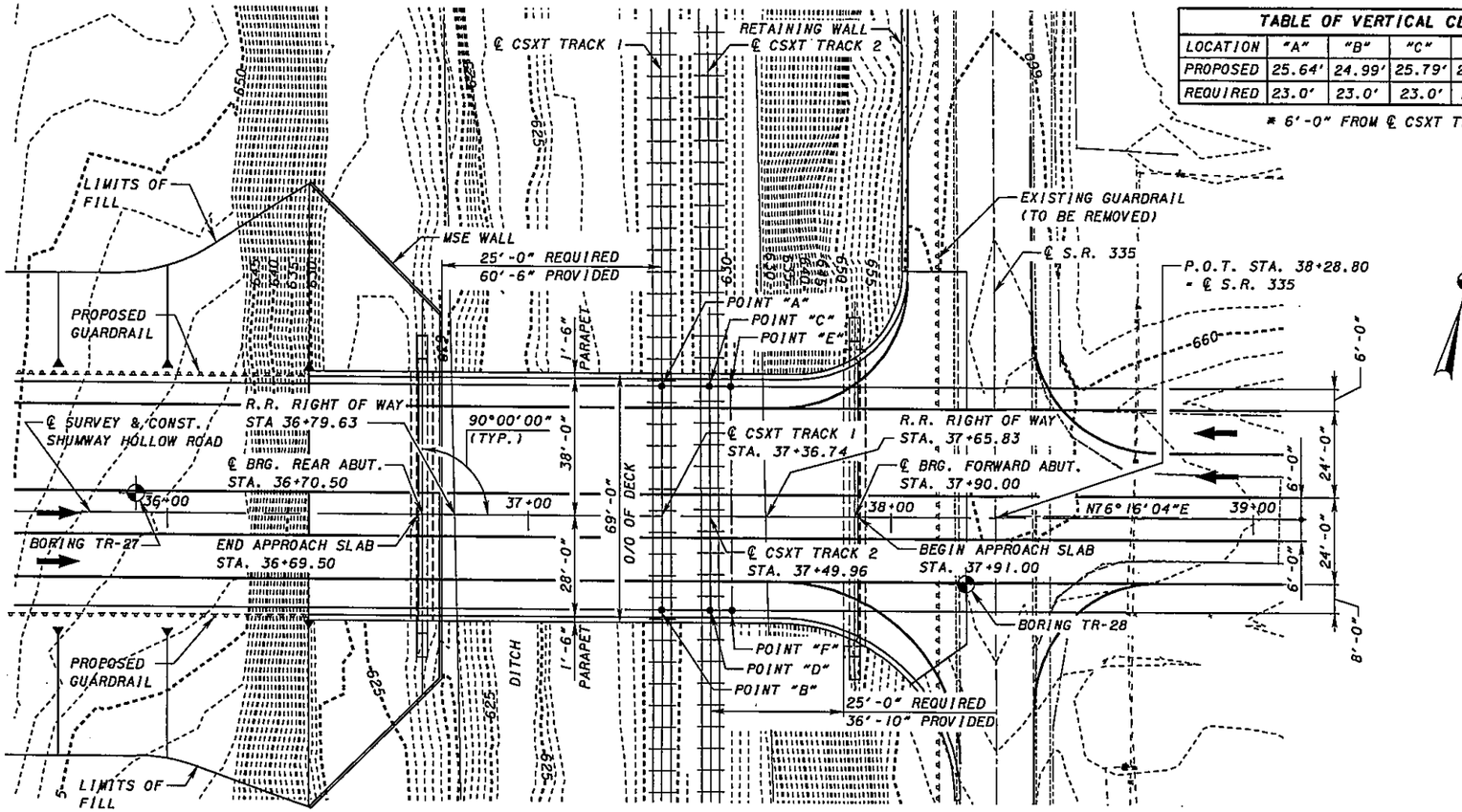
APPENDIX D

Preliminary Structure Site Plan

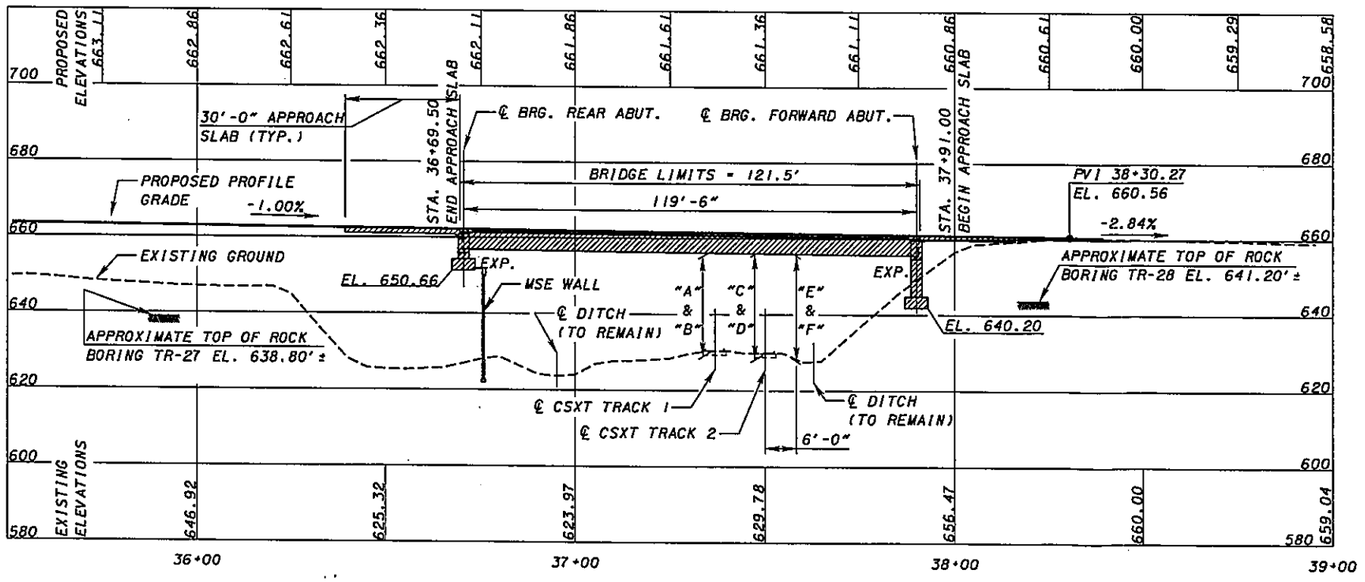
TRANSYSTEMS CORPORATION

TABLE OF VERTICAL CLEARANCES						
LOCATION	"A"	"B"	"C"	"D"	"E"*	"F"*
PROPOSED	25.64'	24.99'	25.79'	25.02'	27.05'	26.41'
REQUIRED	23.0'	23.0'	23.0'	23.0'	23.0'	23.0'

* 6'-0" FROM ℄ CSXT TRACK 2

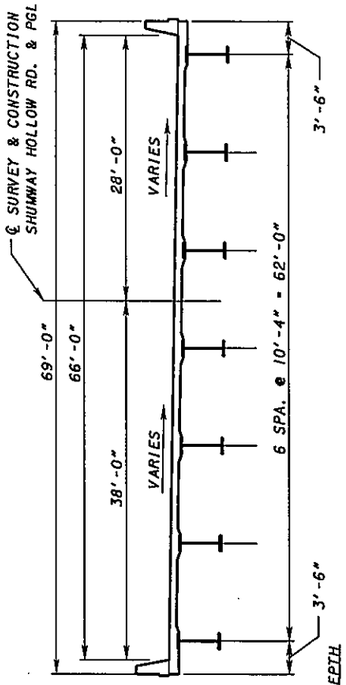


PLAN



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION SHUMWAY HOLLOW ROAD

SUPERSTRUCTURE DATA



STRUCTURE DEPTH

SLAB - 8½"

HAUNCH - 2"

BEAM - 4'-5⅝" / 5'-4⅛"

PROPOSED STRUCTURE

TYPE: SINGLE SPAN STEEL PLATE GIRDERS A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS.

SPANS: 119'-6" C/C BEARINGS

ROADWAY: 66'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS = 60 PSF

SKEW: NONE

CROWN: VARIES

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY
TRANSYSTEMS CORPORATION
2324 EAST NINTH STREET, SUITE 200, CLEVELAND, OHIO 44115

DESIGNED	DRAWN	REVIEWED	DATE
WSL	MTN	JRC	04/27/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
WSL			

SCIOTO COUNTY
STA. 36+69.50
STA. 37+91.00

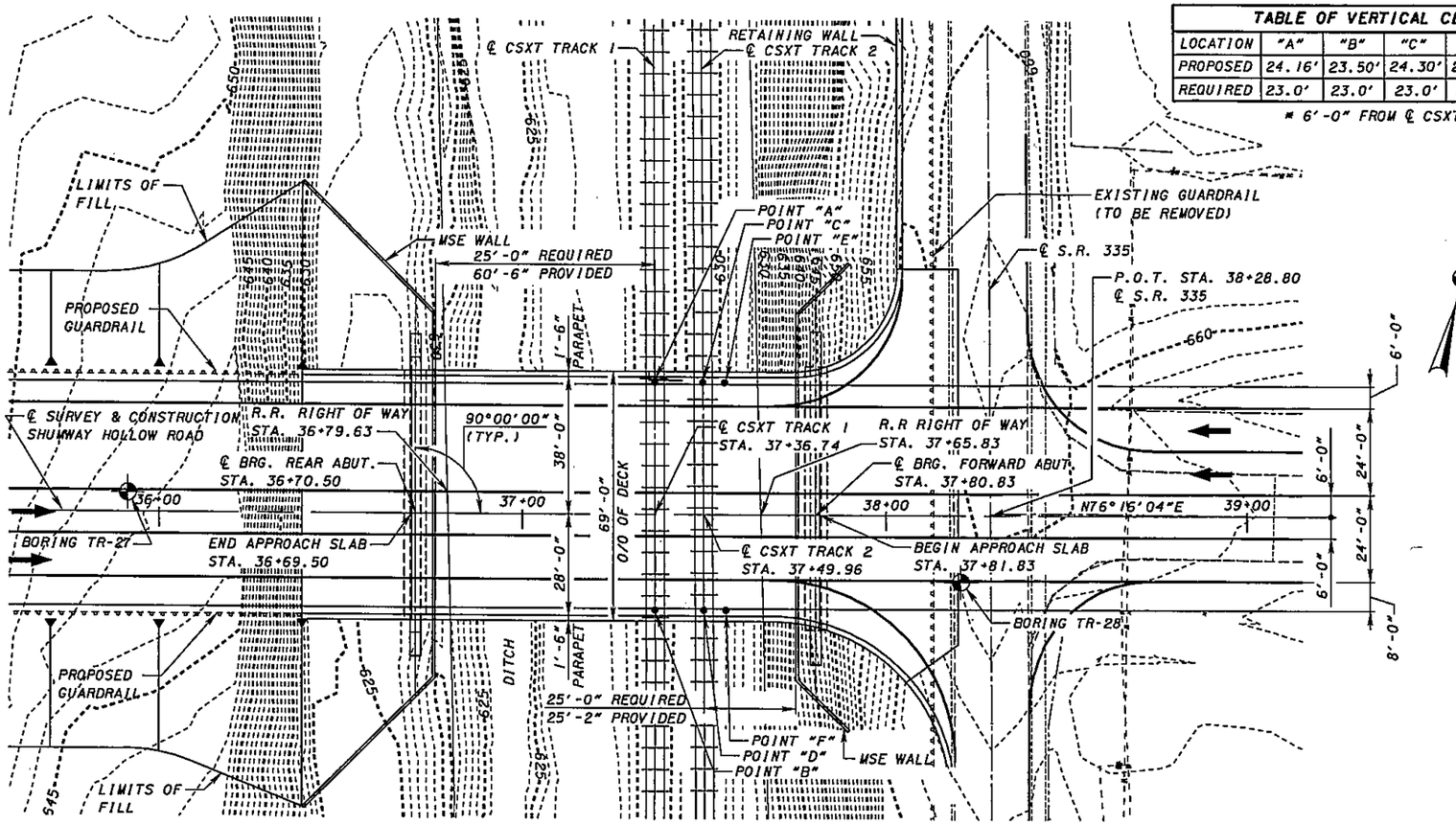
PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

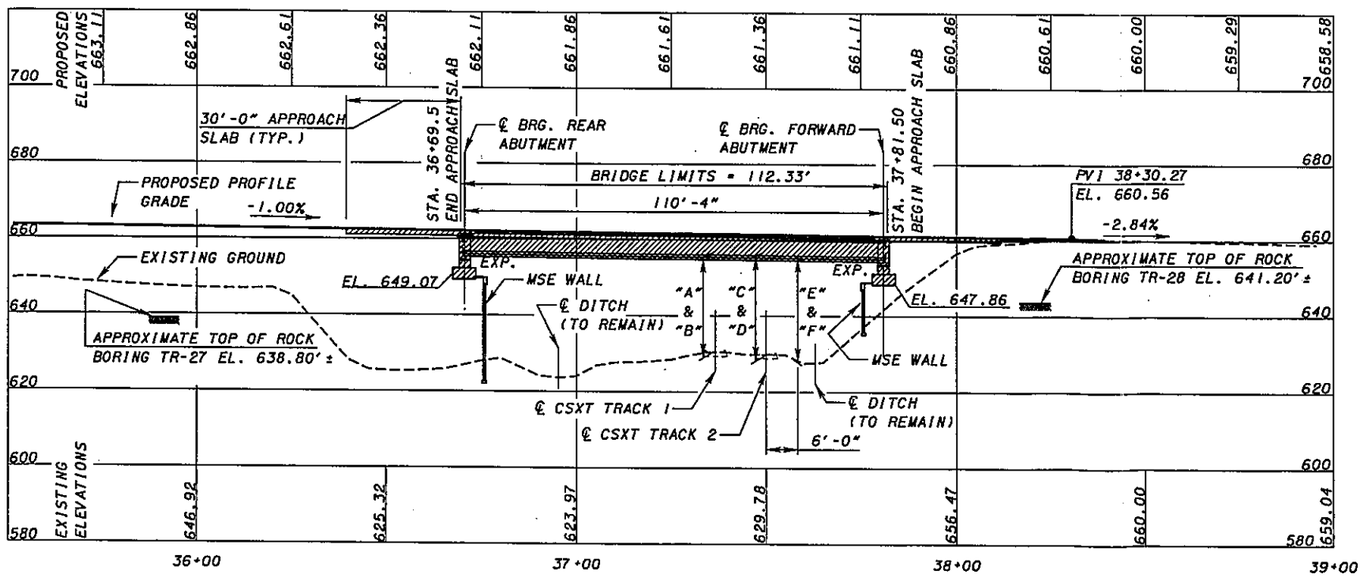
1 / 2

TABLE OF VERTICAL CLEARANCES						
LOCATION	"A"	"B"	"C"	"D"	"E"*	"F"*
PROPOSED	24.16'	23.50'	24.30'	23.53'	25.58'	24.92'
REQUIRED	23.0'	23.0'	23.0'	23.0'	23.0'	23.0'

* 6'-0" FROM ℄ CSXT TRACK 2

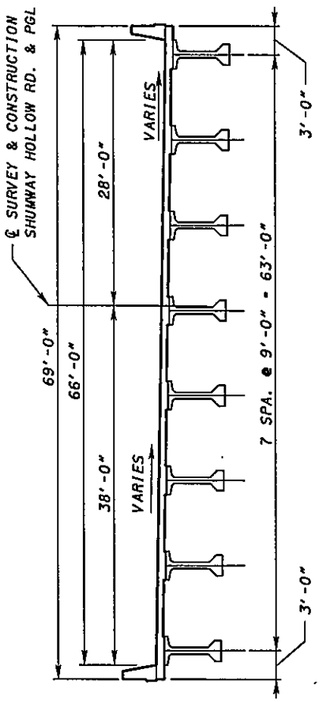


PLAN



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION SHUMWAY HOLLOW ROAD

SUPERSTRUCTURE DATA



STRUCTURE DEPTH

SLAB - 8½"

HAUNCH - 2"

BEAM - 6'-0"

6'-10½"

PROPOSED STRUCTURE

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

SPANS: 110'-4" C/C BEARINGS

ROADWAY: 66'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS = 60 PSF

SKEW: NONE

CROWN: VARIES

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY
TRANSYSTEMS CORPORATION

REVIEWED	DATE
JRC	04/27/06
STRUCTURE FILE NUMBER	
DRAWN MTN	REVISED
DESIGNED MSL	CHECKED MSL

SCIOTO COUNTY
STA. 36+69.50
STA. 37+91.00

PRELIMINARY SITE PLAN - ALTERNATIVE 3

BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

2 / 2

APPENDIX E

Preliminary Geotechnical Report & Preliminary MSE Wall Evaluation

TRANSYSTEMS CORPORATION

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

April 26, 2006

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

Re: **Preliminary Structural Foundation Recommendations (Revised)**
SCI-823 over Relocated Shumway Hollow Road
Relocated Shumway Hollow over CSX Railroad
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0011

Dear Mr. Weeks:

This letter reports the revised findings of the subsurface exploration and preliminary foundation recommendations for the proposed structures at the SCI-823-0.00 Airport Interchange: SCI-823 over relocated Shumway Hollow Road and relocated Shumway Hollow Road over the CSX Railroad. It is anticipated that the proposed structure over Shumway Hollow Road will be a one-span elevated bridge. It is anticipated that the proposed abutments will be founded on a fill section, contained in MSE walls.

The proposed structure over the CSX Railroad is understood to be a one-span bridge. The proposed grade at the new bridge location is understood to be approximately 662 feet. It is anticipated that at least part of the structure will be placed on a fill section, using MSE walls to contain the embankments. See attached plan and profile drawings for both planned structures and boring locations.

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 structures.

Field Exploration

Three borings, TR-24 through TR-26, were drilled at the proposed structure for SCI-823-0.00 over the realigned Shumway Hollow Road between August 19 and 23, 2004. The borings were drilled to depths from 33.0 to 53.5 feet. The borings were extended into bedrock, which was verified by rock coring. Two borings, TR-27 and TR-28, were drilled at the proposed structure over the CSX Railroad on August 25, 2004 and February 2, 2005. The borings were drilled to depths of 17.5 and 30.0 feet, respectively. The borings were extended into bedrock, which was

verified by rock coring. Boring Logs for both structures and information concerning the drilling procedures are attached.

The boring locations were selected by TranSystems Corporation. Ground surface elevations have been accurately established by as-drilled surveys for this project.

Findings

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

SCI-823-0.00 over Relocated Shumway Hollow

The borings for the structure crossing SCI-823-0.00 generally encountered up to 12 inches of topsoil at the surface. Underlying the surficial materials, the borings encountered stiff to hard silt and clay (A-6a), clay (A-7-6), sandy silt (A-4a) and loose to dense gravel with sand (A-1-b) and fine sand (A-3) to depths between 23.0 and 43.5 feet where bedrock was encountered.

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 93 to 100% and RQD values ranged from 42 to 90% with an average RQD of 74%.

Seepage was encountered between depths of 6.0 and 21.0 feet below the ground surface. At completion of drilling, water levels ranged from 8.5 to 29.8 feet. However, the final water levels include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally.

Relocated Shumway Hollow over CSX Railroad

Boring TR-28 encountered 8 inches of asphalt concrete at the surface. Underlying the pavement, the boring encountered very stiff to hard silt and clay (A-6a) and loose to medium dense coarse and fine sand (A-3a) to a depth of 16.0 feet where bedrock was encountered. Boring TR-27 was drilled off the road, but did not encounter topsoil. Underlying the surface, the boring encountered hard sandy silt to a depth of 7.5 feet where bedrock was encountered.

Bedrock encountered at the proposed structure location was composed primarily of medium hard to hard sandstone that was generally slightly fractured to intact. Recovery of the core samples ranged from 50 to 100% and RQD values ranged from 12 to 100% with an average RQD of 76%.

Seepage was encountered at depths between 14.0 and 18.5 feet below the ground surface in boring TR-28. No seepage was encountered in boring TR-27. At completion of drilling, the water level in TR-28 was 10.0 feet. Boring TR-27 collapsed at a depth of 6.0 feet. It should be noted that the final water levels include drilling water and consequently may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally.

Conclusions and Recommendations

SCI-823-0.00 over Relocated Shumway Hollow

Due to the embankment fill, it appears that driven H-piles to bedrock will be the best-suited foundation type for support of the proposed structure. If high lateral or uplift loads are anticipated, drilled shafts founded in bedrock may be needed. The actual design lengths or rock sockets will need to be designed based upon actual loading conditions. A table summarizing the site conditions and foundation recommendations follows subsequently.

Additionally, since the SCI-823-0.00 mainline and the Relocated Shumway Hollow will be located on a relatively large embankment and could be potentially underlain by compressible soils, the abutment and pier locations may need special construction procedures, and/or an additional load applied to the design loads to account for any negative skin friction associated with the embankment loading.

It should be noted that if driven H-piles are selected, special pile-driving techniques may be required. Soils that have high silt and fine sand contents that also have high moisture contents, such as those encountered within this area, tend to produce exaggerated blow counts during pile driving, which do not reflect the actual load carrying ability of the strata due to pore pressures. Piles should be driven to their design capacity, allowed to sit at least 24 hours, then re-driven to ensure that the design capacity has been achieved. If the design capacity has not been achieved due to elevated pore pressures, continue to drive the pile until adequate capacity has been achieved with confirmation after 24 hours.

Because of the large potential lateral loads, embankment heights and depths of relatively compressible soils, differential settlement will also need to be evaluated. It is strongly recommended that we discuss the proposed foundation design after TranSystems has had a chance to review these recommendations.

No grain size analyses were performed for scour analysis since the proposed structure location is not located along a stream location.

Relocated Shumway Hollow over CSX Railroad

Based upon the amount of embankment fill required for the construction of the bridge over the CSX Railroad, spread footings or drilled shafts could be used to support the rear abutment. Grade is expected to remain near existing levels near the forward abutment; however, bedrock on the eastern side of the bridge is deeper so either spread footings on rock or drilled shafts to rock can be used to support the forward abutment. Any footings should be embedded into the bedrock. The table summarizing the site conditions and foundation recommendations follows subsequently. It should be noted that the plan location and elevation of the proposed abutments varies from the preliminary structural borings. It will be necessary to drill borings for the structures once the design has been set.

The railroad the structure crosses is located within a cut. The stability of this railroad cut section should be evaluated relative to the location of the anticipated abutment locations once the final design is complete.

Boring Number	Structural Element	Existing Ground Surface Elevation (Feet)	Approximate Bearing Elevation (Feet)	Recommended Foundation Type	Allowable Bearing Capacity
SCI-823-0.00 over Relocated Shumway Hollow Road					
TR-24	Rear (west) Abutment	686	643	H-Piles	90 tons
TR-25	Pier	675	643	H-Piles	90 tons
TR-26	Forward (east) Abutment	665	643	H-Piles	90 tons
Relocated Shumway Hollow Road over CSX Railroad					
TR-27	Rear Abutment	627*	630*	Drilled Shafts / Spread Footings	15 TSF
TR-28	Forward Abutment	649*	640*	Drilled Shafts / Spread Footings	15 TSF

* Elevations are approximated from topographic surveys and provided plan and profile drawings. Preliminary boring locations and elevations vary from the currently proposed abutment locations.

No grain size analyses were performed for scour analysis since the proposed structure location is not located along a stream location.

Closing

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

Sincerely,

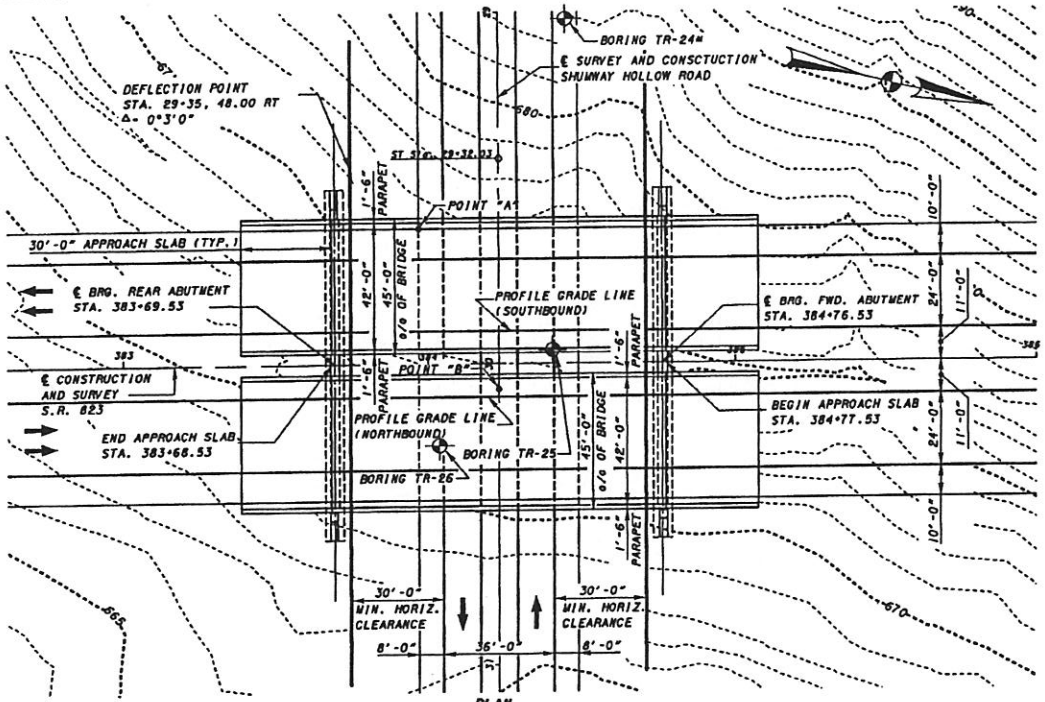
DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

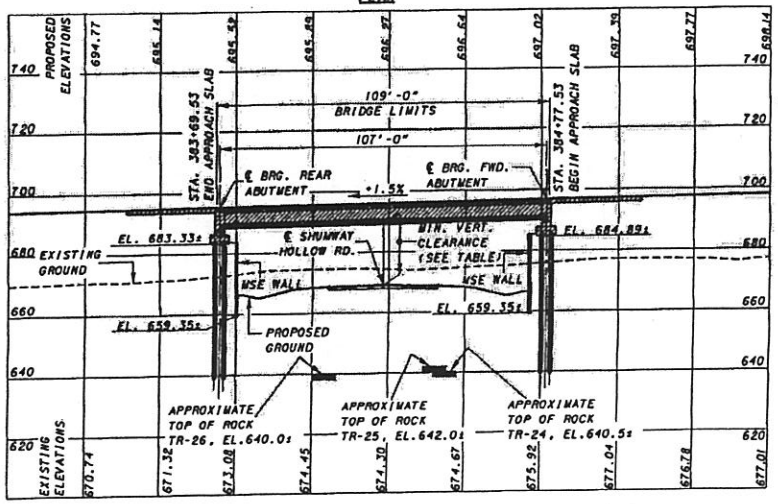
Arthur (Pete) Nix, P.E.
Senior Geotechnical Engineer

Attachments: Site Plan (2)
General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Boring Logs TR-24, TR-25, TR-26, TR-27, TR-28

cc: File



PLAN



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

℄ DENOTES BORING LOCATION

* BORING TR-24 NOT SHOWN TO SCALE

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

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-24	28+52.92	20.23' LT.
TR-25	29+95.64	17.40' LT.
TR-26	30+26.84	19.37 RT.

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

TRAFFIC DATA
SHUWAY HOLLLOW
CURRENT YEAR ADT (2010) = 3,800
CURRENT YEAR ADTT (2030) = 7,800
DESIGN YEAR ADT (2010) =228
DESIGN YEAR ADTT (2030) = 468

PROPOSED STRUCTURE
TYPE: SINGLE SPAN, 72" TYPE 4 (MOD.) PRESTRESSED CONCRETE I-BEAM WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY SEMI-INTEGRAL ABUTMENTS FOUNDED ON PILES AND MSE WALL EMBANKMENTS
SPANS: 107'-0" c/c BEARINGS
ROADWAY: 42' TOE TO TOE OF PARAPETS
LOADING: HS-25 AND ALTERTNATE MILITARY LOADING FWS=60 PSF
SKEW: NONE
CROWN: 0.016 FT/FT
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-81 (30' LONG)
LATITUDE:
LONGITUDE:

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	19.34'	20.42'
REQUIRED	17.0'	17.0'

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.
2. EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 PILES AND HAVE A MAXIMUM CAPACITY OF 90 TONS PER PILE.

ACTIVE RECENT TRANSYSTEMS CORPORATION

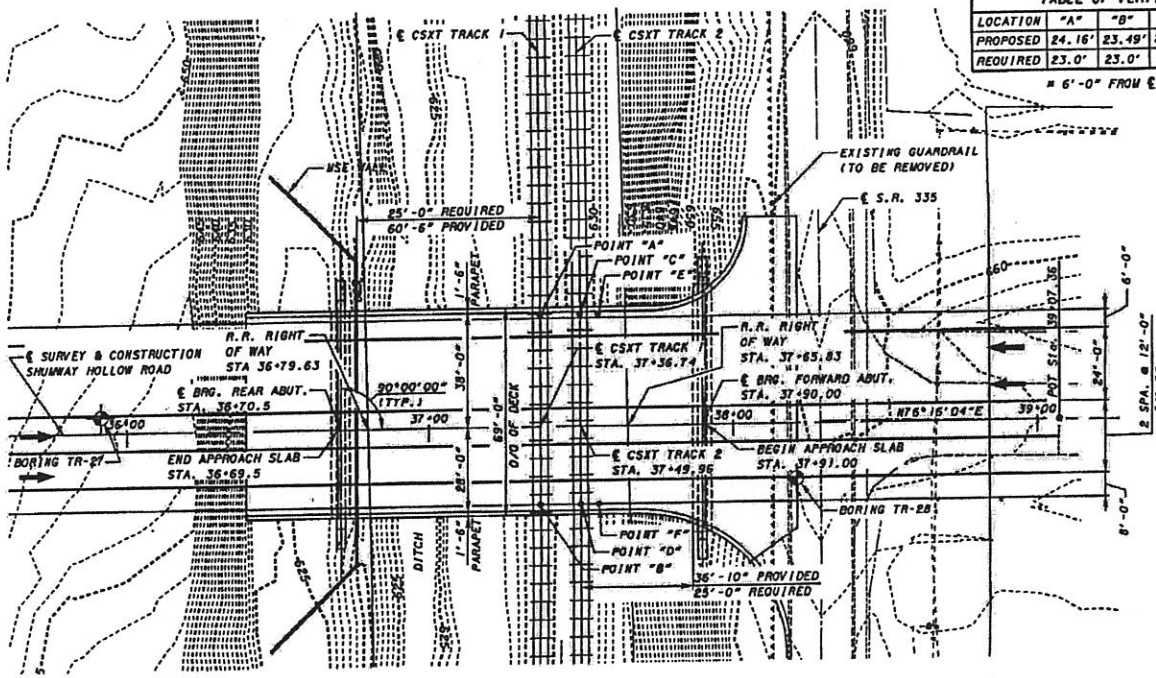
DRAWN CAS DATE 4/19/06
REVISED JRC STRUCTURE FILE NUMBER
REVISED PJP CHECKED
REVISED

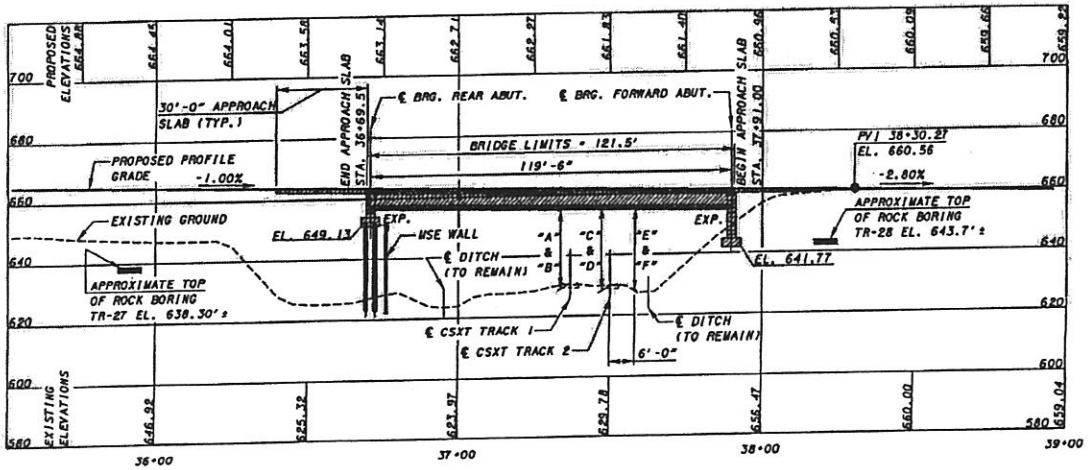
SCIOTO COUNTY
STA. 383+65.53
STA. 384+77.43

PRELIMINARY SITE PLAN -ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SHUWAY HOLLOW ROAD

SCI-823-0.00
PID 19415

1





ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION SHUMWAY HOLLOW ROAD

TABLE OF VERTICAL CLEARANCES						
LOCATION	"A"	"B"	"C"	"D"	"E"*	"F"*
PROPOSED	24.16'	23.49'	24.31'	23.52'	25.58'	24.91'
REQUIRED	23.0'	23.0'	23.0'	23.0'	23.0'	23.0'

* 6'-0" FROM ℄ CSXT TRACK 2

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-27	35+91.27	5.31' LT.
TR-28	38+20.74	18.43' RT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) = 3,800
DESIGN YEAR ADT (2030) = 7,600
CURRENT YEAR ADTT (2010) = 228
DESIGN YEAR ADTT (2030) = 468

PROPOSED STRUCTURE

TYPE: SINGLE SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURE UNITS AND A MSE WALL SUPPORTED EMBANKMENT.

SPANS: 119'-6" C/C BEARINGS

ROADWAY: 66'-0" TOE TO TOE OF PARAPETS

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS = 60 PSI

SKEW: NONE

CROWN: NORMAL 0.016 FT./FT.

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (30'-0" 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 14x93, 90 TON CAPACITY AT REAR ABUTMENT. THE FORWARD ABUTMENT SHALL BE ON A SPREAD FOOTING

UTILITIES:
UTILITIES DISPOSITION WILL BE ADDRESSED DURING THE TS&L SUBMITTAL

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

SCIOTO COUNTY
STA. 36+69.50
STA. 37+91.00

SCI-823-0.00
PID 19415

TRANSYSTEMS CORPORATION

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

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

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

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

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

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

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

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

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

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

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

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

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

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

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

9. Soil Description

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

   Granular Soils – Compactness

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

   Cohesive Soils – Consistency

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

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

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

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

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

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

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

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

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

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

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

10. Rock Hardness and Rock Quality Designation

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

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

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

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

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

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

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-24 | Location: | Date Drilled: 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION
0	686.2						
1.0	685.2	6 10 13	18	1		4.5+	Topsoil - 12" Hard brown SILT AND CLAY (A-6a), little fine to coarse sand; damp.
		13 10 10	18	2		4.5+	
5							
6.0	680.2	3 3 8	12	3		2.75	Stiff to very stiff brown CLAY (A-7-6), little fine to coarse sand, little silt; varved; moist.
		2 3 5	18	4		2.0	
10							
		2 2 3	18	5		2.0	
		2 4 5	18	6		2.25	
15							
		2 3 4	18	7		1.25	
		1 3 4	18	8		3.75	
20							
		2 3 3	18	9		1.0	
		3 4 5	18	10		1.5	
25							
27.0	659.2	4 3 12	18	11		1.75	Medium dense brown FINE SAND (A-3), trace gravel; damp.
		5 5 5	18	12			
30							

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

FILE: 0121-3070-03 [4/26/2006 10:27 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-24 | Location: | Date Drilled: 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8' (Includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) / Natural Moisture Content, % / PL / LL / Blows per foot
30	656.2						Medium dense brown FINE SAND (A-3), trace gravel; damp.							
34.0	652.2	4 2 2	18	13		0.5	Soft gray SILTY CLAY (A-6b), little fine to coarse sand, trace gravel; moist.							
37.0	649.2						Severely weathered gray SANDSTONE argillaceous. DRAFT							
40		10 17 22	18	14			@ 43.0', augers encountered difficult drilling.							
43.5	642.7						Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, moderately to highly fractured. @ 44.8' to 44.9',45.2',45.4',47.0' contains argillaceous laminations and fractures. @ 47.0', slightly weathered, unfractured to slightly fractured.							
45														
50		Core 120"	Rec 118"	RQD 77%	R-1									
53.5	632.7						Bottom of Boring - 53.5'							
55														
60														

STANDARD PENETRATION (N): Natural Moisture Content, % - ● PL ⊢—⊣ LL; Blows per foot - ○ (10, 20, 30, 40)

FILE: 0121-3070-03 [4/25/2006 10:27 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-25 | Location: | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0', 21.0'
Water level at completion: 16.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	674.6	4 7 6	18	1		4.0	Hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.						
		6 8 9	18	2		4.5		4	6	--	13	37	40
5													
5.5	669.1	2 3 5	18	3		2.0	Stiff to very stiff brown CLAY (A-7-6), trace fine sand; varved; damp to moist.	0	0	--	1	11	88
		2 3 5	18	4		1.25							
10		2 4 4	18	5		1.75							
		3 3 5	18	6		2.5							
15		2 3 5	18	7		2.25							
18.0	656.6						Loose brown FINE SAND (A-3), trace silt; damp.						
		4 3 4	18	8									
20							@ 21.0', moist to wet.						
		1 1 3	18	9									
		9 11 12	18	10									
25													
		7 3 7	18	11									
28.0	646.6						Dense brown GRAVEL WITH SAND (A-1-b); contains sandstone fragments; moist.						
30		2 14 16	18	12									

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

66

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-25 | Location: | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0', 21.0'
Water level at completion: 16.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION
30.0	644.6						
	644.6						Severely weathered brown and gray SANDSTONE.
		27 50/5	6	13			
32.0	642.6						Hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, micaceous, argillaceous, massively bedded, slightly fractured. @ 32.0' to 37.0', highly fractured.
		Core 48"	Rec 46"	RQD 42%	R-1		
35							
		Core 72"	Rec 72"	RQD 90%	R-2		
40							
42.0	632.6						Bottom of Boring - 42.0'
45							
50							
55							
60							

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
50+

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-26 | Location: | Date Drilled: 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'
Water level at completion: 8.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	665.2												
1.0	664.2	5 5 8	18	1		4.5	Topsoil - 12" Hard brown CLAY (A-7-6), some to "and" fine to coarse sand; damp to moist.						
5		8 9 11	18	2		4.5+		0	2	–	38	12	48
5.5	659.7	7 7 8	18	3			Loose to medium dense orangish brown COARSE AND FINE SAND (A-3a), little silt; damp to moist.	0	0	–	81	19	
10		4 9 7	18	4									
		3 4 6	18	5									
15		4 5 10	18	6									
		5 4 3	18	7			@ 16.0', wet.						
20		2 3 4	18	8									
20.5	644.7	4 8 13	18	9			Medium dense gray GRAVEL WITH SAND (A-1-b); contains sandstone fragments; moist.						
23.0	642.2						@ 23.0' to 25.5', moderately fractured. Hard gray SANDSTONE; very fine to fine grained, argillaceous, micaceous, slightly to moderately weathered, massively bedded, slightly fractured. @ 23.1', 23.5', thin clay seams.						
25		Core 120"	Rec 111"	RQD 73%	R-1								
30													

GRADATION

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

Non-Plastic

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-26

Location:

Date Drilled: 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'
Water level at completion: 8.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION
30.0	635.2						
	635.2						Hard gray SANDSTONE; very fine to fine grained, argillaceous, micaceous, slightly to moderately weathered, massively bedded, slightly fractured.
33.0	632.2						Bottom of Boring - 33.0'

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-27 | Location: Approx. Sta. 36+00, 5 ft Lt. of Reloc. Shumway Hollow | Date Drilled: 8/25/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (boring collapsed @ 6.0')

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION
0	646.3						
		7 10 13	18	1		4.5+	Hard brown SANDY SILT (A-4a), trace clay, trace to little gravel; damp.
		8 13 13	18	2		4.5+	
5							
		4 10 50	16	3		4.5+	@ 6.0' to 7.5', contains sandstone fragments.
7.5	638.8						Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, slightly to highly weathered, argillaceous, micaceous, massively bedded, slightly fractured.
10		Core 120"	Rec 120"	RQD 98%	R-1		@ 7.5' to 10.0', rust stained. @ 7.8',8.9' and 15.6', low angle fractures.
15							@ 14.9' to 15.2', high angle fractures.
17.5	628.8						Bottom of Boring - 17.5'
20							
25							
30							

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
60 →

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-28 | Location: Approx. Sta. 38+20, 20 ft Rt. of Reloc. Shumway Hollow | Date Drilled: 02-02-05

WATER OBSERVATIONS: Water seepage at: 14.0', 18.5'
Water level at completion: 10.0' (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)
0	659.7													Natural Moisture Content, % - ● PL ⊢—⊣ LL; Blows per foot - ○ (10, 20, 30, 40)
0.7	659.0	4 8 8	16	1		4.0	Asphalt Concrete Pavement - 8" Very stiff to hard brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp.							
3.0	656.7	5 5 7	15	2			Medium dense reddish brown COARSE AND FINE SAND (A-3a); (residual soil); moist.							
5		8 8 7	18	3										
		6 4 2	18	4										
10		3 5 4	14	5										
		1 4 4	13	6										
15														
15.5	644.2	50/2	2	7			Severely weathered gray SANDSTONE argillaceous. @ 18.5' to 24.0', broken.							50/2"
18.5	641.2													
20		Core 60"	Rec 30"	RQD 12%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, massively bedded, slightly fractured.							
25		Core 84"	Rec 84"	RQD 100%	R-2									
30														

DRAFT

FILE: 0121-3070-03 [4/26/2006 10:27 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-28 | Location: Approx. Sta. 38+20, 20 ft Rt. of Reloc. Shumway Hollow | Date Drilled: 02-02-05

WATER OBSERVATIONS: Water seepage at: 14.0', 18.5'
Water level at completion: 10.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ 10 20 30 40
30	629.7													
30.5	629.2						Bottom of Boring - 30.5'							

DRAFT

35 40 45 50 55 60

FILE: 0121-3070-03 [4/26/2006 10:27 AM]

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

April 24, 2006

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

Re: **Preliminary MSE Wall Evaluations**
Relocated Shumway Hollow Road over CSXT Railroad
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0010

Dear Mr. Weeks:

This letter includes the findings of a preliminary evaluation of mechanically stabilized earth (MSE) retaining walls on the above-referenced project. The findings included in this letter pertain only to the MSE walls at the bridge of relocated Shumway Hollow Road over CSXT Railroad. The findings of other preliminary MSE wall evaluations will be submitted in separate documents.

It is understood that MSE walls are proposed for Sta. 36+76 (rear abutment) and Sta. 37+75 (forward abutment). Based upon the proposed grade for Shumway Hollow, which was received in April 2006, this places the rear abutment wall within the valley cut for the CSXT railroad alignment and the forward abutment wall on the slope to the east and above the railroad. The base of the railroad cut lies approximately 20 feet below the existing grade to the west and approximately 30 feet below the existing grade to the east. Sandstone bedrock is exposed on the sides of the cut.

Because the proposed location of the forward abutment MSE wall is on an existing slope where bedrock is exposed, it is likely that considerable rock excavation will need to be performed to provide space for the reinforced fill. Based on this information and conversations with TranSystems personnel, it was concluded that an MSE wall would probably not be used at the forward abutment and no additional analysis was performed at this location.

A previous analysis for MSE walls was performed for this bridge in November 2005. The conditions assumed for the current analysis were essentially the same as the previous analysis, except that the height of the wall differed by a few feet. For the current analysis, it was assumed that 40 feet of fill would need to be placed for the MSE wall at the rear abutment, based on the proposed grade, and the top of the leveling pad was at elevation 622, which included a 3.0-foot embedment below existing grade. The length of the reinforcing was assumed to be 28 feet (0.7 times the wall height). The profile assumed for the analysis was based upon the findings of a preliminary structural boring, TR-27, which was drilled approximately 20 feet above the grade of the railroad and 75 feet west of the proposed wall location. An additional boring, TR-28, was also drilled near the bridge location. Logs of both borings are attached. Although no boring information at the MSE wall

location was available for the analysis, it was assumed that the amount of soil would be minimal, since bedrock is exposed in the cut adjacent to the wall location. Consequently, it was assumed there was a 7.5-foot thick soil layer at the wall location, the same as encountered in Boring TR-27. The soil type and thickness needs to be confirmed with an additional soil boring prior to performing the final wall analysis.

A global stability analysis was performed on the MSE wall at the rear abutment using the above assumptions. The analysis resulted in a critical factor of safety of 1.6, which is considered stable. The wall was not analyzed for bearing capacity, sliding, or settlement.

In order to complete the analysis for the MSE wall at this bridge, it is recommended that an additional soil boring to confirm the soil thickness be drilled at the location of the rear abutment after the bridge type is approved. It should be noted that this additional boring is also needed to provide information to finalize the bridge foundation recommendations. Another soil boring may be needed at the forward abutment, as well.

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.

Dorothy A. Adams

Dorothy A. Adams, P.E.
Geotechnical Engineer

Art E Nix

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

Attachments: Borings Logs for B-27 and B-28

cc: J. Cox, file

M:\proj\0121\3070.03\Stability Analyses\Documents\MSE Wall letters\07 Shumway Hollow Road\MSE Wall Findings - Shumway Hollow CSX Prelim 04-24-06.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-27 | Location: Approx. Sta. 36+00, 5 ft Lt. of Reloc. Shumway Hollow | Date Drilled: 8/25/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (boring collapsed @ 6.0')

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION
0	646.3						
		7 10 13	18	1		4.5+	Hard brown SANDY SILT (A-4a), trace clay, trace to little gravel; damp.
		8 13 13	18	2		4.5+	
5							
		4 10 50	16	3		4.5+	@ 6.0' to 7.5', contains sandstone fragments.
7.5	638.8						
		Core 120"	Rec 120"	RQD 98%	R-1		Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, slightly to highly weathered, argillaceous, micaceous, massively bedded, slightly fractured.
10							@ 7.5' to 10.0', rust stained.
							@ 7.8',8.9' and 15.6', low angle fractures.
15							@ 14.9' to 15.2', high angle fractures.
17.5	628.8						Bottom of Boring - 17.5'
20							
25							
30							

GRADATION: % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
60

FILE: 0121-3070-03 [4/24/2006 3:12 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-28 | Location: Approx. Sta. 38+20, 20 ft Rt. of Reloc. Shumway Hollow | Date Drilled: 02-02-05

WATER OBSERVATIONS: Water seepage at: 14.0', 18.5'
Water level at completion: 10.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION
0	659.7						
0.7	659.0						Asphalt Concrete Pavement - 8"
		4 8 8	16	1		4.0	Very stiff to hard brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp.
3.0	656.7						
		5 5 7	15	2			Medium dense reddish brown COARSE AND FINE SAND (A-3a); (residual soil); moist.
5		8 8 7	18	3			
		6 4 2	18	4			
10		3 5 4	14	5			
		1 4 4	13	6			
15							
15.5	644.2	50/2	2	7			Severely weathered gray SANDSTONE argillaceous.
							@ 18.5' to 24.0', broken.
18.5	641.2						
20		Core 60"	Rec 30"	RQD 12%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, massively bedded, slightly fractured.
25		Core 84"	Rec 84"	RQD 100%	R-2		
30							

GRADATION

% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
50+

FILE: 0121-3070-03 [4/24/2006 3:12 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-28 | Location: Approx. Sta. 38+20, 20 ft Rt. of Reloc. Shumway Hollow | Date Drilled: 02-02-05

WATER OBSERVATIONS: Water seepage at: 14.0', 18.5'
Water level at completion: 10.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	629.7													
30.5	629.2						Bottom of Boring - 30.5'							

35 40 45 50 55 60

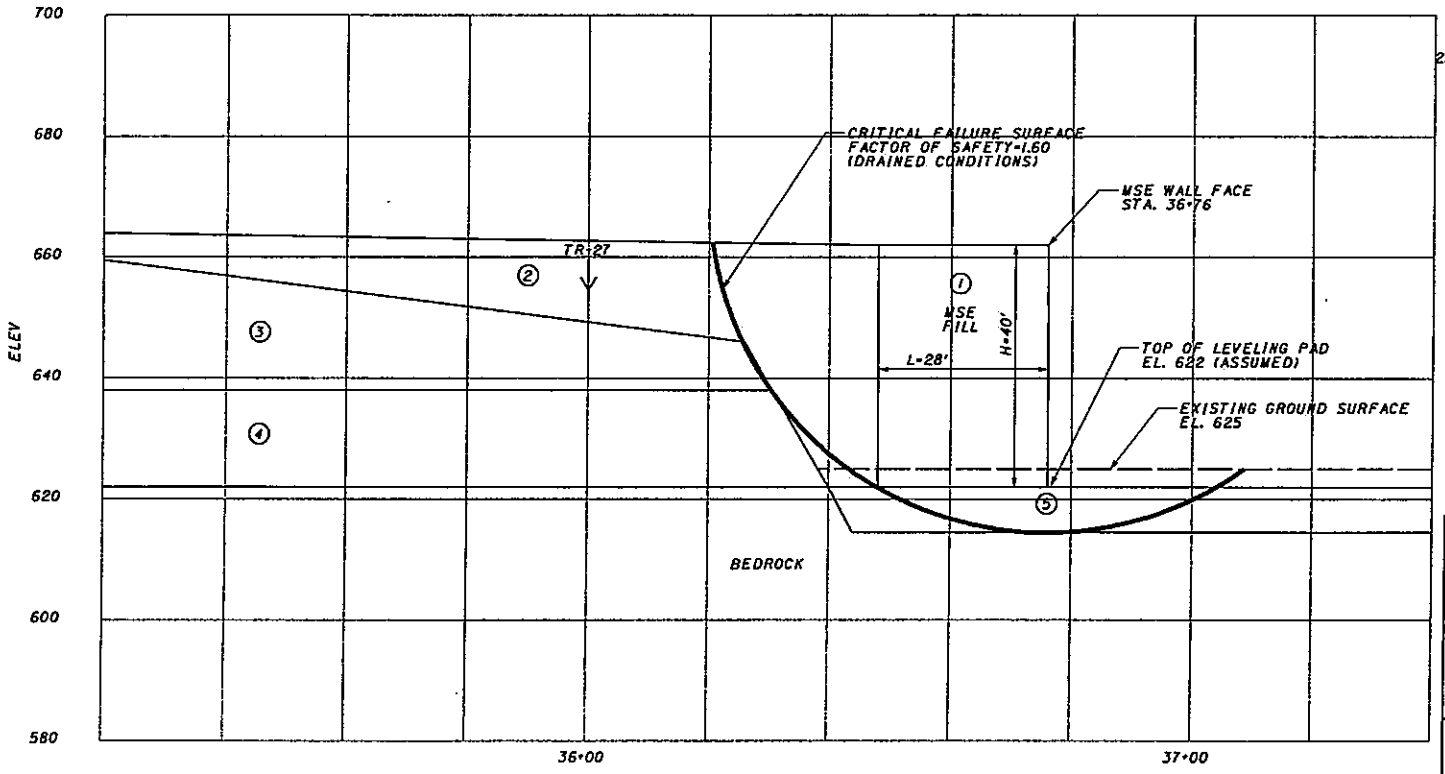
FILE: 0121-3070-03 [4/24/2006 3:12 PM]

MATERIAL PROPERTIES					
MATERIAL	UNIT WEIGHT (pcf)	SHEAR STRENGHT			
		UNDRAINED		DRAINED	
		c	ϕ	c'	ϕ'
1. MSE FILL	120	0	34	0	34
2. BACKFILL	120	0	30	0	30
3. EXISTING EMBANKMENT	120	4000	0	0	32
4. ROCK FACE	120	0	36	0	36
5. FOUNDATION SILTY CLAY	125	2000	0	0	30

NOTES:

1. PROPERTIES OF FOUNDATION SILTY CLAY ARE ASSUMED BASED ON TYPICAL VALUES. MATERIAL PROPERTIES AND LAYER THICKNESS NEED TO BE CONFIRMED BY ADDITIONAL BORINGS.

2. RAILROAD AND FORWARD ABUTMENT AREA NOT SHOWN FOR CLARITY.



DLZ

RELOCATED SHUMWAY HOLLOW
OVER CSX
REAR ABUTMENT
PROFILE BASED ON BORING TR-27

MSE WALL STABILITY ANALYSIS
SCI-823-0.00

PROJ. NO. 0121-3070.03	CALC: DAA	DATE: 4/24/06

CN-Michael Lenett

From: Dorothy Adams [dadams@dlzcorp.com]
Sent: Wednesday, April 26, 2006 3:28 PM
To: CN-Michael Lenett; CN-Jon Cox
Cc: Steve Riedy; Pete Nix
Subject: MSE Walls at Shumway Hollow over CSXT Railroad, Project SCI-823-0.00

Mike and Jon,

It is understood from conversations with Steve Reidy that you had some questions about the feasibility of an MSE wall at the forward abutment of the Relocated Shumway Hollow Bridge over CSXT Railroad. As mentioned in the preliminary report submitted on April 24, 2006 for the MSE walls at this location, an MSE wall at the forward abutment would likely be bearing on bedrock. Based on the information from the borings we have drilled (TR-27 and TR-28) and visual observation of the cut slopes adjacent to the bridge site, the bedrock at the bearing elevation is a hard sandstone. With such a competent material, the global stability, bearing capacity, sliding, and settlement analysis results of the MSE fill on this bedrock are expected to be much greater that the minimum required factors of safety. Consequently, we feel that no further analysis is needed for an MSE wall bearing on bedrock.

To estimate the amount of rock excavation required, you should plan on a reinforcing strap length of 0.7 times the wall height plus allow an additional 5 to 10 feet of room around all sides for construction equipment. In addition, an access ramp will likely need to be excavated because there probably will not be room to build an access ramp at the open side of the excavation adjacent to the railroad.

We are working on an exhibit for the stability analysis at the rear abutment and will forward it to you as soon as it is ready, probably tomorrow morning.

Please call if you have any questions or need additional information.

Dorothy Adams, P.E.
Geotechnical Engineer
DLZ Ohio, Inc.
(614) 888-0040
(614) 888-6415