TranSystems®

SCI-823-10.~~31~~ 13 PID 79977

CR 184 over SR 823

Ohio Department of Transportation
District 9
February 6, 2007

13
SCI-823-10.~~31~~ PID 79977

CR 184 over SR 823

Ohio Department of Transportation
District 9
February 6, 2007

TABLE OF CONTENTS

Table of Contents	***Page No.***
1. Introduction.....	1
2. Design Criteria.....	1
3. Subsurface Conditions and Foundation Recommendation...	1
4. Roadway.....	2
5. Proposed Structure Configurations.....	2-5
6. Recommendations.....	5
APPENDIX A • Cost Comparison Summary (3 Alternatives)	11 Sheets
APPENDIX B • Preliminary Site Plan – Alternative 1 - Preferred (Sheet 1 of 2) • Typical Transverse Section (Sheet 2 of 2)	2 Sheets
APPENDIX C • Preliminary Vertical Clearance Calculations	4 Sheets
APPENDIX D Preliminary Site Plan – Alternative 2A (Sheet 1 of 1) Preliminary Site Plan – Alternative 2B (Sheet 1 of 1)	2 Sheets
APPENDIX E • Preliminary Geotechnical Report	

TranSystems

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 Flatwood-Fallen Timber Road (C.R. 184) over the proposed S.R. 823 bypass. 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. An initial Bridge Type Study report dated 7/15/2005 was submitted to the Department and comments, dated 10/18/2005, were in turn received by TranSystems. However, since these dates, the entire project has experienced a change in profile and the median width along SR 823 has been reduced. This follow-up Bridge Type Study presents the results of these changes as well as investigation of comments in accordance with the 10/18/2005 ODOT comments. As a result, three (3) alternatives for construction of the Flatwood-Fallen Timber Road over S.R. 823 are evaluated in this study and are designated as Alternatives 1, 2A & 2B. Each of these alternatives is evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, constructability and maintenance of traffic. Discussion of these alternatives is presented later in this report.

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, 17th Edition. Horizontal clearances (clear zone width and horizontal sight distance) are based on the Ohio Department of Transportation Location and Design Manual, Volume One – Roadway Design.

3. Subsurface Conditions and Foundation Recommendation

DLZ Ohio, Inc. performed the subsurface exploration for the proposed bridge and prepared the Preliminary Bridge Foundation Recommendations, which are presented 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 the various substructure elements. Because the location of bedrock will be at or near the surface of the proposed grade for S.R. 823, spread foundations appear to be best suited for all alternative's substructure locations. Based on the foundation recommendations, the allowable bearing capacity for all spread footings should be 15 tsf.

DLZ has also provided rock cut recommendations for S.R. 823, in accordance with ODOT Geotechnical Bulletin 3. The results of these recommendations have been incorporated into the layout of the structures. The layout of the rock cut uses 0.5:1 slopes with 5'-0" benches every 30' vertically. At the top of rock a 10'-0" wide overburden bench is proposed with 2:1 cuts above the rock. This layout can be viewed in the drawings for each alternative. Rock cut recommendations for slopes along Flatwood Fallen Timber Road (C.R. 184) will be provided as part of the Stage 1 submittal.

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 previously stated, the structure investigated in this Type Study will carry Flatwood-Fallen Timber Road (C.R. 184) 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 parapet, one 6'-0" shoulder, two 12'-0" travel lanes, one 6'-0" shoulder and finally a 1'-6" parapet, for a total deck width of 39'-0" out to out.

Alignment & Profile: Existing Flatwood-Fallen Timber Road (C.R. 184) will be realigned both horizontally and vertically alignment. The horizontal realignment is not significantly different from existing. The proposed horizontal geometry of Flatwood Fallen Timber Road (C.R. 184) is tangent alignment along the length of structure with a curve ending near the rear approach slab. The superelevation transition, for this curve will be located on the structure. Outside of the limits of the superelevation transition the cross section has a normal crown with a cross slope of 0.020ft/ft. The existing vertical profile has slopes that exceed 15% in some areas. Therefore, the vertical profile was adjusted to minimize steep grades as much as possible within the limits of the structure and maintain reasonable access to the drive at approximately STA. 25+00.

The alignment of proposed S.R. 823 is in a horizontal curve with the simple circular portion under the bridge. The alignment of the circular curve is defined by the following parameters: PI Sta. = 793+44.83 Delta = 91°40'44" (LT) Dc = 1°15'00" R = 4,583.66' e_{max} = 0.044. The proposed mainline profile is a constant grade of +1.70% with the profile grade line located at the inside edges of pavement separated by a 22'-0" wide median. The 22'-0" median when used with the proposed median barrier will provide median shoulders of 9.5'± which is greater than the minimum width required to satisfy horizontal sight distances of 8.5'. Note that the horizontal and vertical geometry of the proposed structure and S.R. 823 are considered are the same for all alternatives.

Rock cut slopes under the bridge along S.R. 823 have been provided by DLZ.

Vertical and Horizontal Clearances – 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.

The minimum horizontal clearances under the structures will be in accordance with Figure 302-1E. The proposed vertical profile of S.R. 823 is in a rock cut section and, therefore, guardrail is proposed along the edge of shoulder for both the northbound and southbound lanes. Proposed S.R. 823 is classified as an Arterial roadway with a design ADT of 26,000. Therefore the guardrail offset is 12'-0" from Figure 301-3E. The proposed guardrail is Type 5 and the minimum barrier clearance is 5'-6" as shown in Figure 603-2E.

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.

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

Structure Types: As per the Scope of Services, TranSystems investigated several bridge types and alternatives as part of this type study. Various span arrangements were investigated and refined to the three span arrangement presented in this report. Typically, for a 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. However, the 8.5' minimum median shoulders, of proposed S.R. 823, allow for approximately a 3'-0" wide pier column and this was not considered feasible for the tall piers under consideration.

A preliminary bridge construction cost has been prepared for the three (3) Alternatives (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, unless different unit prices were recommended by ODOT in September 2005. This estimate will be used as a comparison between alternatives and as a guide to select the most economical structure. Maintenance costs such as painting, overlays and re-decking were included for each Alternative.

The appropriate structure types that were considered are outlined in the Structure Type Alternative Table below:

STRUCTURE TYPE ALTERNATIVE TABLE			
Structure Type Alternative	**1**	**2A**	**2B**
Superstructure Type Description	Prestressed Concrete Girders 72" Modified AASHTOType 4	52" continuous steel plate girder A709 Grade 50W	46" continuous hybrid steel plate girder A709 Grade 70W flanges 50W webs
Proposed Beam Spacing	3 Spaces @ 10'-6"	3 Spaces @ 10'-6"	3 Spaces @ 10'-6"
No. of Spans	3 (92'-120'-92')	3 (92'-120'-92')	3 (92'-120'-92')
Abutment Type	**R. Abut.**: Semi-Integral Type with rock cut spill-through slopes **F.Abut.**: Semi-Integral Type with rock cut spill-through slopes	**R. Abut.**: Semi-Integral Type with rock cut spill-through slopes **F.Abut.**: Semi-Integral Type with rock cut spill-through slopes	**R. Abut.**: Semi-Integral Type with rock cut spill-through slopes **F.Abut.**: Semi-Integral Type with rock cut spill-through slopes
No. of Piers	2	2	2
Pier Type	Telescoping Stem T-Type Pier	Telescoping Stem T-Type Pier	Telescoping Stem T-Type Pier
Skew	9°21'49" LF	9°21'49" LF	9°21'49" LF
Approximate Bridge Length	304'	304'	304'
Approximate Structure Depth **Slab** **Haunch** **Beam** **Total**	 8.75" 2" 72" 82.75" (6.896')	 9.00" 2" 55.5" 66.50" (5.5417')	 9.00" 2" 49" 60.00" (5.0')

Alternatives Discussion:

As stated above, various span configurations were investigated and subsequently refined to the three-span layout chosen. Different superstructures were investigated for this span arrangement.

Alternative 1

Span configuration:
This three-span alternative consists of 92'-0", 120'-0", 92'-0" spans for an overall bridge length of 304'-0" from centerline bearings at abutments. The abutments and piers are oriented with a 9°21'49" left forward skew, parallel to the tangent of S.R. 823 at STA. 756+11.00 (intersection of the centerlines).

Substructure:

I. *Abutments:* The forward and rear abutment will be semi-integral type. The rear abutment is located on an existing side hill cut. Due to this situation the left side of the abutment will be in cut and the right side of the abutment will be in fill. On the right side of the abutment, investigations of both a 45° turnback and a 90° turnback wall revealed that a 90° turnback wingwall effectively retained the fill using a shorter length. Additionally, as a 45° wingwall

extended to the right, existing ground - and presumably the existing rock - drop in elevation requiring deeper foundations. Consequently, due to the grading requirements and economic considerations a 90° turnback wingwall is proposed along the right side of the rear abutment. In order to satisfy the change in grade of existing rock at the rear abutment, the footing should be stepped to follow the rock grade. Consideration was given to making the rear abutment integral type or fixed, as recommended in the 10/18/05 ODOT comments pertaining to the original 7/15/05 type study. However, the stepped abutment geometry was not considered compatible with integral abutment details. Tapered plates should be detailed for the bearings in accordance with AASHTO guidelines. The abutments will be supported on spread footings, with a design capacity of 15 tsf, as they are located in bedrock cut. The details of the abutments will follow ODOT Standard Construction drawings.

I. *Piers:* The heights of the proposed piers, measured from beam seat to bottom of footing, will be approximately 95' at Pier 1 and 99' at Pier 2. Similar to the tall piers proposed on the mainline SR 823 structure over the Little Scioto River, telescoping stem T-type piers are recommended. The piers will both be fixed to resolve the horizontal component of the superstructure weight. The piers will be founded on spread footings bearing on bedrock with a design capacity of 15 tsf. Comments received from ODOT regarding the Little Scioto crossing indicated that a pier of constant cross section was preferred and that the costs of tapered stem construction were difficult to quantify. A hollow stem of constant cross section was also investigated but not recommended due to greater deflections and difficulty in estimating construction cost.

Superstructure:

The preliminary design of this alternative indicates that 4 – 72" Modified AASHTO Type 4 precast concrete girders, spaced at 10'-6", will be required for this structure. The bridge will have 3'-9" overhangs, and will accommodate the HS25 design loading. The structures will be simple span for non-composite dead loads and continuous for superimposed and live loads. In accordance with the BDM the beams are also checked for a simply supported condition under all loads except the future wearing surface. This analysis indicates that concrete strengths of 6000 psi at release and 8000 psi final are required. Discussions with Ohio Prestressers Association indicate concrete strength was not of particular concern or reason for additional cost (please refer to the attached documentation). Scouting of potential delivery routes found that the beams would have to be delivered from SR 823, below the structure. The superstructure width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0".

The initial bridge construction cost for Alternative 1 is estimated to be $4,030,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $609,000, resulting in a total estimated ownership cost of $4,639,000 in year 2008 dollars.

Alternative 2A

Span configuration & Substructure:

The span configuration and substructure types are the same as that used for Alternative 1.

Superstructure:

The preliminary design of this alternative is 4 - 52" web grade 50W steel plate girders, spaced at 10'-6". The bridge will have 3'-9" overhangs, and will accommodate the HS25 design loading. A girder line has

been dropped in accordance with the comments provided on the initial submittal. The width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0.

The initial bridge construction cost for Alternative 2A is estimated to be $3,930,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,053,000, resulting in a total estimated ownership cost of $4,983,000 in year 2008 dollars.

Alternative 2B

Span configuration & Substructure:
The span configuration and substructure types are the same as that used for Alternative 1 & 2A.

Superstructure:
The preliminary design of this alternative is 4 - 46" hybrid steel plate girders with Grade 50W webs and Grade 70W flanges, spaced at 10'-6". The bridge will have 3'-9" overhangs, and will accommodate the HS25 design loading. The hybrid option has been investigated in accordance with the comments provided on the initial submittal. The width will be 36'-0" from toe to toe of parapets with an overall bridge deck width of 39'-0.

The initial bridge construction cost for Alternative 2B is estimated to be $3,920,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,015,000, resulting in a total estimated ownership cost of $4,935,000 in year 2008 dollars.

6. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1**, which consists of 3-span, 72" Modified AASHTO Type 4 precast concrete girders supported by T-Type Piers with telescoping stem and semi-integral abutments with rock cut slopes. (See Appendix B for the Site Plan and Structure Details).

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

a. This Alternative appears to be economical when considering the construction costs.

b. Lowest life cycle costs

c. Lowest total ownership costs

APPENDIX A

Cost Comparison Summary

TranSystems

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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 Const. Cost	Life Cycle Maintenance Cost	Total Relative Ownership Cost
1	3	92'-120'-92'	304.00	4 Prestressed Concrete Girders	72" Modified AASHTO Type 4	$881,000	$2,014,000	$463,200	$671,600	$4,030,000	$609,000	$4,639,000
2A	3	92'-120'-92'	304.00	4 Steel Plate Girders	52" Steel Plate Girder Grade 50W	$819,000	$2,003,000	$451,500	$654,700	$3,930,000	$1,053,000	$4,983,000
2B	3	92'-120'-92'	304.00	4 Steel Plate Girders	46" Hybrid Steel Plate Girder	$802,000	$2,012,000	$450,200	$652,800	$3,920,000	$1,015,000	$4,935,000

NOTES:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill, sealing of concrete surfaces, 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.

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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	Approach Roadway Cost	Framing Alternative	Proposed Girder Section	Concrete Girder Cost	Subtotal Superstructure Cost
1	3	92'-120'-92'	304.00	306.00	425	$249,600	$106,600	$49,100	$0	4 Prestressed Concrete Girders	72" Modified AASHTO Type 4	$475,280	**$881,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	3.12	3.12
Parapets	1	3.12	3.12

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Bridge	0.73	39.00	28.4	2.8	37.5

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

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

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$587.00

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 2005		Annual Escalation	Year 2008		No. Required	
AASHTO Type IV Beams							
Pier Diaphragms	$1,800	ea.	3.5%	$2,070	ea.	6	$12,420
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	27	$37,260
Modified Type 4 I-Beams (72")	$320	per ft.	3.5%	$350	ea.	1216	$425,600
						TOTAL =	**$475,280**

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

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 39 ft
Area = 260 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$165.00	3.5%	$189.00

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Embankment fill	0.00 cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	0.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	0 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	0 ft.	$80.00	3.5%	$88.70

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

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Strip Seal Expansion Joints	1.00	$250.00	3.5%	$318.07

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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	MSE Wall Cost	Additional Crane Cost	Subtotal Substructure Cost
1	3	92'-120'-92'	4 Prestressed Concrete Girders	72" Modified AASHTO Type 4	$1,578,700	$228,600	$91,800	$15,000	$0	$0	$100,000	**$2,014,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	90	$700.00	3.5%	$803.00	$72,270
Stem	1707	$700.00	3.5%	$803.00	$1,370,720
Footings	281	$421.00	3.5%	$483.00	$135,720
Total	2078				$1,578,700

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$700.00	3.5%	$803.00	$0
Columns	0	$700.00	3.5%	$803.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	165	$421.00	3.5%	$483.00	$79,700
Wingwalls	25	$421.00	3.5%	$483.00	$12,100

Note: 15% of abutment volume allowed for wingwalls.

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
	0	SEE QUANTITY CALCULATIONS	0

Pile Foundation Unit Cost ($/ft.):

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

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

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

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$125.00	4.5%	$149.00

Cost of Shafts: $ -

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

	Total Area (sq. ft.)	Year 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 1	0	$50.00	3.5%	$55.40

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

$ 100,000

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

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

By: PJP
Checked: JRC

Date: 2/5/2007
Date: 2/5/2007

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)	36	4.5	7.5	33.75	1215	12	82	23.00	22632	20	5	38.00	3800	27647
Pier 2 (Spr Ftg)	36	4.5	7.5	33.75	1215	12	85	23.00	23460	20	5	38.00	3800	28475
Pier 3														0
Pier 4														0
Pier 5														0
Pier 6														0
Pier 7														0
Total (Cu.Ft.)					**2430**				**46092**				**7600**	**56122**
Total (Cu.Yd.)					**90**				**1707**				**281**	**2079**

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	39.5	3	6.75	20.25	800	3	7	21.00	830	8	3	24	1	948	2577
Fwd. Abut	39.5	3	6.75	20.25	800	3	3	9.00	356	6	3	18	1	711	1866
Total (Cu.Ft.)					**1600**				**1185**					**1659**	**4444**
Total (Cu.Yd.)					**59**				**44**					**61**	**165**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		0	0	0	
RA Wing (L)		0	0	0	
RA Wing (R)		0	0	0	
Fwd Abut		0	0	0	
FA Wing (L)		0	0	0	
FA Wing (R)		0	0	0	
Total (Sq.Ft.)				**0**	

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	*0*	0.0	0.0	0.0	*0*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Total								**0**				**0**

36" Drilled Shafts

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	0.0	*0*
Pier 2	0	0	0	0	0	0	1	*0*	0	0	0.0	*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.)	Spa. Int. diaphragm	No. of Int in span	Number of Int Diap. 1 location	Total No. in Span
Span 1	MOD TYPE 4 72"	4	92.0	368	23.00	3	3	9
Span 2	MOD TYPE 4 72"	4	120.0	480	30.00	3	3	9
Span 3	MOD TYPE 4 72"	4	92.0	368	23.00	3	3	9
Span 4		0	0.0	0	0.00			0
Span 5		0	0.0	0	0.00			0
Span 6		0	0.0	0	0.00			0
Span 7		0	0.0	0	0.00			0
Span 8		0	0.0	0	0.00			0
Span 9		0	0.0	0	**Total**			**27**
Total	**MOD TYPE 4 72"**	**12**	**304.0**	**1216**				

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (pounds)	Structural Steel Cost	Subtotal Superstructure Cost
2A	3	92'-120'-92'	304.00	306.00	435	$255,100	$109,200	$49,100	$0	4 Steel Plate Girders	52" Steel Plate Girder Grade 50W	317,905	$405,400	**$819,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	3.12	3.12
Parapets	1	3.12	3.12

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Bridge	0.75	39.00	29.3	2.9	38.4

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 =			$586.00

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 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.15	3.5%	$1.28	Straight Girders
Level 4 Plate Girders - Grade 70W	n/a	$1.25	3.5%	$1.39	Straight Girders

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

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 39 ft
Area = 260 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2003	Annual Escalation	Year 2008
Strip Seal Expansion Joints	1.00	$250.00	3.5%	$318.07

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Embankment fill	0.00 cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	0.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	0 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	0 ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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	MSE Wall Cost	Additional Crane Cost	Subtotal Substructure Cost
2A	3	92'-120'-92'	4 Steel Plate Girders	52" Steel Plate Girder Grade 50W	$1,592,000	$229,400	$91,800	$15,000	$0	$0	$75,000	**$2,003,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Alt 1 Total Cost
Cap	90	$700.00	3.5%	$803.00	$72,270
Stem	1738	$700.00	3.5%	$803.00	$1,395,610
Footings	257	$421.00	3.5%	$483.00	$124,130
Total	2085				$1,592,000

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	$700.00	3.5%	$803.00	$0
Columns	0	$700.00	3.5%	$803.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	165	$421.00	3.5%	$483.00	$79,700
Wingwalls	25	$421.00	3.5%	$483.00	$12,100

Note: 15% of abutment volume allowed for wingwalls.

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 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 2	0	$50.00	3.5%	$55.40

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

Number of Piles		Total Pile Length
0	SEE QUANTITY CALCULATIONS	0

Pile Foundation Unit Cost ($/ft.):

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

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

	Number of Shafts		Total Shaft Length
Alt. 2	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$125.00	4.5%	$149.00

Cost of Shafts: $ -

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

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

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

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - QUANTITY CALCULATIONS

By: PJP
Checked: JRC

Date: 2/5/2007
Date: 2/5/2007

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)	36	4.5	7.5	33.75	1215	12	83.5	23.00		23046	18	5	38.00		3420	27681
Pier 2 (Spr Ftg)	36	4.5	7.5	33.75	1215	12	86.5	23.00		23874	18	5	39.00		3510	28599
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**2430**					**46920**					**6930**	**56280**
Total (Cu.Yd.)					**90**					**1738**					**257**	**2084**

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	*0*	0.0	0.0	0.0	*0*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Total								**0**				**0**

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	39.5	3	5	15.00	593	3	8.75	26.25		1037	8	3	24	1	948	2577
Fwd. Abut	39.5	3	5	15.00	593	3	4.75	14.25		563	6	3	18	1	711	1866
Total (Cu.Ft.)					**1185**					**1600**					**1659**	**4444**
Total (Cu.Yd.)					**44**					**59**					**61**	**165**

36" Drilled Shafts

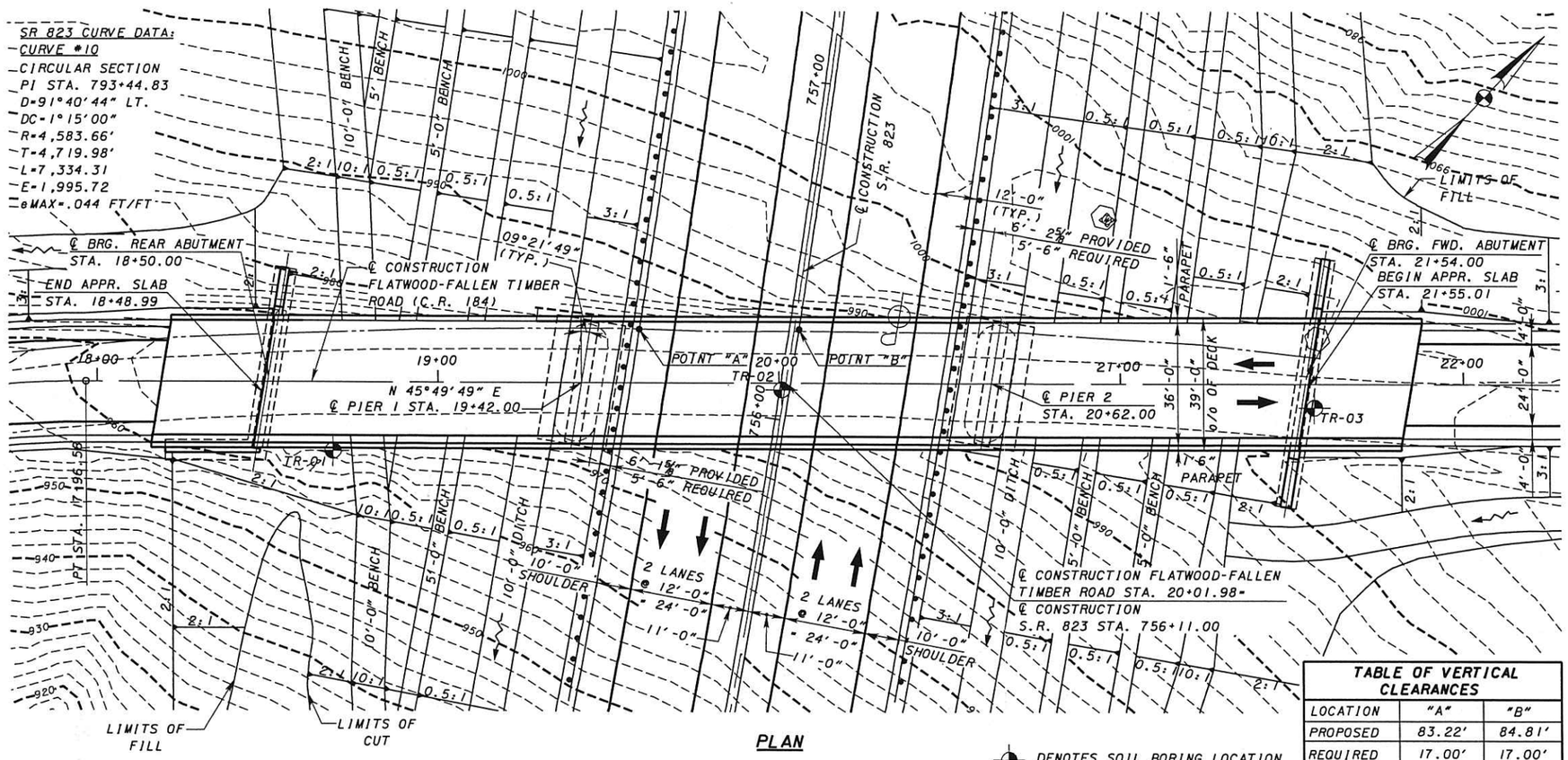
Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 1	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 3	0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

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		0	0	0	
RA Wing (L)		0	0	0	
RA Wing (R)		0	0	0	
Fwd Abut		0	0	0	
FA Wing (L)		0	0	0	
FA Wing (R)		0	0	0	
Total (Sq.Ft.)				**0**	

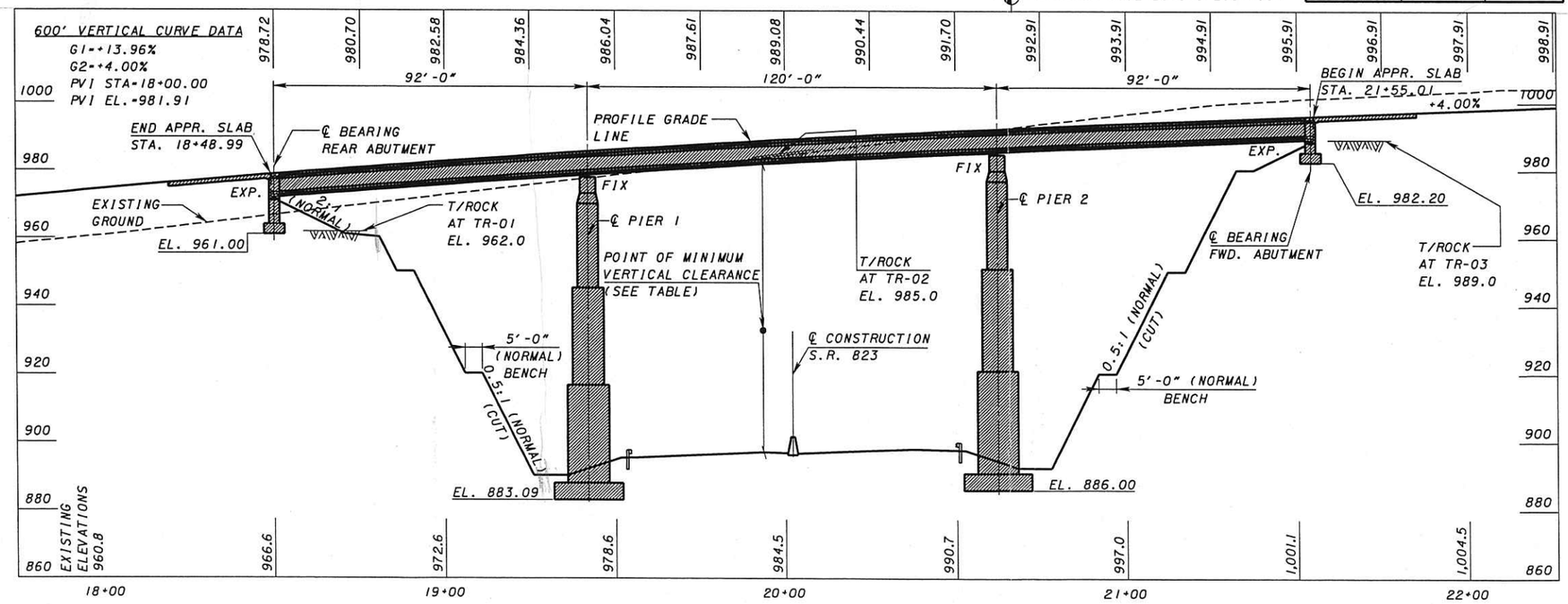
Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	261	4	92.0	96208
Span 2	261	4	120.0	125489
Span 3	261	4	92.0	96208
Span 4		0	0.0	0
Span 5		0	0	0
Span 6		0	0	0
Span 7		0	0	0
Span 8		0	0	0
Total			304	317905



PLAN

DENOTES SOIL BORING LOCATION



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

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	83.22'	84.81'
REQUIRED	17.00'	17.00'

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.

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

TRAFFIC DATA

(FLATWOOD-FALLEN TIMBER ROAD)
CURRENT YEAR ADT (2006) - 768

(S.R. 823)
CURRENT YEAR ADT (2010) - 19,800
DESIGN YEAR ADT (2030) - 26,000
CURRENT YEAR ADTT (2010) - 2770
DESIGN YEAR ADTT (2030) - 3640

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.

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAM WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURES UNITS

SPANS: 92'-0", 120'-0", 92'-0", ℄ BRG. ABUT-℄ PIER-℄ PIER-℄ BRG ABUT

ROADWAY: 36'-0" TOE TO TOE OF PARAPETS

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

SKEW: 9°21'49" LF

CROWN: NORMAL 0.020 FT/FT

ALIGNMENT: TANGENT

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TranSystems, 5747 PERIMETER DRIVE, SUITE 210, DUBLIN, OHIO 43017

DATE 2/5/07 | REVIEWED JRC | DRAWN MSW | DESIGNED PJP | CHECKED MSL | STRUCTURE FILE NUMBER | REVISED

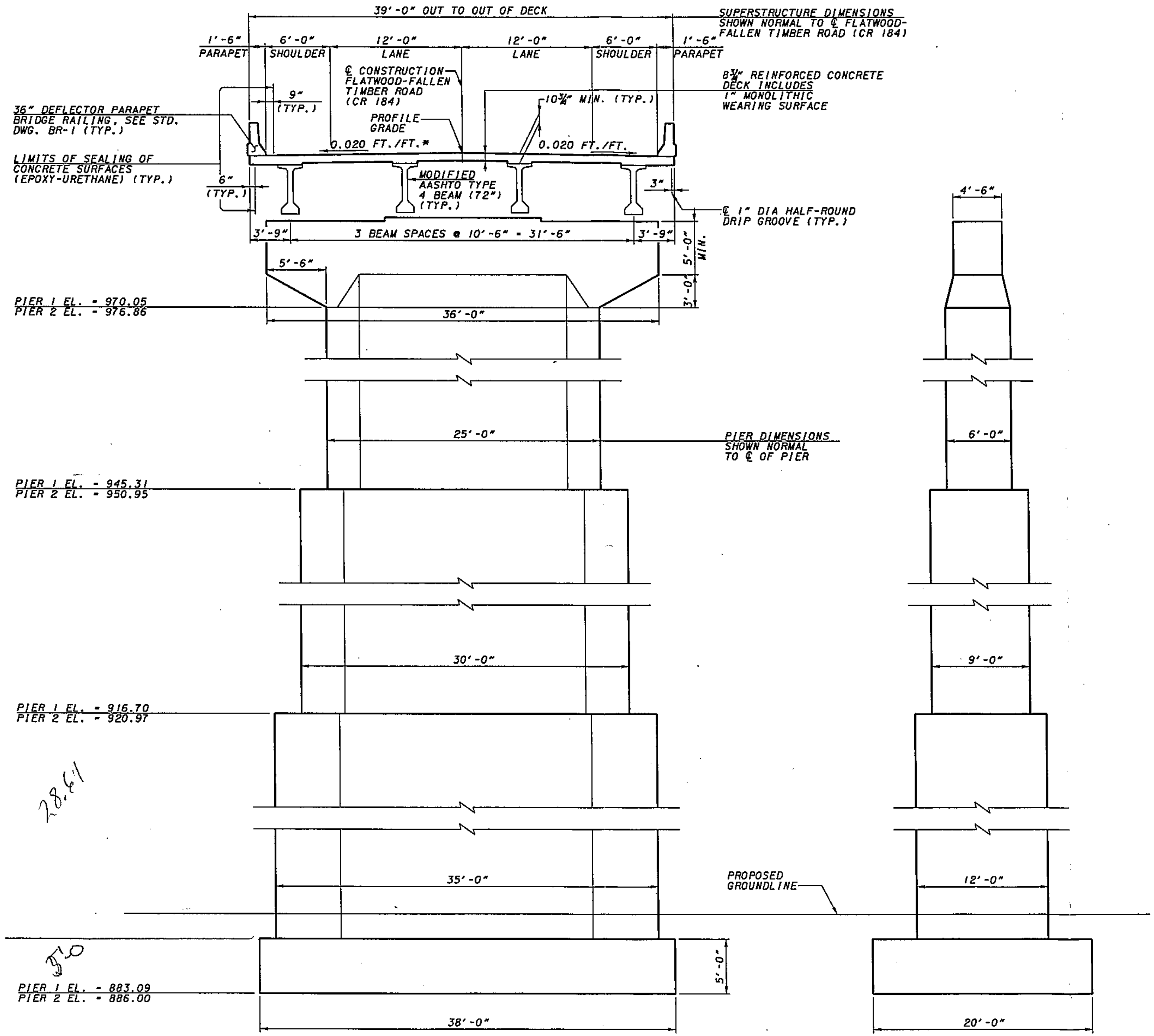
SCIOTO COUNTY
STA. 18+48.99
STA. 21+55.01

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

SCI-823-10.31
PID 79977

1/3

2/7/2007 2:24:14 PM q:\C003\0064\Bridge\CN\BTS\Flatwood Fallen Timber\CRI84_I5Csp0_ALT1.dgn



* VARIES STA 19+10.08 BACK SEE SHEET 3/3

DESIGN AGENCY: Systems

DESIGNED PJP | DRAWN MSW | REVIEWED JRC | DATE 2/5/07 | CHECKED MSL | REVISED | STRUCTURE FILE NUMBER

TRANSVERSE SECTION - ALTERNATIVE I

BRIDGE NO: SCI-823-XXX

FLATWOOD-FALLEN TIMBER ROAD (C.R. 184) OVER S.R. 823

SCI-823-10.31

PID 77977

2 / 3

2:39:53 PM 2/7/2007 g:\C003\0064\Bridge\CN\BTS\Flatwood Fallen Timber\CR184_l5ats02.dgn

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - STEEL ROLLED BEAM ALTERNATIVE 3 - SUPERSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Framing Alternative	Proposed Girder Section	Structural Steel Weight (pounds)	Structural Steel Cost	Subtotal Superstructure Cost
2B	3	92'-120'-92'	304.00	306.00	435	$255,100	$109,200	$49,100	4 Steel Plate Girders	46" Hybrid Steel Plate Girder	289,091	$388,600	**$802,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

	No.	Individual Area (sq. ft.)	Parapet Area (sq. ft.)
Parapets	1	3.12	3.12
Parapets	1	3.12	3.12

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Bridge	0.75	39.00	29.3	2.9	38.4

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 =			$586.00

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 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.15	3.5%	$1.28	Straight Girders
Level 4 Plate Girders - Grade 70W	n/a	$1.25	3.5%	$1.39	Straight Girders
				$1.34	

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 39 ft
Area = 260 sq. yd.

	Year 2004	Annual Escalation	Year 2008
Approach Slabs	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2005	Annual Escalation	Year 2008
Strip Seal Expansion Joints	1.00	$250.00	3.5%	$277.18

Strip Seal Expansion Joints Length 0 ft.

SCI-823-0.00 - PORTSMOUTH BYPASS

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - STEEL ROLLED BEAM ALTERNATIVE 3 - SUBSTRUCTURE

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

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	MSE Wall Cost	Additional Crane Cost	Subtotal Substructure Cost
2B	3	92'-120'-92'	4 Steel Plate Girders	46" Hybrid Steel Plate Girder	$1,600,000	$230,500	$91,700	$15,000	$0	$0	$75,000	**$2,012,000**

COST SUPPORT CALCULATIONS

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	90	$700.00	3.5%	$803.00	$72,270
Stem	1748	$700.00	3.5%	$803.00	$1,403,640
Footings	257	$421.00	3.5%	$483.00	$124,130
Total	2095				$1,600,000

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

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Cap	0	$700.00	3.5%	$803.00	$0
Columns	0	$700.00	3.5%	$803.00	$0
Footings	0	$421.00	3.5%	$483.00	$0
Total					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	165	$421.00	3.5%	$483.00	$79,700
Wingwalls	25	$421.00	3.5%	$483.00	$12,000

Note: 15% of abutment volume allowed for wingwalls.

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 2005 Unit Cost	Annual Escalation	Year 2008
Alt. 3	0	$50.00	3.5%	$55.40

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

Number of Piles		Total Pile Length
0	SEE QUANTITY CALCULATIONS	0

Pile Foundation Unit Cost ($/ft.):

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

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

Number of Shafts		Total Shaft Length
0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$125.00	4.5%	$149.00

Cost of Shafts: $ -

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

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 3	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

Flatwood-Fallen Timber Road (CR 184) over S.R. 823

STRUCTURE TYPE STUDY - STEEL ROLLED BEAM ALTERNATIVE 3 - QUANTITY CALCULATIONS

By: PJP
Checked: JRC

Date: 2/5/2007
Date: 2/5/2007

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)	36	4.5	7.5	33.75	1215	12	84	23.00		23184	18	5	38.00		3420	27819
Pier 2 (Spr Ftg)	36	4.5	7.5	33.75	1215	12	87	23.00		24012	18	5	39.00		3510	28737
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**2430**					**47196**					**6930**	**56556**
Total (Cu.Yd.)					**90**					**1748**					**257**	**2095**

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	39.5	3	4.5	13.50	533	3	9.25	27.75		1096	8	3	24	1	948	2577
Fwd. Abut	39.5	3	4.5	13.50	533	3	5.25	15.75		622	6	3	18	1	711	1866
Total (Cu.Ft.)					**1067**					**1718**					**1659**	**4444**
Total (Cu.Yd.)					**40**					**64**					**61**	**165**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	*Length*	*Area*	*Volume*
Rear Abut		0	0	0	
RA Wing (L)		0	0	0	
RA Wing (R)		0	0	0	
Fwd Abut		0	0	0	
FA Wing (L)		0	0	0	
FA Wing (R)		0	0	0	
Total (Sq.Ft.)				**0**	

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	*0*	0.0	0.0	0.0	*0*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*0*	0	0	0.0	*0*
Total								**0**				**0**

36" Drilled Shafts

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	0.0	*0*
Pier 2	0	0	0	0	0	0	1	*0*	0	0	0.0	*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	238	4	92.0	87488
Span 2	238	4	120.0	114115
Span 3	238	4	92.0	87488
Span 4		0	0.0	0
Span 5		0	0	0
Span 6		0	0	0
Span 7		0	0	0
Span 8		0	0	0
Total			304	289091

By: PJP Date: 2/5/2007
Checked: JRC Date: 2/5/2007

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Lengths	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	3	304.00	4 Prestressed Concrete Girders	$0	0	$0	$27,331	2	$54,661	$0	10	$0
2A	3	304.00	4 Steel Plate Girders	$255,360	2	$510,720	$0	0	$0	$0	10	$0
2B	3	304.00	4 Steel Plate Girders	$236,740	2	$473,480	$0	0	$0	$0	10	$0

Alt. No.	Span Arrangement No. Spans	Lengths	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	3	304	4 Prestressed Concrete Girders	$35,900	$43,600	n/a	1	$79,500	$249,600	$106,600	n/a	$118,600	1	$474,800	**$609,000**	**$4,030,000**	**$4,639,000**
2A	3	304	4 Steel Plate Girders	$35,900	$43,600	n/a	1	$79,500	$255,100	$109,200	n/a	$98,200	1	$462,500	**$1,053,000**	**$3,930,000**	**$4,983,000**
2B	3	304	4 Steel Plate Girders	$35,900	$43,600	n/a	1	$79,500	$255,100	$109,200	n/a	$98,200	1	$462,500	**$1,015,000**	**$3,920,000**	**$4,935,000**

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. 2A	52	4	304.00	18.00	16,011	20%	19,200
Alt. 2B	46	4	304.00	18.00	14,795	20%	17,800

Painting Cost per sq. ft.:

	Year 2005	Annual Escalation	Year 2008
Prep.	$6.75	3.5%	$7.48
Prime	$1.75	3.5%	$1.94
Intermed.	$1.75	3.5%	$1.94
Finish	$1.75	3.5%	$1.94
Total	$12.00		$13.30

Superstructure Sealing:

PS Concrete I-Beam Area:

72" Modified AASHTO Type 4

	H	V	Diag.	No.	Total
Bot. Flange	26			1	26.00
		8		2	16.00
Lower Fillets	9	9	12.73	2	25.46
Web		46		2	92.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00
Total Exposed Perimeter					198.30 in.

66" 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		40		2	80.00
Upper Fillets	3	3	4.24	2	8.49
	11	2	11.18	2	22.36
Top Flange		4		2	8.00 in.
Total Exposed Perimeter					186.30

	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)
Alt. 1	4	304.00	20,095	10%	2,460

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 2005	Annual Escalation	Year 2008
Structural Expansion Joint Including Elastomeric Strip Seal	$250.00	3.5%	$277.18

	Bridge Width	No. Joints
Alt. 1	39.00	0
Alt. 2A	39.00	0
Alt. 2B	39.00	0

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	11,856	$10.00	$118,600
Alt. 2A	11,856	$8.28	$98,200
Alt. 2B	11,856	$8.28	$98,200

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.:

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	11,856	1,317	33	30
Alt. 2A	11,856	1,317	33	30
Alt. 2B	11,856	1,317	33	30

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 2005	Annual Escalation	Year 2008
Elastomeric Strip Seal Gland	$62.50	3.5%	$69.29

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

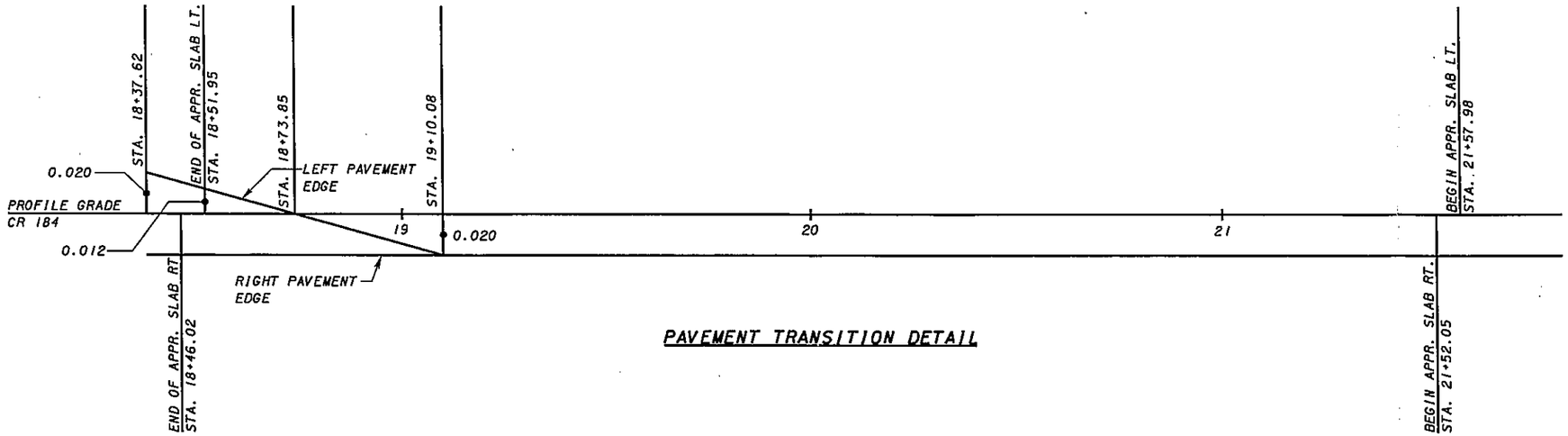
Asphalt Resurfacing Costs:

	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	0.0	0	1.50	0.0
Alt. 2A	0.0	0.0	0	1.50	0.0
Alt. 2B	0.0	0.0	0	1.50	0.0

APPENDIX B

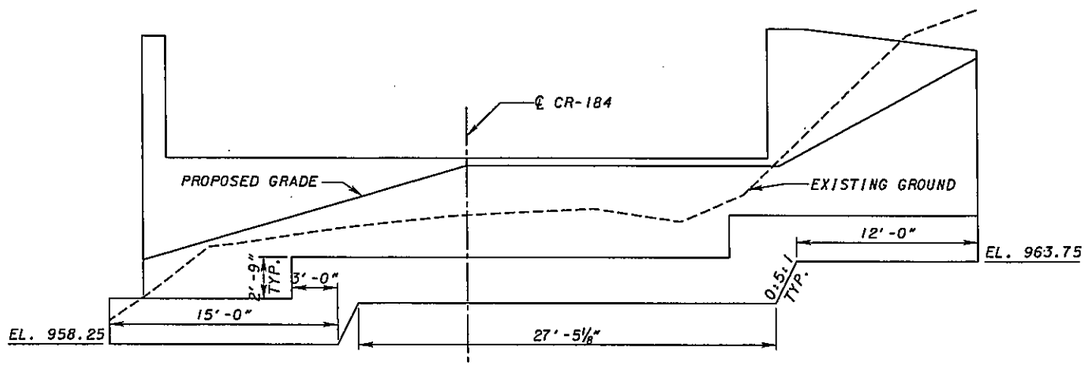
Preferred Alternative Site Plan and Details

TranSystems

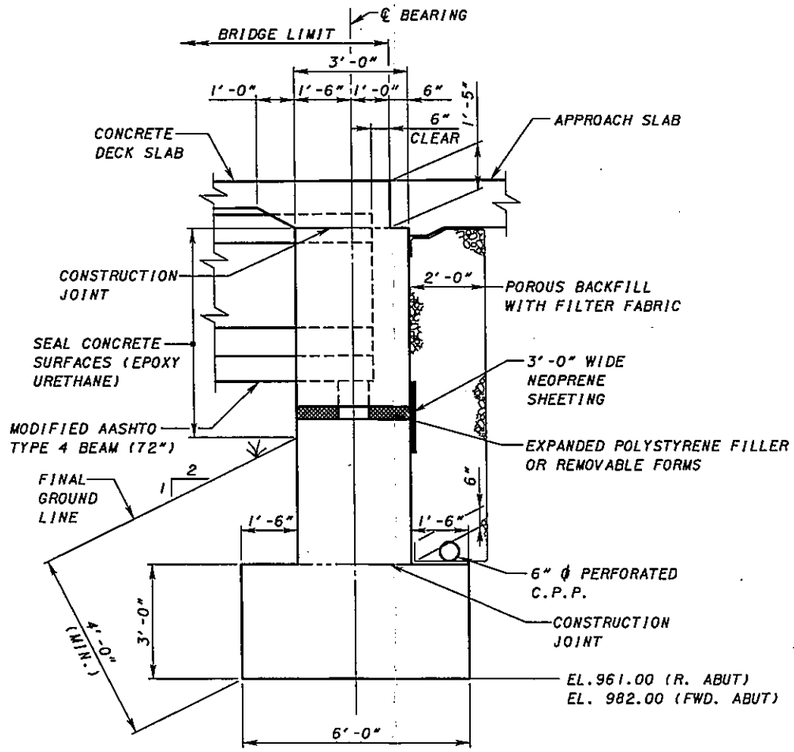


PAVEMENT TRANSITION DETAIL

SUPERSTRUCTURE DEPTH	
ITEM	72" MODIFIED AASHTO TYPE 4 BEAM
SLAB (INCLUDING WEARING SURFACE)	8¾"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
BEAM DEPTH	72"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM (INCHES)	82.75"
TOP OF WEARING SURFACE TO BOTTOM OF BEAM (FEET)	6.895'



REAR ABUTMENT ELEVATION



TYPICAL ABUTMENT SECTION

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

DESIGN AGENCY: Triad Systems, 510 TURNPIKE DRIVE, SUITE 2A, DOVER, OHIO 44622
DESIGNED PJP | DRAWN MSW | REVISED JRC 2/5/07 | DATE | STRUCTURE FILE NUMBER
CHECKED MSL | REVISED

SCI-823-10.31
PID 79977

3 / 3

2/6/2007 q:\co03\0064\Bridge\CNYBTS\Flatwood Fallen Timber\CR184_ABCorf01.dgn
11:17:11 PM

APPENDIX C

Vertical Clearance Calculations

TranSystems

TranSystems

Made By MSW Date 02/02/07 Job No. P403030064
Checked By PJP Date 02/05/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 Structure
Description S.R. 823 UNDER CR184 PID # 79977

Alternative 1 - 4-72" Modified AASHTO Type 4, Three Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.02	x	15.75	-0.315
			Total Adjustment =	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.75	6.9

Total Superstructure Depth (ft) = **6.90**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**19+58.96**	CR 184
Offset Location @ Critical Point	=	**15.75' RIGHT**	
Profile Grade Elevation at Critical Point	=	986.61	
Adjustment for Cross Slopes to Beam CL	=	-0.32	
Top of Deck Elevation @ Critical Point	=	**986.30**	
Total Superstructure Depth	=	-6.90	
Bottom of Beam Elevation @ Critical Point	=	**979.40**	
Station @ Critical Point	=	**756+19.53**	SR 823
Offset Location @ Critical Point	=	**45'**	
Profile Grade Elevation at Critical Point	=	897.67	
Adjustment for Cross Slopes to EOP	=	-1.50	
Top of Pavement @ Critical Point	=	**896.17**	
Actual Vertical Clearance	=	***83.22***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*16.5*	

TranSystems

Made By MSW Date 02/02/07 Job No. P403030064
Checked By PJP Date 02/05/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 Structure
Description S.R. 823 UNDER CR184 PID # 79977

Alternative 1 - 4-72" Modified AASHTO Type 4, Three Span | **Point Location: B**

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.02	x	15.75	=	-0.32
			Total Adjustment	=	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.75	0.73		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.75	6.9		
		Total Superstructure Depth (ft)	≐	**6.90**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**20+05.98**	CR 184
Offset Location @ Critical Point	=	**15.75 Rt.**	
Profile Grade Elevation at Critical Point	=	989.41	
Adjustment for Cross Slopes to Beam CL	=	-0.32	
Top of Deck Elevation @ Critical Point	=	**989.09**	
Total Superstructure Depth	=	-6.90	
Bottom of Beam Elevation @ Critical Point	=	**982.19**	
Station @ Critical Point	=	**756+27.19**	SR 823
Offset Location @ Critical Point	=	**1.41'**	
Profile Grade Elevation at Critical Point	=	897.80	
Adjustment for Cross Slopes to EOP	=	-0.42	
Top of Pavement @ Critical Point	=	**897.38**	
Actual Vertical Clearance	=	***84.81***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*16.5*	

TranSystems

Made By MSW Date 02/01/07 Job No. P403030064
Checked By PJP Date 02/02/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 Structure
Description S.R. 823 UNDER CR184 PID # 79977

Alternative 2A - 4-58" Web Steel Plate Girders, Three Span | **Point Location: A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.02	x	15.75	-0.315
			Total Adjustment =	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	61.75	5.15
	72.75	6.07

Total Superstructure Depth (ft) = **6.07**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**19+58.96**	CR 184
Offset Location @ Critical Point	=	**15.75' RIGHT**	
Profile Grade Elevation at Critical Point	=	986.61	
Adjustment for Cross Slopes to Beam CL	=	-0.32	
Top of Deck Elevation @ Critical Point	=	**986.30**	
Total Superstructure Depth	=	-6.07	
Bottom of Beam Elevation @ Critical Point	=	**980.23**	
Station @ Critical Point	=	**756+19.53**	SR 823
Offset Location @ Critical Point	=	**45'**	
Profile Grade Elevation at Critical Point	=	897.67	
Adjustment for Cross Slopes to EOP	=	-1.50	
Top of Pavement @ Critical Point	=	**896.17**	
Actual Vertical Clearance	=	***84.05***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*16.5*	

TranSystems

Made By MSW Date 02/01/07 Job No. P403030064
Checked By PJP Date 02/02/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 **Structure**
Description S.R. 823 UNDER CR184 **PID #** 79977

Alternative 2A - 4-58" Web Steel Plate Girders, Three Span | ***Point Location:*** ***B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.02	x	15.75	=	-0.32
			Total Adjustment	=	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	61.875	5.16		
	72.875	6.08		
		Total Superstructure Depth (ft)	=	**6.08**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**20+05.98**	CR 184
Offset Location @ Critical Point	=	**15.75 Rt.**	
Profile Grade Elevation at Critical Point	=	989.41	
Adjustment for Cross Slopes to Beam CL	=	-0.32	
Top of Deck Elevation @ Critical Point	=	**989.09**	
Total Superstructure Depth	=	-6.08	
Bottom of Beam Elevation @ Critical Point	=	**983.01**	
Station @ Critical Point	=	**756+27.19**	SR 823
Offset Location @ Critical Point	=	**1.41'**	
Profile Grade Elevation at Critical Point	=	897.80	
Adjustment for Cross Slopes to EOP	=	-0.42	
Top of Pavement @ Critical Point	=	**897.38**	
Actual Vertical Clearance	=	***85.63***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*16.5*	

TranSystems

Made By MSW Date 02/01/07 Job No. P403030064
Checked By PJP Date 02/02/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 Structure
Description S.R. 823 UNDER CR184 PID # 79977

Alternative 2B - 4-46" Web Steel Hybrid Plate Girders, Three Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.02	x	15.75	-0.315
			Total Adjustment =	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	49	4.08
	60	5

Total Superstructure Depth (ft) = **5.00**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**19+58.96**	CR 184
Offset Location @ Critical Point	=	**15.75' RIGHT**	
Profile Grade Elevation at Critical Point	=	986.61	
Adjustment for Cross Slopes to Beam CL	=	-0.32	
Top of Deck Elevation @ Critical Point	=	**986.30**	
Total Superstructure Depth	=	-5.00	
Bottom of Beam Elevation @ Critical Point	=	**981.30**	
Station @ Critical Point	=	**756+19.53**	SR 823
Offset Location @ Critical Point	=	**45'**	
Profile Grade Elevation at Critical Point	=	897.67	
Adjustment for Cross Slopes to EOP	=	-1.50	
Top of Pavement @ Critical Point	=	**896.17**	
Actual Vertical Clearance	=	***85.12***	
Preferred Vertical Clearance	=	*17.0*	
Required Vertical Clearance	=	*16.5*	

TranSystems

Made By MSW Date 02/01/07 Job No. P403030064
Checked By PJP Date 02/02/07 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-10.31 Structure
Description S.R. 823 UNDER CR184 PID # 79977

Alternative 2B - 4-46" Web Steel Hybrid Plate Girders, Three Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.02	x	15.75	=	-0.32
			Total Adjustment	=	**-0.32**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	49	4.08
	60	5

Total Superstructure Depth (ft) = **5.00**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**20+05.98**
Offset Location @ Critical Point	=	**15.75 Rt.**
Profile Grade Elevation at Critical Point	=	989.41
Adjustment for Cross Slopes to Beam CL	=	-0.32
Top of Deck Elevation @ Critical Point	=	**989.09**
Total Superstructure Depth	=	-5.00
Bottom of Beam Elevation @ Critical Point	=	**984.09**
Station @ Critical Point	=	**756+27.19** SR 823
Offset Location @ Critical Point	=	**1.41'**
Profile Grade Elevation at Critical Point	=	897.80
Adjustment for Cross Slopes to EOP	=	-0.42
Top of Pavement @ Critical Point	=	**897.38**
Actual Vertical Clearance	=	***86.71***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

APPENDIX D

Preliminary Structure Site Plan

TranSystems

SR 823 CURVE DATA:
CURVE #10
CIRCULAR SECTION
PI STA. 793+44.83
D=91°40'44" LT.
DC=1°15'00"
R=4,583.66'
T=4,719.98'
L=7,334.31
E=1,995.72
eMAX=.044 FT/FT

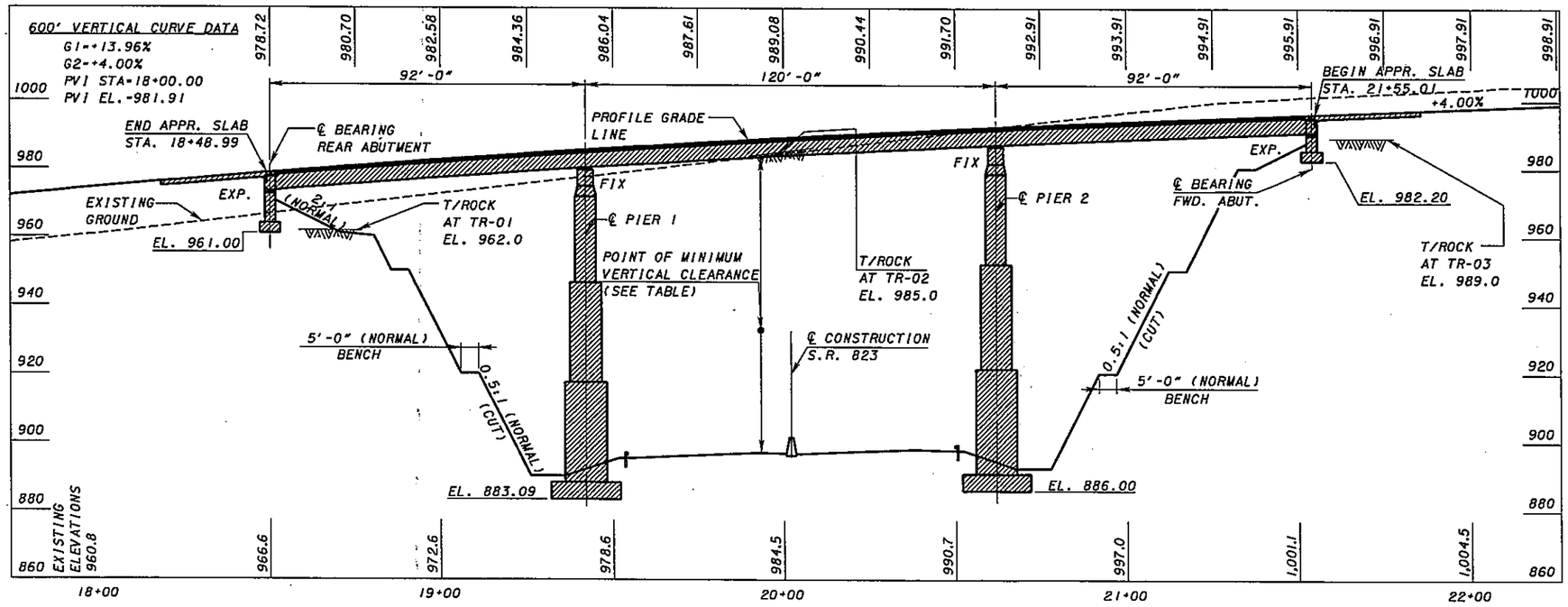
℄ BRG. REAR ABUTMENT STA. 18+50.00
END APPR. SLAB STA. 18+48.99
℄ CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD (C.R. 184)
℄ CONSTRUCTION S.R. 823
℄ BRG. FWD. ABUTMENT STA. 21+54.00
BEGIN APPR. SLAB STA. 21+55.01
LIMITS OF FILL
LIMITS OF CUT
POINT "A" 20+00 TR-02
POINT "B"
N 45°49'49" E
℄ PIER 1 STA. 19+42.00
℄ PIER 2 STA. 20+62.00
TR-01
TR-03
PT STA. 17+196.56
09°21'49" (TYP.)
12'-0" (TYP.)
6'-2½" PROVIDED
5'-6" REQUIRED
2 LANES @ 12'-0" = 24'-0"
11'-0"
10'-0" SHOULDER
5'-0" BENCH
10'-0" DITCH
1'-6" PARAPET
36'-0" 39'-0" b/o DECK
℄ CONSTRUCTION FLATWOOD-FALLEN TIMBER ROAD STA. 20+01.98
℄ CONSTRUCTION S.R. 823 STA. 756+11.00

PLAN

DENOTES SOIL BORING LOCATION

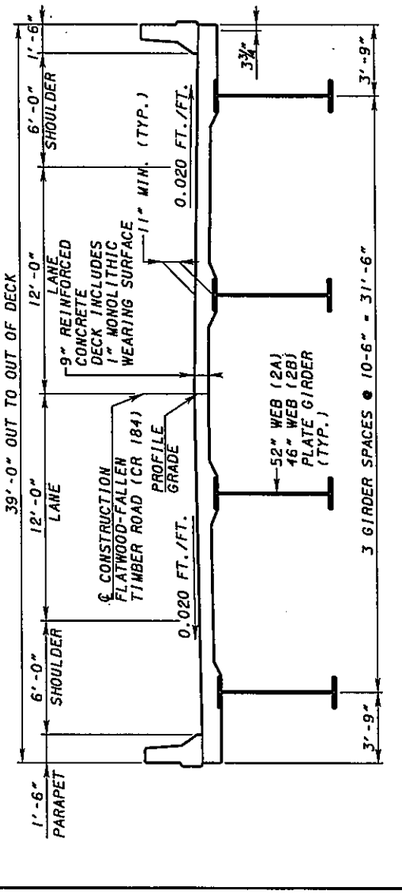
TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED 2A	84.05'	85.63'
PROPOSED 2B	85.12'	86.71'
REQUIRED	17.00'	17.00'



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

SUPERSTRUCTURE DATA



PROPOSED STRUCTURE

TYPE: 2A - 3 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W
2B - 3 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 70W FLANGES 50W WEB
SPANS: 92'-0", 120'-0", 92'-0", ℄ BRG. ABUT-℄ PIER-℄ PIER-℄ BRG ABUT
ROADWAY: 36'-0" TOE TO TOE OF PARAPETS
LOADING: HS25, (CASE III) AND ALTERNATE MILITARY LOADING, FWS = 60 PSF
SKEW: 9°21'49" LF
CROWN: NORMAL 0.020 FT/FT
ALIGNMENT: TANGENT
WEARING SURFACE: MONOLITHIC CONCRETE
APPROACH SLABS: AS-1-81 (25'-0" LONG)
LATITUDE:
LONGITUDE:

DESIGN AGENCY: Systems
DESIGNED PJP | DRAWN MSW | REVISED | CHECKED MSL
REVISED JRC | DATE 2/5/07 | STRUCTURE FILE NUMBER
SCIOTO COUNTY
STA. 18+48.99
STA. 21+55.01

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

SCI-823-10.31
PID 79977

1 / 1

g:\C003\0064\Bridge\CNBTS\Flatwood Fallen Timber\CR184_ISGsp01.ALT2.dgn
2/7/2007 2:35:27 PM

APPENDIX E

Preliminary Geotechnical Report

TranSystems

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

M:\proj\0121\3070.03\Structure Memos\CR184 lt.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

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.

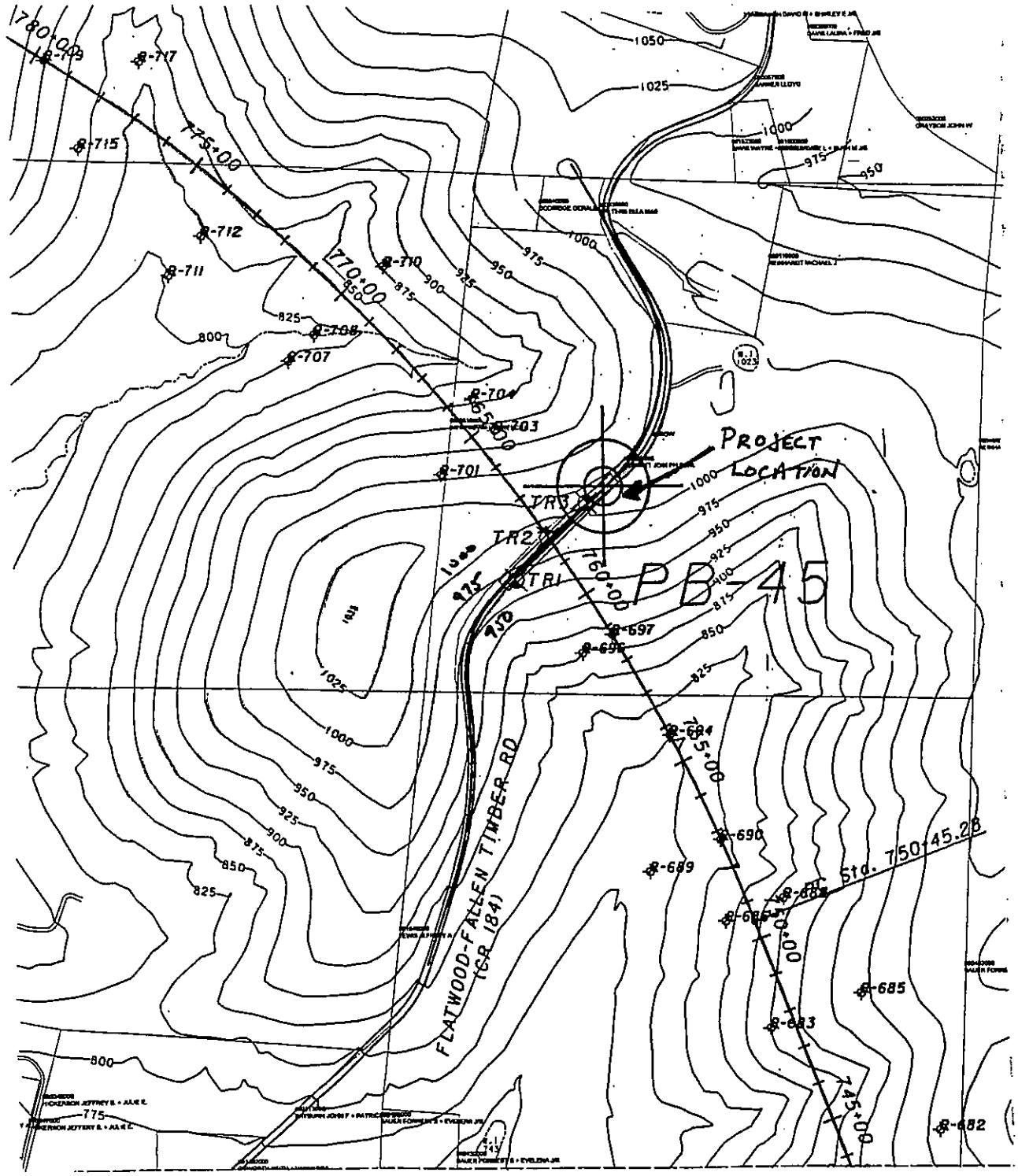
b. Rock Quality Designation, RQD - This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core run.

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.

C:\FORMS\LEGENG.ODT



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 Penetrometer (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.
							@ 9.0', high angle fracture.
10							@ 9.9', low angle fracture.
		Core 108"	Rec 104"	RQD 61%	R-1		@ 10.7'-10.9', wide high angle fracture with clay infilling.
							@ 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

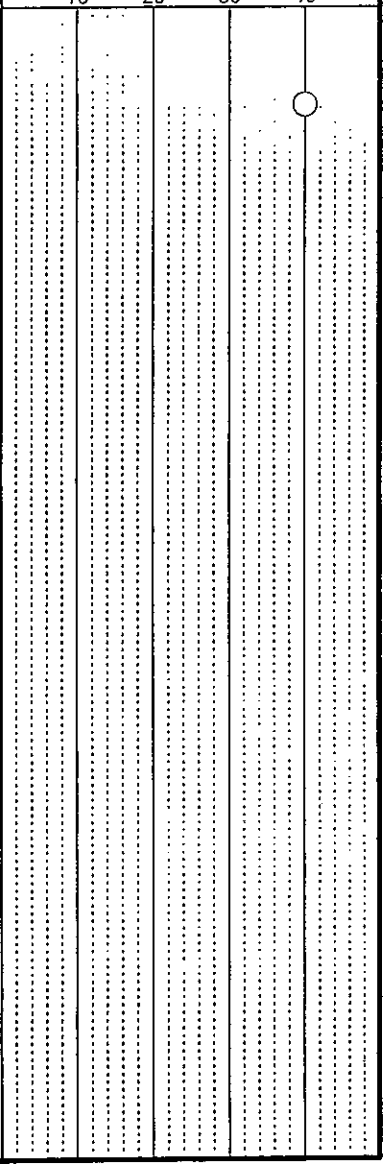
LOG OF: Boring TR-2 | Location: SCI-823 | Date Drilled: 02-04-05

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.
							Bottom of Boring - 16.5'
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 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	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	1001.0												
0.2	1000.8						Asphalt Concrete Pavement - 2"						
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.						
		12 24 24	16	2		4.5+	Hard brown and gray SILT AND CLAY (A-6a), trace gravel; (residual soil); damp.						
5		20 36 35	17	3		4.5+	@ 6.0', resembles decomposed bedrock.						
		24 27 39	18	4		4.5+							
10													
11.0	990.0	50/5	5	5			Soft to medium hard brown and dark brown SILTSTONE; highly weathered, thinly bedded. @ 12.2',12.5', low angle fracture. @ 13.6',13.9', low angle fracture. @ 14.2', low angle fracture. @ 14.9',15.5', low angle fracture. @ 15.5',15.9', low angle fracture.						
15													
16.2	984.8	Core 96"	Rec 96"	RQD 71%	R-1		Soft to medium hard dark gray SILTSTONE; highly weathered, slightly micaceous, thinly bedded. @ 17.0'-17.5', brown. @ 17.8'-18.1', brown.						
18.1	982.9												
20		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. @ 20.0'-20.4', highly weathered to decomposed.						
22.5	978.5						Bottom of Boring - 22.5'						
25													
30													

STANDARD PENETRATION (N)
Natural Moisture Content, % - ●
PL ⊢——⊣ LL
Blows per foot - ○
10 20 30 40
7 1
66

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

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 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 / 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
0	985.0 *										
0.3	984.8	Topsoil - 3"									
5		Very stiff to hard brown SILT and CLAY (A-6a), little fine to coarse sand, trace gravel; damp. @ 3.0', brown and light gray.		3 8 10 / 10		1	2.0				
				8 13 21 / 14		2	4.5				
8.0	977.0			6 19 23 / 17		3	2.5				
10		Soft brown SANDSTONE, decomposed.		11 45 50 / 16		4	4.5+				
13.0	972.0			40 50/3 / 7		5	4.5+				
15		Soft gray SHALE, slightly arenaceous, decomposed.		41 50/1 / 6		6	4.5+				
18.0	967.0			50/5 / 4		7	4.5+				
20		Soft to medium hard brown and gray SANDSTONE, argillaceous, thin bedded, moderately to severely weathered. @ 19.2', 19.3', 20.5', 20.9', 22.7', 22.9'; near horizontal fractures with clay coating or infilling.		50/2 / 1		8	4.5+				
				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.									
25	960.0	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			

* 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: Blows per 6"	Recovery (in.)	Sample No.	Hand Penetrometer (tsf)	GRADATION: % Agg.	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	LAB RESULTS AND REMARKS
			ROCK: Core Length (in.) & RQD (%)	Recovery (in.%)	Run No.	Drill rate (min/ft)	Bedding	Weathering	Hardness	Discontinuities	Fractures/ft	Drill Press. (psi)	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	TK to TH	MW	H to MH	—	0	350	
30		@30.3'; rough clay coated fracture.	60" 100%	60" 100%	3	2:00	TK to TH	MW	H to MH	— / J	0 / 1 / 0	350	
35			60" 100%	60" 100%	4	2:12	TK to TH / TK to TH	MW / MW	H to MH / H to MH	— / J / —	0 / 1 / 0	350	
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	TK to TH	MW	H to MH	—	0	350	
45			60" 96%	58" 96%	6	2:00	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	TK to TH	MW	H to MH	—	0	350	

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

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. / 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.

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 4 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
75	910.0												Liquid Limit, LL
		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	Plasticity Index, PI
79.9	905.1												Water Content, W (%)
80		Hard gray SANDSTONE, fine grained, argillaceous, slightly pyritic, contains siltstone and shale laminae and clasts.	60" 100%	60" 100%	13	1:12	TH to L / TK to TH	U to S	MH / 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.											

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

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 5 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. / 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
100	885.0	Medium hard to hard gray interbedded SANDSTONE, SILTSTONE and SHALE, fresh.		60" 100%	60" 100%	17	2:12	TK to L	U to S	H to MH	—	0	350		
		@ 103.1'-103.2', 103.4'-103.5', 104.6'-104.7'; contains iron staining.													
105				60" 100%	60" 100%	18	2:00	TK to L	U to S	H to MH	—	0	350		
110				60" 100%	60" 100%	19	2:00	TK to L	U to S	H to MH	—	0	350		
115				36" 100%	36" 100%	20	1:00	TK to L	U to S	H to MH	—	0	350		
116.0	869.0	Bottom of Boring - 116.0 Ft.													
120															
125															