SCI-823-0.00

PID No. 19415

S.R. 823 over Blue Run (CR -29)

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

inter-office communication

to: Harry Fry, District 9 Deputy Director date: September 1, 2005

from: Tim Keller P.E., Administrator Office of Structural Engineering by: William J. Krouse, P.E.,

subject: SCI-823-XXXX SR 823 over Blue Run and CR 29. PID: 19415

Attn: Tom Barnitz, Production Administrator

We have completed our review of the Structure Type Study as submitted by TranSystems for the subject project. We offer the following comments:

1) Consider utilizing 40' to 45' tall MSE abutment walls with 45 degree wingwalls. The MSE wall height as stated above is from the top of the leveling pad to the top of the coping under the abutment. The overburden above the sandstone bedrock will need to be excavated and backfilled with 304 materials under the entire MSE wall area. The Consultant should investigate and generate a cost comparison for a single span bridge option with MSE walls.

2) The Design Consultant shall first determine that MSE wall supported abutments can be utilized at the proposed location prior to making any MSE wall recommendations during the Structure Type Study. Subsurface soil conditions are to be evaluated for expected settlements, differential settlements, allowable bearing capacities and global stability of the proposed MSE walls prior to submitting Structure Type Study to our office. The determination of utilizing a spread footing abutment placed directly on the reinforced soil mass can only be made after the above mentioned analysis have been performed as a minimum. Please refer to Section 204.6 of the 2004 Ohio Bridge Design Manual for additional design guidelines on MSE walls and L&D Manual, Volume 3, Section 1403.5.3 for submittal requirements.

3) Provide all analysis (calculations) and recommendations (required construction controls, if any) for the proposed MSE walls.

4) The cost of structural steel and prestressed concrete beams have fluctuated and the following costs are the most recent available. The Consultant should look over their cost calculations and revise as appropriate to the following costs:

Structural Steel

grade 50

rolled beams $0.90-1.00
plate girders $1.00-1.15 level 4
$1.15-1.30 level 5
grade 70 add $0.10-0.15 per pound

Prestressed Concrete I-Beams

45"	$190-200/LF
54"	$215-225/LF
60"	$240-255/LF
66"	$265-280/LF
72"	$295-310/LF

Paint $12.00/SF

MSE $45-50/SF

5) If a prestressed concrete beam is utilized it should meet the criteria outlined in the ODOT Bridge Design Manual, section 302.5.2.8. If a beam of a size given in Standard Drawing PSID-1-99 and the concrete strengths given in the ODOT Bridge Design Manual is feasible, it should be utilized. Prestressed concrete I-beams that utilize concrete with strengths greater then those given in the BDM should be limited to locations where the vertical clearance is limited. If precast concrete I-beams are considered evaluate whether they can be transported to the site.

6) If the required size of the prestressed concrete girders are different than what is shown in the Standard Drawing (PSID-1-99) and/or the required concrete strength is greater than given in the ODOT Bridge Design Manual then the design consultant shall be required to get letters from at least 2 fabricators stating that they can supply the girders.

7) Please provide separate site plans for the twin structures.

We would like the Consultant to investigate the options stated above and resubmit. Should you have any questions or comments, please contact our office.

TJK:wjk

c: Doug Buskirk, Dave Norris, Tom Barnitz, Larry Wills, File

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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 Blue Run (CR-29). 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, four test borings (TR-7, TR-8, TR-9 and TR-10) were drilled and all of them encountered highly weathered soft to medium hard siltstone bedrock between 5 and 16 feet below the existing ground surface. All of the borings also encountered some layers of stiff light brown SILT AND CLAY (A-6a) and very stiff brown SILTY CLAY (A-6b) at various depths. For a more defined description of the material encountered, refer to the subsurface investigation report.

Based on the alternatives considered for this study, two different foundation conditions were considered applicable for various substructure elements. As such, it is recommended that in locations where the proposed substructures are to be constructed in or near bedrock, either a spread footing with minimum rock embedment or drilled shafts with rock sockets should be used. Substructures located in areas of new embankment construction shall be founded on H-piles. It will be necessary to sleeve the H-piles through the approach embankment fill material. It is also recommended that the piles not be driven until the majority of primary consolidation settlement has occurred in order to avoid having high down-drag forces that could significantly reduce the load-carrying capacity of the piles.

HP12x53 piles with a maximum design load of 70 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. Each of the proposed bridge sections will consist of two 12'-0" travel lanes with 6'-0" median shoulders and 12'-0" outside shoulders. Each bridge deck width will be 45'-0" out to out with 1'-6" inside and outside straight face deflector parapets. Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives in accordance with the design standards, have been provided over the bridge for all alternatives considered. The existing Blue Run (CR-29) 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 issue. More than 15'-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" horizontal offset with a Type D barrier will be maintained beneath both structures along the west side Blue Run (CR-29). The proposed substructure layout exceeds the minimum horizontal clearances, therefore the type D barrier will not be provided. An existing creek ditch, which parallels the road, will be maintained on the east side of Blue Run.

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

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

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

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a tangent alignment across the entire length of both the left and right structures. The proposed mainline profile is located on the inside edge of pavement for both bridges and is along a constant sloping grade of +0.6%. The horizontal and vertical geometry for all alternatives considered are the same. Embankment slopes will be a maximum 2:1 in order to minimize right-of-way impacts.

Structure: As per the Scope of Services, we investigated several bridge types and alternatives as part of the type study. Three alternatives were considered, but only two were further developed in this report. A simple span bridge on MSE walls with stub abutments alternative was eliminated in the early layout stages of the design because of potential wall heights exceeding 55 feet or higher on the rear abutment side of the structure. 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 Plate Girders A709 Grade 50W	Tangent, Prestressed Concrete Girders Modified AASHTO Type 4 (60")	
Proposed Beam Spacing	4 Spaces @ 9'-6" /per Bridge	4 Spaces @ 9'-6" /per Bridge	
No. of Spans	3	3	
Abutment Type	Semi Integral Type with spill-through slopes	Semi Integral Type with spill-through slopes	
No. of Piers	2	2	
Pier Type	T-type	T-type	
Substructure Orientation	18°00'00"RF	18°00'00"RF	
Approximate Bridge Length	286'	286'	
Approximate Structure Depth Slab Haunch Beam Total	 8.75" 2" 47.75" 58.5"(4.875')	 8.75" 2" 60" 70.75"(5.8958')	

Alternative Discussion:

Alternative 1

Span configuration: Various span configurations were investigated and they were refined to the 3-span layout configuration. This alternative is comprised of an 88'-110'-88' layout with an end span ratio of 0.80. The height of the new embankment on the east side of Blue Run controlled the length of the end span. The middle span was then proportioned accordingly to equalize the positive moment in all spans as recommended in section 205.6 of the Bridge Design Manual. Embankment slopes will be a maximum of 2:1 in order to minimize right-of-way impacts. The bridge overall length is 286' from centerline of bearing to centerline of bearing.

Substructure: The abutments and piers were all located at an 18°00'00" RF skew to the roadway alignment.

I. *Abutments:* The rear and forward abutments will both be a semi-integral type abutment supported on H-piles (HP 12x53) with a design capacity of 70-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:* Pier 1 will be a T-type pier supported on a spread footing founded on bedrock. Pier 2 will also be a T-type pier, but contrarily, it will be supported on an H-pile foundation.

The H-Pile type foundation for the substructure units will be further evaluated during the Preliminary Engineering Report submittal (TS&L Submittal). It may be necessary to provide drilled shafts type foundation due to the close proximity of rock surfaces to the bottom of the proposed footings.

Superstructure: The preliminary design of this alternative indicates that 5 – continuous welded steel plate girders (Grade 50W) spaced at 9'-6"would be required for each structure to accommodate the HS25 design loading requirements. Each bridge width is 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0".

Alternative 2

Span configuration: This alternative has a similar horizontal and span layout as Alternative 1, except that the bridge is comprised of prestressed concrete beams. The bridge overall length is 286' from centerline of bearing to centerline of bearing.

Substructure: The abutments and piers were all located at an 18°00'00" RF skew to the roadway alignment.

I. *Abutments:* The rear and forward abutments will both be a semi-integral type abutment supported on H-piles (HP 12x53) with a design capacity of 70-tons per pile driven to refusal. Straight or U-turned type wingwalls will also be provided at each abutment. The details of the abutments and wingwalls will follow ODOT Standard Construction drawings.

II. *Piers:* Pier 1 will be a T-type pier supported on a spread footing founded on bedrock. Pier 2 will also be a T-type pier, but contrarily, it will be supported on an H-pile foundation.

Superstructure: The preliminary design of this alternative indicates that a 5 - Prestressed Modified AASHTO Type 4 (60") beams spaced at 9'-6" would be required to accommodate the HS25. Each bridge width is similar to Alternative 1 with a distance of 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0".

6. Preliminary Probable Bridge Construction Cost:

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

7. Summary:

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

SUMMARY OF ALTERNATIVES AND RECOMMENDATIONS				
STRUCTURE TYPE ALTERNATIVE	**STRUCTURE TYPE**	**PROBABLE BRIDGE CONST. COST**	**RATING**	**ADVANTAGES/ DISADVANTAGES**
1	3-span continuous tangent steel plate girders, A572 Grade 50W with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments and T-type piers on various foundations	**Structure Cost: $3,250,000 Additional Life Cycle Cost: $1,192,000 Total Relative Ownership Cost: $4,442,000**	1	***Advantages:*** • This alternative is the least expensive. • Shorter girder lengths with field splices will facilitate easier transport and construction. ***Disadvantages:*** • Uncertainty with Steel Prices.
2	3-span tangent 60" Modified AASHTO Type 4 Prestressed Concrete Beams with a composite reinforced concrete deck slab supported by reinforced concrete semi-integral abutments T-type piers on various foundations.	**Structure Cost: $3,840,000 Additional Life Cycle Cost: $1,305,000 Total Relative Ownership Cost: $5,145,000**	2	***Advantages:*** • None ***Disadvantages:*** • Increased the structure depth. • Potential construction difficulties with long span prestressed girder and high crane lifts.

8. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1 (Three Span, steel plate 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:

1. This Alternative appears to be the most economical from a construction standpoint.
2. Transport and erection of shorter steel pieces during construction will be easier than the longer and heavier prestressed girders.

APPENDIX A

TRANSYSTEMS CORPORATION

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S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

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 (20%)	Total Alternative Cost	Life Cycle Maintenance Cost	Total Relative Ownership Cost
1	3	88' - 110' - 88'	286.00	5 Steel Girders /per BRIDGE	44" Web Grade 50	$1,640,000	$694,000	$373,400	$541,500	$3,250,000	$1,192,000	$4,442,000
2	3	88' - 110' - 88'	286.00	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$1,951,000	$808,000	$441,400	$640,100	$3,840,000	$1,305,000	$5,145,000

NOTES:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill, sealing of concrete surfaces, structural steel painting, bearings, and crushed aggregate slope protection costs.
2. Estimated construction cost does not include existing structure removal (if any), which should be quantified seperately, if required.

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STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Subtotal Superstructure Cost
1	1	88' - 110' - 88'	286	290	959	$566,000	$240,600	$82,500	5 Steel Girders /per BRIDGE	44" Web Grade 50	623,480	$751,200	$1,640,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.9	3.3	44.7
Right Bridge	0.73	45.00	32.9	3.3	44.7

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

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

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$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 = 25 ft. Width = 90 ft
Area = 250 sq. yd.

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

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

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

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STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Subtotal Substructure Cost
1	3	88' - 110' - 88'	5 Steel Girders /per BRIDGE	44" Web Grade 50	$288,800	$65,800	$177,400	$29,100	$133,300	$694,000

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	110	$421.00	3.5%	$483.00	$53,130
Stem	208	$421.00	3.5%	$483.00	$100,460
Footings	280	$421.00	3.5%	$483.00	$135,240
Total Cost	598				$288,800

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	334	$421.00	3.5%	$483.00	$161,300
Wingwalls	33	$421.00	3.5%	$483.00	$16,100

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		$54.00	3.5%	$62.00

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

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

	Number of Piles		Total Pile Length
Alt. 1	152	SEE QUANTITY CALCULATIONS	3,956

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

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

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

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STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - QUANTITY CALCULATIONS

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Length		Volume	Width	Depth	Length		Volume	
Pier 1 (Spr Ftg)	47.31	3	5.27	15.81	748	3	39.93	15.71		1882	15	4	31.54		1892	4522
Pier 2 (Piles)	47.31	3	5.27	15.81	748	3	19.59	15.71		923	15	4	31.54		1892	3564
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					1496					2805					3785	8086
Total (Cu.Yd.)					55					104					140	299
		Qty x 2 (L/R)			110					208					280	598

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footin	Volume	
Rear Abut	47.31	3	6.1875	18.56	878	3	3.86	11.58		548	6	3	18	1	852	2278
Fwd. Abut	47.31	3	6.1875	18.56	878	3	3.58	10.74		508	6	3	18	1	852	2238
Total (Cu.Ft.)					1756					1056					1703	4516
Total (Cu.Yd.)					65					39					63	167
		Qty x 2 (L/R)			130					78					126	334

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length (Feet)
Rear Abut.	0	0	0	0	140	0	1	26	809.0	761.9	49.0	1274
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	24	786	776	12.0	288
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	26	811	797	16.0	416
TotaL								76				1978
							Qty x 2 (L/R)	152				3956

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	218	10	88	191840
Span 2	218	10	110	239800
Span 3	218	10	88	191840
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				623480

total steel weight per girder (lb.) = 19184
Total Span length (ft.)= 286.00
Weight Per ft. = 67

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STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
2	3	88' - 110' - 88'	286.00	290.00	959	$566,000	$240,600	$82,500	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$1,062,200	$1,951,000	0%	$1,951,000

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	4.26	4.26
Parapets	1	4.26	4.26

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.9	3.3	44.7
Right Bridge	0.73	45.00	32.9	3.3	44.7

Note: Deck width is out to out
10% of deck area allowed for haunches and overhangs.

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

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$590.00

Based on parapet and slab percentages
of total concrete area

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

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

Prestressed Concrete Girders
Unit Costs:

	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.	16	$33,120
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	16	$22,080
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	81	$111,780
Modified Type 4 I-Beams (60")	$26,000	ea.	3.5%	$29,840	ea.	30	$895,200
						TOTAL =	$1,062,180

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 = 25 ft. Width = 90 ft
Area = 250 sq. yd.

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

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

	Cost Ratio	Year 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 Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

SUBSTRUCTURE

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	Additional Crane Cost	Subtotal Substructure Cost
2	3	88' - 110' - 88'	5 Prestressed I-Girders /per BRIDGE	Modified AASHTO Type 4 (60")	$314,000	$71,500	$183,800	$30,100	$133,300	$75,000	$808,000

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	166	$421.00	3.5%	$483.00	$80,180
Stem	204	$421.00	3.5%	$483.00	$98,530
Footings	280	$421.00	3.5%	$483.00	$135,240
Total Cost	650				$314,000

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	346	$421.00	3.5%	$483.00	$167,100
Wingwalls	35	$421.00	3.5%	$483.00	$16,700

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

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

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

Number of Piles		Total Pile Length
152	SEE QUANTITY CALCULATIONS	3,956

Pile Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Furnished	$20.15	3.5%	$23.10
Driven	$9.24	3.5%	$10.60
Total			$33.70

Shaft Foundation Unit Cost ($/ft.): 36" Drilled Shaft

	Number of Shafts		Total Shaft Length
Alt. 1	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2007
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

	Total Area (sq. ft.)	Year 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 1		$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.

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

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

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

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Blue Run L/R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE ALTERNATIVE 2 - QUANTITY CALCULATIONS

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

Pier Quantities

Pier Location	Length	Cap				Stem				Footing				Total Volume
		Width	Depth	Area	Volume	Width	Height	Length	Volume	Width	Depth	Length	Volume	
Pier 1 (Spr Ftg)	47.31	4.5	5.27	23.72	1122	3	39.35	15.71	1855	15	4	31.54	1892	4869
Pier 2 (Piles)	47.31	4.5	5.27	23.72	1122	3	19.01	15.71	896	15	4	31.54	1892	3910
Pier 3														0
Pier 4														0
Pier 5														0
Pier 6														0
Pier 7														
Total (Cu.Ft.)					2244				2751				3785	8779
Total (Cu.Yd.)					83				102				140	325
		Qty x 2 (L/R)			166				204				280	650

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat				Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area	Volume	Width	Depth	Area	# Footi	Volume	
Rear Abut	47.31	3	6.771	20.31	961	3	3.779	11.34	536	6	3	18	1	852	2349
Fwd. Abut	47.31	3	6.771	20.31	961	3	3.499	10.50	497	6	3	18	1	852	2309
Total (Cu.Ft.)					1922				1033					1703	4658
Total (Cu.Yd.)					71				38					63	173
		Qty x 2 (L/R)			142				76					126	346

Pile Quantities

Location	Load/girder (Kips)	# Girders	Total Girder Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length (Feet)
Rear Abut.	0	0	0	0	140	0	1	26	809.0	761.9	49.0	1274
Pier 1	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	140	0	1	24	786	776	12.0	288
Pier 3	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 4	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 5	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 6	0	0	0	0	140	0	1	0	0	0	2.0	0
Pier 7	0	0	0	0	140	0	1	0	0	0	2.0	0
Fwd. Abut.	0	0	0	0	140	0	1	26	811	797	16.0	416
TotaL								76				1978
							Qty x 2 (L/R)	152				3956

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 1	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 2	0	0	0	0	0	0	1	0	0	0	2.0	0
Pier 3	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 4	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 5	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 6	0	0	0	0	0	0	1	0	0	0	0.0	0
Pier 7	0	0	0	0	0	0	1	0	0	0	0.0	0
Fwd. Abut.	0	10	0	0	0	0	1	0	0	0	0.0	0
Total								0				0

Superstructure P/S Concrete Quantities

Location	Type of girder	# Girders	Span Length (ft.)	Total Length (ft.)	Spacing Int.	No. of Int in span	Number of Int Diap. 1 location	Total No. in Span
Span 1	MOD TYPE 4 60	10	88	880	29.33	3	9	27
Span 2	MOD TYPE 4 60	10	110	1100	36.67	3	9	27
Span 3	MOD TYPE 4 60	10	88	880	29.33	3	9	27
Span 4		0	0	0	0.00	3	0	0
Span 5		0	0	0	0.00	3	0	0
Span 6		0	0	0	0.00	3	0	0
Span 7		0	0	0	0.00	3	0	0
Span 8		0	0	0	0.00	3	0	0
Span 9		0	0	0	0.00	3	0	0
					Total			81
TotaL	MOD TYPE 4 60	30		2860				

SCI-823-0.00 - PORTSMOUTH BYPASS
S.R. 823 over Blue Run L/R
STRUCTURE TYPE STUDY - LIFE CYCLE COSTS

By: BTA
Checked: ELK

Date: 6/25/2005
Date: 7/1/2005

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Structural Steel Painting: Number of Maintenance Cycles	Structural Steel Painting: Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Superstructure Sealing: Number of Maintenance Cycles	Superstructure Sealing: Total Life Cycle Cost	Approach Pavement Resurfacing: Cost Per Cycle	Approach Pavement Resurfacing: Number of Maintenance Cycles	Approach Pavement Resurfacing: Total Life Cycle Cost
1	3	286.00	5 Steel Girders /per BRIDGE	$373,100	0	$0	$0	0	$0	$0	0	$0
2	3	286.00	5 Prestressed I-Girders /per BRIDGE	$0	0	$0	$56,400	2	$112,800	$0	0	$0

Alt. No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Bridge Deck Overlay (5): Deck Demo & Chipping	Bridge Deck Overlay (5): Deck Overlay	Bridge Deck Overlay (5): Deck Joint Gland (2)	Bridge Deck Overlay (5): Number of Maintenance Cycles	Bridge Deck Overlay (5): Total Life Cycle Cost	Bridge Redecking (5): Deck Concrete Cost (3)	Bridge Redecking (5): Deck Reinforcing Cost (3)	Bridge Redecking (5): Deck Joint Cost (2)	Bridge Redecking (5): Deck Removal Cost	Bridge Redecking (5): Number of Maintenance Cycles	Bridge Redecking (5): Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	3	286	5 Steel Girders /per BRIDGE	$78,000	$94,600	n/a	1	$172,600	$566,000	$240,600	n/a	$213,100	1	$1,019,700	$1,192,000	$3,250,000	$4,442,000
2	3	286	5 Prestressed I-Girders /per BRIDGE	$78,000	$94,600	n/a	1	$172,600	$566,000	$240,600	n/a	$213,100	1	$1,019,700	$1,305,000	$3,840,000	$5,145,000

Structural Steel Painting:
Structural Steel Area:

	Web Depth (in.)	No. Stringers	Total Span Length (ft.)	Assumed Ave. Bot. Flange Width (in.)	Nominal Exposed Girder Area (sq. ft.)	Secondary Member Allowance	Total Exposed Steel Area (sq. ft.)
Alt. 1	44	10	286.00	14.00	30,983	20%	37,200

Painting Cost per sq. ft.:

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

Superstructure Sealing:
PS Concrete I-Beam Area:
60" Modified AASHTO Type 4

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		34		2	68.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00
Total Exposed Perimeter					174.30 in.

54" AASHTO Type 2

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		23		2	46.00
Upper Fillets	6	6	8.49	2	16.97
Top Flange		8		2	16.00
Total Exposed Perimeter					146.43 in.

PS Concrete Area:

	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)
Alt. 2	10	286.00	41,542	10%	5,080

Sealing Cost per sq. yd.:

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

Bridge Redecking:
Bridge Deck Joint Cost per foot:

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

	Bridge Width	No. Joints
Alt. 1	94.63	0
Alt. 2	94.63	0

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	25,740	$8.28	$213,100
Alt. 2	25,740	$8.28	$213,100

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

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

Bridge Deck MSC Overlay Cost per cu. yd.:

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

	Deck Area (3) (sq. ft.)	Deck Area (sq. yd.)	Hand Chipping (sq. yd.)	Variable Thickness Repair (cu. yd.)
Alt. 1	25,740	2,860	72	65
Alt. 2	25,740	2,860	72	65

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

Bridge Deck Joint Gland Replacement Cost per foot:

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

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

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

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

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

Asphalt Resurfacing Costs:

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

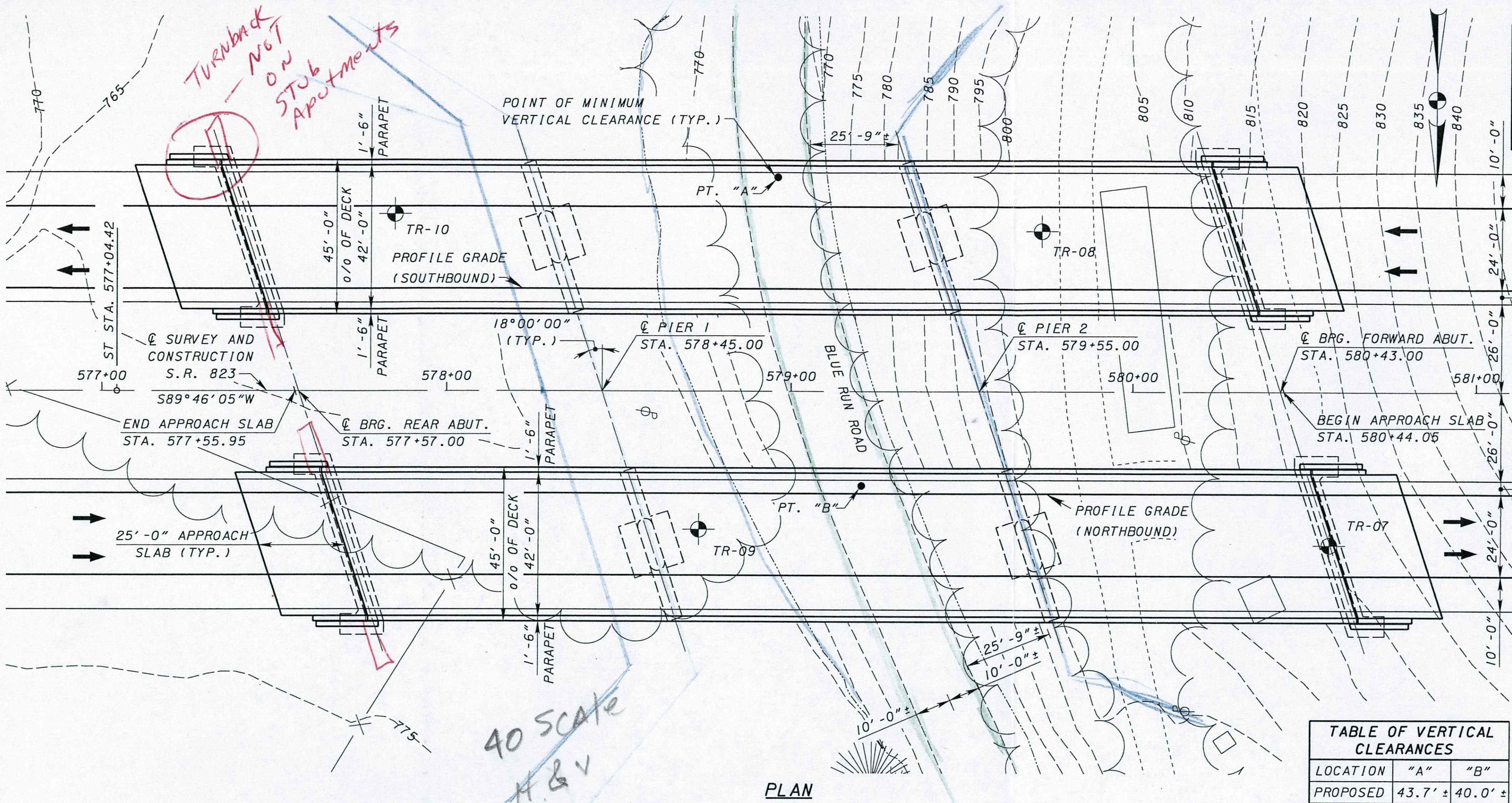
APPENDIX B

TRANSYSTEMS CORPORATION

1. Single Span
w/ MSE Walls

supported
2. Undercut And Backfilled
A) Embankments

B. Tall wall vs partial ht
w/ 304 Embankment



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
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.
B-X	xx+xx.xx	xx.xx' LT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) = 19,800
CURRENT YEAR ADTT (2030) = 2,722
DESIGN YEAR ADT (2010) = 26,000
DESIGN YEAR ADTT (2030) = 3,640

PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK AND SUBSTRUCTURE UNITS

SPANS: 88'-0", 110'-0", 88'-0" c/c BEARINGS

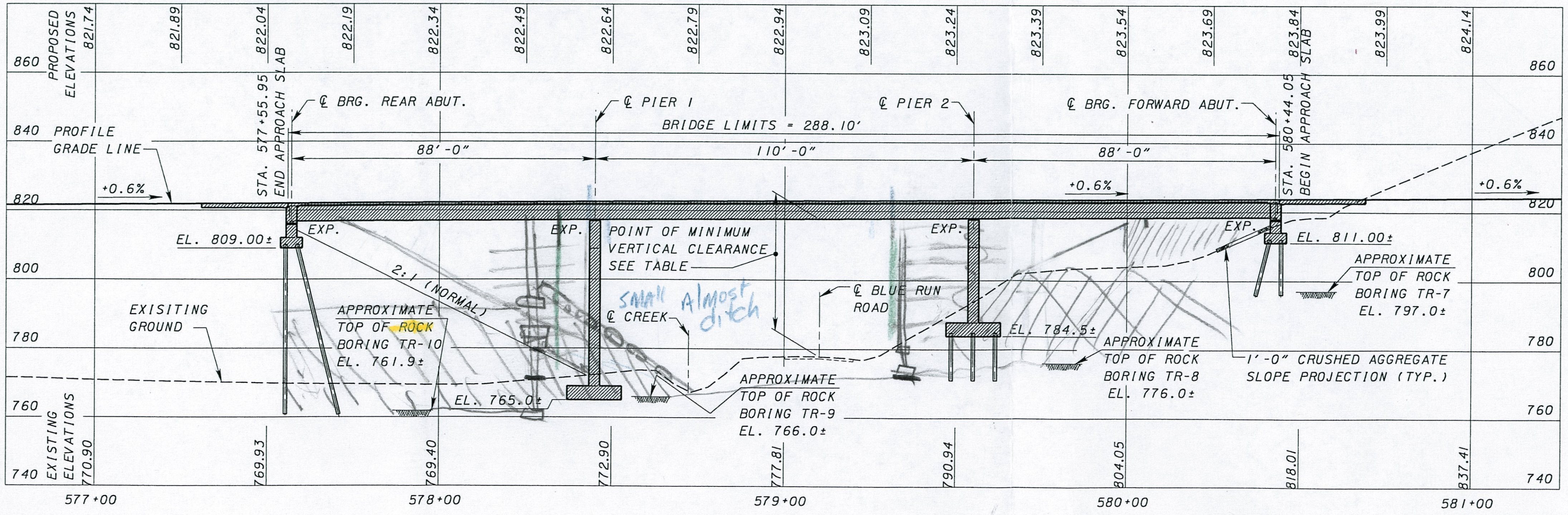
ROADWAY: 2 - 42'-0" TOE TO TOE OF PARAPETS

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

SKEW: 18°00'00" RF
CROWN: 0.016 FT./FT.

ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-81 (25'-0" LONG)
LATITUDE:
LONGITUDE:
STRUCTURE FILE NO.

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	43.7' ±	40.0' ±
REQUIRED*	15.0'	15.0'



ELEVATION ALONG PROFILE GRADE S.R. 823

NOTES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 12x53 PILES AND HAVE A MAXIMUM CAPACITY OF 70 TONS PER PILE.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS & L SUBMITTAL.

Very small ditch

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED BTA | CHECKED RER | DRAWN RCK | REVISED | REVIEWED NFF | DATE 7/9/05 | STRUCTURE FILE NUMBER

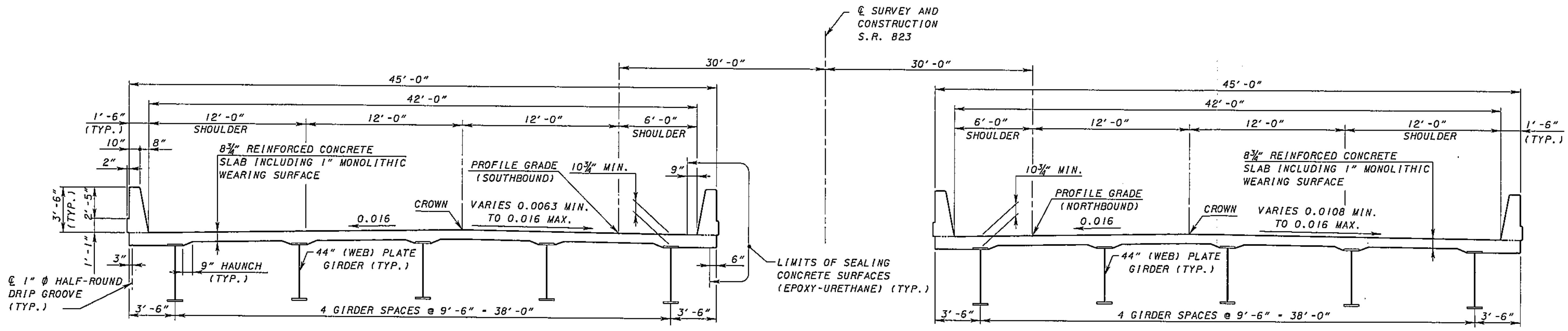
SCIOTO COUNTY
STA. 577+55.95
STA. 580+44.05

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

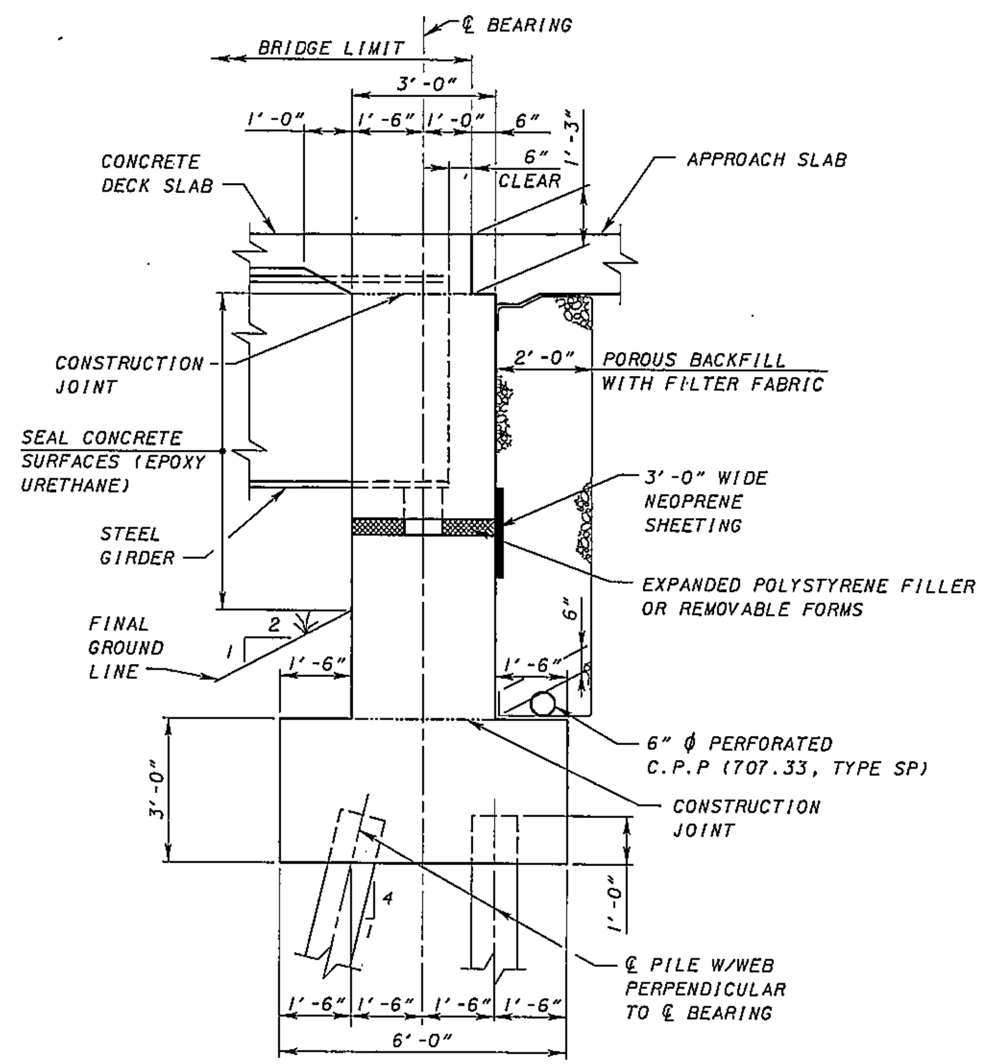
1 / 2

DATE: 7/12/2005 FILE: g:\C003\0064\Bridge\BTS\13-CR29BlueRun\823-13sp01_alt1.dgn



PROPOSED TRANSVERSE SECTION

SUPERSTRUCTURE DEPTH	
ITEM	PLATE GIRDER
	44" WEB
SLAB (INCLUDING WEARING SURFACE)	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
GIRDER DEPTH	47.75"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (INCH)	58.50"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (FEET)	4.875'



TYPICAL ABUTMENT SECTION

DATE: 7/12/2005 FILE: g:\C003\0064\Bridge\BTS\13-CR29BlueRun\823-13tsDLalt.dgn

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

DESIGNED	DRAWN	REVIEWED	DATE
BTA	RCK	NFF	7/9/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
RER			

TRANSVERSE SECTION - ALTERNATIVE I
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

2/2

APPENDIX C

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By	BTA	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 BLUE RUN ROAD PID #: 19415

Alternative 1 - 5 Steel Plate Girders, 3 Span — ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset		
1 Lane:	0.016	x	12	=	0.19
1 Lane:	-0.016	x	12	=	-0.19
Shoulder to Beam CL:	-0.016	x	10		-0.16
			Total Adjustment	=	**-0.16**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.75	0.73		
Haunch:	2	0.17		
Girder or Beam Depth:	47.75	3.98		
	58.5	4.88		
		Total Superstructure Depth (ft)	=	**4.88**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**578+95.39**
Offset Location @ Critical Point	=	**64.00' Left**
Profile Grade Elevation at Critical Point	=	822.92
Adjustment for Cross Slopes to Beam CL	=	-0.16
Top of Deck Elevation @ Critical Point	=	**822.76**
Total Superstructure Depth	=	-4.88
Bottom of Beam Elevation @ Critical Point	=	**817.88**
Approximate Top of Existing Ground @ Critical Point	=	**774.22**
Actual Vertical Clearance	=	***43.66***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure

Description S.R. 823 OVER BLUE RUN ROAD PID # 19415

Alternative 1 - 5 Steel Plate Girders, 3 Span | ***Point Location:*** **B**

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.016	x	4	=	-0.06
				=	0.00
					0
			Total Adjustment	=	**-0.06**

Superstructure Depth

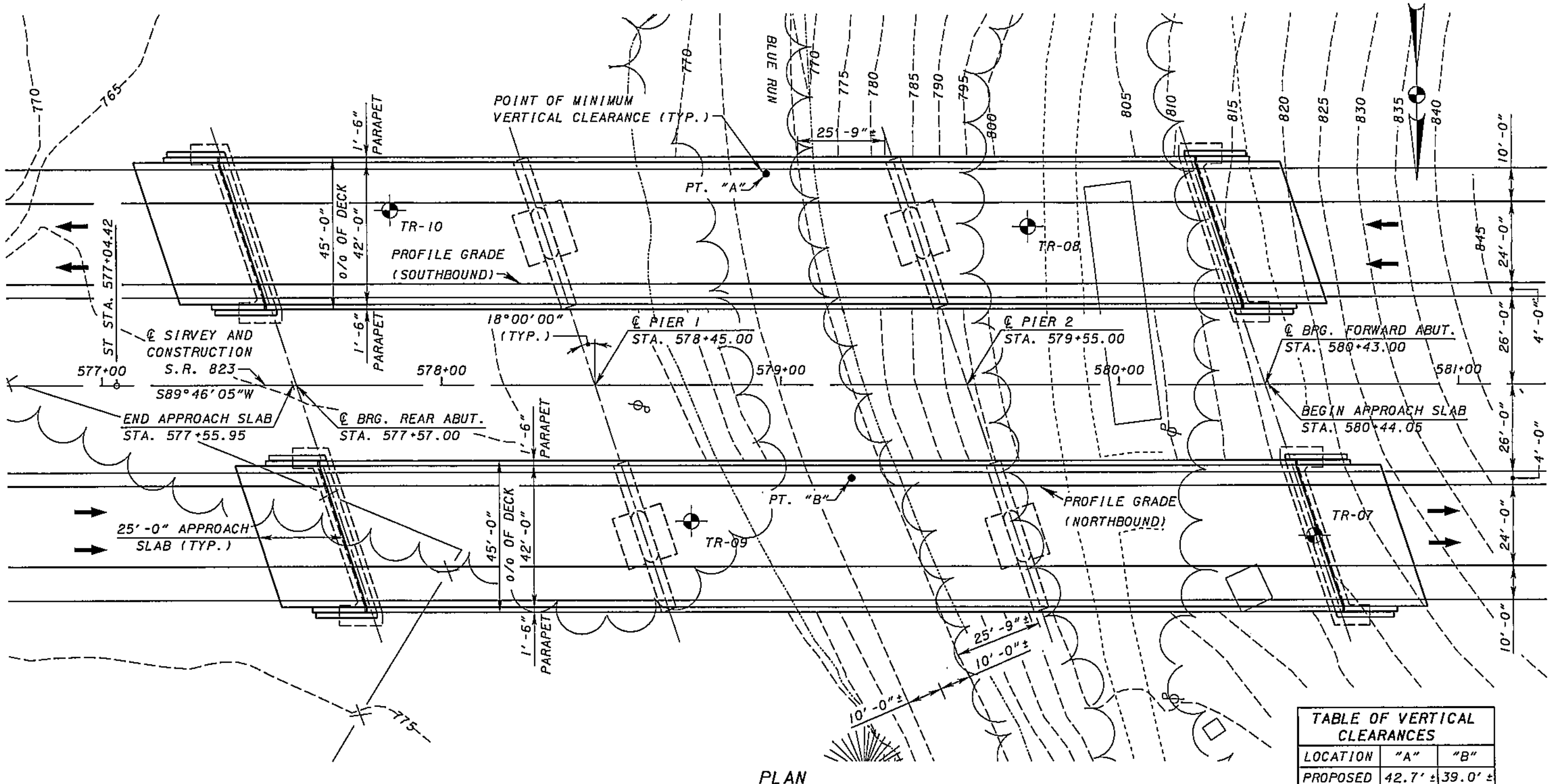
Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	47.75	3.98
	58.5	4.88

Total Superstructure Depth (ft) = **4.88**

Vertical Clearance at Critical Point

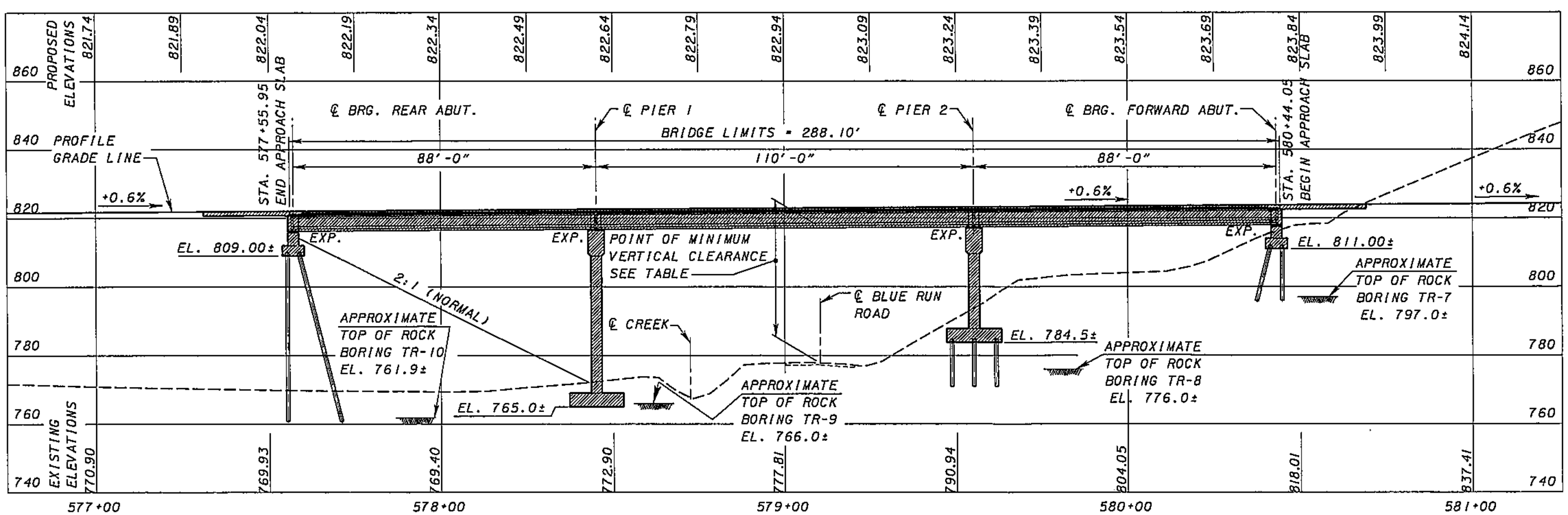
Station @ Critical Point	=	**579+19.44**
Offset Location @ Critical Point	=	**26.00' Right**
Profile Grade Elevation at Critical Point	=	823.06
Adjustment for Cross Slopes to Beam CL	=	-0.06
Top of Deck Elevation @ Critical Point	=	**823.00**
Total Superstructure Depth	=	-4.88
Bottom of Beam Elevation @ Critical Point	=	**818.12**
Approximate Top of Existing Ground @ Critical Point	=	**778.17**
Actual Vertical Clearance	=	***39.95***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

APPENDIX D

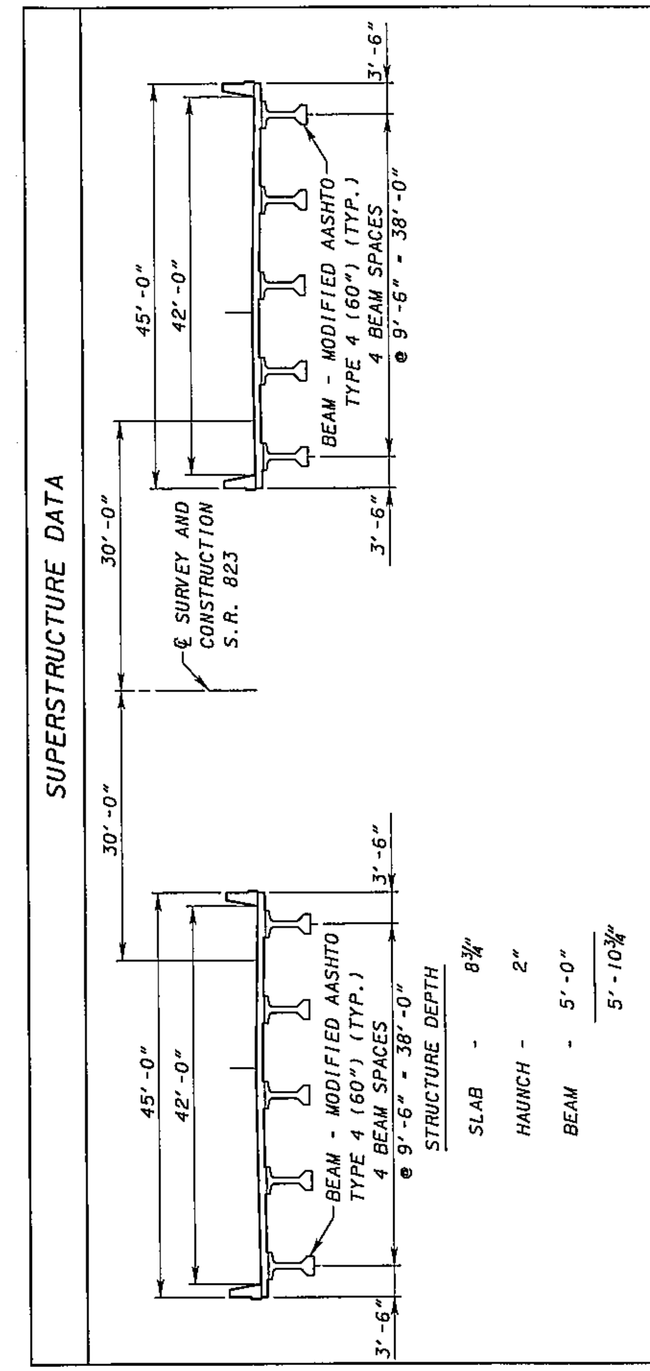


PLAN

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	42.7' ±	39.0' ±
REQUIRED	15.0'	15.0'



ELEVATION ALONG PROFILE GRADE S.R. 823



NOTES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 12x53 PILES AND HAVE A MAXIMUM CAPACITY OF 70 TONS PER PILE.

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

DESIGNED BTA | DRAWN RCK | REVIEWED NFF | DATE
CHECKED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA.
STA.

PRELIMINARY SITE PLAN - ALTERNATIVE 2
S.R. 823 OVER BLUE RUN ROAD (CR-29)

SCI-823-0.00
PID 19415

1 / 1

DATE: 7/12/2005 FILE: g:\C003\0064\Bridges\BTS\3-CR29(BlueRun)\823-13spDl_alt2.dgn

APPENDIX E

TRANSYSTEMS CORPORATION

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April 1, 2005

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

Re: **SCI-823-0.00 over Blue Run Road (C.R. 29)**
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 Blue Run Road (C.R. 29). It is anticipated that the proposed structure will be a three-span, elevated bridge. The existing grade at the proposed new bridge location ranges between elevations 769 and 775 in the plain east of C.R. 29 and extends as high as elevation 818 on the hill west of C.R. 29. It is anticipated that the SCI-823-0.00 mainline will be located in fill sections on either side of the proposed bridge. Approximately 50 feet of new fill is anticipated at the rear (east) abutment. There will likely be a sidehill fill at the forward (west) abutment, with the fill ranging in thickness from 0 to 15 feet. It is anticipated that the piers will be approximately 35 to 45 feet in height.

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-7, TR-8, TR-9, and TR-10, were drilled at the proposed structure between March 11 and 15, 2005. The borings were drilled to depths ranging from 17.0 to 34.5 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. Borings TR-7, TR-8, TR-9, and TR-10 are located approximately at Stations 586+00, 585+00, 584+30, and 583+20,

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respectively. The boring locations and the 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, the borings encountered one to three inches of topsoil. Beneath the topsoil, all of the borings encountered silt and clay (A-6a) and silty clay (A-6b) to depths ranging from 5.0 to 13.5 feet. Beneath the A-6 soils, a hard clay (A-7-6) layer was encountered in Borings TR-7, TR-8, and TR-9 at depths of 8.5 to 10.0 feet, 13.5 to 16.0 feet, and 6.0 to 7.0 feet, respectively.

Bedrock was encountered in the borings at depths between 5.0 and 16.0 feet and consisted primarily of a moderately to highly weathered soft to medium hard siltstone. Below a depth of 7.1 feet in Boring TR-10, the siltstone was less weathered and medium hard to hard. Recovery of the core samples ranged from 94 to 100 %, and the RQD values ranged from 17 to 87%, with an average RQD of 58%.

Water seepage was detected in Borings TR-9 and TR-10 at a depth of 1.0 feet prior to coring operations. Seepage was not detected in Borings TR-7 and TR-8. At the completion of drilling, water levels ranged from 1.3 to 17.4 feet. The final water levels include drilling water and may not be representative of actual groundwater conditions particularly in Borings TR-7 and TR-8. Groundwater levels may vary seasonably.

Conclusions and Recommendations

Based on the subsurface materials encountered in the borings, spread footing foundations appear to be best suited for support of the proposed structure. Competent bedrock was encountered between depths of 5.0 and 16.0 feet in the borings. At the forward (west) abutment, the amount of fill is expected to vary between zero and 15 feet, due to the sidehill fill. However, approximately 50 feet of additional fill is anticipated at the rear (east) abutment location. Consequently, it is anticipated that spread footings will be founded in fill at the rear (east) abutment. Spread footings will likely be founded in bedrock at Pier 1, in either bedrock or natural soil at Pier 2, and in either fill or bedrock at the forward (west) abutment.

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Spread footings bearing in embankment fill or natural soil may be designed for an allowable bearing capacity of 3000 psf. If spread footings are bearing on bedrock, the footings should be embedded into the bedrock. Recommendations for spread footings on rock are presented in the table below.

Additionally, drilled shafts to rock or pre-bored H-piles into bedrock can also be used to support the structure. If high lateral or uplift loads are anticipated, drilled shafts or H-piles socketed into bedrock may be needed. The actual rock socket lengths will need to be designed based upon actual loading conditions.

The following table summarizes the site conditions and bearing capacity recommendations for foundations on rock.

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Top-of-Rock Elevation* (Feet)	Allowable Bearing Capacity
TR-7	Forward (West) Abutment	810.0	797.0	10 TSF
TR-8	Pier 2	792.0	776.0	10 TSF
TR-9	Pier 1	773.0	766.0	10 TSF
TR-10	Rear (East) Abutment	769.0	761.9	10 TSF

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

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Closing

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

Sincerely,

DLZ OHIO, INC.

Edward R Hood

Edward R. Hood, P.E.
Geotechnical Engineer

Dorothy A. Adams

~~Dorothy A. Adams, P.E.~~
Senior Geotechnical Engineer

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Site Plan
Boring Logs TR-7, TR-8, TR-9, and TR-10

cc: File

M:\proj\0121\3070.03\Structures\Blue Run CR 29\CR 29 lt04-01-05.doc

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"	Sand – Fine	0.42 mm to 0.074 mm
Gravel – Coarse	3" to ¾"	Silt	0.074 mm to 0.005 mm
Gravel – 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.**

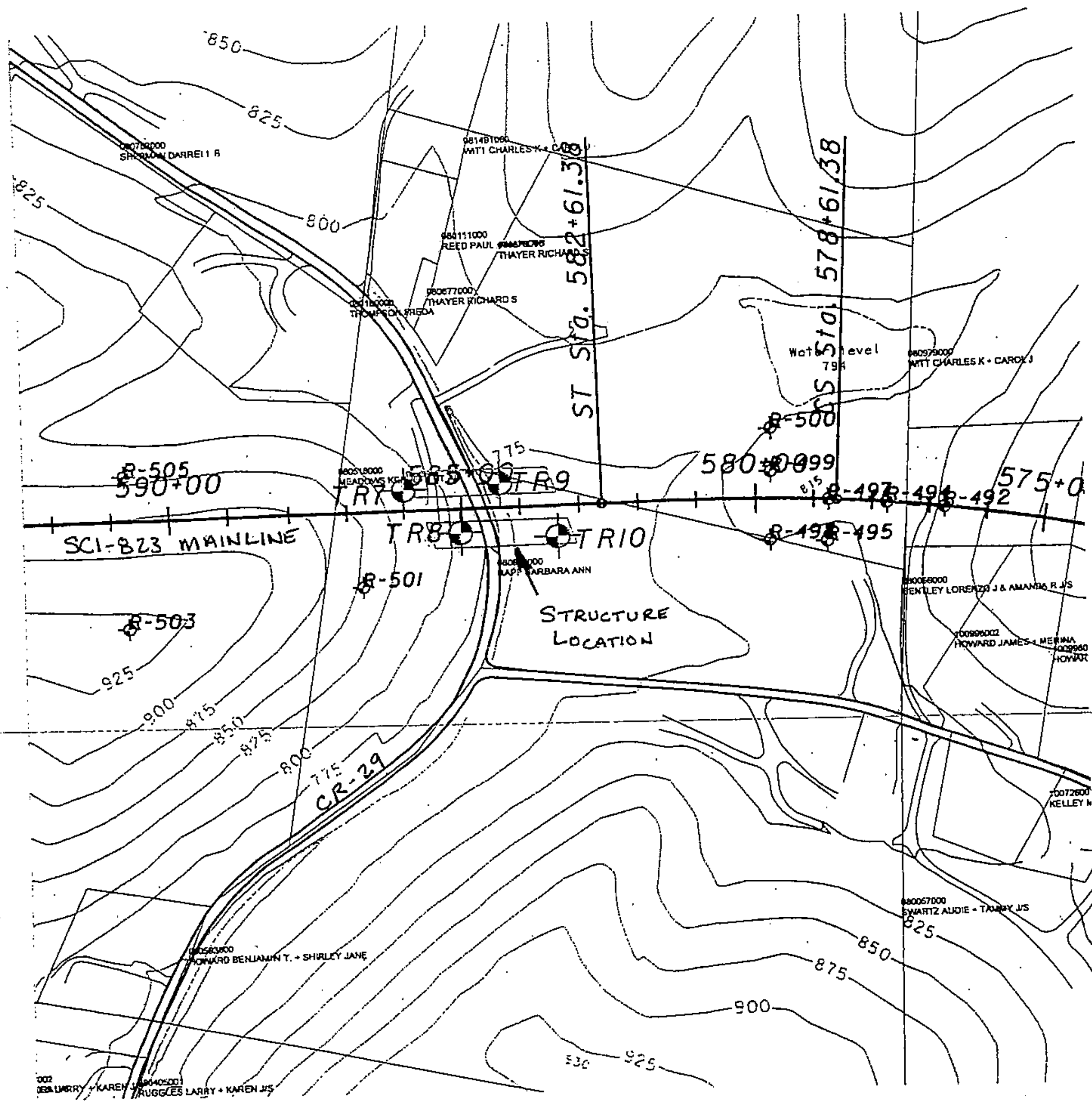
Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed 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

Blue Run Road

SCI-823 over CR 29

SCI-823-0.00

FIGURE 1.

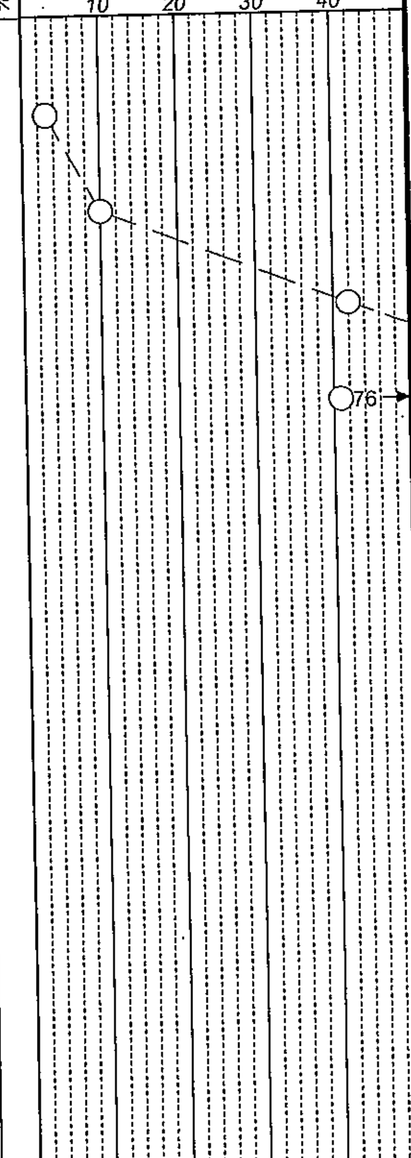
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-7 | Location: SCI-823-0.00 over CR 29 (Forward Abutment) | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
4.1' (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	STANDARD PENETRATION (N) Blows per foot
	810.0													
0.2	809.8						Topsoil - 2"							
		1 1 2	5	1		---	Soft brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp.							
3.0	807.0	4 5 5	17	2		2.0	Stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; (contains relic rock structure); damp.							
		8 20 22	18	3		---								
8.5	801.5	18 30 46	12	4		4.5+	Hard light brown CLAY (A-7-6); (decomposed shale); dry.							76
10.0	800.0	Core-54"	Rec 52"	RQD 17%	R-1		Soft light brown SILTSTONE; highly weathered, thinly laminated, highly fractured, contains several healed fractures.							
13.0	797.0	Core 120"	Rec 120"	RQD 60%	R-2		Soft to medium hard gray SILTSTONE; highly weathered, thinly laminated, highly fractured, contains several healed fractures. @ 14.7'-15.6',17.3'-17.9', decomposed zone.							
24.5	785.5						Bottom of Boring - 24.5'							



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

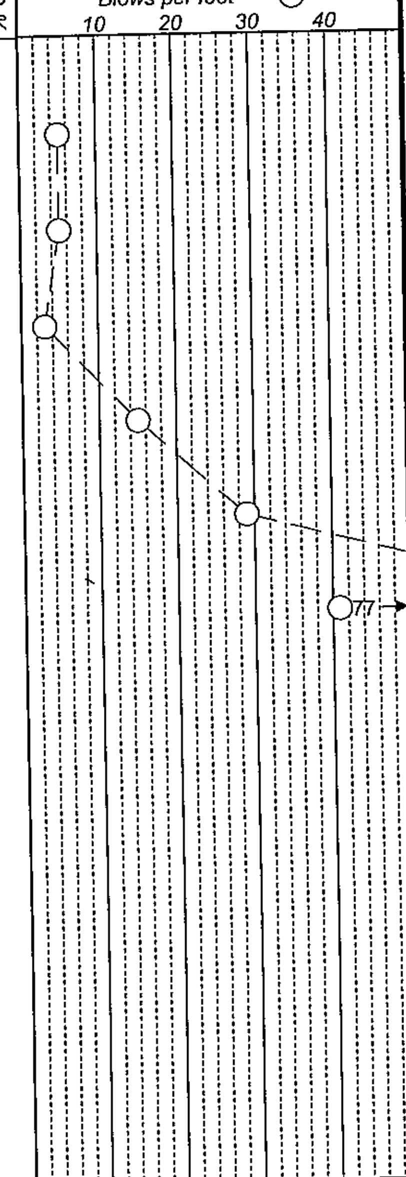
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-8 | Location: SCI-823-0.00 over CR 29 (Pier 2) | Date Drilled: 03/11/05 to 03/14/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
17.4' (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
0.1	792.0 / 791.9						Topsoil - 1"						
		2 3 2	14	1		2.0	Stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; damp.						
		2 2 3	11	2		1.0							
6.5	785.5	1 1 2	9	3		1.5	Stiff light brown SILTY CLAY (A-6b), trace to little fine to coarse sand, trace gravel; damp.						
8.0	784.0	3 7 8	10	4		2.0	Very stiff light brown SILT AND CLAY (A-6a), little fine to coarse sand, trace to little gravel; damp.						
		4 10 19	18	5		3.5							
13.5	778.5	13 31 46	18	6		4.5	Hard brown CLAY (A-7-6), trace fine sand; damp.						
16.0	776.0	Core 114"	Rec 107"	RQD 46%	R-1		Soft light brown SILTSTONE; highly weathered, thinly laminated to thinly bedded, highly fractured.						
20.8	771.2						Soft to medium hard gray SILTSTONE; highly weathered, micaceous, thinly laminated to thinly bedded, highly fractured.						
		Core	Rec	RQD	R-2								

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



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

Job No. 0121-3070.03

Client: TranSystems, Inc. | Project: SCI-823-0.00

LOG OF: Boring TR-8 | Location: SCI-823-0.00 over CR 29 (Pier 2) | Date Drilled: 03/11/05 to 03/14/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
17.4' (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	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
30	762.0	120"	120"	81%			Soft to medium hard gray SILTSTONE; highly weathered, micaceous, thinly laminated to thinly bedded, highly fractured.							
34.5	757.5						Bottom of Boring - 34.5'							
35														
40														
45														
50														
55														

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

Job No. 0121-3070.03

Client: TranSystems, Inc.

Project: SCI-823-0.00

LOG OF: Boring TR-9

Location: SCI-823-0.00 over CR 29 (Pier 1)

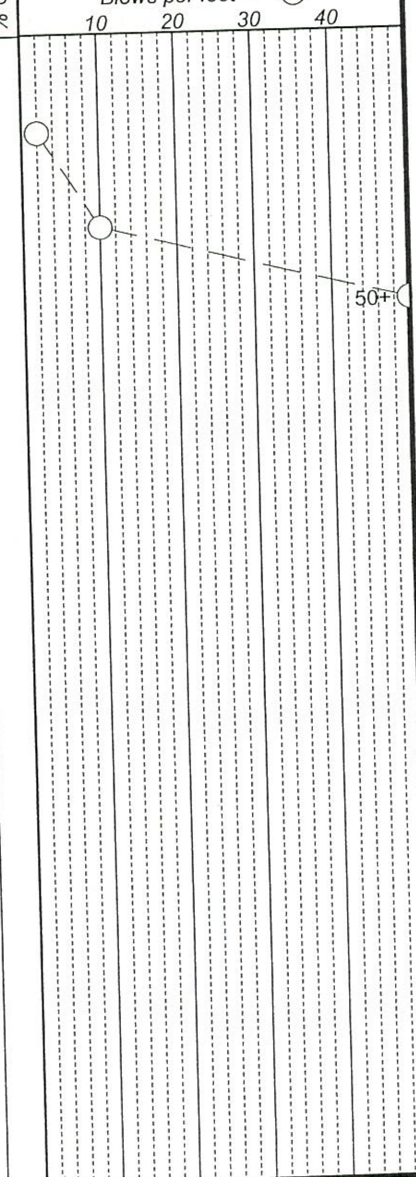
Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: 3.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	773.0												
0.3	772.7						Topsoil - 3"						
		WOH WOH 2	7	1		0.25	Soft dark brown SILTY CLAY (A-6b), trace fine to coarse sand; contains shale fragments; moist.						
3.0	770.0	4 5 5	18	2		2.5	Very stiff light brown SILT AND CLAY (A-6a), trace to little fine to coarse sand, trace gravel; damp.						
6.0	767.0	19 50/3	8	3		4.5+	Hard light brown CLAY (A-7-6), trace fine sand; (decomposed shale); dry to damp.						
7.0	766.0	Core 120"	Rec 120"	RQD 83%	R-1		Soft to medium hard gray SILTSTONE; slightly weathered, micaceous, arenaceous, laminated to thinly bedded, moderately fractured, contains high angle healed fractures.						
17.0	756.0						Bottom of Boring - 17.0'						

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

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



FILE: 0121-3070-03 [4/1/2005 2:23 PM]

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

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

LOG OF: Boring TR-10 | Location: SCI-823-0.00 over CR 29 (Rear Abutment) | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: 1.0'
Water level at completion: 1.3'

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	769.0												
0.3	768.7						Topsoil - 3"						
		1 2 2	8	1		1.0	Medium stiff dark brown SILT AND CLAY (A-6a), little fine to coarse sand, little gravel; damp to moist.						
3.0	766.0	12 11 41	18	2			Hard light brown SILTY CLAY (A-6b), little gravel, trace fine sand; (decomposed rock); dry to damp.						
5.0	764.0						Soft light brown SILTSTONE; highly weathered, laminated, highly fractured, contains high angle healed fractures.						
7.1	761.9	Core 54"	Rec 54"	RQD 33%	R-1		Medium hard to hard gray SILTSTONE; slightly weathered, micaceous, arenaceous, laminated, moderately fractured.						
		Core 120"	Rec 120"	RQD 87%	R-2								
19.5	749.5						Bottom of Boring - 19.5'