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

JULY 15, 2005

Prepared by:

TRANSYSTEMS CORPORATION

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BRIDGE TYPE STUDY NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of new overpass structure that will carry the proposed relocated Shumway Hollow Road over S.R. 823 and CSXT Railroad at the proposed Airport Interchange. As requested by the Scope of Services, a Bridge 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.

2. Design Criteria

The proposed structure will be 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 and 1998 CSXT Criteria for Overhead Structures.

3. Subsurface Conditions and Foundation Recommendation

DLZ Ohio, Inc. performed the subsurface exploration for the proposed bridge and prepared the Preliminary Bridge Foundation Recommendations. It is included in Appendix E.

In summary, two test borings (TR-27 and TR-28) were drilled and all of them encountered sandstone bedrock between 7.5 and 16.0 feet below the existing ground surface, respectively. Underlying the surface the borings encountered hard silt till bedrock was encountered. For description of the material encountered, refer to the subsurface investigation report.

Based on the alternatives considered for this study, and due to the embankment fill, it is recommended that the abutment footings be founded on spread footings or drilled shafts

Due to the structure long span, the abutments and piers were assumed for alternative 1 & 2 to be supported on HP14x73 piles with a maximum design load of 90 tons for the rear abutment, and drilled shafts for the forward abutment. It may be necessary to sleeve the H-piles through the approach embankment in order to reduce the down-drag forces on the piles. Since the piles will be driven to refusal onto hard bedrock, steel points, if necessary, will be used according to Section 202.2.3.2.a of the ODOT Bridge Design Manual.

4. Roadway

The purpose of this project is to construct a new bypass state route around the town of Portsmouth Ohio. The proposed alignment will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with US 52 just east of the town to another interchange with US 23 north of the town in Valley Township. Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives considered. The proposed relocated Shumway Hollow alignment at the interchanges has been investigated as part of the alignment alternatives during the preliminary phases. The alignment shown here is part of the preferred alternative that was agreed to and being forwarded to preliminary engineering. The proposed Shumway Hollow Road Bridge will consist of a 3 -12'-0" lane with a 6'-0" outside shoulders. The bridge deck will be 48'-0" toe to toe of parapet.

Vertical and Horizontal Design - Since this structure's vertical alignment is dictated by the overall vertical design of the new bypass profile, the intersection of the relocated Shumway Hollow Road with SR 335, and the vertical clearance over CSXT railroad tracks, clearance was considered to be critical at this structure location. More than 23'-0" of the required vertical clearance could be provided for all the alternatives considered for this study. In accordance with the CSXT Criteria, a 25'-0" minimum horizontal clearance will need to be maintained underneath the structure. The abutments for the recommended alternative were located to provide that minimum horizontal clearance and to clear the existing ditches that run parallel to the tracks, therefore avoiding any construction work along the 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 - While the new bridge is under construction, rail traffic will be maintained on the tracks. 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 structure and is along a vertical curve and -3.35 % sloping grade. This grade is transitioned into a graphic grade, in order to meet the existing SR 335 profile. The horizontal and vertical geometry for all alternatives considered are the same.

Structure: As per the Scope of Services, we investigated several bridge types and alternates as part of the type study.

As required by the Bridge Design Manual, a single-span bridge with MSE walls at the rear abutment with semi-integral type abutments with 2:1 slope was considered for this site.
In summary, two alternatives have been evaluated in this Structure Type Study, and are designated as Alternative 1 and 2. The appropriate structure types that were considered are outlined in the Structure Type Alternative Table:

STRUCTURE TYPE ALTERNATIVE TABLE		
Structure Type Alternative	**1**	**2**
Superstructure Type Description	1 Span Continuous Steel Girders A709 Grade 50W	1 span Continuous 72" AASHTO P/S Beams
Proposed Beam Spacing	5 Spaces @ 9'-0"	7 Spaces @ 6'-6"
No. of Spans	1	1
Abutment Type	Semi- Integral Type abutments with MSE walls at the rear abutment and spill-through slopes at the forward abutment	Semi- Integral Type abutments with MSE walls at the rear abutment and spill-through slopes at the forward abutment
No. of Piers	none	none
Pier Type	N/A	N/A
Substructure Orientation	00°00'00"	00°00'00"
Approximate Bridge Length	130'	130'
<u>Approximate Structure Depth</u> **Slab** **Haunch** **Girder** **Total**	 8.50" 2" 56" 66..5"(5.54')	 8.50" 2" 72" 82.5"(6.88')

Alternative Discussion:

Alternative 1

Span configuration: Various span configurations were investigated and they were refined to the 1-span layout configuration. Horizontal Clearance requirements dictated the types of the bridges that could be studied. Alternative 1 consists of a long, simple span bridge with Semi-Integral type abutments located outside the horizontal clearances and along a 2:1 embankment slope at the forward abutment. The bridge overall length is 130' from centerline of bearing to centerline of bearing.

Substructure: The abutments were both located parallel to the track alignment beneath the structure.

I. *Abutments:* The abutments will be a semi-integral type abutment founded on HP 14X73 piles at the rear abutment and MSE walls. The piles will be driven to bedrock. Straight type wingwall will also be provided at the rear abutment. The details of the abutments will follow ODOT Standard Construction drawings. The forward abutment will be supported on drilled shafts along the existing 1:1 slope.

Since the design clearances satisfy and/or exceed the design requirements set forth by ODOT and CSX, crashwalls are needed for the structure substructure units.

II. *Piers:* None.

Superstructure: The preliminary design of this alternative indicates that 6 - continuous steel 52" Web Plate Girder spaced at 9'-0"would be required for each structure to accommodate the HS25 design loading requirements. Each bridge width is 48'-0" from toe to toe of parapets with an overall bridge deck width of 51'-0.

Alternative 2

Span configuration: In order to provide an alternative to the steel superstructure, Alternative 2 was studied. This alternative has a similar horizontal layout as Alternative 1, except that the bridge superstructure will consist of prestressed concrete beams. The bridge overall length is 130' from centerline of bearing to centerline of bearing.

Substructure: This alternative is comprised of single span. The abutments were located parallel to the existing tracks alignment.

i. *Abutments:* The abutments will be a semi-integral type abutment founded on H-piles at the rear abutment and MSE walls. The piles will be driven to bedrock. Straight type wingwall will also be provided at the rear abutment. The details of the abutments will follow ODOT Standard Construction drawings. The forward abutment will be supported on spread footings.

II. *Piers:* None.

Superstructure: The preliminary design of this alternative indicates that 8 - continuous 72" Modified AASHTO type 4 prestressed concrete beams spaced at 6'-6"would be required for the structure to accommodate the HS25 design loading requirements. The bridge width is 48'-0" from toe to toe of parapets with an overall bridge deck width of 51'-0.

6. Preliminary Probable Bridge Construction Cost:

A preliminary probable bridge construction cost has been prepared for Alternatives 1, and 2 (See Appendix A). The unit prices were based on ODOT's Summary of Contracts Awarded Year 2004 inflated 3.5% each year to the 2008 sale date. This estimate will be used as a comparison between alternatives and as a guide to select the most economical structure.

7. Summary:

A Summary of Alternatives and Recommendation Table have been provided to facilitate review of the costs for the Structure Alternatives Types investigated:

SUMMARY OF ALTERNATIVES AND RECOMMENDATIONS				
STRUCTURE TYPE ALTERNATIVE	**STRUCTURE TYPE**	**PROBABLE BRIDGE CONST. COST**	**RATING**	**ADVANTAGES/ DISADVANTAGES**
1	1-span continuous 52" steel Girders, A709 Grade 50W with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments on piles and spread footings	**Structure Cost: $1,480,000 Additional Life Cycle Cost: $310,000 Total Relative Ownership Cost: $1,790,000**	2	***Advantages:*** • This alternative present an alternative to the recommended alternatives and has a lower Total relative ownership cost. • Could provide lighter and smaller girder sections, if site delivery becomes an issue. ***Disadvantages:*** • More costly for initial structure cost.
2	1-span continuous 72" Modified AASHTO type 4 Prestressed Beams with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments on piles and spread footings	**Structure Cost: $1,460,000 Additional Life Cycle Cost: $352,000 Total Relative Ownership Cost: $1,812,000**	1	***Advantages:*** • This alternative has the most economical structure cost. • Aesthetically will be similar to the structure over SR 823. ***Disadvantages:*** • Site Delivery could be an issue. • Has slightly higher Life Cycle Cost

8. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 2 (2- Span, 72" Modified AASHTO Type 4 Prestressed Beams with semi-Integral type abutments)** for the Bridge. (See Appendix B for the Site Plan and Structure Details).

Our recommendation for Alternative 2 is based on the following items:

- This Alternative appears to be the most economical structure for this site.

APPENDIX A

TRANSYSTEMS CORPORATION

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SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY

By: NFF
Checked: ELK

Date: 7/5/2005
Date: 7/7/2005

ALTERNATIVE COST SUMMARY

Alternative No.	Span Arrangement		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
	No. Spans	Lengths								
1	1	130.0'	130.00	6~ Welded Plate Girders	52" Web PG Grade 50W	$550,000	$514,000	$170,200	$246,800	$1,480,000
2	1	130.0'	130.00	8 ~ P/S Concrete Beams	72" P/S AASHTO Modified Beam	$539,000	$511,000	$168,000	$243,600	$1,460,000

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 is common to all alternatives.

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SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES- SUPERSTRUCTURE

By: NFF
Checked: ELK

Date: 7/2/2005
Date: 7/7/2005

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
1	1	130.0'	130	137	245	$148,700	$61,500	$46,800	6~ Welded Plate Girders	52" Web PG Grade 50W	213,000	$293,300	$550,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	2	4.26	8.52
Split Median Barriers	0	4.52	0.00

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Alt. 1	0.71	51.00	36.2	3.6	48.4
		33.00	0.0	0.0	8.5

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 =			$606.00

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 2007
Deck Reinforcing	$0.77	3.5%	$0.88

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2004	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%	$1.20	Straight Girders
level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.38	Curved Girders

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft.
Area = 142 sq. yd.
Width = 51 ft

ALT 2
Length = 25 ft.
Area = 0 sq. yd.
Width = 0 ft

	Year 2004	Annual Escalation	Year 2007
Approach Slabs	$144.00	3.5%	$165.00

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

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

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SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE
STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES -SUBSTRUCTURE

By: NFF
Checked: ELK

Date: 7/5/2005
Date: 7/7/2005

SUBSTRUCTURE -HP PILE ALTERNATIVE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Abutment & Wingwall Cost	Temporary Shoring Cost	Temporay Girder Support Cost	Subtotal Substructure Cost
1	1	130.0'	6~ Welded Plate Girders	52" Web PG Grade 50W	$0	$0	$81,300	$13,300	$16,000	$402,900	$0	$0	$514,000

COST SUPPORT CALCULATIONS

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

Component	Alt 1 Volume (cu. yd.)	Alt 2 Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost	Alt 2 Total Cost
Cap	0	0	$421.00	3.5%	$483.00	$0	$0
Columns	0	0	$421.00	3.5%	$483.00	$0	$0
Footings	0	0	$421.00	3.5%	$483.00	$0	$0
Total Cost						$0	$0

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	153	$421.00	3.5%	$483.00	$73,900
Wingwalls	15	$421.00	3.5%	$483.00	$7,400

Alternate 2

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

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

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

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

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1	6,498	$54.00	3.5%	$62.00
Alt. 2	0			

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

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

	Number of Piles		Total Pile Length	HP/Drilled Shaft Option Length	no. of HP
Alt. 1	14	SEE QUANTITIES CALCULATION	476	476	14
Alt. 2	0	SEE QUANTITIES CALCULATION	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 QUANTITIES CALCULATION	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$200.00	4.5%	$239.00

Cost of Shafts: $ -

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

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 1	0	$ -
Alt. 2	0	$ -

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

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SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES - QUANTITY CALCULATIONS

By: NFF
Checked: ELK

Date: 7/2/2005
Date: 7/7/2005

Pier Quantities Alternate 1 (HP-Piles Type Foundation)

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

Pile Quantities Alternate 1

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.	210	6	1260	330	140	11	1.3	*14*	652.3	620.0	34.0	*476*
Pier 1	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 2	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 3	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 7	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Fwd. Abut.	210	6	1260	290	210	0	1.1	*0*	647.25	634	15.0	*0*
TotaL								**14**				**476**

Pier Quantities Alternate 2 (HP-Piles Type Foundation)

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

Pile Quantities Alternate 2

Location	Load/girder (Kips)	# Girders	Total Load (Kips)	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	1.25	*0*	560.5	538.5	35.0	*0*
Pier 1	0	0	0	0	140	0	1.25	*0*	545.5	533	15.0	*0*
Pier 2	0	0	0	0	140	0	1.25	*0*	545.5	533	15.0	*0*
Pier 3	0	0	0	0	140	0	1.25	*0*	545.5	533	15.0	*0*
Pier 4	0	0	0	0	140	0	1.25	*0*	545.5	533	15.0	*0*
Pier 5	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	140	0	1.25	*0*	0	0	2.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1.25	*0*	567	534	35.0	*0*
TotaL								**0**				**0**

Abutment Quantities -Alternate 1

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*		*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Rear Abut	51	3	5.875	17.63	899	3	2.5	7.50		383	6	3	18	1	918	2199
Fwd. Abut	51	3	5.875	17.63	899	3	2.75	8.25		421	4	3	12	1	612	1932
Total (Cu.Ft.)					**1798**					**803**					**1530**	**4131**
Total (Cu.Yd.)					**67**					**30**					**57**	**153**

Superstructure Steel Quantities - Alt 1

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	273	6	130	213000
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				213000

total steel weight per girder (lb.) = 35500
Total Span length (ft.)= 130.00
Weight Per ft. = 273

Superstructure Steel Quantities - Alt 2

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	0	0	0	0
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
Pier Cap	0	0	0	0
TotaL				0

MSE Abutment Wall Quantities -Alt. 1

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		38	171	6498.0	
Fwd. Abut		0	0	0.0	
Total (Sq.Ft.)				**6498**	

Temporary Cofferdams

Location		Wall			
		Height	*Lengt*	*width*	*Area*
Pier 3		0	0	0	0
Pier 4		0	0	0	0
Pier 5		0	0	0	0
Total (Sq.Ft.)					**0**

Expansion Deck Joints - Alt. 1

Abut Location		Special-Modular Joint			
		No. loc	*Length*	*Total*	
Rear Abut		0	0	0	
Fwd. Abut		0	0	0	
Total (Li.Ft.)				**0**	

48" Drilled Shafts Alernative Quantities for Piers in River Alternate 1

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	1.1	*0*	0	0	0.0	*0*
Pier 1	0	0	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Pier 3	0	0	0	0	0	#DIV/0!	1.1	*#DIV/0!*	0	0	2.0	*#DIV/0!*
Pier 4	0	0	0	0	0	#DIV/0!	1.1	*#DIV/0!*	0	0	2.0	*#DIV/0!*
Pier 5	0	0	0	0	0	#DIV/0!	1.1	*#DIV/0!*	0	0	2.0	*#DIV/0!*
Pier 6	0	0	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Pier 7	0	0	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Fwd. Abut.	0	0	0		0	0	1.25	*0*	0	0	0.0	*0*
TotaL								**#DIV/0!**				**#DIV/0!**

Pier Quantities Alternate 1 (HP-Piles/drilled Shaft Type Foundation)

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

SCI-823-0.00 - PORTSMOUTH BYPASS

SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE -SUPERSTRUCTURE

By: NFF
Checked: ELK

Date: 7/5/2005
Date: 7/7/2005

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
2	1	130.0'	130.00	137	245	$144,300	$61,500	$56,100	8 ~ P/S Concrete Beams	72" P/S AASHTO Modified Beam	$277,400	$539,000	0%	$539,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	2	4.26	8.52
Split Median Barriers	0	4.52	0.00

Slab:

T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
0.71	51.00	36.2	3.6	48.4

Note: Deck width IS Southbound+Average of Northbound
10% of deck area allowed for haunches and overhangs.

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

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

Based on parapet and slab percentages of total concrete area

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

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

Prestressed Concrete Girders
Unit Costs:

AASHTO Type IV Beams	Year 2004	Annual Escalation	Year 2008	No. Required	
Type 4 I-Beams	$16,000 ea.	3.5%	$18,360 ea.	0	$0
Pier Diaphragms	$1,800 ea.	3.5%	$2,070 ea.	0	$0
Abutment Diaphragms	$1,200 ea.	3.5%	$1,380 ea.	0	$0
Intermediate Diaphragms	$1,200 ea.	3.5%	$1,380 ea.	28	$38,640
Modified Type 4 I-Beams (72")	$26,000 ea.	3.5%	$29,840 ea.	8	$238,720
				TOTAL =	$277,360

196 $/ft

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

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 51 ft
Area = 170 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 RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE - SUBSTRUCTURE

By: NFF Date: 7/2/2005
Checked: ELK Date: 7/7/2005

SUBSTRUCTURE -HP PILE ALTERNATIVE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Abutment & Wingwall Cost	Subtotal Substructure Cost
2	1	130.0'	8 ~ P/S Concrete Beams	72" P/S AASHTO Modified Beam	$0	$0	$93,300	$15,300	$21,100	$381,700	$511,000

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$421.00	3.5%	$483.00	$0
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	175.7	$421.00	3.5%	$483.00	$84,800
Wingwalls	17.56667	$421.00	3.5%	$483.00	$8,500

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
19	SEE QUANTITIES CALCULATION	627

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

Pile Foundation Unit Cost ($/ft.): 36" DIAMETER Shafts

Number of Piles		Total Pile Length
0	SEE QUANTITIES CALCULATION	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$200.00	4.5%	$239.00

Cost of Shafts: $ -

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

Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
6,156	$54.00	3.5%	$62.00

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

SCI-823-0.00 - PORTSMOUTH BYPASS

SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE - QUANTITY CALCULATIONS

By: NFF
Checked: ELK

Date: 7/2/2005
Date: 7/7/2005

Pier Quantities (HP-Piles Type Foundation)

Pier Location	Length	Cap				Column					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area	# Column	Volume	Width	Depth	Area	# Footing	Volume	
Pier 1	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Pier 2	0	0	0	0.00	0	0	0	0.00		0	0	0	0	0	0	0
Pier 3	0	0	0	0.00	0	0	0	0.00		0	0	0	0	0	0	0
Pier 4	0	0	0	0.00	0	0	0	0.00		0	0	0	0	0	0	0
Pier 5	0	0	0	0.00	0	0	0	0.00		0	0	0	0	0	0	0
Pier 6	0	0	0	0.00	0	0	0	0.00		0	0	0	0	0	0	0
Pier 7	0	0	0	0	0	0	0	0.00		0	0	0	0	0	0	0
Pier 8	0	0	0	0	0	0	0	0.00	0	0	0	0	0	0	0	0
Total (Cu.Ft.)					0					0					0	0
Total (Cu.Yd.)					0					0					0	0

MSE Abutment Wall Quantities

Abut Locat	Wall			
	Height	Length	Area	Volume
Rear Abut	36	171	6156.0	
Fwd. Abut	0	71	0.00	
Total (Sq.Ft.)			6156	

Abutment Quantities

Abut Location	Length	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	51	3	7.875	23.625	1205	3	2.75	8.25		421	6	3	18	1	918	2544
Fwd. Abut	51	3	7.875	23.625	1205	3	2.5	7.50		383	4	3	12	1	612	2199
Total (Cu.Ft.)					2410					803					1530	4743
Total (Cu.Yd.)					89					30					57	176

Superstructure P/S Concrete Quantities

Location	Type of girder	# Girders	Span Length (ft.)	Total Length (ft.)	Spacing Int. diaphragm	No. of Int in span	Number of Int Diap. 1 location	Total No. in Span
Span 1	MOD. AASHTO	8	130	1040	43.33	4	7	28
Span 2	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 3	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 4	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 5	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 6	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 7	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 8	MOD. AASHTO	0	0	0	0.00	3	0	0
Span 9	MOD. AASHTO	0	0	0	0.00	3	0	0
					Total			28
TotaL	MOD. AASHTO	8		1040				

Pile Quantities

Location	Load/ girder	# Girders	Total Girder	Subst Wt	Pile Cap.(Ki	No. Piles	Increa se	Total Piles	Top Elev.	Bot Elev.	Pile Lengt	Total Pile
Rear Abut.	250	8	2000	382	140	17	1.1	19	651.0	620.0	33.0	627
Pier 1	0	8	0	0	140	0	1.25	0	0	0	2.0	0
Pier 2			0	0	140	0	1.25	0			2.0	0
Pier 3			0	0	140	0	1.25	0			2.0	0
Pier 4			0	0	140	0	1.25	0			2.0	0
Pier 5			0	0	140	0	1.25	0			2.0	0
Pier 6			0	0	140	0	1.25	0			2.0	0
Pier 7			0	0	140	0	1.25	0			2.0	0
Pier 8			0	0	140	0	1.25	0			2.0	0
Fwd. Abut.	250	8	2000	330	210	0	1.1	0	646	634	14.0	0
TotaL								19				627

SCI-823-0.00
SHUMWAY HOLLOW ROAD OVER CSX RR - AIRPORT INTERCHANGE
STRUCTURE TYPE STUDY

By: NFF
Checked: ELK

Date: 7/5/2005
Date: 7/7/2005

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Structural Steel Painting: Number of Maintenance Cycles	Structural Steel Painting: Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Superstructure Sealing: Number of Maintenance Cycles	Superstructure Sealing: Total Life Cycle Cost	Approach Pavement Resurfacing: Cost Per Cycle	Approach Pavement Resurfacing: Number of Maintenance Cycles	Approach Pavement Resurfacing: Total Life Cycle Cost
1	1	130.00	6~ Welded Plate Girders	$112,300	0	$0	$0	2	$0	$0	0	$0
2	1	130.00	8 ~ P/S Concrete Beams	$0	2	$0	$23,300	2	$46,600	$0	0	$0
3	0	0.00	0	$0	0	$0	$0	2	$0	$0	7	$0

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Bridge Deck Overlay (5): Deck Demo & Chipping	Bridge Deck Overlay (5): Deck Overlay	Bridge Deck Overlay (5): Deck Joint Gland (2)	Bridge Deck Overlay (5): Number of Maintenance Cycles	Bridge Deck Overlay (5): Total Life Cycle Cost	Bridge Redecking (5): Deck Concrete Cost (3)	Bridge Redecking (5): Deck Reinforcing Cost (3)	Bridge Redecking (5): Deck Joint Cost (2)	Bridge Redecking (5): Deck Removal Cost	Bridge Redecking (5): Number of Maintenance Cycles	Bridge Redecking (5): Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	1	130	6~ Welded Plate Girders	$20,100	$24,400	n/a	1	$44,500	$148,700	$61,500	n/a	$54,900	1	$265,100	$310,000	$1,480,000	$1,790,000
2	1	130	8 ~ P/S Concrete Beams	$20,100	$24,400	n/a	1	$44,500	$144,300	$61,500	n/a	$54,900	1	$260,700	$352,000	$1,460,000	$1,812,000
3	0	0	0	$0	$0	n/a	1	$0	$0	$0	n/a	$0	1	$0	$0	$0	$0

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.1	48	6	130.00	16.00	9,360	20%	11,200
Alt. 2	0	4	0.00	16.00	0	20%	0

Painting Cost per sq. ft.:

	Year 2004	Annual Escalation	Year 2008
Prep.	$5.00	3.5%	$5.74
Prime	$1.25	3.5%	$1.43
Intermed.	$1.25	3.5%	$1.43
Finish	$1.25	3.5%	$1.43
Total			$10.03

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					198.31 in.

36" AASHTO Type 2

	H	V	Diag.	No.	Total
Bot. Flange	18			1	18.00
		6		2	12.00
Lower Fillets	6	6	8.49	2	16.98
Web		15		2	30.00
Upper Fillets	3	3	4.24	2	8.49
Top Flange		6		2	12.00
Total Exposed Perimeter					97.47 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. 2	8	130.00	17,186	10%	2,100
Alt. 4	4	0.00	0	10%	0

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

	Bridge Width	No. Joints
Alt. 1	51.00	0
Alt. 2	51.00	0
Alt. 3	0.00	0
Alt. 4	0.00	0

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	6,630	$8.28	$54,900
Alt. 2	6,630	$8.28	$54,900
Alt. 3	0	$8.28	$0
Alt. 4	0	$8.28	$0

Bridge Deck Overlay (Item 848):
Bridge Deck MSC Overlay Cost per sq. yd.:

	Year 2004	Annual Escalation	Year 2008
Micro Silica Modified Concrete Overlay Using Hydrodemolition (1.25" thick)	$25.58	3.5%	$29.35
Surface Preparation Using Hydrodemolition	$22.85	3.5%	$26.22
Hand Chipping	$37.07	3.5%	$42.54

Bridge Deck MSC Overlay Cost per cu. yd.:

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

	Deck Area (3) (sq. ft.)	Deck Area (sq. yd.)	Hand Chipping (sq. yd.)	Variable Thickness Repair (cu. yd.)
Alt. 1	6,630	737	18	17
Alt. 2	6,630	737	18	17
Alt. 3	0	0	0	0
Alt. 4	0	0	0	0

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 2004	Annual Escalation	Year 2008
Elastomeric Strip Seal Gland	$59.50	3.5%	$68.28

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

NOTES:

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

Approach Pavement Resurfacing:
Resurface Perpetual Asphalt Pavement:
Resurfacing Units Costs:

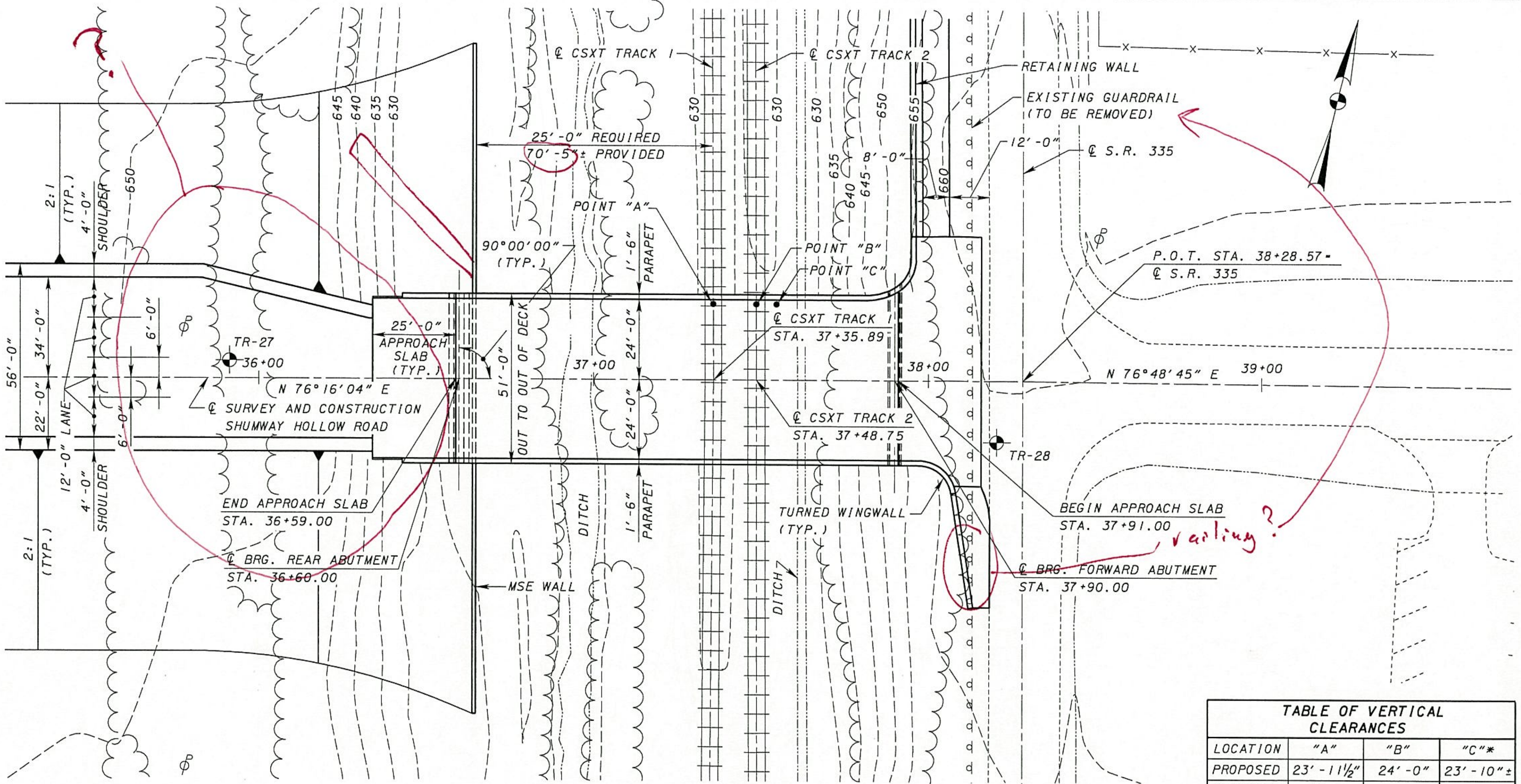
	Year 2004	Annual Escalation	Year 2008
Pavement Planing, Asphalt Concrete, per sq. yd. (Item 254)	$0.98	3.5%	$1.12
Asphalt Concrete Surface Course, per cu. yd.	$72.00	3.5%	$82.62

Asphalt Resurfacing Costs:

	Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
Alt. 1	0.0	51.0	0	1.50	0.0
Alt. 2	0.0	33.0	0	1.50	0.0
Alt. 3	0.0	51.0	0	1.50	0.0
Alt. 4	0.0	0.0	0	1.50	0.0

APPENDIX B

TRANSYSTEMS CORPORATION

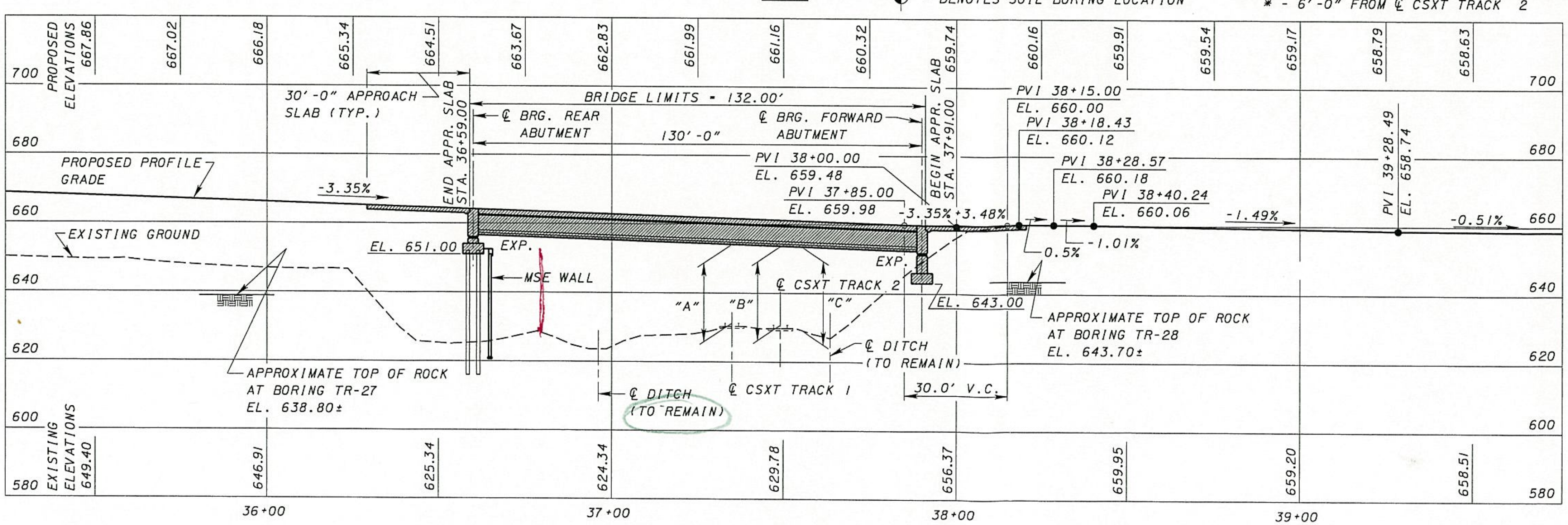


PLAN

- DENOTES SOIL BORING LOCATION

TABLE OF VERTICAL CLEARANCES			
LOCATION	"A"	"B"	"C"*
PROPOSED	23'-11½"	24'-0"	23'-10"±
REQUIRED	23'-0"	23'-0"	23'-0"

* - 6'-0" FROM ℄ CSXT TRACK 2



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION SHUMWAY HOLLOW ROAD

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)

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: A SIMPLE SPAN COMPOSITE 72" PRESTRESSED CONCRETE I-BEAM WITH REINFORCED CONCRETE DECK AND REINFORCED CONCRETE SUBSTRUCTURES ON PILES AND SPREAD FOOTINGS

SPAN: 130'-0" ℄ TO ℄ BEARINGS

ROADWAY: 48'-0" TOE TO TOE OF PARAPETS barrier

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.

DESIGN AGENCY
TRANSYSTEMS CORPORATION
55 PUBLIC SQUARE, SUITE 1900
CLEVELAND, OHIO 44113-1901

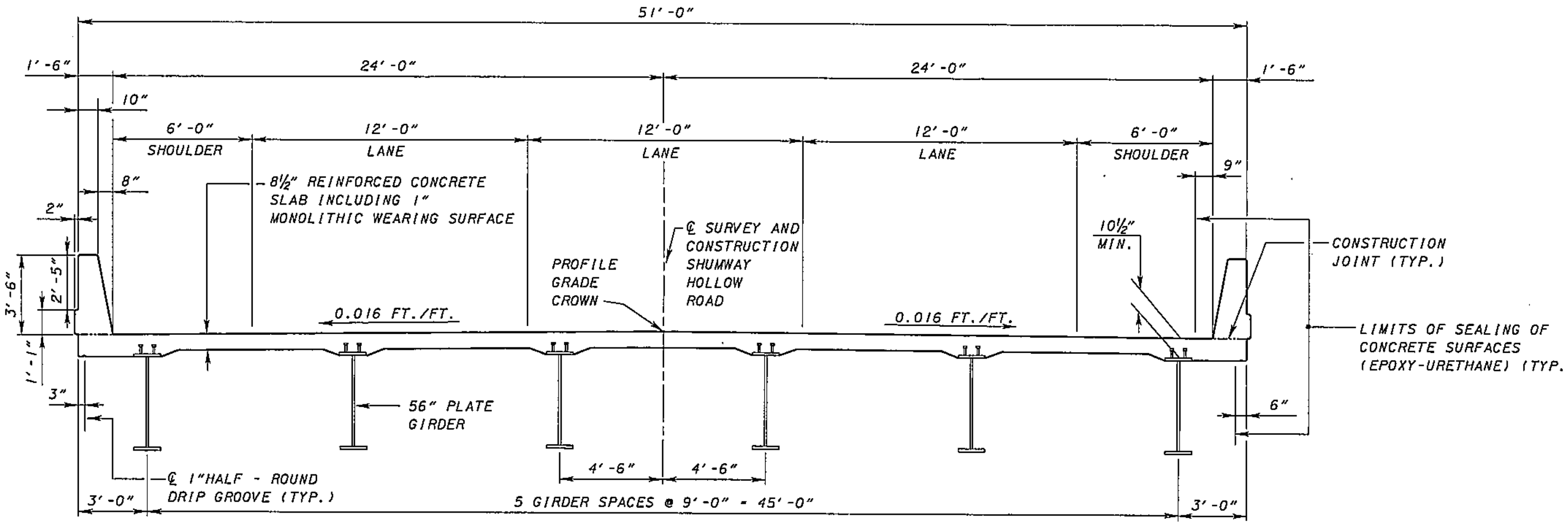
DESIGNED NFF | CHECKED JDH | DRAWN CAG | REVISED | REVIEWED RER | DATE 7/11/05 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 36+59.00
STA. 37+91.00

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

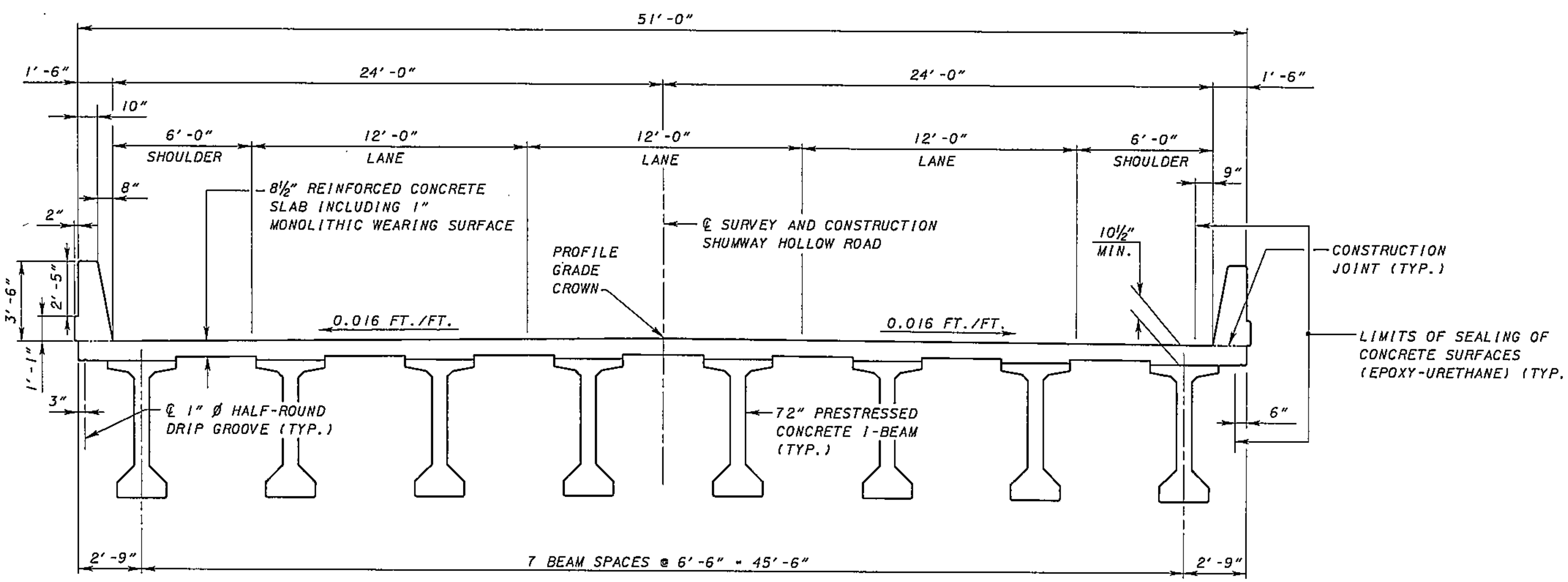
SCI-823-0.00
PID 19415

DATE: 07/13/2005 FILE: g:\C003\0064\Bridge\BTS\10-ShumwayHollow2\SHUM-0sp0l.dgn



PROPOSED TRANSVERSE SECTION

(STEEL - ALTERNATIVE 1)



PROPOSED TRANSVERSE SECTION

(CONCRETE - ALTERNATIVE 2)

SUPERSTRUCTURE DEPTH		
ITEM	STEEL BEAM	CONCRETE I-BEAM
SLAB (INCLUDING WEARING SURFACE)	8½"	8½"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"	2"
BEAM DEPTH	56"	72"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (INCH)	66.5"	82.5"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (FEET)	5.54'	6.875'

DESIGN AGENCY
TRANSYSTEMS CORPORATION
55 PUBLIC SQUARE, SUITE 1900 CLEVELAND, OHIO 44113-1901

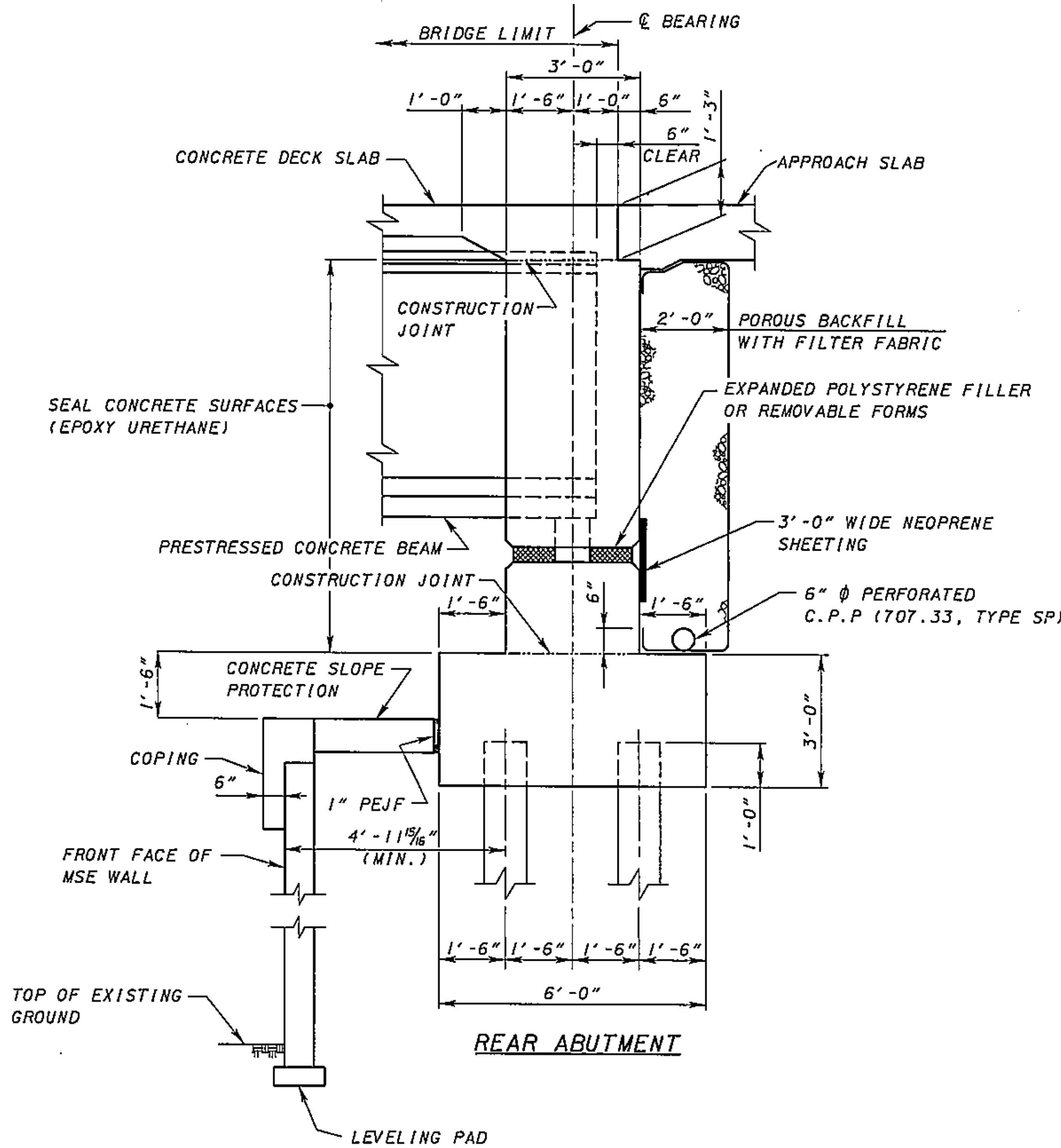
DESIGNED NFF | DRAWN MAK | REVIEWED RER | DATE 7/11/05
CHECKED JDH | REVISED | STRUCTURE FILE NUMBER

TRANSVERSE SECTION-ALTERNATIVES 1 AND 2
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

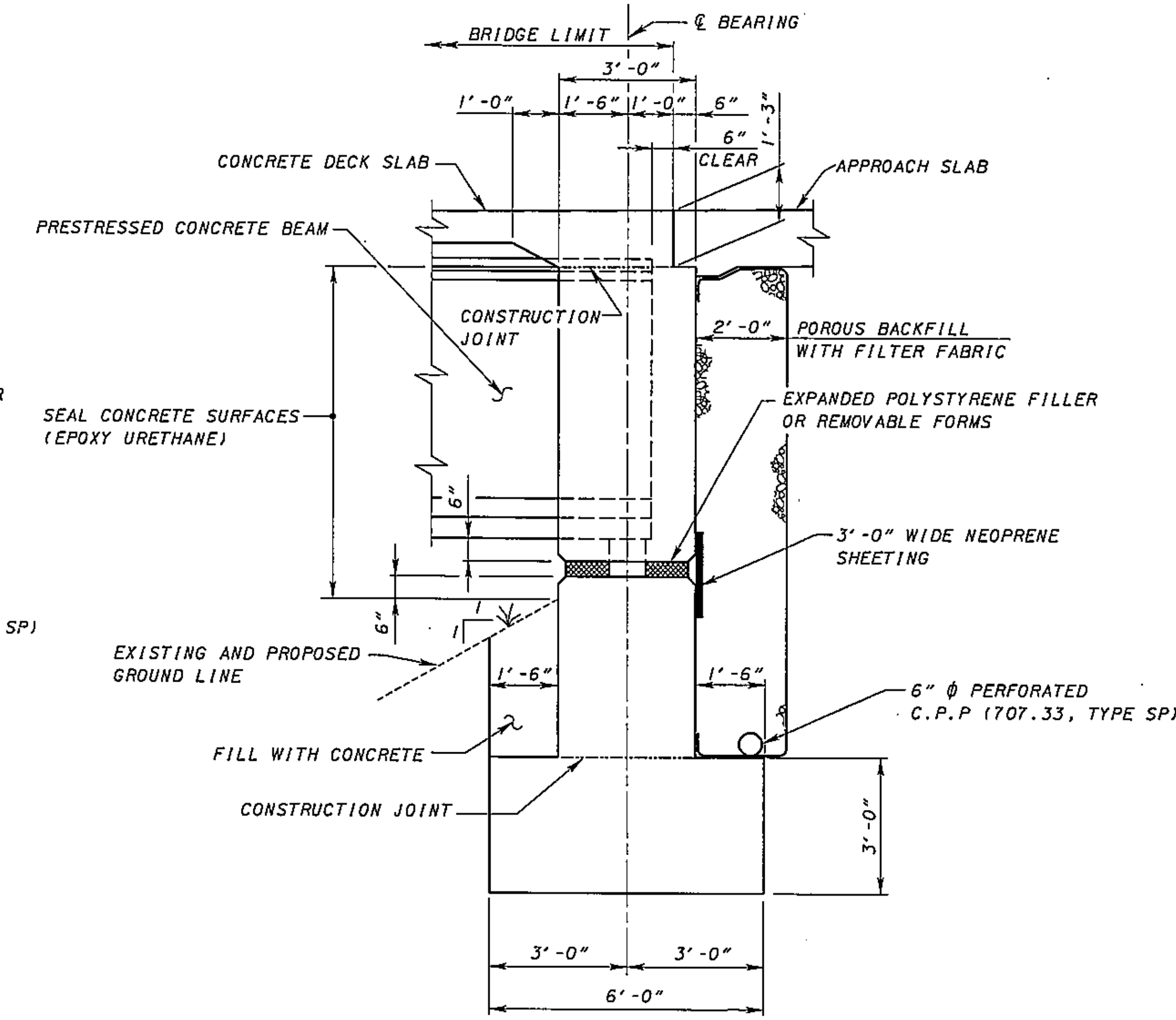
SCI-823-0.00
PID 19415

2/3

DATE: 07/12/2005 FILE: g:\C003\0064\Bridge\BTSL\0-ShumwayHollow2\SHUM-0ts0.dgn



REAR ABUTMENT



FORWARD ABUTMENT

DESIGN AGENCY
TRANSYSTEMS CORPORATION
55 PUBLIC SQUARE, SUITE 1900 CLEVELAND, OHIO 44113-1901

DESIGNED	DRAWN	REVIEWED	DATE
NFF	MAK	RER	7/11/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
JDH			

ABUTMENT DETAILS-ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
SHUMWAY HOLLOW ROAD OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

3/3

DATE: 07/12/2005 FILE: g:\C003\0064\Bridge\BTS\10-ShumwayHollow2\SHUM-I0as01.dgn

APPENDIX C

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By	NFF	Date	07/05/05	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name	SCI-823-0.00	Structure	
Description	SHUMWAY HOLLOW ROAD OVER CSX RR	PID #	19415

Alternative 2 - 8 -72" P/S Beams, 1 Span — ***Point Location:*** ***A***

Adjstment for Cross Slope

Comment	Grade		Offset		
2 Lanes:	-0.016	x	18	=	-0.29
Shoulder to Beam CL:	-0.016	x	6	=	-0.10
			Total Adjustment	=	**-0.39**

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

		TRACK 1	***TRACK 2***	***Track 2 (6'-0)***
Station @ Critical Point	=	**37+35.89**	**37+48.75**	**37+54.75**
Offset Location @ Critical Point	=	**24.0' LT**	**24.0' LT**	**24.0' LT**
Profile Grade Elevation at Critical Point	=	661.63	661.20	661.00
Adjustment for Cross Slopes to Beam CL	=	-0.39	-0.39	-0.39
Top of Deck Elevation @ Critical Point	=	**661.24**	**660.81**	**660.61**
Total Superstructure Depth	=	-6.88	-6.88	-6.88
Bottom of Beam Elevation @ Critical Point	=	**654.36**	**653.93**	**653.73**
Approximate Top of existing Track @ Critical Point	=	**630.40**	**629.93**	**629.93**
Actual Vertical Clearance (feet)	=	***23.96***	***24.00***	***23.80***
Preferred Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*
Required Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*

TRANSYSTEMS CORPORATION

Made By	NFF	Date	07/05/05	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

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

Description SHUMWAY HOLLOW ROAD OVER CSX RR **PID #** 19415

Alternative 1 - 6 Steel Girders, 1Span ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset		
2 Lanes:	-0.016	x	18	=	-0.29
Shoulder to Beam CL:	-0.016	x	6	=	-0.10
			Total Adjustment	=	**-0.39**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	56	4.67
	66.5	5.55

Total Superstructure Depth (ft) = **5.55**

Vertical Clearance at Critical Point

		TRACK 1	*TRACK 2*	*Track 2 (6'-0)*
Station @ Critical Point	=	**37+35.89**	**37+48.75**	**37+54.75**
Offset Location @ Critical Point	=	**24.0' LT**	**24.0' LT**	**24.0' LT**
Profile Grade Elevation at Critical Point	=	661.63	661.20	661.00
Adjustment for Cross Slopes to Beam CL	=	-0.39	-0.39	-0.39
Top of Deck Elevation @ Critical Point	=	**661.24**	**660.81**	**660.61**
Total Superstructure Depth	=	-5.55	-5.55	-5.55
Bottom of Beam Elevation @ Critical Point	=	**655.69**	**655.26**	**655.06**
Approximate Top of proposed Ground @ Critical Point	=	**630.40**	**629.93**	**629.93**
Actual Vertical Clearance (feet)	=	***25.29***	***25.33***	***25.13***
Preferred Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*
Required Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*

APPENDIX D

TRANSYSTEMS CORPORATION

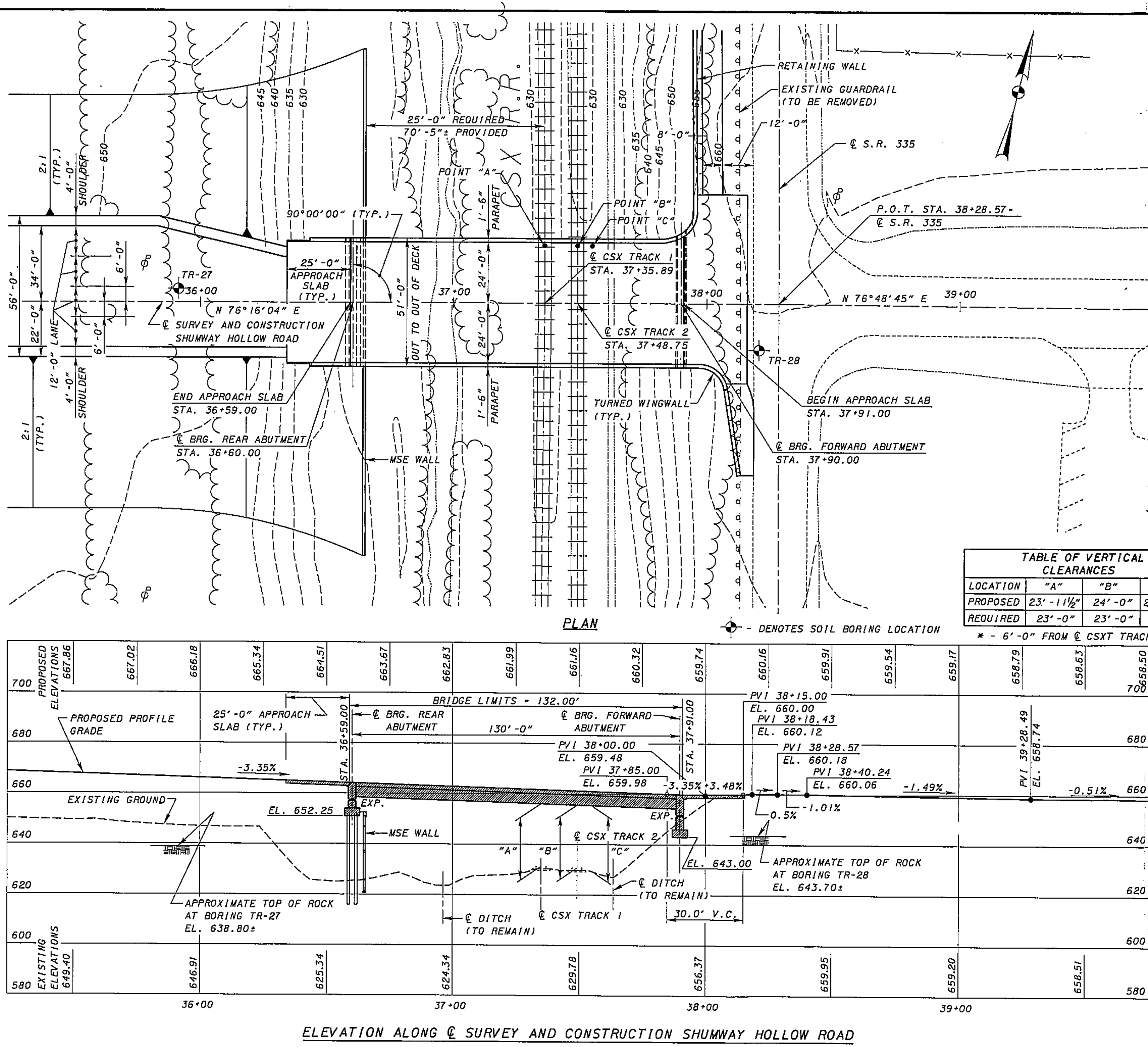


TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"	"C"*
PROPOSED	23'-11½"	24'-0"	23'-10"±
REQUIRED	23'-0"	23'-0"	23'-0"

* - 6'-0" FROM ℄ CSXT TRACK 2

STRUCTURE TYPE:

A SIMPLE SPAN STEEL PLATE GIRDER A 709 GRADE 50 WITH COMPOSITE REINFORCED CONCRETE DECK AND SEMI-INTEGRAL TYPE ABUTMENTS ON PILES AND SPREAD FOOTINGS AND MSE WALLS AT THE REAR ABUTMENT.

STRUCTURE TYPE:

1. FOR TRNSVERSE SECTION REFER TO TRANSVERSE SECTION ALTERNATIVE 1 AND 2 SHEET IN APPENDIX B.

DESIGN AGENCY
TRANSYSTEMS CORPORATION
55 PUBLIC SQUARE, SUITE 1900 CLEVELAND, OHIO 44113-1901

DESIGNED	DRAWN	REVIEWED	DATE
NFF	CAG		
CHECKED	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY
STA. 36+59.00
STA. 37+91.00

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

SCI-823-0.00
PID 19415

1/1

DATE: 07/13/2005 FILE: g:\C003\0064\Bridge\BTS\10-ShumwayHollow2\SHUM-10sp02.dgn

APPENDIX E

TRANSYSTEMS CORPORATION

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PLANNERS • SURVEYORS

March 29, 2005

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

Re: **SCI-823-0.00 Airport Interchange**
Relocated Shumway Hollow over SCI-823-0.00 &
Relocated Shumway Hollow over CSX Railroad
Preliminary Structural Foundation Recommendations
Project SCI-823-0.00
DLZ Job No.: 0121-3070.03

Dear Mr. Parsons:

This letter reports the findings of the subsurface exploration and preliminary foundation recommendations for the proposed structures at the SCI-823-0.00 Airport Interchange: Relocated Shumway Hollow over SCI-823-0.00 and Relocated Shumway Hollow over the CSX Railroad. It is anticipated that the proposed structure over SCI-823-0.00 will be a two-span elevated bridge. It is anticipated that the proposed abutments and pier will be founded on a fill section, however the extent of fill is currently unknown because grading plans are not available at this time.

The proposed structure over the CSX Railroad is understood to be a one-span bridge. The existing grade at the proposed new bridge location varies from approximately 635 to 650 feet. It is anticipated that at least part of the structure will be placed on a fill section, however, as mentioned above, grading plans are unavailable at this time and, consequently, the extent of the fill is unknown.

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.

2162 Front Street • Cuyahoga Falls, Ohio 44221-3288 • (330) 923-0401 • FAX (330) 928-1029
With Offices Throughout The Midwest
www.dlz.com

Field Exploration

Three borings, TR-24 through TR-26, were drilled at the proposed structure over SCI-823-0.00 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 at the boring locations were estimated from the USGS topographic mapping and are presented on the attached Boring Logs.

Findings

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

Relocated Shumway Hollow over SCI-823-0.00

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'. 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

Relocated Shumway Hollow over SCI-823-0.00

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 there 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

Depending on 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. H-piles could be considered at the forward abutment but the depth to bedrock could be too short for adequate lateral support. The use of H-piles could be further evaluated once the design is more advanced and the elevations of the footings and pile caps are known. The table summarizing the site conditions and foundation recommendations follows subsequently.

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.

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Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Approximate Bearing Elevation* (Feet)	Recommended Foundation Type	Allowable Bearing Capacity
SCI-823-0.00					
TR-24	Rear (west) Abutment	684	640	H-Piles	90 tons
TR-25	Pier	674	644	H-Piles	90 tons
TR-26	Forward (east) Abutment	663	640	H-Piles	90 tons
CSX Railroad				H-PILES	90 tons
TR-27	Rear Abutment	646.3 ~~638~~	638.0 ~~630~~	Spread Footings	15 TSF
TR-28	Forward Abutment	~~650~~ 659.7	~~624~~ 643.0	Drilled shafts OR SPREAD FOOTING	15 TSF

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

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.

Richard Hessler
Geotechnical Engineer

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

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

cc: File

GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

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

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

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

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

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LEGEND - BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

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

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

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

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

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

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

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

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

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

9. Soil Description

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

Granular Soils - Compactness

Terms	Blows/Foot Standard Penetration
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	over 50

Cohesive Soils - Consistency

Term	Unconfined Compression tons/sq.ft.	Blows/Foot Standard Penetration	Hand Manipulation
Very Soft	less than 0.25	below 2	Easily penetrated by fist
Soft	0.25 - 0.50	2 - 4	Easily penetrated by thumb
Medium Stiff	0.50 - 1.00	4 - 8	Penetrated by thumb w/ moderate effort
Stiff	1.0 - 2.0	8 - 15	Readily indented by thumb but not penetrated
Very Stiff	2.0 - 4.0	15 - 30	Readily indented by thumb nail
Hard	over 4.0	over 30	Indented with difficulty by thumb nail

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

   c. Texture is based on the ODOT Classification System. Soil particle size definitions are as follows:

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

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

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

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

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

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

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

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

10. Rock hardness and rock quality description.

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

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

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

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

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

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

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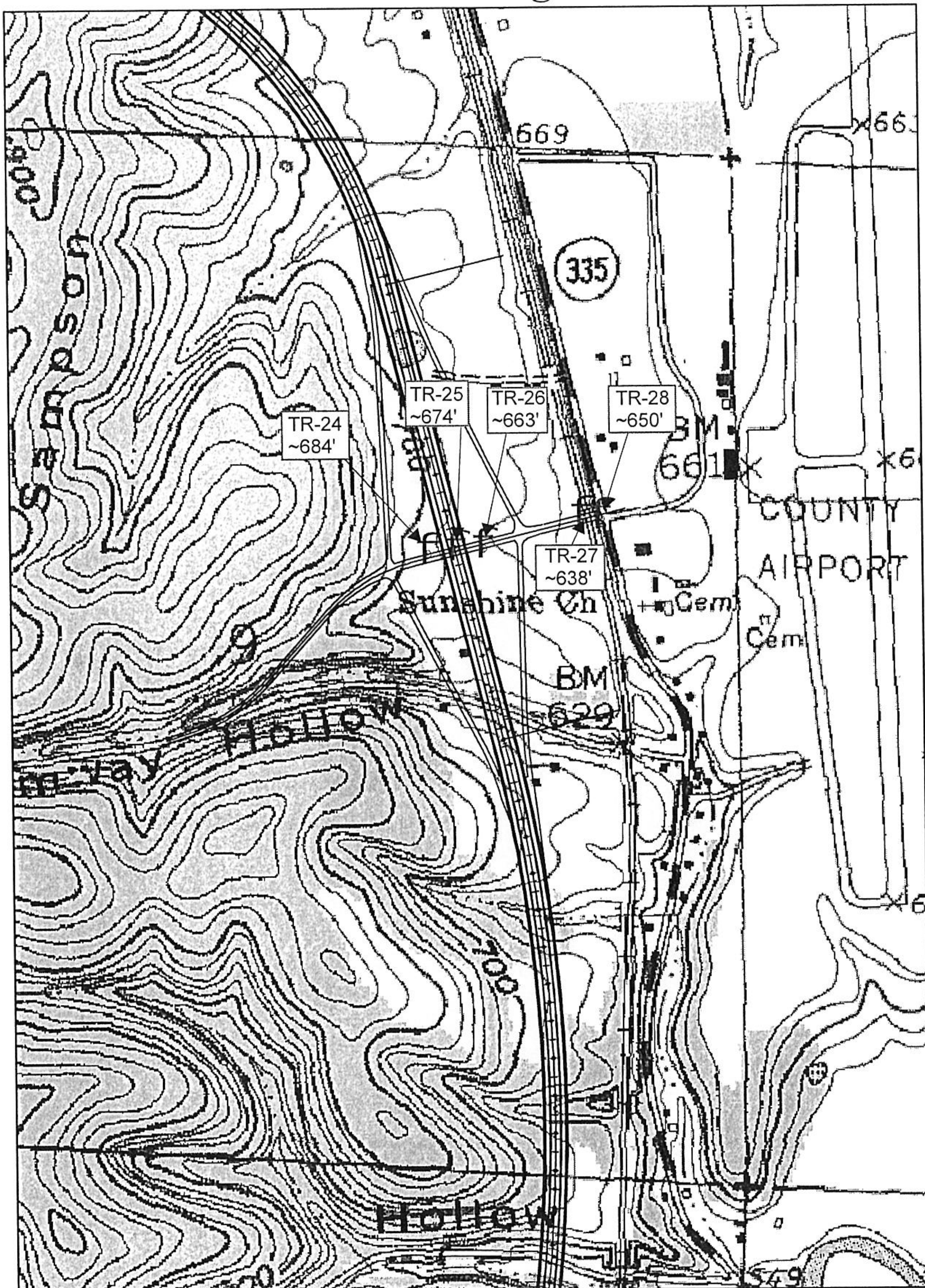
SCI-823 Airport / S R 335 Interchange



Contour Interval 20 feet

0 525 1,050 1,575 2,100

Feet

2

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

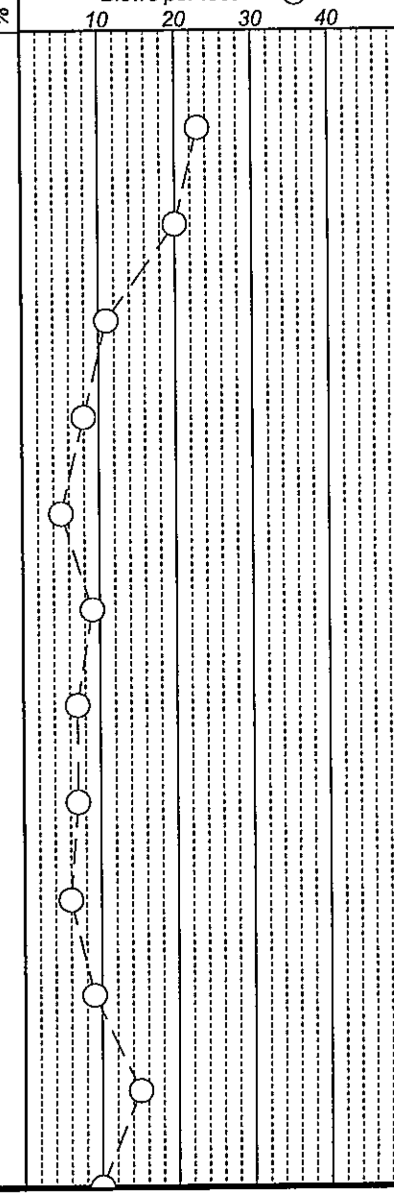
Client: TranSystems, Inc. | *Project:* SCI-823-0.00 | *Job No.* 0121-3070.03

LOG OF: Boring TR-24 | *Location:* As per plan | *Date Drilled:* 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	684.0						Topsoil-12"						
1.0	683.0	10 10 13	18	1		4.5+	Hard brown SILT AND CLAY (A-6a), little fine to coarse sand; damp.						
		13 10 10	18	2		4.5+							
6.0	678.0	3 3 8	12	3		2.75	Stiff to very stiff brown CLAY (A-7-6), little fine to coarse sand; moist.						
		2 3 5	18	4		2.0							
		2 2 3	18	5		2.0							
		2 4 5	18	6		2.25							
		2 3 4	18	7		1.25							
		11 3 4	18	8		3.75							
		2 3 3	18	9		1.0							
		3 4 5	18	10		1.5							
27.0	657.0	4 3 12	18	11		1.75	Loose to medium dense brown FINE SAND (A-3), trace gravel; damp.						
30		5 5 5	18	12									

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



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

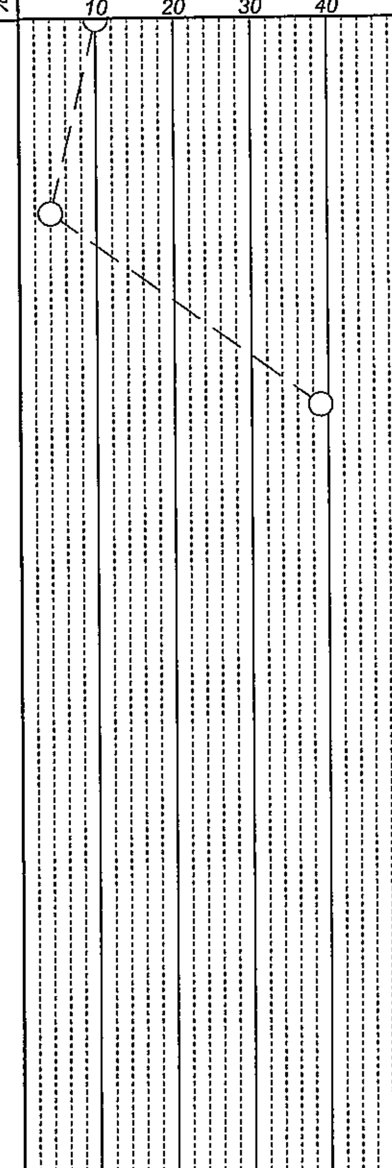
LOG OF: Boring TR-24 | *Location:* As per plan | *Date Drilled:* 8/20/04 to 8/23/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 29.8'

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
30	654.0						Loose to medium dense brown FINE SAND (A-3), trace gravel; damp.						
34.0	650.0	4 2 2	18	13		0.5	Soft to medium stiff gray SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; moist.						
37.0	647.0	10 17 22	18	14			Dense brown GRAVEL WITH SAND (A-1-b); wet.						
43.5	640.5	Core 120"	Rec 118"	RQD 77%	R-1		Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black laminae. @ 44.8'-44.9',45.2',45.4',47.0', shaly laminations, fractures.						
53.5	630.5						Bottom of Boring - 53.5'						

Depth scale: 30, 35, 40, 45, 50, 55, 60

STANDARD PENETRATION (N)



FILE: 0121-31 [3/29/2005 1:15 PM]

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

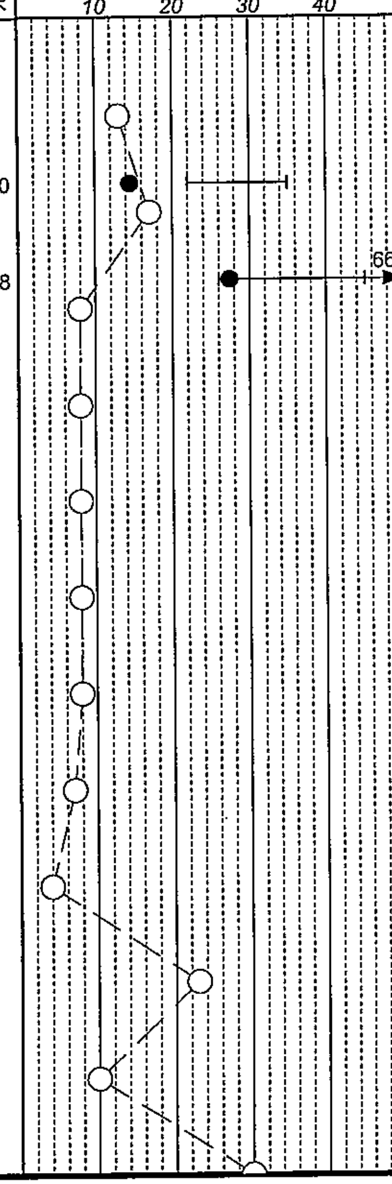
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-25 | Location: As per plan | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0'
Water level at completion: 16.4'

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	674.0						Stiff brown SILT AND CLAY (A-6a); damp.						
		4 7 6	18	1									
		6 8 9	18	2				4	6	--	13	37	40
5.5	668.5						Stiff to very stiff brown CLAY (A-7-6), trace fine to coarse sand; damp to moist.						
		2 3 5	18	3		2.0		0	0	--	1	11	88
		2 3 5	18	4		1.25							
		2 4 4	18	5		1.75							
		3 3 5	18	6		2.5							
		2 3 5	18	7	P-1	2.25							
18.0	656.0						Loose brown FINE SAND (A-3), trace silt; damp.						
		4 3 4	18	8									
		1 1 3	18	9			@ 21.0', moist to wet.						
		9 11 12	18	10									
		7 3 7	18	11									
28.0	646.0						Weathered SANDSTONE; brown.						
30		2 14 16	18	12									

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



FILE: 0121-31 [3/29/2005 1:29 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-25 | Location: As per plan | Date Drilled: 8/19/04 to 8/20/04

WATER OBSERVATIONS: Water seepage at: 16.0'; Water level at completion: 16.4'

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
30.0	644.0						Soft brown SANDSTONE; medium to coarse grained, decomposed, slightly fractured.						
		27 50/5	6	13									
32.0	642.0	Core 48"	Rec 46"	RQD 42%	R-1		Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black laminae. @ 32.0' - 37.0'; highly fractured.						
		Core 72"	Rec 72"	RQD 90%	R-2								
42.0	632.0						Bottom of Boring - 42.0'						

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

Depth scale: 35, 40, 45, 50, 55, 60

FILE: 0121-31 [3/29/2005 1:29 PM]

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

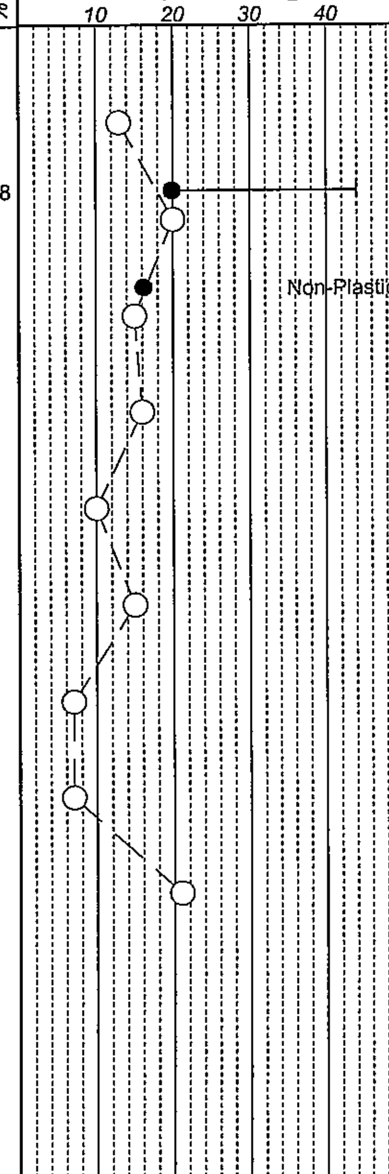
Client: TranSystems, Inc. | *Project:* SCI-823-0.00 | *Job No.* 0121-3070.03

LOG OF: Boring TR-26 | *Location:* As per plan | *Date Drilled:* 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'
Water level at completion: 8.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	663.0						Topsoil - 12"						
1.0	662.0	5 5 8	18	1			Medium dense brown CLAY (A-7-6), "and" fine and coarse sand; damp.						
		8 9 11	18	2				0	2	–	38	12	48
5.5	657.5	7 7 8	18	3			Loose to medium dense brown GRAVEL WITH SAND AND SILT (A-2-4), little silt; damp.	0	0	–	81	19	
		4 9 7	18	4									
		3 4 6	18	5									
		4 5 10	18	6									
		5 4 3	18	7			@ 16.0', moist to wet.						
		2 3 4	18	8									
20.5	642.5	4 8 13	18	9			Medium dense gray GRAVEL WITH SAND (A-1-b); contains sandstone fragments; moist.						
23.0	640.0	Core 120"	Rec 111"	RQD 73%	R-1		Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black laminae. @ 23.1',23.5', clay seam.						
30													

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



FILE: 0121-31 [3/29/2005 1:15 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-26 | *Location:* As per plan | *Date Drilled:* 8/19/04

WATER OBSERVATIONS: Water seepage at: 8.5'; Water level at completion: 8.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N)
30	633.0						Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black laminae.							
33.0	630.0						Bottom of Boring - 33.0'							
35														
40														
45														
50														
55														
60														

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

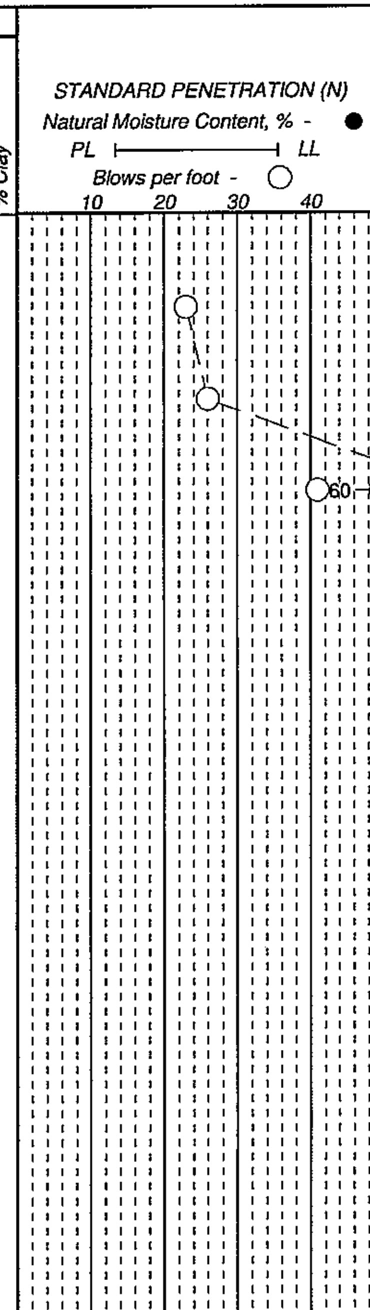
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-27 | Location: | Date Drilled: 8/25/04

WATER OBSERVATIONS: Water seepage at: none
Water level at completion: not recorded

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	646.3						Hard brown SANDY SILT (A-4a), some fine to coarse sand, trace to little gravel; damp.						
		7 10 13	18	1		4.5+							
5		8 13 13	18	2		4.5+							
		4 10 50	16	3		4.5+	@ 6.0'-7.5', contains weathered sandstone fragments.						
7.5	638.8						Hard brown SANDSTONE; fine grained, slightly micaceous, occasional black laminations throughout. @ 7.5'-10.0', rust stained. @ 10.2'-14.9', gray.						
10		Core 120"	Rec 120"	RQD 98%	R-1								
14.9	631.4						Hard gray SILTSTONE; arenaceous, slightly micaceous. @ 14.9'-15.2', near vertical fracture, organic stained.						
17.5	628.8						Bottom of Boring - 17.5'						
20													
25													
30													



FILE: 0121-3070-03 [7/11/2005 1:24 PM]

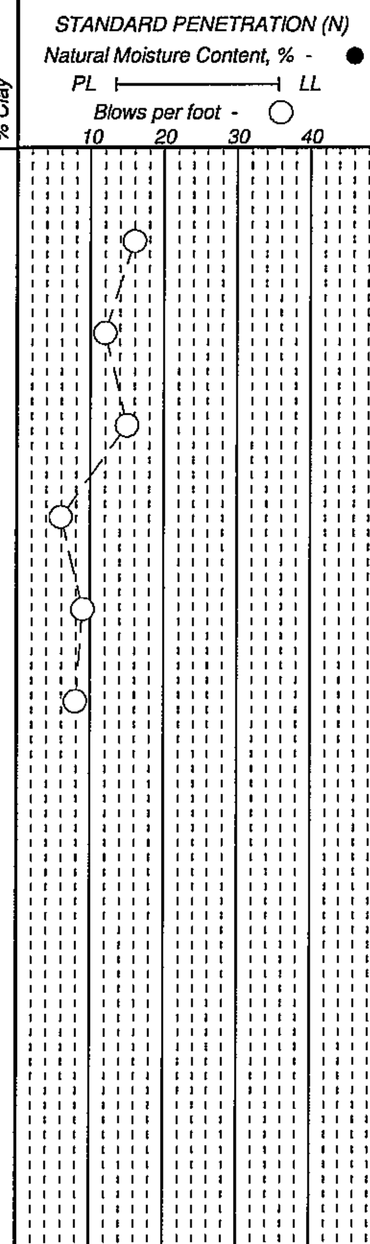
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-28 | Location: SCI-823 | Date Drilled: 02-02-05

WATER OBSERVATIONS: Water seepage at: 14', 18.5'
Water level at completion: 10'

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	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); damp.						
		8 8 7	18	3									
		6 4 2	18	4									
		3 5 4	14	5									
		1 4 4	13	6									
16.0	643.7	50/2	2	7			Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately to highly weathered, slightly argillaceous, thinly bedded to medium bedded, contains argillaceous inclusions. @ 16.0'-24.0', broken.						
		Core 60"	Rec 30"	RQD 12%	R-1								
		Core 84"	Rec 84"	RQD 100%	R-2								
30.0	629.7						Bottom of Boring - 30.0'						



FILE: 0121-3070-03 [7/11/2005 1:24 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:* SCI-823 | *Date Drilled:* 02-02-05

WATER OBSERVATIONS: Water seepage at: 14', 18.5'
Water level at completion: 10'

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													
35														
40														
45														
50														
55														
60														