SCI-823-0.00

PID NO. 19415

S.R. 823 OVER PORTSMOUTH-MINFORD ROAD (S.R. 139)

STRUCTURE TYPE STUDY SUBMITTAL

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

APRIL 14, 2005

Prepared by:

TRANSYSTEMS
CORPORATION

STRUCTURAL ENGINEERING
APR 18 2006
WJK ☐ SM ☐ TJK ☐ JEM ☐
JAC ☐ RZ ☐ AW ☐ ☐
MT ☐ DAG ☐ JCR ☐ ☐
AD ☐ SS ☐ JS ☐ FILE ☐

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BRIDGE TYPE STUDY NARRATIVE

1. Introduction

TranSystems Corporation is providing engineering services to the Ohio Department of Transportation for the design of new left and right overpass structures that will carry the proposed S.R. 823 bypass over existing Portsmouth-Minford Road (SR 139) and Long Run Creek. 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 9/1/2005, were in turn received by Transystems Corporation. However, since these dates, the entire project has experienced a change in profile – the original project profile presented in the Preferred Alternative Verification Report (PAVR) submitted July 2005 has been altered and the revised profile has been approved by the Department. The revised profile raises the elevations of the proposed S.R. 823 Mainline over Portsmouth-Minford Road (SR 139) from the elevations specified in the July 2005 PAVR. Built-up embankments are, therefore, increased which requires lengthening of the span lengths with the use of 2:1 embankment slopes. Due to the changes in span lengths, bridge types for the proposed S.R. 823 Mainline over Portsmouth-Minford Road were reevaluated. This follow-up Bridge Type Study presents the results of these reevaluations as well as alternative bridge types that are investigated in accordance with the 9/1/2005 ODOT comments. As a result, four (4) alternatives for construction of the proposed S.R. 823 Mainline over Portsmouth-Minford Road are evaluated in this study and are designated as Alternatives 1, 1a, 2 and 3. Each of these alternatives is evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, constructability, hydraulic performance 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 were presented in Section 3 and Appendix E of the original 7/15/2005 Structure Type Study report. Per phone discussion with DLZ Ohio, Inc. on 7/06/05, an addendum will be submitted during the TS&L stage stating that substructures located in areas of new embankment construction should be founded on H-piles. Thus, for the abutments which are founded on fill, HP14x73 piles with a maximum design load of 95 tons should be used. Updated boring logs for the four test borings (TR-15, TR-16, TR-18 and TR-19) and preliminary MSE wall evaluations – performed by DLZ Ohio, Inc. – accompany this modified/updated Structure Type Study Report. The preliminary evaluations reveal that MSE walls can be used at the rear and forward abutment locations as long as the naturally occurring soils beneath the proposed MSE walls are overexcavated to top of rock and replaced with compacted, granular fill. Refer to the preliminary MSE wall evaluation report for more details and information.

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.

Both the left and right structures are similar and will consist of two 12'-0" travel lanes with 6'-0" median shoulders and 12'-0" outside shoulders. Including a 1'-6" inside median parapet and a 1'-6" outside straight face deflector parapet yields a structure deck width of 45'-0" out to out.

The distance from the centerline of construction of SR 823 to the near edge of both the left and right structures is constant at 3'-6". Horizontal and vertical sight distances, in accordance with the design standards, have been provided over the bridge for all alternatives considered.

Vertical and Horizontal Design – Since the proposed vertical alignment for all overpass structures on this project was dictated by the overall design of the new bypass profile, vertical clearance was not a critical design issue for each alternative proposed herein. For this report, more than 17'-0" of preferred vertical clearance could be provided for each structure's alternatives considered. In accordance with the ODOT L&D manual, Volume 1, for the twin structures at Portsmouth-Minford Road, a minimum horizontal clear zone width of 23'-0" from edge of traveled way to face of obstruction.

The existing Portsmouth-Minford Road will remain on its current horizontal and vertical alignment. The cross section will remain unchanged.

Pavement Drainage - The collection of storm water runoff will be addressed off of the bridge, thus scuppers will not be required. The type of drainage system will be investigated as part of the preliminary design.

Utilities - No utilities will be placed on the bridge. However, lighting and ITS conduits will be provided as necessary. An existing waterline runs parallel to SR 139 approximately 30' off the east edge of pavement. The waterline is approximately 10'-0" in front of the MSE wall and it is preferred to relocate this waterline. There is an existing aerial electric line also on the east side of SR 139 that will need to be relocated. There are no other utilities known at this point in time.

Maintenance of Traffic - While the new bridges are under construction, traffic will be maintained on the existing Portsmouth-Minford Rd. It is anticipated that there will be limited closures during construction for beam setting.

5. Hydraulic Report

A Hydraulic Report has been prepared for the proposed structures alternatives over Long Run Creek in accordance with section 201.2.3 of the Bridge Design Manual. The hydraulic report shows that all concepts investigated will have minimal effect to the HW elevations when compared to the existing conditions. The report is available in Appendix F of this report.

6. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry is along a 1 degree curve to the right across the entire length of both the left and right structures. The section is superelevated at 3.6% for the given curve with a break at the high side shoulder in accordance with the BDM. The proposed mainline profile grade line is located on the inside edge of pavement for both bridges and begins in a tangent section at -2.9% leading into a 1500' sag vertical curve, PVI= 491+50, El. 675.94 and G2 = 4.5%. The horizontal and vertical geometry for all alternatives considered are the same. Embankment slopes will be a maximum of 2:1 in order to minimize right-of-way impacts.

Structure Types: As per the Scope of Services, we investigated several bridge types and alternatives as part of this type study. Various span configurations were investigated and were refined to the layouts discussed below. The location of the Long Run creek and Portsmouth-Minford Road dictated that either a 2-span or 4-span bridge would be most economical, with horizontal clearances to the roadway and hydraulic requirements of Long Run Creek affecting the locations of the piers and abutments. Three span structure alternatives were also investigated and dismissed. The 3-span arrangements provided for poorly balanced loading conditions to maintain clearances as well as being cost prohibitive in comparison to other options. The different alternatives discussed below modify the location and the number of piers, as well as the type of superstructure.

A preliminary bridge construction cost has been prepared for the four (4) 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 structure types that were considered are outlined in the Structure Type Alternative Table below:

BRIDGE TYPE ALTERNATIVE TABLE				
Structure Type Alternative	1	1a	2	3
Superstructure Type Description	Straight, 66"web, continuous steel plate girders A709 Grade 50W	Prestressed Concrete Girders 72" Modified AASHTO Type 4 beams	Prestressed Concrete Girders 72" Modified AASHTO Type 4 beams	Curved, 68"web, continuous steel plate girders A709 Grade 50W
Proposed Beam Spacing	4 Spaces @ 9'-6"	4 Spaces @ 9'-9"	5 Spaces @ 7'-9"	4 Spaces @ 9'-6"
No. of Spans	2 (115'-115')	2 (115'-115')	4 -(112.5'-145'-110'-78.5')	4 -(112.5'-145'-110'-78.5')
Abutment Type	Stub Type abutments on MSE wall supported embankments (Semi-Integral)	Stub Type abutments on MSE wall supported embankments (Semi-Integral)	Stub Type abutments with 2:1 spill-through slopes (EXJ-6-06 Joint)	Stub Type abutments with 2:1 spill-through slopes (EXJ-4-87Joint)
No. of Piers	1	1	3	3
Pier Type	T-Type Pier	T-Type Pier	T-Type Pier	T-Type Pier
Substructure Orientation	19°00'00"	19°00'00"	19°30'00"	19°30'00"
Approximate Bridge Length	230'	230'	446'	446'
Approximate Structure Depth				
Slab	8.75"	8.5"	8.5"	8.75"
Haunch	2"	2"	2"	2"
Beam	70.0"	72.0"	72.0"	72.0"
Total	80.75" (6.729')	82.5" (6.875')	82.5" (6.875')	82.75" (6.896')

Alternatives Discussion:

Alternative 1

This alternative is comprised of a 2-span structure with span lengths of 115'-0" and 115'-0", for an overall bridge length of 230'-0" from centerline bearings at abutments, as measured at the centerline of construction. The abutments and pier are oriented with a 19°00'00" skew with respect to the reference chord from intersection of centerline of construction and abutment bearing centerlines. Embankment slopes are supported by MSE walls approximately 40'-45' in height at both abutments. The MSE walls are founded 3' above the 500 year headwater elevation in accordance with the comments provided 9/1/05 on the original 7/15/05 Structure Type Study. The slopes in front of the MSE walls will need to be protected with rock channel protection according to the hydraulic analysis. The MSE walls are set to allow for the adequate hydraulic opening. A ditch will be required in front of the forward MSE wall to convey the roadway drainage and floodplain drainage of Long Run Creek. Details of the ditch will need to be coordinated with the nearby stream relocation.

The abutments will be semi-integral type supported on H-piles as they are located in new embankment fill. The piles shall be HP14x73 with a design capacity of 95-tons per pile, driven to refusal on bedrock. The details of the abutments will follow ODOT Standard Construction drawings. Piles will need to be sleeved through the MSE wall embankment zone in accordance with the MSE wall Special Provisions.

The single pier will consist of a T-type pier supported on a spread footing founded on bedrock, with a design capacity of 15 tsf. The pier dimensions were assumed to estimate quantities and will need to be established in final design.

The preliminary design of this alternative consists of 5 - 66" web Grade 50W plate girders, spaced at 9'-6" with 3'-0" minimum and 4'-0" maximum deck overhangs. The design loading applied was HS-25 (Case I fatigue) with Alternate Military Loading and a future wearing surface of 60 psf. The girders will be detailed as straight and placed parallel to the reference chord causing the overhangs to vary to accommodate the large radius curve. Both the left and right bridge width will be 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0". Deck thickness, including a 1" monolithic wearing surface, is 8 ¾".

The initial bridge construction cost for Alternative 1 is estimated to be $5,100,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $2,138,000, resulting in a total estimated ownership cost of $7,238,000 in year 2008 dollars.

Alternative 1a

Alternative 1a is similar to Alternative 1 except that the superstructures for the left and right structures consist of 5 - 72" Type 4 Modified prestressed beams, spaced at 9'-9" with 2'-10 1/2" minimum and 3'-1 1/2" maximum overhangs. The girders will be placed along chords between substructures to accommodate the large radius curve. The structures will be simple span for non-composite dead loads and continuous for composite dead loads and live loads. In accordance with the BDM, the beams were checked for a simply supported condition under under all loads except the future wearing surface. Both the left and right bridge width will be 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0". Deck thickness, including a 1" monolithic wearing surface, is 8 1/2". Standard beam strengths from the BDM were used for this alternative. However, a 1 ksi increase in final and release strengths may allow the use of a smaller 66" beam.

The initial bridge construction cost for Alternative 1a is estimated to be $5,320,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $1,102,000, resulting in a total estimated ownership cost of $6,422,000 in year 2008 dollars.

Alternative 2

This alternative is comprised of a 4-span structure with span lengths of 112'-6", 145'-0", 110'-0" and 78'-6", for an overall bridge length of 446'-0" from centerline bearings at abutments, measured along the centerline of construction. The abutments and piers are oriented with a 19°30'00" skew with respect to the reference chord from intersection of centerline of construction and abutment bearing centerlines. Embankment slopes of 2:1 are used for both abutments. The rear embankment toe of slope was set to extend to a minimum elevation of approximately 632.0 to minimize the amount of fill with below the 100 year flood event. The forward embankment is set to begin at the 23'-0" clear zone allowing for a traversable roadway ditch within that zone.

Both the forward and rear abutments will be stub type supported on H-piles as they are located in new embankment fill. The piles shall be HP14x73 with a design capacity of 95-tons per pile, driven to refusal on bedrock. The details of the abutments will follow ODOT Standard Construction drawings.

The three piers will consist of a T-type piers, each supported on a single spread footing founded on bedrock, with a design capacity of 15 tsf. The pier dimensions were assumed to estimate quantities and will need to be established in final design.

The preliminary design of this alternative consists of 6- 72" Type 4 Modified prestressed beams, spaced at 7'-9" with 3'-0" minimum and 4'-0" maximum overhangs. The design loading applied was HS-25 with Alternate Military Loading and a future wearing surface of 60 psf. The girders will be placed along chords between substructures to accommodate the large radius curve. 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. Preliminary discussions with a precaster indicate concrete strength and shipping feasibility were not of particular concern or reason for additional cost. Both the left and right bridge width will be 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0". Deck thickness, including a 1" monolithic wearing surface, is 8 1/2".

The initial bridge construction cost for Alternative 2 is estimated to be $6,570,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $2,062,000, resulting in a total estimated ownership cost of $8,632,000 in year 2008 dollars.

Alternative 3

Alternative 3 is similar to Alternative 2 except that the superstructures for the left and right structures are 5- 68" web Grade 50W curved plate girders, spaced at 9'-6" with 3'-6" overhangs, would be required to accommodate the HS25 design loading. Both the left and right bridge width will be 42'-0" from toe to toe of parapets with an overall bridge deck width of 45'-0". Transverse stiffeners will be used in approximately 3 locations. This provides for a significant savings in the steel for the web and minimal use of the stiffeners.

The initial bridge construction cost for Alternative 3 is estimated to be $5,990,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $4,187,000, resulting in a total estimated ownership cost of $10,177,000 in year 2008 dollars.

7. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1a**, which consists of 2-Span 72" Type 4 Modified prestressed beams with semi-integral abutments, on MSE wall supported embankments and T-Type piers, for both the left and right structures. (See Appendix B for the Site Plan and Structure Details).

Our recommendation for Alternative 1a 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

TRANSYSTEMS
CORPORATION

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY

By: PJP Date: 4/10/2006
Checked: JRC Date: 4/11/2006

ALTERNATIVE COST SUMMARY

Alternative No.	Span Arrangement		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
	No. Spans	Lengths										
1	2	115' - 115'	230.00	5 Steel Girders /per BRIDGE	66" Web Grade 50W	$1,933,000	$1,729,000	$585,900	$849,600	$5,100,000	$2,138,000	$7,238,000
1a	2	115' - 115'	230.00	5 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$1,978,000	$1,844,000	$611,500	$886,700	$5,320,000	$1,102,000	$6,422,000
2	4	112.5' - 145' - 110' - 78.5'	446.00	6 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$3,397,000	$1,325,000	$755,500	$1,095,500	$6,570,000	$2,062,000	$8,632,000
3	4	112.5' - 145' - 110' - 78.5'	446.00	5 Steel Girders /per BRIDGE	68" Web Grade 50W	$3,203,000	$1,098,000	$688,200	$997,800	$5,990,000	$4,187,000	$10,177,000

NOTES:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill, sealing of concrete surfaces, structural steel painting, bearings, and crushed aggregate slope protection costs.

2. Estimated construction cost does not include existing structure removal (if any), which should be quantified seperately, if required.

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S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement		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	Structural Steel Weight (Pounds)	Steel Girder Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
	No. Spans	Lengths														
1	2	115' - 115'	230.00	233	770	$454,300	$193,100	$99,000	$309,100	5 Steel Girders /per BRIDGE	66" Web Grade 50W	675000	$785,804	$1,841,000	5%	**$1,933,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

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

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.8	3.3	44.6
Right Bridge	0.73	45.00	32.8	3.3	44.6

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

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

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

Based on parapet and slab percentages
of total concrete area

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

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.74	3.5%	$0.85	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.38	Curved Girders

Construction Complexity Factor
Percent of Superstructure = 5% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 90 ft
Area = 300 sq. yd.

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

Approach Roadway

			Year 2005	Annual Escalation	Year 2008
Embankment fill	45,000.00	cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	2,250.00	sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	450	ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	225	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	#####	3.5%	#####

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: PJP Date: 4/10/2006
Checked: JRC Date: 4/11/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Wall Cost	Additional Crane Cost	Subtotal Substructure Cost
1	2	115' - 115'	5 Steel Girders /per BRIDGE	66" Web Grade 50W	$200,900	$45,800	$173,400	$28,400	$184,000	$1,096,900	$0	**$1,729,000**

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	88	$421.00	3.5%	$483.00	$42,500
Stem	216	$421.00	3.5%	$483.00	$104,330
Footings	112	$421.00	3.5%	$483.00	$54,100
Total	416				$200,900

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	312	$421.00	3.5%	$483.00	$150,700
Wingwalls	47	$421.00	3.5%	$483.00	$22,700

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. 1	19,800	$50.00	3.5%	$55.40

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

Number of Piles		Total Pile Length
80	SEE QUANTITY CALCULATIONS	4,600

Pile Foundation Unit Cost ($/ft.):

	Year 2005 Unit Cost	Annual Escalation	Year 2008
Furnished	$26.47	3.5%	$29.30
Driven	$9.62	3.5%	$10.70
Total			$40.00

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
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

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

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

Additional Crane Cost

$ -

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

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

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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)	46	3	8.67	26.01	1196	3	51	19.00		2907	15	4	25.00		1500	5603
Pier 2																
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1196**					**2907**					**1500**	**5603**
Total (Cu.Yd.)					**44**					**108**					**56**	**208**
			Qty x 2 (L/R)		**88**					**216**					**112**	**416**

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	*20*	690.0	631.0	60.0	*1200*
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	*20*	678.5	626	55.0	*1100*
Total								**40**				**2300**
							Qty x 2 (L/R)	**80**				**4600**

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Area*		*Volume*	*Width*	*Depth*	*Area*	*# Footi*	*Volume*	
Rear Abut	47.5	3	6.75	20.25	962	3	2	6.00		285	6	3	18	1	855	2102
Fwd. Abut	47.5	3	6.75	20.25	962	3	2	6.00		285	6	3	18	1	855	2102
Total (Cu.Ft.)					**1924**					**570**					**1710**	**4204**
Total (Cu.Yd.)					**71**					**21**					**63**	**156**
			Qty x 2 (L/R)		**142**					**42**					**126**	**312**

36" Drilled Shafts for Piers

Location	Load/girder (Kips)	# Girders	Total Load	Subst Wt (kips)	Pile Cap.(Kips	No. Piles	Increase Factor	Total Shafts	Top Elev.	Bot Elev.	Pile Length	Total Shaft Length (Feet)
Rear Abut.	0	0	0	0	0	0	1	*0*	0	0	0.0	*0*
Pier 1	0	0	0	0	0	0	1	*0*	0	0	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		40		0.0	
RA Wing (L)				0.0	
RA Wing (R)				0.0	
Fwd Abut		40		0.0	
FA Wing (L)				0.0	
FA Wing (R)				0.0	
Total (Sq.Ft.)				**19800**	

Note: MSE wall area from CAD.

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	293	10	115	337500
Span 2	293	10	115	337500
Span 3	0	0	0	0
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
Total				675000

total steel weight per girder (lb.) =	67500
Total Span length (ft.)=	230.00
Weight Per ft. =	293

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1a - SUPERSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Prestressed Concrete Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
1a	2	115' - 115'	230	233	752	$444,600	$188,700	$99,000	$309,100	5 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$842,100	$1,884,000	5%	**$1,978,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

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

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.71	45.00	31.9	3.2	43.6
Right Bridge	0.71	45.00	31.9	3.2	43.6

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

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

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$591.00

Based on parapet and slab percentages
of total concrete area

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

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

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.	10	$20,700
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$905	ea.	3.5%	$1,040	ea.	60	$62,400
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	2300	$759,000
							$842,100

Construction Complexity Factor
Percent of Superstructure = 5% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=17")
Unit Cost ($/sq. yd.):
Length = 30 ft. Width = 90 ft
Area = 300 sq. yd.

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

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

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

Approach Roadway

			Year 2005	Annual Escalation	Year 2008
Embankment fill	45,000.00	cu.yd.	$4.00	3.5%	$4.43
Roadway incl. base	2,250.00	sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	450	ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	225	ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 1a - SUBSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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
1a	2	115' - 115'	5 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$231,900	$52,800	$173,400	$28,400	$186,000	$1,096,900	$75,000	$1,844,000

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	132	$421.00	3.5%	$483.00	$63,760
Stem	216	$421.00	3.5%	$483.00	$104,330
Footings	132	$421.00	3.5%	$483.00	$63,760
Total	480				$231,900

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	312	$421.00	3.5%	$483.00	$150,700
Wingwalls	47	$421.00	3.5%	$483.00	$22,700

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	19,800	$50.00	3.5%	$55.40

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

Number of Piles		Total Pile Length
96	SEE QUANTITY CALCULATIONS	5,520

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. 1a	0	SEE QUANTITY CALCULATIONS	0

Shaft Foundation Unit Cost ($/ft.):

Unit Cost	Escalation	2008
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

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

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

Additional Crane Cost

$ 75,000

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE1a - QUANTITY CALCULATIONS

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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)	46	4.5	8.67	39.02	1795	3	51	19.00		2907	16	4	28.00		1792	6494
Pier 2																0
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**1795**					**2907**					**1792**	**6494**
Total (Cu.Yd.)					**66**					**108**					**66**	**241**
			Qty x 2 (L/R)		**132**					**216**					**132**	**482**

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footin	Volume	
Rear Abut	47.5	3	6.75	20.25	962	3	2	6.00		285	6	3	18	1	855	2102
Fwd. Abut	47.5	3	6.75	20.25	962	3	2	6.00		285	6	3	18	1	855	2102
Total (Cu.Ft.)					**1924**					**570**					**1710**	**4204**
Total (Cu.Yd.)					**71**					**21**					**63**	**156**
			Qty x 2 (L/R)		**142**					**42**					**126**	**312**

MSE Abutment Wall Quantities

Abut Location		Wall			
		Height	Length	Area	Volume
Rear Abut		40	0	0.0	
RA Wing (L)		0	0	0.0	
RA Wing (R)		0	0	0.0	
Fwd Abut		40	0	0.0	
FA Wing (L)		0	0	0.0	
FA Wing (R)		0	0	0.0	
Total (Sq.Ft.)				**19800**	

Note: MSE wall area from CAD.

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	*24*	690.0	631.0	60.0	*1440*
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	*24*	678.5	626	55.0	*1320*
Total								**48**				**2760**
							Qty x 2 (L/R)	**96**				**5520**

Includes 5' of additional length into rock

36" Drilled Shafts for Piers

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

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	0	0	100	0
Span 2	0	0	100	0
Span 3	0	0	0	0
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
Total				0

total steel weight per girder (lb.) = 0
Total Span length (ft.)= 230.00
Weight Per ft. = 0

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUPERSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Prestressed Concrete Cost	Expansion Joint Cost	Subtotal Superstructure Cost	Construction Complexity Factor	Subtotal Superstructure Cost
2	4	112.5' - 145' - 110' - 78.5'	446	449	1450	$856,700	$363,500	$82,500	$0	6 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$1,932,260	$52,664	$3,235,000	5%	**$3,397,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

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

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.71	45.00	31.9	3.2	43.6
Right Bridge	0.71	45.00	31.9	3.2	43.6

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

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

	Year 2004	Annual Escalation	Year 2008
Deck	$491.00	3.5%	$563.00
Parapets	$615.00	3.5%	$706.00
Weighted Average =			$591.00

Based on parapet and slab percentages
of total concrete area

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

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

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.	30	$62,100
Abutment Diaphragms	$1,200	ea.	3.5%	$1,380	ea.	0	$0
Intermediate Diaphragms	$905	ea.	3.5%	$1,040	ea.	100	$104,000
Modified Type 4 I-Beams (72")	$300	per ft.	3.5%	$330	ea.	5352	$1,766,160
							$1,932,260

Construction Complexity Factor
Percent of Superstructure = 5% Due to Deck forming, Screed and Varying Girder Spaces

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

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

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

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

Strip Seal Expansion Joints Length 190 ft.

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

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - PRESTRESSED CONCRETE GIRDER ALTERNATIVE 2 - SUBSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	MSE Abutment & Wingwall Cost	Additional Crane Cost	Subtotal Substructure Cost
2	4	112.5' - 145' - 110' - 78.5'	6 Prestressed Concrete Girders /per BRIDGE	Modified AASHTO Type 4 (72")	$696,500	$158,600	$165,500	$27,100	$202,200	$0	$75,000	**$1,325,000**

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	398	$421.00	3.5%	$483.00	$192,230
Stem	646	$421.00	3.5%	$483.00	$312,020
Footings	398	$421.00	3.5%	$483.00	$192,230
Total	1442				$696,500

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	298	$421.00	3.5%	$483.00	$143,900
Wingwalls	45	$421.00	3.5%	$483.00	$21,600

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
96	SEE QUANTITY CALCULATIONS	6,000

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
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

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

S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

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

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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)	46	4.5	8.67	39.02	1795	3	53	19.00		3021	16	4	28.00		1792	6608
Pier 2 (Spr Ftg)	46	4.5	8.67	39.02	1795	3	51	19.00		2907	16	4	28.00		1792	6494
Pier 3 (Spr Ftg)	46	4.5	8.67	39.02	1795	3	49	19.00		2793	16	4	28.00		1792	6380
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**5384**					**8721**					**5376**	**19481**
Total (Cu.Yd.)					**199**					**323**					**199**	**722**
			Qty x 2 (L/R)		**398**					**646**					**398**	**1444**

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	*24*	690.0	631.0	65.0	*1560*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*24*	678.5	626	60.0	*1440*
Total								**48**				**3000**
							Qty x 2 (L/R)	**96**				**6000**

Abutment Quantities

Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footin	Volume	
Rear Abut	47.5	1.75	7	12.25	582	3.75	3	11.25		534	6.25	3	18.75	1	891	2007
Fwd. Abut	47.5	1.75	7	12.25	582	3.75	3	11.25		534	6.25	3	18.75	1	891	2007
Total (Cu.Ft.)					**1164**					**1069**					**1781**	**4014**
Total (Cu.Yd.)					**43**					**40**					**66**	**149**
			Qty x 2 (L/R)		**86**					**80**					**132**	**298**

36" Drilled Shafts for Piers

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

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	0	0	0	0
Span 2	0	0	0	0
Span 3	0	0	0	0
Span 4	0	0	0	0
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
Total				0

total steel weight per girder (lb.) =	0
Total Span length (ft.)=	230.00
Weight Per ft. =	0

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S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUPERSTRUCTURE

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement		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	Expansion Joint Cost	Subtotal Superstructure Cost
	No. Spans	Lengths												
3	4	112.5' - 145' - 110' - 78.5'	446.00	449.00	1484	$875,500	$372,100	$82,500	5 Steel Girders /per BRIDGE	68" Web Grade 50W	1,322,000	$1,820,400	$52,664.10	**$3,203,000**

COST SUPPORT CALCULATIONS

Deck Cross-Sectional Area:

Parapets:

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

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.73	45.00	32.8	3.3	44.6
Right Bridge	0.73	45.00	32.8	3.3	44.6

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

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

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

Based on parapet and slab percentages
of total concrete area

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

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.74	3.5%	$0.85	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.38	Curved Girders

Reinforced Concrete Approach Slabs (T=15")
Unit Cost ($/sq. yd.):
Length = 25 ft. Width = 90 ft
Area = 250 sq. yd.

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

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

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

Strip Seal Expansion Joints Length 190 ft.

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S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - SUBSTRUCTURE

By: PJP Date: 4/10/2006
Checked: JRC Date: 4/11/2006

SUBSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Additional Crane Cost	Subtotal Substructure Cost
3	4	112.5' - 145' - 110' - 78.5'	5 Steel Girders /per BRIDGE	68" Web Grade 50W	$601,800	$137,100	$163,300	$26,800	$168,500	$0	**$1,098,000**

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	266	$421.00	3.5%	$483.00	$128,480
Stem	646	$421.00	3.5%	$483.00	$312,020
Footings	334	$421.00	3.5%	$483.00	$161,320
Total	1246				$601,800

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	294	$421.00	3.5%	$483.00	$142,000
Wingwalls	44	$421.00	3.5%	$483.00	$21,300

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 2004 Unit Cost	Annual Escalation	Year 2008
Alt. 3		$50.00	3.5%	$57.40

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

Number of Piles		Total Pile Length
80	SEE QUANTITY CALCULATIONS	5,000

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
$300.00	4.5%	$358.00

Cost of Shafts: $ -

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

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

$ -

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S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3 - QUANTITY CALCULATIONS

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

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)	46	3	8.67	26.01	1196	3	53	19.00		3021	15	4	25.00		1500	5717
Pier 2 (Spr Ftg)	46	3	8.67	26.01	1196	3	51	19.00		2907	15	4	25.00		1500	5603
Pier 3 (Spr Ftg)	46	3	8.67	26.01	1196	3	49	19.00		2793	15	4	25.00		1500	5489
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**3589**					**8721**					**4500**	**16810**
Total (Cu.Yd.)					**133**					**323**					**167**	**623**
			Qty x 2 (L/R)		**266**					**646**					**334**	**1246**

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	*20*	690.0	631.0	65.0	*1300*
Pier 1	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 2	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 3	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 4	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 5	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 6	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Pier 7	0	0	0	0	140	0	1	*0*	0	0	2.0	*0*
Fwd. Abut.	0	0	0	0	140	0	1	*20*	678.5	626	60.0	*1200*
Total								**40**				**2500**
							Qty x 2 (L/R)	**80**				**5000**

Abutment Quantities																
Abut Location	Length (feet)	Backwall				Beam Seat					Footing					Total Volume
		Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footi	Volume	
Rear Abut	47.5	1.75	6.8	11.90	565	3.75	3	11.25		534	6.25	3	18.75	1	891	1990
Fwd. Abut	47.5	1.75	6.8	11.90	565	3.75	3	11.25		534	6.25	3	18.75	1	891	1990
Total (Cu.Ft.)					**1131**					**1069**					**1781**	**3981**
Total (Cu.Yd.)					**42**					**40**					**66**	**147**
			Qty x 2 (L/R)		**84**					**80**					**132**	**294**

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

Superstructure Steel Quantities				
Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	296	10	113	333464
Span 2	296	10	145	429798
Span 3	296	10	110	326054
Span 4	296	10	79	232684
Span 5	0	0	0	0
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
Total				1322000

total steel weight per girder (lb.) =	132200
Total Span length (ft.)=	446.00
Weight Per ft. =	296

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S.R. 823 over Portsmouth - Minford Road (S.R. 139) L&R

STRUCTURE TYPE STUDY - LIFE CYCLE COSTS

By: PJP
Checked: JRC

Date: 4/10/2006
Date: 4/11/2006

LIFE CYCLE MAINTENANCE COST

				Structural Steel Painting *			Superstructure Sealing			Approach Pavement Resurfacing		
Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost
1	2	230.00	5 Steel Girders /per BRIDGE	$569,200	2	$1,138,400	$0	0	$0	$4,200	10	$42,000
1a	2	230.00	5 Prestressed Concrete Girders /per BRIDGE	$0	0	$0	$58,200	2	$116,400	$4,200	10	$42,000
2	4	446.00	6 Prestressed Concrete Girders /per BRIDGE	$0	0	$0	$120,100	2	$240,200	$0	10	$0
3	4	446.00	5 Steel Girders /per BRIDGE	$1,162,400	2	$2,324,800	$0	0	$0	$0	10	$0

				Bridge Deck Overlay (5)					Bridge Redecking (5)								
Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Deck Demo & Chipping	Deck Overlay	Deck Joint Gland (2)	Number of Maintenance Cycles	Total Life Cycle Cost	Deck Concrete Cost (3)	Deck Reinforcing Cost (3)	Deck Joint Cost (2)	Deck Removal Cost	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	2	230	5 Steel Girders /per BRIDGE	$62,800	$76,100	n/a	1	$138,900	$454,300	$193,100	n/a	$171,400	1	$818,800	**$2,138,000**	**$5,100,000**	**$7,238,000**
1a	2	230	5 Prestressed Concrete Girders /per BRIDGE	$62,800	$76,100	n/a	1	$138,900	$444,600	$188,700	n/a	$171,400	1	$804,700	**$1,102,000**	**$5,320,000**	**$6,422,000**
2	4	446	6 Prestressed Concrete Girders /per BRIDGE	$121,700	$147,500	$12,819	1	$269,200	$856,700	$363,500	$52,664	$332,400	1	$1,552,600	**$2,062,000**	**$6,570,000**	**$8,632,000**
3	4	446	5 Steel Girders /per BRIDGE	$121,700	$147,500	$12,819	1	$282,019	$875,500	$372,100	$52,664	$332,400	1	$1,580,000	**$4,187,000**	**$5,990,000**	**$10,177,000**

Structural Steel Painting:

Structural Steel Area:

	Web Depth (in.)	No. Stringers	Total Span Length (ft.)	Assumed Ave. Bot. Flange Width (in.)	Nominal Exposed Girder Area (sq. ft.)	Secondary Member Allowance	Total Exposed Steel Area (sq. ft.)
Alt. 1	66	10	230.00	18.00	35,650	20%	42,800
Alt. 3	68	10	446.00	20.00	72,847	20%	87,400

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	

PS Concrete Area:

	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)
Alt. 1a	12	230.00	42,849	10%	5,240
Alt. 2	12	446.00	88,443	10%	10,810

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	90.00	0
Alt. 1a	90.00	0
Alt. 2	90.00	2
Alt. 3	90.00	2

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	20,700	$8.28	$171,400
Alt. 1a	20,700	$8.28	$171,400
Alt. 2	40,140	$8.28	$332,400
Alt. 3	40,140	$8.28	$332,400

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	20,700	2,300	58	52
Alt. 1a	20,700	2,300	58	52
Alt. 2	40,140	4,460	112	101
Alt. 3	40,140	4,460	112	101

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 except for Alt. 3.
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	216.0	38.0	912	1.50	38.0
Alt. 1a	216.0	38.0	912	1.50	38.0
Alt. 2	0.0	38.0	0	1.50	0.0
Alt. 3	0.0	38.0	0	1.50	0.0

APPENDIX B

TRANSYSTEMS CORPORATION

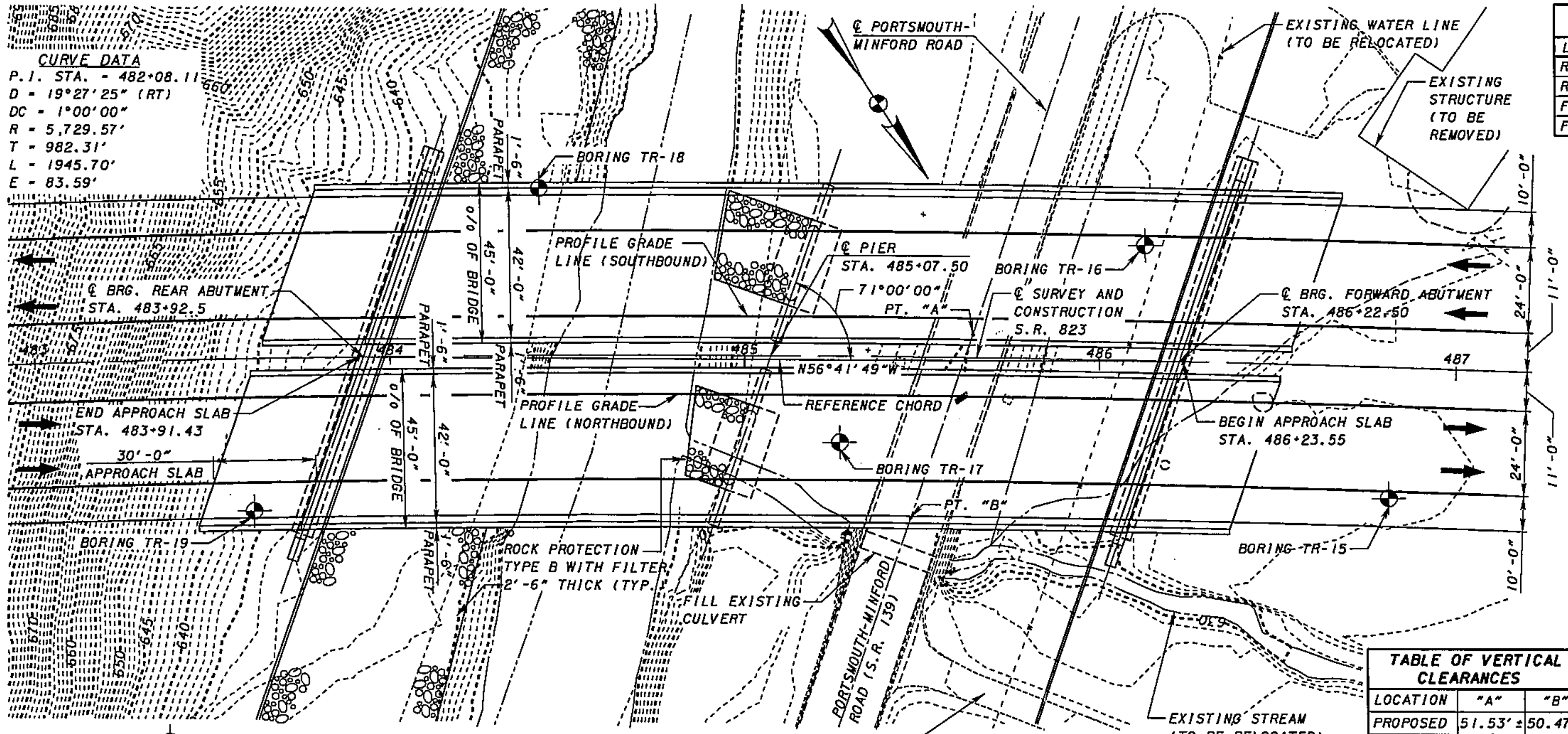
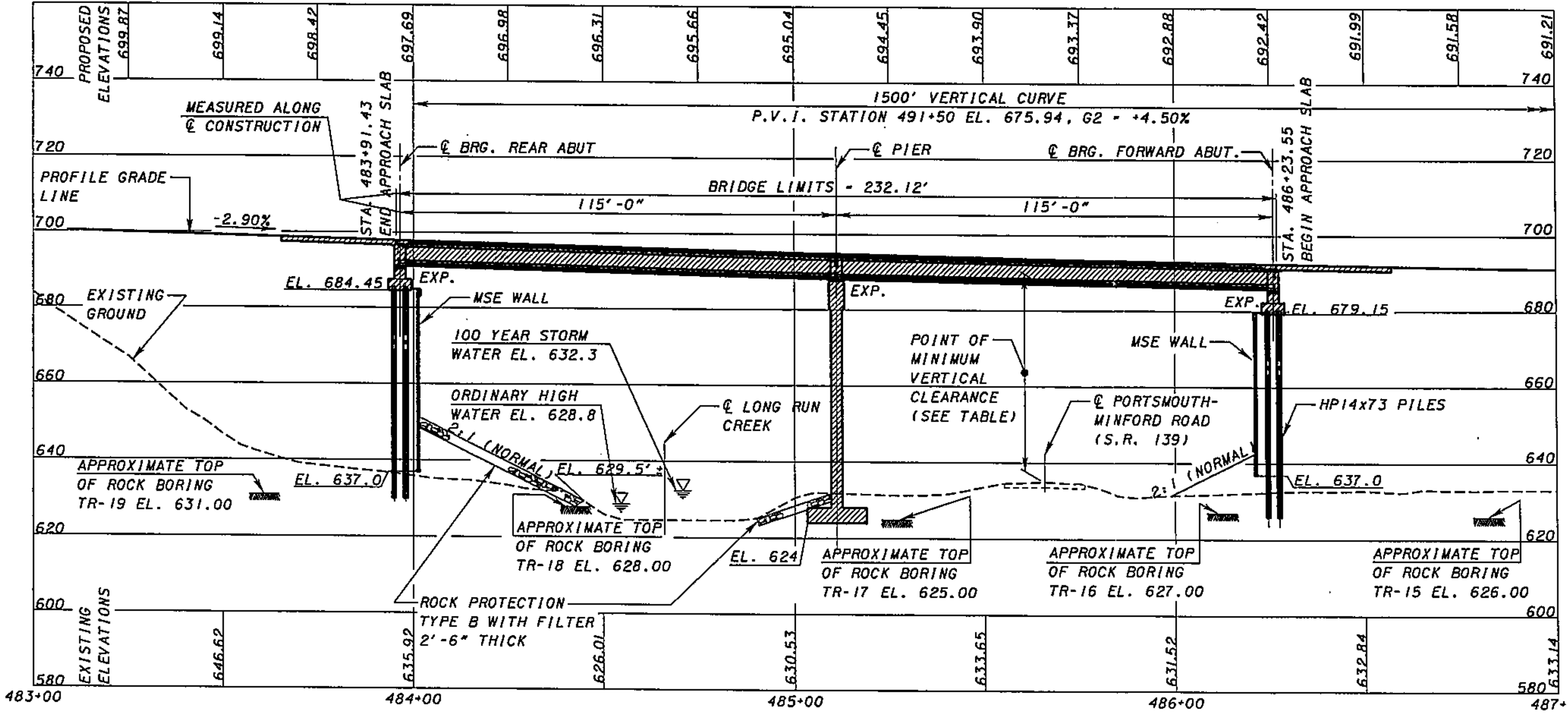


TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	51.53' ±	50.47±
PREFERRED	17.0'	17.0'

⊕ DENOTES SOIL BORING LOCATION

PLAN



ELEVATION ALONG PROFILE GRADE LINE S.R. 823, LEFT BRIDGE

FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS		
LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-15	486+82.23	36.94' RT.
TR-16	486+12.38	32.33' LT.
TR-17	485+26.88	46.98' RT.
TR-18	484+42.66	46.98' LT.
TR-19	483+60.89	42.99' RT.

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

TRAFFIC DATA

(SR 823)
CURRENT YEAR ADT (2010) - 19,800
DESIGN YEAR ADT (2030) - 26,000
CURRENT YEAR ADTT (2010) - 2,770
DESIGN YEAR ADTT (2030) - 3,640

PROPOSED STRUCTURE

TYPE: 2 SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS, T-TYPE PIERS, AND MSE WALL SUPPORTED EMBANKMENT.

SPANS: 115'-0", 115'-0" C/C BEARINGS.

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

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS - 60 PSF.

SKEW: 19°00'00" WITH RESPECT TO REF. CHORD.

SUPER ELEVATION: 0.036 FT/FT.

ALIGNMENT: 1°00'00" CURVE TO THE RIGHT.

WEARING SURFACE: 1" MONOLITHIC CONCRETE.

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

LATITUDE:

LONGITUDE:

HYDRAULIC DATA

DRAINAGE AREA - 13.424 sq.mi. = 8591 acres

Q_{50} - 2230 cfs	Q_{100} = 2572 cfs
V_{50} - 6.8 fps	V_{100} - 7.1 fps
EL_{50} = 631.7	EL_{100} - 632.1

OHWM: EL. 628.8

AREA BELOW OHWM: 0.13 ACRES

TEMP. FILL BELOW OHWM: 835 CY

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.
2. EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

THE PROPOSED PROFILE GRADE IS WITHIN BRIDGE LIMITS. SEE ROADWAY PLANS FOR PAVEMENT ELEVATIONS BEYOND BRIDGE LIMITS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE. SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING CAPACITY OF 15 TSF.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

DESIGN AGENCY
TRANSYSTEMS CORPORATION
730 EAST PETE ROSE WAY, SUITE 300, CINCINNATI, OHIO 45202

DESIGNED	DRAWN	REVIEWED	DATE
PJP	MTN	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY
STA. 483+91.43
STA. 486+23.55

PRELIMINARY SITE PLAN - ALTERNATIVE 1A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD RD. (S.R. 139)

SCI-823-0.00
PID 19415

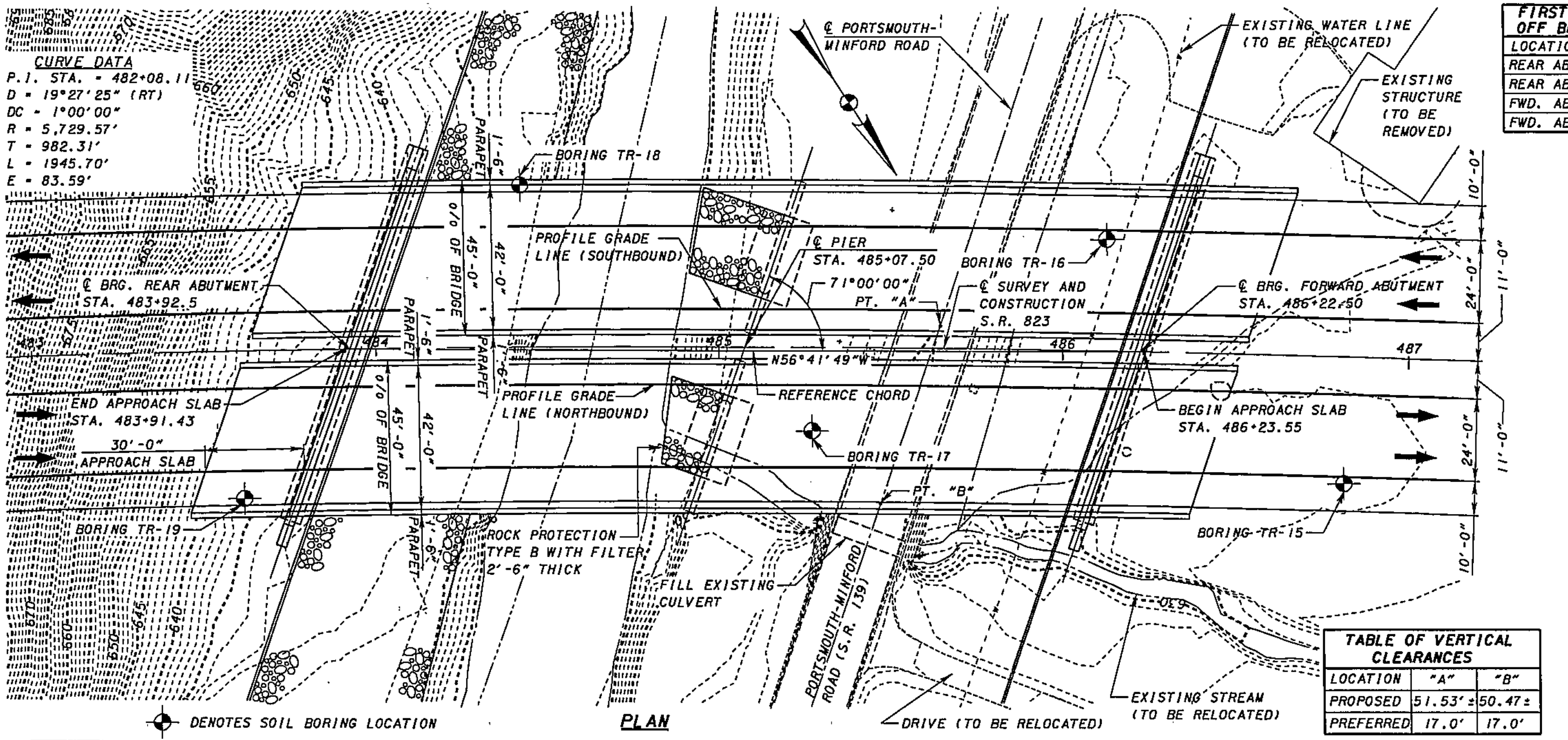
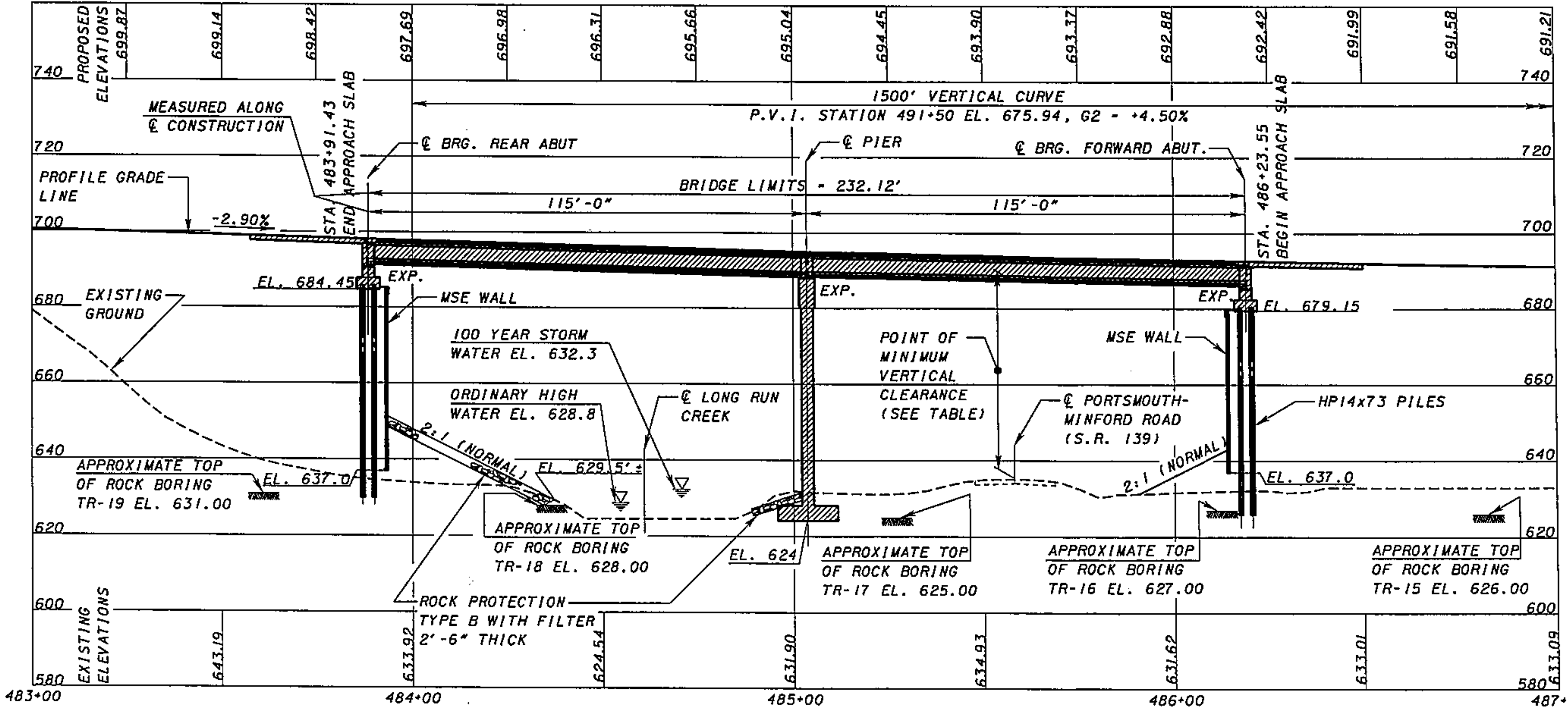


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	51.53'±	50.47±
PREFERRED	17.0'	17.0'

PLAN



ELEVATION ALONG PROFILE GRADE LINE S.R. 823, RIGHT BRIDGE

FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS		
LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-15	486+82.23	36.94' RT.
TR-16	486+12.38	32.33' LT.
TR-17	485+26.88	46.98' RT.
TR-18	484+42.66	46.98' LT.
TR-19	483+60.89	42.99' RT.

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

TRAFFIC DATA

(SR 823)

CURRENT YEAR ADT (2010) - 19,800
DESIGN YEAR ADT (2030) - 26,000
CURRENT YEAR ADTT (2010) - 2,770
DESIGN YEAR ADTT (2030) - 3,640

PROPOSED STRUCTURE

TYPE: 2 SPAN 72" MODIFIED AASHTO TYPE 4 PRESTRESSED CONCRETE I-BEAMS WITH COMPOSITE REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS, T-TYPE PIERS, AND MSE WALL SUPPORTED EMBANKMENT.

SPANS: 115'-0", 115'-0" C/C BEARINGS.

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

LOADING: HS-25 AND ALTERNATE MILITARY LOADING, FWS - 60 PSF.

SKEW: 19°00'00" WITH RESPECT TO REF. CHORD.

SUPER ELEVATION: 0.036 FT/FT.

ALIGNMENT: 1°00'00" CURVE TO THE RIGHT.

WEARING SURFACE: 1" MONOLITHIC CONCRETE.

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

LATITUDE:

LONGITUDE:

HYDRAULIC DATA

DRAINAGE AREA = 13.424 sq.mi. = 8591 acres

Q_{50} - 2230 cfs　　Q_{100} = 2572 cfs
V_{50} - 6.8 fps　　V_{100} - 7.1 fps
EL_{50} = 631.7　　EL_{100} = 632.1

OHWM: EL. 628.8
AREA BELOW OHWM: 0.13 ACRES
TEMP. FILL BELOW OHWM: 835 CY

NOTES:

1. ALL SHEETS WITH PLAN DIMENSIONS ARE SHOWN HORIZONTAL.

2. EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

THE PROPOSED PROFILE GRADE IS WITHIN BRIDGE LIMITS. SEE ROADWAY PLANS FOR PAVEMENT ELEVATIONS BEYOND BRIDGE LIMITS.

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE. SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING CAPACITY OF 15 TSF.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

DESIGN AGENCY
TRANSYSTEMS CORPORATION
720 EAST PETE ROSE WAY, SUITE 300, CINCINNATI, OHIO 45202

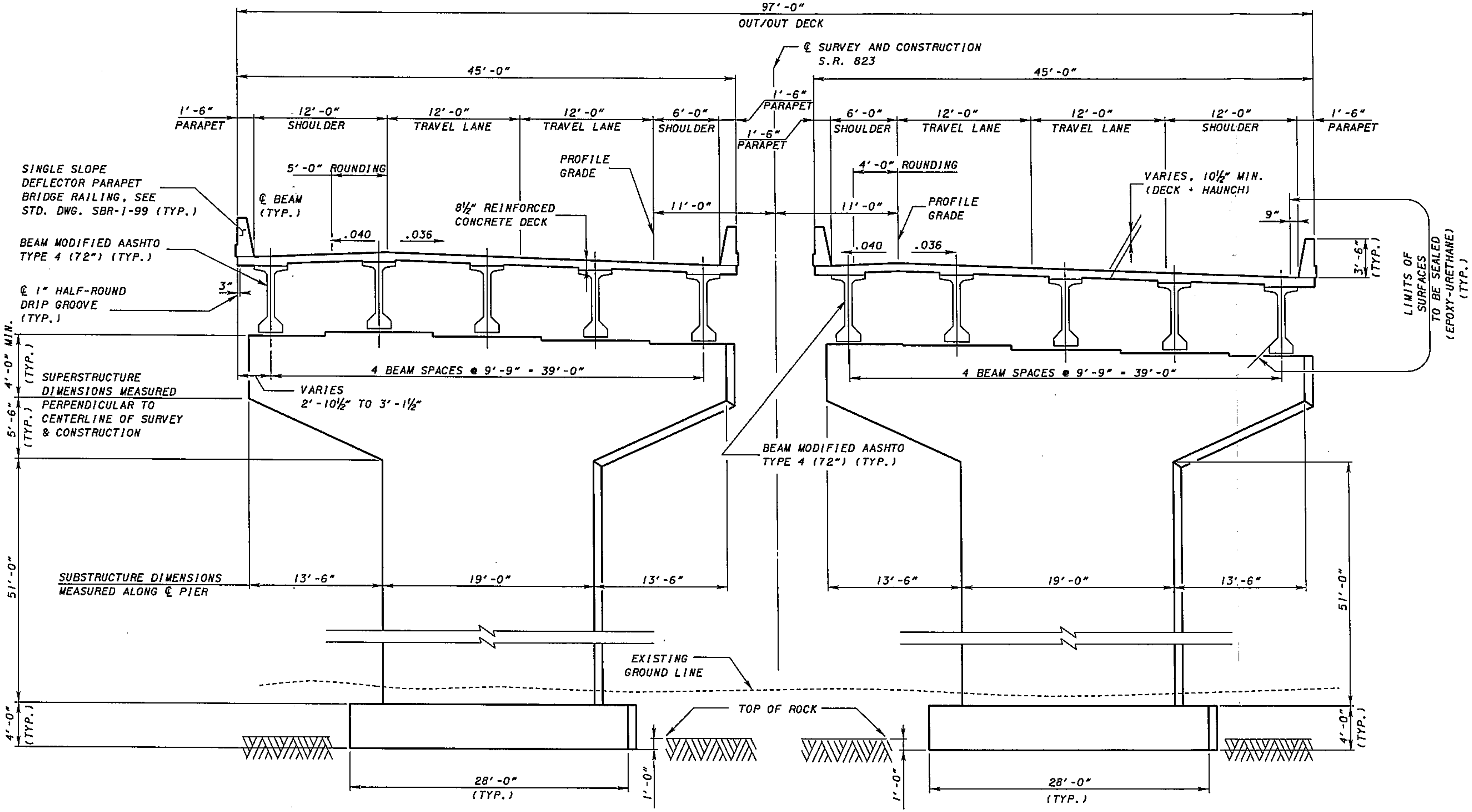
DESIGNED	DRAWN	REVIEWED	DATE
PJP	MTN	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY
STA. 483+91.43
STA. 486+23.55

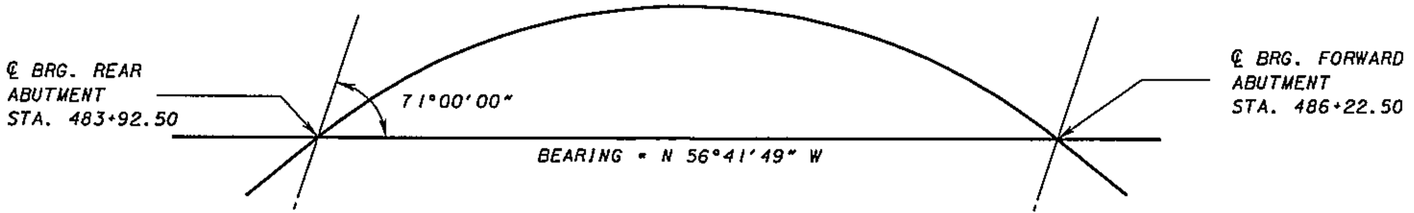
PRELIMINARY SITE PLAN - ALTERNATIVE 1A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD RD. (S.R. 139)

SCI-823-0.00
PID 19415

2/4



TYPICAL TRANSVERSE SECTION



REFERENCE CHORD SCHEMATIC ALTS 1 & 1A

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED	DRAWN	REVIEWED	DATE
PJP	CAS	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
	MTN		

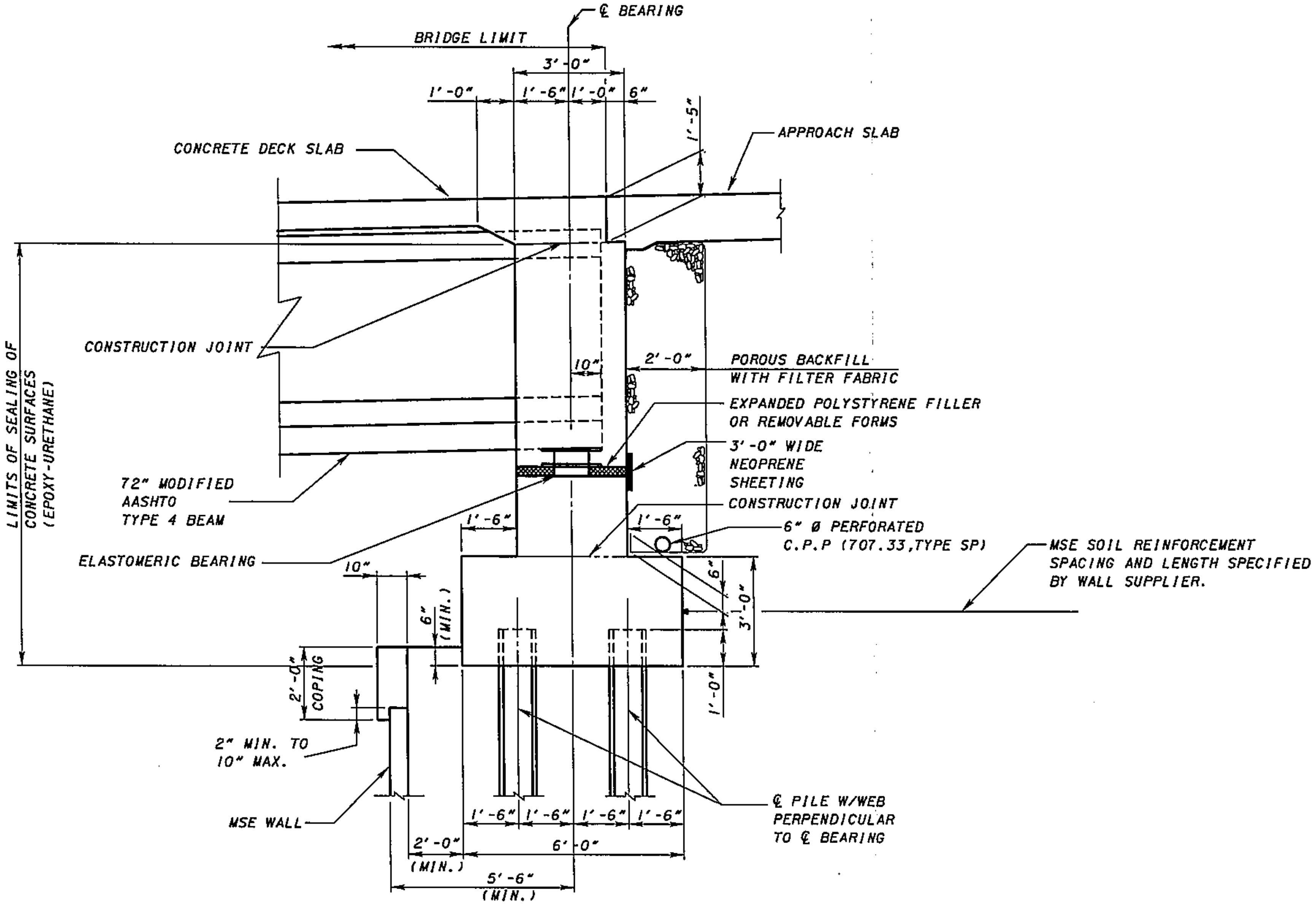
TYPICAL TRANSVERSE SECTION
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD (S.R. 139)

SCI-823-0.00
PID 19415

3 / 4

SUPERSTRUCTURE DEPTH

ITEM	72" MODIFIED AASHTO TYPE 4 BEAM
SLAB (INCLUDING WEARING SURFACE)	8½"
HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE)	2"
GIRDER DEPTH	72"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (INCH)	82.5"
TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (FEET)	6.875'



TYPICAL ABUTMENT SECTION

DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED	DRAWN	REVIEWED	DATE
PJP	MTN	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

ABUTMENT DETAILS - ALTERNATE 1A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD ROAD (S.R 139)

SCI-823-0.00
PID 19415

APPENDIX C

TRANSYSTEMS
CORPORATION

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064
Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 1 - 5-66" Grade 50W Plate Girders, 2-span **_Point Location:_ *A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	4.5	-0.162

Total Adjustment = **-0.16**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	70	5.83
	80.75	6.73

Total Superstructure Depth (ft) = **6.73**

Vertical Clearance at Critical Point

Station @ Critical Point = 485+64.26

Offset Location @ Critical Point = 6.5 LEFT

Profile Grade Elevation at Critical Point = 693.60

Adjustment for Cross Slopes to Beam CL = -0.16

Top of Deck Elevation @ Critical Point = 693.44

Total Superstructure Depth = -6.73

Bottom of Beam Elevation @ Critical Point = 686.71

Approximate Top of Existing Ground @ Critical Point = 635.03

Actual Vertical Clearance = 51.68

Preferred Vertical Clearance = 15.0

Required Vertical Clearance = 14.5

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064
Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 1 - 5-66" Grade 50W Plate Girders, 2-span ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	34.5	=	-1.24
				=	0.00
					0
			Total Adjustment	=	**-1.24**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.75	0.73
Haunch:	2	0.17
Girder or Beam Depth:	70	5.83
	80.75	6.73

Total Superstructure Depth (ft) = **6.73**

Vertical Clearance at Critical Point

Station @ Critical Point = 485+47.00

Offset Location @ Critical Point = 45.5 RIGHT

Profile Grade Elevation at Critical Point = 693.96

Adjustment for Cross Slopes to Beam CL = -1.24

Top of Deck Elevation @ Critical Point = 692.72

Total Superstructure Depth = -6.73

Bottom of Beam Elevation @ Critical Point = 685.99

Approximate Top of Existing Ground @ Critical Point = 635.37

Actual Vertical Clearance = 50.62

Preferred Vertical Clearance = 15.0

Required Vertical Clearance = 14.5

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064

Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 1a - 5- 72" Type 4 Modified Prestressed I-Beams, 2 spans **Point Location:** ***A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	4.5	-0.162

Total Adjustment = **-0.16**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point = **485+64.26**

Offset Location @ Critical Point = **6.50 LEFT**

Profile Grade Elevation at Critical Point = 693.60

Adjustment for Cross Slopes to Beam CL = -0.16

Top of Deck Elevation @ Critical Point = **693.44**

Total Superstructure Depth = -6.88

Bottom of Beam Elevation @ Critical Point = **686.56**

Approximate Top of Existing Ground @ Critical Point = **635.03**

Actual Vertical Clearance = ***51.53***

Preferred Vertical Clearance = *15.0*

Required Vertical Clearance = *14.5*

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064

Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 1a - 5- 72" Type 4 Modified Prestressed I-Beams, 2 spans ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	34.5	=	-1.24
				=	0.00
					0
			Total Adjustment	=	**-1.24**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	8.5	0.71		
Haunch:	2	0.17		
Girder or Beam Depth:	72	6		
	82.5	6.88		
	Total Superstructure Depth (ft)		=	**6.88**

Vertical Clearance at Critical Point

Station @ Critical Point = 485+47.00

Offset Location @ Critical Point = 45.5 RIGHT

Profile Grade Elevation at Critical Point = 693.96

Adjustment for Cross Slopes to Beam CL = -1.24

Top of Deck Elevation @ Critical Point = 692.72

Total Superstructure Depth = -6.88

Bottom of Beam Elevation @ Critical Point = 685.84

Approximate Top of Existing Ground @ Critical Point = 635.37

Actual Vertical Clearance = 50.47

Preferred Vertical Clearance = 15.0

Required Vertical Clearance = 14.5

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064
Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 2 - 6-72" Type 4 Modified Prestressed I-Beams, 4 spans — ***Point Location:*** ***A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	4.5	-0.162

Total Adjustment = **-0.16**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point = **485+64.26**
Offset Location @ Critical Point = **6.5 LEFT**
Profile Grade Elevation at Critical Point = 693.60
Adjustment for Cross Slopes to Beam CL = -0.16
Top of Deck Elevation @ Critical Point = **693.44**

Total Superstructure Depth = -6.88
Bottom of Beam Elevation @ Critical Point = **686.56**

Approximate Top of Existing Ground @ Critical Point = **635.03**
Actual Vertical Clearance = ***51.53***
Preferred Vertical Clearance = *15.0*
Required Vertical Clearance = *14.5*

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064

Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

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

Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 2 - 6-72" Type 4 Modified Prestressed I-Beams, 4 spans ***Point Location:*** ***B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	34.5	=	-1.24
				=	0.00
					0
			Total Adjustment	=	**-1.24**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	8.5	0.71
Haunch:	2	0.17
Girder or Beam Depth:	72	6
	82.5	6.88

Total Superstructure Depth (ft) = **6.88**

Vertical Clearance at Critical Point

Station @ Critical Point = **485+47.00**

Offset Location @ Critical Point = **45.50 RIGHT**

Profile Grade Elevation at Critical Point = 693.96

Adjustment for Cross Slopes to Beam CL = -1.24

Top of Deck Elevation @ Critical Point = **692.72**

Total Superstructure Depth = -6.88

Bottom of Beam Elevation @ Critical Point = **685.84**

Approximate Top of Existing Ground @ Critical Point = **635.37**

Actual Vertical Clearance = ***50.47***

Preferred Vertical Clearance = *15.0*

Required Vertical Clearance = *14.5*

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064
Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 3 - 5-68" web cont. steel plate girders (A709, Gr. 50W), 4 spans ***Point Location:*** ***A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	4	-0.144

Total Adjustment = **-0.14**

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 = **485+64.41**
Offset Location @ Critical Point = **7.00' LEFT**
Profile Grade Elevation at Critical Point = 693.59
Adjustment for Cross Slopes to Beam CL = -0.14
Top of Deck Elevation @ Critical Point = **693.45**

Total Superstructure Depth = -6.90
Bottom of Beam Elevation @ Critical Point = **686.55**

Approximate Top of Existing Ground @ Critical Point = **635.02**
Actual Vertical Clearance = ***51.53***
Preferred Vertical Clearance = *15.0*
Required Vertical Clearance = *14.5*

TRANSYSTEMS CORPORATION

Made By MTN **Date** 04/11/06 **Job No.** P403030064
Checked By PJP **Date** 04/11/06 **Sheet No.**

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER PORTSMOUTH-MINFORD ROAD **PID #** 19415

Alternative 3 - 5-68" web cont. steel plate girders (A709, Gr. 50W), 4 spans ***Point Location:*** ***B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	34	=	-1.22
				=	0.00
					0
			Total Adjustment	=	**-1.22**

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**

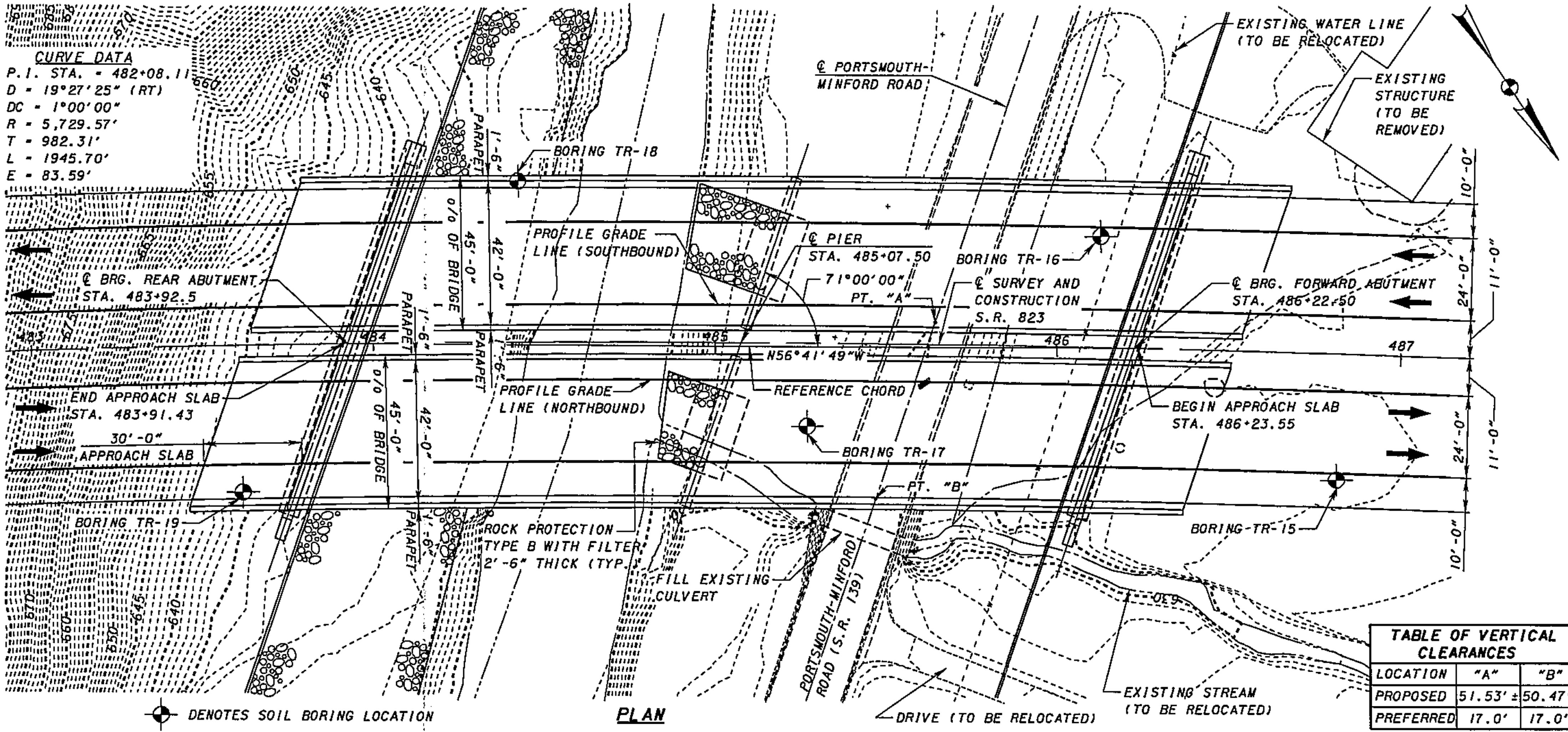
Vertical Clearance at Critical Point

Station @ Critical Point	=	**485+47.17**
Offset Location @ Critical Point	=	**45.00' RIGHT**
Profile Grade Elevation at Critical Point	=	693.96
Adjustment for Cross Slopes to Beam CL	=	-1.22
Top of Deck Elevation @ Critical Point	=	**692.74**
Total Superstructure Depth	=	-6.90
Bottom of Beam Elevation @ Critical Point	=	**685.84**
Approximate Top of Existing Ground @ Critical Point	=	**635.37**
Actual Vertical Clearance	=	***50.47***
Preferred Vertical Clearance	=	*15.0*
Required Vertical Clearance	=	*14.5*

APPENDIX D

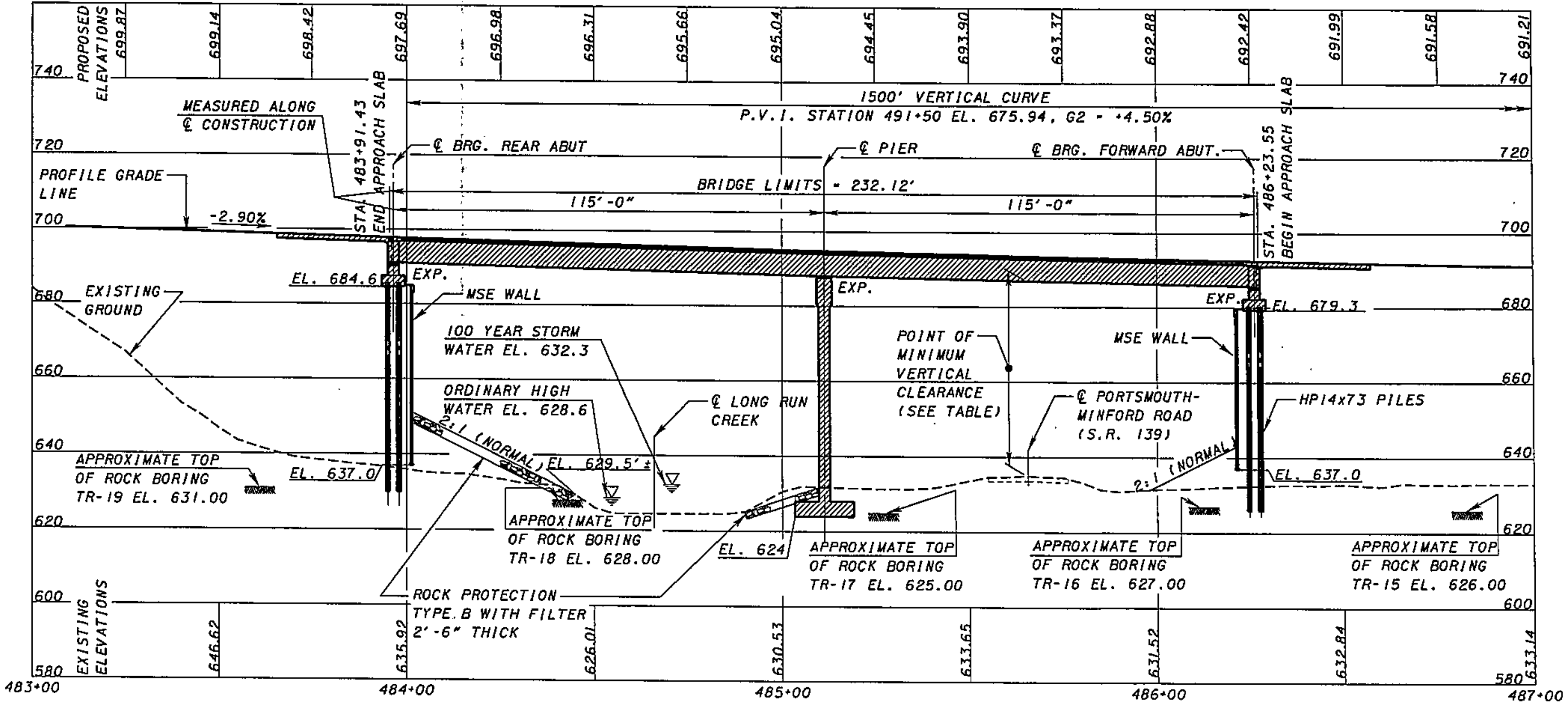
TRANSYSTEMS CORPORATION

CURVE DATA
P.I. STA. = 482+08.11
D = 19°27'25" (RT)
DC = 1°00'00"
R = 5,729.57'
T = 982.31'
L = 1945.70'
E = 83.59'



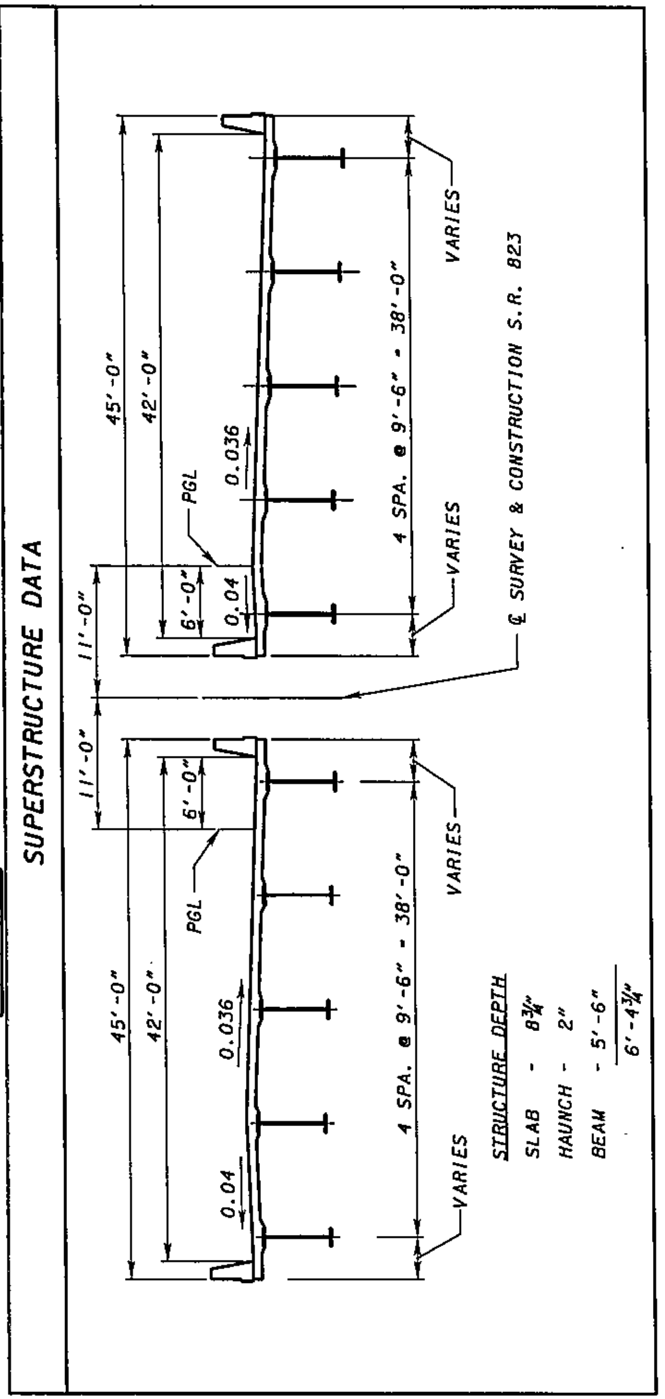
PLAN

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	51.53' ±	50.47' ±
PREFERRED	17.0'	17.0'



ELEVATION ALONG PROFILE GRADE LINE S.R. 823, LEFT BRIDGE

SUPERSTRUCTURE DATA



STRUCTURE DEPTH
SLAB - 8¾"
HAUNCH - 2"
BEAM - 5'-6"
6'-4¾"

PROPOSED STRUCTURE

TYPE: 2 SPAN CONTINUOUS STEEL PLATE GIRDERS A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURE UNITS AND MSE WALL SUPPORTED EMBANKMENT.

SPANS: 115'-0", 115'-0" C/C BEARINGS.

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

LOADING: HS-25 AND ALTERNATE MILITARY LOADING. FWS = 60 PSF.

SKEW: 19°00'00" WITH RESPECT TO REF. CHORD.

SUPER ELEVATION: 0.036 FT/FT.

ALIGNMENT: 1°00'00" CURVE TO THE RIGHT.

WEARING SURFACE: 1" MONOLITHIC CONCRETE.

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY
TRANSYSTEMS CORPORATION
720 EAST PETE ROSE WAY, SUITE 300, CINCINNATI, OHIO 45202

DESIGNED	DRAWN	REVIEWED	DATE
PJP	MTN	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY
STA. 483+91.43
STA. 486+23.55

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD RD. (S.R. 139)

SCI-823-0.00
PID 19415

CURVE DATA
P.I. STA = 482+08.11
Δ = 19°27′25″ (RT)
DC = 1°00′00″
R = 5,729.57′
T = 982.31′
L = 1945.70′
E = 83.59′

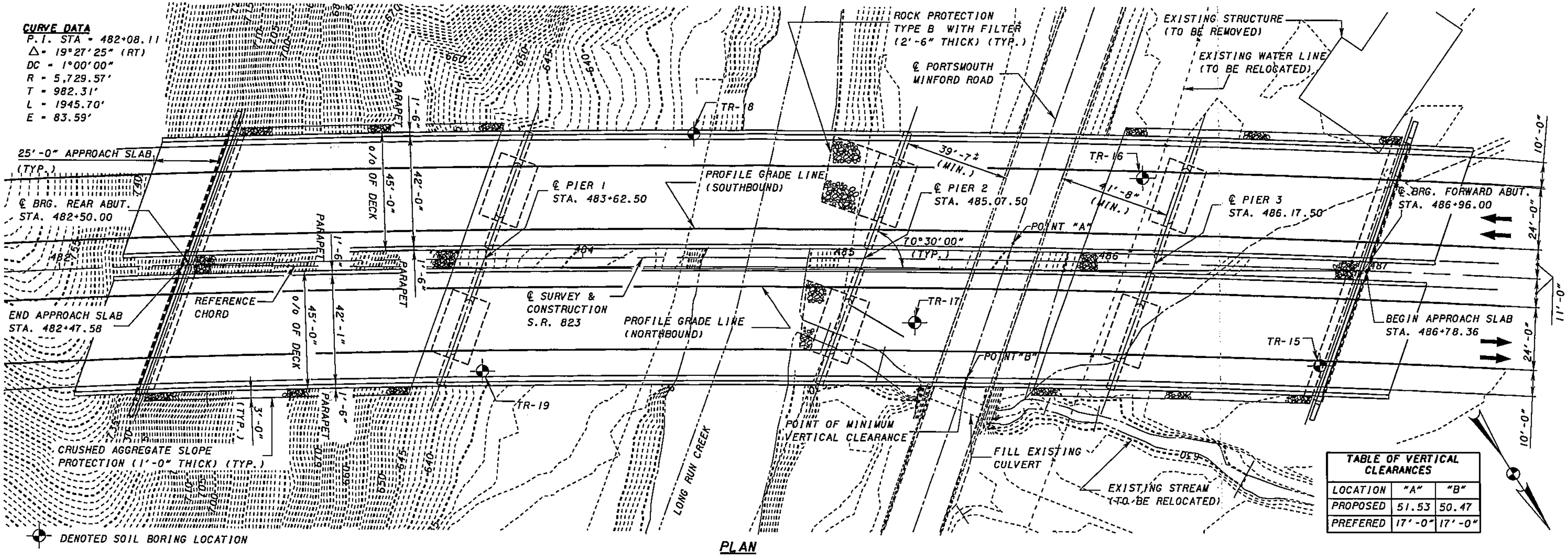
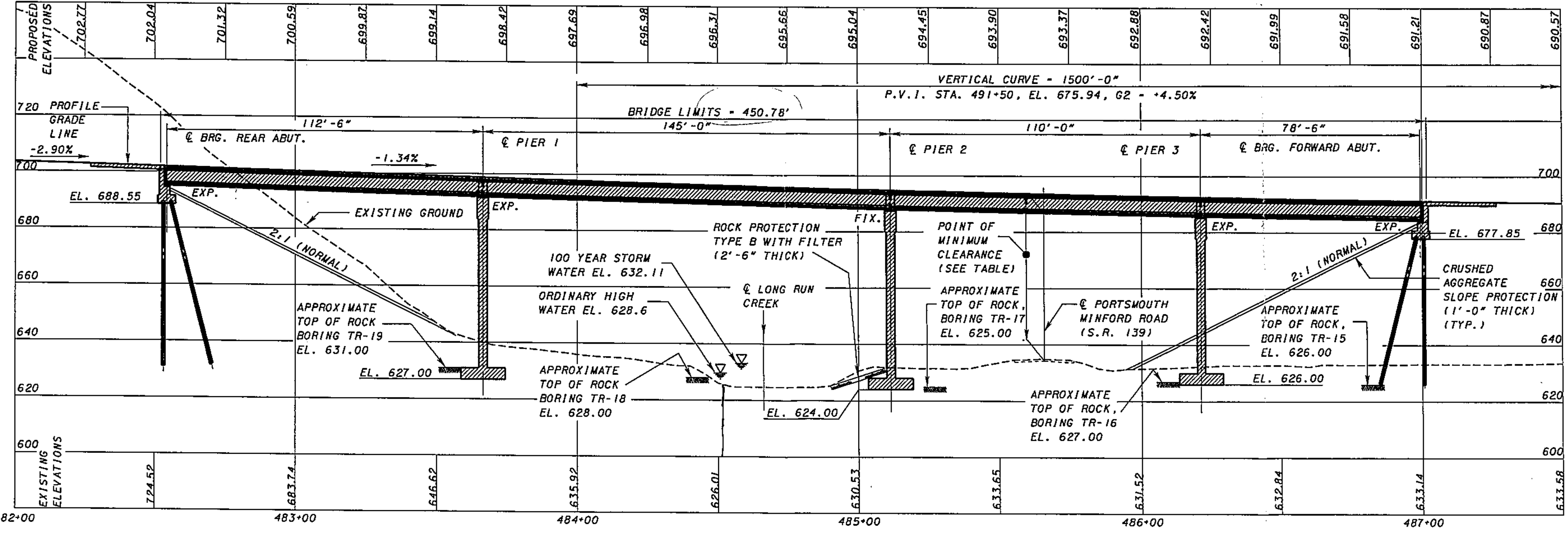


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	51.53	50.47
PREFERED	17′-0″	17′-0″

PLAN



ELEVATION ALONG PROFILE GRADE LINE S.R. 823, LEFT BRIDGE

PRELIMINARY SITE PLAN - ALTERNATE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH MINFORD (S.R. 139)

SCIOTO COUNTY
STA. 482+47.58
STA. 486+98.36

DESIGNED	DRAWN	REVIEWED	DATE
PJP	CAS	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

DESIGN AGENCY
TRANSYSTEMS CORPORATION

SCI-823-0.00
PID 19415

2 / 4

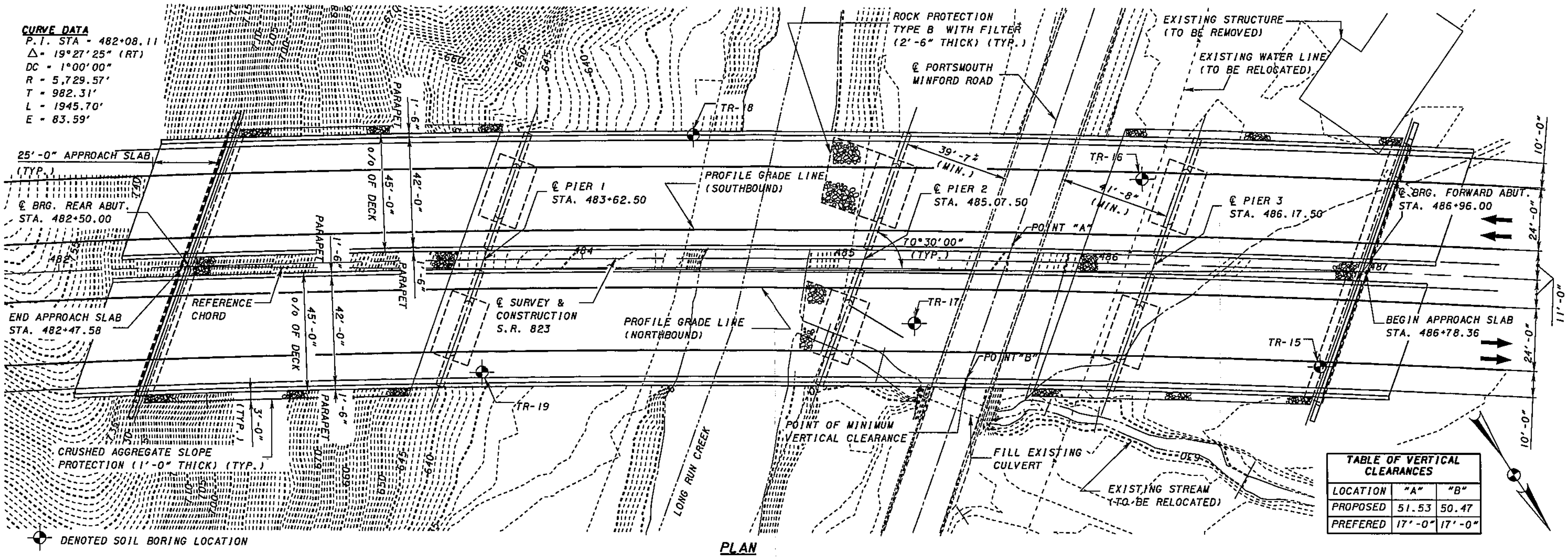
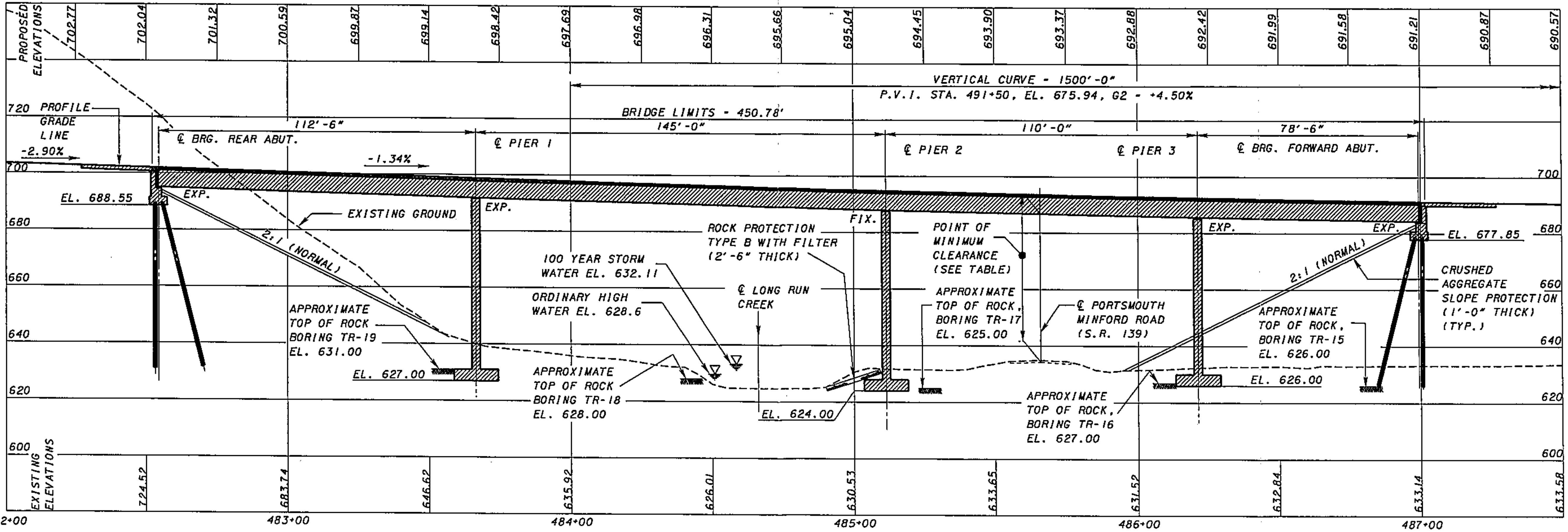


TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	51.53	50.47
PREFERED	17'-0"	17'-0"

PLAN



ELEVATION ALONG PROFILE GRADE LINE S.R. 823, LEFT BRIDGE

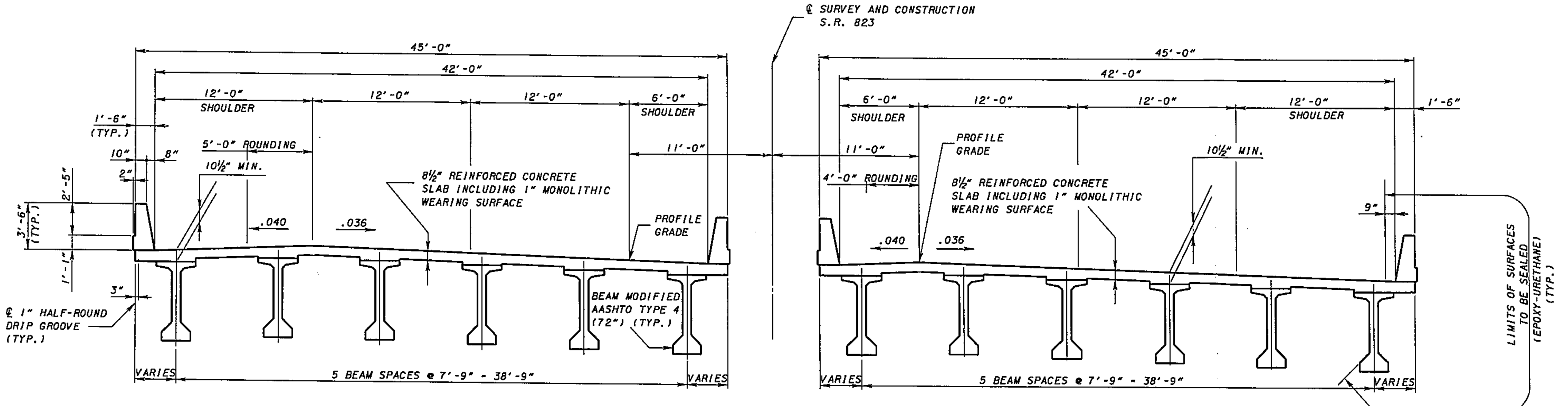
DESIGN AGENCY
TRANSYSTEMS CORPORATION

DESIGNED	DRAWN	REVIEWED	DATE
PJP	CAS	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

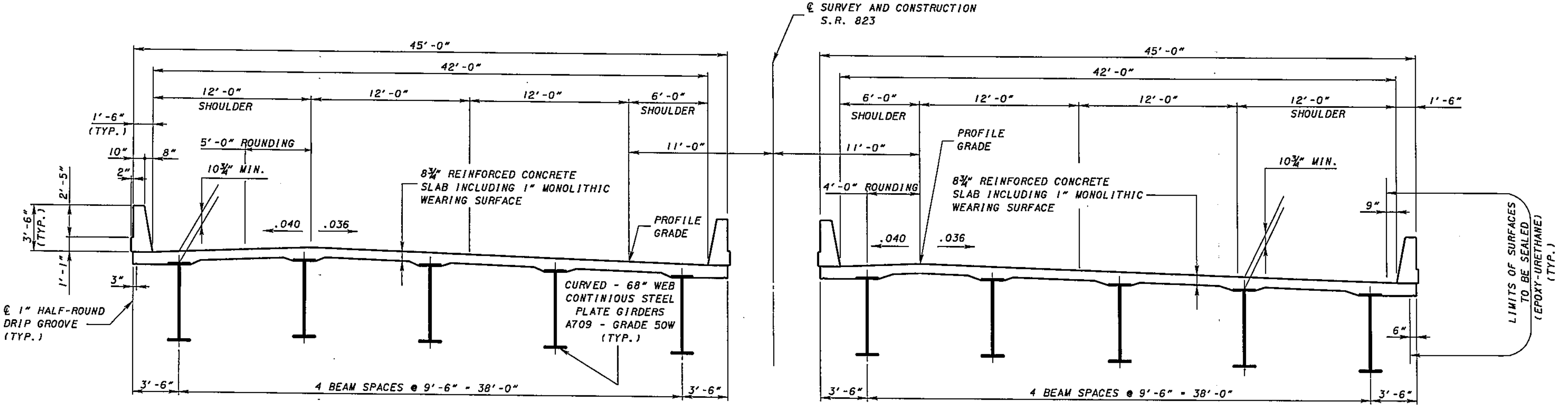
SCIOTO COUNTY
STA. 482+47.58
STA. 486+98.36

PRELIMINARY SITE PLAN - ALTERNATE 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH MINFORD (S.R. 139)

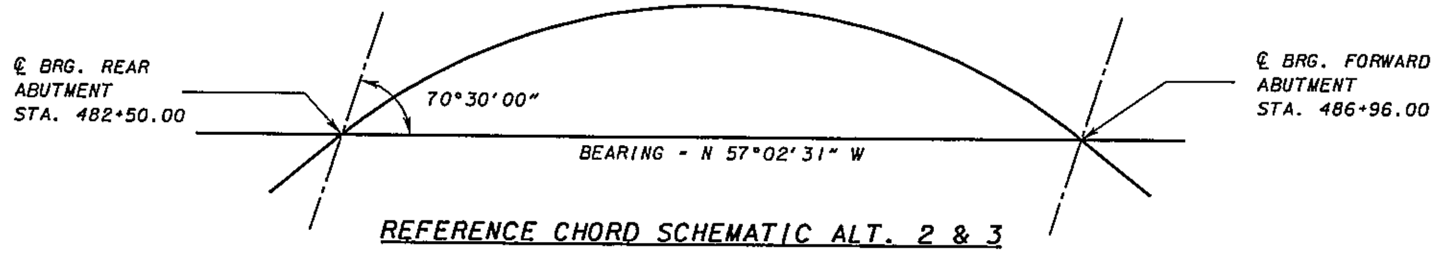
SCI-823-0.00
PID 19415



ALTERNATIVE 2



ALTERNATIVE 3



REFERENCE CHORD SCHEMATIC ALT. 2 & 3

DESIGN AGENCY
TRANSYSTEMS CORPORATION
700 EAST PETE ROSE WAY, SUITE 300, CINCINNATI, OHIO 45202

DESIGNED	DRAWN	REVIEWED	DATE
PJP	CAS	JRC	4/13/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	

TRANSVERSE SECTION - ALTERNATIVE 2 AND 3
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD (S.R. 139)

SCI-823-0.00
PID 19415

APPENDIX E

TRANSYSTEMS
CORPORATION

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 27, 2006

Michael D. Weeks, P.E., P.S.
TranSystems Corporation
5747 Perimeter Drive, Suite 240
Dublin, OH 43017

Re: **Preliminary MSE Wall Evaluations**
Portsmouth – Minford Road
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0007

Dear Mr. Weeks:

This letter includes the findings of preliminary evaluations of mechanically stabilized earth (MSE) retaining walls on the above-referenced project. The findings included in this letter pertain to the MSE walls at the intersection of proposed 823 and Portsmouth – Minford Road. The findings of other preliminary MSE wall evaluations will be submitted in separate documents at a later date.

It should be noted that the results of these evaluations are based upon the findings of four preliminary structural borings. Boring logs for borings TR-15, TR-16, TR-18, and TR-19 are attached. After the bridge design is finalized, it will be necessary to drill additional borings in the area of the proposed MSE walls in accordance with ODOT's specifications for subsurface investigations in order to finalize the MSE wall evaluations.

An MSE retaining wall essentially consists of good quality backfill material with layers of metal or plastic reinforcing that are attached to concrete facing panels. The MSE wall and associated backfill should be constructed in accordance with the specifications of the manufacturer of the MSE wall.

At the time this letter was prepared, it was understood that the plan location of the bridge structure for proposed 823 over Portsmouth – Minford Road is similar to the location shown on the plan and profile drawings dated 07/09/05. See attached plan and profile drawing. It is understood that the planned structure is being modified as follows: placing MSE walls at approximately stations 484+08 and 486+08 to contain the abutments and hold back the roadway embankment, thus shortening the bridge structure. Furthermore, it is understood that the height of the MSE wall at station 484+08 (Rear Abutment) will be approximately 64 feet high, while the MSE wall at station 486+08 (Forward Abutment) will be approximately 61.5 feet high.

A preliminary global stability analysis and preliminary bearing capacity analysis was performed for the MSE walls at this bridge location in accordance with ODOT and AASHTO guidelines. The MSE walls were also analyzed for sliding and overturning. At the time this letter was prepared, it was not known what foundation type was to be used at this site to support the bridge abutments. However, the use of MSE walls at this site does not preclude the use of most common foundation types. Once a foundation type has been selected, DLZ should be informed so that the analyses may be revised as necessary.

Preliminary calculations for bearing capacity, sliding and overturning, as well as the results of the global stability analyses are attached. Other external and internal stability analyses are required for the design of an MSE wall, but are considered outside the scope of this report. The parameters required to perform the stability analyses are presented below.

In accordance with ODOT guidelines, a unit weight of 120 pcf and a friction angle of 34 degrees was selected for the backfill material in the reinforced zone. Similarly, the fill material used to construct the roadway embankments is assumed to have a unit weight of 120 pcf and a friction angle of 30 degrees. If the embankment fill material or backfill material for the reinforcing zone has properties significantly different from these values, DLZ should be informed so that the analyses may be revised as necessary.

The results of analyses for the MSE walls at station 484+08 (Rear Abutment) and station 486+08 (Forward Abutment) will be presented separately in this letter.

MSE Wall Evaluation at Station 484+08 (Rear Abutment)

In the area of this proposed MSE wall, boring TR-18 encountered 12 inches of topsoil at the surface. Below the topsoil layer, primarily loose brown silt (A-4b) was encountered to a depth of 3.0 feet below ground surface. Below 3.0 feet, primarily loose brown sandy silt (A-4a) was encountered to a depth of approximately 7.3 feet below ground surface at the top of bedrock. Underlying the soil, this boring encountered hard, slightly weathered sandstone to the bottom of the boring, at a depth of 20.3 feet.

The MSE wall at the rear abutment is understood to be approximately 64.0 feet high. The minimum required embedment depth for this wall is H/10 or 6.4 feet.

Analyses for the MSE wall bearing on natural soils at this location yielded acceptable factors of safety for global stability, bearing capacity, sliding and overturning. It should be noted the minimum embedment depth is only slightly above the bedrock surface. Therefore, it should be anticipated that bedrock may be encountered while excavating for the leveling pad. It should be noted that variations in the topography may be encountered within the proposed footprint of the proposed MSE wall, causing the bedrock elevation to vary significantly. If soft soils are encountered while excavating for the MSE wall leveling pad, these soils should be removed and replaced with compacted granular fill. In areas where compacted granular fill is to be placed on bedrock, a level bench must be cut into the rock to place the fill for stability purposes. For stability, preliminary calculations have shown that a minimum reinforcement length of 0.8H or 49.0 feet is required for stability.

It should be noted that the foundation leveling pad of the MSE wall at the rear abutment is in close proximity to Long Run Creek, which is running essentially parallel to Portsmouth - Minford Road. The approximate elevation of bedrock under the MSE wall is 624 feet, which is near the bottom of the creek. If scour and erosion near the TOE of the MSE wall are a concern, then slope protection should be provided with riprap.

MSE Wall Evaluation at Station 486+08 (Forward Abutment)

In the area of this proposed MSE wall, boring TR-15 encountered two inches of topsoil at the surface. Below the topsoil layer, primarily very soft to stiff brown sandy silt (A-4a) was encountered to a depth of 7.0 feet below ground surface, at the top of bedrock. Underlying the soil, this boring encountered medium hard to hard, slightly to moderately weathered sandstone to the bottom of the boring, at a depth of 18.0 feet.

The MSE wall at the forward abutment is understood to be approximately 61.5 feet high. The minimum required embedment depth for this wall is H/10 or 6.2 feet.

Initial analyses for the MSE wall bearing on natural soils at this location yielded inadequate factors of safety for undrained bearing capacity, undrained sliding, and undrained global stability. Consequently, analyses were performed assuming overexcavation to the top of bedrock and backfilled with compacted, granular fill. These analyses indicated adequate safety factors for both undrained and drained conditions. As a result, it is recommended that the soils beneath the proposed MSE wall be overexcavated to rock and replaced with compacted, granular fill. It should be anticipated that variations in the topography may be encountered within the footprint of the proposed MSE wall, causing the bedrock elevations to vary significantly. In areas where compacted granular fill is to be placed on bedrock, a level bench must be cut into the rock to place the fill for stability purposes. A minimum reinforcing length of 0.7H or 47 feet is required for the MSE wall at this location.

Settlement calculations are not necessary for the MSE walls at this site. The MSE walls will either bear on or near bedrock resulting in negligible settlement.

Calculations for bearing capacity, overturning, and sliding are attached for both MSE wall locations. A drawing showing the results of the global stability analyses is also attached.

A summary of soil properties, summary of the results of calculations, and results of global stability analyses are attached.

We appreciate having the opportunity to be of service to you on this project. Please do not hesitate to call if you have any questions concerning our preliminary findings.

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

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

Encl: As noted

cc: file

M:\proj\0121\3070.03\Stability Analyses\Documents\MSE Wall letters\04 Portsmouth-Minford Road\MSE Wall Findings - Portsmouth-Minford Rd 03-27-06 SJR.doc

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-15

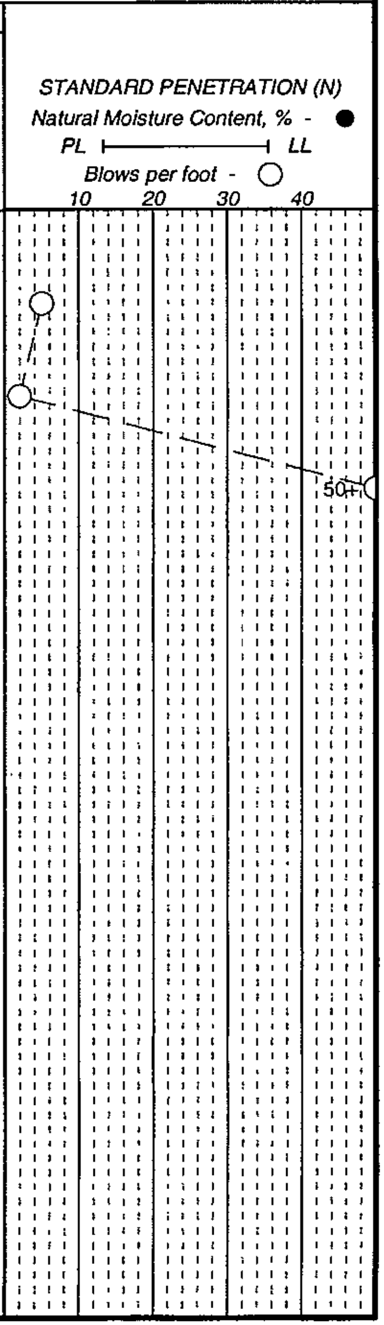
Location:

Date Drilled: 7/9/04

WATER OBSERVATIONS:
Water seepage at: 6.0'
Water level at completion: none

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0.2	631.3 631.1						Topsoil - 2"						
		4 2 3	14	1		1.0	Stiff to very stiff brown SANDY SILT (A-4a), trace gravel; moist.						
		2 1 1	13	2		<0.25	@ 3.5' to 5.0', very soft, contains rust stains.						
7.0	624.3	3 20 50/2	13	3A 3B		3.25	Severely weathered brownish-gray SILTSTONE fragments.						
8.0	623.3	Core 120"	Rec 99"	RQD 70%	R-1		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, massively bedded, slightly fractured. @ 8.0' to 9.0', probable core loss.						
18.0	613.3						Bottom of Boring - 18.0'						

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



DRAFT

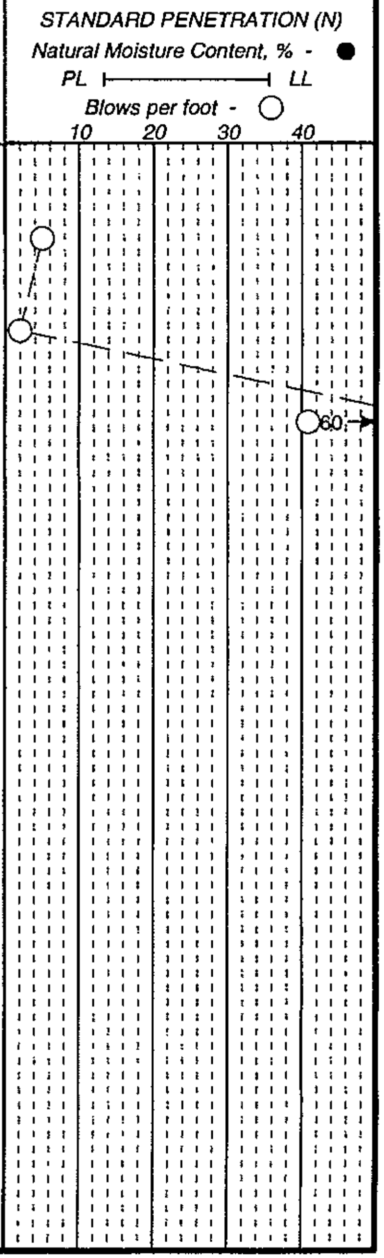
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

Client: TranSystems, Inc.	*Project:* SCI-823-0.00	*Job No.* 0121-3070.03
LOG OF: Boring TR-16	*Location:*	*Date Drilled:* 7/9/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 6.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	631.9						Medium stiff brown SANDY SILT (A-4a); moist.						
		2 3 2	16	1		1.0							
5		1 1 1	15	2		0.75							
		4 10 50/5	12	3		--	@ 6.0' to 7.4', contains rock fragments.						
9.2	622.7						Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly weathered, micaceous, argillaceous, massively bedded, slightly fractured.						
10													
		Core 120"	Rec 118"	RQD 85%	R-1								
15													
							@ 17.0', contains few argillaceous laminations.						
18.5	613.4						Bottom of Boring - 18.5'						
20													
25													
30													

DRAFT



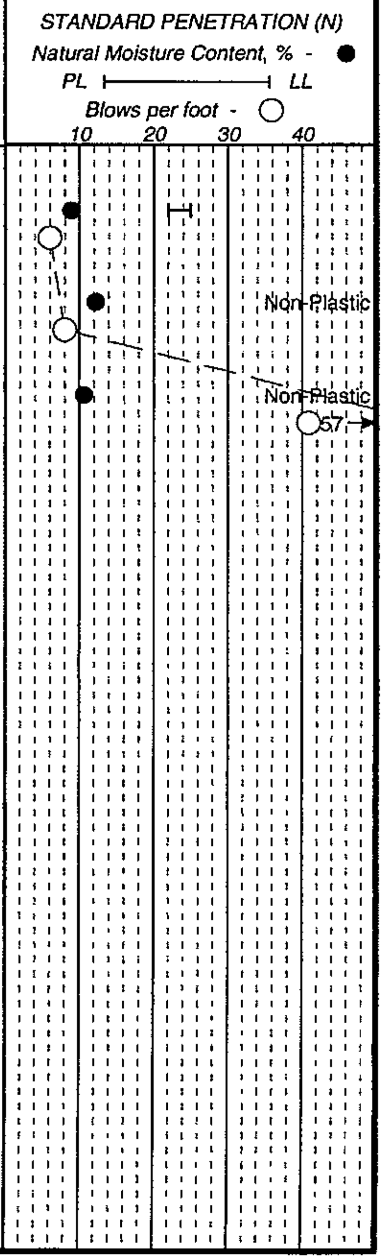
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-18 | *Location:* | *Date Drilled:* 8/17/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 9.4' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No.		Hand Penetro-meter (tsf)	DESCRIPTION	GRADATION					
				Drive	Press / Core			% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	631.3						Topsoil - 12"						
1.0	630.3	2 3 3	18	1			Loose brown SILT (A-4b), little fine to coarse sand, little gravel; contains roots; dry to damp.	13	7	--	9	58	13
3.0	628.3	3 4 4	18	2			Loose brown SANDY SILT (A-4a), little clay, trace to little gravel; damp.	0	3	--	40	45	12
5		6 7 50/3	12	3				11	20	--	28	31	10
7.3	624.0	Core 84"	Rec 84"	RQD 88%	R-1		Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, slightly to moderately fractured. @ 7.3' to 7.6', broken. @ 7.3' to 7.8',8.0',8.6' to 8.8', brown, rust-stained fracture. @ 7.3' to 7.8', vertical fracture.						
10													
15		Core 72"	Rec 71"	RQD 94%	R-2								
20 20.3	611.0						Bottom of Boring - 20.3'						
25													
30													



DRAFT

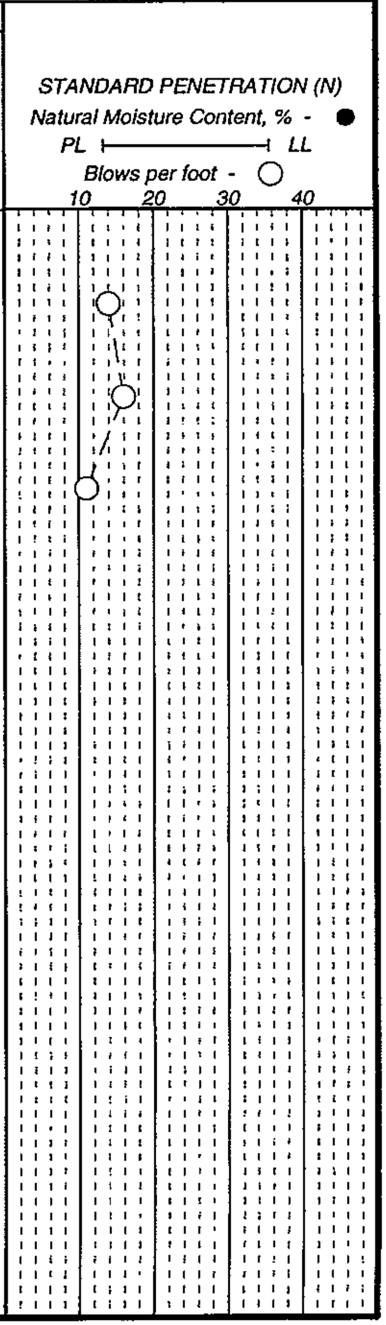
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-19
Location:
Date Drilled: 8/16/04 to 8/17/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 16.3' (includes drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	633.0						Topsoil - 12"						
1.0	632.0	3 7 7	18	1			Medium dense brown SANDY SILT (A-4a), trace gravel, trace clay; contains sandstone fragments; damp.						
5		4 7 9	18	2									
		4 5 6	18	3									
8.7	624.3	50/2	2	4			Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, massively bedded, slightly fractured. @ 9.2' to 9.4', decomposed. @ 8.8' to 9.0', brown. @ 13.1' to 13.3', vertical fracture.						
10		Core 30"	Rec 30"	RQD 57%	R-1								
15		Core 108"	Rec 108"	RQD 70%	R-2		@ 13.9' to 14.0', vertical fracture. @ 15.5', unfractured to slightly fractured. @ 14.7' to 15.5', broken zone. @ 15.4' to 15.5', clay filled fracture.						
20.2	612.8						Bottom of Boring - 20.2'						
25													
30													



PRELIMINARY SITE PLAN - ALTERNATIVE 3

BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH-MINFORD RD (S.R. 139)

SCIOTO COUNTY
STA. 485+36.36
STA. 486+78.64

SCI-823-0.00
PID 19415

1/2

TranSystems Corporation

DESIGNED JDH	CHECKED RER	DRAWN MLA	REVISED
REVIEWED KFF	DATE 7/9/05	STRUCTURE FILE NUMBER	

FIRST GUARDRAIL POST OFF BRIDGE LOCATIONS		
LOCATION	STATION	SIDE
REAR ABUT.	x	RT.
REAR ABUT.	x	LT.
FWD. ABUT.	x	RT.
FWD. ABUT.	x	LT.

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-15	486+82.23	36.94' RT.
TR-16	486+12.38	32.33' LT.
TR-17	485+26.88	21.34' RT.
TR-18	484+42.66	46.98' LT.
TR-19	483+60.89	42.99' RT.

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

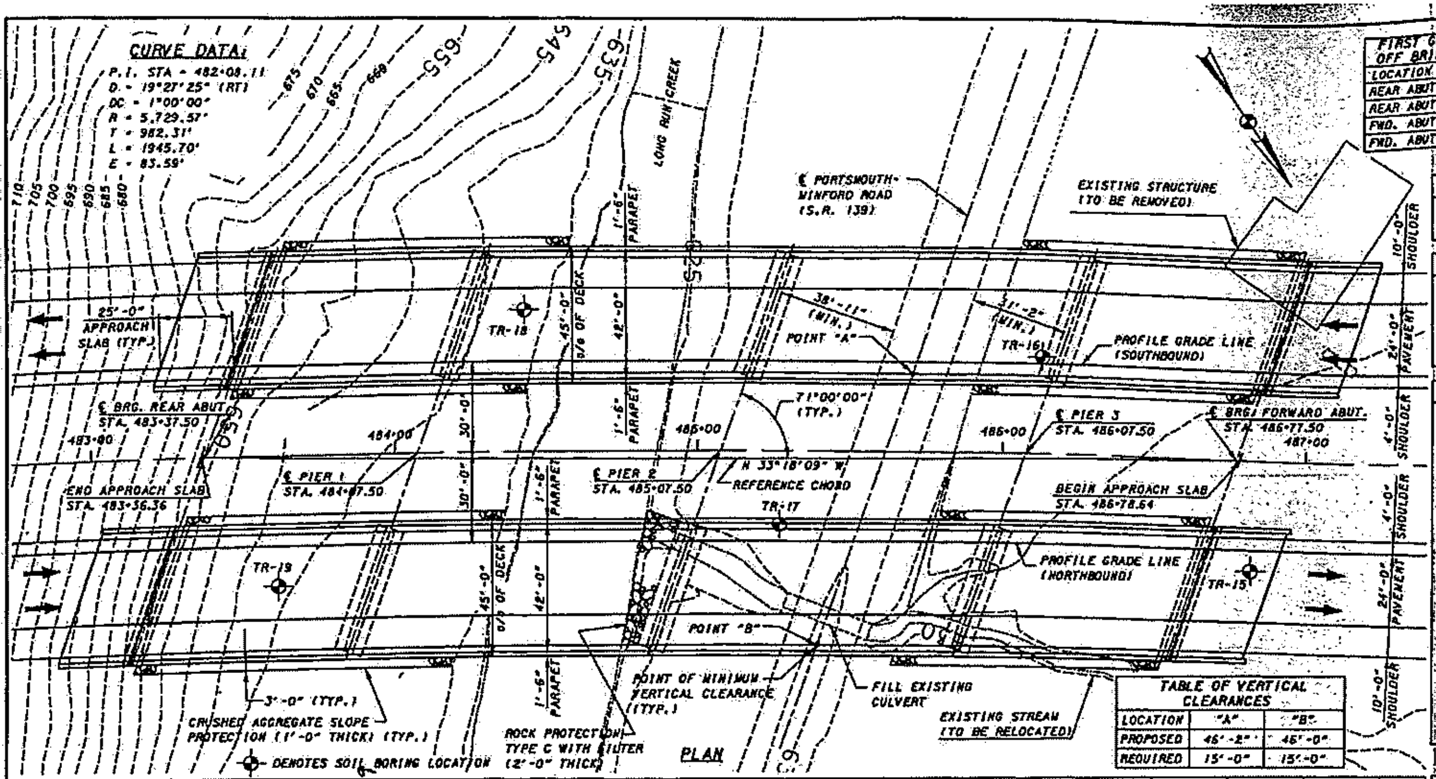
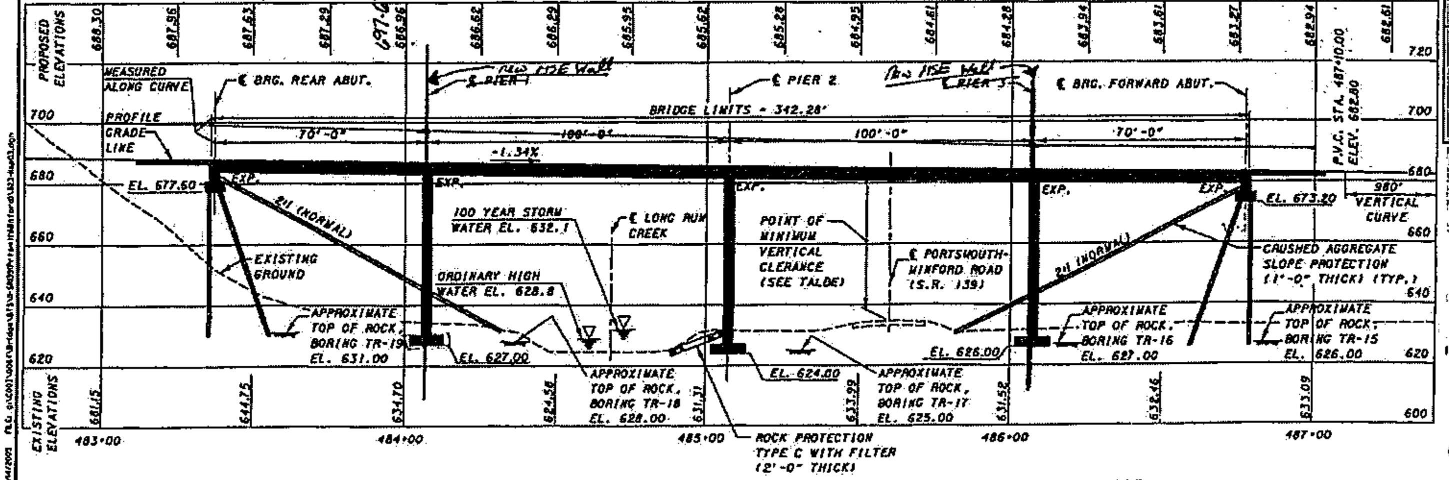


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	46'-2"	46'-0"
REQUIRED	15'-0"	15'-0"



ELEVATION ALONG ℄ SURVEY & CONSTRUCTION S.R. 823

TRAFFIC DATA

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

PROPOSED STRUCTURE

TYPE: 4-SPAN CONTINUOUS STEEL ROLLED BEAM A709 GRADE 50W WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE SUBSTRUCTURE UNITS.

SPANS: 70'-0", 100'-0", 100'-0", 70'-0" C/C BEARINGS. (MEASURED ALONG CURVE)

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

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

SKEW: 19°00'00" WITH RESPECT TO REF. CHORD.

CROWN: NORMAL 0.016 FT./FT.

ALIGNMENT: 1°00'00" CURVE.

WEARING SURFACE: 1" MONOLITHIC CONCRETE.

APPROACH SLABS: AS-1-81 (25'-0" LONG).

LATITUDE:

LONGITUDE:

STRUCTURE FILE NO.:

HYDRAULIC DATA

DRAINAGE AREA = 13.424 sq.mi. = 8591 acres

Q_{50} = 2230 cfs	Q_{100} = 2572 cfs
V_{50} = 6.8 fps	V_{100} = 7.1 fps
EL_{50} = 631.7	EL_{100} = 632.1

NOTES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE. SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING CAPACITY OF 15 TSF.

UTILITIES:

UTILITIES DISPOSITION WILL BE ADDRESSED DURING TS&L SUBMITTAL.

$XXX
$YYY

Soil Parameters Used in MSE Wall Stability Analyses
Portsmouth – Minford Road

Zone	Soil Type	Unit Weight (pcf)	Strength Parameters			
			Undrained		Drained	
			c	ϕ	c'	ϕ'
Reinforced Fill	Compacted Granular Fill	120	0	34	0	34
Retained Soil	Compacted Embankment Fill	120	0	30	0	30
Foundation Soil (Rear Abutment) (Borings TR-18&19)	Loose to Medium Dense Sandy Silt	125	0	29	0	29
Foundation Soil (Forward Abutment) (Boring TR-15&16)	Very Soft to Stiff Sandy Silt	125	500	0	0	29
Foundation Soil (Forward Abutment)	Compacted Granular Fill	125	0	36	0	36

MSE Retaining Wall Parameters and Analyses Results
Portsmouth – Minford Road (Rear Abutment) *Natural Soil foundation*

Retained Soil (New Embankment)
Unit Weight = 120 pcf
Coefficient of Active Earth Pressure (K_a) = 0.33
(Based on $\Phi = 30^{\circ}$)

Sliding along base of MSE wall
Sliding Coefficient (μ)(0.67) = tan 29°(0.67) = 0.37 Use (μ)(0.67)
Use (μ)(0.67) =0.35 as a maximum value as per AASHTO, BDM,303.4.1.1

Allowable Bearing Capacity – Undrained Condition
q_{all} = 12,695 psf
For MSE wall with minimum 56-foot long reinforcing

Allowable Bearing Capacity – Drained Condition
q_{all} = 12,695 psf
For MSE wall with minimum 56-foot long reinforcing

Global Stability
Factor of Safety – Undrained Condition = NA (Sandy Silt – Drained Condition)
Factor of Safety – Drained Condition = 2.0
Factor of Safety – Seismic Condition = 1.9
For MSE wall with 56-foot long reinforcing

Estimated Settlement of MSE volume
Total settlement = 0 inches
Differential settlement = 0 <1/100

Full Height of MSE Wall = 64.0 feet
Minimum Embedment Depth = 6.4 feet
Minimum Length of Reinforcement for External Stability = 56 feet

MSE Retaining Wall Parameters and Analyses Results
Portsmouth – Minford Road (Forward Abutment)
Compacted Granular Fill Foundation

Retained Soil (New Embankment)
Unit Weight = 120 pcf
Coefficient of Active Earth Pressure (K_a) = 0.33
(Based on $\Phi = 30^{\circ}$)

Sliding along base of MSE wall
Sliding Coefficient (μ)(0.67) = tan 29°(0.67) = 0.49 Use (μ)(0.67)
Use (μ)(0.67) =0.55 as a maximum value as per AASHTO, BDM,303.4.1.1

Allowable Bearing Capacity – Undrained Condition
q_{all} = 28,843 psf
For MSE wall with minimum 47-foot long reinforcing

Allowable Bearing Capacity – Drained Condition
q_{all} = 28,843 psf
For MSE wall with minimum 47-foot long reinforcing

Global Stability
Factor of Safety – Undrained Condition = 2.4
Factor of Safety – Drained Condition = 2.4
Factor of Safety – Seismic Condition = 2.3
For MSE wall with 47-foot long reinforcing

Estimated Settlement of MSE volume
Total settlement = 0 inches
Differential settlement = 0 < 1/100

Full Height of MSE Wall = 61.5 feet
Minimum Embedment Depth = 6.2 feet
Minimum Length of Reinforcement for External Stability = 47 feet

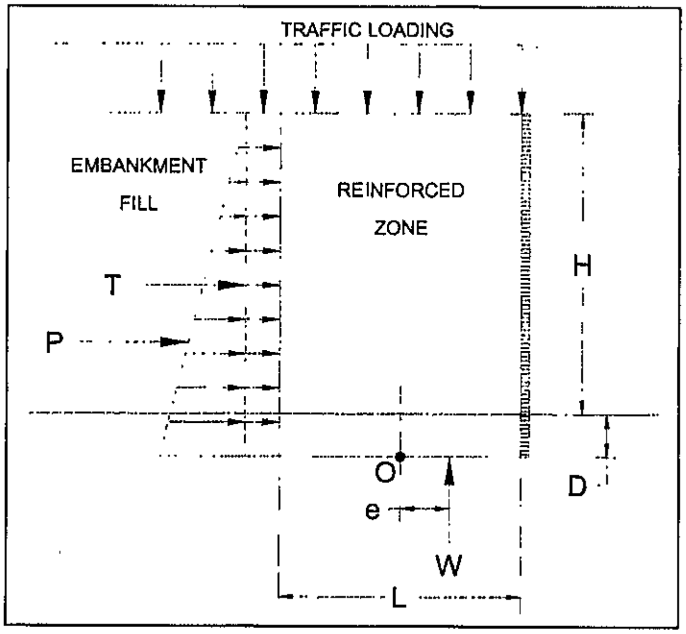
DLZ SUBJECT

Client TranSystems / ODOT D-9
Project SCI 823-0.00 Portsmouth Bypass
Item Bearing Capacity (Rear Abutment)
04 - 823 over Portsmouth - Minford Rd.
Borings TR-18 & TR-19

JOB NUMBER 0121-3070.03
SHEET NO. OF
COMP. BY SJR DATE 3/23/06
CHECKED BY DATE

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 10,614 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma' B N_\gamma$$

q_{ULT} = 31,738 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 12,695 psf

Factor of Safety = **2.99** **OK**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma' B N_\gamma$$

q_{ULT} = 31,738 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 12,695 psf

Factor of Safety = **2.99** **OK**

Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	120	pcf	Unit weight	Foundation soil
c	=	0	psf	Cohesion	Foundation soil
ϕ	=	29	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	29	deg.	Friction ang.	Foundation soil

Loads and Parameters

q_t	=	240	psf	Traffic loading
L=B	=	56.32	ft	Length of MSE reinforcement
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	6.4	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	70.4	ft	
H	=	64	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	23.467	ft	Moment arm
Γ Wt	=	35.2	ft	Moment arm
B'	=	46.10	ft	
γ'	=	57.6	pcf	
W_t		13,517	lb/ft of wall	Weight from traffic
W_{mse}	=	475,791	lb/ft of wall	Weight from MSE wall

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	27.86	N_c	27.86
N_q	16.44	N_q	16.44
N_γ	19.34	N_γ	19.34

Eccentricity of Resultant Force

e = 5.11 ft

Kern

e < L/6 = 9.39 ft

DLZ

SUBJECT	Client TranSystems / ODOT D-9	JOB NUMBER	0121-3070.03
	Project SCI 823-0.00 Portsmouth Bypass	SHEET NO.	OF
	Item MSE Wall Stability (Rear Abutment)	COMP. BY SJR	DATE 03/23/06
	04 - 823 over Portsmouth - Minford Rd.	CHECKED BY	DATE
	Borings TR-18 & TR-19		

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=64'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

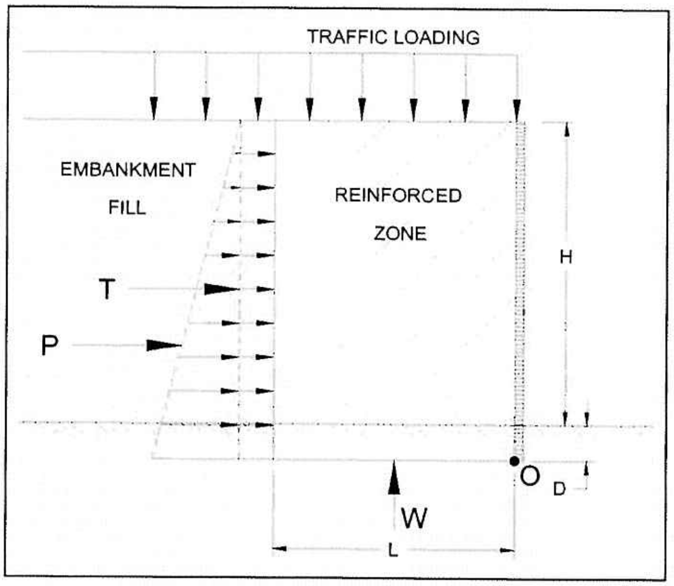
Wall Properties

H+D	=	70.4	feet
γ_{mse}	=	120	pcf
L	=	56.32	feet
L factor	=	0.80	Length factor-range (0.7 - 1.0)
ϕ	=	30	deg Friction Angle of Embankment Fill

Foundational Soil Properties

c	=	0	psf	Cohesion
ϕ'	=	29	deg	Friction angle
ω_T	=	240	psf	Traffic loading

RESISTANCE AGAINST SLIDING ALONG BASE



Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 103,708 lbs per foot of wall

Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.37

0.67μ Max. = 0.35 {AASHTO, Bridge Design Manual, 303.4.1.1}

P_r = 166,527 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 0 lbs per foot of wall

Use Drained Value

$$FS = \frac{P_r}{P_a}$$

Calculated FS = **1.61** Required FS = 1.50 Resistance Against Sliding is **OK**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 13,398,285 lb-ft

$\Sigma M_{overturning}$ = 2,499,094 lb-ft

$$\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$$

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

$$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturnin\ g}}$$

Calculated FS = **5.36** Required FS = 2.00 Resistance Against Overturning is **OK**

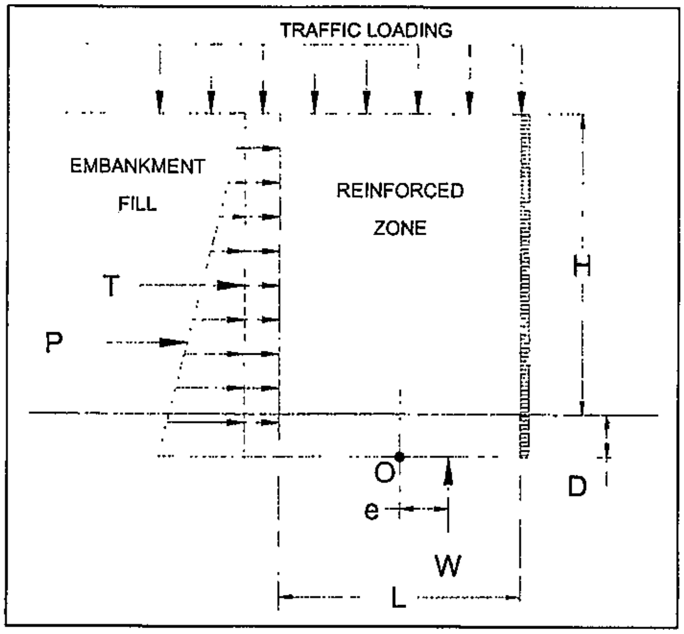
DLZ SUBJECT

Client TranSystems / ODOT D-9
Project SCI 823-0.00 Portsmouth Bypass
Item Bearing Capacity (Forward Abutment)
04 - 823 over Portsmouth - Minford Rd.
Borings TR-15 & TR-16

JOB NUMBER 0121-3070.03
SHEET NO. OF
COMP. BY SJR DATE 3/23/06
CHECKED BY DATE

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 10,221 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma' B N_\gamma$$

q_{ULT} = 2,927 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 1,171 psf

Factor of Safety = **0.29** **No Good**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma' B N_\gamma$$

q_{ULT} = 30,557 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 12,223 psf

Factor of Safety = **2.99** **OK**

Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	120	pcf	Unit weight	Foundation soil
c	=	500	psf	Cohesion	Foundation soil
ϕ	=	0	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	29	deg.	Friction ang.	Foundation soil

Loads and Parameters

ω_t	=	240	psf	Traffic loading
L=B	=	54.16	ft	Length of MSE reinforcement
L factor	=	0.8		Length factor-range (0.7 - 1.0)
D	=	6.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	67.7	ft	
H	=	61.5	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	22.567	ft	Moment arm
Γ Wt	=	33.85	ft	Moment arm
B'	=	44.32	ft	
γ'	=	57.6	pcf	
W_t		12,998	lb/ft of wall	Weight from traffic
W_{mse}	=	439,996	lb/ft of wall	Weight from MSE wall

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	5.14	N_c	27.86
N_q	1.00	N_q	16.44
N_γ	0.00	N_γ	19.34

Eccentricity of Resultant Force

e = 4.92 ft

Kern

e < L/6 = 9.03 ft

DLZ

SUBJECT
Client TranSystems / ODOT D-9
Project SCI 823-0.00 Portsmouth Bypass
Item MSE Wall Stability (Forward Abutment)
04 - 823 over Portsmouth - Minford Rd.
Borings TR-15 & TR-16

JOB NUMBER 0121-3070.03
SHEET NO. OF
COMP. BY SJR DATE 03/23/06
CHECKED BY DATE

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=61.5'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

Wall Properties

$H+D$ = 67.7 feet
γ_{mse} = 120 pcf
L = 54.16 feet
L factor = 0.80
ϕ = 30 deg

Foundational Soil Properties

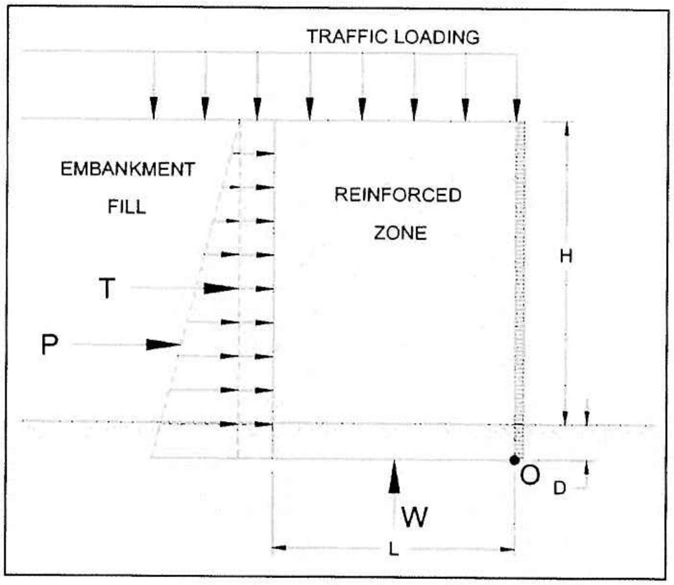
c = 500 psf Cohesion
ϕ' = 29 deg Friction angle
ω_T = 240 psf Traffic loading
Length factor-range (0.7 - 1.0)
Friction Angle of Embankment Fill

RESISTANCE AGAINST SLIDING ALONG BASE

Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 96,111 lbs per foot of wall



Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.37

0.67μ Max. = 0.35 {AASHTO, Bridge Design Manual, 303.4.1.1}

P_r = 153,999 lbs per foot of wall

Use Undrained Value

$P_r = L(c)$ (Undrained)

P_r = 27,080 lbs per foot of wall

USE THIS VALUE

$FS = \frac{P_r}{P_a}$

Calculated FS = **0.28**

Required FS = 1.50

Resistance Against Sliding is **No Good**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 11,915,087 lb-ft

$\Sigma M_{overturning}$ = 2,229,404 lb-ft

$$\Sigma M_{resisting} = \gamma HL\left(\frac{L}{2}\right)$$

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

$$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturnin\ g}}$$

Calculated FS = **5.34**

Required FS = 2.00

Resistance Against Overturning is **OK**

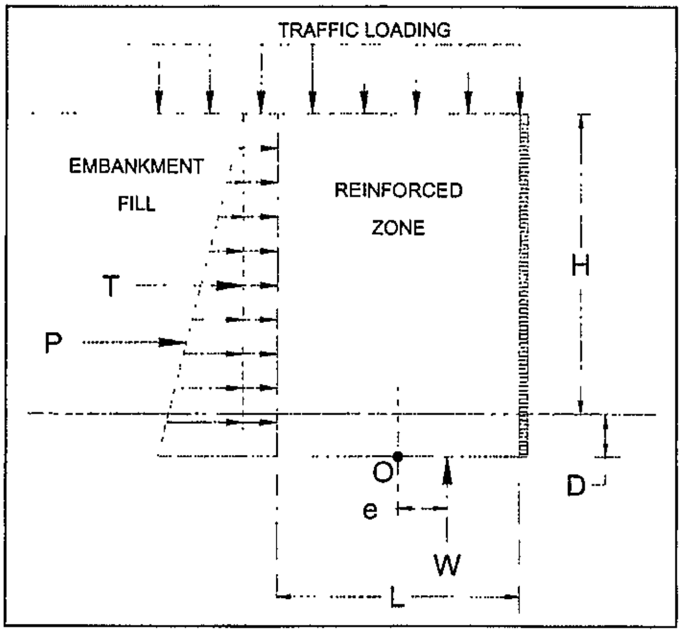
DLZ

SUBJECT
Client TranSystems / ODOT D-9
Project SCI 823-0.00 Portsmouth Bypass
Item Bearing Capacity (Forward Abutment)
04 - 823 over Portsmouth - Minford Rd.
Granular Fill Foundation

JOB NUMBER 0121-3070.03
SHEET NO. OF
COMP. BY SJR DATE 3/23/06
CHECKED BY DATE

BEARING CAPACITY OF A MSE WALL

Ref: {AASHTO; STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 17th Edition, 2002}



Effective Bearing Pressure

$$\sigma_v = \frac{W_t + W_{MSE}}{L - 2e}$$

σ_v = 10,965 psf

Ultimate undrained bearing capacity, q_{ult}

$$q_{ULT} = cN_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 72,107 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 28,843 psf

Factor of Safety = **6.58** **OK**

Ultimate drained bearing capacity, q_{ult}

$$q_{ULT} = c'N_c + \sigma'_D N_q + \frac{1}{2}\gamma B N_\gamma$$

q_{ULT} = 72,107 psf

$$q_{ALL} = \frac{q_{ULT}}{FS}$$

q_{ALL} = 28,843 psf

Factor of Safety = **6.58** **OK**

Soil Properties

γ_{EMB}	=	120	pcf	Unit weight	Embankment fill
ϕ'_{EMB}	=	30	deg.	Friction ang.	Embankment fill
γ_{FDN}	=	120	pcf	Unit weight	Foundation soil
c	=	0	psf	Cohesion	Foundation soil
ϕ	=	36	deg.	Friction ang.	Foundation soil
c'	=	0	psf	Cohesion	Foundation soil
ϕ'	=	36	deg.	Friction ang.	Foundation soil

Loads and Parameters

ω_t	=	240	psf	Traffic loading
L=B	=	47.39	ft	Length of MSE reinforcement
L factor	=	0.7		Length factor-range (0.7 - 1.0)
D	=	6.2	ft	Embedment depth
Dw	=	0	ft	Groundwater depth
H+D	=	67.7	ft	
H	=	61.5	ft	Height of wall
Ka	=	0.33		
Γ Pa	=	22.567	ft	Moment arm
Γ Wt	=	33.85	ft	Moment arm
B'	=	36.15	ft	
γ'	=	57.6	pcf	
W_t		11,374	lb/ft of wall	Weight from traffic
W_{mse}	=	384,996	lb/ft of wall	Weight from MSE wall

Bearing Capacity Factors for Equations

Undrained		Drained	
N_c	50.59	N_c	50.59
N_q	37.75	N_q	37.75
N_γ	56.31	N_γ	56.31

Eccentricity of Resultant Force

e = 5.62 ft

Kern

e < L/6 = 7.90 ft

DLZ

SUBJECT

Client TranSystems / ODOT D-9
Project SCI 823-0.00 Portsmouth Bypass
Item MSE Wall Stability (Forward Abutment)
04 - 823 over Portsmouth - Minford Rd.
Granular Fill Foundation

JOB NUMBER 0121-3070.03
SHEET NO. OF
COMP. BY SJR DATE 03/23/06
CHECKED BY DATE

STABILITY OF MSE WALL

Assumptions:

1 Estimated height of embankment; H=61.5'
2 It is assumed that the bridge is supported on piles
3 Ground water; Dw=0.0'
4 Traffic loading is neglacted in resisting forces
5

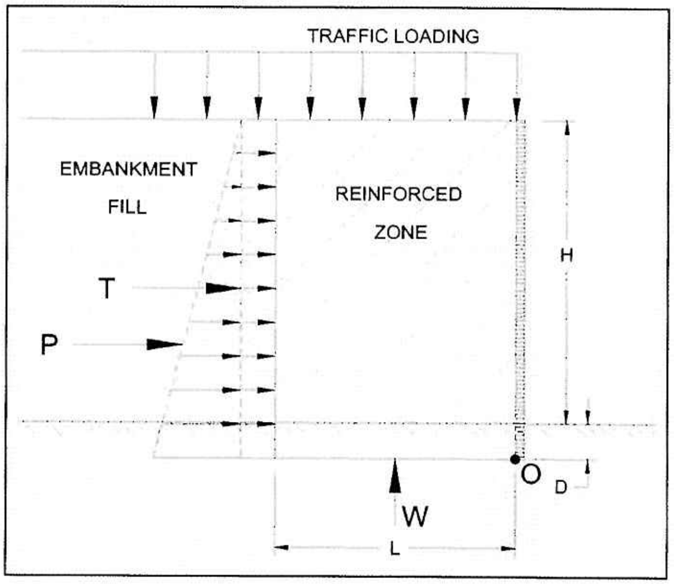
Wall Properties

H+D = 67.7 feet
γ_{mse} = 120 pcf
L = 47.39 feet
L factor = 0.70
ϕ = 30 deg

Foundational Soil Properties

c = 0 psf Cohesion
ϕ' = 36 deg Friction angle
ω_T = 240 psf Traffic loading
Length factor-range (0.7 - 1.0)
Friction Angle of Embankment Fill

RESISTANCE AGAINST SLIDING ALONG BASE



Thrust: $P_a = K_a\left[\frac{1}{2}\gamma H^2 + \omega_T H\right]$

where; $K_a = \tan^2(45 - \frac{\phi}{2})$ K_a = 0.33

P_a = 96,111 lbs per foot of wall

Resistance: $P_r = W(0.67)(\mu)$ (Drained)

where; $\mu = \tan(\phi)$ 0.67μ = 0.49

0.67μ Max. = 0.55 {AASHTO, Bridge Design Manual, 303.4.1.1}

P_r = 188,648 lbs per foot of wall

USE THIS VALUE

$P_r = L(c)$ (Undrained)

P_r = 0 lbs per foot of wall

Use Drained Value

$FS = \frac{P_r}{P_a}$

	Calculated	Required
	FS = **1.96**	FS = 1.50

Resistance Against Sliding is **OK**

RESISTANCE AGAINST OVERTURNING

* Summation of Moments about point "O" (base of wall).
* Traffic loading is neglected in resisting forces

$\Sigma M_{resisting}$ = 9,122,489 lb-ft

$\Sigma M_{overturning}$ = 2,229,404 lb-ft

$$\Sigma M_{resisting} = \gamma H L\left(\frac{L}{2}\right)$$

$$\Sigma M_{overturning} = K_a\left[\frac{1}{2}\gamma H^2\left(\frac{H}{3}\right) + \omega_T H\left(\frac{H}{2}\right)\right]$$

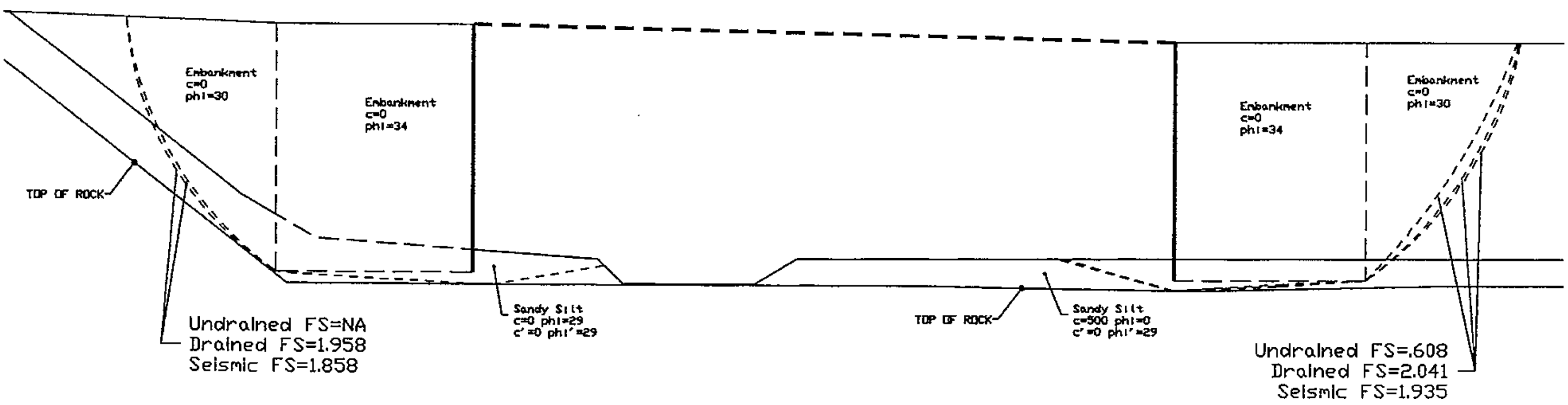
$$FS = \frac{\Sigma M_{resisting}}{\Sigma M_{overturnin\ g}}$$

	Calculated	Required
	FS = **4.09**	FS = 2.00

Resistance Against Overturning is **OK**

MSE Wall Stability
Portsmouth-Minford Road
Rear Abutment Sta. 484+08
Based on TR-18 & TR-19
Composite Strength Values
H=64' (full height)
Embedment=6.4
Length=0.8(H+D)=49'

MSE Wall Stability
Portsmouth-Minford Road
Forward Abutment Sta. 486+08
Based on TR-15 & TR-16
Composite Strength Values
H=61.5' (full height)
Embedment=6.2'
Length=0.8(H+D)=54'



Undrained FS=NA
Drained FS=1.958
Seismic FS=1.858

Undrained FS=.608
Drained FS=2.041
Seismic FS=1.935

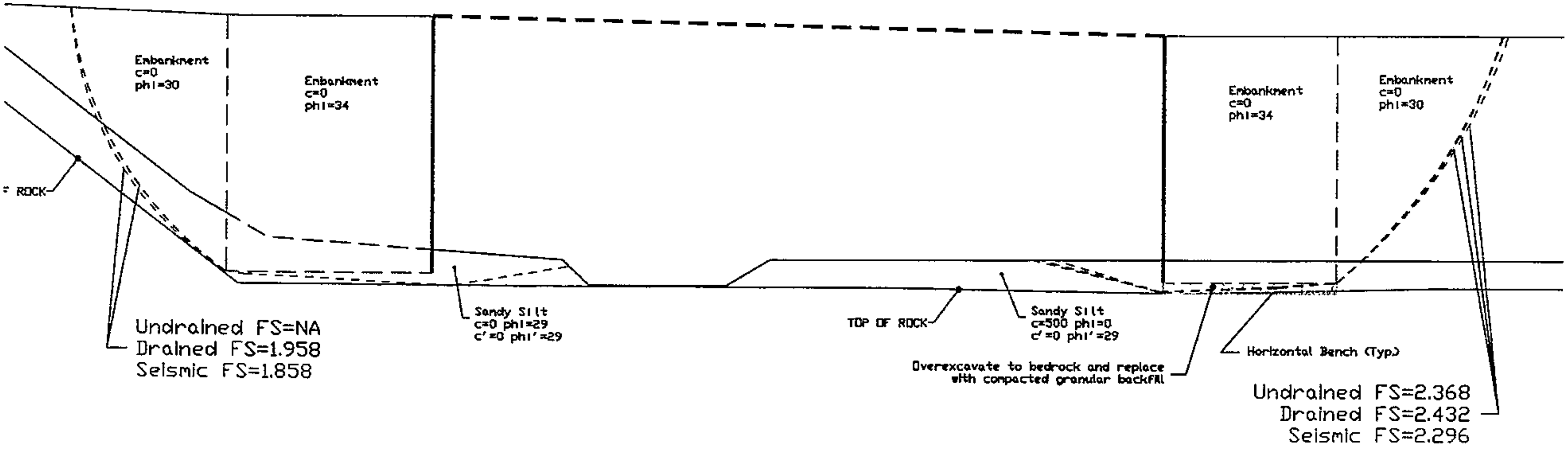
PORTSMOUTH - MINFORD ROAD
REAR ABUTMENT STA: 484+08
FORWARD ABUTMENT STA: 486+08

MSE WALL STABILITY ANALYSIS
INITIAL ANALYSIS
SCI-823-0.00

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-24-06

MSE Wall Stability
Portsmouth-Minford Road
Rear Abutment Sta. 484+08
Based on TR-18 & TR-19
Composite Strength Values
H=64' (full height)
Embedment=6.4
Length=0.8(H+D)=49'

MSE Wall Stability
Portsmouth-Minford Road
Forward Abutment Sta. 486+08
Based on TR-15 & TR-16
Composite Strength Values
H=61.5' (full height)
Embedment=6.2'
Length=0.7(H+D)=47'



PORTSMOUTH - MINFORD ROAD
REAR ABUTMENT STA: 484+08
FORWARD ABUTMENT STA: 486+08

MSE WALL STABILITY ANALYSIS
PRELIMINARY DESIGN ANALYSIS
SCI-823-0.00

PROJECT NO. 0121-3070.03	CALC: SJR	DATE 03-24-06

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DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 31, 2005

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

Re: **SCI-823-0.00 over Portsmouth-Minford Rd (SR 139)**
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 SCI-823-0.00 over Portsmouth-Minford Rd. (SR 139). It is anticipated that the proposed structure will be a four-span, elevated bridge with embankment fills for both abutments. At the present time, it is understood that the forward abutment will be founded on an embankment with a maximum height of 46 feet. The grade at the proposed location of the rear abutment varies along the cross section. The embankment fill is understood to vary from 0 feet to the far left of centerline and up to 35 feet to the right of centerline. It is anticipated that the piers for the structure will be located at elevations similar to those existing at State Route 139 and will be generally 45 feet in height. Currently Portsmouth-Minford Rd. (SR 139) is located along the north side of Long Run.

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.

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Field Exploration

A total of five borings, TR-15 through TR-19, were drilled at the proposed structure between July 9, 2004 and February 23, 2005. The borings were drilled to depths from 18.0 to 27.0 feet. The borings were extended into bedrock, which was verified by rock coring. Boring Logs and information concerning the drilling procedures are attached.

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

Findings

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

The borings generally encountered 2 to 12 inches of topsoil at the surface. Boring TR-16 did not encounter topsoil. Underlying the surficial materials, the borings encountered loose to very dense silt (A-4b) and gravel with sand and silt (A-2-4) and medium stiff to very stiff sandy silt (A-4a) and silt and clay (A-6a) to depths between 6.0 and 8.7 feet where bedrock was encountered.

The bedrock encountered at the proposed structure location was composed primarily of medium hard to hard sandstone and siltstone that was generally slightly fractured to intact. Recovery of the core samples ranged from 83 to 100% and RQD values ranged from 57 to 97% with an average RQD of 83%.

Seepage was encountered in borings TR-15, TR-16, and TR-17 between depths of 6.0 and 7.0 feet. The remaining borings did not encounter seepage. At completion of drilling, water levels ranged from 1.6 to 16.3 feet. However, the final water levels include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally and should be expected to correspond with the level of Long Run.

Conclusions and Recommendations

Based on existing proposed cross section plans, it would appear that deep foundations would be necessary for the abutments and shallow foundations would be appropriate for the pier foundations. The following is a brief discussion of the recommendations for the substructures.

Due to the large amount of embankment fill, it appears that drilled shafts bearing on bedrock will be the best-suited foundation type for the support of the proposed structural abutments. If high lateral or uplift loads are anticipated, deeper rock sockets may be needed. The actual design lengths or rock sockets will need to be designed based upon actual loading conditions.

Competent bedrock was encountered at shallow depths at the expected pier locations. Therefore, the use of spread footings on rock should be the best-suited foundation type for support of the proposed structure's piers. The footings should be embedded into the bedrock. If an alternative foundation type is required due to lateral or uplift loads, drilled shafts with rock sockets can be utilized.

The following table summarizes the site conditions and foundation recommendations.

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Approximate Bearing Elevation* (Feet)	Recommended Foundation Type	Allowable Bearing Capacity
TR-15	Forward Abutment	637	630	Drilled Shafts	15 TSF
TR-16	Pier	636	627	Spread Footing	15 TSF
TR-17	Pier	631	625	Spread Footing	15 TSF
TR-18	Pier	635	628	Spread Footing	15 TSF
TR-19	Rear Abutment	644	635	Drilled Shafts	15 TSF

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

Grain-size analyses were performed for scour analysis since the proposed structure location is located perpendicular to Long Run. The following table outlines the D85 and D50 particle sizes from the grain-size analysis. The laboratory data sheets for the grain-size analyses are attached.

Boring	Sample	Depth	Grain Size	
			D_{85}	D_{50}
TR-18	S-1	1.0' - 2.5'	1.23 mm	0.0297 mm
TR-18	S-2	3.5' – 5.0'	0.207 mm	0.0574 mm
TR-18	S-3	6.0' – 7.5'	1.24 mm	0.13 mm

Closing

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

Sincerely,

DLZ OHIO, INC.

Richard Hessler
Geotechnical Engineer

Pete Nix
Arthur (Pete) Nix, P.E.
Senior Geotechnical Engineer

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Site Plan
Boring Logs TR-15, TR-16, TR-17, TR-18, TR-19
Particle Size Distribution Test Reports

cc: File

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GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

In the laboratory all samples were visually classified by a soils 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.

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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:

<u>Granular Soils - Compactness</u>

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

<u>Cohesive Soils - Consistency</u>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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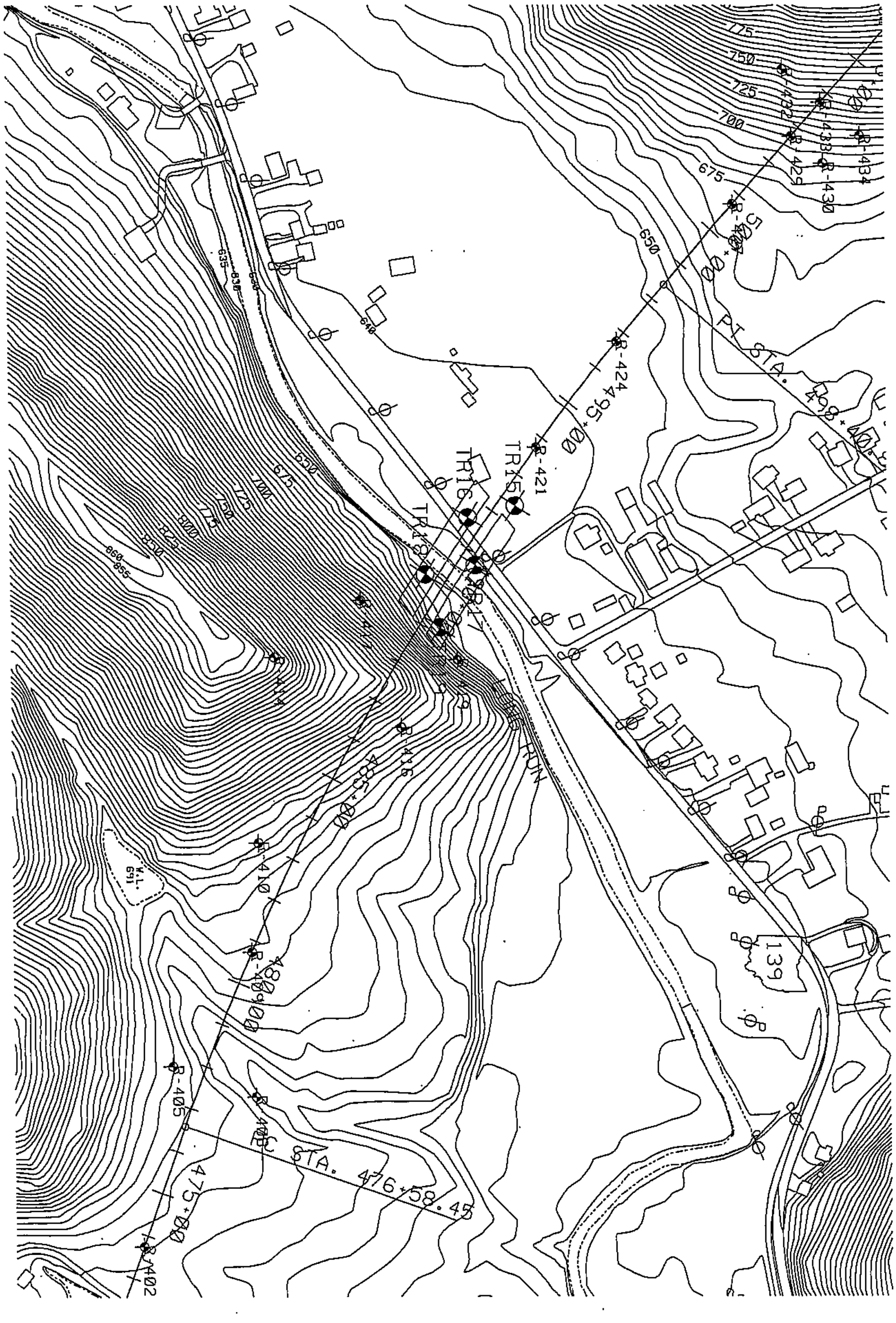


1/1

SCI-823-0.00

SITE PLAN
SCI-823-0.00 OVER PORTSMOUTH-
MINFORD RD (SR 139)

DRAWN BY
RJH
CHECKED
PPP

0 100
50 200
HORIZONTAL
SCALE IN FEET

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

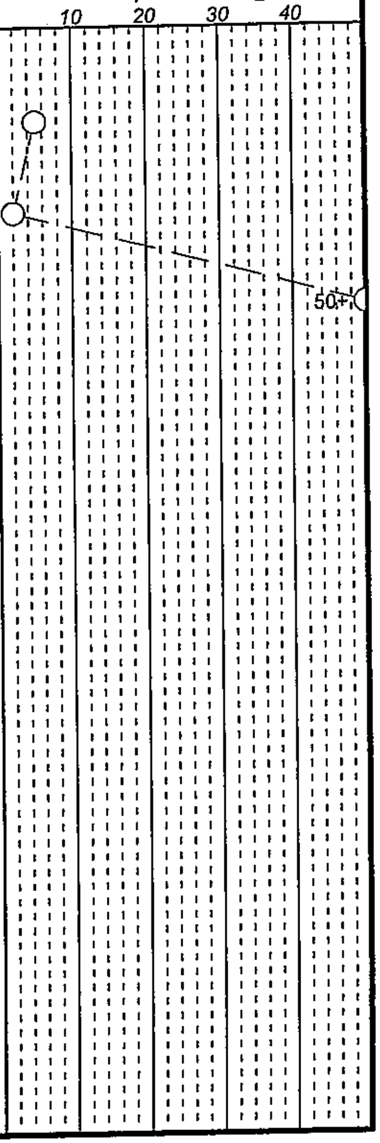
Client: TranSystems, Inc.
Project: SCI-823-0.00
Job No. 0121-3070.03

LOG OF: Boring TR-15
Location: Station 492+40, 35' Right
Date Drilled: 7/9/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 18'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No.		Hand Penetro-meter (tsf)	DESCRIPTION	GRADATION					
				Drive	Press / Core			% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
	637.0												
0.2	636.8						Topsoil-2"						
		4 2 3	14	1		1.0	Stiff to very stiff brown SANDY SILT (A-4a), trace gravel; moist.						
		2 1 1	13	2		<0.25	@3.5' - 5.0', very soft.						
5													
7.0	630.0	3 20 50/2	13	3A 3B		3.25	Severely weathered brownish-gray SILTSTONE fragments.						
8.0	629.0						Hard gray SANDSTONE; fine grained, contains occasional rust stains. @8.0' - 9.0', probable core loss.						
10													
		Core 120"	Rec 99"	RQD 70%	R-1		@13.0' - 14.0', argilllacious.						
14.0	623.0						Medium hard to hard gray SILTSTONE; arenaceous, slightly micaceous.						
15													
18.0	619.0						Bottom of Boring - 18.0'						
20													
25													
30													

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



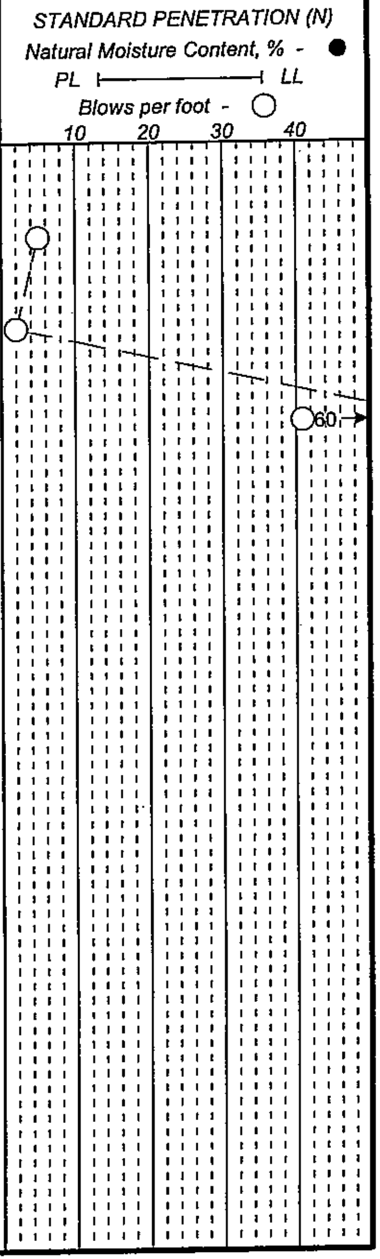
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

LOG OF: Boring TR-16
Location: Station 491+60, 35' Left
Date Drilled: 7/9/04

WATER OBSERVATIONS: Water seepage at: 6.0'
Water level at completion: 6.5'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	636.0						Medium stiff to stiff brown SANDY SILT (A-4a); moist.						
		2 3 2	16	1		1.0							
5		1 1 1	15	2		0.75							
		4 10 50/5	12	3		–	@ 6.0'-7.4', contains rock fragments.						
8.5	627.5						Medium hard to hard gray SILTSTONE. @8.9'-9.2', possible clay seam, washed out.						
9.2	626.8						Hard gray SANDSTONE; fine grained.						
10													
		Core 120"	Rec 118"	RQD 85%	R-1								
15													
17.0	619.0						Medium hard to hard gray SILTSTONE; arenaceous.						
18.5	617.5						Bottom of Boring - 18.5'						
20													
25													
30													



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

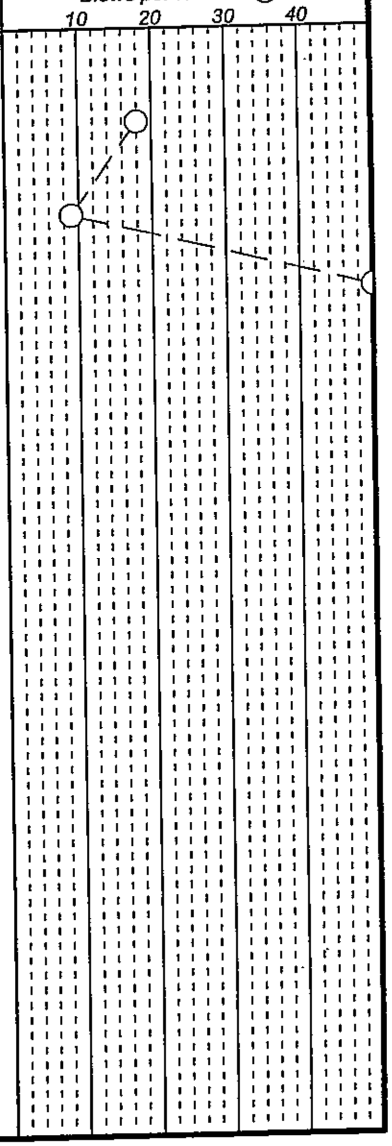
Client: TranSystems, Inc.
Project: SCI-823-0.00
Job No. 0121-3070.03

LOG OF: Boring TR-17
Location: Station 490+80, 35' Right
Date Drilled: 2/23/05

WATER OBSERVATIONS: Water seepage at: 6.3' - 7.0'
Water level at completion: 1.6' (inside hollowstem augers after coring)

Depth (ft)	*Elev. (ft)*	*Blows per 6"*	*Recovery (in)*	*Sample No.*		*Hand Penetro-meter (tsf)*	*DESCRIPTION*	*GRADATION*					
				Drive	*Press / Core*			*% Aggregate*	*% C. Sand*	*% M. Sand*	*% F. Sand*	*% Silt*	*% Clay*
0	631.0						Topsoil - 5"						
0.4	630.6	6 8 10	18	1			Medium dense brown SILT (A-4b), little fine to coarse sand, trace clay; damp.						
3.0	628.0	6 4 5	18	2			Loose brown GRAVEL WITH SAND AND SILT (A-2-4); damp.						
5.5	625.5	3 50/5	11	3A 3B			Very dense brown SANDY SILT (A-4a); wet.						
6.3	624.7						Weathered SILTSTONE, gray.						
7.0	624.0	Core 120"	Rec 120"	RQD 83%	R-1		Medium hard brown and gray SANDSTONE; fine grained, moderately weathered, slightly micaceous, slightly fractured. @ 7.3'-7.4', very soft, highly weathered. @ 8.5', irregular fracture. @ 8.7', gray. @ 16.0', 1" soft, weathered zone.						
17.0	614.0	Core 120"	Rec 120"	RQD 97%	R-2		Hard brown and gray SANDSTONE; fine grained, slightly weathered, slightly micaceous, slightly fractured. @ 22.8'-23.0', very soft, highly weathered siltstone seam. @ 23.0'-23.2', siltstone seam.						
27.0	604.0						Bottom of Boring - 27.0'						

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



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

Job No. 0121-3070.03

Client: TranSystems, Inc.

Project: SCI-823-0.00

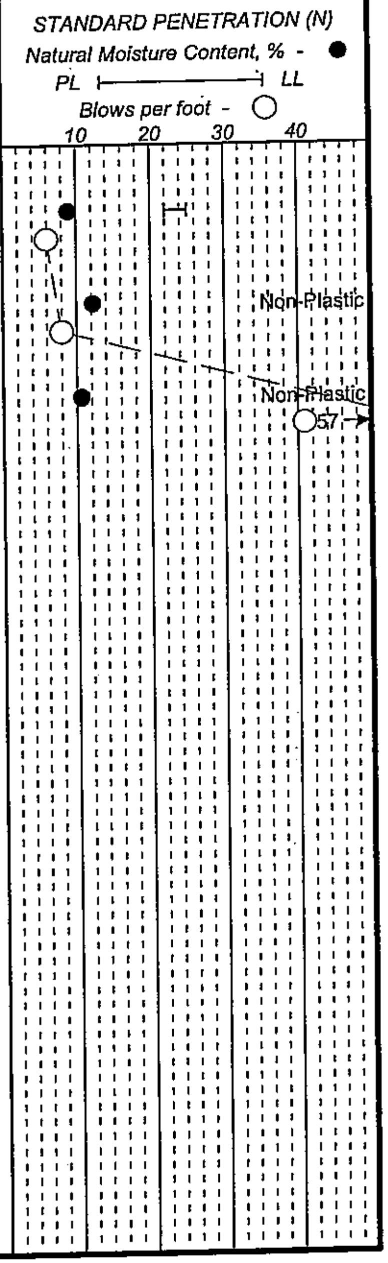
LOG OF: Boring TR-18

Location: Station 490+00, 35' Left

Date Drilled: 8/17/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 9.4'

Depth (ft)	*Elev. (ft)*	*Blows per 6"*	*Recovery (in)*	*Sample No. Drive*	*Sample No. Press / Core*	*Hand Penetro-meter (tsf)*	*DESCRIPTION*	*GRADATION % Aggregate*	*% C. Sand*	*% M. Sand*	*% F. Sand*	*% Silt*	*% Clay*
0	635.0						Topsoil - 12"						
1.0	634.0	2 3 3	18	1			Loose brown SILT (A-4b), some fine sand; dry. S-1 contains roots.	13	7	--	9	58	13
		3 4 4	18	2				0	3	--	40	45	12
5													
6.0	629.0	6 7 50/3	12	3			Severely weathered brown and gray SILTSTONE fragments, rust stains.	11	20	--	28	31	10
7.3	627.7	Core 84"	Rec 84"	RQD 95%	R-1		Hard gray SANDSTONE; fine grained, slightly micaceous. @ 7.3'-7.8',8.0',8.6'-8.8', brown rust-stained. @ 7.3' - 7.6'; vertical fracture.						
10													
15													
17.5	617.5	Core 72"	Rec 72"	RQD 94%	R-2		Hard dark gray SILTSTONE; fine grained, slightly micaceous, arenaceous.						
20.3	614.7						Bottom of Boring - 20.3'						
25													
30													



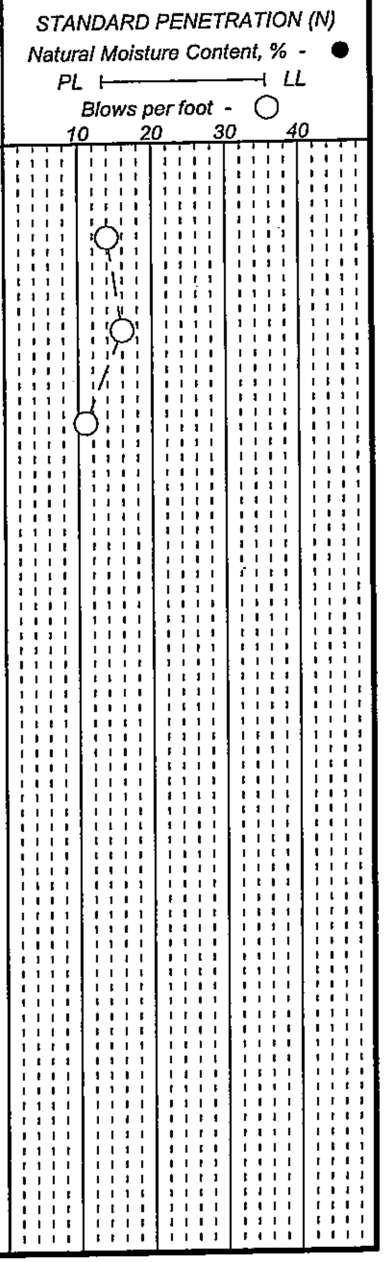
DLZ OHIO INC. * 6121 HUNTLEY ROAD, COLUMBUS, OHIO 43229 * (614)888-0040

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

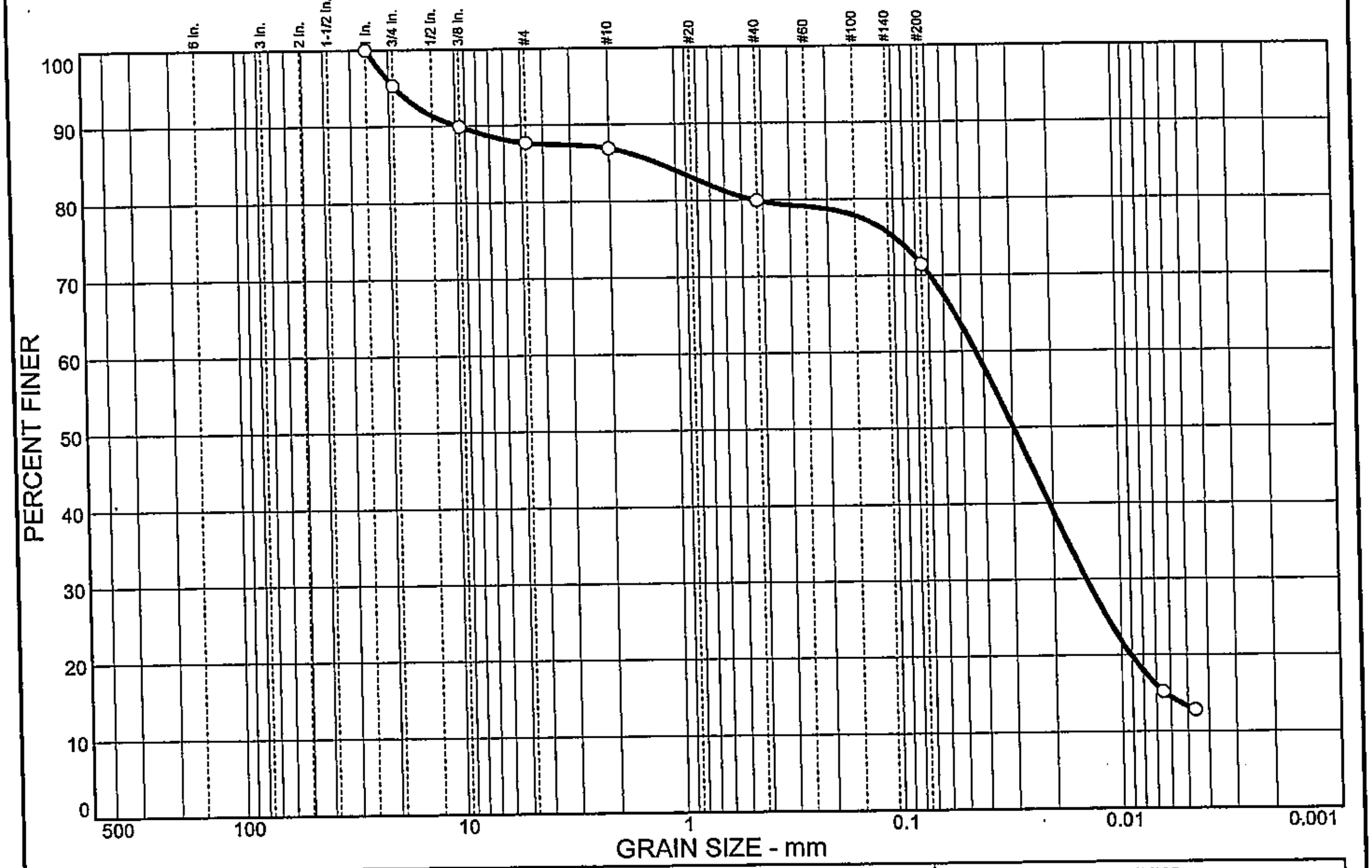
LOG OF: Boring TR-19 | *Location:* Station 489+10, 35' Right | *Date Drilled:* 8/16/04 to 8/17/04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: 16.3'

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetro-meter (tsf)	DESCRIPTION	% Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	644.0						Topsoil-12"						
1.0	643.0	3 7 7	18	1		–	Stiff to very stiff brown SILT AND CLAY (A-6a), little fine to coarse sand; damp. @ 3.5'; trace gravel.						
		4 7 9	18	2		–							
5													
6.0	638.0	4 5 6	18	3			Medium dense brown SILT (A-4b), some fine to coarse sand; damp. @ 8.5'; contains siltstone/shale fragments.						
8.7	635.3	50/2	2	4			Hard gray SANDSTONE; fine grained, slightly micaceous, occasional black lamination. @ 8.8'-9.0',9.2'-9.4', brown rust-stained. @ 13.1'-13.3', 45 degree fracture.						
		Core 30"	Rec 30"	RQD 57%	R-1								
10													
13.7	630.3	Core 108"	Rec 108"	RQD 70%	R-2		Medium hard to hard gray SILTSTONE; fine grained, slightly micaceous, arenaceous. @ 13.9'-14.0', 45 degree fracture. @ 14.7'-15.5', broken zone. @ 14.8'-15.0', sandstone seam. @ 15.4'-15.5', clay seam.						
15													
20.0	624.0						Bottom of Boring - 20.0'						
25													
30													



PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	4.7	7.6	0.8	7.0	8.5	58.1	13.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
.75 in.	95.3		
3/8 in.	89.9		
#4	87.7		
#10	86.9		
#40	79.9		
#200	71.4		

* (no specification provided)

Soil Description

Atterberg Limits

PL= 22 LL= 25 PI= 3

Coefficients

D_{85}= 1.23 D_{60}= 0.0433 D_{50}= 0.0297

D_{30}= 0.0143 D_{15}= 0.0063 D_{10}=

C_u= C_c=

Classification

USCS= ML AASHTO= A-4(1)

Remarks

Moisture Content= 8.9%

Sample No.: 1 **Source of Sample:** TR-18 **Date:** 3/24/05

Location: **Elev./Depth:** 1.0

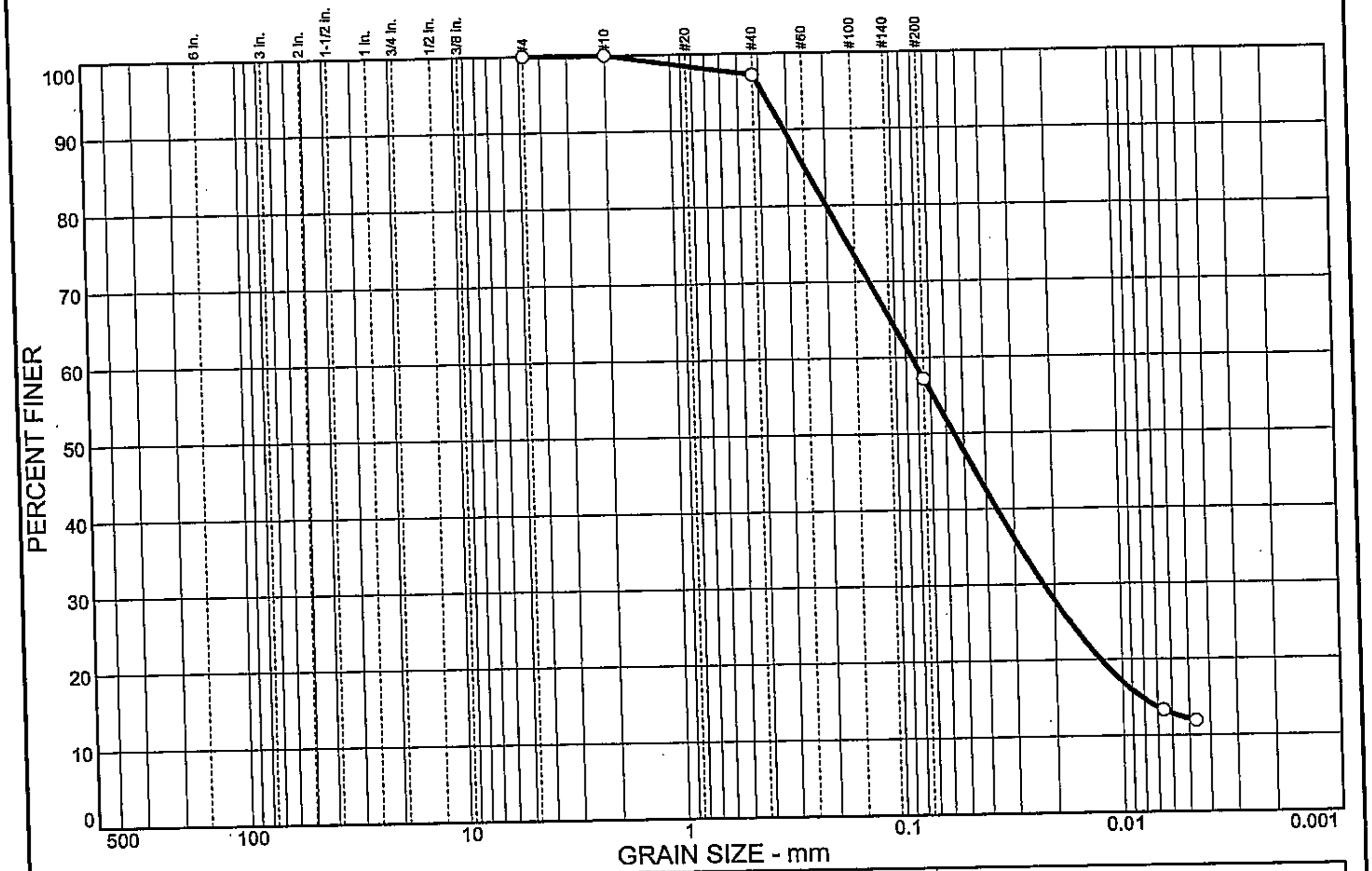
DLZ

Client: TranSystems, Inc.

Project: SCI-823-0.00

Project No: 0121-3070.03 **Figure**

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	2.8	40.0	45.1	12.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#40	97.2		
#200	57.2		

* (no specification provided)

Soil Description

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.249 D_{60}= 0.0845 D_{50}= 0.0553

D_{30}= 0.0223 D_{15}= 0.0082 D_{10}=

C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 12.2%

Sample No.: 2
Location:

Source of Sample: TR-18

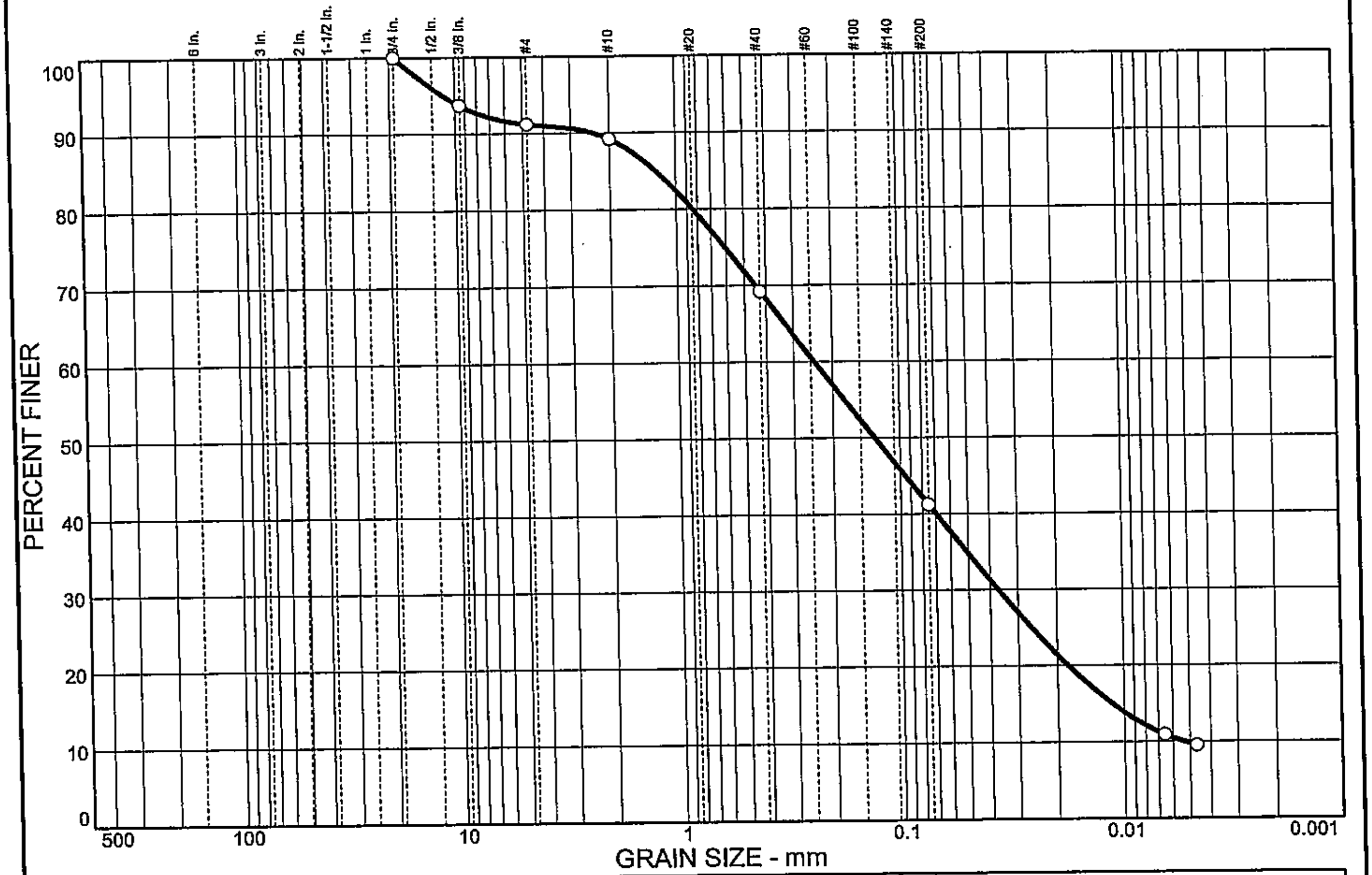
Date: 3/24/05
Elev./Depth: 3.5

DLZ

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

Figure

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	8.8	2.0	20.0	28.0	31.4	9.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.375 in.	93.7		
#4	91.2		
#10	89.2		
#40	69.2		
#200	41.2		

* (no specification provided)

Soil Description

Atterberg Limits

PL= NP
LL= NP
PI= NP

Coefficients

D_{85}= 1.24
D_{60}= 0.241
D_{50}= 0.130
D_{30}= 0.0368
D_{15}= 0.0114
D_{10}= 0.0053
C_u= 45.38
C_c= 1.06

Classification

USCS= SM
AASHTO= A-4(0)

Remarks

Moisture Content= 10.6%

Sample No.: 3
Location:
Source of Sample: TR-18
Date: 3/24/05
Elev./Depth: 6

DLZ

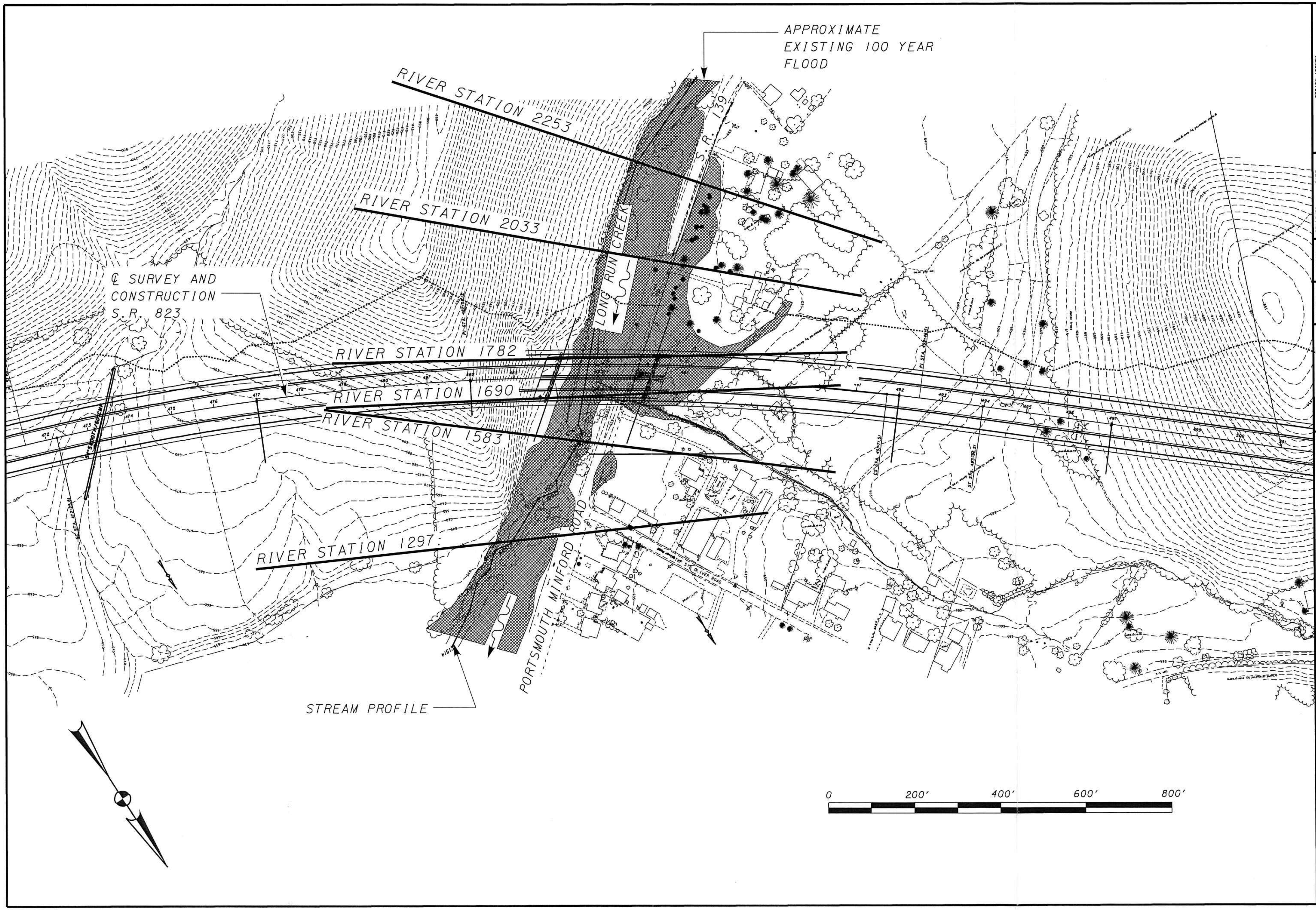
Client: TranSystems, Inc.
Project: SCI-823-0.00
Project No: 0121-3070.03
Figure

APPENDIX F

TRANSYSTEMS
CORPORATION

Table of Contents

SUPPLEMENTAL SITE PLAN



SUPPLIMENTARY SITE PLAN
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER PORTSMOUTH MINFORD (S.R. 139)

SCIOTO COUNTY
STA. 472+00
STA. 501+00

DESIGNED	DRAWN	REVIEWED	DATE
HJS	CAS		
CHECKED	REVISED	STRUCTURE FILE NUMBER	

DESIGN AGENCY
TRANSYSTEMS CORPORATION
720 EAST PETE ROSE WAY, SUITE 360, CINCINNATI, OHIO 45202

SCI-823-0.00
PID 19415

/ /

DRAINAGE AREA


AREA 32
8591AC
13.4sq.mi.
DRAINAGE AREA MAP
13.0ac
16.7ac
5.2ac
8.8ac
8591.0ac
6.1ac
44.2ac
109.5ac
593.8ac
MADISON
JEFFERSON
WAYNE
HARRISON
NATIONAL FOREST
Clarktown
Peach Orchard Hill
Rubyville
Harrison Furnace
Middle Ridge
Woods Ridge Lookout Tower
Houston Hollow Ch
Long Run Ch
Grace Ch
Candy Run Ch
Long Run Cem
Summers Cem
Oil Well
Burns Hollow
Butler Hollow
Greenbrier Hollow
Harrison Furnace Creek
Tattle Creek
Benner Hollow
Long Run
Sweet Run
Candy Run
Lintz Hollow
Feurt Hill
RIDDLEBARGER ROAD
WOODS RIDGE ROAD
LUCASVILLE
MINFORD 1.5 MI.
OHIO 335
(MINFORD)
4461 IV SE

CHANNEL PHOTOGRAPHS

Looking downstream from west of culvert

Looking upstream from west of culvert

Looking upstream across culvert that is to be relocated

Looking at the Long Run stream bank. Photo shows channel cut in rock.

RUNOFF CALCULATION

TECHNIQUES FOR ESTIMATING FLOOD-PEAK DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A

U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

Values	Units	Definitions
374226426.10	SQ. FT.	
13.424	SQ. MI.	**CONTDA =** Contributing Drainage Area
0.00	SQ. FT.	
0.00	%	**STORAGE =** Storage Area
31530.00	FT.	**TOTAL CHANNEL LENGTH**
3153.00	FT.	L_{10} = 10% of the Distance along channel
743	FT.	$Elev_{10}$ = Elevation at point L_{10}
26800.50	FT.	L_{85} = 85% of the Distance along channel
810	FT.	$Elev_{85}$ = Elevation at point L_{85}
23647.50	FT.	**Length =** $L_{85} - L_{10}$
14.96	FT./MI.	**SLOPE** = $(Elev_{10}-Elev_{85})/Length$
	CFS	$Q_{\#}$ = Flood-Peak Discharge # = Frequency of Storm

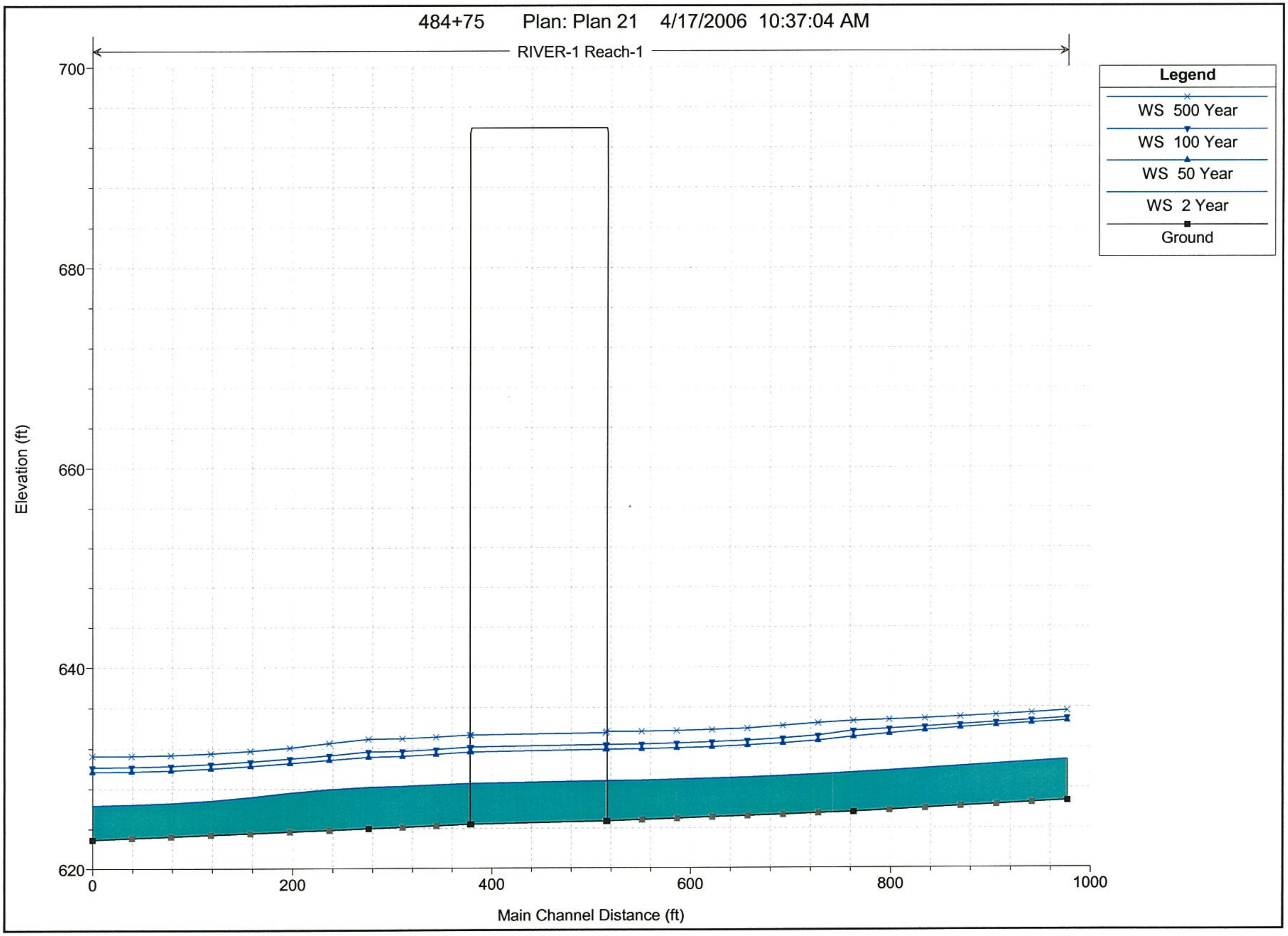
Q_2	680.83	CFS	$= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}$
Q_5	1131.99	CFS	$= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}$
Q_{10}	1463.54	CFS	$= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}$
Q_{25}	1896.48	CFS	$= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}$
Q_{50}	2230.16	CFS	$= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}$
Q_{100}	2571.80	CFS	$= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}$

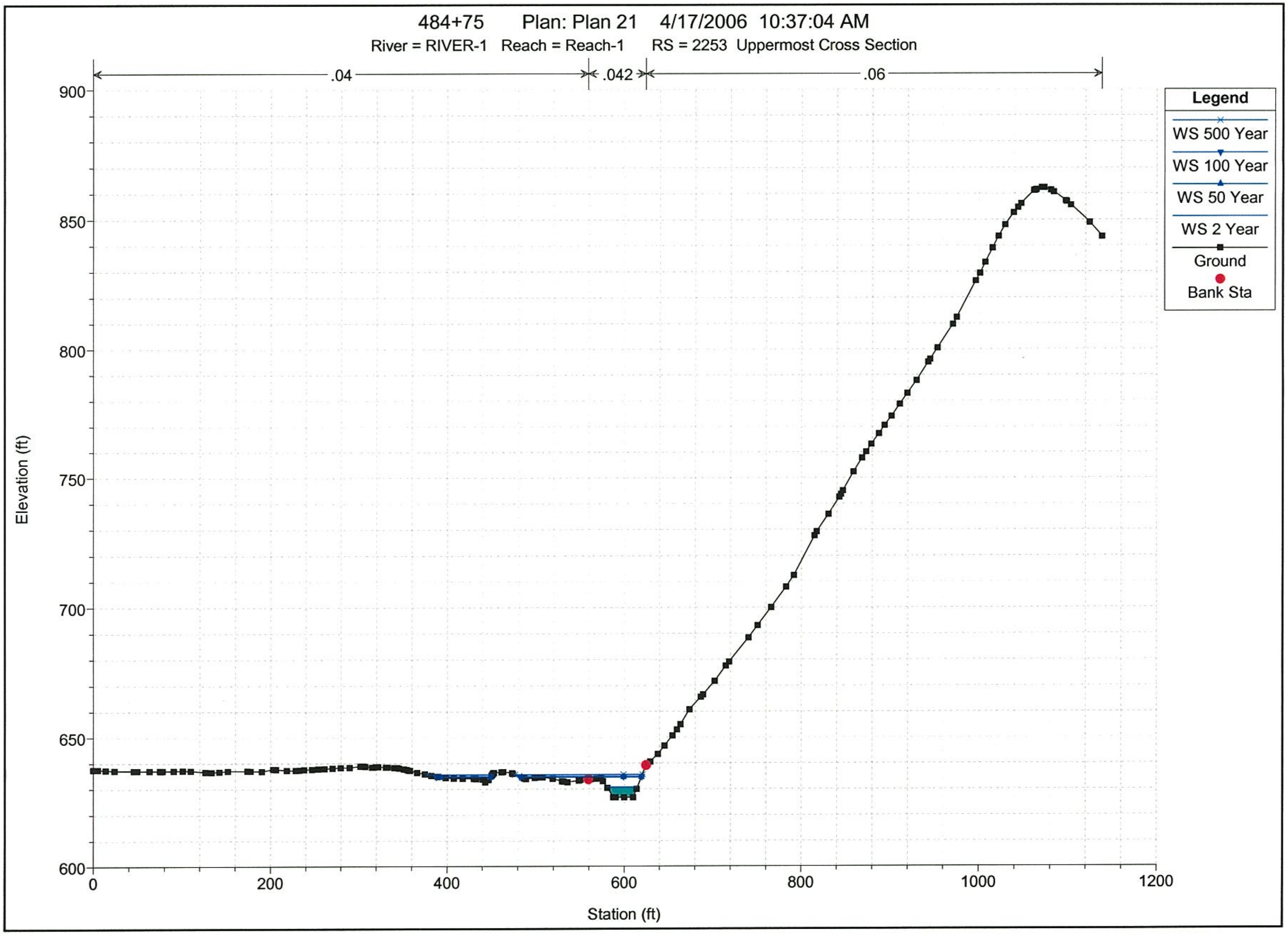
HYDRAULIC BRIDGE CALCULATION

HEC-RAS Plan: Plan 19 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2253	2 Year	680.80	626.70	630.79		631.32	0.005926	5.83	116.69	34.68	0.56
Reach-1	2253	50 Year	2230.20	626.70	634.62		635.32	0.005599	7.06	383.67	191.70	0.57
Reach-1	2253	100 Year	2571.80	626.70	634.90		635.62	0.005581	7.29	438.79	199.87	0.58
Reach-1	2253	500 Year	3600.50	626.70	635.61		636.38	0.005508	7.84	587.73	217.77	0.58
Reach-1	2033	2 Year	680.80	625.60	629.54		630.05	0.006027	5.74	118.61	34.95	0.55
Reach-1	2033	50 Year	2230.20	625.60	633.08	631.25	633.98	0.007953	7.79	325.83	176.38	0.66
Reach-1	2033	100 Year	2571.80	625.60	633.68		634.37	0.005645	7.11	453.04	220.86	0.56
Reach-1	2033	500 Year	3600.50	625.60	634.65		635.23	0.004266	6.90	677.61	245.26	0.50
Reach-1	1782	2 Year	680.80	624.70	628.74	626.82	628.96	0.002307	3.74	181.89	53.91	0.36
Reach-1	1782	50 Year	2230.20	624.70	631.84	629.14	632.39	0.002975	5.96	393.42	118.15	0.44
Reach-1	1782	100 Year	2571.80	624.70	632.33	629.55	632.90	0.003011	6.18	456.38	141.96	0.45
Reach-1	1782	500 Year	3600.50	624.70	633.60	630.61	634.14	0.002445	6.34	741.00	318.17	0.42
Reach-1	1736		Bridge									
Reach-1	1690	2 Year	680.80	624.40	628.51		628.67	0.001500	3.19	213.45	57.07	0.29
Reach-1	1690	50 Year	2230.20	624.40	631.62		631.99	0.001795	5.08	511.16	147.02	0.35
Reach-1	1690	100 Year	2571.80	624.40	632.11		632.49	0.001744	5.25	587.10	163.41	0.35
Reach-1	1690	500 Year	3600.50	624.40	633.30		633.71	0.001657	5.67	870.44	304.70	0.35
Reach-1	1583	2 Year	680.80	624.00	628.16		628.39	0.003138	3.88	175.26	61.51	0.41
Reach-1	1583	50 Year	2230.20	624.00	631.14		631.66	0.003144	5.83	416.42	141.92	0.45
Reach-1	1583	100 Year	2571.80	624.00	631.65		632.18	0.002993	5.98	496.87	178.63	0.44
Reach-1	1583	500 Year	3600.50	624.00	632.92		633.44	0.002455	6.16	760.64	230.79	0.41
Reach-1	1297	2 Year	680.80	622.92	626.36	624.91	626.60	0.003101	3.93	173.15	58.63	0.40
Reach-1	1297	50 Year	2230.20	622.92	629.68	626.98	630.16	0.003106	5.56	401.76	83.78	0.44
Reach-1	1297	100 Year	2571.80	622.92	630.14	627.36	630.67	0.003102	5.87	441.77	99.77	0.44
Reach-1	1297	500 Year	3600.50	622.92	631.27	628.47	631.92	0.003105	6.59	599.45	160.57	0.45

STREAM CROSS SECTION OUTPUT FROM HEC-RAS


484+75 Plan: Plan 21 4/17/2006 10:37:04 AM
RIVER-1 Reach-1
Legend
WS 500 Year
WS 100 Year
WS 50 Year
WS 2 Year
Ground
Elevation (ft)
700
680
660
640
620
0
200
400
600
800
1000
Main Channel Distance (ft)

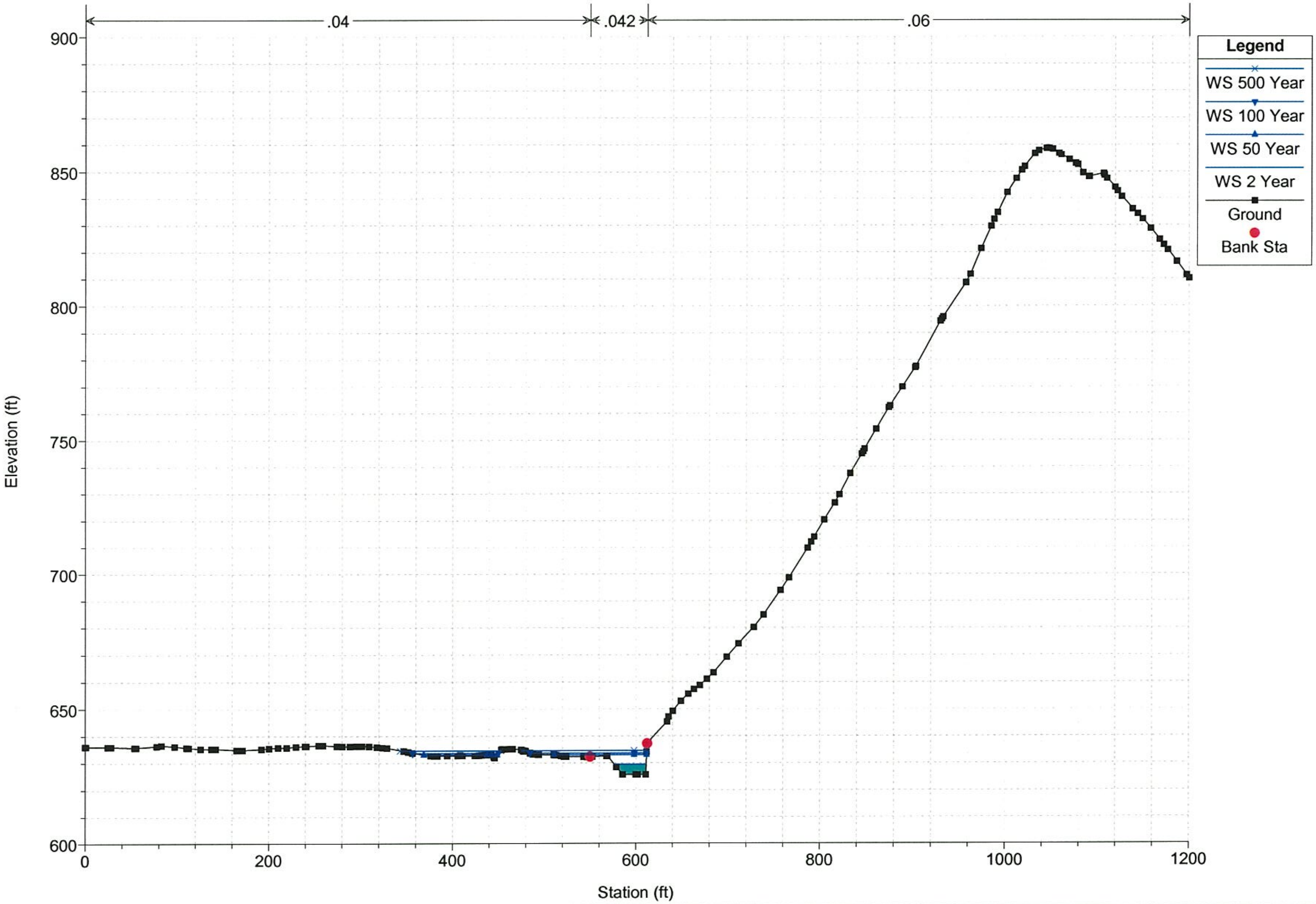


484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

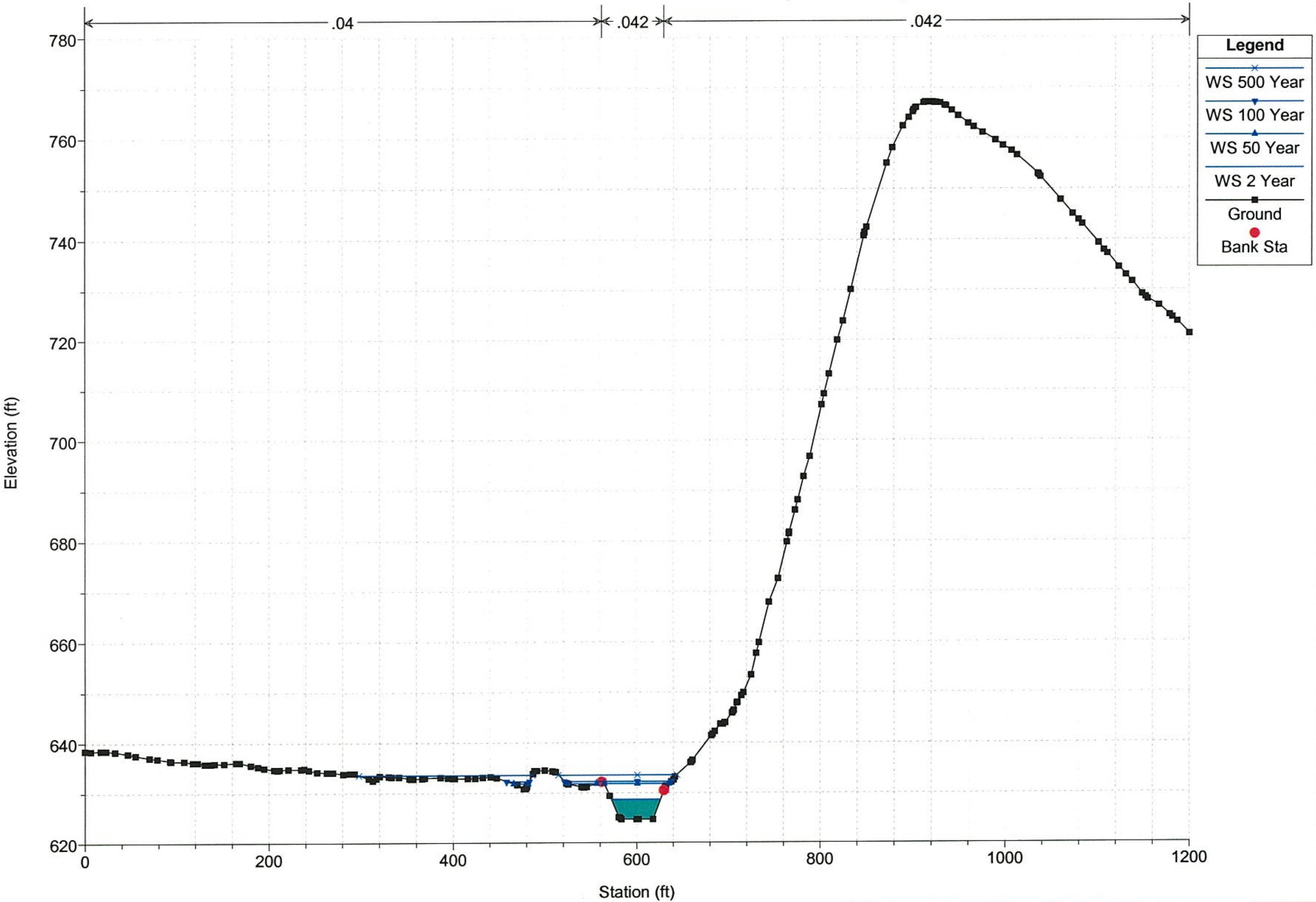
River = RIVER-1 Reach = Reach-1 RS = 2253 Uppermost Cross Section

484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

River = RIVER-1 Reach = Reach-1 RS = 2033

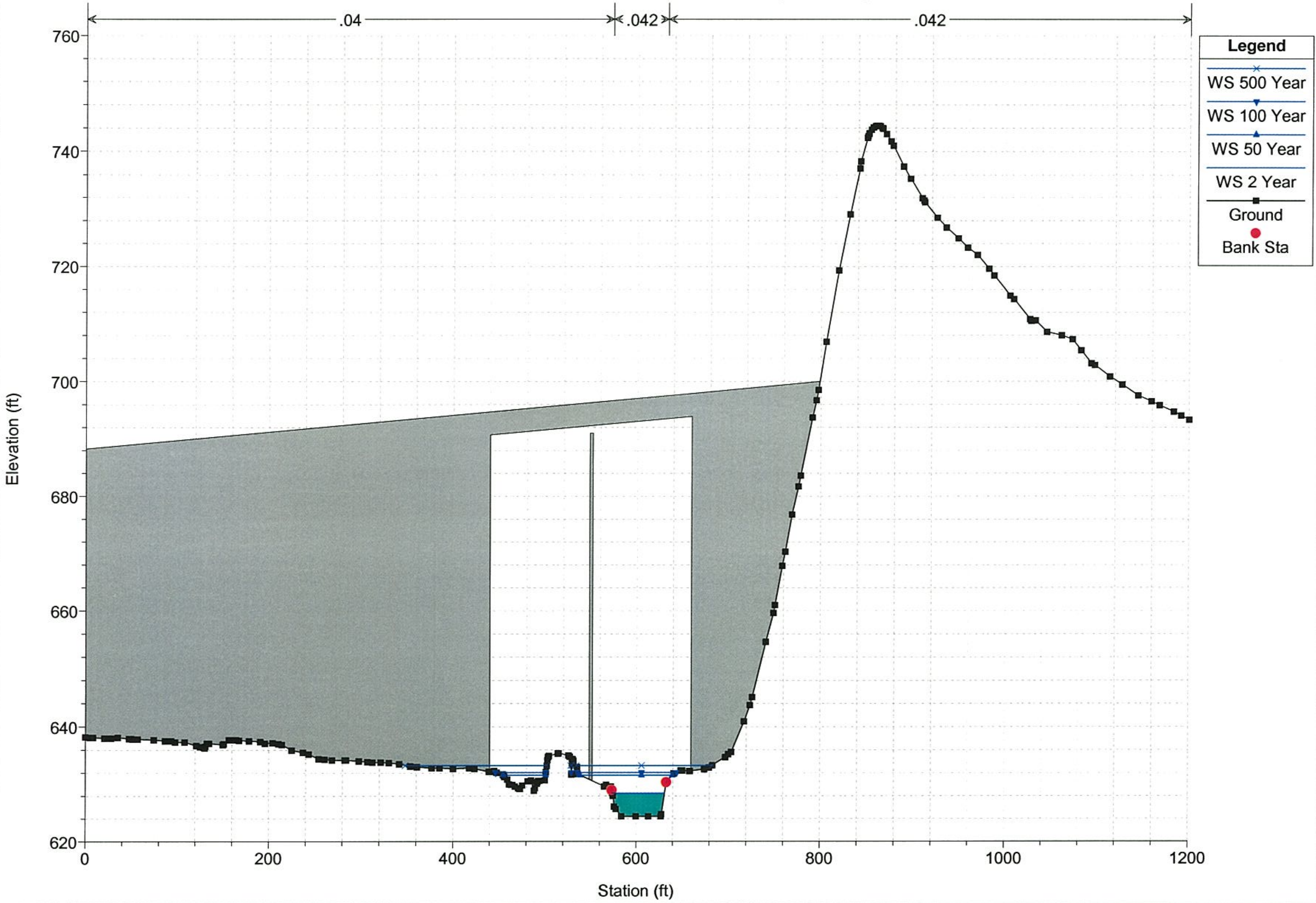


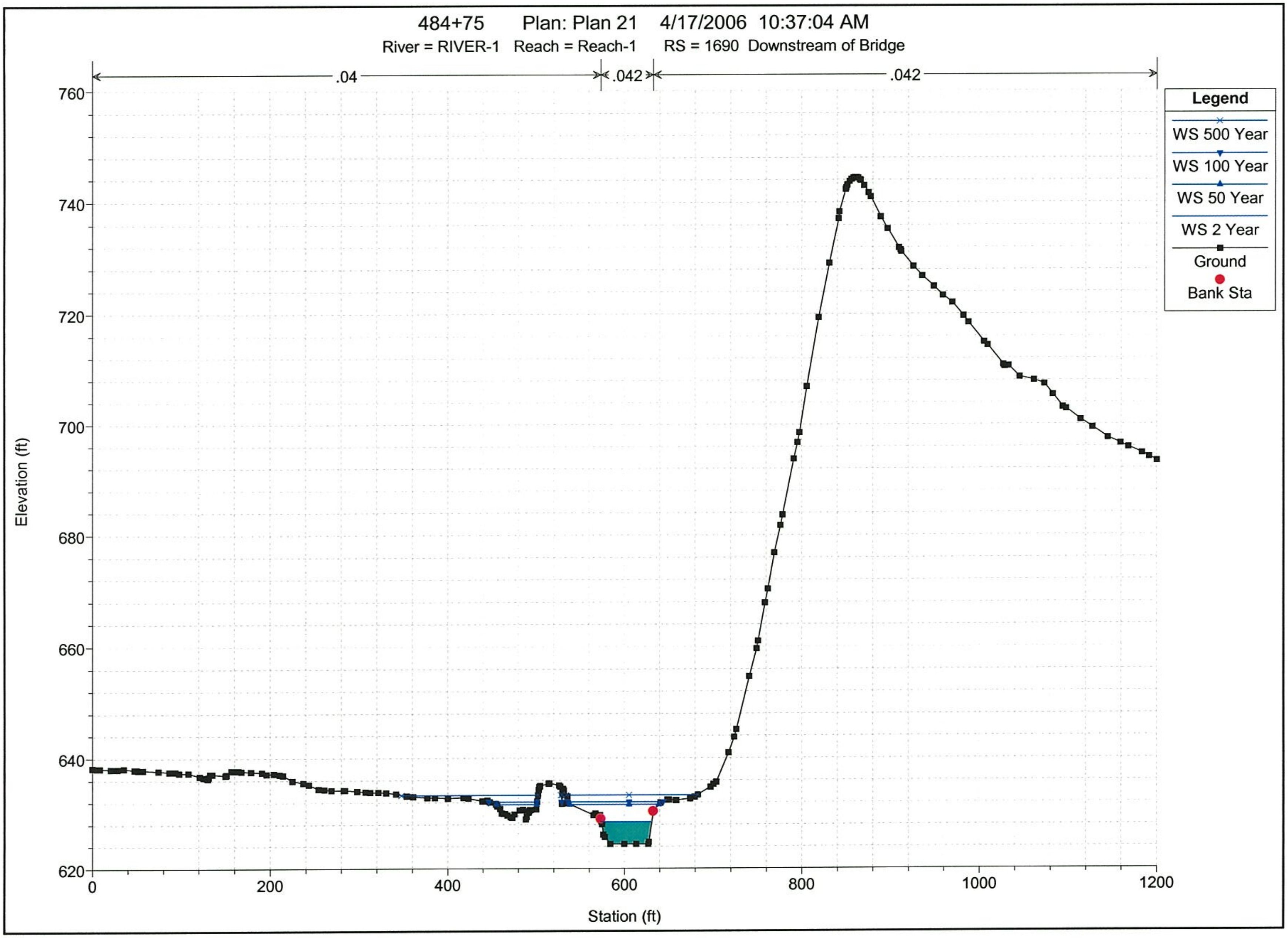
484+75 Plan: Plan 21 4/17/2006 10:37:04 AM
River = RIVER-1 Reach = Reach-1 RS = 1782 Upstream of Bridge



484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

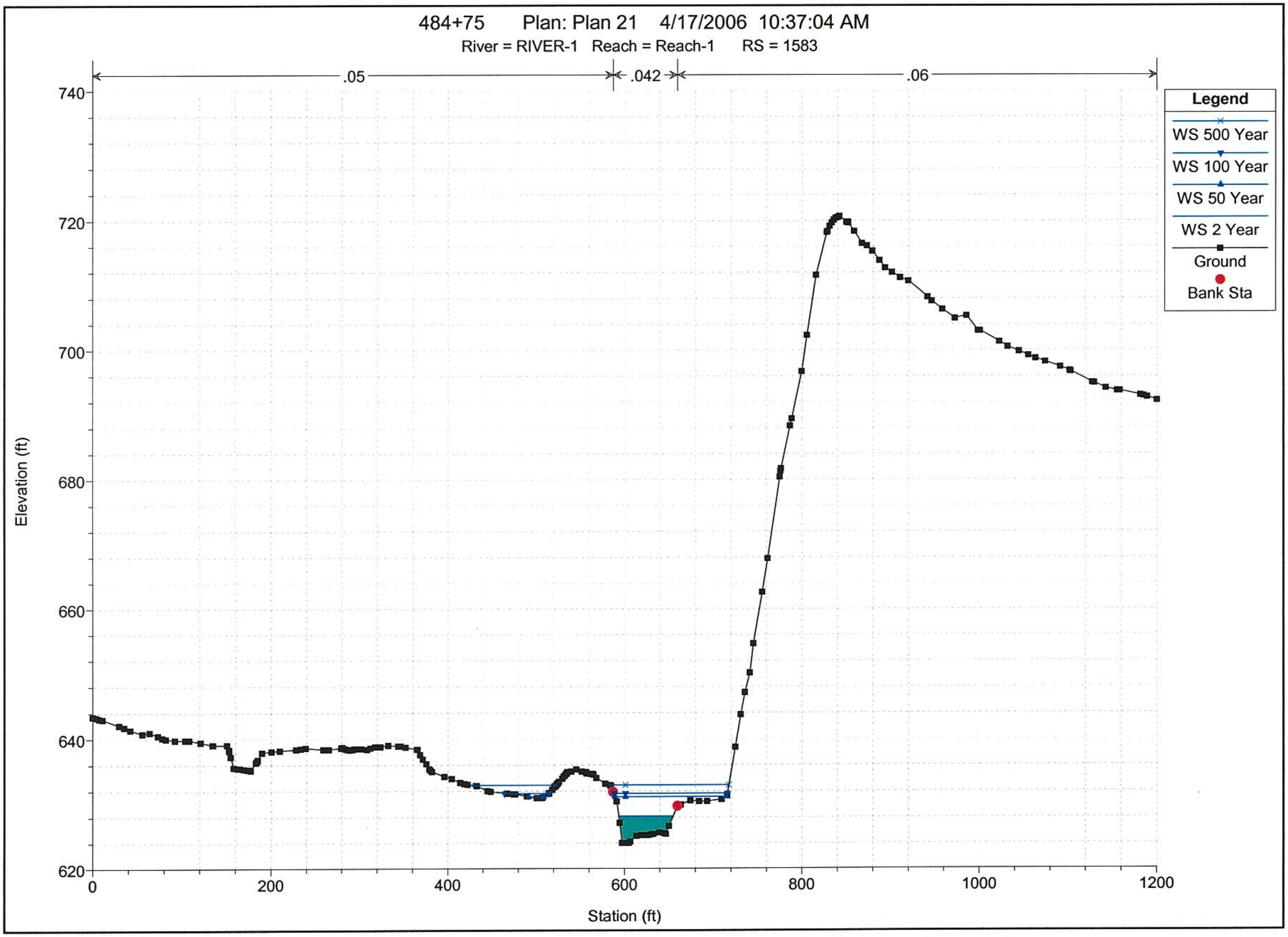
River = RIVER-1 Reach = Reach-1 RS = 1736 BR Bridge over Long Run and SR 139





484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

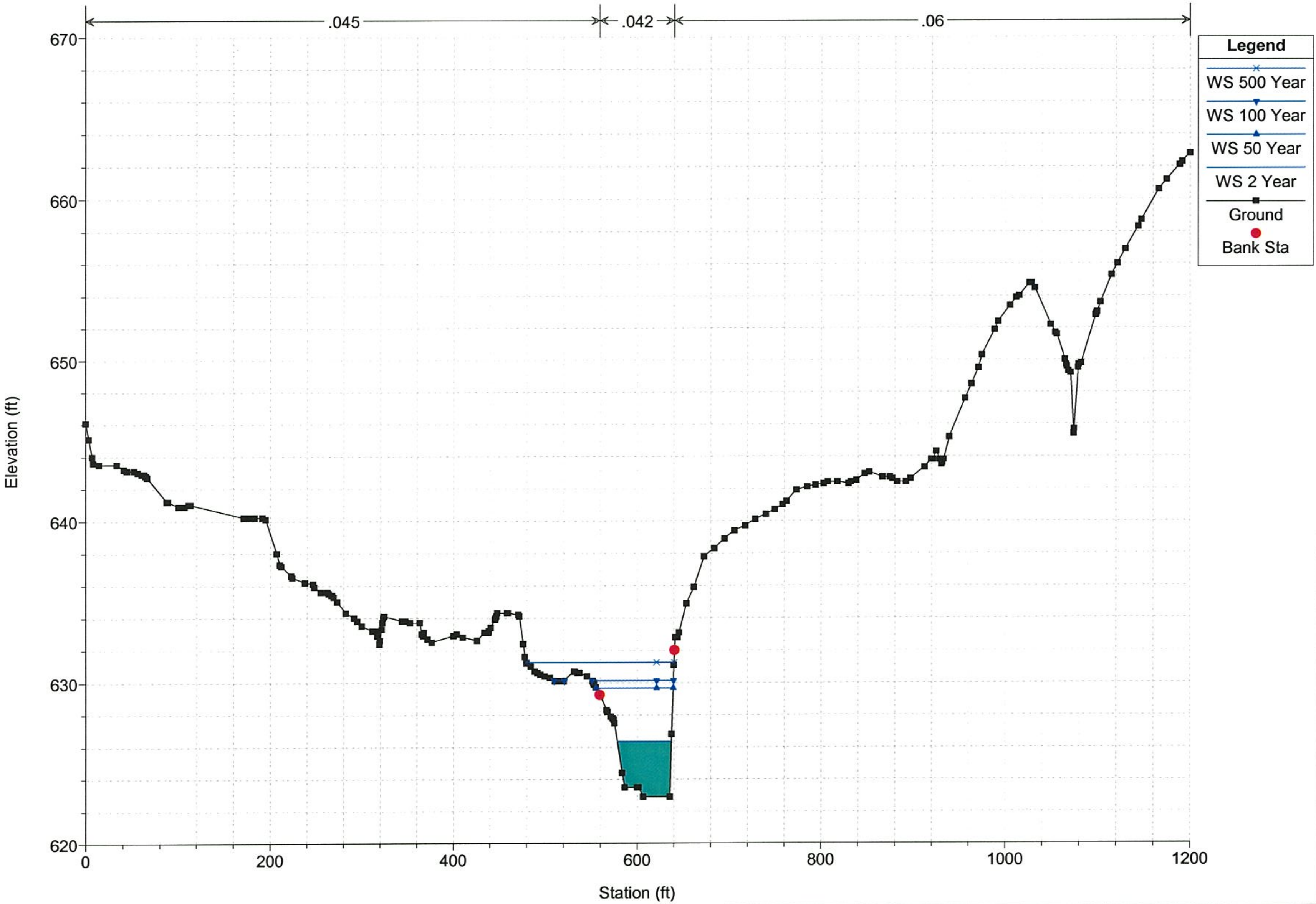
River = RIVER-1 Reach = Reach-1 RS = 1690 Downstream of Bridge

 484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

River = RIVER-1 Reach = Reach-1 RS = 1583

484+75 Plan: Plan 21 4/17/2006 10:37:04 AM

River = RIVER-1 Reach = Reach-1 RS = 1297 Lowermost Cross Section



SCOUR ANALYSIS

The scour calculations indicate a scour depth of approximately 17 feet. The elevations to top of rock as per the borings, range from 628 to 625. The existing channel bottom is near elevation 624. These differences elevations indicate the channel is in rock. Therefore the scour calculations would not be applicable to this part of the stream. The last photograph in the Channel Photo Section shows the channel in the rock.

HYDRAULIC NARRATIVE

Currently there are no FEMA Flood Studies or Flood Insurance Studies available for this section of Long Run.

Runoff calculations were performed using the Report produced by the United States Geological Survey (USGS) titled "TECHNIQUES FOR ESTIMATING FLOOD-PEAK DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126".

These calculations were input into a spread sheet <823 Flood-Peak Discharge Area 32.xls> to facilitate ease of use. A survey of the area was incorporated into the tin file for the project. Cross sections were cut from the aforementioned tin file using the GEOPAK software program. These cross sections were the basis of the hydraulic model. A HEC-RAS model was performed to calculate the existing the Hydraulic Data. This model was then modified to incorporate the site changes caused by the proposed bridge. The purpose of the Flood Hazard Flood Evaluation is to evaluate any flooding concerns with Long Run and any effect the proposed bridge structures might have on existing Long Run.

There is an existing culvert that crosses under existing SR 139 (Portsmouth-Minford Road) and drains into the main channel. This culvert located under the proposed SR 823 bridge, is to be relocated downstream of it's current location. The stream that the culvert carries is to be relocated so that the stream passes under the bridge on it's way to the relocated culvert. The slope of the main channel remains unchanged as the span of the bridge was utilized to the allow flow of the main channel.

The design year storm was selected as the 50 year as per the Ohio Department of Transportation (ODOT) criteria. As a check of the conditions of the 100 year storm was to be modeled. The ODOT Office of Structural Engineering (OSE) requested a 500 year storm was to be modeled for the MSE wall alternative (Alternative 1A). The 500 year runoff is not contained in the within the modeling parameters of the Water Resources Investigation Report 89-4126. Common practice is to calculate the flow 500year flow (Q) by multiplying 1.4 times the 100 year Q. This common practice was utilized for the analysis.

FLOOD HAZARD EVALUATION

Local residents spoken to, have seen water over the road on a few occasions. It is not a common occurrence and has happened only a few times in a resident's life. The highwater marks are approximately 8 feet from the channel bottom. This is consistent with the HEC-RAS model for the 50 year storm. In this area, the existing flood plain includes one house. This house will be removed for the construction of proposed SR 823. The proposed structures raise the existing 100 year flood from 632.1 to 632.3 a difference of 0.2 feet. The existing 500 year flood elevation is 633.3 the proposed structure will raise the flood to 633.6. This is a difference of 0.3 feet.