STRUCTURAL ENGINEERING

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SCI-823-0.00

PID No. 19415

S.R. 823 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 a new overpass structure that will carry the proposed S.R. 823 bypass over three CSX Railroad tracks near Highland Bend. 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, 2002 AASHTO Standard Specifications for Highway Bridges and CSX Transportation Criteria for Overhead Bridges.

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, four test borings (TR-39, TR-40, TR-41, and TR-42) were drilled and all of them encountered sandstone bedrock between 90 and 93 feet below the existing ground surface. Beneath the topsoil, generally cohesive soil (sandy silt and clay) were encountered to top of bedrock with intermittent layers of granular soil.

Based on the alternatives considered for this study, it is recommended that driven H-piles or CIP piles or drilled shafts to rock will be best suited foundation types for the support of the proposed structure. For the purpose of this study the substructures were assumed to be founded on friction type H-piles. It is also recommended that if piles are selected in the TS&L stage, special driving techniques may be required due to the large embankment, compressible soils to try to avoid having high down-drag forces that could significantly reduce the load-carrying capacity of the piles. Also, once piles have set for 24 hours, re-drive piles to ensure that pore pressures have dissipated. If required, H-piles bearing or socketed into bedrock may be considered pending the preliminary design of the recommended structure in the TS&L stage.

HP14x73 friction type piles with a maximum design load of 95 tons are assumed for this Bridge Type Study.

4. Roadway

The purpose of this project is to construct a new bypass state route around the town of Portsmouth Ohio. The proposed alignment will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with US 52 just east of the town to another interchange with US 23 north of the town in Valley Township. Each direction of the proposed bridge will consist of two 12'-0" travel lanes with a 6'-0" median shoulder and a 12'-0" outside shoulder separated by a Type A1 median parapet and a 1'-6" outside straight face deflector parapets for a total bridge deck width of 89'-5 3/4" out to out. Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives considered. The three CSXT tracks will remain on their current horizontal and vertical alignments. We have contacted CSXT and they have indicated that they will requested authorization for preliminary engineering from Heidi Nunemaker of ODOT Central Office in order to evaluate the proposed project location and CSXT's operational and future characteristics in the area. The proposed piers will be located outside the limit of existing tracks to allow for future realignment of tracks within the existing footprint.

Vertical and Horizontal Design - Since this structure's vertical alignment was dictated by the overall vertical design of the new bypass profile, clearance was not a critical issue. More than 23'-0" of preferred vertical clearance could be provided for all the alternatives considered for this study.
The horizontal clearances provided of 30'-0" will exceed the required minimum of 25'-0" (which includes clearnces for typical roadbed section with standard ditches.. This was done to provide area for maintenance roadways on the outside of the tracks and keep the piers and slopes out of the required clearance zone.

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 and ITS conduits will be provided if necessary.

Maintenance of Traffic - While the new bridge is under construction, rail traffic will be maintained on the existing tracks. It is anticipated that there will be limited closures during construction of the new structure and this will be limited to beam placement.

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a tangent alignment across the entire length the new structure. The proposed mainline profile is located on the inside edge of pavement for the bridge and is along a constant sloping grade of -3.57%. The horizontal and vertical geometry for all alternatives considered are the same. Embankment slopes will be a maximum 2:1 in order to minimize right-of-way impacts.

Structure: As per the Scope of Services, we investigated several bridge types and alternates as part of the type study. The use of mechanically stabilized earth abutments was quickly dismissed in that the height of the fills is excessive. A combination of normal embankment fill with MSE abutments on top was considered, however, the conventional spill through abutments with piles are the preferred type abutment however, the bridge limits could allow the use of the semi-integral type abutments and are selected to be consistent with other bridges in the project corridor.
The use of a center pier was reviewed, however, due to the close proximity of the existing tracks, limitations on future track placement, and the excess under clearance provided, it was ruled out.

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	Tangent, Continuous Steel Girders A709 Grade 50W	Tangent, Continuous Steel Girders A709 Grade 50W
Proposed Beam Spacing	9 Spaces @ 9'-3"	9 Spaces @ 9'-3"
No. of Spans	3	3
Abutment Type	Semi-Integral Type abutments with spill-through slopes	Semi-Integral Type abutments with spill-through slopes
No. of Piers	2	2
Pier Type	T-Type	T-Type
Substructure Orientation	37°00'00"RF and 32°17'02"RF	37°00'00"RF
Approximate Bridge Length	460' and varies to 470'	460'
Approximate Structure Depth		
Slab	8.75"	8.75"
Haunch	2"	2"
Girder	60"	60"
Total	70.75"(5.89')	70.75"(5.89')

Alternative Discussion:

Alternative 1

Span configuration: Various span configurations were investigated and they were refined to the 3-span layout configuration. Horizontal Clearance requirements and the relatively high proposed embankment reaching 60'-0" dictated the types of the bridges that could be studied. Embankment slopes will be a maximum 2:1 in order to minimize right-of-way impacts. The bridge overall length is 465' average from centerline of bearing to centerline of bearing for the longest beam. This layout utilized 30' from center of outside track to face of pier for laying out piers. Note the skew angles are different for each pier and abutment making the center span variable length.

Substructure: This alternative is comprised of three spans (135'-190' varying to 200'-135') with a span ratio of 0.68 for the 200' center span. The abutments and piers were both located normal to the adjacent track alignment.

I. *Abutments:* The abutments will be a semi-integral type abutment founded on H-piles HP 14x73 with a design capacity of 95-tons per pile driven to design capacity. Straight or U-turned type wingwall will also be provided at each abutment. The details of the abutments and wingwalls will follow ODOT Standard Construction drawings.

II. *Piers:* Due to the height of the proposed embankment, it is anticipated that the piers will be T-type piers and will be founded on driven H-piles.

Superstructure: The preliminary design of this alternative indicates that 10 - continuous steel 60" Plate Girder spaced at 9'-3"would be required for each structure to accommodate the HS25 design loading requirements. The north span may be reduced to achieve a shorter span which can be further investigated at the TS&L stage.

Alternative 2

Span configuration: In order to simplify steel fabrication and construction of the bridge, Alternative 2 was studied. This alternative has a similar horizontal layout as Alternative 1, except that the bridge substructure units were placed to be parallel to the alignment of the existing southernmost CSXT track. Thus the center main bridge span is constant length. This allows more future options for tracks north of the existing southern two tracks. The bridge overall length is 465' from centerline of bearing to centerline of bearing.

Substructure: This alternative is comprised of three spans (135'-190'-135') with a span ratio of 0.71. The abutments and piers were both located at a 37°00'00" skew to the south track alignment. The face of the south pier is located 30'-0" from the centerline of track and the north pier is located a minimum of 30'-0" from the north track. The bridge will be designed using semi-integral type abutments since it does not exceed the limitations outlined in the Bridge Design Manual:

I. *Abutments:* The abutments will consist of semi-integral type abutments supported on H-piles (HP 14x73) with a design capacity of 95-tons per pile driven to design capacity.

II. *Piers:* Due to the height of the proposed embankment, it is anticipated that the piers will be T-type piers and will be founded on driven H-piles.

Superstructure: The preliminary design of this alternative indicates that 10 - continuous steel 60" Plate Girder spaced at 9'-3"would be required for each structure to accommodate the HS25 design loading requirements. The north span may be reduced to achieve a shorter span which can be further investigated at the TS&L stage.

Other options considered were hybrid steel plate girders and prestressed spliced bulb tee posttensioned concrete girders. Due to the fact that underclearance is not an issue at this bridge, it provides an opportunity to investigate different forms of bridge technology. If ODOT desires, further investigation can be made during the TS&L stage.

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 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. Maintenance costs associated with deck replacements were not added into the cost since it will be required for all Alternatives.

7. Summary:

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

We acknowledge that life cycle cost comparisons for all alternates are to be included along with the initial construction costs. However, life cycle costs were considered essentially equal for all alternatives, and therefore were not included as part of the cost comparisons. (i.e., using weathering steel, deck overlay and deck replacements at year 50, for all alternatives).

SUMMARY OF ALTERNATIVES AND RECOMMENDATIONS

STRUCTURE TYPE ALTERNATIVE	STRUCTURE TYPE	PROBABLE BRIDGE CONST. COST	RATING	ADVANTAGES/ DISADVANTAGES
1	3-span continuous tangent 60" (web) steel Girders, A709 Grade 50W with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments and T-type piers on piles	**Structure Cost:** **$6,440,000**	2	***Advantages:*** • Aligns piers with tracks • Decreases slightly Pier 2 and Forward Abutment length. ***Disadvantages:*** • Will increase the fabrication cost per pound of steel. • Increases complexity of design and construction. • Variable length beams affects stiffness.
2	3-span continuous tangent 60" (web) steel Girders, A709 Grade 50W with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments and T-type piers on piles	**Structure Cost:** **$6,450,000**	1	***Advantages:*** • Consistent center span length. • Uniform geometry for end spans. • Increased flexibility for future track placement for north track. ***Disadvantages:*** • None.

8. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 2 (Three Span, 60" (web) steel girders with parallel piers and semi-integral abutments and T-type piers)** 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 allows CSXT Railroad more options for track placement beneath bridge.
- Constructability concerning girders fabrication, delivery and erection will be less complicated.

APPENDIX A

TRANSYSTEMS
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SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 OVER CSX Railroad

STRUCTURE TYPE STUDY

By: AFK
Checked: ELK

Date: 7/6/2005
Date: 7/8/2005

ALTERNATIVE COST SUMMARY

Alternative No.	No. Spans	Span Arrangement Lengths (Ft) Span #1	Span #2	Span #3	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
1	3	135	190 to 200	135	460 to 470	10 ~ Welded Plate Girders	60" Web PG Grade 50	$3,301,000	$1,326,000	$740,300	$1,073,500	$6,440,000
2	3	135	190	135	460	10 ~ Welded Plate Girders	60" Web PG Grade 50	$3,266,000	$1,365,000	$741,000	$1,074,400	$6,450,000

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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S.R. 823 OVER CSX Railroad

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES- SUPERSTRUCTURE

By: AFK
Checked: ELK

Date: 5/13/2005
Date: 7/8/2005

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths (ft) Span 1	Span2	Span 3	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	3	135	190 to 200	135	460 to 470	472	1570	$928,100	$393,800	$99,000	10 ~ Welded Plate Girders	60" Web PG Grade 50	1,560,000	$1,879,600	$3,301,000
2	3	135	190	135	460	467	1554	$918,300	$389,700	$99,000	10 ~ Welded Plate Girders	60" Web PG Grade 50	1,542,500	$1,858,600	$3,266,000

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	1	9.04	9.04

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Alt. 1	0.73	90.00	65.7	6.6	89.8
Alt. 2	0.73	90.00	65.7	6.6	89.8

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 =			$591.00

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 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 = 30 ft.
Area = 300 sq. yd.

Alternate 1
Width = 90 ft

Alternate 2
Length = 30 ft.
Area = 300 sq. yd.

Width = 90 ft

	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
Modular Expansion Joints	1.00	$863.00	3.5%	$1,097.98

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S.R. 823 OVER CSX Railroad

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES -SUBSTRUCTURE

By: AFK
Checked: ELK

Date: 7/7/2005
Date: 7/8/2005

SUBSTRUCTURE -HP PILE ALTERNATIVE

Alternative No.	Span Arrangement No. Spans	Length (ft) Span 1	Span 2	Span 3	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Abutment & Wingwall Cost	Retaining Wall Cost	Temporay Girder Support Cost	Subtotal Substructure Cost
1	3	135	190 to 200	135	10 ~ Welded Plate Girders	60" Web PG Grade 50	$526,200	$119,800	$193,500	$31,700	$454,500	$0	$0	$0	$1,326,000
2	3	135	190	135	10 ~ Welded Plate Girders	60" Web PG Grade 50	$541,500	$123,300	$199,200	$32,700	$467,800	$0	$0	$0	$1,365,000

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	338	348	$421.00	3.5%	$483.00	$163,070	$167,950
Columns	436	448	$421.00	3.5%	$483.00	$210,510	$216,320
Footings	316	325	$421.00	3.5%	$483.00	$152,630	$157,200
Total Cost						$526,200	$541,500

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	364	$421.00	3.5%	$483.00	$175,900
Wingwalls	36	$421.00	3.5%	$483.00	$17,600

Alternate 2

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	375	$421.00	3.5%	$483.00	$181,100
Wingwalls	38	$421.00	3.5%	$483.00	$18,100

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	0	$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 14X73 Piles, Furnished & Driven*

	Number of Piles		Total Pile Length	HP/Drilled Shaft Option Length	no. of HP
Alt. 1	129	SEE QUANTITIES CALCULATION	11,005	11005	129
Alt. 2	132	SEE QUANTITIES CALCULATION	11,327		

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$24.41	3.5%	$28.00
Driven	$11.57	3.5%	$13.30
Total			$41.30

Shaft Foundation Unit Cost ($/ft.): 60" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	#DIV/0!	SEE QUANTITIES CALCULATION	#DIV/0!

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$300.00	4.5%	$358.00

Cost of Shafts: #DIV/0!

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

Retaining Wall Unit Cost ($/sq. ft.):

	Total Area (sq. ft.)	Year 2008 Unit Cost
Alt. 2	0	$120.00

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S.R. 823 OVER CSX Railroad

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES - QUANTITY CALCULATIONS

By: AFK
Checked: ELK

Date: 7/7/2005
Date: 7/8/2005

Pier Quantities Alternate 1 (HP-Piles Type Foundation)

Pier Location	Length	Cap (x2 for each Pier)				Column (x2 for each Pier)					Footing (x2 for each Pier)					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*	*# Column*	*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Pier 1	56.33	0	0	0.00	4694	0	0	0.00	1	6506	0	0	0	0	4394	15595
Pier 2	53.05	0	0	0.00	4421	0	0	0.00	1	5261	0	0	0	0	4138	13820
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	0
Total (Cu.Ft.)					9115					11768					8532	29415
Total (Cu.Yd.)					338					436					316	1089

Pier Quantities Alternate 2 (HP-Piles Type Foundation)

Pier Location	Length	Cap (x2 for each Pier)				Column (x2 for each Pier)					Footing (x2 for each Pier)					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*	*# Column*	*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Pier 1 L/R	56.33	0	0	0.00	4694	0	0	0.00	1	6506	0	0	0	0	4394	15595
Pier 2 L/R	56.33	0	0	0.00	4694	0	0	0.00	1	5586	0	0	0	0	4394	14675
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	0.00	0	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	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.)					9389					12093					8788	30269
Total (Cu.Yd.)					348					448					325	1121

Abutment Quantities -Alternate 1

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume (x2)
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*		*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Rear Abut	56.332	3	6.229	18.69	1053	3	2.75	8.25		465	6	3	18	1	1014	5063
Fwd. Abut	53.05	3	6.229	18.69	991	3	2.75	8.25		438	6	3	18	1	955	4768
Total (Cu.Ft.)					2044					902					1969	9831
Total (Cu.Yd.)					76					33					73	364

MSE Abutment Wall Quantities -Alt. 1

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

Temporary Cofferdams

Location		Wall			
		Height	*Lengt*	*widt*	*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	

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

Abutment Quantities - Alternate 2

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume (x2)
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*		*Volume*	*Width*	*Depth*	*Area*	*# Footing*	*Volume*	
Rear Abut	56.33	3	6.229	18.69	1053	3	2.75	8.25		465	6	3	18	1	1014	5063
Fwd. Abut	56.33	3	6.229	18.69	1053	3	2.75	8.25		465	6	3	18	1	1014	5063
Total (Cu.Ft.)					2105					929					2028	10126
Total (Cu.Yd.)					78					34					75	375

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.	193	10	1930	759	190	14	1.5	*21*	629.5	495.0	137.0	*2877*
Pier 1	458	10	4580	2339	190	36	1.25	*46*	568	505	65.0	*2990*
Pier 2	458	10	4580	2073	190	35	1.25	*44*	567	505	64.0	*2816*
Pier 3	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 7	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Fwd. Abut.	193	10	1930	715	190	14	1.25	*18*	618.5	492	129.0	*2322*
TotaL								129				11005

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.	193	10	1930	759	190	14	1.5	*21*	629.5	495.0	137.0	*2877*
Pier 1	458	10	4580	2339	190	36	1.25	*46*	568	505	65.0	*2990*
Pier 2	458	10	4580	2201	190	36	1.25	*45*	567	505	64.0	*2880*
Pier 3	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	190	0	1.25	*0*	0	0	2.0	*0*
					190					0		
Fwd. Abut.	173	10	1730	759	190	13	1.5	*20*	618.5	492	129.0	*2580*
TotaL								132				11327

Superstructure Steel Quantities - Alt 1

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	325	10	135	438750
Span 2	350	10	195	682500
Span 3	325	10	135	438750
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				1560000

~~total steel weight per girder (lb.) = 156000~~
~~Total Span length (ft.)= 425.00~~
~~Weight Per ft. = 367~~

Superstructure Steel Quantities - Alt 2

Location	Wt.of girder	# Girders	Span Length	Total Weighl
Span 1	325	10	135	438750
Span 2	350	10	190	665000
Span 3	325	10	135	438750
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				1542500

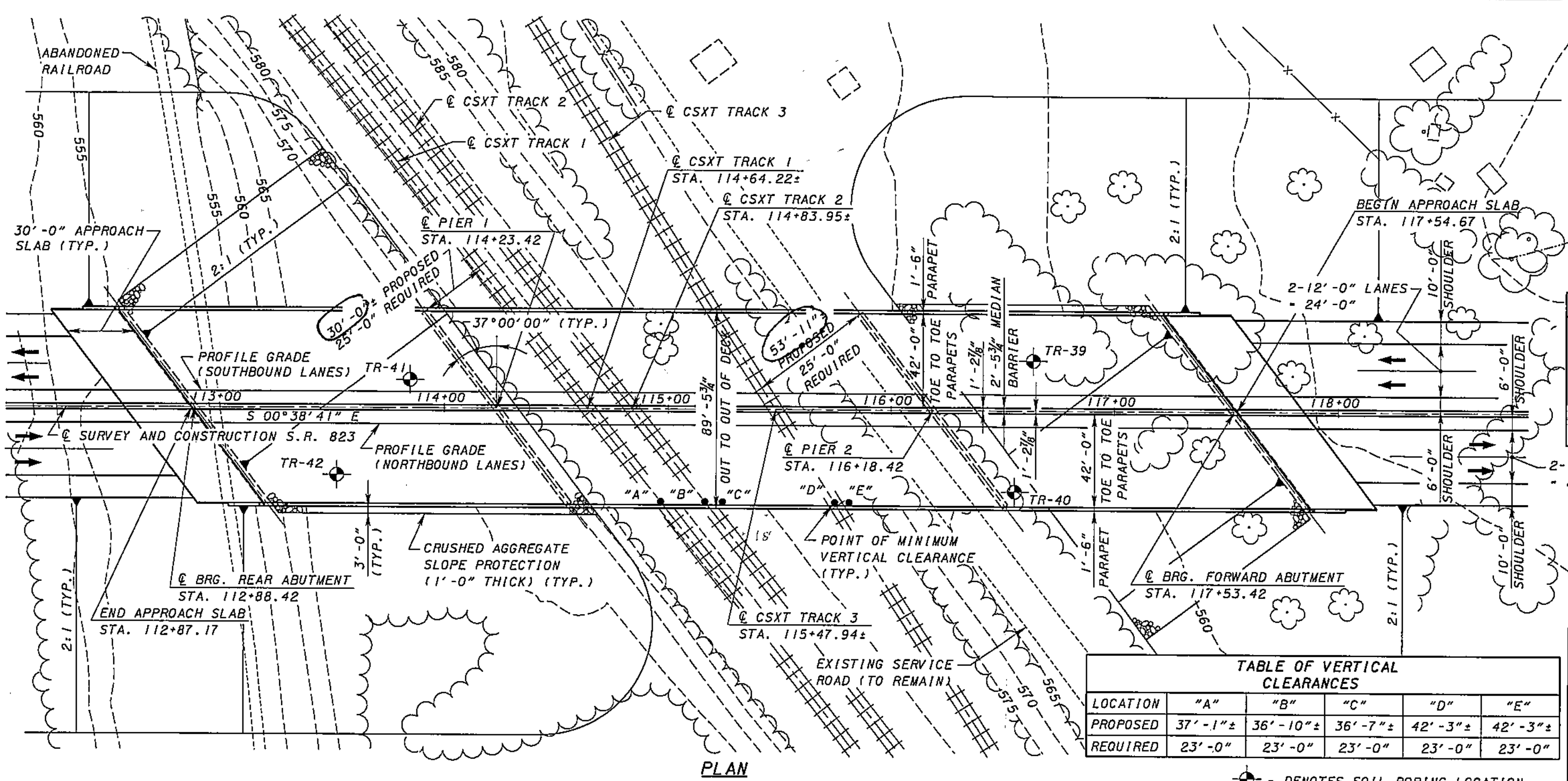
~~total steel weight per girder (lb.) = 154250~~
~~Total Span length (ft.)= 425.00~~
~~Weight Per ft. = 363~~

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	10	0		0	0	1.1	*0*	0	0	0.0	*0*
Pier 1	0	10	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Pier 2	0	10	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	10	0		0	0	1.25	*0*	0	0	0.0	*0*
TotaL								#DIV/0!				#DIV/0!

APPENDIX B

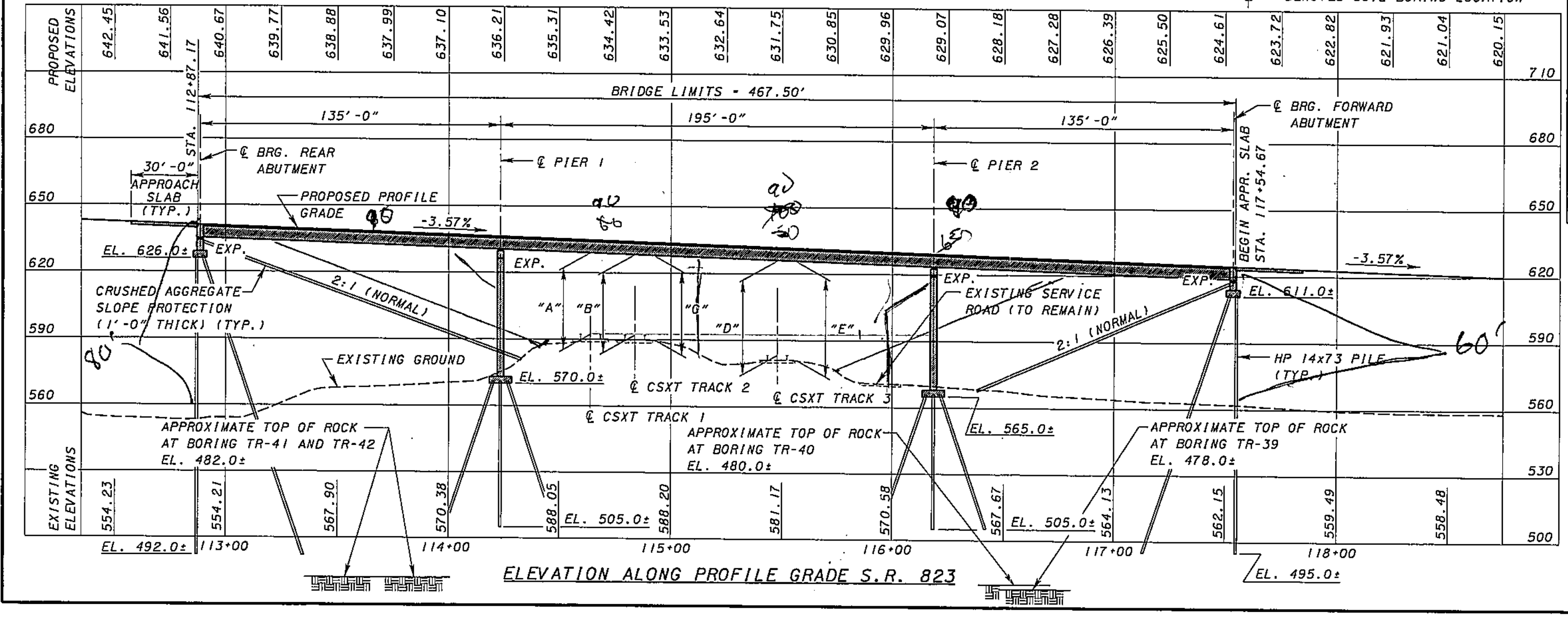
TranSystems Corporation



PLAN

TABLE OF VERTICAL CLEARANCES					
LOCATION	"A"	"B"	"C"	"D"	"E"
PROPOSED	37'-1"±	36'-10"±	36'-7"±	42'-3"±	42'-3"±
REQUIRED	23'-0"	23'-0"	23'-0"	23'-0"	23'-0"

⊕ - DENOTES SOIL BORING LOCATION



ELEVATION ALONG PROFILE GRADE S.R. 823

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-39	116+63.48	22.42' LT.
TR-40	116+55.18	36.50' RT.
TR-41	113+84.44	12.59' LT.
TR-42	113+51.70	30.30' RT.

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

TRAFFIC DATA

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

PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINUOUS A709 GRADE 50W STEEL PLATE GIRDER WITH A COMPOSITE REINFORCED CONCRETE DECK AND SUBSTRUCTURES SUPPORTED ON PILES

SPANS: 135'-0", 195'-0", 135'-0" ℄ TO ℄ BEARINGS

ROADWAY:

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

SKEW: 37°00'00" RIGHT FORWARD

CROWN: NORMAL - 0.016 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

STRUCTURE FILE NO.:

NOTES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 FRICTION PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE.

FOUNDATION DATA:

UTILITIES DISPOSITION WILL BE ADDRESSED IN THE TS&L SUBMITTAL.

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

DESIGNED	DRAWN	REVIEWED	DATE
AK	CAG	NFF	7/12/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
RER			

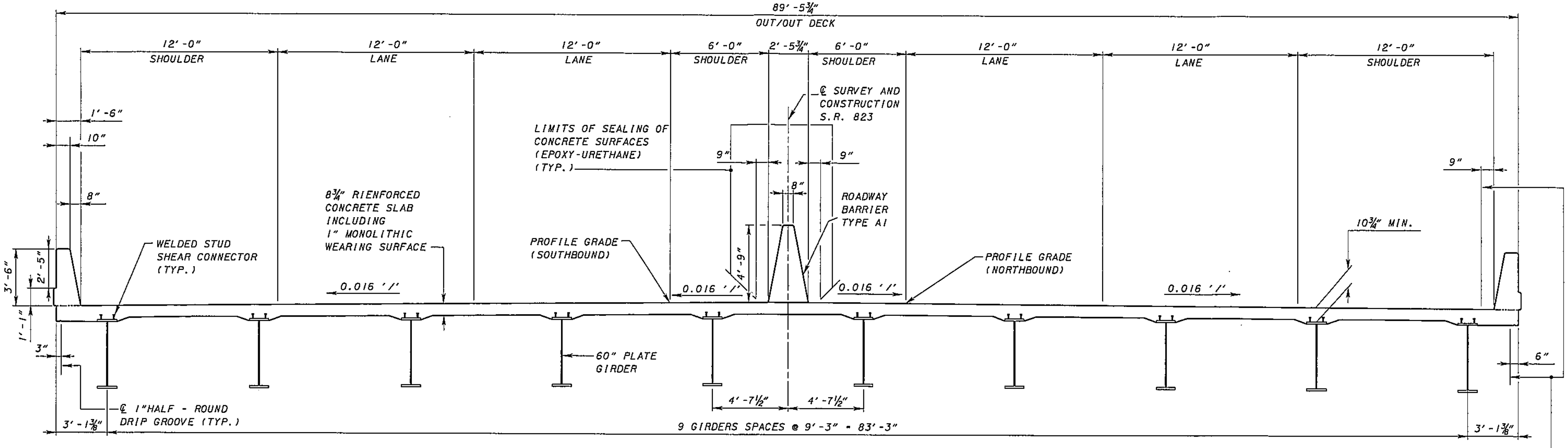
SCIOTO COUNTY
STA. 112+87.17
STA. 117+54.67

PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER CSXT RAILROAD

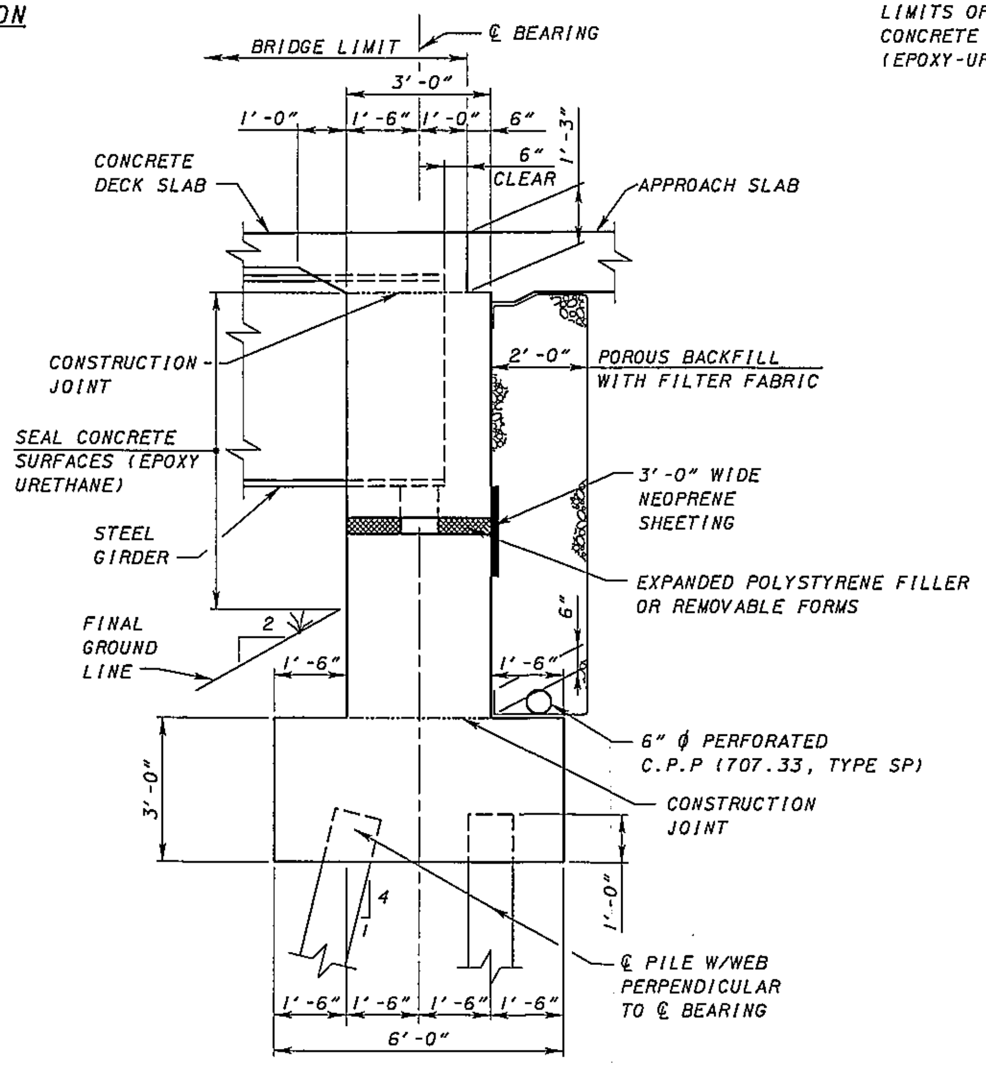
SCI-823-0.00
PID 19415

1 / 2

DATE: 07/13/2005 FILE: g:\C003\0064\Bridge\BTS\05-CSXRR\823-05sp01.dgn



PROPOSED TRANSVERSE SECTION



TYPICAL ABUTMENT SECTION

SUPERSTRUCTURE DEPTH	
ITEM	DEPTH
SLAB (INCLUDING WEARING SURFACE)	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
GIRDER DEPTH	60"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (INCH)	70¾"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (FEET)	5.90'

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

DESIGNED AK	DRAWN MAK	REVIEWED NFF	DATE 7/12/05
CHECKED RER	REVISED	STRUCTURE FILE NUMBER	

TRANSVERSE SECTION
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

2/2

DATE: 07/13/2005 FILE: g:\C003\0064\Bridge\BTS\05-CSXRR\823-05tsv01.dgn

APPENDIX C

TRANSYSTEMS
CORPORATION

TRANSYSTEMS CORPORATION

Made By BTA **Date** 07/12/05 **Job No.** P403030064

Checked By **Date** **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER CSXT RAILROAD **PID #** 19415

Alternative 2 - 10 Steel Girders, 3 Span | ***Point Location: A, B & C***

Adjstment for Cross Slope

Comment	Grade		Offset		
2 Lanes:	-0.016	x	24	=	-0.38
Shoulder to Beam CL:	-0.016	x	10.385	=	-0.17
			Total Adjustment	=	**-0.55**

Superstructure Depth

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

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

Vertical Clearance at Critical Point

		TRACK 1	*TRACK 2*	*Track 2 (6.0')*
Station @ Critical Point	=	**114+96.55**	**115+16.33**	**115+23.94**
Offset Location @ Critical Point	=	**41.63' RT**	**41.63' RT**	**41.63' RT**
Profile Grade Elevation at Critical Point	=	633.65	632.95	632.68
Adjustment for Cross Slopes to Beam CL	=	-0.55	-0.55	-0.55
Top of Deck Elevation @ Critical Point	=	**633.10**	**632.40**	**632.13**
Total Superstructure Depth	=	-5.90	-5.90	-5.90
Bottom of Beam Elevation @ Critical Point	=	**627.20**	**626.50**	**626.23**
Approximate Top of proposed Ground @ Critical Point	=	**590.12**	**589.64**	**589.65**
Actual Vertical Clearance (feet)	=	***37.08***	***36.86***	***36.58***
Preferred Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*
Required Vertical Clearance (feet)	=	*23.0*	*23.0*	*23.0*

TRANSYSTEMS CORPORATION

Made By BTA Date 07/12/05 Job No. P403030064
Checked By ______ Date ______ Sheet No. ______

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure ______
Description S.R. 823 OVER CSXT RAILROAD PID # 19415

Alternative 2 - 10 Steel Girders, 3 Span *Point Location: D & E*

Adjstment for Cross Slope

Comment	Grade		Offset		
2 Lanes:	-0.016	x	24	=	-0.38
Shoulder to Beam CL:	-0.016	x	10.385	=	-0.17
			Total Adjustment	=	**-0.55**

Superstructure Depth

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

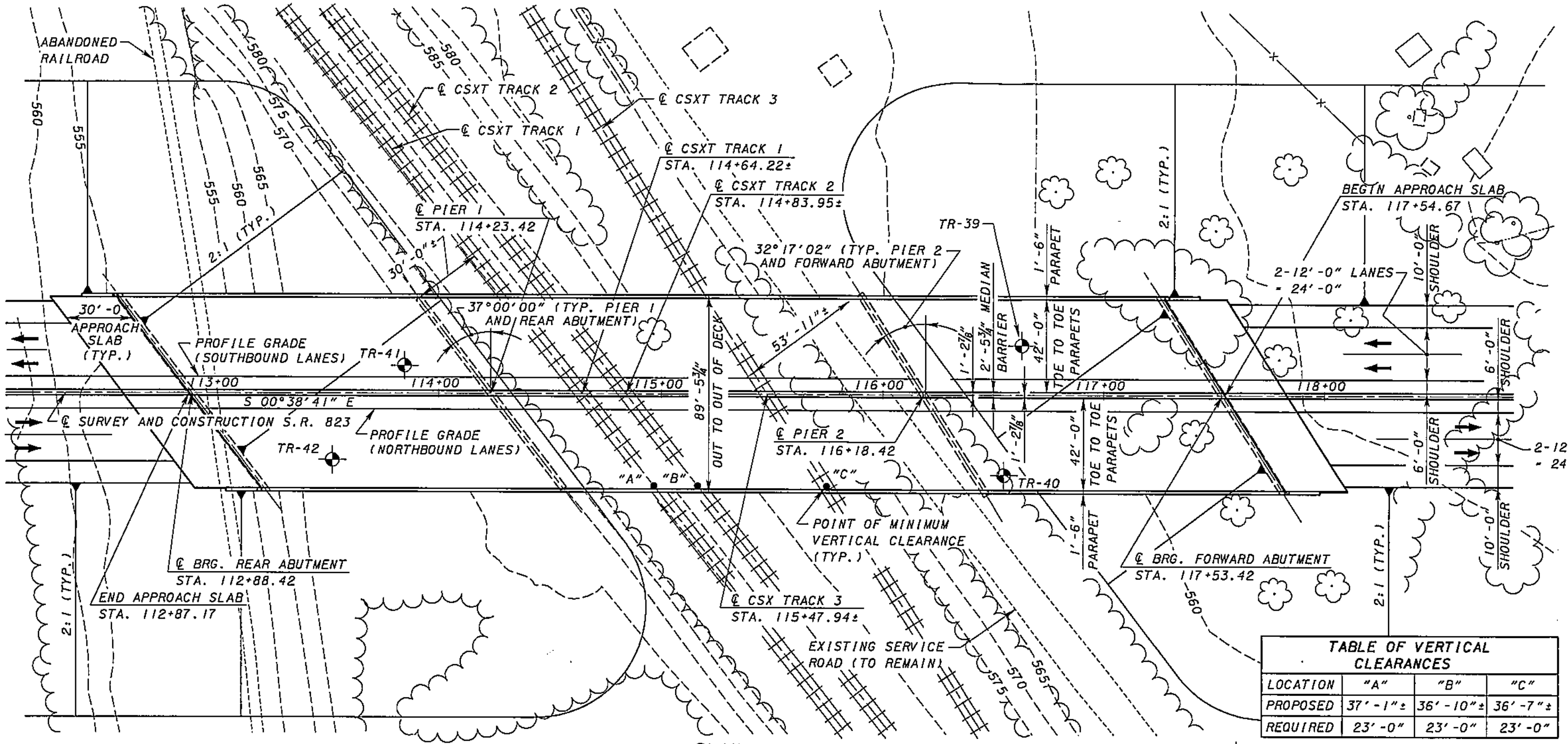
Total Superstructure Depth (ft) = **5.90**

Vertical Clearance at Critical Point

		TRACK 3	*TRACK 3 (6.0')*
Station @ Critical Point	=	**115+74.44**	**115+81.55**
Offset Location @ Critical Point	=	**41.63' RT**	**41.63' RT**
Profile Grade Elevation at Critical Point	=	630.87	630.62
Adjustment for Cross Slopes to Beam CL	=	-0.55	-0.55
Top of Deck Elevation @ Critical Point	=	**630.32**	**630.07**
Total Superstructure Depth	=	-5.90	-5.90
Bottom of Beam Elevation @ Critical Point	=	**624.42**	**624.17**
Approximate Top of proposed Ground @ Critical Point	=	**582.15**	**581.96**
Actual Vertical Clearance (feet)	=	***42.27***	***42.21***
Preferred Vertical Clearance (feet)	=	*23.0*	*23.0*
Required Vertical Clearance (feet)	=	*23.0*	*23.0*

APPENDIX D

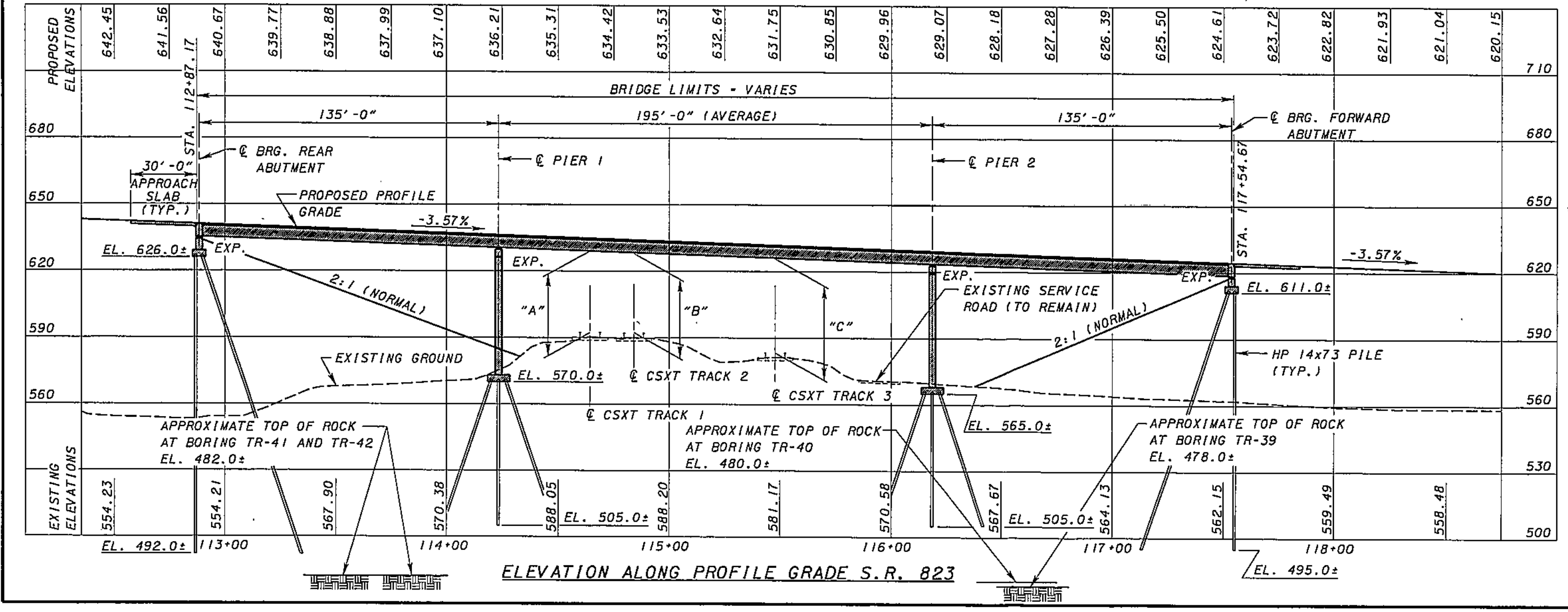
TRANSYSTEMS
CORPORATION



PLAN

TABLE OF VERTICAL CLEARANCES			
LOCATION	"A"	"B"	"C"
PROPOSED	37'-1"±	36'-10"±	36'-7"±
REQUIRED	23'-0"	23'-0"	23'-0"

⌖ - DENOTES SOIL BORING LOCATION



ELEVATION ALONG PROFILE GRADE S.R. 823

STRUCTURE TYPE:

3-SPAN CONTINUOUS A709 GRADE 50W STEEL PLATE GIRDER WITH A COMPOSITE REINFORCED CONCRETE DECK AND SUBSTRUCTURES SUPPORTED ON PILES.

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. 112+87.17
STA. 117+54.67

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

11
1

DATE: 07/13/2005 FILE: g:\C003\0064\Bridge\BTS\05-CSXRR\823-05sp02.dgn

APPENDIX E

TRANSYSTEMS
CORPORATION

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 25, 2005

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

Re: **SCI-823-0.00 over CSX RR (Highland Bend)**
Preliminary Structural Foundation Recommendations
Project SCI-823-0.00
DLZ Job No.: 0121-3070.03

Dear Mr. Parsons:

This letter reports the findings of the subsurface exploration and preliminary foundation recommendations for the proposed structure SCI-823-0.00 over CSX Railroad within the Highland Bend area. It is anticipated that the proposed structure will be a three-span, elevated bridge with embankment fills at both abutments. The existing grade at the proposed new bridge location is relatively flat with an elevation between 569 and 575. The existing CSX Railroad is located on an embankment around elevation 593. It is anticipated that the SCI-823-0.00 mainline will require embankment constructed to approximate heights of 40 to 70 feet. The existing Highland Bend area is located within the Little Scioto River valley with the overburden being primarily composed of glacial and alluvial deposits.

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

Field Exploration

A total of four borings, TR-39 through TR-42, were drilled at the proposed structure between February 2, 2005 and February 22, 2005. The borings were drilled to depths between 112 and 115 feet. The borings were extended into bedrock, which was verified by rock coring. Boring Logs and information concerning the drilling procedures are attached.

The boring locations were selected by TranSystems Corporation. Ground surface elevations at the boring locations were estimated from the established topographic mapping for the project and are presented on the attached Boring Logs.

Findings

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

At the ground surface topsoil was encountered at depths of 4 to 9 inches. Beneath the topsoil, generally cohesive soils were encountered to top of bedrock with intermittent layers of granular soil. The cohesive soils encountered ranged from sandy silt (A-4a) to clay (A-7-6), and were generally stiff to hard. The granular soils ranged from sandy silt (A-4a) to fine sand (A-3). The granular soils were generally loose to dense. Generally, the granular layers were encountered just above top of rock.

Bedrock was encountered between 90 and 93 feet below the ground surface, which was generally a medium hard to hard sandstone that was slightly broken to intact. Recovery of the core samples ranged from 80 to 100%, and RQD values ranged from 50 to 100% with an average RQD of 82%.

Seepage was detected in all of the borings ranging in depth from 25 to 93 feet below the ground surface. Seepage was generally detected within granular layers. Water levels recorded at completion of drilling ranged from 3.0 to 12.0 feet. However, the final water levels included drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally.

Conclusions and Recommendations

It appears that driven piles will be the best-suited foundation type for the support of the proposed structure. Due to the size of the structure, it is anticipated that HP 14X73 H-pile sections, with a 95-ton capacity, or 16-inch CIP, with a 90-ton capacity, will be used. Drilled shafts or H-piles socketed into bedrock may be considered. The rock sockets will need to be designed based upon actual loading conditions. The following table summarizes the site conditions and foundation recommendations.

Foundation Recommendations

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Top of Rock Elevation* (Feet)	Estimated H-pile Tip Elevation* (HP 14X73 95 Ton capacity)	Estimated CIP Tip Elevation* (16" Dia. 90 Ton capacity)	Estimated Drilled Shaft Tip Elevation*	Allowable Bearing Capacity for Drilled Shafts (TSF)
TR-39	Forward Abutment	569	478	495	492	475	20
TR-40	Pier 2	575	485	505	502	482	20
TR-41	Pier 1	575	482	505	503	479	20
TR-42	Rear Abutment	575	482	492	486	479	20

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

Additionally, since the SCI-823-0.00 mainline will be located on a relatively large embankment through the Highland Bend area, and could be potentially underlain by compressible soils, the abutment 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.

Spread footings could be considered, but differential settlement concerns would need to be addressed. Pre-loading or other techniques may be necessary if footings are used.

It should be noted that if driven H-piles are selected, special pile-driving techniques may be required. Wet silts and fine sands, such as those encountered within this area, tend to produce exaggerated blow counts during pile driving, due to increased pore pressures during driving, which do not reflect the actual load carrying ability of the strata. Piles should be driven to the design capacity, allowed to sit at least 24 hours to allow pore pressures to dissipate, then re-driven to ensure that the design capacity has been achieved. If the design capacity has not been achieved, the pile should be re-driven until the design capacity has been achieved with confirmation after 24 hours.

Because of the many geotechnical factors across the anticipated structure location, such as, large potential lateral loads, large embankment heights, depths of relatively compressible soils, and potential for differential settlement, a detailed evaluation of all geotechnical parameters will need to be considered for the final design. 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.

Closing

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

Sincerely,

DLZ OHIO, INC.

P. Paul Painter

P. Paul Painter
Engineering Geologist

Dorothy A. Adams for

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

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Boring Location Plan
Boring Logs TR-39, TR-40, TR-41, TR-42

cc: File

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GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

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

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

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

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

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

1. Depth (in feet) – refers to distance below the ground surface.
2. Elevation (in feet) – is referenced to mean sea level, unless otherwise noted.
3. Standard Penetration (N) – the number of blows required to drive a 2-inch O.D., 1-3/8 inch I.D., split-barrel sampler, using a 140-pound hammer with a 30-inch free fall. The blows are recorded in 6-inch drive increments. Standard penetration resistance is determined from the total number of blows required for one foot of penetration by summing the second and third 6-inch increments of an 18-inch drive.

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

4. The length of the sampler drive is indicated graphically by horizontal lines across the "Standard Penetration" and "Recovery" columns.
5. Sample recovery from each drive is indicated numerically in the column headed "Recovery".
6. The drive sample location is designated by the heavy vertical bar in the "Sample No., Drive" column.
7. The length of hydraulically pressed "Undisturbed" samples is indicated graphically by horizontal lines across the "Press" column.
8. Sample numbers are designated consecutively, increasing in depth.
9. Soil Description

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

   Granular Soils – Compactness

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

   Cohesive Soils – Consistency

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

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

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

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

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

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

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

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

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

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

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

10. Rock Hardness and Rock Quality Designation

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

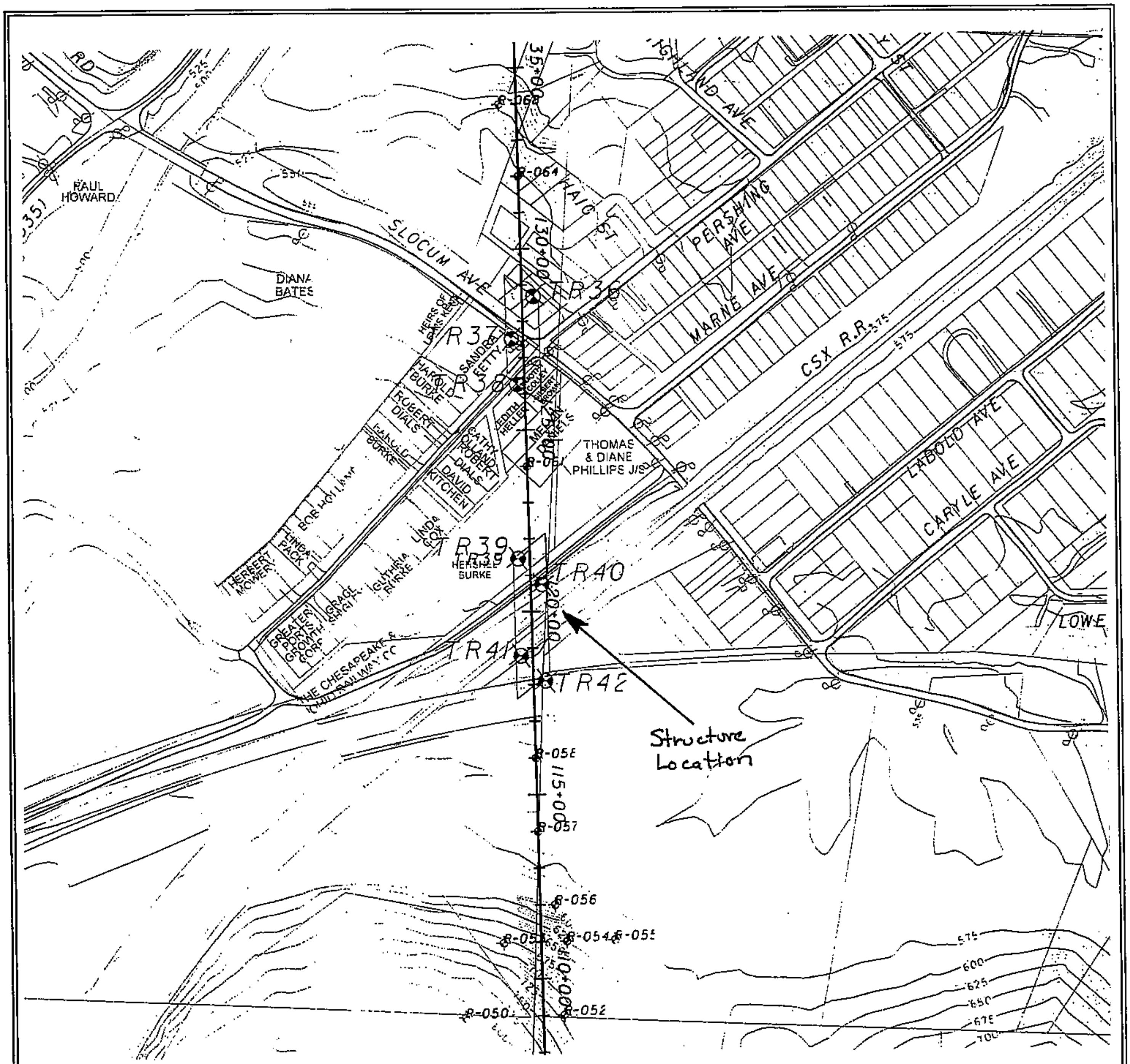
Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed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

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

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

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

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



Source: Topographic Mapping provided by TranSystems Corporation, Dated 2004

NORTH

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SITE PLAN

CSX RR at Highland Band

SCI-823 over CSX RailRoad

SCI-823-0.00

FIGURE 1.

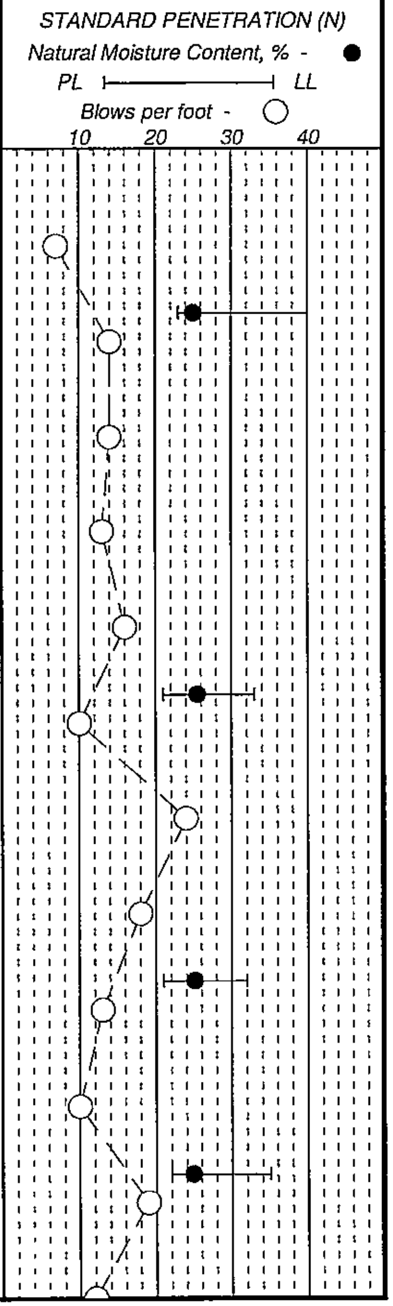
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-39
Location: Forward Abutment SCI-823.00 over CSX RR
Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS:
Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	569.0												
0.3	568.7						Topsoil - 4"						
		1 3 7 4	16	1		2.25	Very stiff brown SILTY CLAY (A-6b); damp. @ 0.3'-1.5', contains organics.						
5		3 6 14 8	18	2		3.5		0	0	--	1	47	52
		3 5 14 9	18	3		2.25							
8.0	561.0						Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp.						
10		3 5 13 8	18	4		3.25							
		4 7 16 9	16	5		2.75							
15		3 5 10 5	18	6		2.75		0	0	--	1	53	46
		5 10 24 14	16	7		4.0	@ 16.0'-20.5', very stiff to hard.						
20		4 8 18 10	15	8		3.75-4.5+							
		4 6 13 7	18	9		3.25		0	0	--	1	59	40
25		4 4 10 6	16	10		3.0							
		6 8 19 11	18	11		3.0		0	0	--	1	46	53
							@ 28.0', occasional moist thin A-4b seams.						
30		4 6 6	18	12		3.25							



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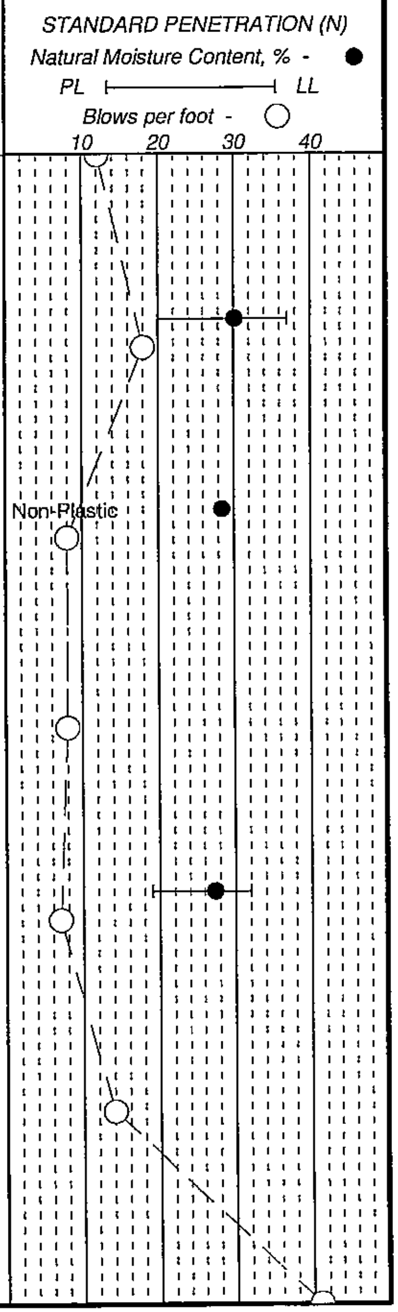
Client: TranSystems, Inc. *Project:* SCI-823-0.00 *Job No.* 0121-3070.03

LOG OF: Boring TR-39 *Location:* Forward Abutment SCI-823.00 over CSX RR *Date Drilled:* 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30.0	539.0 539.0						Very stiff brown SILTY CLAY (A-6b); moist.						
35		6 8 10	18	13		2.25		0	0	--	1	80	19
37.0	532.0						Loose gray SILT (A-4b), trace fine sand; moist.						
40		5 3 5	15	14				0	0	--	1	81	19
45		3 3 5	16	15									
47.0	522.0						Medium stiff to stiff gray SILT AND CLAY (A-6a); damp to moist.						
50		3 3 4	18	16		0.5		0	0	--	1	57	42
55		4 5 9	18	17		1.0							
57.0	512.0						Hard brownish gray SILTY CLAY (A-6b), trace to little fine sand; damp.						
60		9 16 25	18	18		4.5+							



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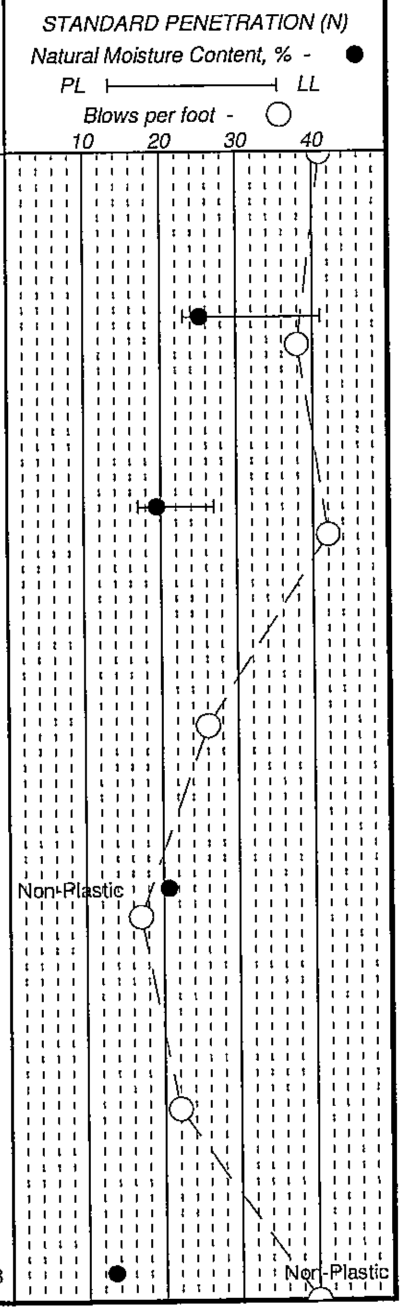
Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay.
60	509.0						Hard brownish gray SILTY CLAY (A-6b), trace to little fine sand; damp.						
		12 15 23	16	19		4.5+		0	0	--	3	32	65
65													
67.0	502.0						Very stiff gray SILT (A-4b), trace fine sand; slightly organic; damp.						
		11 18 24	15	20		2.5		0	0	--	9	60	31
70													
		5 10 16	16	21		3.5							
75													
77.0	492.0						Medium dense brown SANDY SILT (A-4a), trace gravel; slightly organic; wet.						
		7 8 9	18	22				0	3	--	38	48	11
80													
		12 10 12	18	23									
85													
87.0	482.0						Dense brown and gray GRAVEL WITH SAND (A-1-b), trace to little silty clay; contains angular sandstone fragments; wet.						
		27 23 17	14	24				41	11	--	13	27	8
90													



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WATER OBSERVATIONS:
Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	GRADATION % C. Sand	GRADATION % M. Sand	GRADATION % F. Sand	GRADATION % Silt	GRADATION % Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ├──┤ LL Blows per foot - ○ 10 20 30 40
90	479.0													
90.5	478.5						Dense brown and gray GRAVEL WITH SAND (A-1-b), wet.							
91.0	478.0						soft to medium hard gray SANDSTONE; very fine to fine grained, highly weathered to decomposed.							
95		Core 60"	Rec 60"	RQD 90%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains siltstone layers.							
100		Core 60"	Rec 56"	RQD 93%	R-2		@ 97.7',97.8', low angle fracture. @ 100.7'-101.1', highly weathered and broken. @ 101.7'-101.9', limestone layer.							
105		Core 60"	Rec 60"	RQD 100%	R-3		@ 104.2'-104.5', fine to medium grained clean sandstone.							
110		Core 60"	Rec 60"	RQD 100%	R-4		@ 109.2'-109.7', fine to medium grained clean sandstone. @ 111.0'-111.3', limestone layer. @ 111.3'-112.0', fine to medium grained clean sandstone.							
112.0	457.0						Bottom of Boring - 112.0'							
115														
120														

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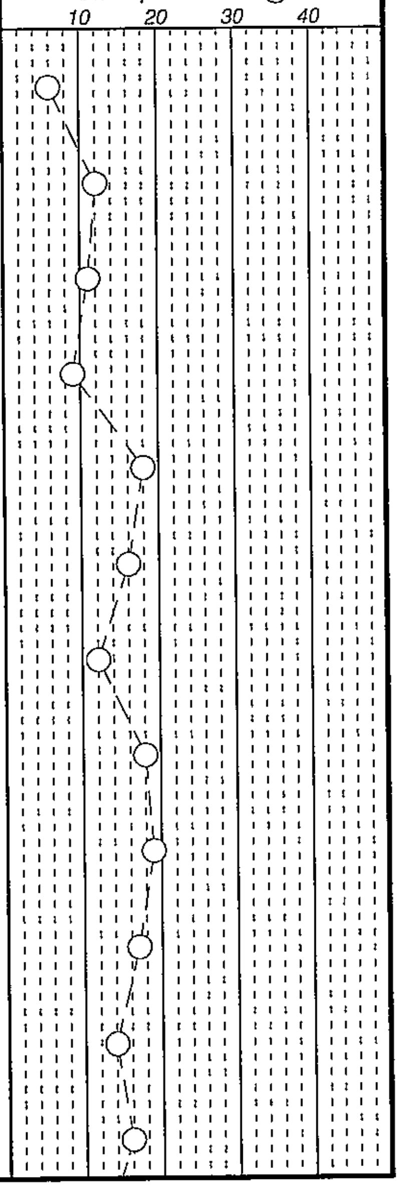
Client: TranSystems, Inc.
Project: SCI-823-0.00
Job No. 0121-3070.03

LOG OF: Boring TR-40
Location: Pier 2 SCI-823.00 over CSX RR
Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS:
Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	575.0												
0.5	574.5	1 2 6 4	18	1		1.5	Topsoil - 6" Stiff to very stiff brown SILTY CLAY (A-6b), trace fine sand; damp to moist.						
		2 6 12 6	16	2		3.5							
5.0	570.0	3 5 11 6	18	3		1.5	Stiff brown SILT AND CLAY (A 6a), trace fine sand; damp.						
		4 4 9 5	16	4		1.5							
10		6 8 18 10	18	5		2.5	@ 10.0', very stiff.						
		4 6 16 10	18	6		2.5							
15		2 5 12 7	18	7		2.5							
		5 8 18 10	18	8		4.0	@ 17.0'-27.0', hard.						
20		3 7 19 12	16	9		4.5+							
		5 7 17 10	18	10		4.0							
25		4 6 14 8	16	11		4.5							
		5 8 16 8	18	12		2.25							
30													

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



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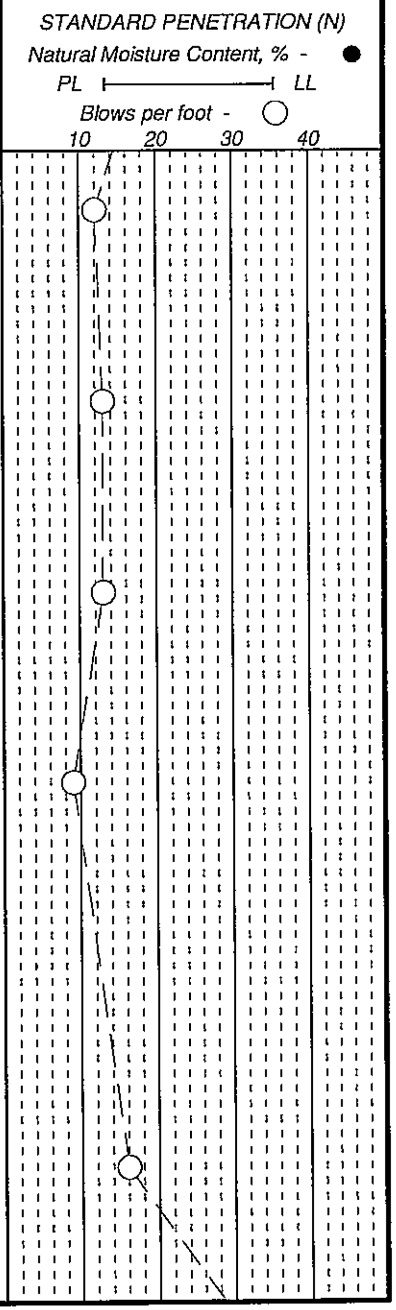
Client: TranSystems, Inc. | *Project:* SCI-823-0.00 | *Job No.* 0121-3070.03

LOG OF: Boring TR-40 | *Location:* Pier 2 SCI-823.00 over CSX RR | *Date Drilled:* 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	545.0	5 5 12 7	15	13		2.0	Stiff to very stiff brown SILT AND CLAY (A-6a), trace fine sand; damp to moist.						
33.0	542.0						Stiff to very stiff brown SILT (A-4b), little fine sand, little clay; moist to wet.						
35		6 7 13 6	17	14		1.5							
40		4 5 13 8	18	15		2.0							
43.0	532.0						Stiff to very stiff gray SILT AND CLAY (A-6a), trace fine sand; damp to moist.						
45		4 4 9 5	18	16		1.5							
50		WOH WOH 3		17		1.5							
55		4 8 8		18		3.5							
60													



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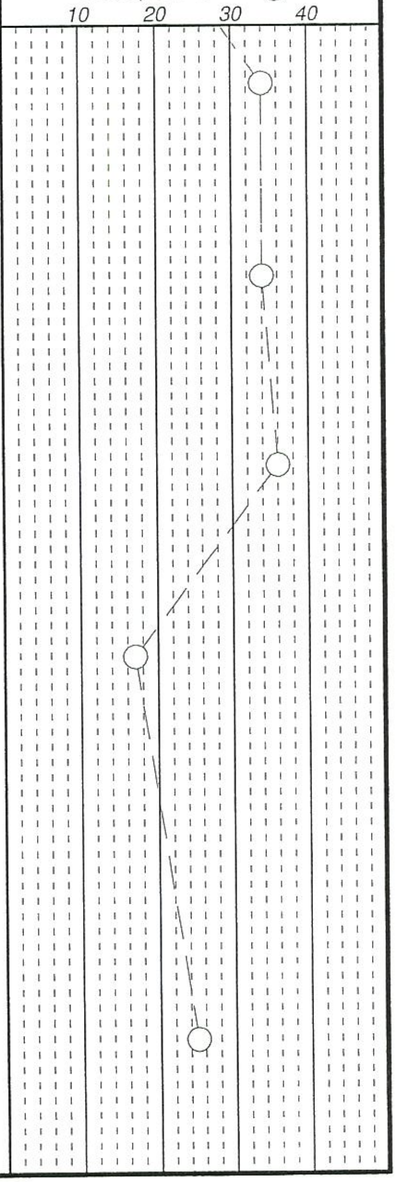
WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No.		Hand Penetro-meter (tsf)	DESCRIPTION	GRADATION					
				Drive	Press / Core			% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60	515.0	8 15 19	18	19		3.0	Stiff to very stiff gray SILT AND CLAY (A-6a), trace fine sand; damp to moist.						
65		5 15 19	18	20		3.0							
70		11 16 20	16	21		4.5+							
75		4 7 10	18	22		3.5							
78.0	497.0						Loose to medium dense brown and gray FINE SAND (A-3), trace silty clay; wet.						
80		WOH WOH 16	15	23									
85		9 11 14	18	24									
88.0	487.0						Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet.						
90													

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



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WATER OBSERVATIONS:
Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

Depth (ft)	*Elev. (ft)*	*Blows per 6"*	*Recovery (in)*	*Sample No.*		*Hand Penetro-meter (tsf)*	*DESCRIPTION*	*GRADATION*						*STANDARD PENETRATION (N)*
				Drive	*Press / Core*			*% Aggregate*	*% C. Sand*	*% M. Sand*	*% F. Sand*	*% Silt*	*% Clay*	*Natural Moisture Content, % - ●* *PL ⊢—⊣ LL* *Blows per foot - ○* 10 20 30 40
90	485.0	50/5	5	25			Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet.							
95.0	480.0	Core 60"	Rec 58"	RQD 67%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, arenaceous, thinly bedded to thickly bedded.							
100		Core 60"	Rec 60"	RQD 93%	R-2		@ 95.5',95.8',99.6', low angle clay filled fractures.							
105		Core 60"	Rec 49"	RQD 75%	R-3		@ 100.8',102.7',103.0', low angle clay filled fractures.							
110		Core 60"	Rec 60"	RQD 90%	R-4		@ 106.7',112.5', low angle clay filled fractures.							
115.0	460.0						Bottom of Boring - 115.0'							
120														

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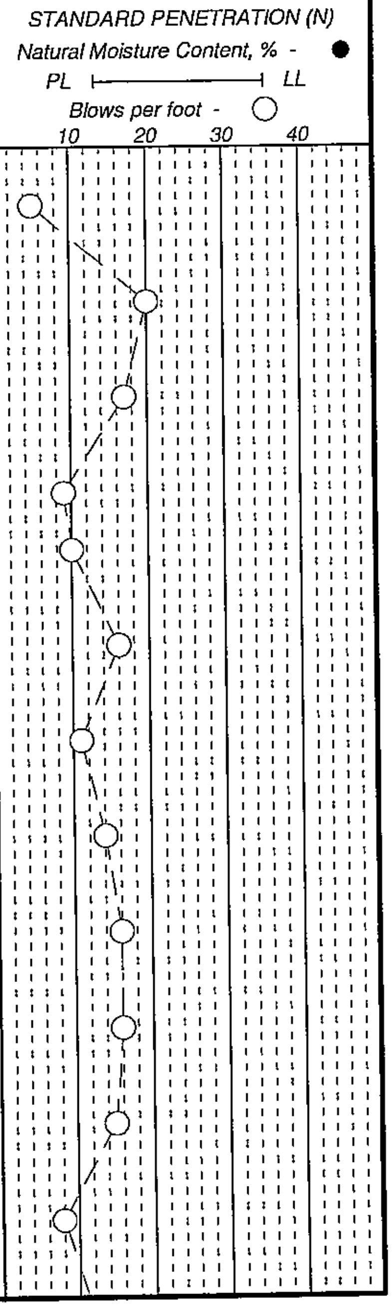
Client: TranSystems, Inc.
Project: SCI-823-0.00
Job No. 0121-3070.03

LOG OF: Boring TR-41
Location: Pier 1 SCI-823.00 over CSX RR
Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS:
Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

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	575.0	2 3 5 2	15	1		2.0	Topsoil 9"						
0.8	574.2						Very stiff brown SILT AND CLAY (A-6a), trace fine sand; moist.						
		4 9 20 11	18	2		4.0							
5		4 7 17 10	18	3		2.5							
		3 4 9 5	18	4		2.25							
10		2 4 10 6	18	5		2.5							
		4 7 16 9	18	6		3.5							
15		3 4 11 7	18	7		3.25							
		2 6 14 8	18	8		3.5							
20		2 6 16 10	18	9		4.0							
21.0	554.0						Very stiff brown SANDY SILT (A-4a), little clay, trace fine sand; moist.						
		6 7 16 9	18	10		3.75							
25		6 7 15 8	18	11		2.5							
		2 3 8 5	18	12		2.5							
30		2 5 1		13		2.5							



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Project: SCI-823-0.00
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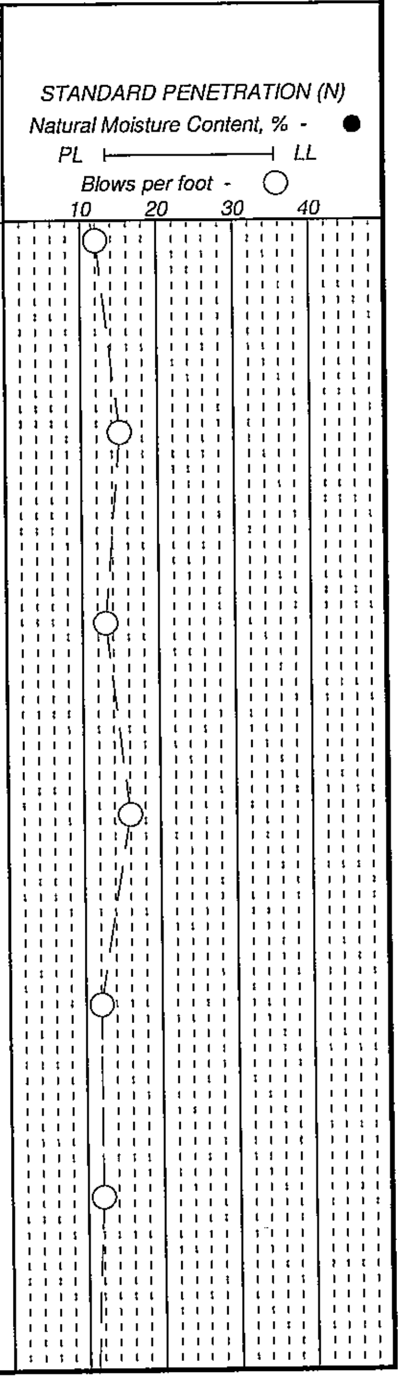
LOG OF: Boring TR-41
Location: Pier 1 SCI-823.00 over CSX RR
Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS:
Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	545.0	7	18				Stiff to very stiff brown SANDY SILT (A-4a), little clay, trace fine sand; moist.						
35		3 6 15 9	18	14		2.25							
39.5	535.5						Stiff to very stiff gray SILT AND CLAY (A-6a), little clay, trace fine sand; moist.						
40		5 6 13 7	18	15		2.5							
45		3 7 16 9	18	16		1.5							
50		3 5 12 7	18	17		2.0							
55		4 5 12 7	18	18		2.5							
60		2 5		19		1.75							



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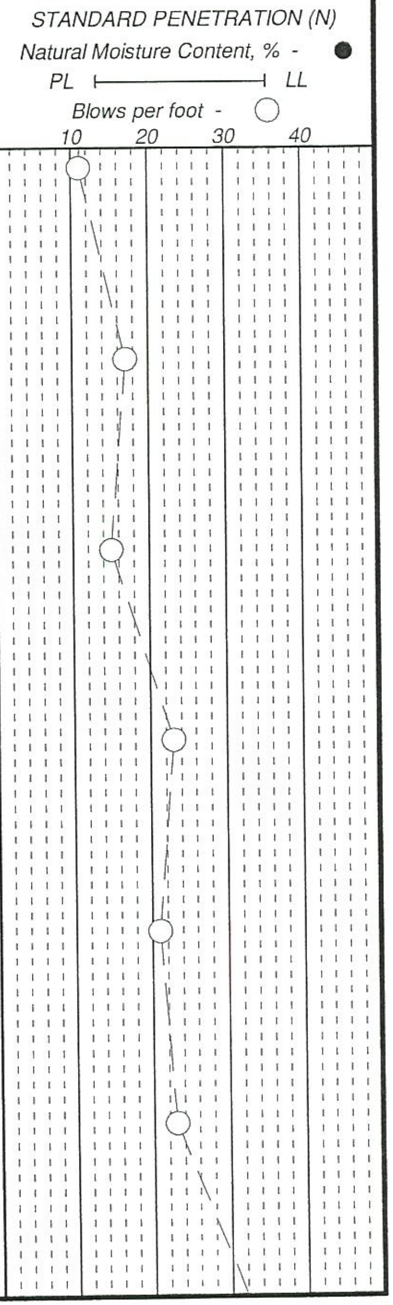
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60	515.0	6	18				Stiff to very stiff gray SANDY SILT (A-4a), little clay, trace fine sand; moist.						
65		7 7 10	18	20		2.0	@ 64.0'-65.5', trace organics.						
68.0	507.0						Loose to medium dense gray FINE SAND (A-3), little silty clay; wet.						
70.0	505.0	10 7 8	18	21		NA	Stiff to very stiff gray SANDY SILT (A-4a), little clay, trace fine sand; moist.						
75		5 9 14	18	22		3.0							
80		3 9 12	18	23		1.5							
83.0	492.0						Loose to medium dense gray FINE SAND (A-3), little silty clay; wet.						
85		10 9 14	18	24		NA							
87.0	488.0						Medium dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet.						
90		10 12		25		NA							



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

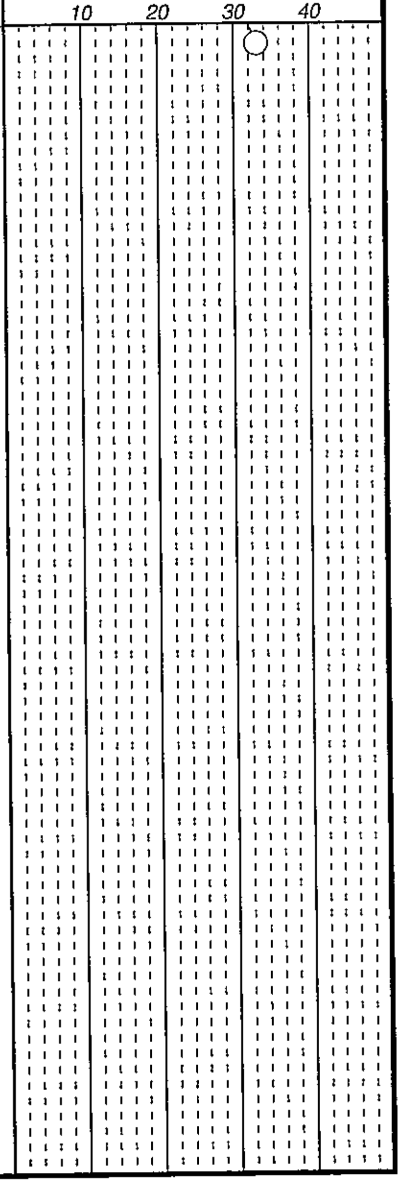
Client: TranSystems, Inc. | *Project:* SCI-823-0.00 | *Job No.* 0121-3070.03

LOG OF: Boring TR-41 | *Location:* Pier 1 SCI-823.00 over CSX RR | *Date Drilled:* 2/15/05 to 2/16/05

WATER OBSERVATIONS:
Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

Depth (ft)	*Elev. (ft)*	*Blows per 6"*	*Recovery (in)*	*Sample No. Drive*	*Sample No. Press / Core*	*Hand Penetrometer (tsf)*	*DESCRIPTION*	*% Aggregate*	*% C. Sand*	*% M. Sand*	*% F. Sand*	*% Silt*	*% Clay*
90	485.0	21	17				Medium dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet.						
93.0	482.0						Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, micaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle rust stained fractures. @ 95.1'-95.5', broken zone. @ 93.0'-93.7', lost recovery.						
95 95.6	479.4	Core 60"	Rec 48"	RQD 50%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded, moderately fractured, with typically low angle clay filled fractures.						
100		Core 60"	Rec 60"	RQD 85%	R-2								
105		Core 60"	Rec 54"	RQD 67%	R-3		@ 103.0'-103.5', lost recovery. @ 103.5'-104.0',106.7'-107.7',1 broken zone.						
110		Core 60"	Rec 60"	RQD 90%	R-4								
113.0	462.0						Bottom of Boring - 113.0'						
115													
120													

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



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

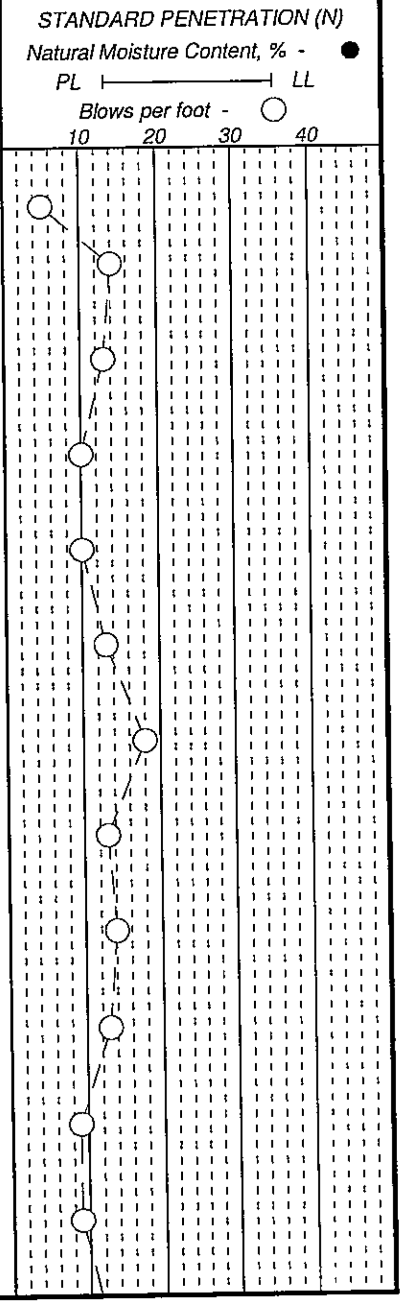
LOG OF: Boring TR-42

Location: Rear Abutment SCI-823.00 over CSX RR

Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS:
Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

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	575.0	1 3 2	13	1		1.75	Stiff dark brown SANDY SILT (A-4a), trace gravel; damp.						
		4 4 10	18	2		2.0	@ 1.5', Brown; contains roots.						
3.5	571.5						Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; dry to damp.						
5		4 5 8	18	3		3.5							
		2 4 6	18	4		3.5							
10		2 4 6	18	5		3.75							
		2 6 7	18	6		3.25							
15		4 7 11	18	7		4.0	@ 14.0', Hard.						
		4 6 7	18	8		4.5+							
20		4 5 9	18	9		4.5+							
		3 5 8	18	10		3.5	@ 21.5', Very stiff; damp.						
25		3 4 5	18	11		2.75							
		3 4 5	18	12		3.0							
30		4 5		13		3.0							



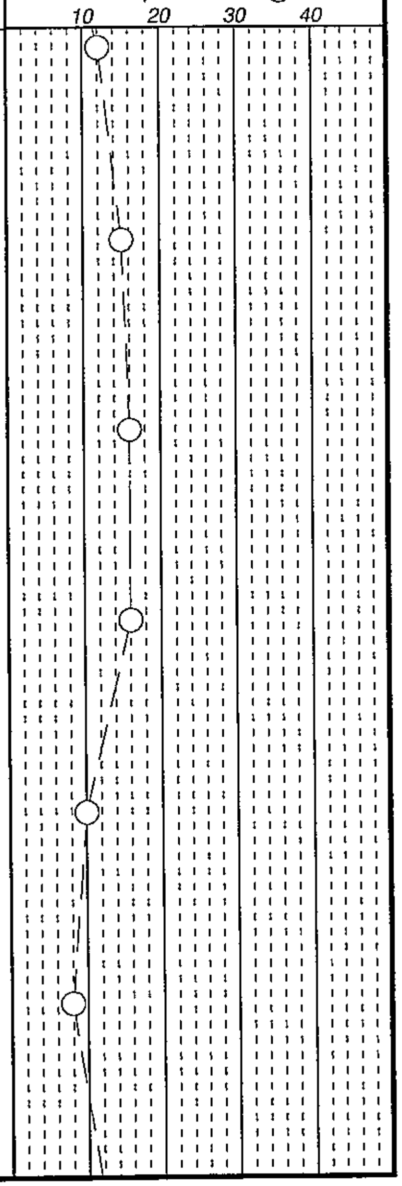
Client: TranSystems, Inc.
Project: SCI-823-0.00
Job No. 0121-3070.03

LOG OF: Boring TR-42
Location: Rear Abutment SCI-823.00 over CSX RR
Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS:
Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	545.0	7	18				Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp.						
							@ 34.0', Moist.						
35		4 7 8	18	14		2.0							
37.0	538.0						Hard brownish gray SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist.						
40		6 5 11	18	15		4.5+							
45		5 6 10	18	16		3.5	@ 44.0', Very stiff.						
50		3 4 6	18	17		2.5							
							@ 53.0'-58.0', stiff.						
55		3 3 5	18	18		1.5							
60		4 5		19		3.25							

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



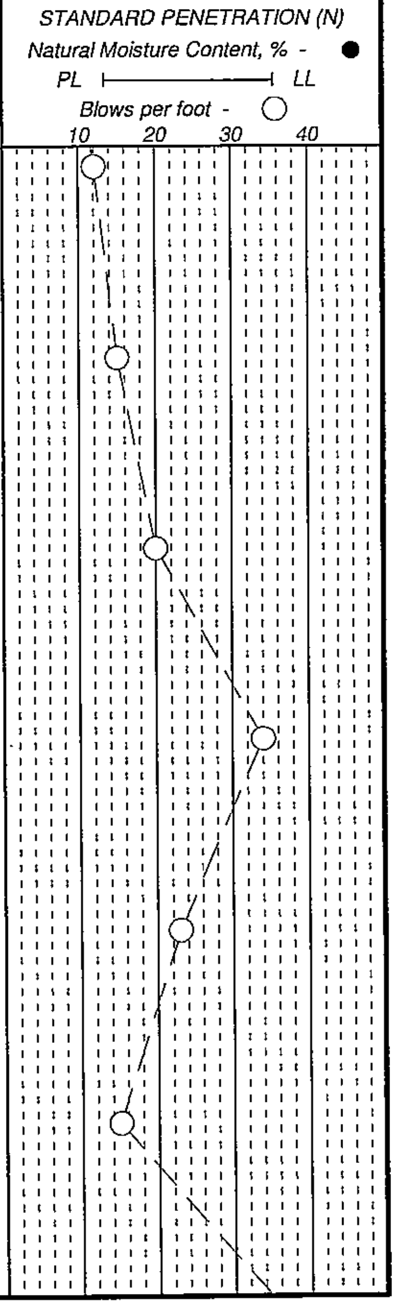
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-42
Location: Rear Abutment SCI-823.00 over CSX RR
Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS:
Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60	515.0	7	18				Very stiff brownish gray SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist.						
65		4 7 8	18	20		2.0							
67.0	508.0						Medium dense brown COARSE AND FINE SAND (A-3a), trace gravel; moist.						
70		4 10 10	18	21									
72.0	503.0						Medium dense to dense brownish gray SANDY SILT (A-4a), trace clay, trace gravel; dry to damp.						
75		7 14 20	18	22		2.25							
80		5 7 16		23		3.75							
85		8 6 9	18	24									
90		10 14		25			@ 89.0', some gravel.						



FILE: 0121-3070-03 [3/31/2005 9:34 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-42
Location: Rear Abutment SCI-823.00 over CSX RR
Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS:
Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

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
90	485.0	23	18				Medium dense to dense brownish gray SANDY SILT (A-4a), some gravel, trace clay; damp.						
92.0	483.0						Medium hard gray SANDSTONE; moderately weathered, argillaceous.						
94.0 95	481.0	Core 60"	Rec 48"	RQD 75.0%	R1		Hard gray SANDSTONE; slightly weathered, arenaceous. @ 94.1', 94.6', 95.1', 96.1', 97.4', 97.8', 100.8' and 101.4', fractured. @ 104.0', 45° degree fracture. @ 102.2', 105.8' and 108.9' clay seem. @ 104.5' to 105.0', 105.9' to 106.8' and 108.3 to 110.9, moderately fractured.						
100		Core 60"	Rec 58"	RQD 88.3%	R2								
105		Core 60"	Rec 55"	RQD 60.0%	R3								
110		Core 60"	Rec 59"	RQD 85.0%	R4								
112.0	463.0						Bottom of Boring - 112.0'						
115													
120													

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