SCI-823-0.00

PID No. 19415

FLATWOOD-FALLEN TIMBER ROAD

(C.R. 184) OVER S.R. 823

STRUCTURE TYPE STUDY SUBMITTAL

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

JULY 15, 2005

Prepared by:

TRANSYSTEMS CORPORATION

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BRIDGE TYPE STUDY NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of a new underpass structure that will carry the proposed S.R. 823 bypass under the relocated Flatwood-Fallen Timber Road (C.R. 184). 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 (3) test borings (TR-01, TR-02 and TR-03) were drilled which all encountered sandstone bedrock between 5 and 12 feet below the existing ground surface. Above these elevations, relatively stiff sandy silt (A-4a) or Silt and Clay (A-6a) were encountered, overlain by Gravel (A-1-a). At the surface approximately 2" of asphalt was encountered.

Based on the alternatives considered for this study, only one foundation type was considered applicable for various substructure elements. As the location of bedrock will be at or near the surface, after the excavation for the proposed S.R. 823 roadway, spread foundations appear to be best suited for all alternative's substructure locations. Based on the foundation recommendations, the allowable bearing capacity for all alternates should be 15 tsf.

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 Portsmouth to another interchange with US 23, located north of Portsmouth in Valley Township.

As stated above, the structure will carry Flatwood-Fallen Timber Road over the proposed S.R. 823 highway. The cross section for this bridge will consist of the following, left to right: one 1'-6" outside straight face deflector parapet, one 6'-0" shoulder, two 12'-0" travel lanes, one 6'-0" shoulder and finally a 1'-6" straight face deflector parapet, for a total deck width of 39'-0" out to out.

Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives considered.

Vertical and Horizontal Design – Since the proposed vertical alignment for all overpass structures on this project was dictated by the overall design of the new bypass profile, vertical clearance was not a critical design issue for each alternative proposed herein. For this report, more than 17'-0" of preferred vertical clearance will be provided for each alternative considered.

For this underpass structure at Flatwood-Fallen Timber Road, a 30'-0" minimum horizontal offset from edge of pavement to toe of slope will be maintained underneath the proposed SR 823 for all Alternatives.

The existing Flatwood-Fallen Timber Road will be realigned for both horizontal and vertical alignment. While the horizontal realignment is slight, as shown in plan view on the proposed alternative, the vertical realignment is substantial. The vertical clearance to the proposed S.R. 823 below however will be much more than required.

The cross section of Flatwood-Fallen Timber Road will be widened from 2-lanes with approximately 20'-0" pavement width, to a two-lane cross section with 24'-0" pavement width.

Drainage Design - The collection of storm water runoff will be addressed off of the bridge, thus scuppers will not be required. 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 on the existing Flatwood-Fallen Timber Road will be detoured.

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a tangent alignment across the entire length of structure. The proposed profile grade line is located at the centerline of the bridge, and is along a constant sloping grade of +6%. Additional forces from the superstructure to the substructure will be introduced due to this steep grade, and will be investigated at TS&L submittal.

The vertical geometry for all alternatives considered is the same. The horizontal geometry however is varies for the alternatives as the span lengths vary. Embankment slopes will be 1:1 for all alternatives, due to the profusion of bedrock.

Structure: As per the Scope of Services, we investigated several bridge types and alternatives as part of this type study. Three (3) alternatives have been evaluated in this Structure Type Study, and are designated as Alternative 1 though 4. The appropriate structure types that were considered are outlined in the Structure Type Alternative Table below:

STRUCTURE TYPE ALTERNATIVE TABLE

Structure Type Alternative	1	2	3
Superstructure Type Description	Tangent, 58" continuous steel plate girder Grade 50W	Tangent Prestressed Concrete Girders 54" AASHTO Type 4	Tangent, W33 rolled beams Grade 50W
Proposed Beam Spacing	4 Spaces @ 8'-3"	4 Spaces @ 8'-3""	4 Spaces @ 8'-3"
No. of Spans	2	4	4
Abutment Type	Stub Type abutments with 1:1 spill-through slopes (Semi Integral Type)	Stub Type abutments with 1:1 spill-through slopes (Semi Integral Type)	Stub Type abutments with 1:1 spill-through slopes (Semi Integral Type)
No. of Piers	1	1	2
Pier Type	T-Type Pier	T-Type Pier	T-Type Pier
Substructure Orientation	09°00'00" LF	09°00'00" LF	09°00'00" LF
Approximate Bridge Length	322'	322'	322'
Approximate Structure Depth			
Slab	8.5"	8.5"	8.5"
Haunch	2"	2"	2"
Beam	58"	54"	33"
Total	68.5" (5.708')	64.5" (5.375')	43.5" (3.625')

Alternatives Discussion:

As stated above, various span configurations were investigated and were refined to either the two-span (Alternative 1) or four-span (Alternatives 2 and 3) layout configuration chosen.

Typically, for grade separation structure spanning a divided highway with a median, ODOT prefers a two-span structure as stated in the Bridge Design Manual, Section 205.2. This layout is provided in Alternative 1. However, to provide a prestressed concrete alternative, a four-span structure was designed for Alternative 2, along with a corresponding wide-flange beam structure for Alternative 3.

Finally, the different alternatives discussed below modify the location and orientation of the abutments, as well as the type of abutment and type of superstructure.

Alternative 1

Span configuration: This two-span alternative consists of a 153'-0" and a 169'-0" span, for an overall bridge length of 322'-0" from centerline bearings at abutments. The abutments and pier are oriented with a 9°00'00" skew to the roadway. As stated previously, 1:1 spill through slopes are utilized due to the presence of sandstone bedrock.

Substructure:

I. *Abutments:* Both the forward and rear abutments will be semi-integral type supported on spread footings, with a design capacity of 15 tsf, as they are located in bedrock cut. Spill-through slopes will be used to provide the embankment for the approach roadways. The details of the abutments will follow ODOT Standard Construction drawings.

II. *Pier:* The single pier will consist of T-type column also supported on a spread footing with a design capacity of 15 tsf.

Superstructure: The preliminary design of this alternative indicates that 5 - 58" Grade 50W plate girders, spaced at 8'-3", will be required for this structure. The bridge will have 3'-0" overhangs, and will accommodate the HS25 design loading. The width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0.

Alternative 2

Span configuration: This four-span alternative consists of a 65'-0" – 88'-0" – 98'-0" – 71'-0" span arrangement, for an overall bridge length of 322'-0" from centerline bearings at abutments. The abutments and piers are oriented with a 9°00'00" skew to the roadway. As stated previously, 1:1 spill through slopes are utilized due to the presence of sandstone bedrock.

Substructure:

III. *Abutments:* Both the forward and rear abutments will be semi-integral type supported on spread footings, with a design capacity of 15 tsf, as they are located in bedrock cut. Spill-through slopes will be used to provide the embankment for the approach roadways. The details of the abutments will follow ODOT Standard Construction drawings.

IV. *Piers:* The three piers will consist of T-type columns, also supported on spread footings, with a design capacity of 15 tsf.

Superstructure: The preliminary design of this alternative indicates that 5 - 54" AASHTO Type 4 prestressed beams, spaced at 8'-3", will be required for this structure. The bridge will have 3'-0" overhangs, and will accommodate the HS25 design loading. The width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0.

Alternative 3

Span configuration: Similar to Alternate 2, this four-span alternative consists of a 65'-0" – 88'-0" – 98'-0" – 71'-0" span arrangement, for an overall bridge length of 322'-0" from centerline bearings at abutments.. The abutments and piers are oriented with a 9°00'00" skew to the roadway. As stated previously, 1:1 spill through slopes are utilized due to the presence of sandstone bedrock.

Substructure:

V. *Abutments:* Both the forward and rear abutments will be semi-integral type supported on spread footings, with a design capacity of 15 tsf, as they are located in bedrock cut. Spill-through slopes will be used to provide the embankment for the approach roadways. The details of the abutments will follow ODOT Standard Construction drawings.

VI. *Piers:* The three piers will consist of T-type columns, also supported on spread footings, with a design capacity of 15 tsf.

Superstructure: The preliminary design of this alternative indicates that 5 – W33 Grade 50W rolled beams, spaced at 8'-3", will be required for this structure. The bridge will have 3'-0" overhangs, and will accommodate the HS25 design loading. The width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0.

6. Preliminary Probable Bridge Construction Cost:

A preliminary probable bridge construction cost has been prepared for Alternatives 1 through 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 were included for each Alternative.

7. Summary:

A Summary of Alternatives and Recommendation Table have been provided to facilitate review of the costs for the Structure Alternatives Types investigated, as shown on the next page.

SUMMARY OF ALTERNATIVES AND RECOMMENDATIONS

STRUCTURE TYPE ALTERNATIVE	STRUCTURE TYPE	PROBABLE BRIDGE CONSTRUCTION COST	RATING	ADVANTAGES/ DISADVANTAGES
1	3-span continuous tangent plate girders, A709 Grade 50W with a composite reinforced concrete deck slab supported by semi-integral abutments with 1:1 slopes and a T-type column pier, all on spread foundations	**Structure Cost: $1,980,000** **Additional Life Cycle Cost: $592,000** **Total Relative Ownership Cost: $2,572,000**	1	***Advantages:*** • 2-span bridge provides more open line of sight for roadway underneath • Preferred Alternative per ODOT BDM Section 205.2 • Weathering steel provides for lower life cycle maintenance costs than painted steel ***Disadvantages:*** • Most expensive alternative • Uncertainty with steel prices • Size of crane picks
2	4-span continuous for live load 54" AASHTO Type 4 Prestressed Concrete Beams with a composite reinforced concrete deck slab supported by semi-integral abutments with 1:1 slopes and a T-type column pier, all on spread foundations	**Structure Cost: $1,712,000** **Additional Life Cycle Cost: $633,000** **Total Relative Ownership Cost: $2,345,000**	3	***Advantages:*** • Prestressed beams require less maintenance versus painted steel beams ***Disadvantages:*** • Construction lead time for Prestressed may affect schedule • 4-span alternative provides more obstructed line of sight versus 2-span alternative
3	4-span continuous tangent rolled steel beams, A709 Grade 50W with a composite reinforced concrete deck slab supported by semi-integral abutments with 1:1 slopes and T-type column piers, all on spread foundations	**Structure Cost: $1,469,000** **Additional Life Cycle Cost: $592,000** **Total Relative Ownership Cost: $2,061,000**	2	***Advantages:*** • Weathering steel provides for lower life cycle maintenance costs than painted steel • Lowest initial and relative ownership cost ***Disadvantages:*** • Uncertainty with Steel Prices • 4-span alternative provides more obstructed line of sight versus 2-span alternative

8. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1**, which consists of 2-span 68" deep Grade 50W plate girders, supported by one T-Type Pier and semi-integral abutments on 1:1 spill through slopes. (See Appendix B for the Site Plan and Structure Details).

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

- The 2-span bridge provides more open line of sight for roadway underneath
- Preferred Alternative per ODOT BDM Section 205.2
- Weathering steel provides for lower life cycle maintenance costs than painted steel

APPENDIX A

TRANSYSTEMS CORPORATION

SCI-823-0.00

Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY

Filename: G:\CO03\0064\Bridge\BTS\15-CR184(Flat-FallenTimber)\Prelim Calcs\[flatwoodVertClrCalc.xls]Pt B
By: JDH
Checked: ELK

Date: 7/9/2005
Date: 7/12/2005

COST COMPARISON SUMMARY

Alternative No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Total Initial Superstructure Cost	Total Initial Substructure Cost	Total Initial Construction Cost
1	4	153.00	169.00	0.00	0.00	322.00	5 ~ Steel Plate Girders	64" Web - Grade 50W	$1,231,000	$191,000	$1,980,000
2	4	65.00	88.00	98.00	71.00	322.00	5 ~ P.S. Concrete I-Beams	AASHTO Type 4	$877,000	$353,000	$1,712,000
3	4	65.00	88.00	98.00	71.00	322.00	5 ~ Steel Rolled Beams	W33 - Grade 50W	$706,000	$349,000	$1,469,000

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Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY

Filename: G:\CO03\0064\Bridge\BTS\15-CR184(Flat-FallenTimber)\Prelim Calcs\[flatwoodVertClrCalc.xls]Pt B
By: JDH Date: 7/9/2005
Checked: ELK Date: 7/12/2005

ALTERNATIVE COST SUMMARY

Alternative No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Subtotal Superstructure Cost	Subtotal Substructure Cost	Approach Roadway Length (1)	Approach Roadway Cost (2, 3)	Structure Incidental Cost (16%)	Structure Contingency Cost (20%)
1	2	153.00	169.00	0.00	0.00	322.00	5 ~ Steel Plate Girders	64" Web - Grade 50W	$1,231,000	$191,000	0.0	$0	$228,000	$330,000
2	4	65.00	88.00	98.00	71.00	322.00	5 ~ P.S. Concrete I-Beams	AASHTO Type 4	$877,000	$353,000	0.0	$0	$197,000	$285,000
3	4	65.00	88.00	98.00	71.00	322.00	5 ~ Steel Rolled Beams	W33 - Grade 50W	$706,000	$349,000	0.0	$0	$169,000	$245,000

NOTES:

1. Approach roadway length equals the difference between the maximum bridge length and the bridge length for the alternative being considered.

2. Use 2004 pvm't cost = $33.20 /sq. yd. Allow 3.5% escalation for years 2005 - 2008
   2008 Unit Cost = $38.10 /sq. yd.

   Pavement Widths:

Alternative	Rear Appr.	Fwd Appr.	Average
Alt. 1	39.00 ft.	39.00 ft.	39.00 ft.
Alt. 2	39.00 ft.	39.00 ft.	39.00 ft.
Alt. 3	39.00 ft.	39.00 ft.	39.00 ft.

3. Use 2004 Concrete Barrier, Single Slope, Type B1 cost = $50.30 /ft.
   Allow 3.5% escalation for years 2005 - 2008 2008 Unit Cost = $57.70 /ft.

4. Structure incidental cost allowance includes provision for structure excavation, porous backfill & drainage pipe, sealing of concrete surfaces, structural steel painting, bearings, (minor) temporary shoring, crushed aggregate slope protection, pile driving equipment mobilization, shear connectors, settlement platforms, expansion joints, joint sealers, and joint fillers costs.

5. Estimated construction cost does not include existing structure removal, which should be quantified separately, if required.

6. No profile adjustment costs associated with raising the profiles have been considered, since all alternatives satisfy the minimum required vertical clearance of 17'-0" for steel structures and 17'-0" for concrete structures.

Alternative	Vertical Clearance Provided (ft.)	Profile Adjustment Required (ft.)
Alt. 1	0.00 ft.	0.00 ft.
Alt. 2	0.00 ft.	0.00 ft.
Alt. 3	0.00 ft.	0.00 ft.

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STRUCTURE TYPE STUDY

Filename: G:\CO03\0064\Bridge\BTS\15-CR184(Flat-FallenTimber)\Prelim Calcs\[flatwoodVertClrCalc.xls]Pt B
By: JDH Date: 7/9/2005
Checked: ELK Date: 7/12/2005

SUPERSTRUCTURE

Alternative No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Deck Length (ft.)	Deck Area (sq. 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	Prestressed Girder Cost	Initial Superstructure Cost
1	2	153.00	169.00	0.00	0.00	322.00	324.00	12,600	478	$283,700	$119,800	$35,800	5 ~ Steel Plate Girders	64" Web - Grade 50W	657180.0	$791,800	$0	**$1,231,000**
2	4	65.00	88.00	98.00	71.00	322.00	324.00	12,600	467	$277,300	$117,100	$35,800	5 ~ P.S. Concrete I-Beams	AASHTO Type 4	0.0	$0	$447,200	**$877,000**
3	4	65.00	88.00	98.00	71.00	322.00	324.00	12,600	478	$283,700	$119,800	$35,800	5 ~ Steel Rolled Beams	W33 - Grade 50W	314474.4	$267,000	$0	**$706,000**

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Edge	2	4.26	8.52
Median	0	4.26	0.00

Slab:

	T (ft.)	Ave. W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Alt. 1	0.73	39.00	28.4	2.8	39.8
Alt. 2	0.71	39.00	27.6	2.8	38.9
Alt. 3	0.73	39.00	28.4	2.8	39.8

Number of structures = 1
Note: Deck width measured as average width.
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 =			$594.00

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
Alt. 2						
AASHTO I-Beams						
Type 4	$16,000	ea.	3.5%	$18,360	ea.	20
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	12
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	8
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	32

Reinforced Concrete Approach Slabs (T=15")

Unit Cost ($/sq. yd.):

Length = 25 ft. Average Width = 39.00 ft
Area = 108 sq. yd.

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

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
Plate Girders - Grade 50	n/a	$1.05	3.5%	$1.20
Hybrid Plate Girders - Grade 50/70\	1.10	$1.16	3.5%	$1.33

Note - all structural steel weight will be estimated 30 pounds per each square foot of bridge deck area for long-span tangent girders.
and 25 pounds per each square foot of bridge deck area for short-span tangent girders.

	Year 2008		Quantity Per Beam		No. Required	Total	
Alt. 1							
Plate Girder							
54" Web - Plate Girder - Grade 50V	$1.20	/lb	121,700	lb/e	5	608,500	
Crossframes (10% of beam weight)	$1.20	/lb	12,170	lb/e	4	48,680	
Total			133,870	lb/ea		657,180	
Alt. 3							
Rolled Beam							
W33 - Grade 50W	$0.85	/lb	58,236	lb/e	5	291,180	lbs
Crossframes (10% of beam weight)	$0.85	/lb	5,824	lb/e	4	23,294	lbs
Total			64,060	lb/ea		314,474	lbs

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Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY - Alternate 1 - Substructure Quantity Calculations

By: JDH
Checked: ELK

Date: 7/9/2005
Date: 7/13/2005

Pier Quantities (T-Type Pier Cap on Spread Foundation)

Pier Location	Length	Pier Cap				Single Rectangular Column					Footing						Total Volume
		Width	Depth	Area	Volume	Width	Height	Depth	Columi	Volume	Width	Height	Area	Depth	# Footing	Volume	
Pier 1	37.5	3.5	8	250	875	12.50	66.11	3	1	2479	23	4	92	9	1	828	4182
Total (Cu.Ft.)					875					2479						828	4182
Total (Cu.Yd.)					32					92						31	155

Semi-Integral Abutment Quantities (on Spread Footing)

Abut Location		Backwall				Beam Seat					Footing						Total Volume
	Length	Width	Depth	Area	Volume	Width	Height		Area	Volume	Width	Depth		Area	# Footing	Volume	
Rear Abutment	39.5	3	7.25	21.75	859	3	5		15.00	593	6	3		18	1	711	2163
Fwd Abutment	39.5	3	7.25	21.75	859	3	5		15.00	593	6	3		18	1	711	2163
Total (Cu.Ft.)					1718					1185						1422	4325
Total (Cu.Yd.)					64					44						53	160

MSE Abutment Wall Quantities

Abutment Location	Wall			
	Height	Return	Length	Area
Rear Abutment				
	0	0	40	0
	0	0	0	0
Fwd Abutment				
	0	0	40	0
	0	0	0	0
Total (Sq.Ft.)				0

Spread Footing Allowable Load Check - Alt 1

Location	Load/ girder (Kips)			# Girders	Total Girder Load (kips)	Subst Wt (kips)	Total Load (kips)	Footing Area	Applied Load (ksf)	Allowable (ksf)	Check
	DL	LL + I	Total								
Rear Abut.	100	80	180	5	900	324	1224	237	5.2	30	OK
Pier 1	449	175	624	5	3120	627	3747	207	18.1	30	OK
Fwd. Abut.	123	80	203	5	1015	324	1339	237	5.7	30	OK
TotaL	672	335	1007	15	5035	1276		444			

Allowable load from DLZ Geotechnical Report dated March 8, 2005

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Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY - Alternate 2 - Substructure Quantity Calculations

By: JDH
Checked: ELK

Date: 7/9/2005
Date: 7/13/2005

Pier Quantities (T-Type Pier Cap on Spread Foundation)

Pier Location	Length	Pier Cap				Single Rectangular Column					Footing						Total Volume
		Width	Depth	Area	Volume	Width	Height	Depth	Columi	Volume	Width	Height	Area	Depth	# Footing	Volume	
Pier 1	37.5	3.5	8	250	875	12.50	65.2	3	1	2445	23	3	69	8	1	552	3872
Pier 2	37.5	3.5	8	250	875	12.50	70.5	3	1	2644	23	3	69	8	1	552	4071
Pier 3	37.5	3.5	8	250	875	12.50	66.4	3	1	2490	23	3	69	8	1	552	3917
Total (Cu.Ft.)					**2625**					**7579**						**1656**	**11860**
Total (Cu.Yd.)					**97**					**281**						**61**	**439**

Semi-Integral Abutment Quantities (on Spread Footing)

Abut Location		Backwall				Beam Seat					Footing						Total Volume
	Length	Width	Depth	Area	Volume	Width	Height		Area	Volume	Width	Depth		Area	# Footing	Volume	
Rear Abutment	39.5	3	6	18	711	3	5		15.00	593	6	3		18	1	711	2015
Fwd Abutment	39.5	3	6	18	711	3	5		15.00	593	6	3		18	1	711	2015
Total (Cu.Ft.)					**1422**					**1185**						**1422**	**4029**
Total (Cu.Yd.)					**53**					**44**						**53**	**149**

MSE Abutment Wall Quantities

Abutment Location	Wall			
	Height	Return	Length	Area
Rear Abutment				
	0	0	40	0
	0	0	0	0
Fwd Abutment				
	0	0	40	0
	0	0	0	0
Total (Sq.Ft.)				**0**

Spread Footing Allowable Load Check

Location	Load/ girder (Kips)			# Girders	Total Girder Load (kips)	Subst Wt (kips)	Total Load (kips)	Footing Area	Applied Load (ksf)	Allowable (ksf)	Check
	DL	LL + I	Total								
Rear Abut.	59	70	128.5	5	642.5	302	945	237	4.0	30	OK
Pier 1	209	95	303.5	5	1517.5	581	2098	184	11.4	30	OK
Pier 2	240	103	343	5	1715	611	2326	184	12.6	30	OK
Pier 3	242	101	342.5	5	1712.5	588	2300	184	12.5	30	OK
Fwd. Abut.	60	71	131	5	655	302	957	237	4.0	30	OK
TotaL	**808.5**	**440**	**1248.5**	**25**	**6242.5**	**2383**		**1026**			

Allowable load from DLZ Geotechnical Report dated March 8, 2005

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Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY - Alternate 3 - Substructure Quantity Calculations

By: JDH
Checked: ELK

Date: 7/9/2005
Date: 7/13/2005

Pier Quantities (T-Type Pier Cap on Spread Foundation)

Pier Location	Length	Pier Cap				Single Rectangular Column					Footing						Total Volume
		Width	Depth	Area	Volume	Width	Height	Depth	Colum	Volume	Width	Height	Area	Depth	# Footing	Volume	
Pier 1	37.5	3.5	8	250	875	12.50	66.95	3	1	2511	23	3	69	8	1	552	3938
Pier 2	37.5	3.5	8	250	875	12.50	72.25	3	1	2709	23	3	69	8	1	552	4136
Pier 3	37.5	3.5	8	250	875	12.50	68.15	3	1	2556	23	3	69	8	1	552	3983
Total (Cu.Ft.)					**2625**					**7776**						**1656**	**12057**
Total (Cu.Yd.)					**97**					**288**						**61**	**447**

Semi-Integral Abutment Quantities (on Spread Footing)

Abut Location		Backwall				Beam Seat					Footing						Total Volume
	Length	Width	Depth	Area	Volume	Width	Height		Area	Volume	Width	Depth		Area	# Footing	Volume	
Rear Abutment	39.5	3	4.5	13.5	533	3	5		15.00	593	6	3		18	1	711	1837
Fwd Abutment	39.5	3	4.5	13.5	533	3	5		15.00	593	6	3		18	1	711	1837
Total (Cu.Ft.)					**1067**					**1185**						**1422**	**3674**
Total (Cu.Yd.)					**40**					**44**						**53**	**136**

MSE Abutment Wall Quantities

Abutment Location	Wall			
	Height	Return	Length	Area
Rear Abutment				
	0	0	40	0
	0	0	0	0
Fwd Abutment				
	0	0	40	0
	0	0	0	0
Total (Sq.Ft.)				**0**

Spread Footing Allowable Load Check

Location	Load/ girder (Kips)			# Girders	Total Girder Load (kips)	Subst Wt (kips)	Total Load (kips)	Footing Area	Applied Load (ksf)	Allowable (ksf)	Check
	DL	LL + I	Total								
Rear Abut.	39	70	109	5	545	276	821	237	3.5	30	OK
Pier 1	139	95	234	5	1170	591	1761	184	9.6	30	OK
Pier 2	160	103	263	5	1315	620	1935	184	10.5	30	OK
Pier 3	161	101	262	5	1310	597	1907	184	10.4	30	OK
Fwd. Abut.	40	71	111	5	555	276	831	237	3.5	30	OK
TotaL	**539**	**440**	**979**	**25**	**4895**	**2360**		**1026**			

Allowable load from DLZ Geotechnical Report dated March 8, 2005

SCI-823-0.00

Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY

Filename: G:\CO03\0064\Bridge\BTS\15-CR184(Flat-FallenTimber)\Prelim Calcs\[flatwoodVertClrCalc.xls]Pt B
By: JDH Date: 6/28/2005
Checked: ELK Date: 7/13/2005

SUBSTRUCTURE

Alternative No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Abutment Wall Cost	Temporary Shoring Cost	Initial Substructure Cost
1	2	153.00	169.00	0.00	0.00	322.00	5 ~ Steel Plate Girders	64" Web - Grade 50W	$74,800	$17,000	$85,200	$14,000	$0	$0	$0	**$191,000**
2	4	65.00	88.00	98.00	71.00	322.00	5 ~ P.S. Concrete I-Beams	AASHTO Type 4	$212,200	$48,300	$79,200	$13,000	$0	$0	$0	**$353,000**
3	4	65.00	88.00	98.00	71.00	322.00	5 ~ Steel Rolled Beams	W33 - Grade 50W	$215,700	$49,100	$72,400	$11,900	$0	$0	$0	**$349,000**

Pier QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	32.4	$421.00	3.5%	$483.00	$15,650
Columns	91.8	$421.00	3.5%	$483.00	$44,350
Footings	30.7	$421.00	3.5%	$483.00	$14,810
Total Pier Cost					$74,800

Alternate 2

Component	Volume	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	97.2	$421.00	3.5%	$483.00	$46,960
Columns	280.7	$421.00	3.5%	$483.00	$135,580
Footings	61.3	$421.00	3.5%	$483.00	$29,620
Total Pier Cost					$212,200

Alternate 3

Component	Volume	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	97.2	$421.00	3.5%	$483.00	$46,960
Columns	288.0	$421.00	3.5%	$483.00	$139,100
Footings	61.3	$421.00	3.5%	$483.00	$29,620
Total Pier Cost					$215,700

Abutment QC/QA Concrete, Class QSC1 Cost:

Alternate 1

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment					
Rear	80.1	$421.00	3.5%	$483.00	$38,700
Forward	80.1	$421.00	3.5%	$483.00	$38,700
Wingwalls					
Rear	8.0	$421.00	3.5%	$483.00	$3,900
Forward	8.0	$421.00	3.5%	$483.00	$3,900

Note: Wingwall concrete estimated at 10% of Abutment concrete quantity

Alternate 2

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment					
Rear	74.6	$421.00	3.5%	$483.00	$36,000
Forward	74.6	$421.00	3.5%	$483.00	$36,000
Wingwalls					
Rear	7.5	$421.00	3.5%	$483.00	$3,600
Forward	7.5	$421.00	3.5%	$483.00	$3,600

Note: Wingwall concrete estimated at 10% of Abutment concrete quantity

Alternate 3

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment					
Rear	68.0	$421.00	3.5%	$483.00	$32,900
Forward	68.0	$421.00	3.5%	$483.00	$32,900
Wingwalls					
Rear	6.8	$421.00	3.5%	$483.00	$3,300
Forward	6.8	$421.00	3.5%	$483.00	$3,300

Note: Wingwall concrete estimated at 10% of Abutment concrete quantity

Pile Foundation Unit Cost ($/ft.):

HP14 x 73 Steel Piles, Furnished & Driven
Abutment and Pier Piles

	Number	Total Pile Length	Total Cost
Alt. 1	0	0	$0
Alt. 2	0	0	$0
Alt. 3	0	0	$0

HP14 x 73 Steel Piles, Furnished & Driven

	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

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

	Temp. Shoring Area (sq. ft.)	Temp. MSE W Area (sq. ft.)	Total Cost
Alt. 1	0	0	$0
Alt. 2	0	0	$0
Alt. 3	0	0	$0
Alt. 4	0	0	$0

	Year 2004 Unit Cost	Annual Escalation	Year 2008
Temporary Shoring	$23.50	3.5%	$27.00
Temporary MSE Wall	$27.50	3.5%	$31.60

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.):

	Rear Abutment Area (sq. ft.)	Forward Abutment Area (sq. ft.)	Total Cost
Alt. 1	0	0	$0
Alt. 2	0	0	$0
Alt. 3	0	0	$0
Alt. 4	0	0	$0

	Year 2004 Unit Cost	Annual Escalation	Year 2008
MSE Wall	$54.00	3.5%	$62.00

SCI-823-0.00

Flatwood-Fallen Timber Road over SR 823

STRUCTURE TYPE STUDY

Filename: G:\CO03\0064\Bridge\BTS\15-CR184(Flat-FallenTimber)\Prelim Calcs\[flatwoodVertClrCalc.xls]Pt B

By: JDH Date: 6/25/2005

Checked: ELK Date: 7/13/2005

LIFE CYCLE MAINTENANCE COST

Alt. No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Approach Pavement Resurfacing: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost
1	2	153	169	0	0	322	5 ~ Steel Plate Girders	$250,800	0	$0	$0	0	$0	$0	7	$0
2	4	65	88	98	71	322	5 ~ P.S. Concrete I-Beams	$0	0	$0	$25,100	2	$50,200	$0	7	$0
3	4	65	88	98	71	322	5 ~ Steel Rolled Beams	$144,400	0	$0	$0	0	$0	$0	0	$0

Alt. No.	No. Spans	Span Arrangement Span 1	Span 2	Span 3	Span 4	Total Span Length (ft.)	Framing Alternative	Bridge Deck Overlay (5): Deck Demo & Chipping	Deck Overlay	Deck Joint Gland (2)	Number of Maintenance Cycles	Total Life Cycle Cost	Bridge Redecking (5): Deck Concrete Cost (3)	Deck Reinforcing Cost (3)	Deck Joint Cost (2)	Deck Removal Cost	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	2	153	169	0	0	322	5 ~ Steel Plate Girders	$38,200	$46,300	n/a	1	$84,500	$283,700	$119,800	n/a	$104,300	1	$507,800	$592,000	$1,980,000	$2,572,000
2	4	65	88	98	71	322	5 ~ P.S. Concrete I-Beams	$38,200	$46,300	n/a	1	$84,500	$277,300	$117,100	n/a	$104,300	1	$498,700	$633,000	$1,712,000	$2,345,000
3	4	65	88	98	71	322	5 ~ Steel Rolled Beams	$38,200	$46,300	n/a	1	$84,500	$283,700	$119,800	n/a	$104,300	1	$507,800	$592,000	$1,469,000	$2,051,000

Structural Steel Painting:

Structural Steel Area:

Alternate	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.)
1	64	4	322.00	22.00	20,823	20%	25,000
3	32	4	322.00	16.00	12,021	20%	14,400

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:

54" AASHTO Type IV

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	8.49	2	16.98
Web		23		2	46.00
Upper Fillets	6	6	8.49	2	16.97
Top Flange		8		2	16.00
Total Exposed Perimeter					137.95 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	5	322.00	18,508	10%	2,260

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	39.00	0
Alt. 2	39.00	0
Alt. 3	39.00	0

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	12,600	$8.28	$104,300
Alt. 2	12,600	$8.28	$104,300
Alt. 3	12,600	$8.28	$104,300

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	12,600	1,400	35	32
Alt. 2	12,600	1,400	35	32
Alt. 3	12,600	1,400	35	32

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%	$68.26

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

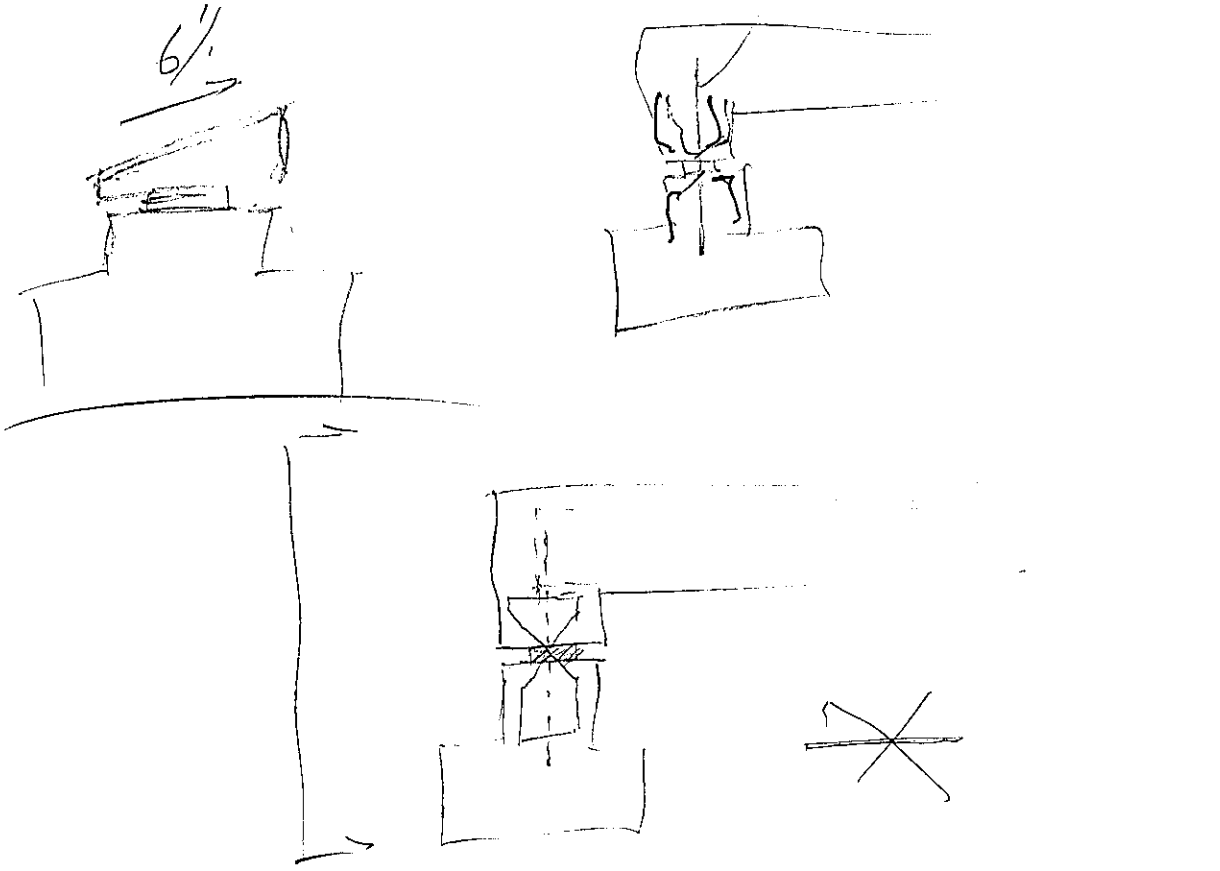
Asphalt Resurfacing Costs:

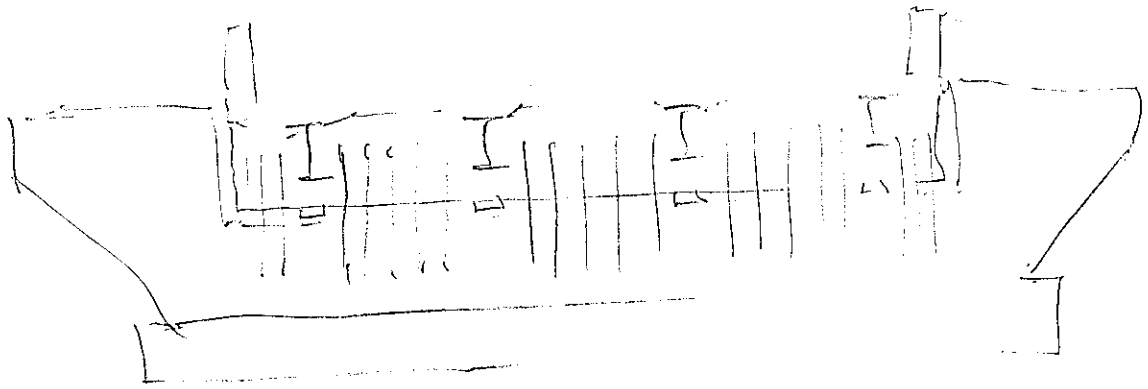
	Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
Alt. 1	0.0	39.0	0	1.50	0.0
Alt. 2	0.0	39.0	0	1.50	0.0
Alt. 3	0.0	39.0	0	1.50	0.0

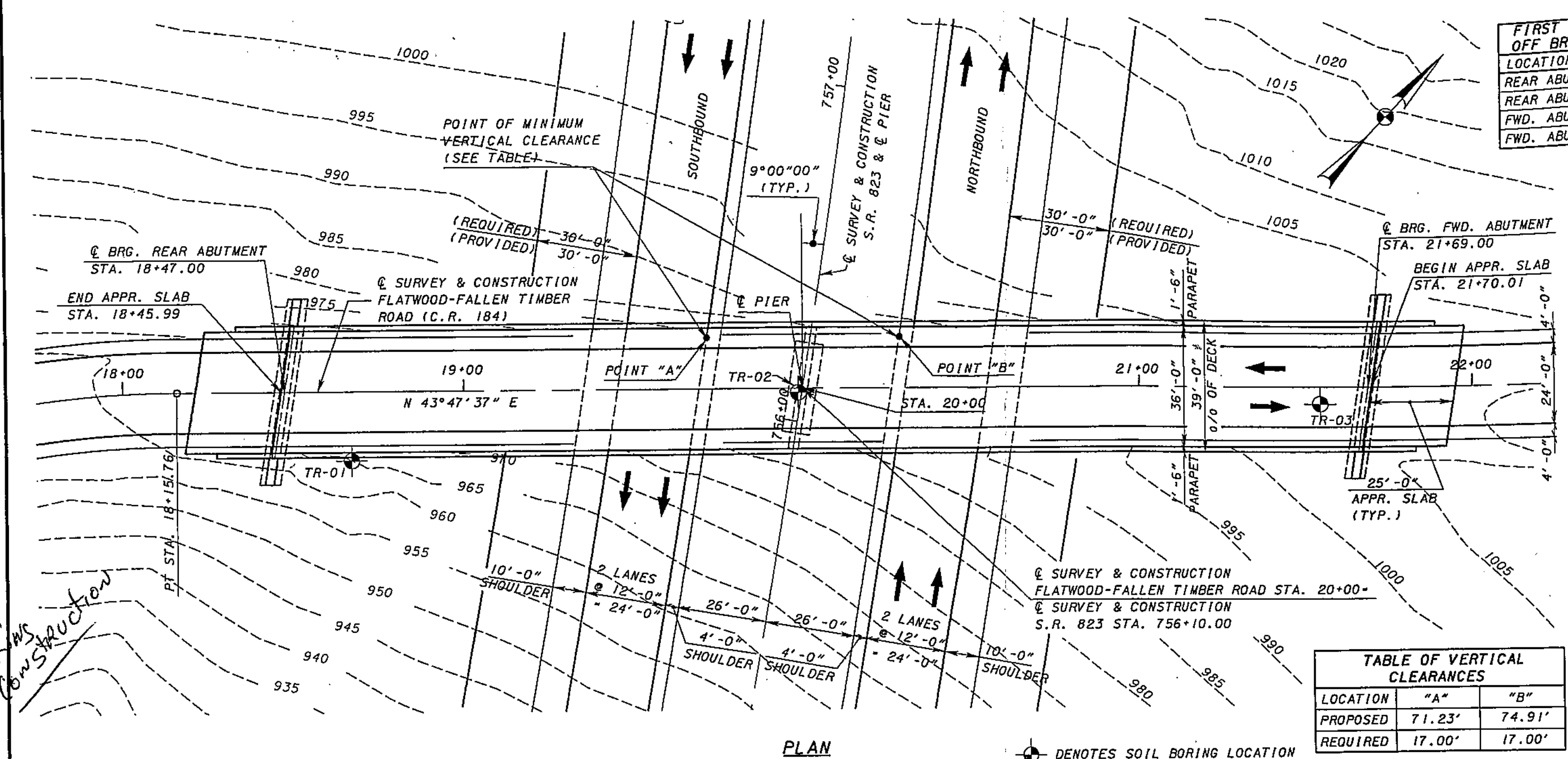
APPENDIX B

TRANSYSTEMS CORPORATION

Galvanized
#8 Bar @ 6"



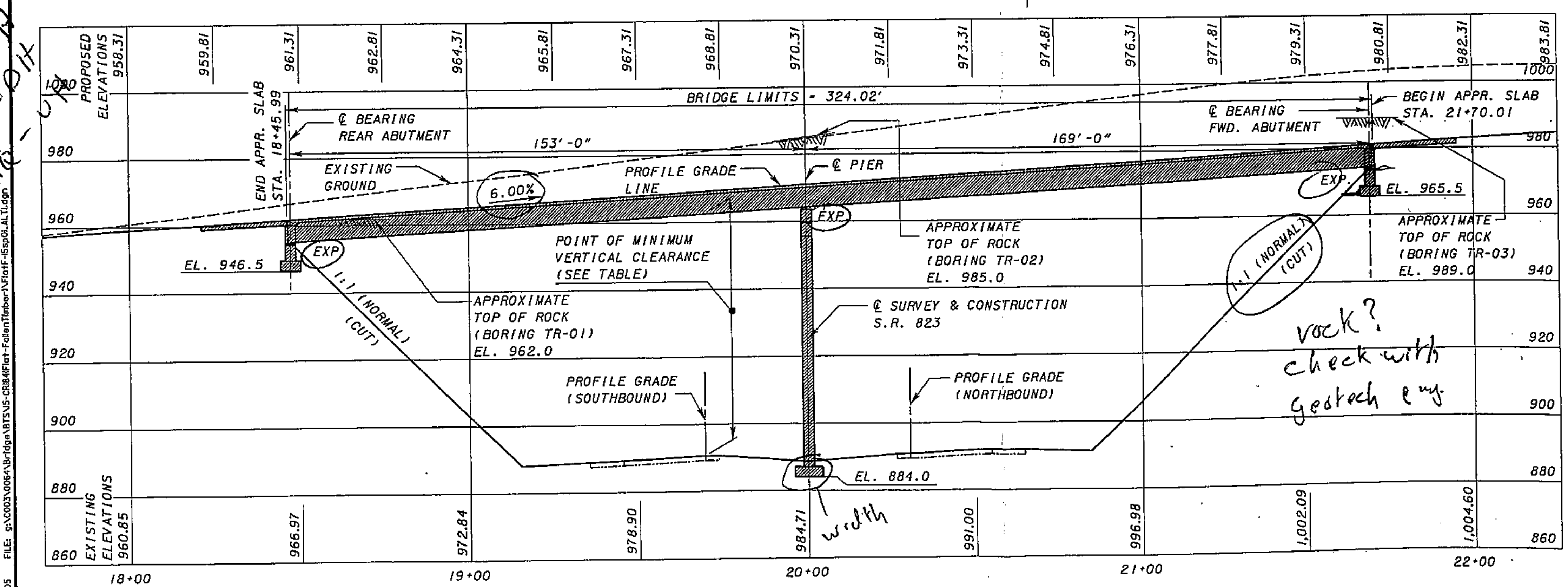




PLAN

⊕ DENOTES SOIL BORING LOCATION

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	71.23'	74.91'
REQUIRED	17.00'	17.00'



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD (C.R. 184)

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-01	18+66.93	20.51' RT.
TR-02	19+98.75	1.27' RT.
TR-03	21+54.60	5.12' RT.

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

TRAFFIC DATA

(FLATWOOD-FALLEN TIMBER ROAD)
TRAFFIC DATA TO BE PROVIDED AT TS&L SIBMITTAL

(S.R. 823)
CURRENT YEAR ADT (2010) = 19,800
DESIGN YEAR ADT (20XX) = 26,000
CURRENT YEAR ADTT (2010) = 2770
DESIGN YEAR ADTT (20XX) = 3640

PROPOSED STRUCTURE

TYPE: 2 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50 WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURES UNITS
SPANS: 153'-0", 169'-0" C/C BEARINGS
ROADWAY: 32'-0" TOE TO TOE OF PARAPETS
LOADING: HS25, (CASE II) AND ALTERNATE MILITARY LOADING, FWS = 60 PSF
SKEW: 9°00'00" LF
CROWN: NORMAL 0.016 FT/FT
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-81 (25'-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:

SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING OF 15 TSF CAPACITY.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

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

DESIGNED JDH | CHECKED RER | DRAWN GHD | REVISED | REVIEWED NFF | DATE 7/14/05 | STRUCTURE FILE NUMBER

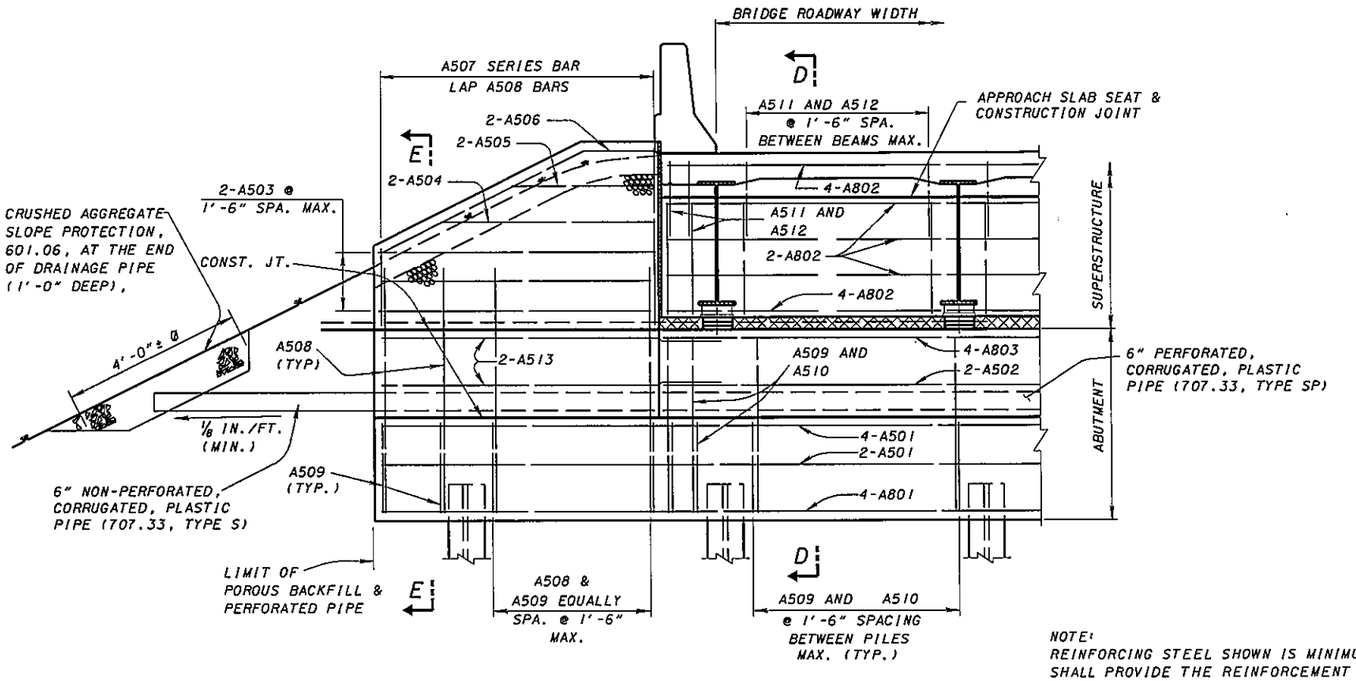
SCIOTO COUNTY STA. 18+45.99 STA. 21+70.01

PRELIMINARY SITE PLAN - ALTERNATIVE I
BRIDGE NO. SCI-823-XXXX
FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-0.00
PID 19415

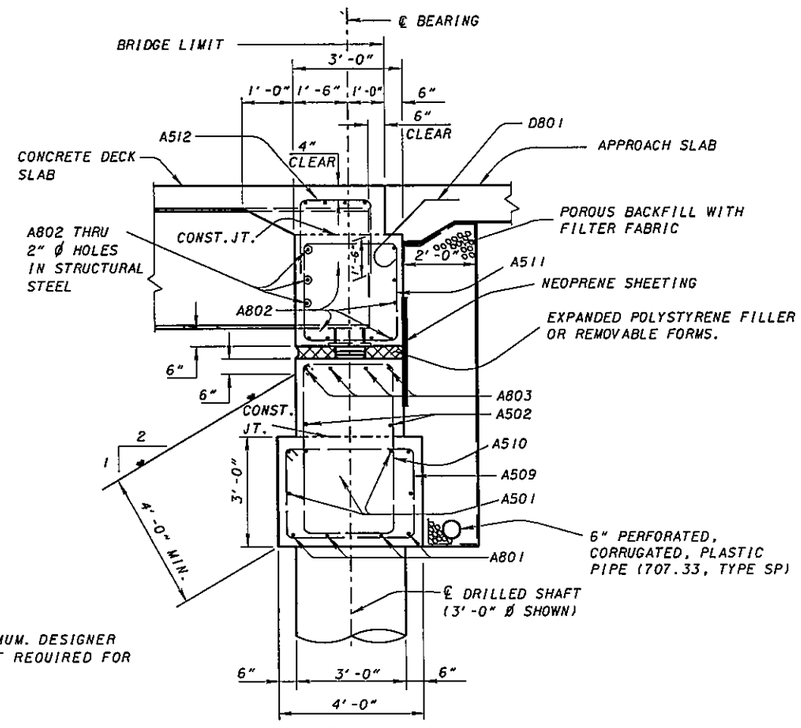
1/2

DATE: 7/14/2005



PART ELEVATION

NOTE:
REINFORCING STEEL SHOWN IS MINIMUM. DESIGNER SHALL PROVIDE THE REINFORCEMENT REQUIRED FOR THE INDIVIDUAL STRUCTURE.



SECTION D-D
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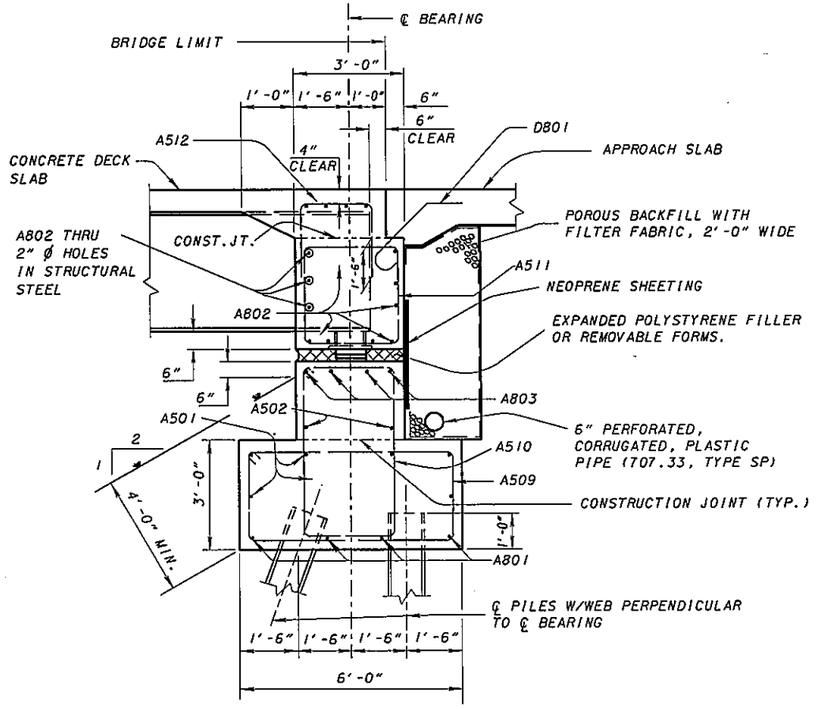

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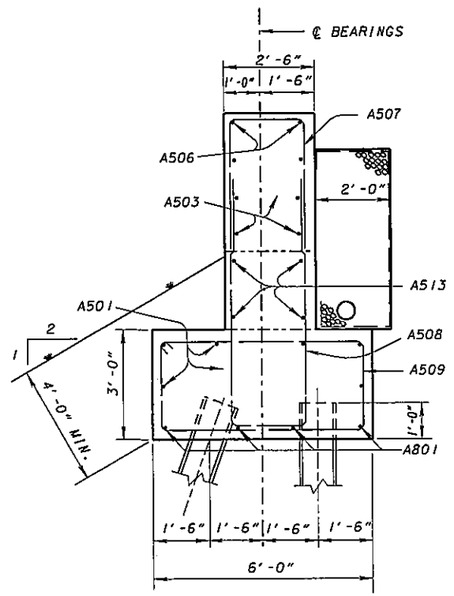

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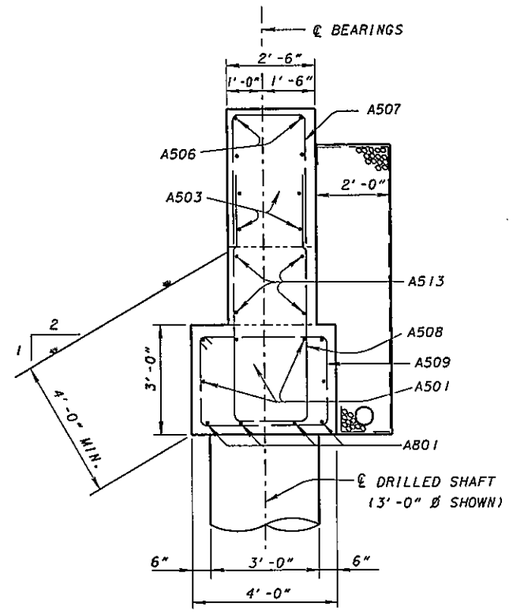


SECTION E-E
(ON DRILLED SHAFT)

DESIGN AGENCY
OFFICE
OF
STRUCTURAL ENGINEERING

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
Brad Fagrell — ADMINISTRATOR
2-12-97 — DATE

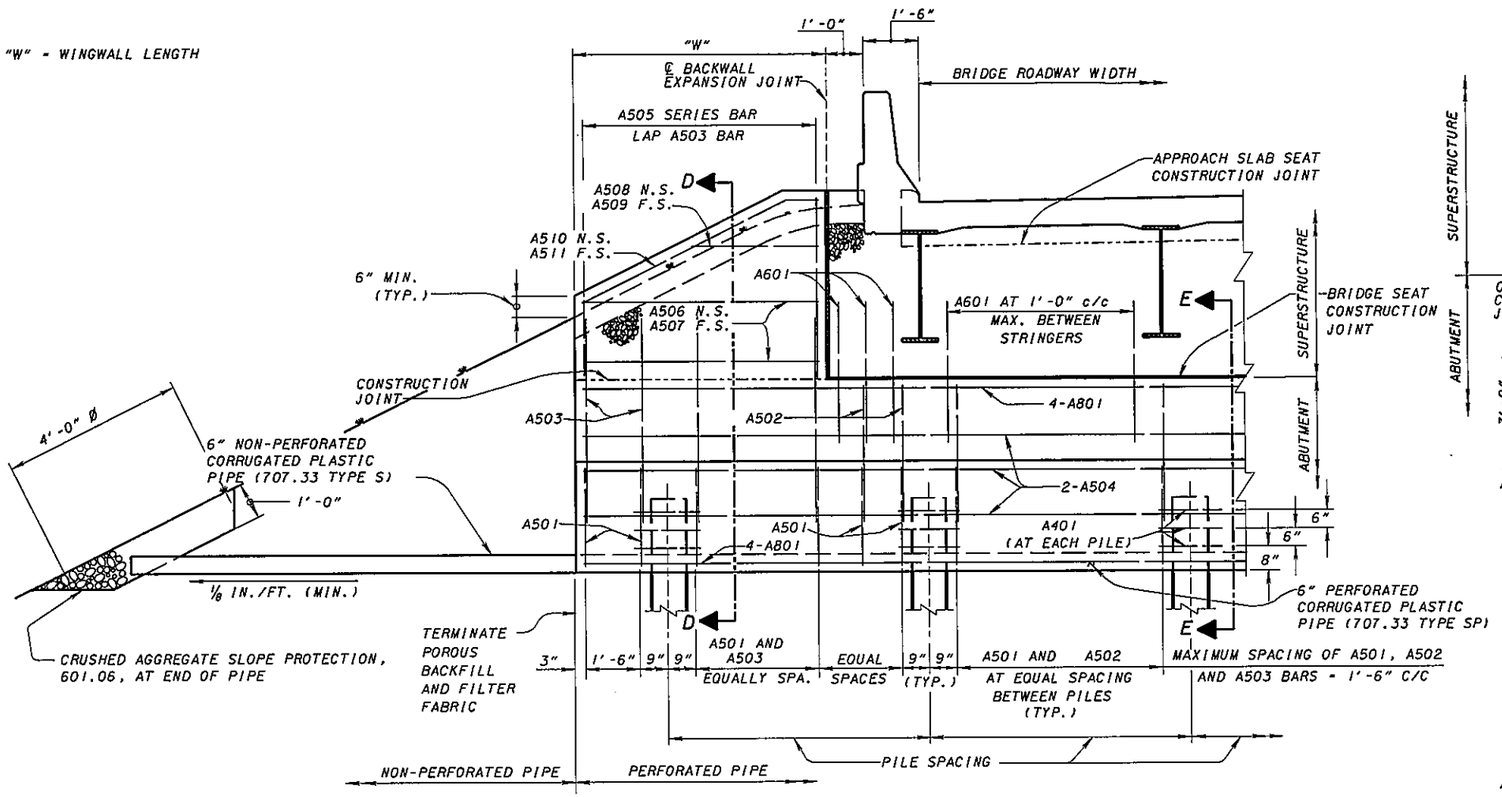
DESIGNED	DRAWN	CHECKED	REVIEWED
WLF	WLF	MRG/JS	LMW

SICD-1-96

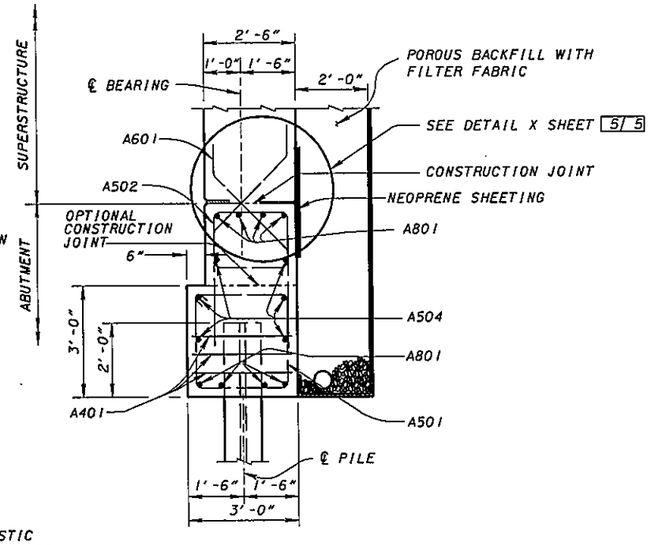
REVISIONS	
04-20-01	
07-19-02	

STANDARD
SEMI-INTEGRAL CONSTRUCTION DETAILS
FOR STEEL BEAM AND GIRDER BRIDGES
ON RIGID ABUTMENTS

3 / 7



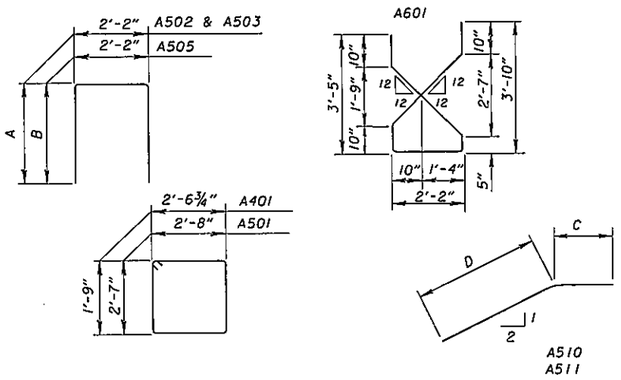
SECTION C-C



SECTION E-E

REINFORCING STEEL

MARK	LENGTH	SHAPE	BENDING DIAGRAMS
A801	①	ST.	
A601	10'-9"	BT.	
A501	11'-0"	BT.	
A502	A	BT.	
A503	A	BT.	
A504	①	ST.	
A505	B	BT.	
A506	②	ST.	
A507	②	ST.	
A508	②	ST.	
A509	②	ST.	
A510	②	BT.	
A511	②	BT.	
A401	9'-1"	BT.	

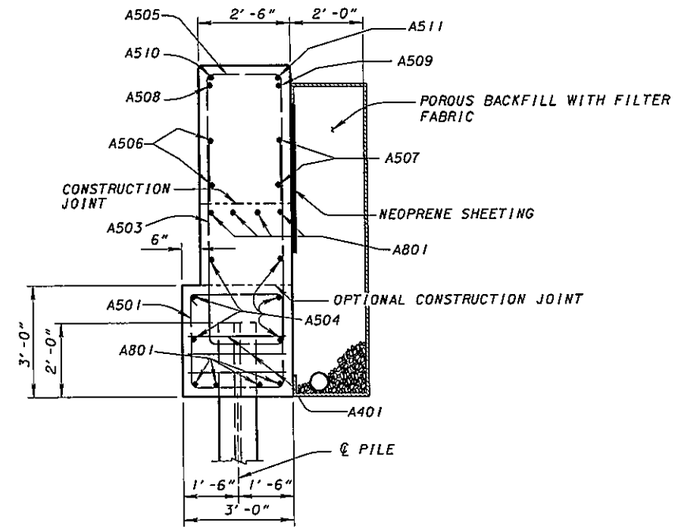


A,C,D-LENGTH MAY VARY WITH EACH INDIVIDUAL STRUCTURE.

B-LENGTH AND INCREMENT (SERIES BAR) MAY VARY WITH EACH INDIVIDUAL STRUCTURE.

① - ½ (LENGTH OF ABUTMENT-4") + ½ BAR LAP.

② - LENGTH IS DEPENDENT UPON DIMENSION "W" (LENGTH OF WINGWALL).



SECTION D-D

DESIGN AGENCY
OFFICE OF STRUCTURAL ENGINEERING

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
Richard P. Engel ADMINISTRATOR
3-20-95 DATE

REVISIONS	DESIGNED	CHECKED	REVIEWED
04-20-01	MPB/MLW	RLD/JS	WJJ/LMW
07-19-02	DRAWN AJH/MLW		ICD-1-82

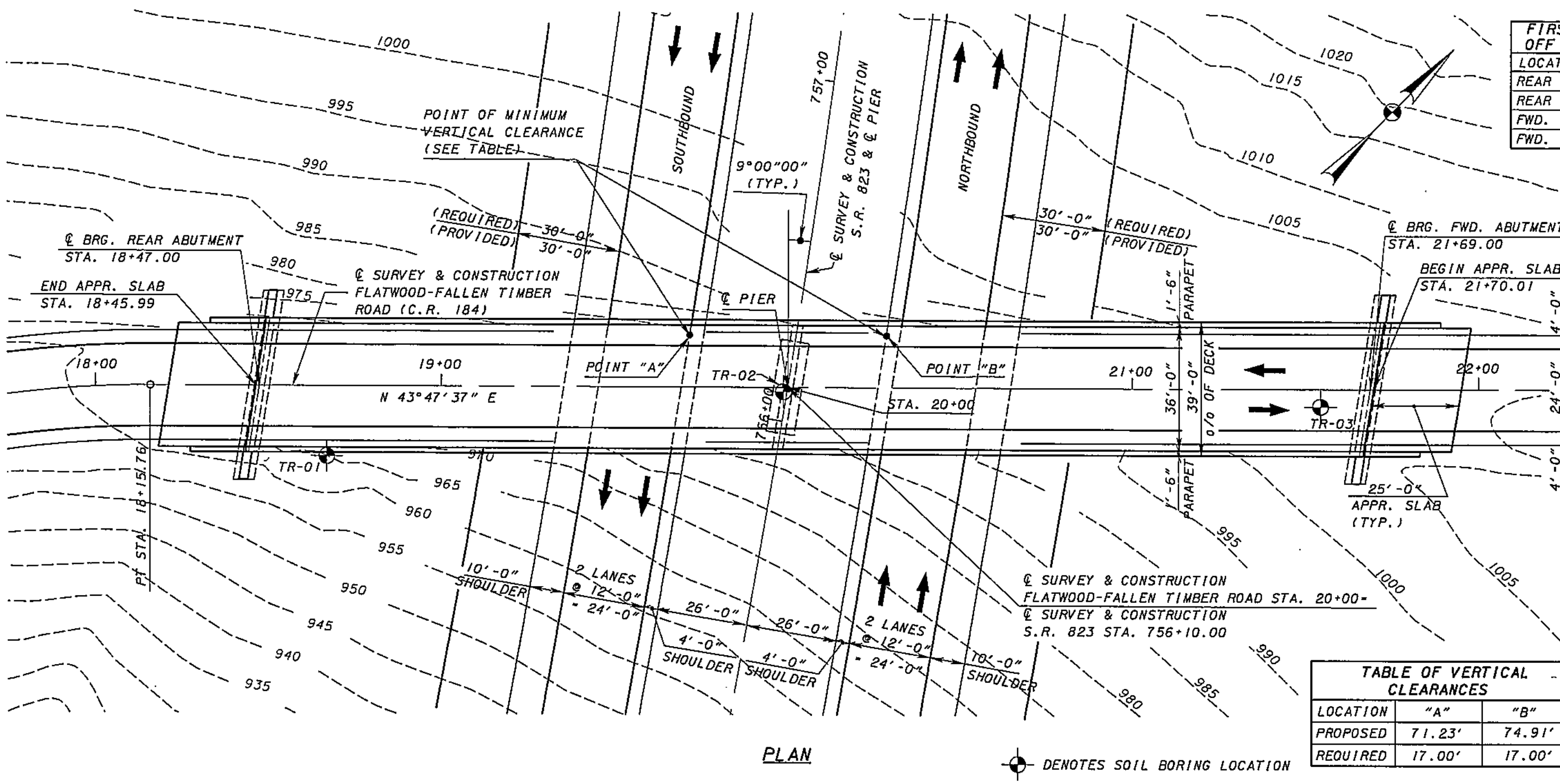
STANDARD
INTEGRAL CONSTRUCTION DETAILS
FOR STEEL BEAM AND GIRDER BRIDGES
ON FLEXIBLE ABUTMENTS

2/5

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-01	18+66.93	20.51' RT.
TR-02	19+98.75	1.27' RT.
TR-03	21+54.60	5.12' RT.

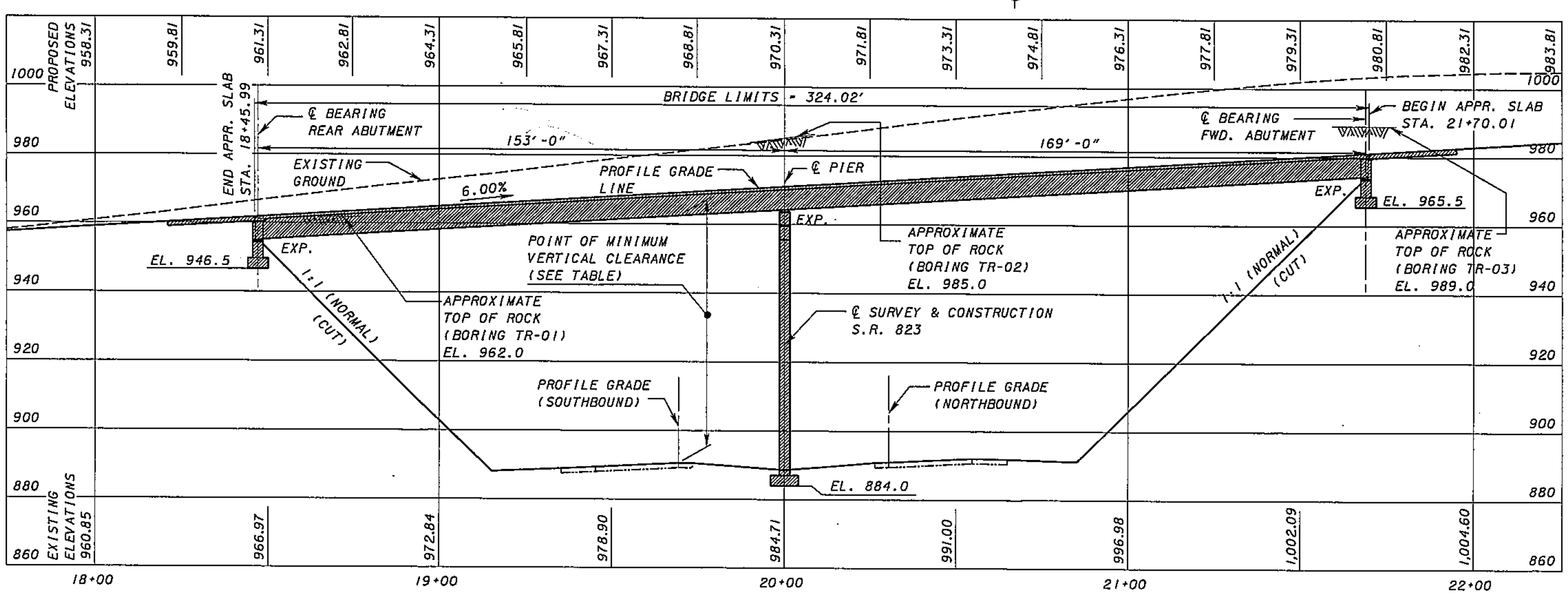
BENCHMARK 1	BENCHMARK 2
(TO BE PROVIDED LATER)	(TO BE PROVIDED LATER)



PLAN

DENOTES SOIL BORING LOCATION

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	71.23'	74.91'
REQUIRED	17.00'	17.00'



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD (C.R. 184)

TRAFFIC DATA

(FLATWOOD-FALLEN TIMBER ROAD)
TRAFFIC DATA TO BE PROVIDED AT TS&L SIBMITTAL

(S.R. 823)
CURRENT YEAR ADT (2010) = 19,800
DESIGN YEAR ADT (20XX) = 26,000
CURRENT YEAR ADTT (2010) = 2770
DESIGN YEAR ADTT (20XX) = 3640

PROPOSED STRUCTURE

TYPE: 2 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50 WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURES UNITS

SPANS: 153'-0", 169'-0" C/C BEARINGS

ROADWAY: 32'-0" TOE TO TOE OF PARAPETS

LOADING: HS25, (CASE II) AND ALTERNATE MILITARY LOADING, FWS = 60 PSF

SKEW: 9°00'00" LF

CROWN: NORMAL 0.016 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: 1" MONOLITHIC CONCRETE

APPROACH SLABS: AS-1-81 (25'-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:

SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING OF 15 TSF CAPACITY.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

Ask consultant to investigate fixing substructures

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

DATE 7/14/05 | REVIEWED NFF | DRAWN GHD | DESIGNED JDH | CHECKED RER | STRUCTURE FILE NUMBER | REVISED

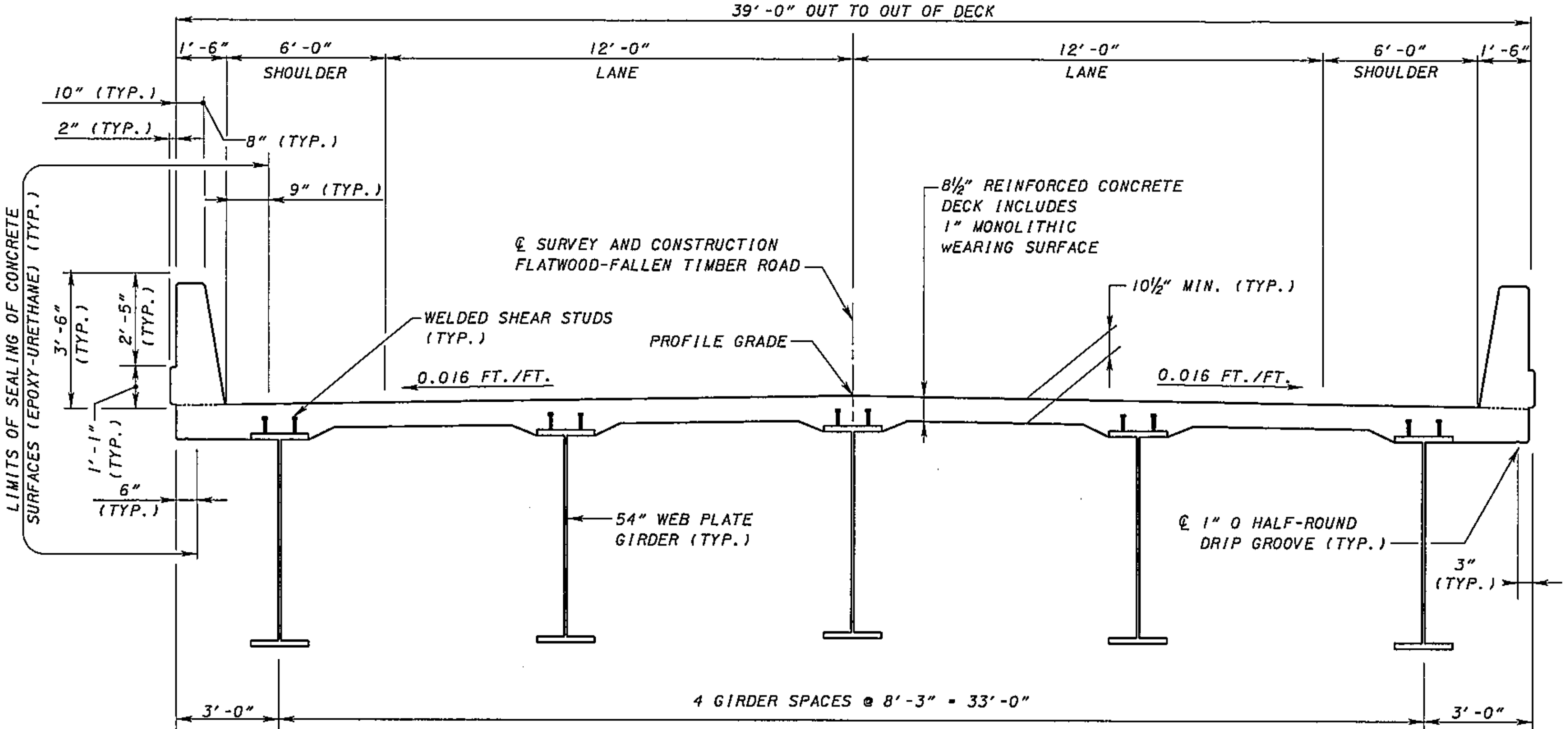
SCIOTO COUNTY STA. 18+45.99 STA. 21+70.01

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-0.00
PID 19415

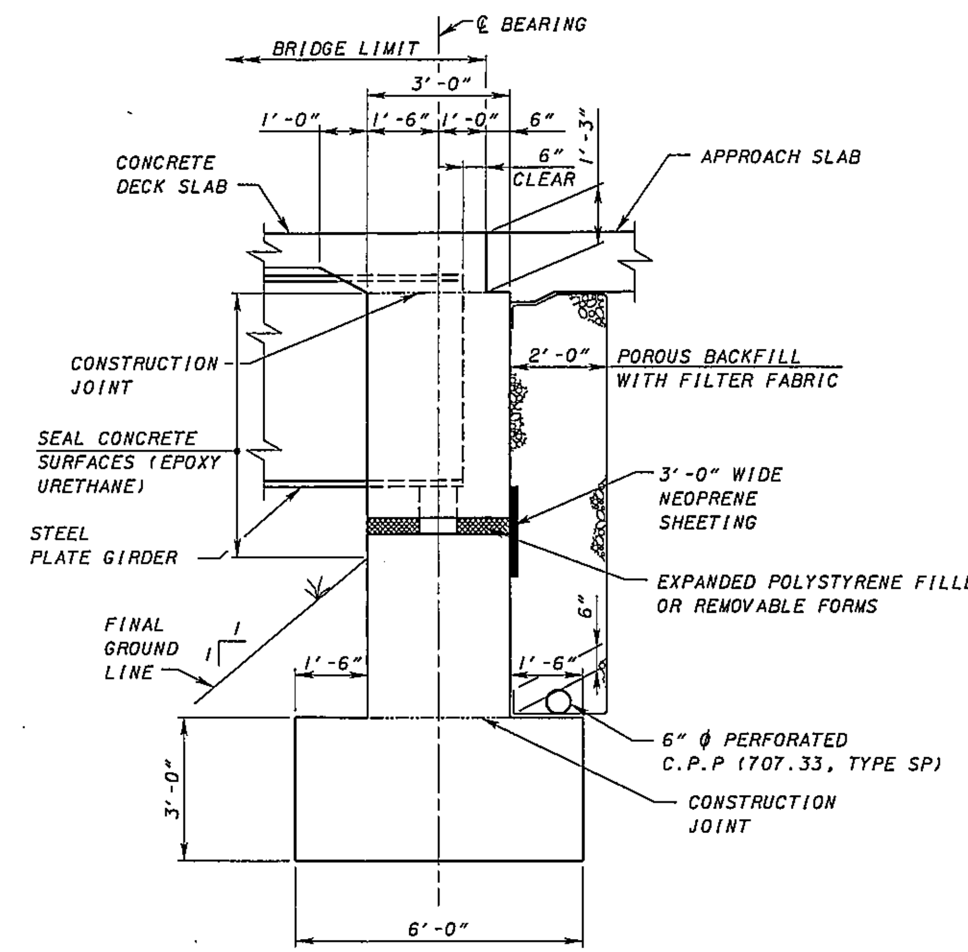
1 / 2

DATE: 7/14/2005 FILE: g:\C003\0064\Bridge\BTS\S-CR184(Flat-FallenTimber)\FlatF-15sp0L4LT.dgn



TRANSVERSE SECTION

SUPERSTRUCTURE DEPTH	
ITEM	STEEL GIRDER
SLAB (INCLUDING WEARING SURFACE)	8½"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
BEAM DEPTH	58"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM (INCHES)	68.5"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM (FEET)	5.71'



TYPICAL ABUTMENT SECTION

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

DESIGNED	DRAWN	REVIEWED	DATE
JDH	MAK	NFF	7/13/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
RER			

TRANSVERSE SECTION - ALTERNATIVE I
BRIDGE NO. SCI-823-XXX
FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-0.00
PID 19415

2 / 2

DATE: 7/11/2005 FILE: g:\C003\0064\Bridge\BTS\S-CR184(Flat-FallenTimber)\FlatF-ISTsol.dgn

APPENDIX C

TRANSYSTEMS CORPORATION

TRANSYSTEMS CORPORATION

Made By JDH Date 07/13/05 Job No. P403030064

Checked By _____ Date _____ Sheet No. _____

VERTICAL CLEARANCE CALCULATIONS

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

Description Flatwood Fallen Timber Rd over SR823 **PID #** 19415

Alternative1 - Five 58" deep Plate Girders at 8.25 feet spacing | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset		
PGL to Beam CL:	-0.016	x	16.5	=	-0.26
			Total Adjustment	=	**-0.26**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	58	4.83
	68.5	5.71

Total Superstructure Depth (ft) = **5.71**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**19+72.22**	
Offset Location @ Critical Point	=	**16.5 '**	**Left**
Profile Grade Elevation at Critical Point	=	968.64	
Adjustment for Cross Slopes to Beam CL	=	-0.26	
Top of Deck Elevation @ Critical Point	=	**968.38**	
Total Superstructure Depth	=	-5.71	
Bottom of Beam Elevation @ Critical Point	=	**962.67**	
Approximate Top of Existing Ground @ Critical Point	=	**891.44**	
Actual Vertical Clearance	=	***71.23***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*15.0*	

TRANSYSTEMS CORPORATION

Made By JDH Date 07/13/05 Job No. P403030064

Checked By Date Sheet No.

VERTICAL CLEARANCE CALCULATIONS

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

Description Flatwood Fallen Timber Rd over SR823 **PID #** 19415

Alternative1 - Five 58" deep Plate Girders at 8.25 feet spacing | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
PGL to Beam CL:	-0.016	x	16.5	=	-0.26
			Total Adjustment	=	**-0.26**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	58	4.83
	68.5	5.71

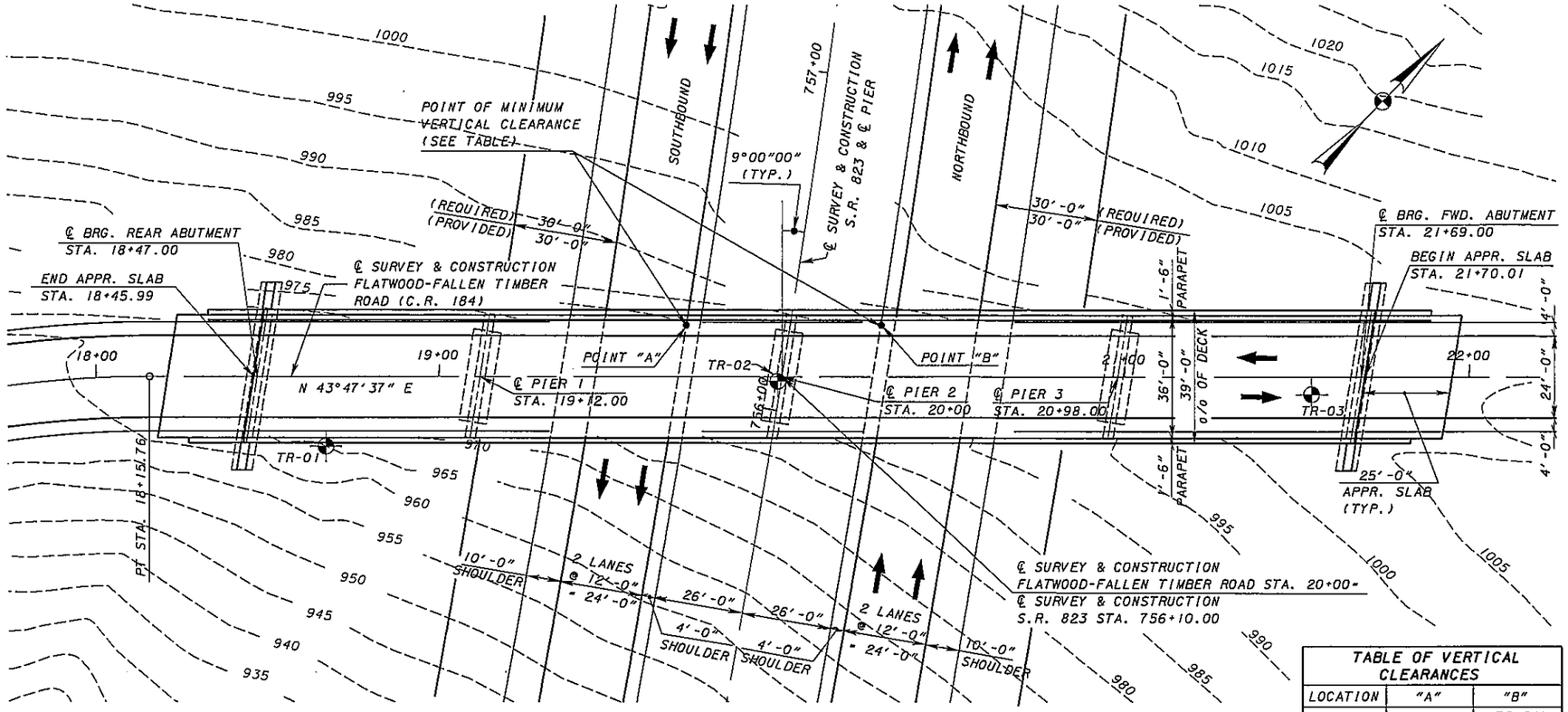
Total Superstructure Depth (ft) = **5.71**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**20+28.89**	
Offset Location @ Critical Point	=	**16.5 '**	**Left**
Profile Grade Elevation at Critical Point	=	972.04	
Adjustment for Cross Slopes to Beam CL	=	-0.26	
Top of Deck Elevation @ Critical Point	=	**971.78**	
Total Superstructure Depth	=	-5.71	
Bottom of Beam Elevation @ Critical Point	=	**966.07**	
Approximate Top of Existing Ground @ Critical Point	=	**891.16**	
Actual Vertical Clearance	=	***74.91***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*15.0*	

APPENDIX D

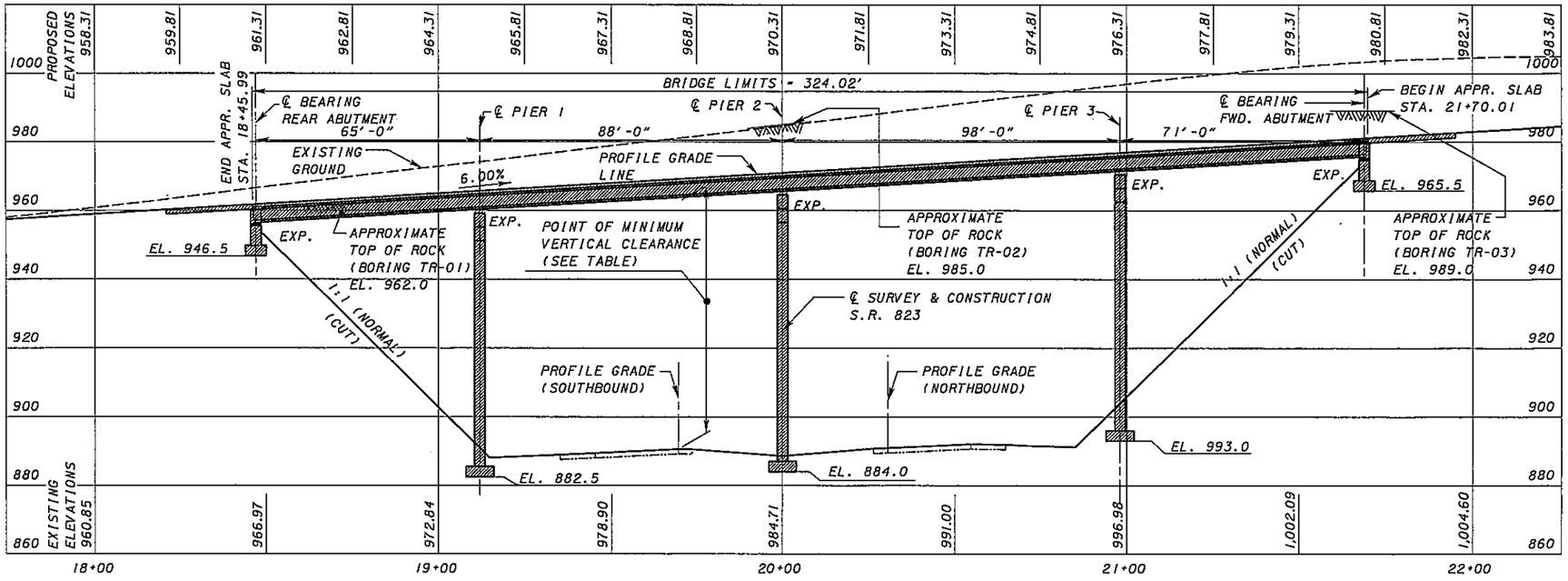
TRANSYSTEMS CORPORATION



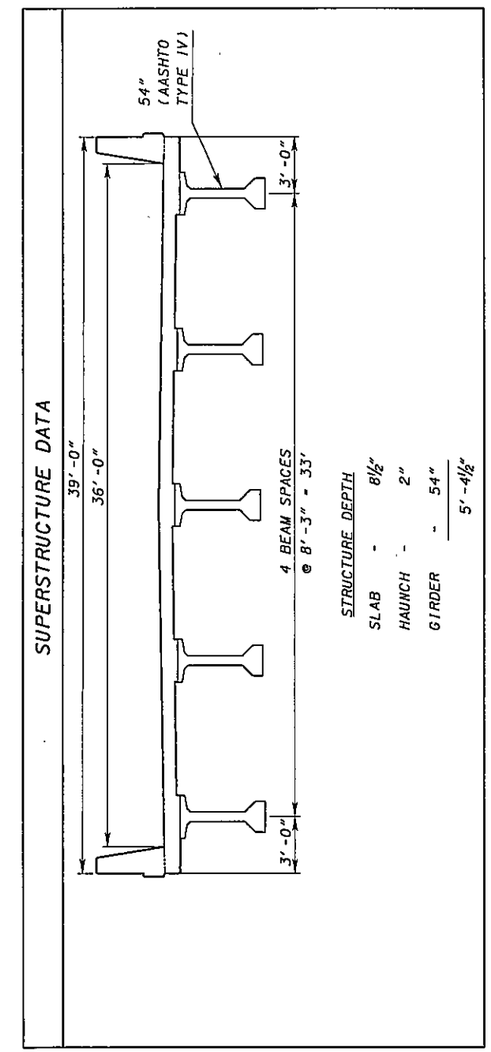
PLAN

℄ DENOTES SOIL BORING LOCATION

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	71.56'	78.24'
REQUIRED	17.00'	17.00'



ELEVATION ALONG ℄ SURVEY AND CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD (C.R. 184)



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:

SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING OF 15 TSF CAPACITY.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

DESIGN AGENCY
TRANSYSTEMS CORPORATION
55 PUBLIC SQUARE, SUITE 1300
CLEVELAND, OHIO 44113-1901

DESIGNED	DRAWN	REVIEWED	DATE
JDH	GHD	NFF	7/14/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
RER			

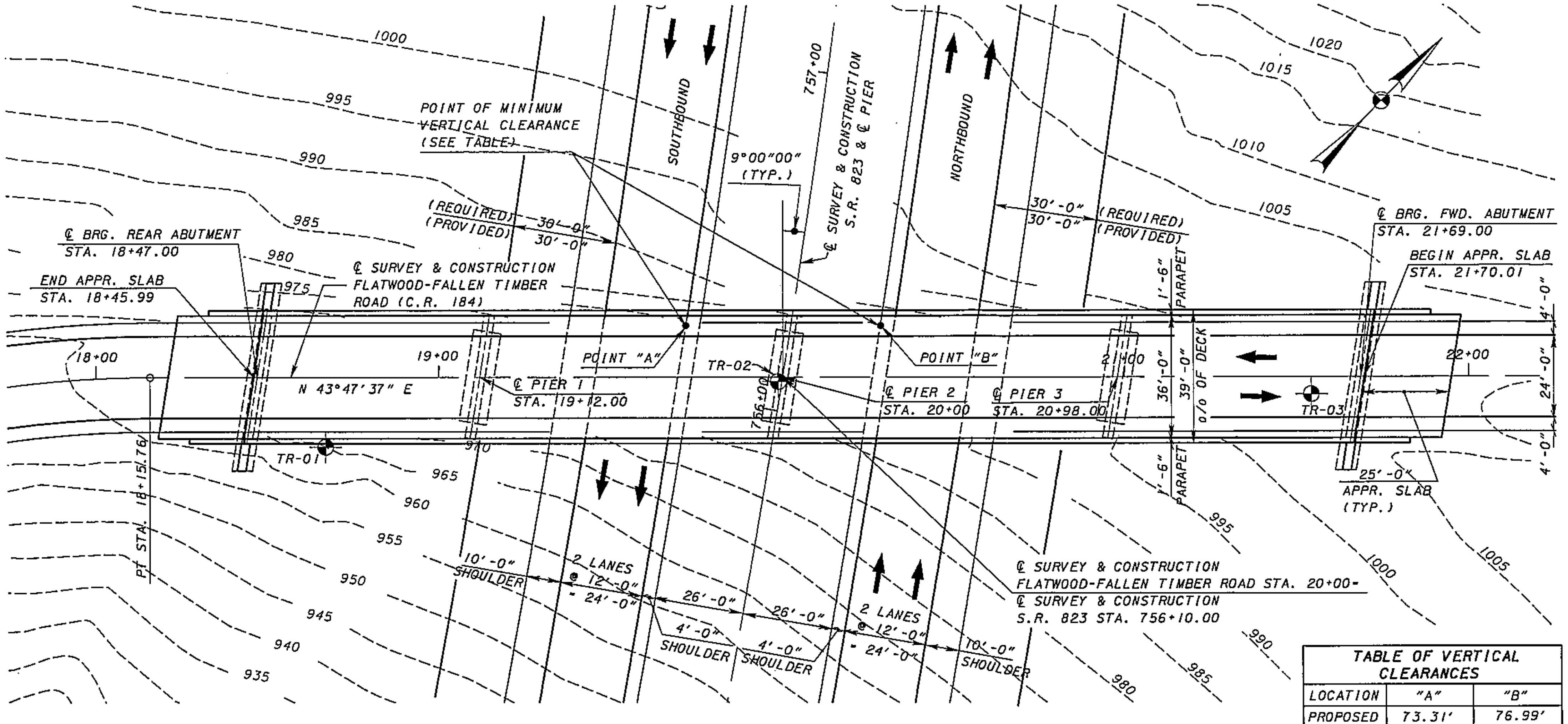
SCIOTO COUNTY
STA. 18+45.99
STA. 21+70.01

PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-0.00
PID 19415

1 / 1

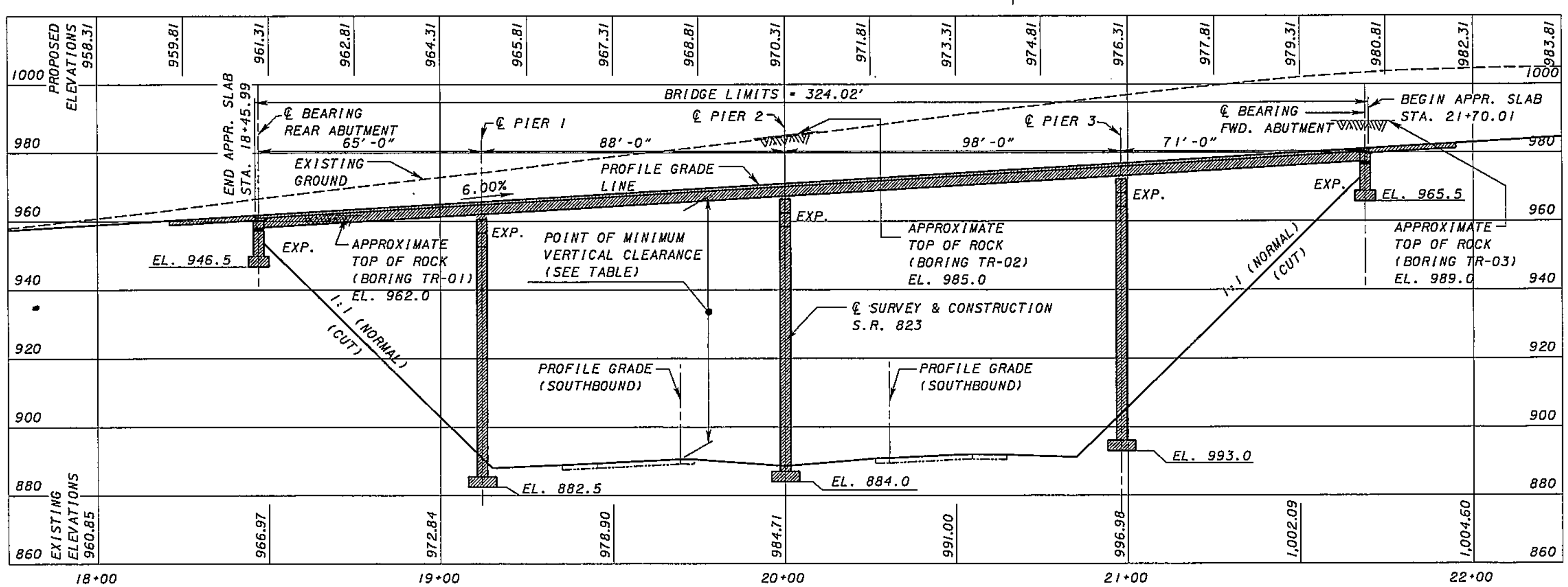
DATE: 7/14/2005 FILE: g:\C003\0056A\Bridge\BTSV5-CR184Flat-FallenTimber\VIo1F-i5spOLALT2.dgn



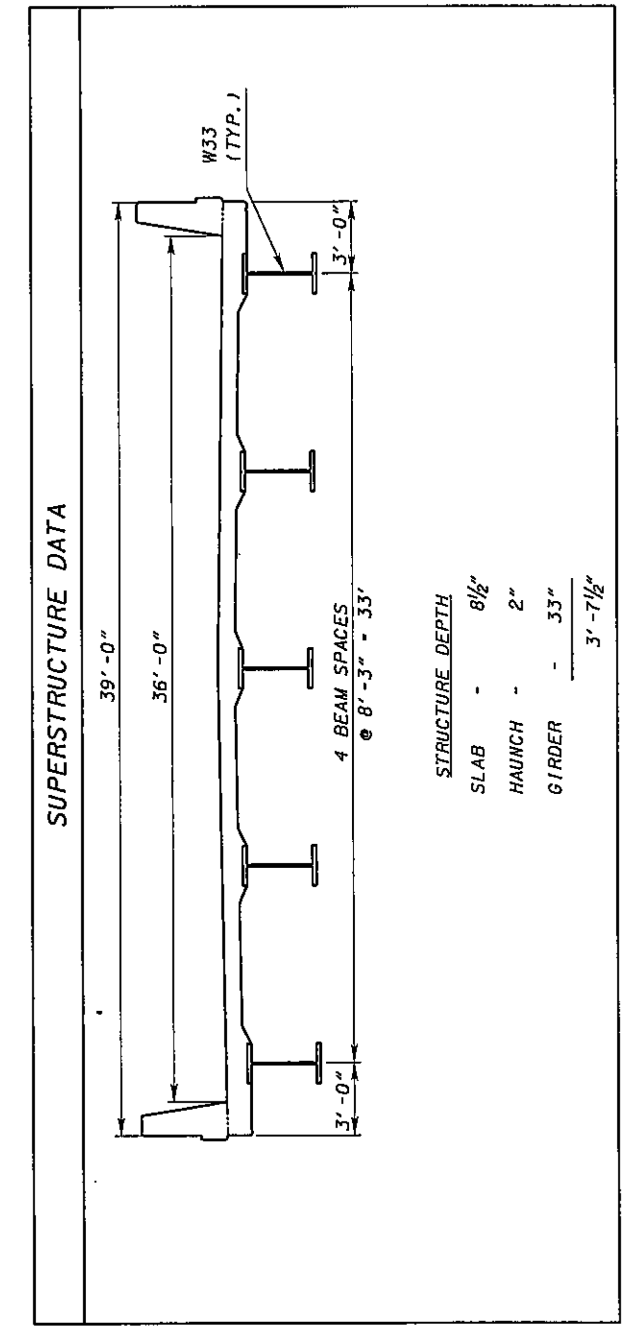
PLAN

⌖ DENOTES SOIL BORING LOCATION

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	73.31'	76.99'
REQUIRED	17.00'	17.00'



ELEVATION ALONG Ⓒ SURVEY AND CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD (C.R. 184)



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:

SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING OF 15 TSF CAPACITY.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

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

DESIGNED	DRAWN	REVIEWED	DATE
JDH	GHD	NFF	7/14/05
CHECKED	REVISED	STRUCTURE FILE NUMBER	
RER			

SCIOTO COUNTY
STA. 18+45.99
STA. 21+70.01

PRELIMINARY SITE PLAN - ALTERNATIVE 3
BRIDGE NO. SCI-823-XXXX
FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-0.00
PID 19415

DATE: 7/14/2005

APPENDIX E

TRANSYSTEMS CORPORATION

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 8, 2005

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

Re: **Flatwood-Fallen Timbers Rd. (CR 184) over SCI-823-0.00**
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 on Flatwood-Fallen Timbers Rd. (CR 184) over SCI-823-0.00. It is anticipated that the proposed structure will be a two-span elevated bridge. The existing grade at the proposed new bridge location is at approximate elevations 965 and 1005 feet at the south and north abutment, respectively. It is anticipated that the SCI-823-0.00 mainline will be located within a cut section at the proposed bridge extending approximately 94 feet below the existing grade at centerline. It is anticipated that the center pier will be approximately 94 feet in height, and the abutments will be located at the top of the cut section backslopes. Currently Flatwood-Fallen Timbers Rd. (CR 184) is located along an eastern hillside of a ridgeline leading to Rose Hill. Bedrock exposures are evident along the west side of the roadway above the ditch line.

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-1 through TR-3, were drilled at the proposed structure on February 4, 2005. The borings were drilled to depths between 16.5 and 22.5 feet. The borings were extended into bedrock, which was verified by rock coring. Additionally, a preliminary boring, PB-45, was drilled approximately 450 feet northeast of the anticipated north abutment. This boring was drilled between June 4 and 5, 2003 to a depth of 116 feet (elevation 869.0). 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 two inches of asphalt concrete were encountered. Beneath the asphalt concrete, gravel (A-1-a) was encountered between 1.0 and 3.0 feet. Beneath the gravel, a thin layer of residual soils consisting of sandy silt (A-4a) and silt and clay (A-6a) was encountered in Borings TR-1 and TR-3, respectively. These soils were encountered to depths of 6.0 and 11.0 feet, respectively. Immediately beneath the gravel layer in Boring TR-2 and below the residual soils in the remaining borings, bedrock was encountered. Bedrock encountered at the proposed structure location was composed primarily of medium hard sandstone with a soft to medium hard siltstone layer from elevation 925.8 to 905.1 (PB-45).

Seepage was not detected in any of the borings. Water levels were not detected prior to coring. At completion of drilling, water levels ranged from 3.0 to 10.0 feet. However, the final water levels include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally.

Conclusions and Recommendations

It appears that spread footings on rock will be the best-suited foundation type for support of the proposed structure. Competent bedrock was encountered at shallow depths at the abutment locations and the pier will be located in a rock cut section. The footings should be embedded into the bedrock. If an alternative foundation type is required due to lateral or uplift loads, a pile-type foundation can be used. H-piles can be used if pre-bored sockets into bedrock are utilized. Additionally, drilled shafts socketed into rock can also be used. The depth of the spread footing embedment or the sockets will need to be designed based upon actual loading conditions. The following table summarizes the site conditions and foundations recommendations.

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Top of Rock Elevation* (Feet)	Allowable Bearing Capacity
TR-1	South Abutment	968	962	15 TSF
TR-2	Pier	990	985	15 TSF
TR-3	North Abutment	1001	989	15 TSF

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

Additionally, since SCI-823-0.00 mainline will be located within a cut section at the proposed structure location, the cut slopes should be evaluated to ensure that adequate stability of the backslope is achieved. If the backslope should experience instability, then the abutments may also experience instability.

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

Closing

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

Sincerely,

DLZ OHIO, INC.

P. Paul Painter

P. Paul Painter
Engineering Geologist

Dorothy A. Adams

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-1, TR-2, TR-3, PB-45

cc: File

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GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

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

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

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

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

LEGEND - BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

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

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

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

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

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

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

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

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

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

9. **Soil Description**

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

Granular Soils - Compactness

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

Cohesive Soils - Consistency

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

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

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

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

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

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

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

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

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

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

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

10. **Rock hardness and rock quality description.**

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

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

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

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

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

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

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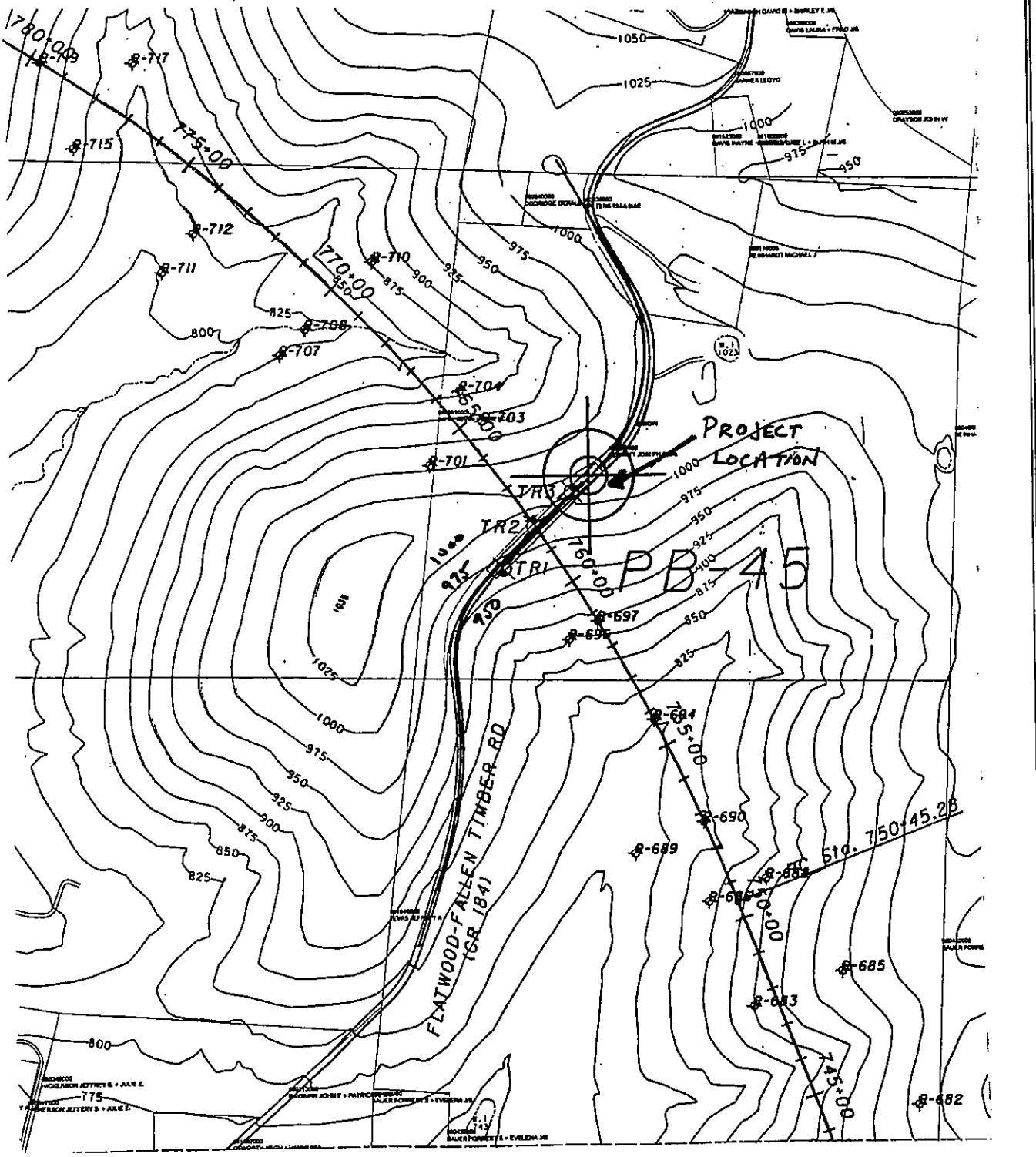

Source: Topographic Mapping provided by TranSystems Corporation, Dated 2004

NORTH

DLZ

ENGINEERS * ARCHITECTS * SCIENTISTS

SITE PLAN

Flatwood-Fallen Timbers Rd
CR 184 over SCI-823
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-1 | Location: SCI-823 | Date Drilled: 02/04/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
10.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetro-meter (tsf)	DESCRIPTION
0	968.0						
0.2	967.8						Asphalt Concrete Pavement - 2"
		6 5 5	13	1			POSSIBLE FILL: Medium dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; (primarily angular sandstone fragments; damp.
3.0	965.0						Stiff reddish brown SANDY SILT (A-4a), little gravel; damp.
		4 4 5	9	2		2.0	
5							
6.0	962.0	17 50/4	9	3			Medium hard brown SANDSTONE; very fine to fine grained, highly weathered, thinly bedded to medium bedded.
							@ 7.5',7.6',7.8',7.9', low angle fracture.
							@ 8.1'-8.3', high angle fracture.
							@ 8.6',8.7', low angle fracture.
10							@ 9.0', high angle fracture.
							@ 9.9', low angle fracture.
							@ 10.7'-10.9', wide high angle fracture with clay infilling.
		Core 108"	Rec 104"	RQD 61%	R-1		@ 11.2', low angle fracture.
15							@ 13.0'-13.2', broken.
							@ 13.8'-14.0', gray.
							@ 14.8', becomes hard and gray.
							@ 16.0'-16.3', brown.
		Core 36"	Rec 36"	RQD 100%	R-2		@ 17.0'-17.5', brown.
19.5	948.5						Bottom of Boring - 19.5'
20							
25							
30							

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

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

FILE: 0121-3070-03 [3/2/2005 2:20 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-2 | Location: SCI-823 | Date Drilled: 02-04-05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
3.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press /Core	Hand Penetrometer (tsf)	DESCRIPTION
0	990.0						
0.2	989.8						Asphalt Concrete Pavement - 2"
1.0	989.0	11 22 18	14	1			POSSIBLE FILL: Medium dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; (primarily angular sandstone fragments; damp.
		50/3	2	2			Soft brown SANDSTONE; very fine to fine grained, highly weathered to decomposed.
5.0	985.0	Core 78"	Rec 76"	RQD 44%	R-1		Medium hard brown SANDSTONE; very fine to fine grained, moderately to highly weathered, slightly fossilferous, thinly bedded to medium bedded. @ 5.8', low angle fracture. @ 6.4'-6.6', clay seam. @ 6.7', very thin clay seam. @ 7.1',7.3', low angle fracture. @ 8.3', low angle fracture. @ 8.5',8.7', contains multiple thin clay seams.
9.8	980.2						
12.0	978.0	Core 60"	Rec 57"	RQD 43%	R-2		Medium hard brown SANDSTONE; very fine grained, highly weathered, pitted, thinly bedded to medium bedded. @ 10.2', low angle fracture. @ 10.3'-10.7', high angle fracture. @ 10.8',11.3', low angle fracture.
15							
16.5	973.5						Medium hard brown SANDSTONE; very fine to fine grained, moderately to highly weathered. @ 12.4', low angle fracture. @ 12.6', thin clay seam. @ 13.3',13.7', high angle fracture with heavy rust deposits. @ 15.5',15.7', thin clay seam.
20							Bottom of Boring - 16.5'
25							
30							

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

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

FILE: 0121-3070-03 (3/2/2005 1:06 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-3 | Location: SCI-823 | Date Drilled: 02/04/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: None (prior to coring)
5.0' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N)
0.2	1001.0 / 1000.8						Asphalt Concrete Pavement - 2"							Natural Moisture Content, % - ● PL ⊢—⊣ LL; Blows per foot - ○ (10, 20, 30, 40)
1.0	1000.0	3 11 14	13	1		4.5+	POSSIBLE FILL: Medium dense brown GRAVEL (A-1-a), little fine to coarse sand, trace silt; (primarily angular sandstone fragments; damp.							
5		12 24 24	16	2		4.5+	Hard brown and gray SILT AND CLAY (A-6a), trace gravel; (residual soil); damp.							
		20 36 35	17	3		4.5+	@ 6.0', resembles decomposed bedrock.							71
10		24 27 39	18	4		4.5+								66
11.0	990.0	50/5	5	5			Soft to medium hard brown and dark brown SILTSTONE; highly weathered, thinly bedded.							
15							@ 12.2',12.5', low angle fracture.							
							@ 13.6',13.9', low angle fracture.							
							@ 14.2', low angle fracture.							
		Core 96"	Rec 96"	RQD 71%	R-1		@ 14.9',15.5', low angle fracture.							
16.2	984.8						@ 15.5',15.9', low angle fracture.							
18.1	982.9						Soft to medium hard dark gray SILTSTONE; highly weathered, slightly micaceous, thinly bedded.							
							@ 17.0'-17.5', brown.							
20							@ 17.8'-18.1', brown.							
		Core 30"	Rec 29"	RQD 70%	R-2		Medium hard reddish brown SANDSTONE; very fine to fine grained, highly weathered, slightly micaceous, medium bedded.							
							@ 18.6', very thin clay seam.							
22.5	978.5						@ 20.0'-20.4', highly weathered to decomposed.							
25							Bottom of Boring - 22.5'							
30														

GRADATION

FILE: 0121-3070-03 [3/2/2005 1:06 PM]

DLZ Ohio, Inc.

Project: SCI-823-0.00 Portsmouth Bypass Prel. Borings

Driller: D. Chapman | Location:

Geologist: J. Babione | Client: Ohio Department of Transportation - District 9

Drill Equip: Mobile B-57 | Sampler: 2" split spoon | Hammer Wt: 140 lb.

Size & Type Core Barrel: NQ2 Wireline | Hammer Drop: 30"

LOG of BORING: PB-45

Page 1 of 5

Job No. 0121-3070.02

Date Started: 06/04/03

Date Finished: 06/05/03

WATER LEVELS

Date	Depth to Water	Bot. of Casing	Bot. of Hole
06/04/03	Dry *	19'	19'
06/05/03	7.4' **	19'	116'

WATER: * Prior to coring ** Including core water

Depth (ft)	Elev. (ft)	DESCRIPTION	SOIL: Blows per 6"	Recovery (in.)	Sample No.	Hand Penetrometer (tsf)	GRADATION: % Agg.	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	LAB RESULTS AND REMARKS
0	985.0	*											
0.3	984.8	Topsoil - 3"											
		Very stiff to hard brown SILT and CLAY (A-6a), little fine to coarse sand, trace gravel; damp.	3 8 10	10	1	2.0							
		@ 3.0', brown and light gray.	8 13 21	14	2	4.5							
8.0	977.0		6 19 23	17	3	2.5							
		Soft brown SANDSTONE, decomposed.	11 45 50	16	4	4.5+							
			40 50/3	7	5	4.5+							
13.0	972.0												
		Soft gray SHALE, slightly arenaceous, decomposed.	41 50/1	6	6	4.5+							
			50/5	4	7	4.5+							
18.0	967.0												
		Soft to medium hard brown and gray SANDSTONE, argillaceous, thin bedded, moderately to severely weathered.	50/2	1	8	4.5+							
		@ 19.2', 19.3', 20.5', 20.9', 22.7', 22.9'; near horizontal fractures with clay coating or infilling.	60" 86%	57" 95%	1	1:40	TK to TH	MW to SW	MH to S	J	2 2 0 3	350	
23.1	961.9	@ 22.3'; 45° rough stepped wide fracture.											
		Medium hard to hard brown SANDSTONE, very fine to fine grained, moderately weathered, contains argillaceous clasts.	60" 96%	58" 96%	2	0:48	TK to TH	MW	H to MH	--- J	--- 1	350	
25	960.0												

ROCK: Core Length (in.) & RQD (%) | Recovery (in./%) | Run No. | Drill rate (min/ft) | Bedding | Weathering | Hardness | Discontinuities | Fractures/ft | Drill Press. (psi) | Water Loss, WL (%) | Inst. Installation

* Ground surface elevation estimated from topographic mapping provided.

NO INSTRUMENTATION - HOLE GROUTED AT COMPLETION

DLZ Ohio, Inc.

Driller: D. Chapman | Geologist: J. Babione | Drill Equip: Mobile B-57 | Size & Type Core Barrel: NQ2 Wireline

Project: SCI-823-0.00 Portsmouth Bypass Prel. Borings
Location:
Client: Ohio Department of Transportation - District 9
Sampler: 2" split spoon | Hammer Wt: 140 lb.
Hammer Drop: 30"

LOG of BORING: PB-45
Page 2 of 5
Job No. 0121-3070.02
Date Started: 06/04/03
Date Finished: 06/05/03

WATER LEVELS

Date	Depth to Water	Bot. of Casing	Bot. of Hole
06/04/03	Dry *	19'	19'
06/05/03	7.4' **	19'	116'

WATER: * Prior to coring ** Including core water

Depth (ft)	Elev. (ft)	DESCRIPTION	SOIL / ROCK	Blows per 6" / Core Length (in.) & RQD (%)	Recovery (in.) / Recovery (in./%)	Sample No. / Run No.	Hand Penetrometer (tsf) / Drill rate (min/ft)	GRADATION: % Agg. / % C. Sand / % M. Sand / % F. Sand / % Silt / % Clay	Bedding / Weathering / Hardness / Discontinuities / Fractures/ft / Drill Press. (psi)	LAB RESULTS AND REMARKS: Liquid Limit, LL / Plasticity Index, PI / Water Content, W (%) / Water Loss, WL (%)	Inst. Installation
25	960.0										
		Medium hard to hard brown SANDSTONE, very fine to fine grained, moderately weathered, contains argillaceous clasts. @ 24.0'; rough clean fracture.		60" 96%	58" 96%	2	0:48	0	TK to TH / MW / H to MH / — / 0 / 350		
30		@30.3'; rough clay coated fracture.		60" 100%	60" 100%	3	2:00	0	TK to TH / MW / H to MH / — / 0 / 350 J / 1 — / 0		
35				60" 100%	60" 100%	4	2:12	0	TK to TH / MW / H to MH / — / 0 / 350 TK to TH / MW / H to MH / J / 1 — / 0		
36.0	949.0										
		Medium hard to hard gray SANDSTONE, very fine to fine grained, moderately weathered, contains dark gray laminae. @ 36.6'; near horizontal rough fracture.									
40				60" 95%	57" 95%	5	2:00	0	TK to TH / MW / H to MH / — / 0 / 350		
45				60" 96%	58" 96%	6	2:00	0	TK to TH / MW / H to MH / — / 0 / 350		
50	935.0	@ 49.1'; occasional argillaceous laminae of siltstone and/or shale.		60" 92%	55" 92%	7	2:12	0	TK to TH / MW / H to MH / — / 0 / 350		

DLZ Ohio, Inc.	Project:	SCI-823-0.00 Portsmouth Bypass Prel. Borings	LOG of BORING: PB-45
Driller: D. Chapman	Location:		Page 3 of 5
Geologist: J. Babione	Client:	Ohio Department of Transportation - District 9	Job No. 0121-3070.02
Drill Equip: Mobile B-57	Sampler:	2" split spoon Hammer Wt: 140 lb.	Date Started: 06/04/03
Size & Type Core Barrel: NQ2 Wireline		Hammer Drop: 30"	Date Finished: 06/05/03

WATER LEVELS

Date	Depth to Water	Bot. of Casing	Bot. of Hole
06/04/03	Dry *	19'	19'
06/05/03	7.4' **	19'	116'

WATER: * Prior to coring ** Including core water

Depth (ft)	Elev. (ft)	DESCRIPTION	SOIL / ROCK	Blows per 6" / Core Length (in.) & RQD (%)	Recovery (in.) / Recovery (in./%)	Sample No. / Run No.	Hand Penetrometer (tsf) / Drill rate (min/ft)	GRADATION: % Agg. / Bedding	% C. Sand / Weathering	% M. Sand / Hardness	% F. Sand / Discontinuities	% Silt / Fractures/ft	% Clay / Drill Press. (psi)	LAB RESULTS AND REMARKS: Liquid Limit, LL; Plasticity Index, PI; Water Content, W (%); Water Loss, WL (%)	Inst. Installation
50	935.0	Medium hard to hard gray SANDSTONE, very fine to fine grained, moderately weathered, contains dark gray laminae.		60" 92%	55" 92%	7	2:12	TK to TH	MW	H to MH	---	0	350		
55				60" 100%	60" 100%	8	1:36	TK to TH	MW	H to MH	---	0	350		
59.2	925.8							TK to TH	MW	H to MW					
60		Medium hard gray SILTSTONE, micaceous, slightly arenaceous, contains occasional thin sandstone layer.		60" 100%	60" 100%	9	2:00	TH to L	U to S	MH	---	0	350		
65		@ 64.7'; pyrite clast.		60" 100%	60" 100%	10	1:12	TH to L	U to S	MH	---	0	350		
70				60" 100%	60" 100%	11	1:12	TH to L	U to S	MH	---	0	350		
75	910.0			60" 100%	60" 100%	12	1:00	TH to L	U to S	MH	---	0	350		

DLZ Ohio, Inc.	Project:	SCI-823-0.00 Portsmouth Bypass Prel. Borings	LOG of BORING: PB-45
Driller: D. Chapman	Location:		Page 4 of 5
Geologist: J. Babione	Client:	Ohio Department of Transportation - District 9	Job No. 0121-3070.02
Drill Equip: Mobile B-57	Sampler:	2" split spoon Hammer Wt: 140 lb.	Date Started: 06/04/03
Size & Type Core Barrel: NQ2 Wireline		Hammer Drop: 30"	Date Finished: 06/05/03

WATER LEVELS			
Date	Depth to Water	Bot. of Casing	Bot. of Hole
06/04/03	Dry *	19'	19'
06/05/03	7.4' **	19'	116'

WATER: * Prior to coring ** Including core water

Depth (ft)	Elev. (ft)	DESCRIPTION	SOIL: Blows per 6"	SOIL: Recovery (in.)	Sample No.	Hand Penetrometer (tsf)	GRADATION: % Agg.	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	LAB RESULTS AND REMARKS: Liquid Limit, LL / Plasticity Index, PI / Water Content, W (%)	Inst. Installation
			ROCK: Core Length (in.) & RQD (%)	ROCK: Recovery (in./%)	Run No.	Drill rate (min/ft)	Bedding	Weathering	Hardness	Discontinuities	Fractures/ft	Drill Press. (psi)	Water Loss, WL (%)	
75	910.0													
		Medium hard gray SILTSTONE, micaceous, slightly arenaceous, contains occasional thin sandstone layer.	60" 100%	60" 100%	12	1:00	TH to L	U to S	MH	---	0	350		
79.9	905.1						TH to L	U to S	MH					
80		Hard gray SANDSTONE, fine grained, argillaceous, slightly pyritic, contains siltstone and shale laminae and clasts.	60" 100%	60" 100%	13	1:12	TK to TH	U to S	H	---	0	350		
85		@ 84.6'; rust staining.	60" 100%	60" 100%	14	0:48	TK to TH	U to S	H	---	0	350		
90		@ 89.9' - 90.5', impure limestone.	60" 100%	60" 100%	15	1:12	TK to TH	U to S	H	---	0	350		
95			60" 100%	60" 100%	16	1:00	TK to TH	U to S	H	---	0	350		
99.5	885.5		60" 100%	60" 100%	17	2:12	TK to TH	U to S	H	---	0	350		
100	885.0	Interbedded SANDSTONE/SILTSTONE.												

DLZ Ohio, Inc.

Project: SCI-823-0.00 Portsmouth Bypass Prel. Borings
Location:
Client: Ohio Department of Transportation - District 9

LOG of BORING: PB-45
Page 5 of 5

Driller: D. Chapman
Geologist: J. Babione
Drill Equip: Mobile B-57
Sampler: 2" split spoon
Hammer Wt: 140 lb.
Size & Type Core Barrel: NQ2 Wireline
Hammer Drop: 30"

Job No. 0121-3070.02
Date Started: 06/04/03
Date Finished: 06/05/03

WATER LEVELS

Date	Depth to Water	Bot. of Casing	Bot. of Hole
06/04/03	Dry *	19'	19'
06/05/03	7.4' **	19'	116'

WATER: * Prior to coring ** Including core water

Depth (ft)	Elev. (ft)	DESCRIPTION	SOIL / ROCK	Blows per 6" / Core Length (in.) & RQD (%)	Recovery (in.) / Recovery (in./%)	Sample No. / Run No.	Hand Penetrometer (tsf) / Drill rate (min/ft)	GRADATION: % Agg. / % C. Sand / % M. Sand / % F. Sand / % Silt / % Clay	Bedding / Weathering / Hardness / Discontinuities / Fractures/ft / Drill Press. (psi)	LAB RESULTS AND REMARKS: Liquid Limit, LL / Plasticity Index, PI / Water Content, W (%) / Water Loss, WL (%)	Inst. Installation
100	885.0	Medium hard to hard gray interbedded SANDSTONE, SILTSTONE and SHALE, fresh.		60" 100%	60" 100%	17	2:12	--- 0 350	TK to L / U to S / H to MH		
		@ 103.1'-103.2', 103.4'-103.5', 104.6'-104.7'; contains iron staining.									
105				60" 100%	60" 100%	18	2:00	--- 0 350	TK to L / U to S / H to MH		
110				60" 100%	60" 100%	19	2:00	--- 0 350	TK to L / U to S / H to MH		
115				36" 100%	36" 100%	20	1:00	--- 0 350	TK to L / U to S / H to MH		
116.0	869.0	Bottom of Boring - 116.0 Ft.									
120											
125											