SCI-823-0.00

PID No. 19415

S.R. 823 over Slocum Avenue

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 left and right overpass structures that will carry the proposed S.R. 823 bypass over Slocum Ave at 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 and the 2002 AASHTO Standard Specifications for Highway 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, three test borings (TR-36, TR-37 and TR-38) were drilled and all of them encountered sandstone bedrock between 73 and 80 feet below the existing ground surface. Boring T-36 also encountered thicker granular layers than TR-37 and TR-38. Beneath the topsoil, generally cohesive soils (sandy silt to silt and clay) were encountered to the top of bedrock with intermittent layers of granular soil. For description of the material encountered, refer to the subsurface investigation report.

Based on the alternatives considered for this study, it is recommended that driven H-piles to rock 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 H-piles. It is also recommended 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.

HP14x73 piles with a maximum design load of 95 tons are assumed for this Bridge Type Study. Since the piles will be driven to refusal onto hard bedrock, the feasibility of using steel points will be investigated as required by 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. The proposed bridge section will consist of two 12'-0" travel lanes with 6'-0" median shoulders and 12'-0" outside shoulders 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 intersection of existing Slocum and Pershing Avenues will be reconfigured; however, Slocum Ave will remain on its current horizontal and vertical alignment.

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 at this structure location. More than 17'-0" of preferred vertical clearance could be provided for all the alternatives considered for this study. In accordance with the L&D manual, Volume 1, a 6'-0" minimum horizontal offset with a Type D barrier will need to be maintained underneath both structures. The piers for the recommended alternative were located to provide a minimum of 16'-6" horizontal clearance from the edge of the pavement.

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

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

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

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a tangent alignment across the entire length of both the left and right structures. The proposed mainline profile is located on the inside edge of pavement for both bridges 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.

Three alternatives have been evaluated in this Structure Type Study, and are designated as Alternative 1, 2 and 3. The appropriate structure types that were considered are outlined in the Structure Type Alternative Table:

STRUCTURE TYPE ALTERNATIVE TABLE			
Structure Type Alternative	**1**	**2**	**3**
Superstructure Type Description	Tangent, Continuous Steel Girders	Tangent, Continuous Steel Girders	Tangent Prestressed Concrete Girders 60" Modified AASHTO Type 4
Proposed Beam Spacing	9 Spaces @ 9'-3"	9 Spaces @ 9'-3"	9 Spaces @ 9'-3"
No. of Spans	3	3	3
Abutment Type	Semi-Integral Type abutments with spill-through slopes	Semi-Integral Type abutments with spill-through slopes	Semi-Integral Type abutments with spill-through slopes)
No. of Piers	2	2	2
Pier Type	T-Type	T-Type	T-Type
Substructure Orientation	00°00'00"	38°35'20"LF	38°35'20"LF
Approximate Bridge Length	405'	315'	315'
Approximate Structure Depth			
Slab	8.75"	8.75"	8.5"
Haunch	2"	2"	2"
Girder	58"	52"	60"
Total	68.75"(5.73')	62.75"(5.23')	70.5"(5.875')

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 proposed 50'-0" embankment dictated the type 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 405' from centerline of bearing to centerline of bearing.

Substructure: This alternative is comprised of three spans (130'-145'-130') with a span ratio of 0.89. The abutments and piers were both located normal to the roadway 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 refusal. 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 H-piles driven to bedrock.

Superstructure: The preliminary design of this alternative indicates that 10 - continuous steel 58" Plate Girder spaced at 9'-3"would be required for each structure to accommodate the HS25 design loading requirements.

Alternative 2

Span configuration: In order to reduce the length 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 Slocum Ave. The bridge overall length is 315' from centerline of bearing to centerline of bearing. It is anticipated that retaining walls will be required to support the 2:1 slope embankment of the proposed bridge along Pershing Ave.

Substructure: This alternative is comprised of three spans (100'-115'-100') with a span ratio of 0.87. The abutments and piers were both located at a 38°35'20" LF skew to the roadway alignment. The face of the piers is located 33'-6" from the edge of the pavement of Slocum Ave. The bridge will be designed using semi-integral type abutment 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 bedrock.

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 H-piles driven to bedrock.

Superstructure: The preliminary design of this alternative indicates that 10 - continuous steel 52" Plate Girder spaced at 9'-3"would be required for each structure to accommodate the HS25 design loading requirements.

Alternative 3

Span configuration: This alternative has a similar horizontal and span layout as Alternative 2, except that the bridge is comprised of prestressed concrete beams. The bridge overall length is 315' from centerline of bearing to centerline of bearing.

Substructure: This alternative is comprised of three spans (100'-115'-100') with a span ratio of 0.87. The abutments and piers were both located at a 38°35'20" LF skew to the roadway alignment.

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 bedrock.

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 H-piles driven to bedrock.

Superstructure: The preliminary design of this alternative indicates that a 10 - 60" Prestressed Modified AASHTO Type 4 beam spaced at 9'-3" would be required to accommodate the HS25. the bridge width is similar to Alternatives 1 and 2.

6. Preliminary Probable Bridge Construction Cost:

A preliminary probable bridge construction cost has been prepared for Alternatives 1, 2, and 3 (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. 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 or PS concrete superstructures, 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 54" (web) steel Plate 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: $3,590,000**	1	***Advantages:*** • This alternative is the least expensive to construct. • This alternative will eliminate the skew of the substructure units. • More aesthetically pleasant. ***Disadvantages:*** • Will increase the bridge length. • Increased the structure depth.
2	3-span continuous tangent 48" (web) steel Plate 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: $3,670,000**	2	***Advantages:*** • Shorter bridge length. • Beams are lighter to erect ***Disadvantages:*** • Longer substructure units. • Retaining Wall along the proposed Pershing Ave. would create limited sight distance at the intersection • Pier locations will also create limited sight distance at the intersection.
3	3-span continuous 60" Modified AASHTO Type 4 Prestressed Concrete Beams with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments and T-type piers on piles	**Structure Cost: $4,350,000**	3	***Advantages:*** • Potentially less maintenance then the steel Alternatives. ***Disadvantages:*** • Most expensive alternative. • Heavy beams, might present construction delivery and issues with beam settings. • Retaining Wall along the proposed Pershing Ave. would create limited sight distance at the intersection • Pier locations will also create limited sight distance at the intersection.

8. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1 (Three Span, 54" (web) steel girders with semi-integral abutments and T-type piers)** for the Bridge. (See Appendix B for the Site Plan and Structure Details).

Our recommendation for Alternative 1 is based on the following items:

- This Alternative appears to be the most economical from a construction standpoint.
- Constructability concerning girders delivery and erection could be less complicated.
- It will provide for adequate sight distance at the proposed intersection.

APPENDIX A

TRANSYSTEMS CORPORATION

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S.R. 823 OVER SLOCUM ROAD L/R

STRUCTURE TYPE STUDY

By: NFF
Checked: MAK

Date: 6/17/2005
Date: 6/27/2005

ALTERNATIVE COST SUMMARY

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Subtotal Superstructure Cost	Subtotal Substructure Cost	Structure Incidental Cost (16%)	Structure Contingency Cost (10%)	Total Alternative Cost
1	3	130' - 145' - 130'	405.00	10 ~ Welded Plate Girders	54" Web PG Grade 50W	$1,901,000	$911,000	$449,900	$326,200	$3,590,000
2	3	100'-115'-100'	315.00	10 ~ Welded Plate Girders	48" Web PG Grade 50W	$1,483,000	$1,393,000	$460,200	$333,600	$3,670,000
3	3	100'-115'-100'	315.00	10~ Mod. Type 4 (66") PS Girders	66" Deep P/S Girders	$1,962,000	$1,447,000	$545,400	$395,400	$4,350,000

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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STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES- SUPERSTRUCTURE

By: NFF
Checked: MAK

Date: 5/13/2005
Date: 6/27/2005

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 Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
1	3	130' - 145' - 130'	405	412	1401	$826,600	$351,400	$99,000	10 ~ Welded Plate Girders	54" Web PG Grade 50W	517,821	$623,900	$1,901,000
2	3	100'-115'-100'	315	322	1095	$646,000	$274,600	$132,000	10 ~ Welded Plate Girders	48" Web PG Grade 50W	357,525	$430,800	$1,483,000

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	2	4.52	9.04

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Alt. 1	0.75	90.00	67.5	6.8	91.8
Alt. 2	0.75	90.00	67.5	6.8	91.8

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 =			$590.00

Based on parapet and slab percentages
of total concrete area

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

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 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 = 400 sq. yd.

Width = 120 ft

Alternate 1
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	2001 Price

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STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES -SUBSTRUCTURE

By: NFF
Checked: MAK

Date: 10/11/2004
Date: 6/27/2005

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	Retaining Wall Cost	Temporay Girder Support Cost	Subtotal Substructure Cost
1	3	130' - 145' - 130'	10 ~ Welded Plate Girders	54" Web PG Grade 50W	$304,800	$69,400	$160,900	$52,800	$323,000	$0	$0	$0	$911,000
2	3	100'-115'-100'	10 ~ Welded Plate Girders	48" Web PG Grade 50W	$445,800	$101,500	$207,600	$68,100	$377,700	$0	$192,000	$0	$1,393,000

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	160	219	$421.00	3.5%	$483.00	$77,280	$105,900
Columns	240	359	$421.00	3.5%	$483.00	$115,920	$173,160
Footings	231	345	$421.00	3.5%	$483.00	$111,630	$166,720
Total Cost						$304,800	$445,800

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	303	$421.00	3.5%	$483.00	$146,300
Wingwalls	30	$421.00	3.5%	$483.00	$14,600

Alternate 2

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	391	$421.00	3.5%	$483.00	$188,700
Wingwalls	39	$421.00	3.5%	$483.00	$18,900

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

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

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

	Total Area (sq. ft.)	Year 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	88	SEE QUANTITIES CALCU;ATION	7,822	7822	88
Alt. 2	102	SEE QUANTITIES CALCU;ATION	9,146		

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 CALCU;ATION	#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	1,200	$160.00

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S.R. 823 OVER SLOCUM ROAD L/R

STRUCTURE TYPE STUDY - STEEL GIRDER ALTERNATIVES - QUANTITY CALCULATIONS

By: NFF
Checked: MAK

Date: 6/25/2005
Date: 6/27/2005

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 L/R	90	0	0	0.00	2160	0	0	0.00	0	3240	0	0	0	0	3120	8520
Pier 2 L/R	90	0	0	0.00	2160					3240	0	0	0	0	3120	8520
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	4	0	0	0	0
Total (Cu.Ft.)					**4320**					**6480**					**6240**	**17040**
Total (Cu.Yd.)					**160**					**240**					**231**	**631**

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.	180	5	900	613	140	11	1.25	*14*	600.0	482.0	120.0	*1680*
Pier 1	425	5	2125	1278	140	24	1.25	*30*	550	476	76.0	*2280*
Pier 2	425	5	2125	1278	140	24	1.25	*30*	550	476	76.0	*2280*
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.	180	5	900	613	140	11	1.25	*14*	586	475	113.0	*1582*
TotaL								**88**				**7822**

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 L/R	120	0	0	0.00	2960	0	0	0.00	0	4840	0	0	0	0	4660	12460
Pier 2 L/R	120	0	0	0.00	2960					4840	0	0	0	0	4660	12460
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	0	0	0	0.00	0	0	0	0	0	0	0	0
Pier 7																0
Total (Cu.Ft.)					**5920**					**9680**					**9320**	**24920**
Total (Cu.Yd.)					**219**					**359**					**345**	**923**

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.	160	5	800	791	140	11	1.5	*17*	599.0	482.0	119.0	*2023*
Pier 1	380	5	1900	1869	140	27	1.25	*34*	550	476	76.0	*2584*
Pier 2	380	5	1900	1869	140	27	1.25	*34*	550	476	76.0	*2584*
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*
Fwd. Abut.	160	5	800	791	140	11	1.5	*17*	588.0	475.0	115.0	*1955*
TotaL								**102**				**9146**

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	90	3	6.396	19.19	1727	3	2.75	8.25		743	6	3	18	1	1620	4089
Fwd. Abut	90	3	6.396	19.19	1727	3	2.75	8.25		743	6	3	18	1	1620	4089
Total (Cu.Ft.)					**3454**					**1485**					**3240**	**8179**
Total (Cu.Yd.)					**128**					**55**					**120**	**303**

Superstructure Steel Quantities - Alt 1

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	256	5	130	166214
Span 2	256	5	145	185393
Span 3	256	5	130	166214
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				517821

Weight Per ft. = (Alt 2 Value*1.125 256

Superstructure Steel Quantities - Alt 2

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	227	5	100	113500
Span 2	227	5	115	130525
Span 3	227	5	100	113500
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				357525

total steel weight per girder (lb.) = 71600
Total Span length (ft.)= 315.00
Weight Per ft. = 227

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	*Length*	*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	5	0		0	0	1.1	*0*	0	0	0.0	*0*
Pier 1	0	5	0	0	0	0	1.25	*0*	0	0	0.0	*0*
Pier 2	0	5	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	5	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
S.R. 823 OVER SLOCUM ROAD L/R
STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE -SUPERSTRUCTURE

By: NFF
Checked: MAK

Date: 5/16/2005
Date: 6/27/2005

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
3	3	100'-115'-100'	315.00	322	1045	$618,800	$262,200	$132,000	10~ Mod. Type 4 (66") PS Girders	66" Deep P/S Girders	$949,000	$1,962,000	0%	$1,962,000

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	2	4.52	9.04

Slab:

T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
0.71	90.00	63.7	6.4	87.7

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 =			$592.00

Based on parapet and slab percentages
of total concrete area

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

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

Prestressed Concrete Girders
Unit Costs:

	Year 2004		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Type 4 I-Beams	$16,000	ea.	3.5%	$18,360	ea.	0	$0
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	0	$0
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	8	$11,040
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	81	$111,780
Modified Type 4 I-Beams (66")	$24,000	ea.	3.5%	$27,540	ea.	30	$826,200
						TOTAL =	$949,020

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.
Area = 400 sq. yd.
Width = 120 ft

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 OVER SLOCUM ROAD L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE - SUBSTRUCTURE

By: NFF
Checked: MAK

Date: 5/16/2005
Date: 6/27/2005

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	Retaining wall Cost	Subtotal Substructure Cost
3	3	100'-115'-100'	10~ Mod. Type 4 (66") PS Girders	66" Deep P/S Girders	$445,800	$101,500	$235,500	$77,200	$395,000	$192,000	$1,447,000

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	219	$421.00	3.5%	$483.00	$105,900
Columns	359	$421.00	3.5%	$483.00	$173,160
Footings	345	$421.00	3.5%	$483.00	$166,720
Total Cost					$445,800

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	443.3	$421.00	3.5%	$483.00	$214,100
Wingwalls	44.33	$421.00	3.5%	$483.00	$21,400

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

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

Pile Foundation Unit Cost ($/ft.): HP 14X73 Piles, Furnished & Driven

Number of Piles		Total Pile Length
114	SEE QUANTITIES CALCU;ATION	9,564

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

Additional Crane Cost
$ 75,000

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

	Total Area (sq. ft.)	Year 2008 Unit Cost
Alt. 3	1,200	$160.00

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

Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
0	$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

S.R. 823 OVER SLOCUM ROAD L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE - QUANTITY CALCULATIONS

By: NFF
Checked: MAK

Date: 6/20/2005
Date: 6/27/2005

Pier Quantities T-Type(HP-Piles Type Foundation)

Pier Location	Length	Cap				Column					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area	depth	Volume	Width	Depth	Area	# Footing	Volume	
Pier 1	120	0	0	0.00	2960	0	0	0.00	0	4840	0	0	0	0	4660	12460
Pier 2	120	0	0	0.00	2960					4840	0	0	0	0	4660	12460
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.)					5920					9680					9320	24920
Total (Cu.Yd.)					219					359					345	923

MSE Abutment Wall Quantities

Abut Locat		Wall			
		Height	Length	Area	Volume
Rear Abut		0	0	0.0	
Fwd. Abut		0	0	0.00	
Total (Sq.Ft.)				0	

Abutment Quantities (Semi-Integral)

Abut Location	Length	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	120	3	7.875	23.625	2835	3	2.75	8.25		990	6	3	18	1	2160	5985
Fwd. Abut	120	3	7.875	23.625	2835	3	2.75	8.25		990	6	3	18	1	2160	5985
Total (Cu.Ft.)					5670					1980					4320	11970
Total (Cu.Yd.)					210					73					160	443

Superstructure P/S Concrete Quantities

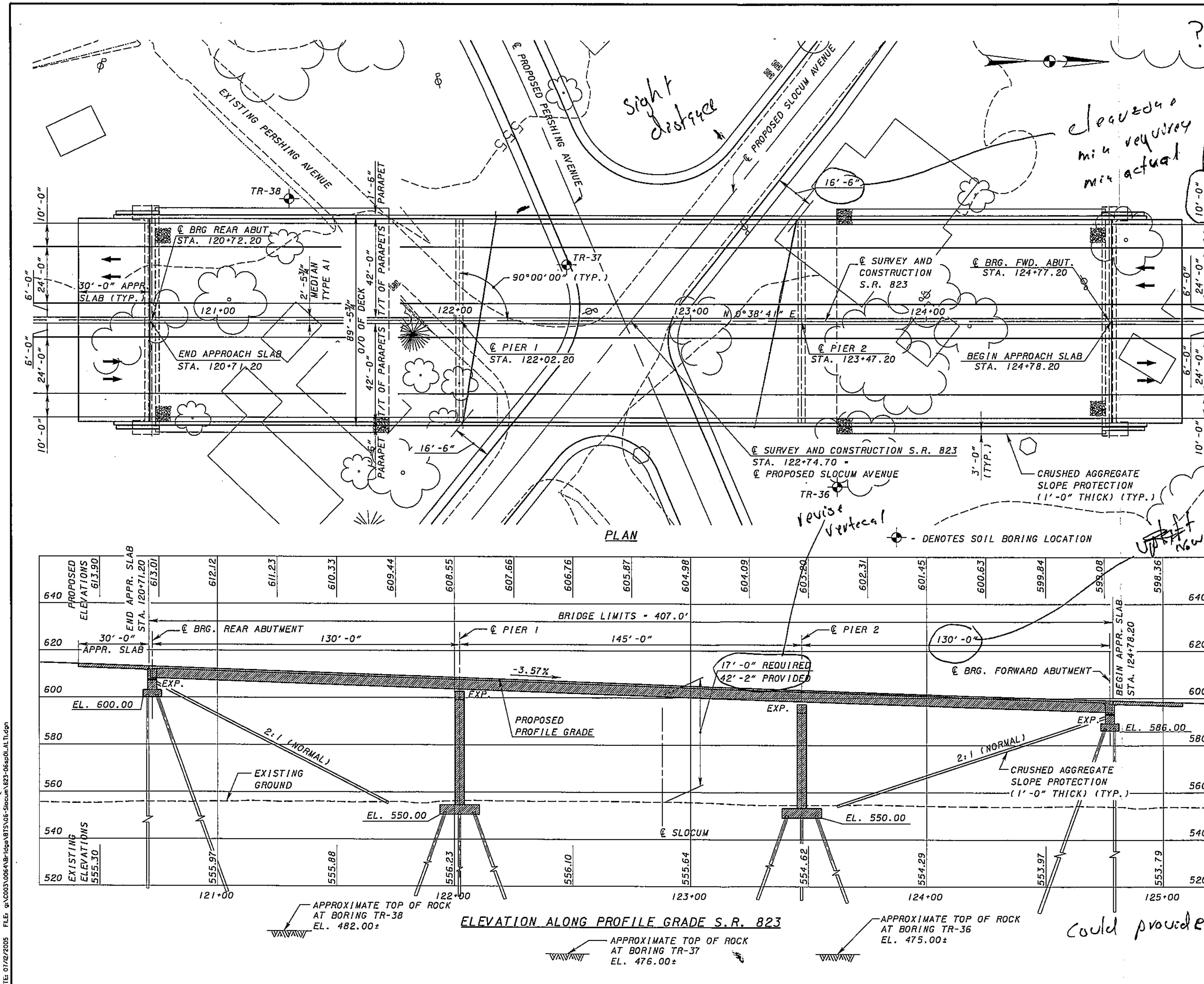
Location	Type of girder	# Girders	Span Length (ft.)	Total Length (ft.)	Spacing Int. diaphragm	No. of Int in span	Number of Int Diap. 1 location	Total No. in Span
Span 1	MOD. AASHTO	10	100	1000	33.33	3	9	27
Span 2	MOD. AASHTO	10	115	1150	38.33	3	9	27
Span 3	MOD. AASHTO	10	100	1000	33.33	3	9	27
Span 4	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			81
TotaL	MOD. AASHTO	30		3150				

Pile Quantities

Location	Load/ girder	# Girders	Total Girder	Subst Wt	Pile Cap.(Ki	No. Piles	Increase	Total Piles	Top Elev.	Bot Elev.	Pile Lengt	Total Pile
Rear Abut.	218	5	1090	898	140	14	1.25	18	598.0	482.0	118.0	2124
Pier 1	496	5	2480	1869	140	31	1.25	39	550	482	70.0	2730
Pier 2	496	5	2480	1869	140	31	1.25	39	550	482	70.0	2730
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.	218	5	1090	898	140	14	1.25	18	590	482	110.0	1980
TotaL								114				9564

APPENDIX B

TRANSYSTEMS CORPORATION



FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS

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

BORING LOCATIONS

BORING No.	STATION	OFFSET
TR-36	123+62.19	70.37' RT.
TR-37	122+47.30	23.87' LT.
TR-38	121+30.05	51.68' LT.

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

TRAFFIC DATA

(SR 823)

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

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS STEEL PLATE GIRDER A 709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BT REINFORCED CONCRETE SUBSTRUCTURES ON PILES.

SPANS: 130'-145'-130' C/C BEARINGS

ROADWAY: 2-42'-0" T/T OF PARAPETS

LOADING: HS-25(CASE 1) AND ALTERNATE MILITARY LOADING, FWS-60PSF.

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:

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 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE.

UTILITIES:

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

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

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

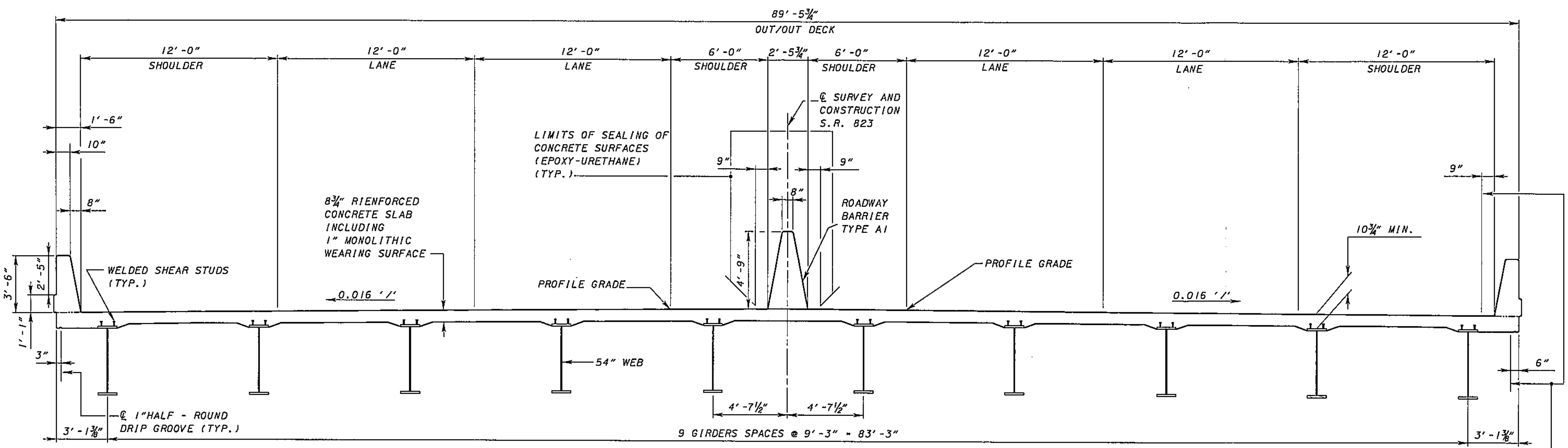
SCIOTO COUNTY
STA. 120+71.20
STA. 124+78.20

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SLOCUM AVENUE

SCI-823-0.00
PID 19415

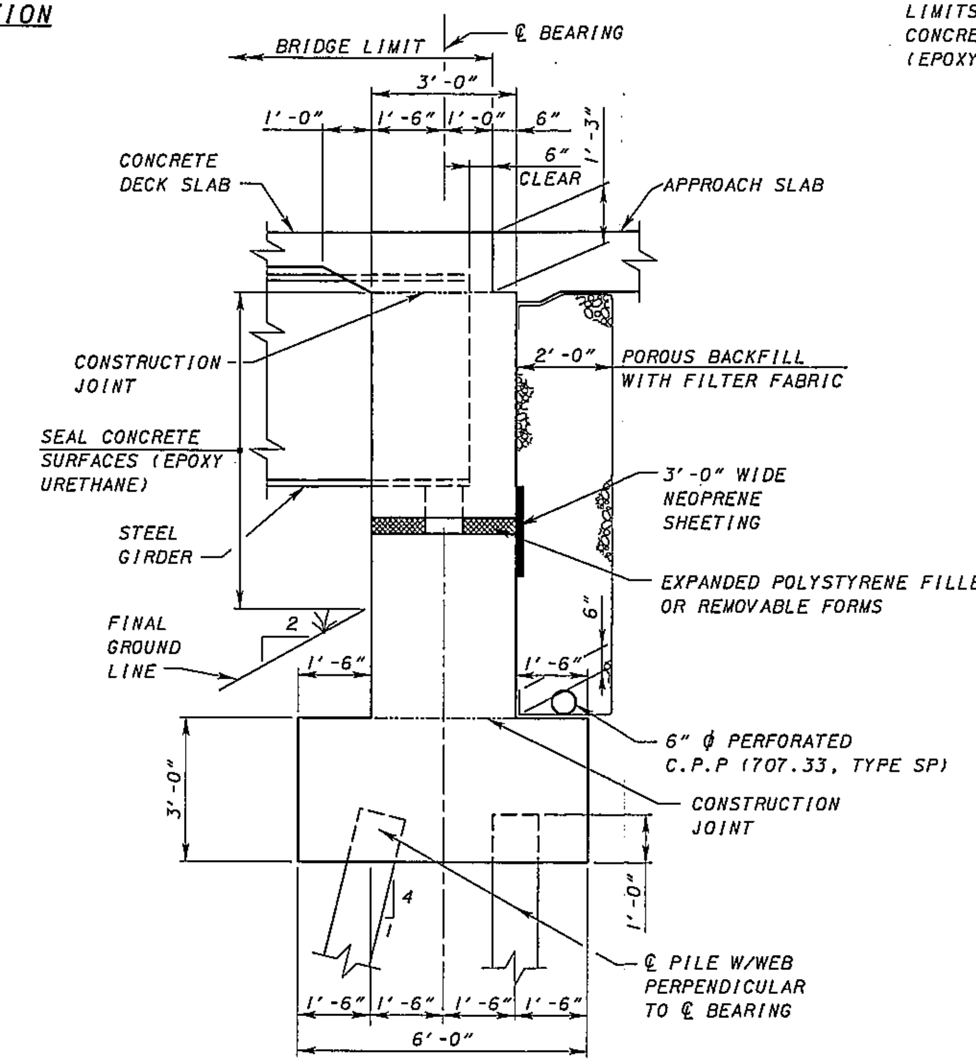
1 / 2

DATE: 07/12/2005 FILE: g:\C003\0064\Bridge\BTS\06-Slocum\823-06sp01ALT1.dgn



PROPOSED TRANSVERSE SECTION

LIMITS OF SEALING OF CONCRETE SURFACES (EPOXY-URETHANE) (TYP.)



TYPICAL ABUTMENT SECTION

SUPERSTRUCTURE DEPTH	
ITEM	DEPTH
SLAB (INCLUDING WEARING SURFACE)	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
BEAM DEPTH	58"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (INCH)	68¾"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (FEET)	5.73'

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	
BTA			

TRANSVERSE SECTION
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SLOCUM AVENUE

SCI-823-0.00
PID 19415

2 / 2

DATE: 07/12/2005 FILE: g:\C003\0064\Bridge\BTS\06-Slocum\823-06ts01.dgn

APPENDIX C

TRANSYSTEMS CORPORATION

TranSystems Corporation

Made By	NFF	Date	06/25/05	Job No.	P403030064
Checked By		Date		Sheet No.	

VERTICAL CLEARANCE CALCULATIONS

Job Name: SCI-823-0.00
Structure:
Description: S.R. 823 OVER SLOCUM AVE.
PID #: 19415

Alternative 1 - 10 Steel Girders, 3 Span — ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset		
2 Lanes:	-0.016	x	24	=	-0.38
Shoulder to Beam CL:	-0.016	x	10	=	-0.16

Total Adjustment = **-0.54**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	58	4.83
	68.75	5.73

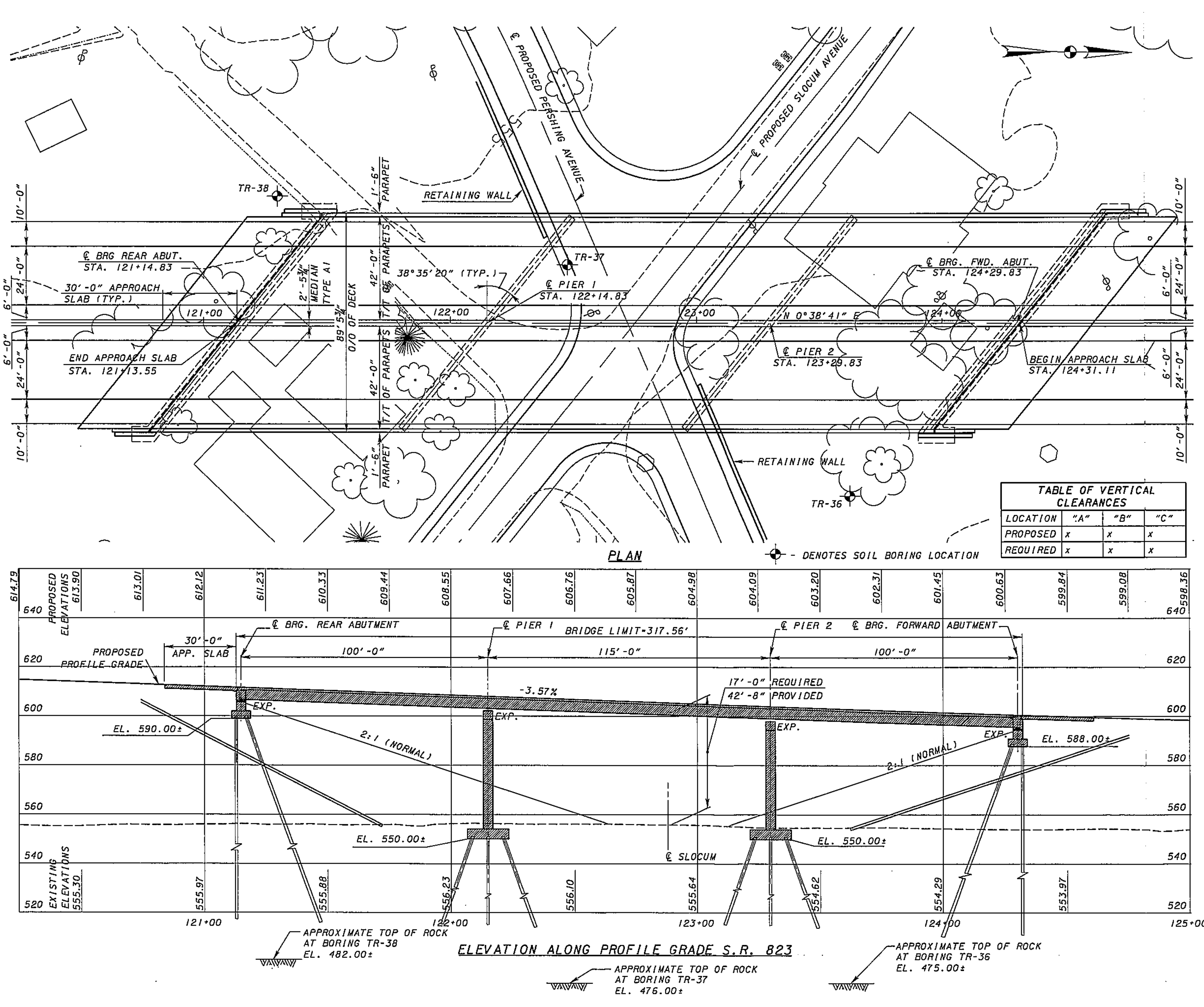
Total Superstructure Depth (ft) = **5.73**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**123+10.28**
Offset Location @ Critical Point	=	**34' Left**
Profile Grade Elevation at Critical Point	=	604.61
Adjustment for Cross Slopes to Beam CL	=	-0.54
Top of Deck Elevation @ Critical Point	=	**604.07**
Total Superstructure Depth	=	-5.73
Bottom of Beam Elevation @ Critical Point	=	**598.34**
Approximate Top of Existing Ground @ Critical Point	=	**556.20**
Actual Vertical Clearance	=	***42.14***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

APPENDIX D

TranSystems Corporation



BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-36	123+62.19	70.37' RT.
TR-37	122+47.30	23.87' LT.
TR-38	121+30.05	51.68' LT.

TABLE OF VERTICAL CLEARANCES			
LOCATION	"A"	"B"	"C"
PROPOSED	x	x	x
REQUIRED	x	x	x

STRUCTURE TYPE:

3 SPAN CONTINUOUS STEEL PLATE GIRDER A 709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BT REINFORCED CONCRETE SUBSTRUCTURES ON PILES.

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 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE.

DESIGN AGENCY: TRANSYSTEMS CORPORATION

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

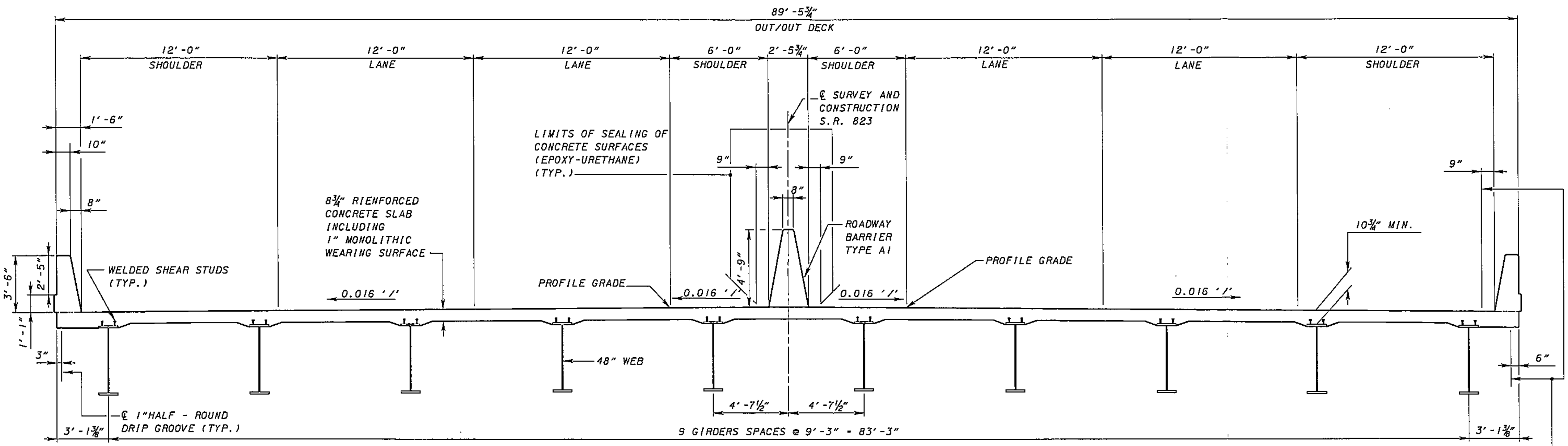
SCIOTO COUNTY
STA. 121+13.55
STA. 124+31.11

PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SLOCUM AVENUE

SCI-823-0.00
PID 19415

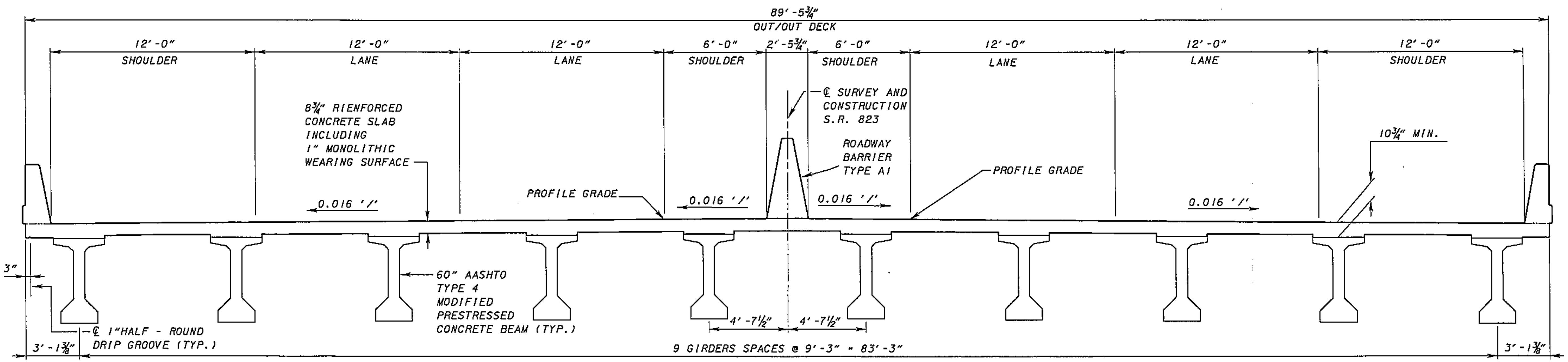
1 / 2

DATE: 07/12/2005



PROPOSED TRANSVERSE SECTION

(STEEL ALTERNATIVE)



PROPOSED TRNASVERSE SECTION

(CONCRETE ALTERNATIVE)

SUPERSTRUCTURE DEPTH		
ITEM	STEEL	CONCRETE
SLAB (INCLUDING WEARING SURFACE)	8¾"	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"	2"
BEAM DEPTH	52"	60"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (INCH)	62¾"	70¾"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM FLANGE (FEET)	5.23'	5.90'

DATE: 07/12/2005 FILE: g:\C003\0064\Bridge\BTS\06-Slocum\823-06ts01ALT.dgn

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

DESIGNED HFF | CHECKED | DRAWN MAK | REVISED | REVIEWED | DATE | STRUCTURE FILE NUMBER

TRANSVERSE SECTION - ALTERNATIVE 2 & 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER SLOCUM AVENUE

SCI-823-0.00
PID 19415

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APPENDIX E

TRANSYSTEMS CORPORATION

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March 31, 2005

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

Re: **SCI-823-0.00 over Slocum Ave. (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 Slocum Ave within the Highland Bend area. It is anticipated that the proposed structure will be a two-span, elevated bridge with embankment fills at both abutments. The existing grade at the proposed new bridge location is relatively flat with an elevation around 555. It is anticipated that the SCI-823-0.00 mainline will require an 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 three borings, TR-36 through TR-38, were drilled at the proposed structure between January 27, 2005 and February 10, 2005. The borings were drilled to depths between 94 and 100 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 to depths of 3 to 4 inches. Beneath the topsoil, generally cohesive soils were encountered to the top of bedrock with intermittent layers of granular soil. The cohesive soils encountered ranged from sandy silt (A-4a) to silt and clay (A-6a), and were generally stiff to very stiff. The granular soils ranged from sandy silt (A-4a) to fine sand (A-3). The granular soils were generally very loose to medium dense. Boring TR-36 encountered thicker granular layers than TR-37 or TR-38.

Bedrock was encountered between 73 and 80 feet below the ground surface, which generally was a medium hard to hard sandstone that was slightly broken to intact. Borings TR-36 and TR-37 encountered a siltstone layer ranging in thickness from 1.5 to 1.7 feet within the sandstone. Recovery of the core samples ranged from 0 to 100%, and RQD values ranged from 0 to 99% with an average RQD of 74%.

Seepage was detected in all of the borings ranging in depth from 10 to 80 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 include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally, and may be influenced by the level of the Little Scioto River.

Conclusions and Recommendations

It appears that driven H-piles to rock or drilled shafts to rock will be the best-suited foundation types for the support of the proposed structure. Due to the size of the structure, if H-piles are used it is anticipated that HP 14X73 H-pile sections, with a 95-ton capacity, will be used. If high lateral or uplift loads are anticipated drilled shafts or socketed H-piles into bedrock may be needed. The actual lengths of the rock sockets will need to be designed based upon actual loading conditions. The following table summarizes the site conditions and preliminary foundation recommendations.

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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 Drilled Shaft Tip Elevation*	Allowable Bearing Capacity for Drilled Shafts (TSF)
TR-36	North Abutment	555	482	~~502~~ 482	476	20
TR-37	Pier	555	476	~~509~~ 476	472	20
TR-38	South Abutment	555	475	~~498~~ 475	472	20

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

† AS PER DISCUSSION WITH PAUL PAINTER ON 6/20/05 "NEED TO DRIVE TO BEDROCK".

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 added to the design loads to account for negative skin friction associated with the embankment settlement.

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.

Spread footings could be considered, but differential settlement concerns would need to be addressed. Recommendations can be presented if the spread footing option is considered. Pre-loading or other techniques may be necessary if footings are used.

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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.

Closing

If you have any questions or wish to schedule an opportunity to discuss the recommendations presented, please contact our office.

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-36, TR-37, TR-38

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 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**.

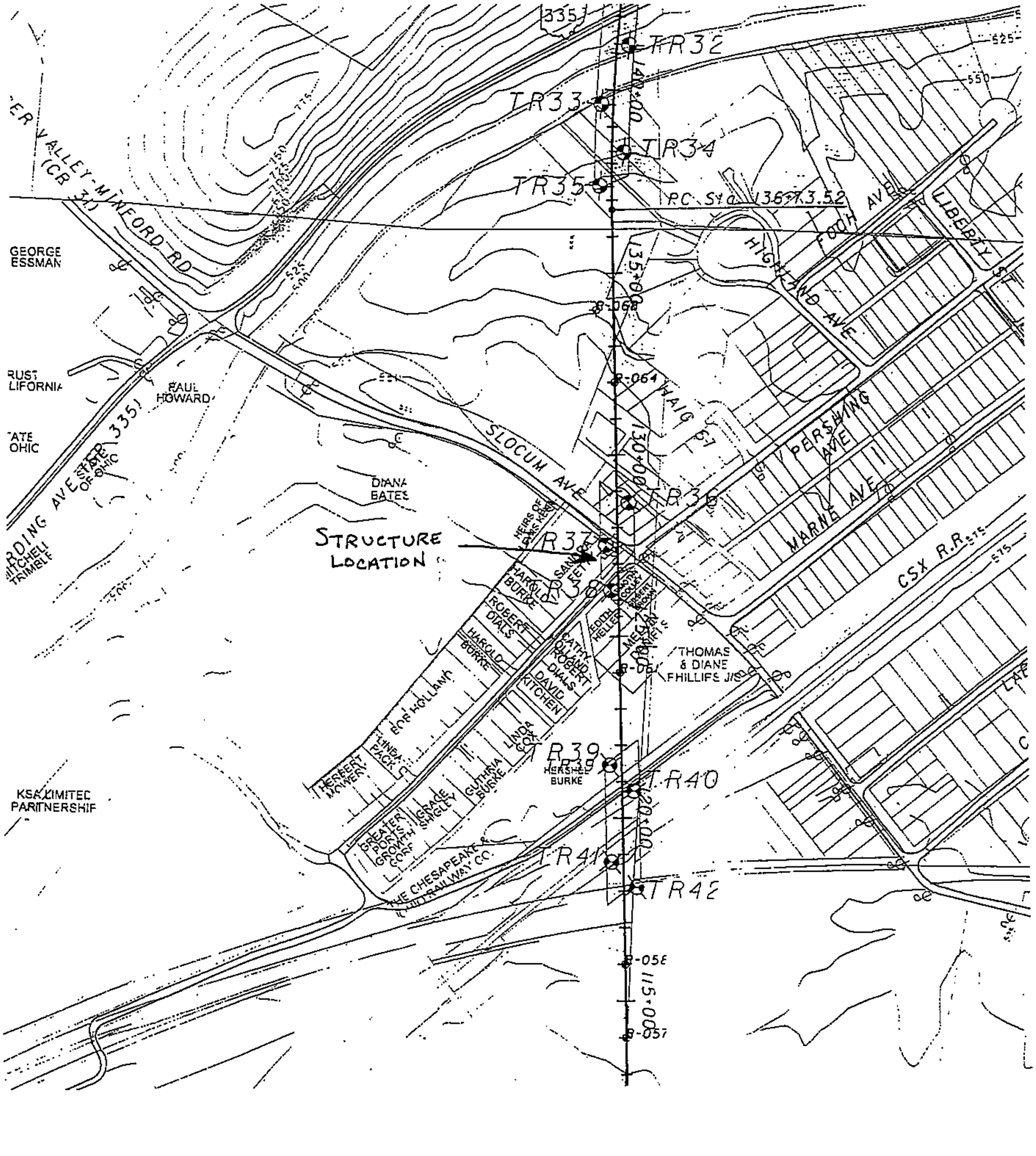
Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed 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	DLZ ENGINEERS * ARCHITECTS * SCIENTISTS	**SITE PLAN** Slocum Avenue SCI-823 over Slocum Ave. 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

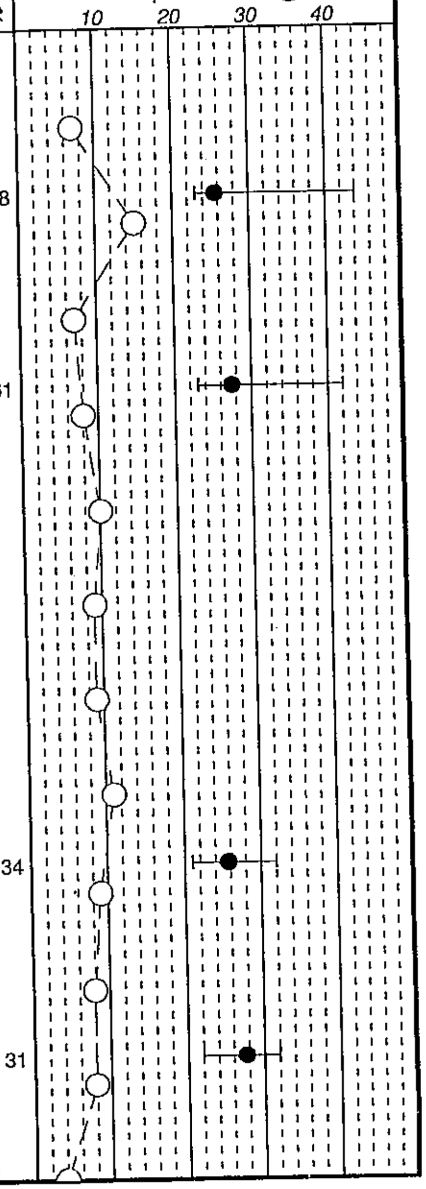
LOG OF: Boring TR-36

Location: Forward Abutment SCI-823.00 over Slocum Ave | Date Drilled: 01/31/05 to 02/01/05

WATER OBSERVATIONS:
Water seepage at: 62'-73'
Water level at completion: 12.0' (Prior to coring)
12.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	555.0												
0.3	554.7						Topsoil - 4"						
		2 3 4	17	1		2.0	Very stiff brown and gray CLAY (A-7-6), trace fine sand; moist. @ 0.3'-1.8', contains root fragments.						
								0	0	--	1	31	68
		6 7 8	16	2		3.0							
5													
5.5	549.5						Very stiff brown CLAY (A-7-6), trace fine sand; varved; moist.						
		3 3 4	18	3		3.0							
								0	0	--	1	38	61
		2 3 5	16	4		3.0							
10													
		3 4 6	18	5		2.5							
		2 4 5	18	6		3.25							
15													
		3 4 5	18	7		3.0	@ 16.0', brown and brownish gray.						
		4 5 6	18	8		3.0							
20													
20.5	534.5						Very stiff brown SILT (A-4b); varved; moist.						
									0	--	1	66	34
		3 4 5	18	9		3.25							
		3 4 4	18	10		3.0							
25													
								0	0	--	2	67	31
		2 4 4	18	11		3.5							
							@ 28.0', gray, moist.						
		2 2 2	18	12		2.75							
30													

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



FILE: 0121-3070-03 [3/28/2005 9:06 AM]

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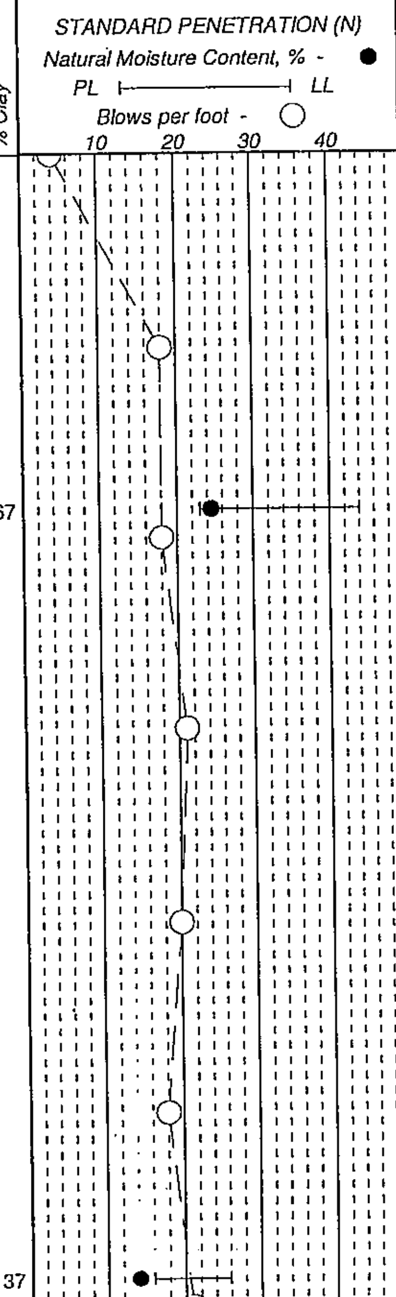
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-36 | Location: Forward Abutment SCI-823.00 over Slocum Ave | Date Drilled: 01/31/05 to 02/01/05

WATER OBSERVATIONS: Water seepage at: 62'-73'
Water level at completion: 12.0' (Prior to coring)
12.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	525.0						Loose brown SILT (A-4b), little fine to coarse sand; varved; damp to moist.						
32.0	523.0						Very stiff gray CLAY (A-7-6); varved; damp to moist.						
		5 8 10	11	13		3.75							
		7 8 10	18	14		3.75	@ 38.0', brownish gray.		0	--	0	33	67
							@ 42.0'-47.0', hard.						
		4 9 12	18	15		4.0-4.5+							
							@ 47.0', gray, damp to moist.						
		7 10 10	18	16		2.75							
		5 9 9	18	17		3.0							
57.0	498.0						Hard gray SILT (A-4b); damp.						
		5 10 11	18	18		4.5+		0	1	--	9	53	37



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

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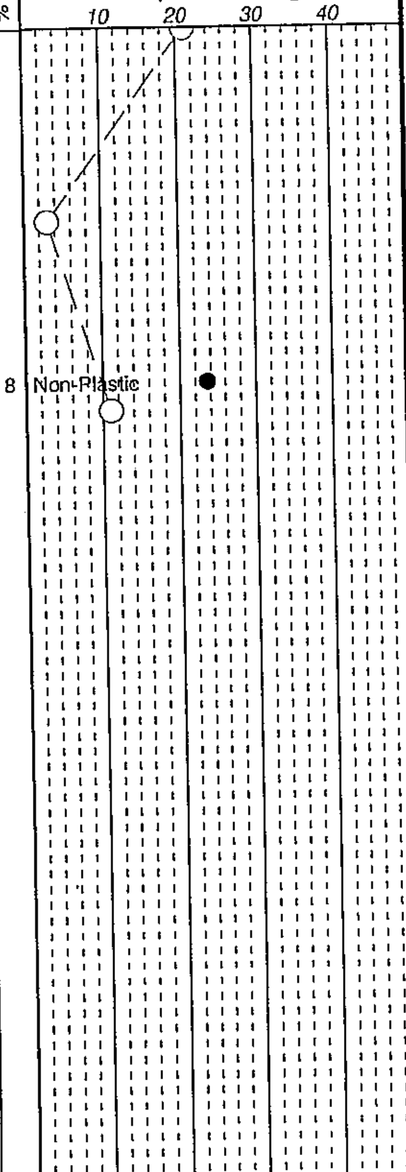
12.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60	495.0						Hard gray SILT (A-4b); damp.						
62.0	493.0						Very loose gray SANDY SILT (A-4a); wet.						
		5 1 2	18	19									
65													
		0 4 7	18	20			@ 69.0', medium dense.	0	1	--	60	31	8
70													
73.0	482.0	50/1	1	21			Hard light gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains argillacous clasts. @ 74.4'-75.7', very broken. @ 76.0',76.3', low angle fracture. @ 77.6',77.7', low angle fracture. @ 79.6', low angle fracture. @ 81.0'-81.4', high angle thin shale burrow. @ 81.7',82.1', low angle fracture.						
75													
80		Core 120"	Rec 116"	RQD 70%	R-1								
83.4	471.6						Medium hard dark gray SILTSTONE; moderately weathered, thinly bedded, broken.						
84.9	470.1						Hard light gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains argillacous clasts.						
90		Core 120"	Rec 119"	RQD 93%	R-2								

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-36 | Location: Forward Abutment SCI-823.00 over Slocum Ave | Date Drilled: 01/31/05 to 02/01/05

WATER OBSERVATIONS: Water seepage at: 62'-73'
Water level at completion: 12.0' (Prior to coring)
12.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N): Natural Moisture Content, % - ● ; PL ├──┤ LL ; Blows per foot - ○ (10 20 30 40)
90	465.0						Hard light gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains argillacous clasts. @ 90.2'-90.5', limestone layer. @ 92.6'-97.1', calcareous.							
94.0	461.0						Bottom of Boring - 94.0'							
95														
100														
105														
110														
115														
120														

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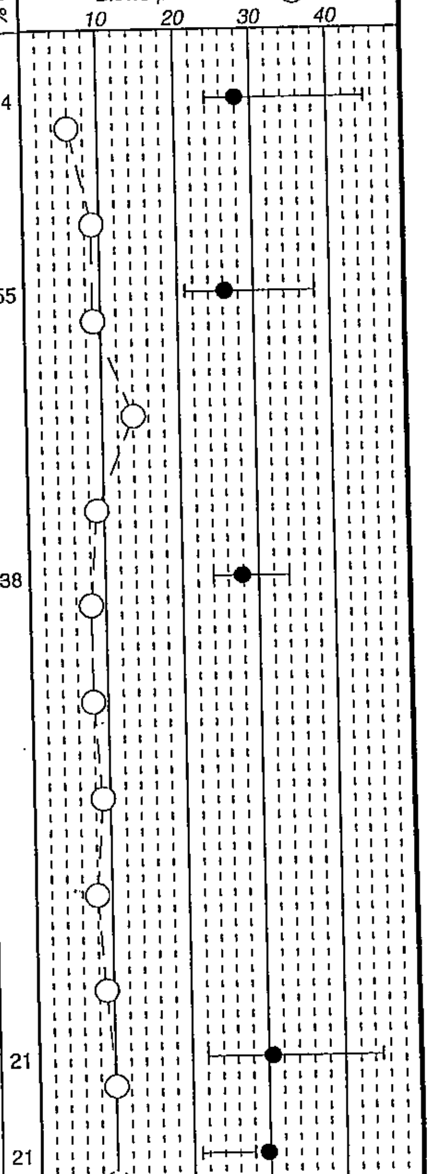
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-37 | Location: Pier 1 SCI-823.00 over Slocum Ave | Date Drilled: 01/27/05 to 01/31/05

WATER OBSERVATIONS: Water seepage at: 16.0'-18.0', 37'-37.5', 68'
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	555.0												
0.3	554.7						Topsoil - 3"						
		2 3 3	14	1		2.25	Very stiff brown CLAY (A-7-6); trace fine to coarse sand; moist.	0	1	--	4	41	54
							@ 3.0', brown and gray.						
		3 4 5	18	2		2.0							
5.5	549.5						Hard brown SILT CLAY (A-6b), trace fine to coarse sand; damp.	0	1	--	6	38	55
		3 4 5	18	3		1.5							
							@ 8.0', hard; damp.						
		3 6 8	17	4		4.5+							
10.5	544.5						Very stiff brown SILT (A-4b), little fine to coarse sand; varved; damp to moist.						
		3 4 5	10	5		2.25							
		2 3 5	18	6		3.0		0	0	--	1	61	38
		2 4 4	18	7		---	@ 16.0'-18.0', stiff, moist to wet.						
		3 4 5	18	8		2.0							
		2 3 5	18	9		2.25							
		2 4 5	18	10		2.0							
25.5	529.5						Stiff to very stiff brown CLAY (A-7-6); moist.	0	0	--	0	78	21
		3 5 5	18	11		---							
28.0	527.0						Medium dense brown SILT (A-4b); moist.	0	0	--	2	77	21
		3 4 6	18	12									
30													

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



FILE: 0121-3070-03 [3/28/2005 9:06 AM]

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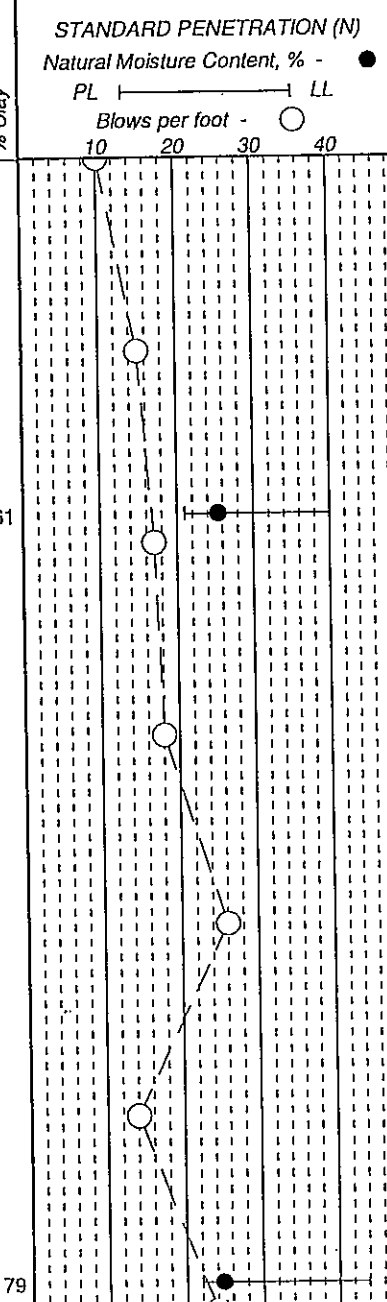
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-37 | Location: Pier 1 SCI-823.00 over Slocum Ave | Date Drilled: 01/27/05 to 01/31/05

WATER OBSERVATIONS: Water seepage at: 16.0'-18.0', 37'-37.5', 68'
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
30	525.0						Medium dense brown SILT (A-4b); moist.						
32.0	523.0						Hard brownish gray SILTY CLAY (A-6b), trace fine sand; moist.						
		4 6 9	18	13		4.5+							
		6 8 9	18	14		4.25		0	0	--	1	38	61
		4 7 11	18	15		4.25							
		8 13 13	18	16		4.5+							
		4 7 7	18	17		4.0							
57.0	498.0						Hard gray CLAY (A-7-6); damp to moist.						
		8 12 12	18	18		4.5+		0	0	--	0	21	79



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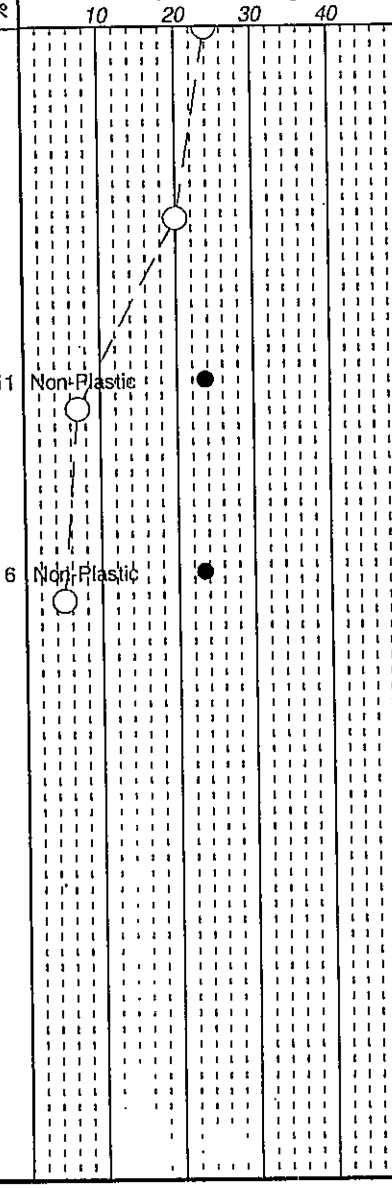
WATER OBSERVATIONS: Water seepage at: 16.0'-18.0', 37'-37.5', 68'
Water level at completion: Not Recorded

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
60	495.0						Hard gray CLAY (A-7-6); damp to moist.						
62.0	493.0						Medium dense light gray SILT (A-4b); contains organic material; damp.						
63.5–65		7 10 10	18	19									
68.5–70		3 3 4	18	20			@ 68.0', loose, wet.	1	2	--	30	57	11
72.0	483.0						Loose gray GRAVEL WITH SAND AND SILT (A-2-4); wet.						
73.5–75		0 1 4	18	21				17	3	--	53	21	6
78.6	476.4	50/2	1	22			Hard gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains argillacous clasts. @ 79.0'-80.2', broken. @ 80.8', low angle fracture. @ 86.0', low angle fracture.						
		Core 120"	Rec 117"	RQD 74%	R-1								
87.5	467.5						Medium hard dark gray SILTSTONE; moderately weathered, thinly bedded, broken.						
89.2	465.8						Hard gray SANDSTONE; very fine to fine grained, moderately						
90													

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



FILE: 0121-3070-03 [3/28/2005 9:06 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-37 | Location: Pier 1 SCI-823.00 over Slocum Ave | Date Drilled: 01/27/05 to 01/31/05

WATER OBSERVATIONS: Water seepage at: 16.0'-18.0', 37'-37.5', 68'
Water level at completion: Not Recorded

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

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	465.0	Core 120"	Rec 119"	RQD 99%	R-2		weathered, argillaceous, thinly bedded to medium bedded, contains argillacous clasts. @ 91.9'-92.0', calcareous. @ 94.4'-94.7', calcareous. @ 96.9'-97.4', limestone layer.						
99.0	456.0						Bottom of Boring - 99.0'						

Depth scale: 90, 95, 100, 105, 110, 115, 120

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

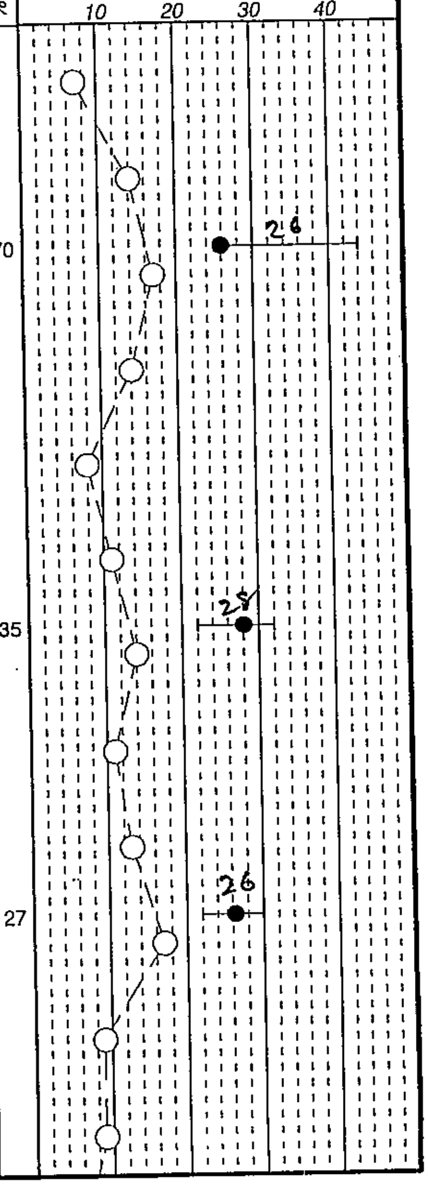
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-38 | Location: Rear Abutment SCI-823.00 over Slocum Ave | Date Drilled: 02/09/05 to 02/10/05

WATER OBSERVATIONS: Water seepage at: 10.0'-21.5' 33.0'-38.5', 65.0'-80.0'
Water level at completion: 9.8' (Prior to coring)
7.3' *Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.3	555.0 / 554.7	WOH 3 4 (7)	18	1		2.5	Topsoil - 4"; Very stiff CLAY (A-7-6), brown , trace fine sand; damp.						
		3 5 9 (14)	18	2		3.25							
5		4 6 11 (17)	18	3		3.5		0	0	--	1	29	70
		4 6 8 (14)	18	4		2.0							
10.0	545.0	2 3 5 (4)	18	5		1.5	Stiff brown SILT (A-4b), little clay, trace fine to coarse sand; moist.						
		3 5 6 (11)	18	6		1.5							
15		3 5 9 (14)	18	7		1.25		0	1	--	2	63	35
		2 5 6 (11)	18	8		1.25							
20		3 5 8 (13)	18	9		1.5							
		4 8 9 (17)	16	10		1.5		0	0	--	1	72	27
25.0	530.0	2 4 5 (9)	18	11		1.5	Stiff brown SILT AND CLAY (A-6a), little fine sand; contains silt laminae; moist.						
		3 4 5 (9)	18	12		1.0							
30													

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



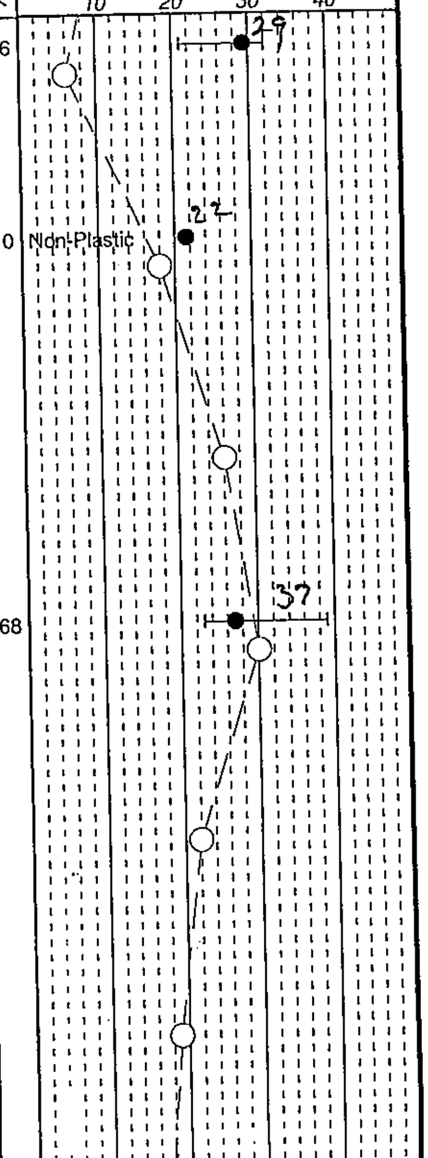
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-38 | Location: Rear Abutment SCI-823.00 over Slocum Ave | Date Drilled: 02/09/05 to 02/10/05

WATER OBSERVATIONS: Water seepage at: 10.0'-21.5' 33.0'-38.5', 65.0'-80.0'
Water level at completion: 9.8' (Prior to coring)
7.3' *Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
30	525.0	3 2 4 6	16	13		1.0	Stiff brown SILT AND CLAY (A-6a), little fine sand; moist.	0	0	--	5	59	36
33.0	522.0						Medium dense gray GRAVEL WITH SAND AND SILT (A-2-4); moist.						
35		4 7 11 18	18	14				0	21	--	50	20	10
38.0	517.0						Very stiff gray SILTY CLAY (A-6b), little fine sand; damp to moist.						
40		7 12 14 26	18	15		3.5							
45		10 13 17 30	18	16		3.0		0	0	--	1	32	68
50		5 9 13 22	18	17		4.0							
55.0	500.0	7 9 10 19	18	18		3.5	Very stiff gray SILT (A-4b), little fine sand, little silty clay; moist.						
60													



FILE: 0121-3070-03 [3/28/2005 9:06 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-38 | Location: Rear Abutment SCI-823.00 over Slocum Ave | Date Drilled: 02/09/05 to 02/10/05

WATER OBSERVATIONS: Water seepage at: 10.0'-21.5' 33.0'-38.5', 65.0'-80.0'
Water level at completion: 9.8' (Prior to coring)
7.3' *Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60.0	495.0	4 8 9	18	19		2.5	Medium dense gray COARSE AND FINE SAND (A-3a), some silt, little clay; moist.						
65		6 6 7	18	20			@ 65.0', wet.						
68.0	487.0	WOH 5 5	15	21			Loose gray SANDY SILT (A-4a); wet.	0	1	--	54	45	
73.0	482.0	9 20 50/3	13	22			Very dense gray GRAVEL WITH SAND (A-1-b); wet.	50	19	--	12	20	
80.0	475.0	Core 60"	Rec 60"	RQD 90%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, arenaceous, thinly bedded to thickly bedded. @ 80.0'-80.2',84.0'-84.2', broken zones.						
85		Core 60"	Rec 60"	RQD 80%	R-2		@ 85.9',86.2',86.7', low angle clay filled fractures.						
90													

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