SCI-823-0.00

PID No. 19415

S.R. 823 OVER S.R. 335 AND

LITTLE SCIOTO RIVER

STRUCTURE TYPE STUDY SUBMITTAL

Prepared for:

OHIO DEPARTMENT OF TRANSPORTATION
DISTRICT 9
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JULY 12, 2006

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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 the existing S.R. 335 and Little Scioto River. As requested by the Scope of Services, a Structure 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 Structure 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 in order to reduce the fill heights over culverts and to rebalance the cut and fill earthwork along the entire project length. This revised project profile was approved 2/15/2006 by the Department and the revised profile at the proposed bridge site involves a change to the vertical curvature of S.R. 823. The profile grade of S.R. 823 at this site has been updated to a 1700' vertical curve with PVI at Station 131+00.00, g_1 = -4.10% and g_2 = 5.00% (as compared to the original profile grade vertical curve which had a 1400' length, PVI at Station 130+60.00, g_1 = -3.57% and g_2 = 3.80%). Due to this revision in the vertical layout, the profile of the proposed S.R. 823 Mainline over the existing S.R. 335 and Little Scioto River has risen in elevation from that originally specified in the July 2005 PAVR. This increase in profile elevation causes an increase in the height of built-up embankments, specifically at the original rear abutment position. Based on the original July 2005 PAVR submission and the 7/15/2005 Structure Type Study report, approximately 40 feet of fill was being positioned above the existing soils in this region. According to the revised profile, an *additional* 7 feet of fill is required in this same region. Embankment stability analyses performed by DLZ Ohio, Inc. identified stability concerns/issues with the resulting rear abutment embankment. Consequently, DLZ recommended that the rear abutment be relocated an additional 80+ feet to the south or a drilled shaft retaining wall be installed through the soil failure zone to improve embankment stability. As a result of these geotechnical issues - which were magnified by the efforts to rebalance fill and cut quantities along the entire project limits - the number of spans, span lengths, and bridge types for the proposed S.R. 823 Mainline were reevaluated. This follow-up Structure Type Study presents the results of these reevaluations as alternative bridge types. These alternatives are also based on the 9/1/2005 ODOT comments to the original 7/15/2005 Structure Type Study report. Five (5) alternatives are evaluated in this study for construction of the proposed S.R. 823 Mainline over the existing S.R. 335 and Little Scioto River and are designated as Alternatives 1, 2A, 2B, 3A, and 3B. Each of these alternatives is evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, constructability, and maintenance of traffic. Discussion of these alternatives is presented later in this report.

2. Design Criteria

The proposed structure types are 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. An updated Subsurface Exploration report for the Highland Bend region embankments, dated 6/8/2006, has since been prepared by DLZ Ohio, Inc. This region includes the rear abutment – or southern end – of the S.R. 823 Mainline over S.R. 335 and the Little Scioto River. The 6/8/2006 report does not change/alter the previously submitted foundation recommendations which were presented in the original 7/15/2005 Structure Type Study report. However, the updated Subsurface Exploration report and an addendum to this report – prepared by DLZ and dated 6/29/2006 – do include several stability analyses for the rear abutment embankments of the mainline bridge. In summary, with the rear abutment positioned in the vicinity of Station 131+35.00 and the toe of the associated 2:1 embankment at approximately Station 132+23.00, the global stability analyses for undrained and drained conditions yield factors of safety below minimum required values (this also applies when the rear abutment is positioned near Station 132+00.00). Changing the slope of the embankment to 2.5:1 also results in insufficient factors of safety. Consequently, it was determined that stable rear abutment embankments could be achieved through two different solutions:

1) The rear abutment can be relocated downstation (behind Station 131+00.00) and positioned on embankments constructed with 2.5:1 slopes using wick drains and staged construction. This solution provides adequate drained and seismic global stability, however, it will introduce an overall increase in bridge length and construction costs.
2) A drilled shaft retaining wall can be used to stabilize the existing ground profile. The drilled shafts would be installed through the soil failure zone to improve embankment stability. This solution permits the rear abutment to be located upstation (forward Station 131+00.00) and positioned on embankments with 2:1 slopes. Wick drains and staged construction would not be required and overall bridge length would be less than that obtained through the first solution.

Note that these two geotechnical solutions to rear abutment embankment stability warrant the investigation of different bridge types. The updated 6/8/2006 Subsurface Exploration report and its 6/29/2006 addendum contain the calculations and document the information associated with these two solutions. They are provided, in their entirety, as an accompaniment to this Structure Type Study report.

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 north of Portsmouth in Valley Township. For the proposed mainline structure over S.R. 335 and the Little Scioto River, two lanes of northbound traffic and two lanes of southbound traffic will be carried on separate bridge sections. Both the proposed northbound and southbound bridge sections will consist of two 12'-0" travel lanes with 6'-0" median shoulders and 12'-0" outside shoulders. Each bridge deck will be 44'-11½" out-to-out with a 1'-6" outside straight face deflector parapet (SBR-1-99) and a 1'-5 ½" inside straight face deflector parapet (similar to a Type A1 barrier from Roadway Standard Construction Drawing RM-4.3 but using a base width of 1'-5 ½" and top width of 6 5/8"). The northbound and southbound bridge sections will be separated from one another, along their inside fascia, by 1". The profile grade line for both bridge sections will be located at the inside edge of pavement, which is 7'-6" from the centerline of survey and construction of S.R. 823.

Because these mainline structures are positioned within a horizontal curve, their respective decks are superelevated. The superelevation rate and layout are based on Figure 202-7E of the ODOT Location and Design Manual, Volume One – Roadway Design (using a degree of curve of 1° 00' and design speed of 70 mph) and Figure 205 of the ODOT Bridge Design Manual, respectively. Using these design references results in a superelevation rate of 0.036 ft/ft (3.6%) across the northbound and southbound travel lanes. Furthermore,

horizontal and vertical sight distances, in accordance with the design standards, have been provided over the proposed mainline bridges for all alternatives considered. The existing S.R. 335 will remain on its current horizontal and vertical alignment and its cross-section will remain unchanged. Note that further discussion regarding the profile of the proposed mainline structures may be found in Section 5 of this report.

Vertical and Horizontal Design – The vertical alignment of these mainline structures is dictated by the overall vertical design of the new bypass profile. According to the ODOT Location and Design Manual, Volume One – Roadway Design, Figure 302-1E, a preferred vertical clearance of 17'-0" (minimum of 16'-6") must be provided over S.R. 335 which is positioned directly below the S.R. 823 mainline structures at this site. Each alternative considered provides more than the preferred 17'-0" clearance.

Due to the existing conditions along the southern and northern edges of S.R. 335, a horizontal clear zone width of 5'-6" minimum from the face of the existing guardrail to the face of pier (or other type of obstruction) should be maintained on the southern edge of S.R. 335 whereas a horizontal clear zone width of 15'-0" minimum from the edge of traveled way to face of obstruction should be maintained along the northern edge of S.R. 335. The 5'-6" distance from the face of existing guardrail is based on using a Type 5 steel beam guardrail in Table 603-2E of the ODOT Location and Design Manual, Volume One. The 15'-0" clear zone from edge of traveled way is based on Figure 600-1E of the ODOT L&D Manual, Volume One. The information input into Figure 600-1E is as follows:

a) the existing S.R. 335 may be classified as a Rural Collector Street. From Figure 104-2E the *recommended design speed is 50 mph*;
b) from the ODOT Office of Technical Services, the 2030 ADT for S.R. 335 is *6600*;
c) the existing groundline along the northern edge of S.R. 335 forms a backslope with an *approximate slope of 2:1, which is steeper than 4:1*.

Using the identified parameters of items a) through c) in Figure 600-1E results in the minimum horizontal clear zone width of 15'-0". The proposed substructure layout for each alternative in this updated Structure Type Study report satisfies both the 5'-6" and 15'-0" minimum horizontal clearances while simultaneously keeping substructure units out of the Little Scioto River.

Drainage Design – Due to the span lengths, and thus overall bridge length, as well as the width and cross-slope (superelevation) of the bridge deck, the collection of stormwater runoff must be addressed for each proposed alternative through the use of scuppers. Justification for the use of scuppers is presented for each alternative in Appendix F. Scupper locations for a particular alternative are shown in the respective framing plan (see Appendices B and D).

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

Maintenance of Traffic – While the new bridge is under construction, traffic will be maintained on the existing S.R. 335. It is anticipated that there will be limited closures during construction, primarily for beam setting.

5. Proposed Structure Configurations

Alignment & Profile: The proposed horizontal geometry for both the left and right structures lies within a horizontal curve that is part of a spiral-curve-spiral alignment. This spiral-curve-spiral alignment may be defined by the following parameters: TS = Station 126+95.51, SC = Station 129+20.51, CS = Station 165+64.71, ST = Station 167+89.71, Δ = 38°41'31", D_c (degree of curve) = 1°00'00", R (radius) = 5729.578', L_s = 225.00', θ = 1°07'30", LT = 150.00', ST = 75.00', x = 224.99', y = 1.47', k = 112.50', p = 0.37', Δ_c (deflection angle) = 36°26'31", L_c = 3644.19', T_s = 2124.26', and E_s = 343.27'. The proposed mainline profile for each structure is

located on the inside edge of pavement which is 7'-6" from the centerline of survey and construction S.R. 823. The left and right profiles are within a 1700' vertical curve with PVI at Station 131+00.00, g_1 = -4.10% and g_2 = 5.00%. The horizontal and vertical geometry for all alternatives considered are the same.

The substructure layout for each alternative ensures that piers are not positioned within the Little Scioto River and have minimal, if any, impact on S.R. 335 which is to remain open during construction. If a drilled shaft retaining wall is not used to stabilize the soils in the vicinity of the rear abutment, then embankment slopes will be constructed at a maximum grade of 2.5:1 in accordance with DLZ recommendations. However, the use of a drilled shaft retaining wall permits 2:1 embankment slopes at the rear abutment. Please refer to Section 3 of this report and DLZ's 6/8/2006 updated Subsurface Exploration report for an explanation/summary of the grading to be used at the rear abutment embankments. Regardless of which embankment grade is used, there will be no impact on right-of-way since there are no local roads being traversed in the vicinity of the rear abutment. The forward abutment will require a combination of rock-cutting and built-up 2:1 embankments, yet this earthwork will tie into the existing ground so as to have minimal right-of-way impact on S.R. 335.

Structure: As per the Scope of Services, we investigated several bridge types and alternatives as part of this type study. A total of five (5) alternatives were considered and are outlined in the following Structure Type Alternative Table:

STRUCTURE TYPE ALTERNATIVE TABLE					
Structure Type Alternative	**1**	**2A**	**2B**	**3A**	**3B**
Structure Type Description	Dog-legged, 105" web, continuous Steel Plate Girders A709 Grade 50W	Dog-legged, 140" web, continuous Steel Plate Girders A709 Grade 50W	Dog-legged, 125" web, continuous Steel Hybrid Plate Girders A709 Gr. 50W (web), Gr. 70W (flanges)	Dog-legged, 117" web, continuous Steel Plate Girders A709 Grade 50W	Dog-legged, 103" web, continuous Steel Hybrid Plate Girders A709 Gr. 50W (web), Gr. 70W (flanges)
Proposed Beam Spacing	4 Spaces @ 10'-2"± per Bridge	4 Spaces @ 10'-1 ½"± per Bridge	4 Spaces @ 10'-1 ½"± per Bridge	4 Spaces @ 10'-1 ¼"± per Bridge	4 Spaces @ 10'-1 ¼"± per Bridge
No. of Spans	5	3	3	3	3
Abutment Type	**R. Abut.**: Stub Type with 2.5:1 spill-through slopes **F.Abut.**: Stub Type with rock cut and 2:1 spill-through slopes	**R. Abut.**: Stub Type with 2.5:1 spill-through slopes **F.Abut.**: Stub Type with rock cut and 2:1 spill-through slopes	**R. Abut.**: Stub Type with 2.5:1 spill-through slopes **F.Abut.**: Stub Type with rock cut and 2:1 spill-through slopes	**R. Abut.**: Stub Type with 2:1 spill-through slopes stabilized by drilled shaft retaining wall **F.Abut.**: Stub Type with rock cut and 2:1 spill-through slopes	**R. Abut.**: Stub Type with 2:1 spill-through slopes stabilized by drilled shaft retaining wall **F.Abut.**: Stub Type with rock cut and 2:1 spill-through slopes
No. of Piers	4	2	2	2	2
Pier Type	T-Type	T-Type	T-Type	T-Type	T-Type
Substructure Orientation	0°52'36" RF (w/ respect to Reference Chord)	10°00'00" RF (w/respect to Reference Chord)	10°00'00" RF (w/respect to Reference Chord)	0°00'00" (w/respect to Reference Chord)	0°00'00" (w/respect to Reference Chord)
Approximate Bridge Length	950'	910'	910'	820'	820'
Approximate Structure Depth					
Slab	9.00"	9.00"	9.00"	9.00"	9.00"
Haunch	2"	2"	2"	2"	2"
Beam	107.75"	142.75"	127.75"	120.5625"	106.00"
Total	118.75" (9.896')	153.75" (12.813')	138.75" (11.563')	131.56" (10.963')	117.00" (9.750')

Alternative Discussion:

Various span configurations were investigated and were refined to the layouts discussed below (and shown in the Structure Type Alternative Table). The location of the Little Scioto River and S.R. 335 dictated that either a 3-span or 5-span bridge would be most economical, with horizontal clearances to the roadway and Little Scioto River affecting the locations of piers. The positioning of the rear abutment was dictated by embankment stability – DLZ Ohio, Inc.'s evaluations and 6/8/2006 updated Subsurface Exploration report for the proposed Highland Bend embankments revealed unsatisfactory embankment stability for the rear abutment when positioned at either the original 7/15/2005 station of 132+20.00 or at a revised station of 131+35.00. Pushing the rear abutment further downstation – behind Station 131+00.00

– and using 2.5:1 slopes with wick drains and staged construction results in embankments with adequate drained and seismic global stability. Consequently, without installing a structure through the soil failure zone to improve embankment stability, the rear abutment must be positioned at a station below 131+00.00. Using a drilled shaft retaining wall through the soil failure zone will permit the rear abutment to be positioned at a station beyond/ahead (i.e., forward) of 131+00.00 with embankment grades of 2:1.

Through the use of the pier positions, the concept of symmetrical spans, and the span ratios of ODOT BDM 205.6, the rear abutment position will help dictate the position of the forward abutment. However, to construct the forward abutment and satisfy both the grading at this location and horizontal clearances with S.R. 335, rock must be cut from the hill and 2:1 embankments must be built at the forward abutment position. Rock cuts will add to construction costs, therefore the positioning of the forward abutment must also take into account the quantity of rock that must be removed from the site. In essence, the span configurations discussed below are based on optimal combinations that simultaneously address: a) rear abutment embankment stability, b) forward abutment rock cuts, c) horizontal clearances with respect to S.R. 335, and d) keeping piers out of the Little Scioto River.

Alternative 1

Span configuration: Alternative 1 is comprised of a 5-span structure with span lengths of 150'-0", 200'-0", 250'-0", 200'-0", and 150'-0" for an overall bridge length of 950'-0" from centerline bearing rear abutment to centerline bearing forward abutment. These lengths are measured along the centerline of survey and construction S.R. 823 and satisfy the span ratios of ODOT BDM 205.6 (0.8 x 250' = 200', 0.75 x 200' = 150'). The centerline bearing rear abutment is positioned at Station 130+75.00, thus ensuring the stability of 2.5:1 embankments when not using a drilled shaft retaining wall. Piers are located in order to satisfy horizontal clearances with S.R. 335 as well as ODOT span ratios and are positioned outside the Little Scioto River, which minimizes disruption to the river and its bed. The forward abutment is positioned at Station 140+25.00, which satisfies span ratios, span symmetry, and minimizes rock cutting/removal at the forward abutment location. The forward abutment will be partially founded on existing bedrock but due to the proposed S.R. 823 alignment as it crosses into the hill, the northeast corner of this abutment will be supported on drilled shafts through fill. Using the same low skew angle (less than 1°) for each substructure unit with respect to the reference chord is ideal for a horizontally curved structure – the low skew helps minimize torsional effects on the I-shaped plate girders and permits parallel girder segments to be fabricated at the same length.

Substructure:

1. Abutments: Due to the horizontal curvature and a bearing-to-bearing length of 950'-0" (> 400' total length), a conventional, or stub-type, abutment must be used at both the rear and forward abutments. From their original foundation recommendations (dated 3/31/2005 and presented in Appendix E of the original 7/15/2005 Structure Type Study report), DLZ recommends founding the rear abutment on either drilled shafts or HP14x73 driven piles. A precursory load and cost analysis of the rear abutment reveals driven piles to be the less expensive foundation type, so it is recommended that the rear abutment be founded on HP14x73 driven piles (note that this analysis and recommendation address comment 10 from ODOT's 9/1/2005 comments to the original 7/15/2005 Structure Type Study report). The forward abutment shall be founded on a continuous spread footing embedded in bedrock (with a gross allowable bearing capacity of 20 tsf), except for the northeast corner of the abutment where the footing will be supported on 3'-0" diameter drilled shafts embedded in

rock sockets. Turnback wingwalls will be used at both the rear and forward abutments and all abutment and wingwall details will follow ODOT Standard Drawing A-1-69.

II. Piers: Both the southbound (left) and northbound (right) bridge require four piers. Each pier will be a T-type pier. A T-type is selected over a cap-and-column type due to the anticipated height of pier which, for this alternative, can range from approximately 40' to nearly 90'. The columns of a cap-and-column pier with such height may be considered slender columns and to minimize/eliminate these slenderness effects, the wide and thick stem of a T-type pier is useful.

According to the boring logs and subsurface evaluation/foundation recommendations of DLZ, the same foundation type cannot be used amongst the piers. As with the rear abutment, Pier 1 can be founded on either drilled shafts or HP14x73 driven piles. A precursory load and cost analysis of Pier 1 reveals driven piles to be the less expensive foundation type, so it is recommended that Pier 1 be founded on HP14x73 piles driven to rock. Piers 2 and 3 are positioned outside the waterway of the Little Scioto River but still within the floodplain. The weak soils at these locations lie above bedrock which was encountered approximately 35'-40' below existing groundline. Due to very low blow counts and the possibility of scour, the weak soils above the bedrock cannot provide sufficient bearing, therefore drilled shafts with rock sockets in competent bedrock should be used to found Piers 2 and 3. A preliminary design using a gross allowable end bearing capacity of 20 tsf results in drilled shafts with 8'-0" diameter above rock and 7'-6" diameter within the rock socket. The heavy loads from both the tall T-type piers and the superstructure necessitated the use of the larger shaft diameter to reduce the quantity. Pier 4 shall be founded on a spread footing. Borings reveal bedrock at or near the ground surface, therefore a direct cut into rock will be required. The dimensions of the spread footing will need to be established using a gross allowable bearing capacity of 15 tsf. Please note that all allowable bearing capacities and subsurface evaluations are based on DLZ analyses/recommendations.

Superstructure:

I. Girders and Deck: The superstructure for both the left and right bridge of this alternative consists of 5-continuous welded steel plate girders, Grade 50W, with 105" deep webs. The plate girders are dog-legged to accommodate the horizontal curvature of the bridge and to permit fabrication of straight girder segments which is easier and less costly than the fabrication of curved girder segments. The straight girder segments are dog-legged at splice points and placed parallel to one another between splices. Recall that scuppers are required for the collection and removal of stormwater runoff (refer to Appendix F). In accordance with Section 205.6 of the ODOT Bridge Design Manual, an overhang of 1'-6" must be provided between centerline of fascia girder and deck fascia at locations where scuppers are needed. When the positioning of scuppers, the location of splice points, and the dog-legging and parallel placement of straight plate girder segments are considered simultaneously, a center-to-center girder spacing of 10'-2"± results (spacing between splice points actually varies from 10'-1 5/8" to 10'-2"± - refer to the framing plan for Alternative 1). With such spacing, the 5-continuous welded steel plate girders discussed above will satisfy the HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf.

Both the left and right bridge have a 42'-0" width from toe-to-toe of parapet with an overall bridge deck width of 44'-11 ½". Deck thickness, including a 1" monolithic wearing surface, is 9".

II. Expansion Devices and Bearings: A preliminary evaluation of expansion devices involved designating Pier 2 as a "fixed" pier (i.e., Pier 2 is a thermal neutral point). This resulted in a rear abutment expansion length of 350' and a forward abutment expansion length of 600'. Section 306.3.3 of the ODOT Bridge Design Manual and ODOT Standard Drawing EXJ-4-87 reveal that a 5" strip seal expansion joint can be used at the rear abutment whereas a modular expansion device is needed at the forward abutment. Note that these results are based on a simple preliminary evaluation of the bridge system and ignore, for now, the effects of horizontal curvature. In addition, a preliminary evaluation of bearings was performed. Both Methods A and B were used to evaluate elastomeric bearings. To accommodate the large vertical reactions at the piers and abutments as well as the large horizontal displacements due to thermal expansion/contraction, a very thick bearing (> 5") comprised of many layers would be needed and it would require large plan dimensions, L and W. However, it was very difficult to satisfy simultaneously the compressive stress, rotation, and stability requirements of each method. Consequently, pot bearings should be used, and are recommended, as the bearing type for Alternative 1. Pot bearings can support high vertical loads and multi-directional displacements/rotations which will occur due to the horizontal curvature of these bridges.

The initial bridge construction cost for Alternative 1 is estimated to be $20,270,000 in year 2008 dollars. The present life cycle maintenance costs for this alternative are estimated to be $11,242,000, resulting in a total estimated ownership cost of $31,512,000 in year 2008 dollars.

Alternative 2A

Span configuration: Alternative 2A is comprised of a 3-span structure with span lengths of 280'-0", 350'-0", and 280'-0" for an overall bridge length of 910'-0" from centerline bearing rear abutment to centerline bearing forward abutment. These lengths are measured along the centerline of survey and construction S.R. 823 and satisfy the span ratios of ODOT BDM 205.6 (0.8 x 350' = 280'). Note that this alternative utilizes two fewer spans than Alternative 1 – fewer piers are used with longer individual spans which reduces substructure costs as well as the overall length of the bridge. The centerline bearing rear abutment is positioned at Station 130+70.00, thus ensuring the stability of 2.5:1 embankments when not using a drilled shaft retaining wall. Pier centerlines are positioned at Stations 133+50.00 and 137+00.00 which are outside the Little Scioto River and thus minimize disruption to the river and its bed. These pier locations also satisfy horizontal clearances with S.R. 335 as well as ODOT span ratios and span symmetry. To minimize disruption to S.R. 335 during construction, Pier 2 must be skewed 10°00'00" RF with respect to the reference chord. Consequently, all substructure units are skewed 10°00'00" RF with respect to the reference chord – using the same skew angle amongst the substructures permits the parallel girder segments of the superstructure to be fabricated with the same length. The low skew will also have minimal torsional effect on the I-shaped plate girders of this horizontally curved structure. The forward abutment is positioned at Station 139+80.00, which satisfies span ratios and span symmetry. Furthermore, moving the forward abutment downstation reduces the quantity of rock that must be removed. As with Alternative 1, the forward abutment will be partially founded on existing bedrock but due to the proposed S.R. 823 alignment, the northeast corner of this abutment will be supported on drilled shafts through fill.

Substructure:

I. Abutments: Due to the horizontal curvature and a 910'-0" bearing-to-bearing length (> 400' total length), stub-type abutments should be used at both the rear and forward abutments. Although the rear abutment can be founded on either drilled shafts or driven piles, a precursory load and cost analysis reveals driven piles to be less expensive. The rear abutment shall therefore be founded on HP14x73 driven piles. The forward abutment shall be founded on a continuous spread footing embedded in bedrock (with a gross allowable bearing capacity of 20 tsf), except for the northeast corner of the abutment where the footing will be supported on 3'-0" diameter drilled shafts embedded in rock sockets. Turnback wingwalls will be used at both the rear and forward abutments and all abutment and wingwall details will follow ODOT Standard Drawing A-1-69.

II. Piers: The left and right bridges require two piers. Each pier will be a T-type so that the slenderness effects of a tall pier are minimized or eliminated. The piers will be founded on drilled shafts with rock sockets in competent bedrock. Such foundations are required because the weak soils that lie above bedrock cannot provide sufficient bearing capacity and may scour away. A preliminary design using a gross allowable end bearing capacity of 20 tsf results in drilled shafts with 9'-0" diameter above rock and 8'-6" diameter within the rock socket. The heavy loads from both the tall T-type piers and the superstructure necessitated the use of the larger shaft diameter to reduce the quantity.

Superstructure:

I. Girders and Deck: The superstructure for both the left and right bridge of this alternative consists of 5-continuous welded steel plate girders, Grade 50W, with 140" deep webs. As with Alternative 1, straight girder segments are placed parallel to one another between splice points and the girders are dog-legged at the splices to accommodate the horizontal curvature. Splices have been positioned in an effort to shorten, as best as possible, the length of straight girder segments, thus allowing a larger number of fabricators to bid on the steel superstructure (shorter length sections permit truck transportation to the site and are thus not strictly dependent on barge transportation). Scuppers are also required on this alternative to collect and remove stormwater runoff (refer to Appendix F), so a 1'-6" overhang must be provided where scuppers are needed. When scupper positions, splice locations, and dog-legging and parallel placement of straight girder segments are taken into consideration, a center-to-center girder spacing of 10'-1 ½"± results (spacing between splice points actually varies from 9'-11 $^{3}/_{8}$" to 10'-2 $^{13}/_{16}$"± - refer to the framing plan for Alternative 2A). With such spacing, the 5-continuous welded steel plate girders discussed above will satisfy the HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf.

Both the left and right bridge have a 42'-0" width from toe-to-toe of parapet with an overall bridge deck width of 44'-11 ½". Deck thickness, including a 1" monolithic wearing surface, is 9".

II. Expansion Devices and Bearings: A preliminary evaluation of expansion devices involved designating Pier 1 as a "fixed" pier (i.e., Pier 1 is a thermal neutral point). This resulted in a rear abutment expansion length of 280' and a forward abutment expansion length of 630'. Section 306.3.3 of the ODOT Bridge Design Manual and ODOT Standard Drawing EXJ-4-87

reveal that a 4" strip seal expansion joint can be used at the rear abutment whereas a modular expansion device is needed at the forward abutment. As with Alternative 1 these results are based on a simple preliminary evaluation of the bridge system and currently ignore the effects of horizontal curvature. A preliminary bearing evaluation results in a recommendation of pot bearings – vertical reactions at the piers and abutments are larger than those for Alternative 1 and thermal expansion lengths, and thus thermal displacements/rotations, are similar to those from Alternative 1. Since pot bearings were required for Alternative 1, it falls to reason that such bearings should be utilized for Alternative 2A.

The initial bridge construction cost for Alternative 2A is estimated to be $29,810,000 in year 2008 dollars. The present life cycle maintenance costs for this alternative are estimated to be $12,719,000, resulting in a total estimated ownership cost of $42,529,000 in year 2008 dollars.

Alternative 2B

Alternative 2B is identical to Alternative 2A except that the superstructures for the left and right bridges consist of 5-continuous hybrid steel plate girders which are comprised of Grade 70W flanges and a 125" Grade 50W web. Live load deflections do increase due to the use of hybrid sections, however, these deflections do not exceed AASHTO limits.

The initial bridge construction cost for Alternative 2B is estimated to be $26,920,000 in year 2008 dollars. The present life cycle maintenance costs for this alternative are estimated to be $11,993,000, resulting in a total estimated ownership cost of $38,913,000 in year 2008 dollars.

Alternative 3A

Span configuration: Alternative 3A is a 3-span structure with span lengths of 260'-0", 300'-0", and 260'-0" for an overall bridge length of 820'-0" from centerline bearing rear abutment to centerline bearing forward abutment. These lengths are measured along the centerline of survey and construction S.R. 823. This alternative is able to use shorter spans than those in Alternative 2A due to the use of a drilled shaft retaining wall located near Station 132+23.00. This drilled shaft retaining wall is installed through the soil failure zone to improve embankment stability – it stabilizes the in-situ soils below the built-up embankment thus stabilizing the embankment itself. This allows the rear abutment and its stabilized embankment to be positioned upstation (forward Station 131+00.00). The centerline bearing rear abutment is located at Station 131+40.00. Locating the rear abutment at a position further upstation (through the use of a drilled shaft retaining wall) will make it more difficult to properly – and simultaneously – situate the piers and forward abutment. Pier positions will either fall within the limits of the Little Scioto River or violate horizontal clearance requirements for S.R. 335 and although moving the rear abutment upstation would permit the forward abutment to be located downstation (closer to Pier 2), the 2:1 embankments associated with this downstation relocation will encroach on S.R. 335 and violate horizontal clearances. Consequently, Pier 2 and the forward abutment are positioned to ensure horizontal clearances with S.R. 335 are satisfied. Pier 2, as with Pier 1, must also be sufficiently distant from the Little Scioto River. Pier 1 is therefore positioned at Station 134+00.00 and Pier 2 is located at Station 137+00.00 which will, in addition, minimize traffic disruptions during construction. The centerline bearing forward abutment is positioned at Station 139+60.00. This location satisfies span symmetry, but more importantly, it permits the construction of embankments and rock cuts that fulfill the 15'-0" horizontal clearance requirements along the northern edge of S.R. 335. These requirements are satisfied by

founding the forward abutment footing at an elevation of 595.50'± which, in turn, allows the top of embankment (at the front face of abutment breast wall) to be positioned at an elevation of approximately 601.00'. If higher elevations are used for the footing and top of embankment, the resulting 2:1 embankments will encroach on S.R. 335 and thus violate horizontal clearance requirements. Note as well that if the forward abutment is positioned further downstation (at a station below 139+60.00), the abutment itself would need to be taller due to the increasing difference in profile grade and existing ground elevations. In addition, it becomes increasingly difficult at downstation positions to construct 2:1 embankments that meet the 15'-0" horizontal clearance along the northern edge of S.R. 335. As with Alternatives 1, 2A, and 2B, the forward abutment will be partially founded on existing bedrock but due to the proposed alignment of S.R. 823, the northeast corner of this abutment will be supported on drilled shafts through fill. With the substructure positions and resulting span configuration discussed above, it is possible to maintain a skew, with respect to the reference chord, of 0°00'00" for each substructure unit and yet minimize disruption to S.R. 335 during construction.

Substructure:

I. Abutments: Due to the horizontal curvature and an 820'-0" bearing-to-bearing length (> 400' total length), stub-type abutments should be used at both the rear and forward abutments. The rear abutment shall be founded on HP14x73 piles driven to rock (a more economical foundation type than drilled shafts) whereas the forward abutment shall be founded on a continuous spread footing embedded in bedrock (with a gross allowable bearing capacity of 20 tsf). The northeast corner of the forward abutment will be supported on 3'-0" diameter drilled shafts embedded in rock sockets. Turnback wingwalls will be used at both the rear and forward abutments and, unless noted otherwise, abutment and wingwall details will follow ODOT Standard Drawing A-1-69. The drilled shaft retaining wall required for embankment stability at the rear abutment will be comprised of 30" diameter shafts reinforced with W18x60 sections. The shafts are to be spaced 4'-0" center-to-center. Details regarding this drilled shaft wall are presented in the 6/29/2006 addendum to DLZ's 6/8/2006 Subsurface Exploration report.

II. Piers: The left and right bridges require two piers, each of which will be a T-type to minimize/eliminate slenderness effects. For the same reasons as Alternatives 1, 2A, and 2B, the piers will be founded on drilled shafts with rock sockets in competent bedrock. Preliminary design efforts using a gross allowable end bearing capacity of 20 tsf reveal that 9'-0" diameter drilled shafts should be used above rock and 8'-6" diameter shafts should be used within the rock socket. The heavy loads from both the tall T-type piers and the superstructure necessitated the use of a larger shaft diameter to reduce quantity and permit construction of a reasonably sized footing.

Superstructure:

I. Girders and Deck: The superstructure for both the left and right bridge of this alternative consists of 5-continuous welded steel plate girders, Grade 50W, with 117" deep webs. Once again, the girders are dog-legged at the splices to accommodate the horizontal curvature and the splices are positioned to shorten the length of straight girder segments. Scuppers are required to collect and remove stormwater runoff (refer to Appendix F), so a 1'-6" overhang must be provided where scuppers are needed. When scupper positions, splice locations, and dog-legging and parallel placement of straight girder segments are taken into consideration, a center-to-center girder spacing of 10'-1 ¼"± results (spacing between splice points actually varies from 10'-1 $^{3}/_{16}$"± to 10'-1 $^{1}/_{2}$"± - refer to the framing plan for Alternative 3A). With such

spacing, the 5-continuous welded steel plate girders discussed above will satisfy the HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf.

Both the left and right bridge have a 42'-0" width from toe-to-toe of parapet with an overall bridge deck width of 44'-11 ½". Deck thickness, including a 1" monolithic wearing surface, is 9".

II. Expansion Devices and Bearings: A simple preliminary evaluation of expansion devices (i.e., one that currently ignores the effects of horizontal curvature) involved designating Pier 1 as the thermal neutral point. This resulted in a rear abutment expansion length of 260' and a forward abutment expansion length of 560'. Section 306.3.3 of the ODOT Bridge Design Manual and ODOT Standard Drawing EXJ-4-87 reveal that a strip seal expansion joint (3" or 4") can be used at the rear abutment whereas a modular expansion device is needed at the forward abutment. As with Alternatives 2A and 2B, pot bearings are the recommended bearing type due to large vertical reactions and multi-directional thermal displacements/rotations.

The initial bridge construction cost for Alternative 3A is estimated to be $23,030,000 in year 2008 dollars. The present life cycle maintenance costs for this alternative are estimated to be $10,635,000, resulting in a total estimated ownership cost of $33,665,000 in year 2008 dollars.

Alternative 3B

Alternative 3B is identical to Alternative 3A except that the superstructures for the left and right bridges consist of 5-continuous hybrid steel plate girders which are comprised of Grade 70W flanges and a 103" Grade 50W web. As experienced with Alternative 2B, live load deflections do increase due to the use of hybrid sections, however, these deflections do not exceed AASHTO limits.

The initial bridge construction cost for Alternative 3B is estimated to be $22,940,000 in year 2008 dollars. The present life cycle maintenance costs for this alternative are estimated to be $9,717,000, resulting in a total estimated ownership cost of $32,657,000 in year 2008 dollars.

6. Recommendations

Based upon the above information and discussions, Transystems recommends **Structure Type Alternative 1,** which is a 5-span structure comprised of A709 Grade 50W continuous plate girders with 105" deep webs (girders are dog-legged at splice locations), stub-type abutments (2.5:1 embankment slopes constructed with wick drains and in stages at the rear abutment; a combination of rock cuts and 2:1 embankments at forward abutment), and T-Type piers. See Appendix B for the Site Plan and Structure Details.

Although Alternatives 1, 3A, and 3B provide similar total estimated ownership costs, Alternative 1 is preferred, and thus recommended, based on the following items:

1. Loads on piers near the Little Scioto River are smaller, thus permitting the use of smaller diameter drilled shafts;

2. Girders/spans utilize a more balanced span configuration in line with the span ratios of ODOT BDM 205.6;
3. Alternatives 3A and 3B do reduce the number of substructure units (piers), however, they require the use of a drilled shaft retaining wall to stabilize rear abutment embankments. Alternative 1 does not require this drilled shaft retaining wall, thus reducing construction complexity and substructure costs;
4. Alternative 1 offers the lowest initial construction costs of all five alternatives and less complex construction methods and is thus more economical from a construction standpoint;
5. Of all five alternatives, Alternative 1 provides the lowest total relative ownership cost.

APPENDIX A

Cost Comparison Summary

TranSystems

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S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

ALTERNATIVE COST SUMMARY

Alternative No.	Span Arrangement No. Spans	Span Arrangement Lengths	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Subtotal Superstructure Cost	Subtotal Substructure Cost	Structure Incidental Cost (16%)	Structure Contingency Cost (20%)	Total Alternative Cost	Life Cycle Maintenance Cost	Total Relative Ownership Cost
1	5	150' - 200' - 250' - 200' - 150'	950.00	5 Steel Girders /per BRIDGE	105" Web Grade 50W	$10,845,000	$3,716,000	$2,329,800	$3,378,200	$20,270,000	$11,242,000	$31,512,000
2a	3	280' - 350' - 280'	910.00	5 Steel Girders /per BRIDGE	140" Web Grade 50W	$18,340,000	$3,072,000	$3,425,900	$4,967,600	$29,810,000	$12,719,000	$42,529,000
2b	3	280' - 350' - 280'	910.00	5 Steel Hybrid Girders /per BRIDGE	125" Web Grade 50W Grade 70W Flanges	$16,248,000	$3,090,000	$3,094,100	$4,486,400	$26,920,000	$11,993,000	$38,913,000
3a	3	260' - 300' - 260'	820.00	5 Steel Girders /per BRIDGE	117" Web Grade 50W	$12,687,000	$3,859,000	$2,647,400	$3,838,700	$23,030,000	$10,635,000	$33,665,000
3b	3	260' - 300' - 260'	820.00	5 Steel Hybrid Girders /per BRIDGE	103" Web Grade 50W Grade 70W Flanges	$12,622,000	$3,857,000	$2,636,600	$3,823,100	$22,940,000	$9,717,000	$32,657,000

NOTES:

1. Structure incidental cost allowance includes provision for structure excavation, porous backfill, sealing of concrete surfaces, cofferdams, 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 S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Approach Roadway Cost	Framing Alternative	Proposed Girder Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
1	5	150' - 200' - 250' - 200' - 150'	950.00	952	3251	$1,921,300	$815,300	$113,400	$0	5 Steel Girders /per BRIDGE	105" Web Grade 50W	5,914,972	$7,869,600	$125,300	$10,845,000

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	4.7747	4.77

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.75	44.96	33.7	3.4	46.1
Right Bridge	0.75	44.96	33.7	3.4	46.1

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.33	Curved Girders

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	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Modular Expansion Joints	1.00	$907.42	3.5%	$1,041.29
Strip Seal Expansion Joints	1.00	$306.27	3.5%	$351.45

Modular Expansion Joints Length	90 ft.
Strip Seal Expansion Joints Length	90 ft.

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Granular Embnkmnt.	0.00 cu.yd.	$10.00	3.5%	$11.09
Excavation- Rock	0.00 cu.yd.	$6.00	3.5%	$6.65
Wick Drains	0.00 ft.	$1.00	3.5%	$1.11
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 S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

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	Drilled Shaft Foundation Cost	Earthwork Cost	Subtotal Substructure Cost
1	5	150' - 200' - 250' - 200' - 150'	5 Steel Girders /per BRIDGE	105" Web Grade 50W	$1,381,400	$314,600	$158,400	$26,000	$365,200	$914,300	$555,700	**$3,716,000**

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	456	$421.00	3.5%	$483.00	$220,250
Stem	1306	$421.00	3.5%	$483.00	$630,800
Footings	1098	$421.00	3.5%	$483.00	$530,330
Total Cost	2860				$1,381,400

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	328	$421.00	3.5%	$483.00	$158,400
Wingwalls	0	$421.00	3.5%	$483.00	$0

Excavation and Embankment Costs:

Component	Quantity	Year 2005	Annual Escalation	Year 2008	Total Cost
Embankment	28200	$10.00	3.5%	$11.00	$310,200
Rock Excavation	27400	$6.00	3.5%	$6.65	$182,200
Wick Drains	57000	$1.00	3.5%	$1.11	$63,300

Note: Structure Excavation included in contingency esimates.

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

Shaft Foundation Unit Cost ($/ft.): Abutment Drilled Shafts

	Number of Shafts		Total Shaft Length
42" Above Bedrock	3	SEE QUANTITY CALCULATIONS	36
36" Into Bedrock	3	SEE QUANTITY CALCULATIONS	18.0

Shaft Foundation Unit Cost ($/ft.): Pier Drilled Shafts

	Number of Shafts		Total Shaft Length
96" Above Bedrock	16	SEE QUANTITY CALCULATIONS	496
90" Into Bedrock	16	SEE QUANTITY CALCULATIONS	176

Shaft Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008	Total Cost
42" Above Bedrock	$300.00	3.5%	$344.00	$12,384
36" Into Bedrock	$450.00	3.5%	$516.00	$9,288
96" Above Bedrock	$1,000.00	3.5%	$1,148.00	$569,408
90" Into Bedrock	$1,600.00	3.5%	$1,836.00	$323,136
Total Drilled Shaft Cost				**$914,216**

Pile Foundation Unit Cost ($/ft.): ***HP 14x73 Piles, Furnished & Driven***

Number of Piles		Total Pile Length
94	SEE QUANTITY CALCULATIONS	9,130

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP
Checked: MSL

Date: 7/12/2006
Date: 7/12/2006

Pier Quantities

Pier Location	Length	Cap				Stem				Footing				Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*	*Volume*	*Width*	*Depth*	*Length*	*Volume*	
Pier 1 (Pile)	43.667	4	8.8	35.20	1537	4	29.295	20.00	2344	17	4	37.00	2516	6397
Pier 2 (D.S.)	43.667	4	8.8	35.20	1537	4	78.62	20.00	6290	35	4	35.00	4900	12727
Pier 3 (D.S.)	43.667	4	8.8	35.20	1537	4	84.875	20	6790	35	4	35.00	4900	13227
Pier 4	43.667	4	8.8	35.20	1537	4	27.725	20	2218	25	4	25.00	2500	6255
Pier 5														0
Pier 6														0
Pier 7														0
Total (Cu.Ft.)					**6148**				**17641**				**14816**	**38605**
Total (Cu.Yd.)					**228**				**653**				**549**	**1430**
			Qty x 2 (L/R)		456				**1306**				**1098**	**2860**

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	45	1.75	10.08	17.64	794	3.75	3	11.25	506	6.25	3.25	20.313	1	914	2214
Fwd. Abut	45	1.75	10.08	17.64	794	3.75	3	11.25	506	6.25	3.25	20.313	1	914	2214
Total (Cu.Ft.)					**1588**				**1013**					**1828**	**4428**
Total (Cu.Yd.)					**59**				**38**					**68**	**164**
			Qty x 2 (L/R)		118				**76**					**136**	**328**

Superstructure Steel Quantities

Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight
Span 1	623	10	150	933943
Span 2	623	10	200	1245257
Span 3	623	10	250	1556572
Span 4	623	10	200	1245257
Span 5	623	10	150	933943
Span 6	0	0	0	0
Span 7	0	0	0	0
Span 8	0	0	0	0
Total			950	5914972

Drilled Shafts Above Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0.0	0.0	0.0	*0*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*8*	498.68	467	32.0	*256*
Pier 3	*8*	499.71	470	30.0	*240*
Pier 4	*8*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	606.5	595	12.0	*36*
Total	**27**				**532**

Drilled Shafts Into Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0	0	0.0	*0*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*8*	0	0	11.0	*88*
Pier 3	*8*	0	0	11.0	*88*
Pier 4	*8*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**27**				**194**

Steel H-Piles to Bedrock

Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Length
Rear Abut.	*46*	579.5	469.0	115.0	*5290*
Pier 1	*48*	544.75	469	80.0	*3840*
Pier 2	*0*	0	0	0.0	*0*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*0*	0	0	0.0	*0*
Total	**94**				**9130**

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2a - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
2a	3	280' - 350' - 280'	910	912	3114	$1,840,600	$781,100	$113,400	$102,500	5 Steel Girders /per BRIDGE	140" Web Grade 50W	11,555,842	$15,374,600	$127,300	**$18,340,000**

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	4.7747	4.77

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.75	44.96	33.7	3.4	46.1
Right Bridge	0.75	44.96	33.7	3.4	46.1

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.95	3.5%	$1.05	
Level 4 Plate Girders - Grade 50W	n/a	$1.05	3.5%	$1.16	Straight Girders
Level 5 Plate Girders - Grade 50W	n/a	$1.20	3.5%	$1.33	Curved Girders

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	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2004	Annual Escalation	Year 2008
Modular Expansion Joints	1.00	$907.42	3.5%	$1,041.29
Strip Seal Expansion Joints	1.00	$306.27	3.5%	$351.45

Modular Expansion Joints Length 91 ft.
Strip Seal Expansion Joints Length 91 ft.

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Granular Embnkmnt.	2,960 cu.yd.	$10.00	3.5%	$11.09
Excavation- Rock	7,544 cu.yd.	$6.00	3.5%	$6.65
Wick Drains	0.00 ft.	$1.00	3.5%	$1.11
Roadway incl. base	400.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	80 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	40 ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2a - SUBSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

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	Drilled Shaft Foundation Cost	Pile Foundation Cost	Earthwork Cost	Subtotal Substructure Cost
2a	3	280' - 350' - 280'	5 Steel Girders /per BRIDGE	140" Web Grade 50W	$918,700	$209,200	$176,800	$29,000	$1,047,500	$220,000	$471,100	**$3,072,000**

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	230	$421.00	3.5%	$483.00	$111,090
Stem	770	$421.00	3.5%	$483.00	$371,910
Footings	902	$421.00	3.5%	$483.00	$435,670
Total Cost	1902				$918,700

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	366	$421.00	3.5%	$483.00	$176,800
Wingwalls	0	$421.00	3.5%	$483.00	$0

Excavation and Embankment Costs:

Component	Quantity	Year 2005	Annual Escalation	Year 2008	Total Cost
Embankment	26400	$10.00	3.5%	$11.00	$290,400
Rock Excavation	17650	$6.00	3.5%	$6.65	$117,400
Wick Drains	57000	$1.00	3.5%	$1.11	$63,300

Note: Structure Excavation included in contingency esimates.

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

Shaft Foundation Unit Cost ($/ft.): Abutment Drilled Shafts

	Number of Shafts		Total Shaft Length
42" Above Bedrock	3	SEE QUANTITY CALCULATIONS	24
36" Into Bedrock	3	SEE QUANTITY CALCULATIONS	18

Shaft Foundation Unit Cost ($/ft.): Pier Drilled Shafts

	Number of Shafts		Total Shaft Length
108" Above Bedrock	16	SEE QUANTITY CALCULATIONS	528
102" Into Bedrock	16	SEE QUANTITY CALCULATIONS	176

Shaft Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008	Total Cost
42" Above Bedrock	$300.00	3.5%	$344.00	$8,256
36" Into Bedrock	$450.00	3.5%	$516.00	$9,288
108" Above Bedrock	$1,125.00	3.5%	$1,291.00	$681,648
102" Into Bedrock	$1,725.00	3.5%	$1,979.00	$348,304
Total Drilled Shaft Cost				**$1,047,496**

Pile Foundation Unit Cost ($/ft.): ***HP 14x73 Piles, Furnished & Driven***

Number of Piles		Total Pile Length
50	SEE QUANTITY CALCULATIONS	5,500

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

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2a - QUANTITY CALCULATIONS

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1 (D.S.)	44	4	8.8	35.20	1549	4	66	20.00		5280	39	4	39.00		6084	12913
Pier 2 (D.S.)	44	4	8.8	35.20	1549	4	64	20.00		5120	39	4	39.00		6084	12753
Pier 3																0
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**3098**					**10400**					**12168**	**25666**
Total (Cu.Yd.)					**115**					**385**					**451**	**951**
			Qty x 2 (L/R)		**230**					**770**					**902**	**1902**

Drilled Shafts Above Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0.0	0.0	0.0	*0*
Pier 1	*8*	506.785	480	28.0	*224*
Pier 2	*8*	507.885	470	38.0	*304*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	601.32	595	8.0	*24*
Total	**19**				**552**

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	45.6	1.75	12.88	22.54	1028	3.75	3	11.25		513	6.25	3.25	20.313	1	926	2467
Fwd. Abut	45.6	1.75	12.88	22.54	1028	3.75	3	11.25		513	6.25	3.25	20.313	1	926	2467
Total (Cu.Ft.)					**2056**					**1026**					**1853**	**4934**
Total (Cu.Yd.)					**76**					**38**					**69**	**183**
			Qty x 2 (L/R)		**152**					**76**					**138**	**366**

Drilled Shafts Into Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0	0	7.0	*0*
Pier 1	*8*	0	0	11.0	*88*
Pier 2	*8*	0	0	11.0	*88*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**19**				**194**

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	1270	10	280	3555644
Span 2	1270	10	350	4444555
Span 3	1270	10	280	3555644
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			910	11555842

Steel H-Piles to Bedrock

Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Length
Rear Abut.	*50*	576.6	469.0	110.0	*5500*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*0*	0	0	0.0	*0*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*0*	0	0	0.0	*0*
Total	**50**				**5500**

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2b - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Approach Roadway Cost	Framing Alternative	Proposed Stringer Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
2b	3	280' - 350' - 280'	910	912	3114	$1,840,400	$781,000	$99,000	$102,500	5 Steel Hybrid Girders /per BRIDGE	125" Web Grade 50W Grade 70W Flanges	9,593,639	$13,297,300	$127,300	**$16,248,000**

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	4.77	4.77

Slab:	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.75	44.96	33.7	3.4	46.1
Right Bridge	0.75	44.96	33.7	3.4	46.1

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

Structural Steel
Unit Costs ($/lb.):

	Cost Ratio	Year 2005	Annual Escalation	Year 2008	
Rolled Beams - Grade 50	n/a	$0.74	3.5%	$0.82	
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%	$1.33	Curved Girders
Level 5 Plate Girders - Grade 70W	n/a	$1.35	3.5%	$1.50	Curved Girders Grade 70W
			Weighted Average =	$1.39	

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	
Modular Expansion Joints	1.00	$907.42	3.5%	$1,041.29	2001 Price
Strip Seal Expansion Joints	1.00	$306.27	3.5%	$351.45	

Modular Expansion Joints Length 91 ft.
Strip Seal Expansion Joints Length 91 ft.

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Granular Embnkmnt.	2,960 cu.yd.	$10.00	3.5%	$11.09
Excavation- Rock	7,544 cu.yd.	$6.00	3.5%	$6.65
Wick Drains	0.00 ft.	$1.00	3.5%	$1.11
Roadway incl. base	400.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	80 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	40 ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2b - SUBSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

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	Drilled Shaft Foundation Cost	Pile Foundation Cost	Earthwork Cost	Subtotal Substructure Cost
2b	3	280' - 350' - 280'	5 Steel Hybrid Girders /per BRIDGE	125" Web Grade 50W Grade 70W Flanges	$924,500	$210,500	$186,000	$30,500	$1,047,500	$220,000	$471,100	**$3,090,000**

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	230	$421.00	3.5%	$483.00	$111,090
Stem	782	$421.00	3.5%	$483.00	$377,710
Footings	902	$421.00	3.5%	$483.00	$435,670
Total Cost	1914				$924,500

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 Cost					$0

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	350	$421.00	3.5%	$483.00	$169,100
Wingwalls	35	$421.00	3.5%	$483.00	$16,900

Excavation and Embankment Costs:

Component	Quantity	Year 2005	Annual Escalation	Year 2008	Total Cost
Embankment	26400	$10.00	3.5%	$11.00	$290,400
Rock Excavation	17650	$6.00	3.5%	$6.65	$117,400
Wick Drains	57000	$1.00	3.5%	$1.11	$63,300

Note: Structure Excavation included in contingency esimates.

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

Shaft Foundation Unit Cost ($/ft.): Abutment Drilled Shafts

	Number of Shafts		Total Shaft Length
42" Above Bedrock	3	SEE QUANTITY CALCULATIONS	24
36" Into Bedrock	3	SEE QUANTITY CALCULATIONS	18

Shaft Foundation Unit Cost ($/ft.): Pier Drilled Shafts

	Number of Shafts		Total Shaft Length
108" Above Bedrock	16	SEE QUANTITY CALCULATIONS	528
102" Into Bedrock	16	SEE QUANTITY CALCULATIONS	176

Shaft Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008	Total Cost
42" Above Bedrock	$300.00	3.5%	$344.00	$8,256
36" Into Bedrock	$450.00	3.5%	$516.00	$9,288
108" Above Bedrock	$1,125.00	3.5%	$1,291.00	$681,648
102" Into Bedrock	$1,725.00	3.5%	$1,979.00	$348,304
Total Drilled Shaft Cost				**$1,047,496**

Pile Foundation Unit Cost ($/ft.): ***HP 14x73 Piles, Furnished & Driven***

Number of Piles		Total Pile Length
50	SEE QUANTITY CALCULATIONS	5,500

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

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

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

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 2b - QUANTITY CALCULATIONS

By: PJP
Checked: MSL

Date: 7/12/2006
Date: 7/12/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1 (D.S.)	44	4	8.8	35.20	1549	4	67	20.00		5360	39	4	39.00		6084	12993
Pier 2 (D.S.)	44	4	8.8	35.20	1549	4	65	20.00		5200	39	4	39.00		6084	12833
Pier 3																
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**3098**					**10560**					**12168**	**25826**
Total (Cu.Yd.)					**115**					**391**					**451**	**957**
			Qty x 2 (L/R)		**230**					**782**					**902**	**1914**

Drilled Shafts Above Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0.0	0.0	0.0	*0*
Pier 1	*8*	506.785	480	28.0	*224*
Pier 2	*8*	507.885	470	38.0	*304*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	602.57	595	8.0	*24*
Total	**19**				**552**

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	45.6	1.75	11.625	20.34	928	3.75	3	11.25		513	6.25	3.25	20.313	1	926	2367
Fwd. Abut	45.6	1.75	11.625	20.34	928	3.75	3	11.25		513	6.25	3.25	20.313	1	926	2367
Total (Cu.Ft.)					**1855**					**1026**					**1853**	**4734**
Total (Cu.Yd.)					**69**					**38**					**69**	**175**
			Qty x 2 (L/R)		**138**					**76**					**138**	**350**

Drilled Shafts Into Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Abut.	*0*	0	0	0.0	*0*
Pier 1	*8*	0	0	11.0	*88*
Pier 2	*8*	0	0	11.0	*88*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**19**				**194**

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	1054	10	280	2951889
Span 2	1054	10	350	3689861
Span 3	1054	10	280	2951889
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			910	9593639

Steel H-Piles to Bedrock

Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Length
Rear Abut.	*50*	577.8	469.0	110.0	*5500*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*0*	0	0	0.0	*0*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*0*	0	0	0.0	*0*
Total	**50**				**5500**

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3a - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Approach Roadway Cost	Framing Alternative	Proposed Girder Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
3a	3	260' - 300' - 260'	820.00	822.00	2810	$1,660,900	$704,800	$113,400	$558,500	5 Steel Girders /per BRIDGE	117" Web Grade 50W	7,158,407	$9,524,000	$125,300.00	**$12,687,000**

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	4.77	4.77

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.75	45.00	33.8	3.4	46.2
Right Bridge	0.75	45.00	33.8	3.4	46.2

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

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%	$1.33	Curved Girders

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	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2005	Annual Escalation	Year 2008
Modular Expansion Joints	1.00	$907.42	3.5%	$1,041.29
Strip Seal Expansion Joints	1.00	$306.27	3.5%	$351.45

Modular Expansion Joints Length 90 ft.
Strip Seal Expansion Joints Length 90 ft.

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Granular Embnkmnt.	29,634 cu.yd.	$10.00	3.5%	$11.09
Excavation- Rock	19,613 cu.yd.	$6.00	3.5%	$6.65
Wick Drains	32,400 ft.	$1.00	3.5%	$1.11
Roadway incl. base	1,300.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	260 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	130 ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3a - SUBSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

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	Drilled Shaft Foundation Cost	Pile Foundation Cost	Earthwotk Cost	Subtotal Substructure Cost
3a	3	260' - 300' - 260'	5 Steel Girders /per BRIDGE	117" Web Grade 50W	$961,200	$218,900	$163,300	$26,800	$1,953,800	$202,400	$332,400	**$3,859,000**

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	226	$421.00	3.5%	$483.00	$109,160
Stem	862	$421.00	3.5%	$483.00	$416,350
Footings	902	$421.00	3.5%	$483.00	$435,670
Total Cost	1990				$961,200

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	338	$421.00	3.5%	$483.00	$163,300
Retaining Wall	0	$421.00	3.5%	$483.00	$0

Excavation and Embankment Costs:

Component	Quantity	Year 2005	Annual Escalation	Year 2008	Total Cost
Embankment	22750	$10.00	3.5%	$11.00	$250,300
Rock Excavation	12350	$6.00	3.5%	$6.65	$82,100
Wick Drains	0	$1.00	3.5%	$1.11	$0

Note: Structure Excavation included in contingency esimates.

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

Shaft Foundation Unit Cost ($/ft.): Abutment Drilled Shafts

	Number of Shafts		Total Shaft Length
30" Above Bedrock	67	SEE QUANTITY CALCULATIONS	3051
42" Above Bedrock	3	SEE QUANTITY CALCULATIONS	36
36" Into Bedrock	3	SEE QUANTITY CALCULATIONS	18

Shaft Foundation Unit Cost ($/ft.): Pier Drilled Shafts

	Number of Shafts		Total Shaft Length
108" Above Bedrock	16	SEE QUANTITY CALCULATIONS	480
102" Into Bedrock	16	SEE QUANTITY CALCULATIONS	176

Shaft Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008	Total Cost
30" Above Bedrock	$275.00	3.5%	$316.00	$964,116
42" Above Bedrock	$300.00	3.5%	$344.00	$12,384
36" Into Bedrock	$450.00	3.5%	$516.00	$9,288
108" Above Bedrock	$1,125.00	3.5%	$1,291.00	$619,680
102" Into Bedrock	$1,725.00	3.5%	$1,979.00	$348,304
Total Drilled Shaft Cost				**$1,953,772**

Pile Foundation Unit Cost ($/ft.): ***HP 14x73 Piles, Furnished & Driven***

Number of Piles		Total Pile Length
46	SEE QUANTITY CALCULATIONS	5,060

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

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

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 3a	0	$ -

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

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

By: PJP
Checked: MSL

Date: 7/12/2006
Date: 7/12/2006

Pier Quantities

	Length	Cap				Stem					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1 (D.S.)	43.5	4	8.8	35.20	1531	4	68.5	20.00		5480	39	4	39.00		6084	13095
Pier 2 (D.S.)	43.5	4	8.8	35.20	1531	4	77	20.00		6160	39	4	39.00		6084	13775
Pier 3																
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**3062**					**11640**					**12168**	**26870**
Total (Cu.Yd.)					**113**					**431**					**451**	**995**
			Qty x 2 (L/R)		**226**					**862**					**902**	**1990**

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	45	1.75	10.95	19.16	862	3.75	3	11.25		506	6.25	3.25	20.313	1	914	2283
Fwd. Abut	45	1.75	10.95	19.16	862	3.75	3	11.25		506	6.25	3.25	20.313	1	914	2283
Total (Cu.Ft.)					**1725**					**1013**					**1828**	**4565**
Total (Cu.Yd.)					**64**					**38**					**68**	**169**
			Qty x 2 (L/R)		**128**					**76**					**136**	**338**

Retaining Wall Quantities

Abut Location	Length (feet)	End Wingwall				Middle Wall					Footing					Total Volume
		Width	*Height*	*Area*	*Volume*	*Width*	*Height*	*Area*	*Length*	*Volume*	*Width*	*Depth*	*Area*	*# Footi*	*Volume*	
Rear Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Fwd. Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Total (Cu.Ft.)					**0**					**0**					**0**	**0**
Total (Cu.Yd.)					**0**					**0**					**0**	**0**

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	873	10	260	2269739
Span 2	873	10	300	2618929
Span 3	873	10	260	2269739
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			820	7158407

Drilled Shafts Above Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Wall	*67*	554.0	509.0	45.0	*3015*
Pier 1	*8*	499.345	480	20.0	*160*
Pier 2	*8*	509.51	470	40.0	*320*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	595.5	585	12.0	*36*
Total	**86**				**3531**

Drilled Shafts Into Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Wall	*0*	0	0	0.0	*0*
Pier 1	*8*	0	0	11.0	*88*
Pier 2	*8*	0	0	11.0	*88*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**19**				**194**

Steel H-Piles to Bedrock

Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Length
Rear Abut.	*46*	578.8	469.0	110.0	*5060*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*0*	0	0	0.0	*0*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*0*	0	0	0.0	*0*
Total	**46**				**5060**

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3a - SUPERSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

SUPERSTRUCTURE

Alternative No.	Span Arrangement No. Spans	Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Approach Roadway Cost	Framing Alternative	Proposed Girder Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Expansion Joint Cost	Subtotal Superstructure Cost
3b	3	260' - 300' - 260'	820.00	822.00	2810	$1,660,900	$704,800	$113,400	$558,500	5 Steel Hybrid Girders /per BRIDGE	103" Web Grade 50W Grade 70W Flanges	6,687,343	$9,459,500	$125,300.00	**$12,622,000**

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	4.77	4.77

Slab:

	T (ft.)	W (ft.)	Slab Area	Haunch & Overhang Area	Total Concrete Area (sq. ft.)
Left Bridge	0.75	45.00	33.8	3.4	46.2
Right Bridge	0.75	45.00	33.8	3.4	46.2

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

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%	$1.33	Curved Girders
Level 5 Plate Girders - Grade 70W	n/a	$1.35	3.5%	$1.50	Curved Girders Grade 70W
			Weighted Average =	$1.41	

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	$165.00	3.5%	$189.00

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

	Cost Ratio	Year 2005	Annual Escalation	Year 2008
Modular Expansion Joints	1.00	$907.42	3.5%	$1,041.29
Strip Seal Expansion Joints	1.00	$306.27	3.5%	$351.45

Modular Expansion Joints Length 90 ft.
Strip Seal Expansion Joints Length 90 ft.

Approach Roadway

		Year 2005	Annual Escalation	Year 2008
Granular Embnkmnt.	29,634 cu.yd.	$10.00	3.5%	$11.09
Excavation- Rock	19,613 cu.yd.	$6.00	3.5%	$6.65
Wick Drains	32,400 ft.	$1.00	3.5%	$1.11
Roadway incl. base	1,300.00 sq.yd.	$26.00	3.5%	$28.83
Barrier (single faced)	260 ft.	$50.00	3.5%	$55.44
Barrier (dble faced)	130 ft.	$80.00	3.5%	$88.70

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 3a - SUBSTRUCTURE

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

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	Drilled Shaft Foundation Cost	Pile Foundation Cost	Earthwotk Cost	Subtotal Substructure Cost
3b	3	260' - 300' - 260'	5 Steel Hybrid Girders /per BRIDGE	103" Web Grade 50W Grade 70W Flanges	$967,000	$220,200	$156,500	$25,700	$1,942,400	$212,320	$332,400	**$3,857,000**

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	226	$421.00	3.5%	$483.00	$109,160
Stem	874	$421.00	3.5%	$483.00	$422,140
Footings	902	$421.00	3.5%	$483.00	$435,670
Total Cost	2002				$967,000

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

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

Abutment QC/QA Concrete, Class QSC1 Cost:

Component	Volume (cu. yd.)	Year 2004	Annual Escalation	Year 2008	Total Cost
Abutment	324	$421.00	3.5%	$483.00	$156,500
Retaining Wall	0	$421.00	3.5%	$483.00	$0

Excavation and Embankment Costs:

Component	Quantity	Year 2005	Annual Escalation	Year 2008	Total Cost
Embankment	22750	$10.00	3.5%	$11.00	$250,300
Rock Excavation	12350	$6.00	3.5%	$6.65	$82,100
Wick Drains	0	$1.00	3.5%	$1.11	$0

Note: Structure Excavation included in contingency esimates.

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

Shaft Foundation Unit Cost ($/ft.): Abutment Drilled Shafts

	Number of Shafts		Total Shaft Length
30" Above Bedrock	70	SEE QUANTITY CALCULATIONS	3015
42" Above Bedrock	3	SEE QUANTITY CALCULATIONS	36
36" Into Bedrock	3	SEE QUANTITY CALCULATIONS	18

Shaft Foundation Unit Cost ($/ft.): Pier Drilled Shafts

	Number of Shafts		Total Shaft Length
108" Above Bedrock	16	SEE QUANTITY CALCULATIONS	480
102" Into Bedrock	16	SEE QUANTITY CALCULATIONS	176

Shaft Foundation Unit Cost ($/ft.):

	Year 2004 Unit Cost	Annual Escalation	Year 2008	Total Cost
30" Above Bedrock	$275.00	3.5%	$316.00	$952,740
42" Above Bedrock	$300.00	3.5%	$344.00	$12,384
36" Into Bedrock	$450.00	3.5%	$516.00	$9,288
108" Above Bedrock	$1,125.00	3.5%	$1,291.00	$619,680
102" Into Bedrock	$1,725.00	3.5%	$1,979.00	$348,304
Total Drilled Shaft Cost				**$1,942,396**

Pile Foundation Unit Cost ($/ft.): ***HP 14x73 Piles, Furnished & Driven***

Number of Piles		Total Pile Length
49	SEE QUANTITY CALCULATIONS	5,308

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

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

	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sum)
Alt. 3b	0	$ -

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

SCI-823-0.00 - PORTSMOUTH BYPASS

S.R. 823 over S.R. 335 and Little Scioto River

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

By: PJP
Checked: MSL

Date: 7/12/2006
Date: 7/12/2006

Pier Quantities

Pier Location	Length	Cap				Stem					Footing					Total Volume
		Width	*Depth*	*Area*	*Volume*	*Width*	*Height*	*Length*		*Volume*	*Width*	*Depth*	*Length*		*Volume*	
Pier 1 (D.S.)	43.5	4	8.8	35.20	1531	4	69.5	20.00		5560	39	4	39.00		6084	13175
Pier 2 (D.S.)	43.5	4	8.8	35.20	1531	4	78	20.00		6240	39	4	39.00		6084	13855
Pier 3																
Pier 4																0
Pier 5																0
Pier 6																0
Pier 7																0
Total (Cu.Ft.)					**3062**					**11800**					**12168**	**27030**
Total (Cu.Yd.)					**113**					**437**					**451**	**1001**
		Qty x 2 (L/R)			**226**					**874**					**902**	**2002**

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	45	1.75	9.8	17.15	772	3.75	3	11.25		506	6.25	3.25	20.313	1	914	2192
Fwd. Abut	45	1.75	9.8	17.15	772	3.75	3	11.25		506	6.25	3.25	20.313	1	914	2192
Total (Cu.Ft.)					**1544**					**1013**					**1828**	**4384**
Total (Cu.Yd.)					**57**					**38**					**68**	**162**
		Qty x 2 (L/R)			**114**					**76**					**136**	**324**

Retaining Wall Quantities

Abut Location	Length (feet)	Retaining Wall														Total Volume
		Width	*Height*	*Area*	*Volume*	*Width*	*Height*	*Area*	*Length*	*Volume*	*Width*	*Depth*	*Area*	*# Footi*	*Volume*	
Rear Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Fwd. Abut	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	0	0	0
Total (Cu.Ft.)					**0**					**0**					**0**	**0**
Total (Cu.Yd.)					**0**					**0**					**0**	**0**

Superstructure Steel Quantities

Location	Wt.of girder	# Girders	Span Length	Total Weight
Span 1	816	10	260	2120377
Span 2	816	10	300	2446589
Span 3	816	10	260	2120377
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			820	6687343

Drilled Shafts Above Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Wall	*67*	554.0	509.0	45.0	*3015*
Pier 1	*8*	499.345	480	20.0	*160*
Pier 2	*8*	509.51	470	40.0	*320*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	596.75	585	12.0	*36*
Total	**86**				**3531**

Drilled Shafts Into Bedrock

Location	Total Shafts	Top Elev.	Bot Elev.	Shaft Length	Total Length
Rear Wall	*0*	0	0	0.0	*0*
Pier 1	*8*	0	0	11.0	*88*
Pier 2	*8*	0	0	11.0	*88*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**19**				**194**

Steel H-Piles to Bedrock

Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Length
Rear Abut.	*46*	580.0	469.0	115.0	*5290*
Pier 1	*0*	0	0	0.0	*0*
Pier 2	*0*	0	0	0.0	*0*
Pier 3	*0*	0	0	0.0	*0*
Pier 4	*0*	0	0	0.0	*0*
Pier 5	*0*	0	0	0.0	*0*
Pier 6	*0*	0	0	0.0	*0*
Pier 7	*0*	0	0	0.0	*0*
Fwd. Abut.	*3*	0	0	6.0	*18*
Total	**49**				**5308**

By: PJP Date: 7/12/2006
Checked: MSL Date: 7/12/2006

LIFE CYCLE MAINTENANCE COST

Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Structural Steel Painting: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Sealing: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost	Approach Pavement Resurfacing: Cost Per Cycle	Number of Maintenance Cycles	Total Life Cycle Cost
1	5	950.00	5 Steel Girders /per BRIDGE	$3,612,300	2	$7,224,600	$0	0	$0	$0	10	$0
2a	3	910.00	5 Steel Girders /per BRIDGE	$4,431,600	2	$8,863,200	$0	0	$0	$800	10	$8,000
2b	3	910.00	5 Steel Hybrid Girders /per BRIDGE	$4,068,500	2	$8,137,000	$0	0	$0	$800	10	$8,000
3a	3	820.00	5 Steel Girders /per BRIDGE	$3,549,800	2	$7,099,600	$0	0	$0	$3,300	10	$33,000
3b	3	820.00	5 Steel Hybrid Girders /per BRIDGE	$3,090,900	2	$6,181,800	$0	0	$0	$3,300	10	$33,000

Alt. No.	Span Arrangement No. Spans	Lengths	Framing Alternative	Bridge Deck Overlay (5): Deck Demo & Chipping	Deck Overlay	Deck Joint Gland (2)	Number of Maintenance Cycles	Total Life Cycle Cost	Bridge Redecking (5): Deck Concrete Cost (3)	Deck Reinforcing Cost (3)	Deck Joint Cost (2)	Deck Removal Cost	Number of Maintenance Cycles	Total Life Cycle Cost	Superstructure Life Cycle Maintenance Cost (1)	Total Initial Construction Cost	Total Relative Ownership Cost
1	5	950	5 Steel Girders /per BRIDGE	$259,000	$314,000	$30,277	1	$573,000	$1,921,300	$815,300	$125,300	$707,300	1	$3,443,900	**$11,242,000**	**$20,270,000**	**$31,512,000**
2a	3	910	5 Steel Girders /per BRIDGE	$248,000	$300,700	$30,714	1	$548,700	$1,840,600	$781,100	$127,300	$677,500	1	$3,299,200	**$12,719,000**	**$29,810,000**	**$42,529,000**
2b	3	910	5 Steel Hybrid Girders /per BRIDGE	$248,000	$300,700	$30,714	1	$548,700	$1,840,400	$781,000	$127,300	$677,500	1	$3,298,900	**$11,993,000**	**$26,920,000**	**$38,913,000**
3a	3	820	5 Steel Girders /per BRIDGE	$223,700	$271,300	$30,277	1	$525,277	$1,660,900	$704,800	$125,300	$611,100	1	$2,976,800	**$10,635,000**	**$23,030,000**	**$33,665,000**
3b	3	820	5 Steel Hybrid Girders /per BRIDGE	$223,700	$271,300	$30,277	1	$525,277	$1,660,900	$704,800	$125,300	$611,100	1	$2,976,800	**$9,717,000**	**$22,940,000**	**$32,657,000**

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	105	10	950.00	25.30	226,338	20%	271,600
Alt. 2a	140	10	910.00	28.70	277,626	20%	333,200
Alt. 2b	125	10	910.00	28.70	254,876	20%	305,900
Alt. 3a	117	10	820.00	30.50	222,425	20%	266,900
Alt. 3b	103	10	820.00	25.80	193,657	20%	232,400

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.

54" AASHTO Type 2

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

PS Concrete Area:

	No. Stringers	Total Span Length (ft.)	Nominal Exposed Beam Area (sq. ft.)	Secondary Member Allowance	Total Exposed Concrete Area (sq. yd.)

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	$306.27	3.5%	$339.57
Modular Expansion Joints	$907.42	3.5%	$1,006.07

	Bridge Width	No. Joints
Alt. 1	90.00	2
Alt. 2a	91.30	2
Alt. 2b	91.30	2
Alt. 3a	90.00	2
Alt. 3b	90.00	2

Bridge Deck Removal Cost:

	Deck Area (3) (sq. ft.)	Year 2008	Deck Removal Cost
Alt. 1	85,421	$8.28	$707,300
Alt. 2a	81,824	$8.28	$677,500
Alt. 2b	81,824	$8.28	$677,500
Alt. 3a	73,800	$8.28	$611,100
Alt. 3b	73,800	$8.28	$611,100

Bridge Deck Overlay (Item 848):

Bridge Deck MSC Overlay Cost per sq. yd.:

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

Bridge Deck MSC Overlay Cost per cu. yd.:

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	85,421	9,491	237	214
Alt. 2a	81,824	9,092	227	205
Alt. 2b	81,824	9,092	227	205
Alt. 3a	73,800	8,200	205	185
Alt. 3b	73,800	8,200	205	185

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	$76.57	3.5%	$84.89
Modular Expansion Joint Glands	$226.86	3.5%	$251.52

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

	Year 2004	Annual Escalation	Year 2008
Asphalt Concrete Surface Course, per cu. yd.	$72.00	3.5%	$82.62

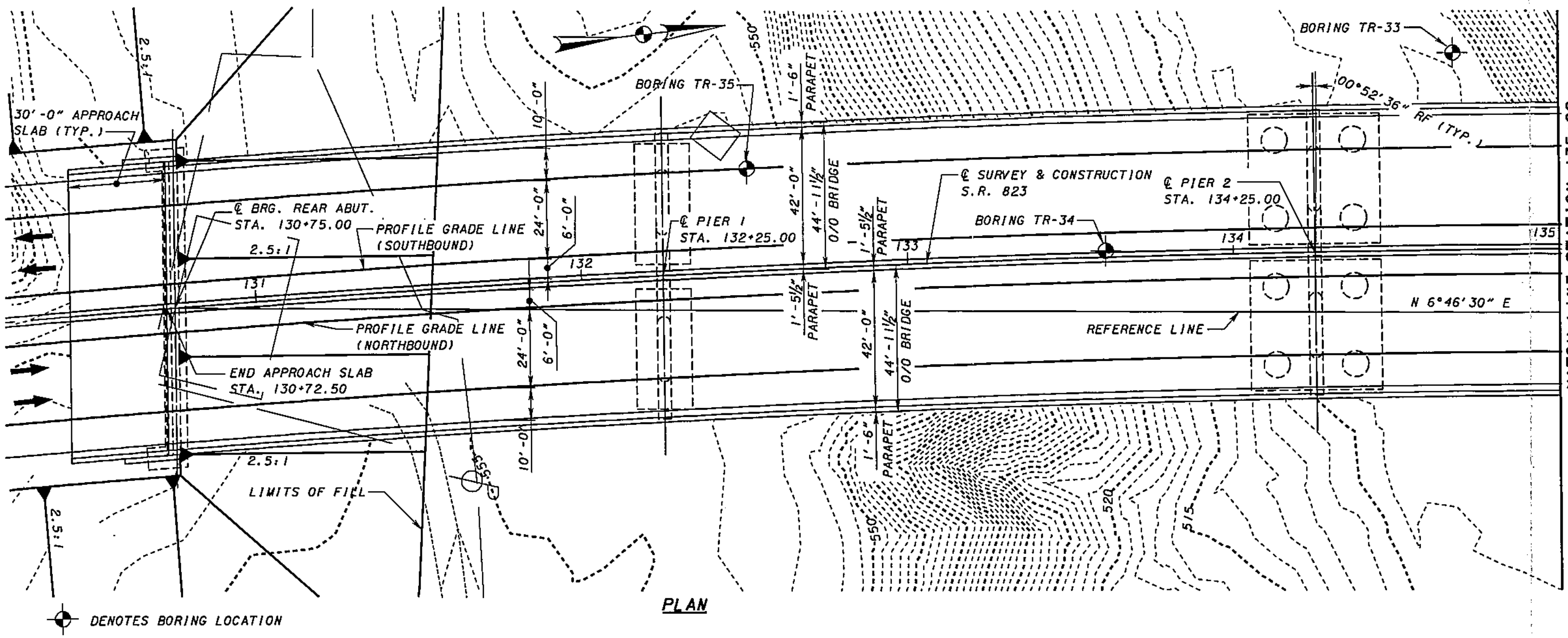
Asphalt Resurfacing Costs:

	Approach Roadway Length (ft.) (4)	Approach Roadway Width (ft.)	Resurfacing Area (sq. yd.)	Wearing Course Thickness (in.)	Wearing Course Volume (cu. yd.)
Alt. 1	0.0	38.0	0	1.50	0.0
Alt. 2a	40.0	38.0	169	1.50	7.0
Alt. 2b	40.0	38.0	169	1.50	7.0
Alt. 3a	170.0	38.0	718	1.50	29.9
Alt. 3b	170.0	38.0	718	1.50	29.9

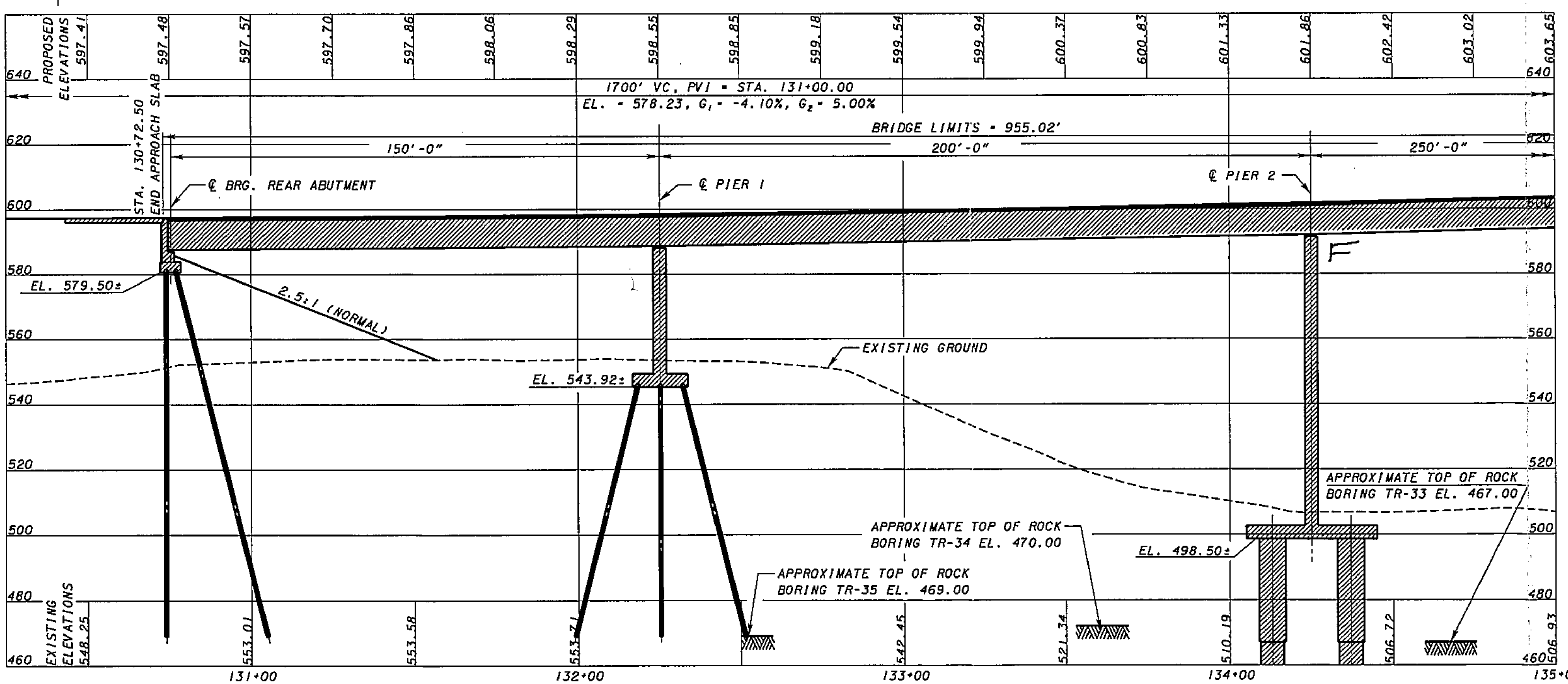
APPENDIX B

Preferred Alternative Site Plan and Details

TranSystems



PLAN



ELEVATION PROFILE GRADE LINE S.R. 823 LEFT BRIDGE

BORING LOCATIONS

BORING No.	STATION	OFFSET
TR-29	140+26.71	84.49' LT.
TR-30	139+35.00	52.27' LT.
TR-31	138+68.69	66.40' LT.
TR-32	136+60.60	10.36' LT.
TR-33	134+67.78	60.60' LT.
TR-34	133+61.14	2.01' LT.
TR-35	132+52.32	31.48' LT.

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

TRAFFIC DATA

S.R. 823
CURRENT YEAR ADT (2010) = 21,200
DESIGN YEAR ADT (2030) = 31,200
CURRENT YEAR ADTT (2010) = 2,970
DESIGN YEAR ADTT (2030) = 4,370

PROPOSED STRUCTURE

TYPE: 5 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W, DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS

SPANS: 150'-0", 200'-0", 250'-0", 200'-0", 150'-0" C/C BEARINGS

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

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

SKEW: 0°52'36" RF WITH RESPECT TO THE REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT ACROSS TRAVEL LANES

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

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.

UTILITIES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP14x73 PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS. DRILLED SHAFTS SHALL BE 8'-0" DIAMETER WITH 7'-6" DIAMETER ROCK SOCKET AT PIERS 2 & 3 AND 3'-6" DIAMETER WITH 3' DIAMETER ROCK SOCKETS AT FORWARD ABUTMENT AND HAVE ALLOWABLE END BEARING CAPACITY OF 20 TSF. SPREAD FOOTINGS SHALL HAVE AN ALLOWABLE BEARING CAPACITY OF 15 TSF.

DESIGN AGENCY: TranSystems

DESIGNED MSL | CHECKED MSL | DRAWN MTN | REVISED | REVIEWED JRC | DATE 07/12/06 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 130+72.50
STA. 140+27.52

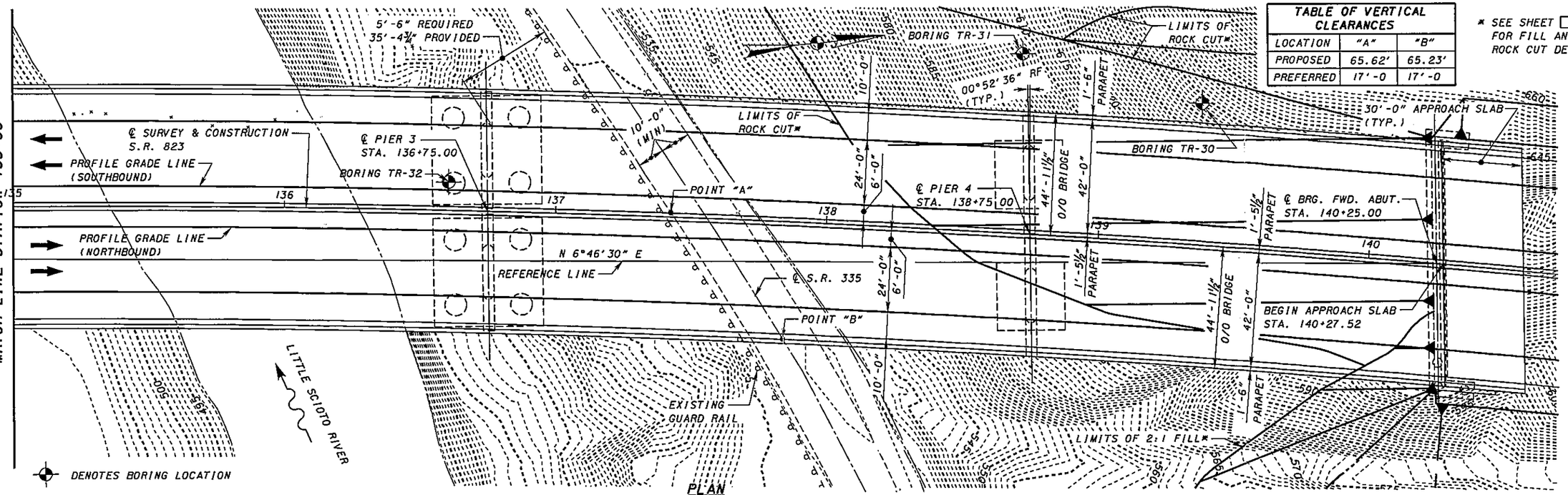
PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCO-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

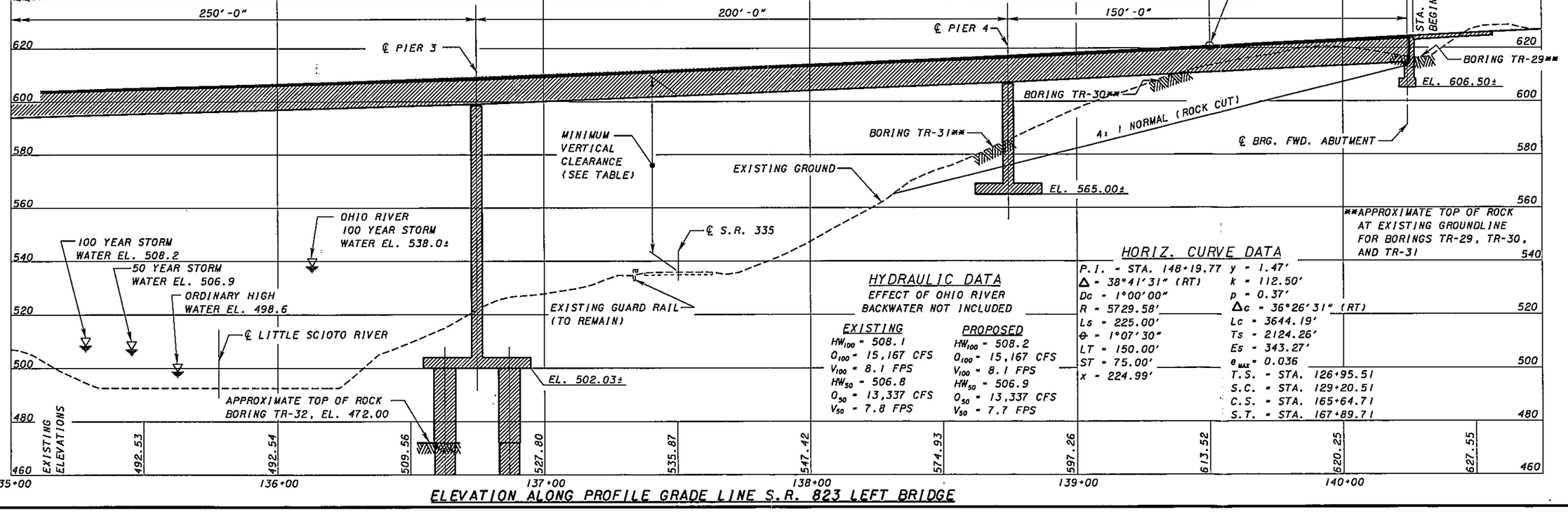
SCI-823-0.00
PID 19415

1 / 9

TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	65.62'	65.23'
PREFERRED	17'-0	17'-0

* SEE SHEET 9 | 9 FOR FILL AND ROCK CUT DETAILS





HYDRAULIC DATA
EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
HW_{100} = 508.1	HW_{100} = 508.2
Q_{100} = 15,167 CFS	Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS	V_{100} = 8.1 FPS
HW_{50} = 506.8	HW_{50} = 506.9
Q_{50} = 13,337 CFS	Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS	V_{50} = 7.7 FPS

HORIZ. CURVE DATA

P.I. = STA. 148+19.77	y = 1.47'
Δ = 38°41'31" (RT)	k = 112.50'
Dc = 1°00'00"	p = 0.37'
R = 5729.58'	Δc = 36°26'31" (RT)
Ls = 225.00'	Lc = 3644.19'
θ = 1°07'30"	Ts = 2124.26'
LT = 150.00'	Es = 343.27'
ST = 75.00'	e_{MAX} = 0.036
x = 224.99'	T.S. = STA. 126+95.51
	S.C. = STA. 129+20.51
	C.S. = STA. 165+64.71
	S.T. = STA. 167+89.71

**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31

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

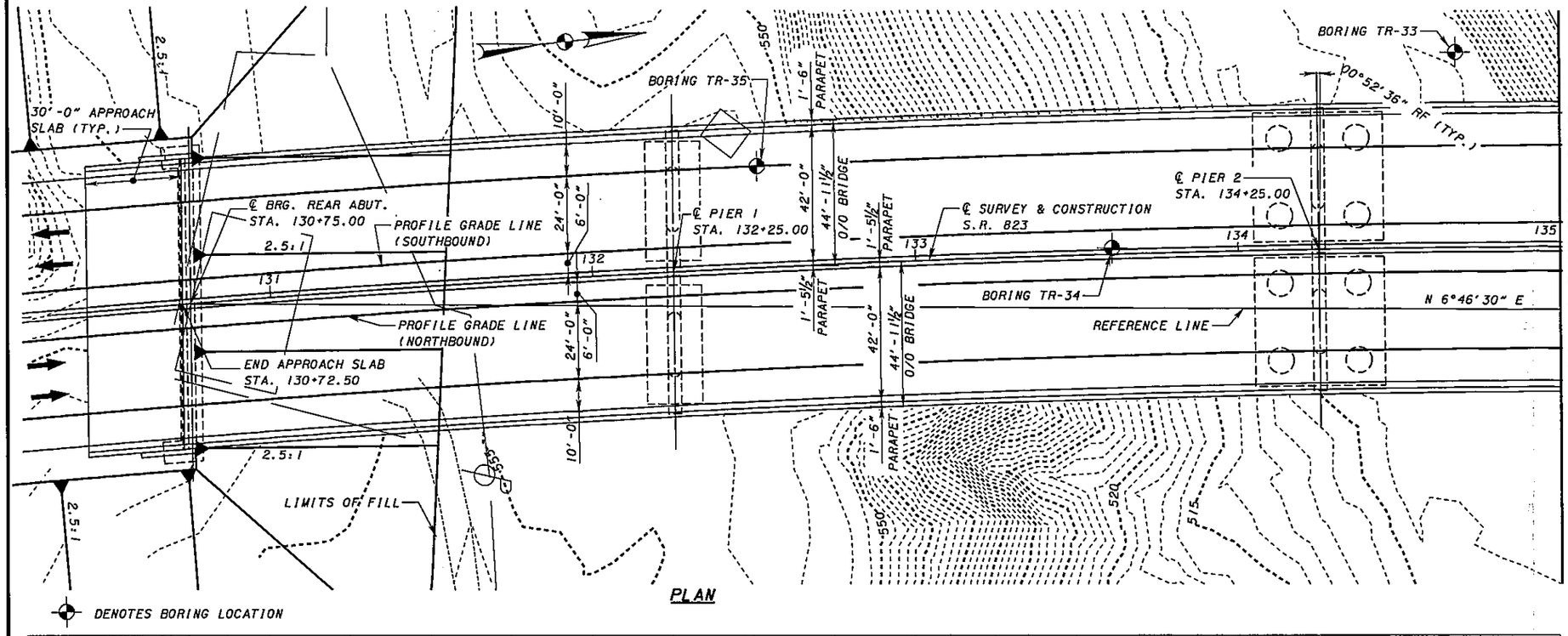
DESIGN AGENCY: Trans Systems, 3939 PENNSYLVANIA DRIVE, SUITE 100, DUBLIN, OHIO, 43017

DRAWN	ADVANCED	DATE
MTN	JRC	07/12/06
DESIGNED	REVISED	STRUCTURE FILE NUMBER
MSL		
CHECKED		
MSL		

SCIOTO COUNTY
STA. 130+72.50
STA. 140+27.52

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415



PLAN

ELEVATION PROFILE GRADE LINE S.R. 823 RIGHT BRIDGE

BORING LOCATIONS		
BORING No.	STATION	OFFSET
TR-29	140+26.71	84.49' LT.
TR-30	139+35.00	52.27' LT.
TR-31	138+68.69	66.40' LT.
TR-32	136+60.60	10.36' LT.
TR-33	134+67.78	60.60' LT.
TR-34	133+61.14	2.01' LT.
TR-35	132+52.32	31.48' LT.

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

TRAFFIC DATA

S.R. 823
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ROADWAY: 2 - 42'-0" TOE TO TOE PARAPETS

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

SKEW: 0°52'36" RF WITH RESPECT TO THE REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT ACROSS TRAVEL LANES

ALIGNMENT: Dc - 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

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UTILITIES:

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DESIGN AGENT: TranSystems, 347 FRANKLIN CHTC., SUITE 100, DUBLIN, OHIO, 43017

DATE: 07/12/06
REVISED: JRC
DRAWN: MTN
DESIGNED: MSL
CHECKED: MSL
STRUCTURE FILE NUMBER
REVISED

SCIOTO COUNTY
STA. 130+72.50
STA. 140+27.52

PRELIMINARY SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCO-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

3 / 9

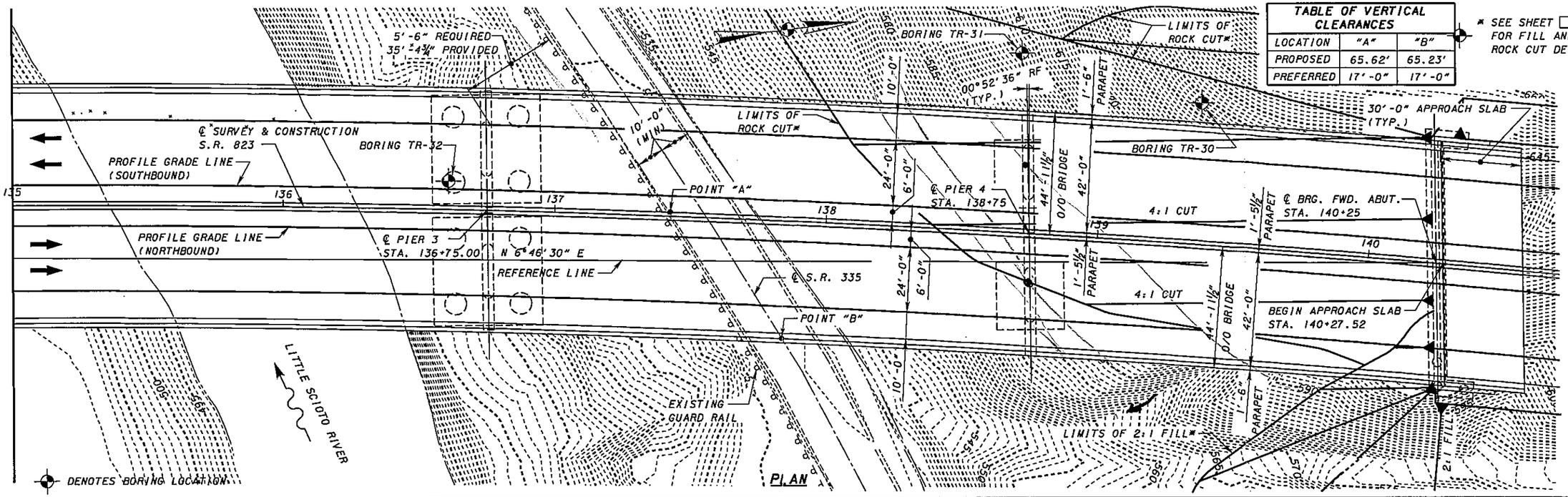
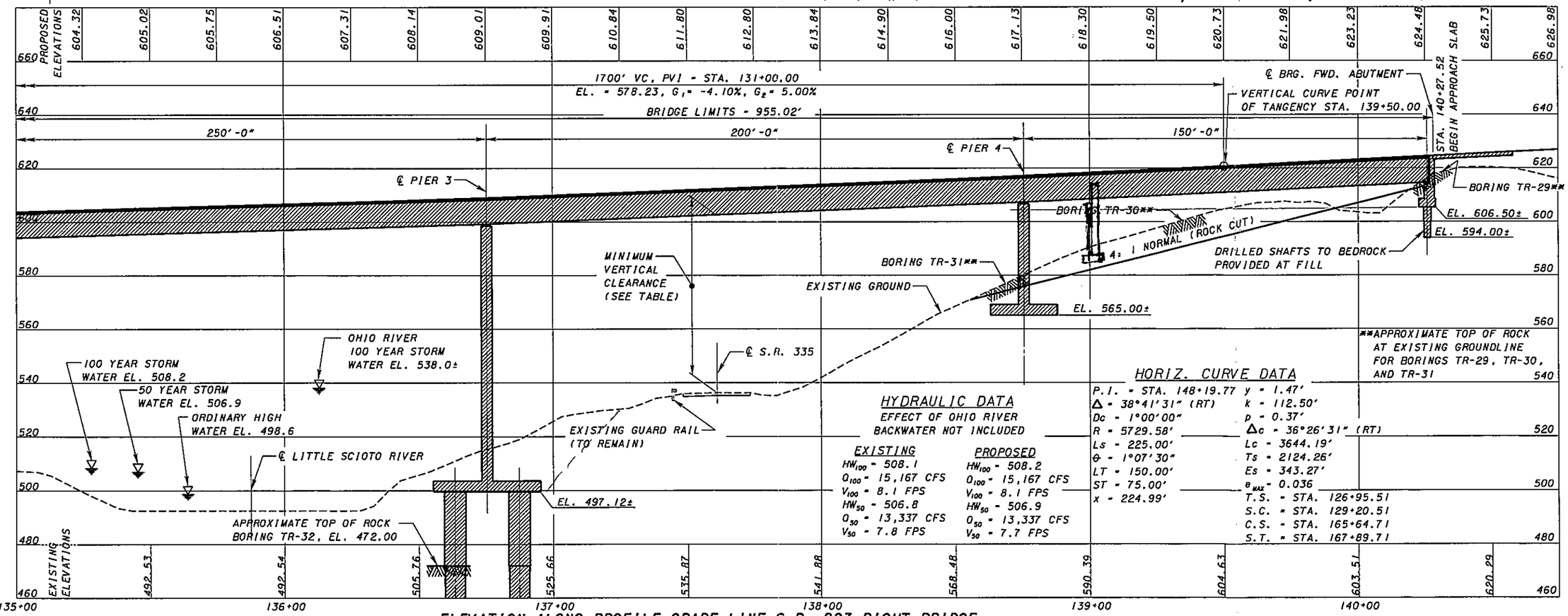


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	65.62'	65.23'
PREFERRED	17'-0"	17'-0"

* SEE SHEET 9 | 9 FOR FILL AND ROCK CUT DETAILS



**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
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Q_{100} = 15,167 CFS	Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS	V_{100} = 8.1 FPS
HW_{50} = 506.8	HW_{50} = 506.9
Q_{50} = 13,337 CFS	Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS	V_{50} = 7.7 FPS

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Dc = 1°00'00"	p = 0.37'
R = 5729.58'	Δc = 36°26'31" (RT)
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θ = 1°07'30"	Ts = 2124.26'
LT = 150.00'	Es = 343.27'
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x = 224.99'	T.S. = STA. 126+95.51
	S.C. = STA. 129+20.51
	C.S. = STA. 165+64.71
	S.T. = STA. 167+89.71

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

DESIGN AGENCY: TranSystems, 5191 PERIMETER BLVD., SUITE 240, DUBLIN, OHIO, 43017

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

PRELIMINARY SITE PLAN - ALTERNATIVE 1

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

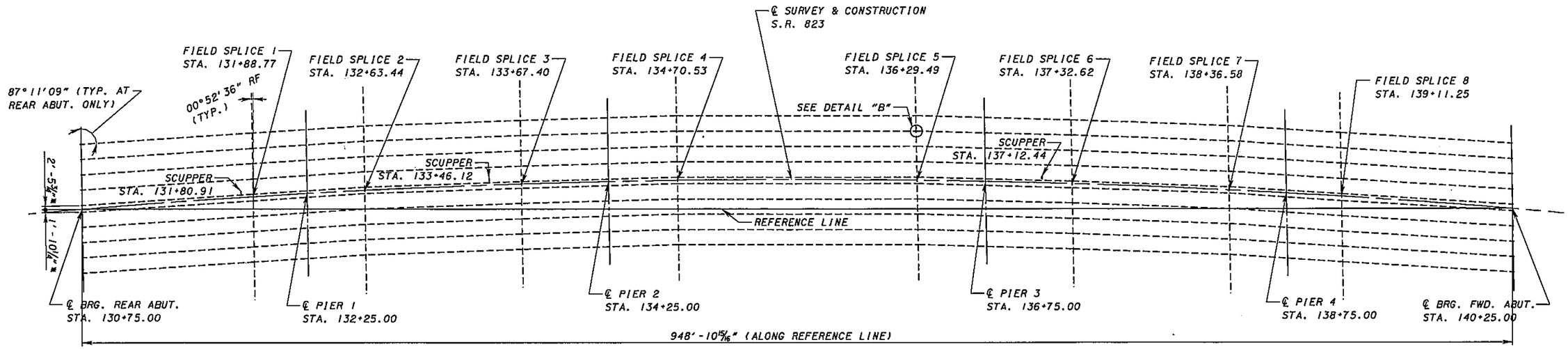
SCIOTO COUNTY

STA. 130+72.50

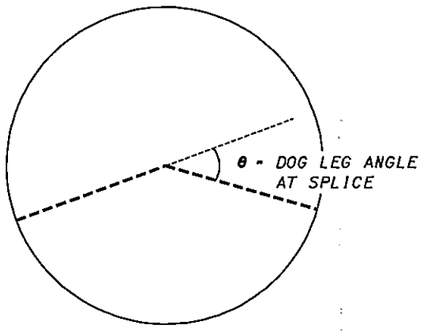
STA. 140+27.52

SCI-823-0.00

PID 19415



FRAMING PLAN



DETAIL "B"

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 130+75.00	N/A
SPLICE 1	STA. 131+88.77	0.00°
℄ PIER 1	STA. 132+25.00	N/A
SPLICE 2	STA. 132+63.44	1.65°
SPLICE 3	STA. 133+67.40	0.43°
℄ PIER 2	STA. 134+25.00	N/A
SPLICE 4	STA. 134+70.53	1.64°
SPLICE 5	STA. 136+29.49	1.63°
℄ PIER 3	STA. 136+75.00	N/A
SPLICE 6	STA. 137+32.62	0.40°
SPLICE 7	STA. 138+36.58	1.68°
℄ PIER 4	STA. 138+75.00	N/A
SPLICE 8	STA. 139+11.25	0.10°
℄ BRG. FWD. ABUT.	STA. 140+25.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	114.47'	4 SPACES @ 10'-1 7/8"± = 40.6223'
SPLICE 1	SPLICE 2	74.70'	4 SPACES @ 10'-1 7/8"± = 40.6223'
SPLICE 2	SPLICE 3	103.95'	4 SPACES @ 10'-2"± = 40.6330'
SPLICE 3	SPLICE 4	103.13'	4 SPACES @ 10'-2"± = 40.6680'
SPLICE 4	SPLICE 5	158.95'	4 SPACES @ 10'-2"± = 40.6667'
SPLICE 5	SPLICE 6	103.15'	4 SPACES @ 10'-1 7/8"± = 40.6326'
SPLICE 6	SPLICE 7	103.93'	4 SPACES @ 10'-1 7/8"± = 40.6193'
SPLICE 7	SPLICE 8	74.72'	4 SPACES @ 10'-1 5/8" = 40.5413'
SPLICE 8	℄ BRG. FWD. ABUT	114.39'	4 SPACES @ 10'-1 5/8" = 40.5547'

* GIRDER SPACINGS ARE NORMAL TO GIRDER CENTERLINE

NOTES:

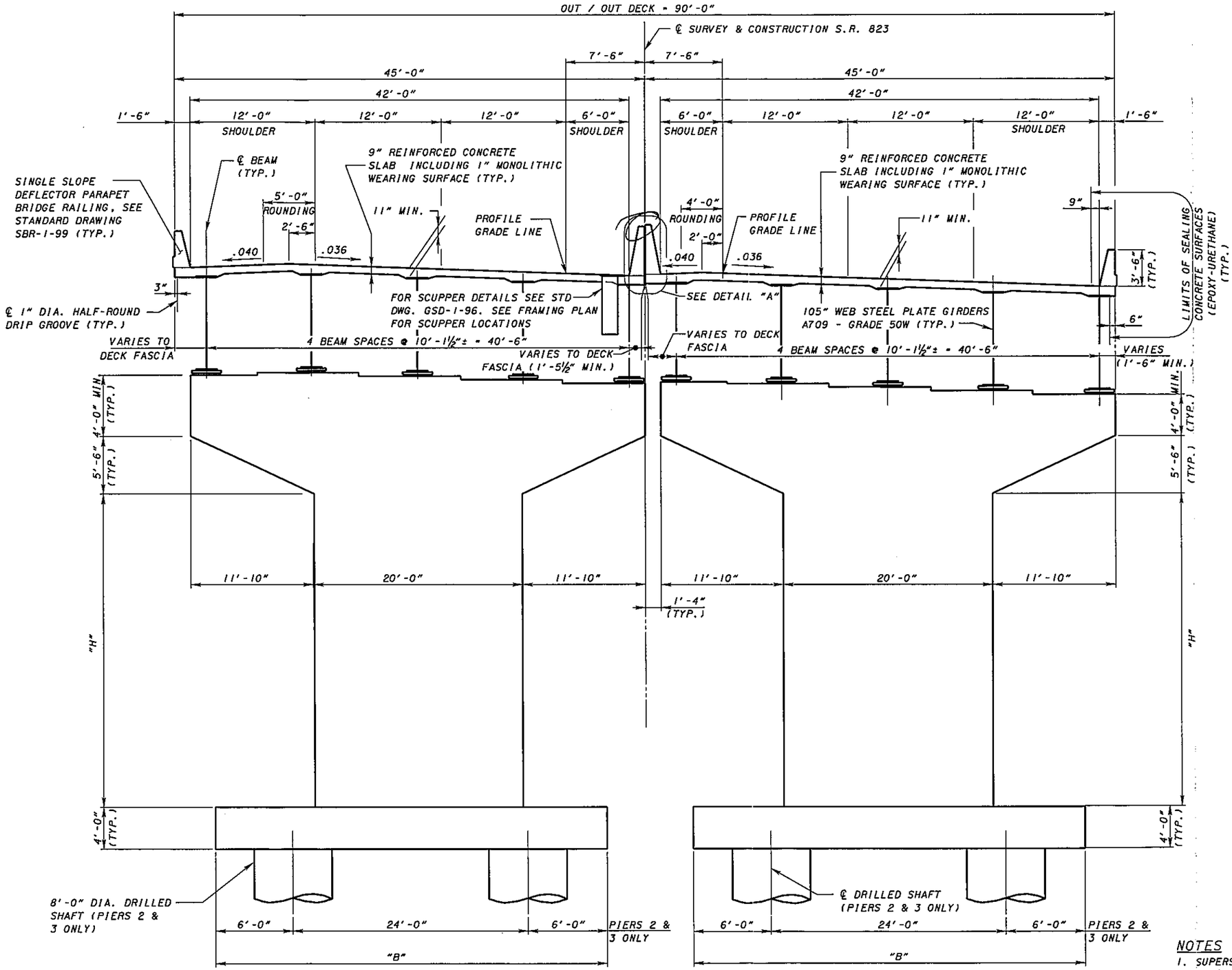
1. θ, GIRDER LENGTH, AND GIRDER SPACING IN TABLES ABOVE APPLY TO BOTH THE LEFT RIGHT BRIDGE.

DESIGN AGENCY: TranSystems, 347 FRANKLIN AVE., SUITE 240, WHITE, MICH., 48317

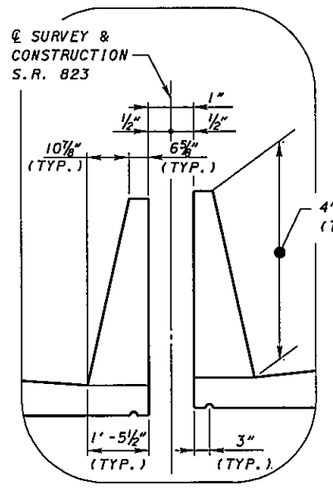
DESIGNED	DRAWN	REVISED	DATE
WSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
WSL			

FRAMING PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415



TYPICAL TRANSVERSE SECTION



DETAIL "A"

(NOT SHOWN TO SCALE)

* PARAPETS ARE SIMILAR TO TYPE A1 BARRIER FROM ROADWAY STANDARD DRAWING RM-4.3

PIER	"H"	"B"
1L	30'-8 5/16"	37'-0"
1R	27'-11 5/16"	37'-0"
2L	79'-4 1/4"	36'-0"
2R	77'-10 7/8"	36'-0"
3L	82'-11 3/4"	36'-0"
3R	86'-10 7/16"	36'-0"
4L	28'-2 5/16"	25'-0"
4R	27'-3 1/8"	25'-0"

stemon site plan looks taller (35')

NOTES

1. SUPERSTRUCTURE DIMENSIONS ARE MEASURED PERPENDICULAR TO ℄ OF SURVEY & CONSTRUCTION S.R. 823.
2. SUBSTRUCTURE DIMENSIONS ARE MEASURED ALONG ℄ PIER

DESIGN AGENCY: Trans Systems, 5161 PEARL PKWY., SUITE 200, BOULDER, COLO., 80301

DATE: 07/12/06

REVISED: JRC — STRUCTURE FILE NUMBER

DRAWN: AWB — REVISED

DESIGNED: MSL — CHECKED: MSL

TYPICAL TRANSVERSE SECTION - ALTERNATIVE 1

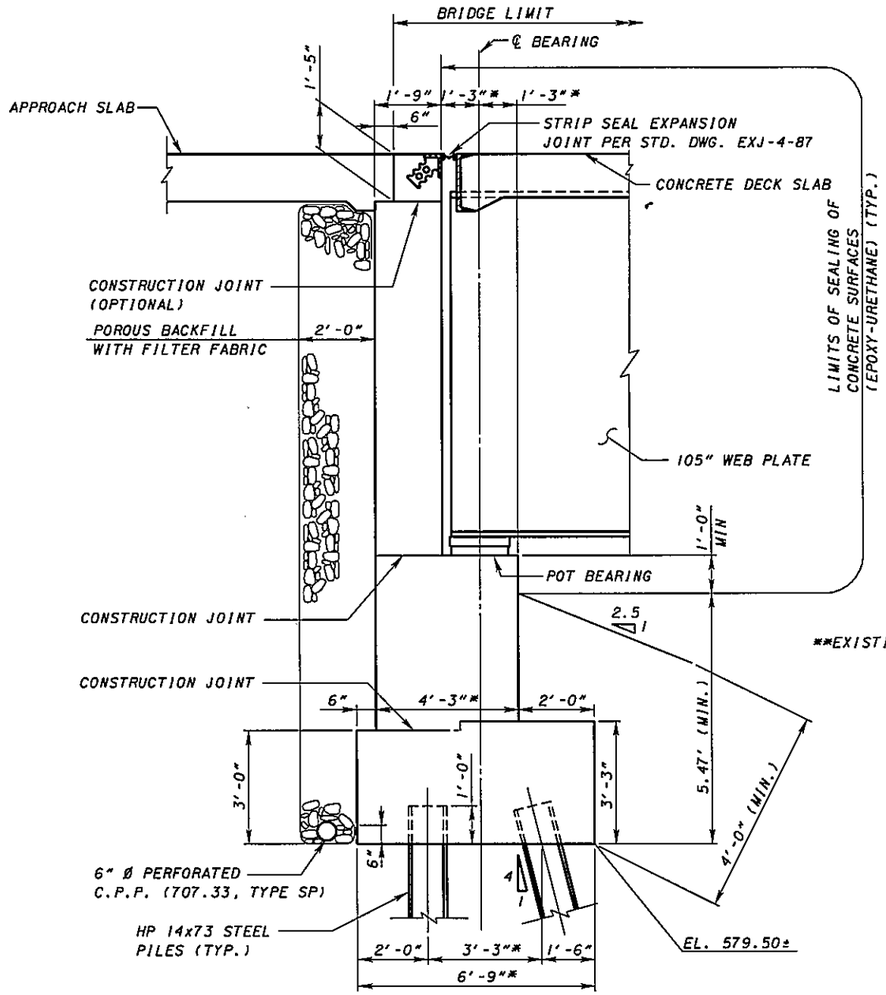
BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00

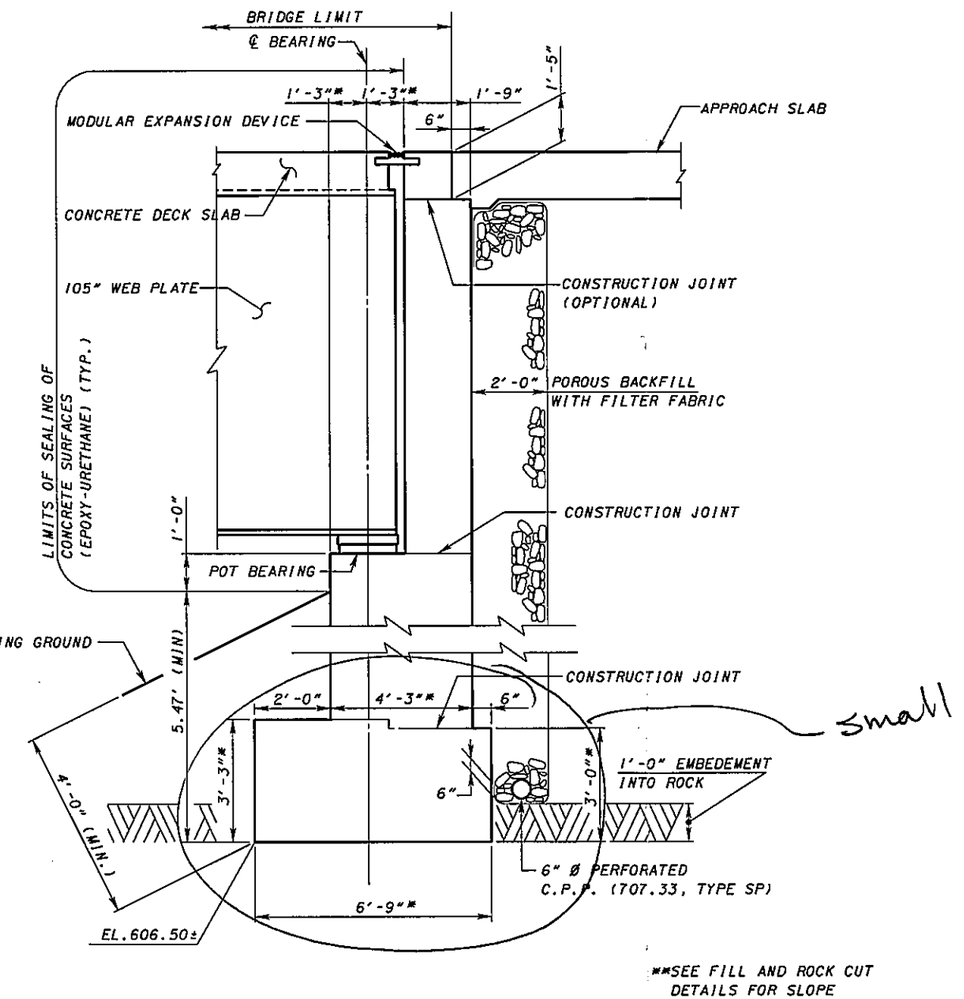
PID 19415

6 / 9



REAR ABUTMENT SECTION

* DIMENSIONS TO BE FINALIZED DURING TS&L SUBMITTAL



FORWARD ABUTMENT SECTION

**SEE FILL AND ROCK CUT DETAILS FOR SLOPE (SHEET 9 / 9).

DESIGN AGENCY: TranSystems, 5747 PERIMETER DRIVE, SUITE 140, DUBLIN, OHIO, 43017

DESIGNED	DRAWN	REVISED	DATE
MSL	CAS	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

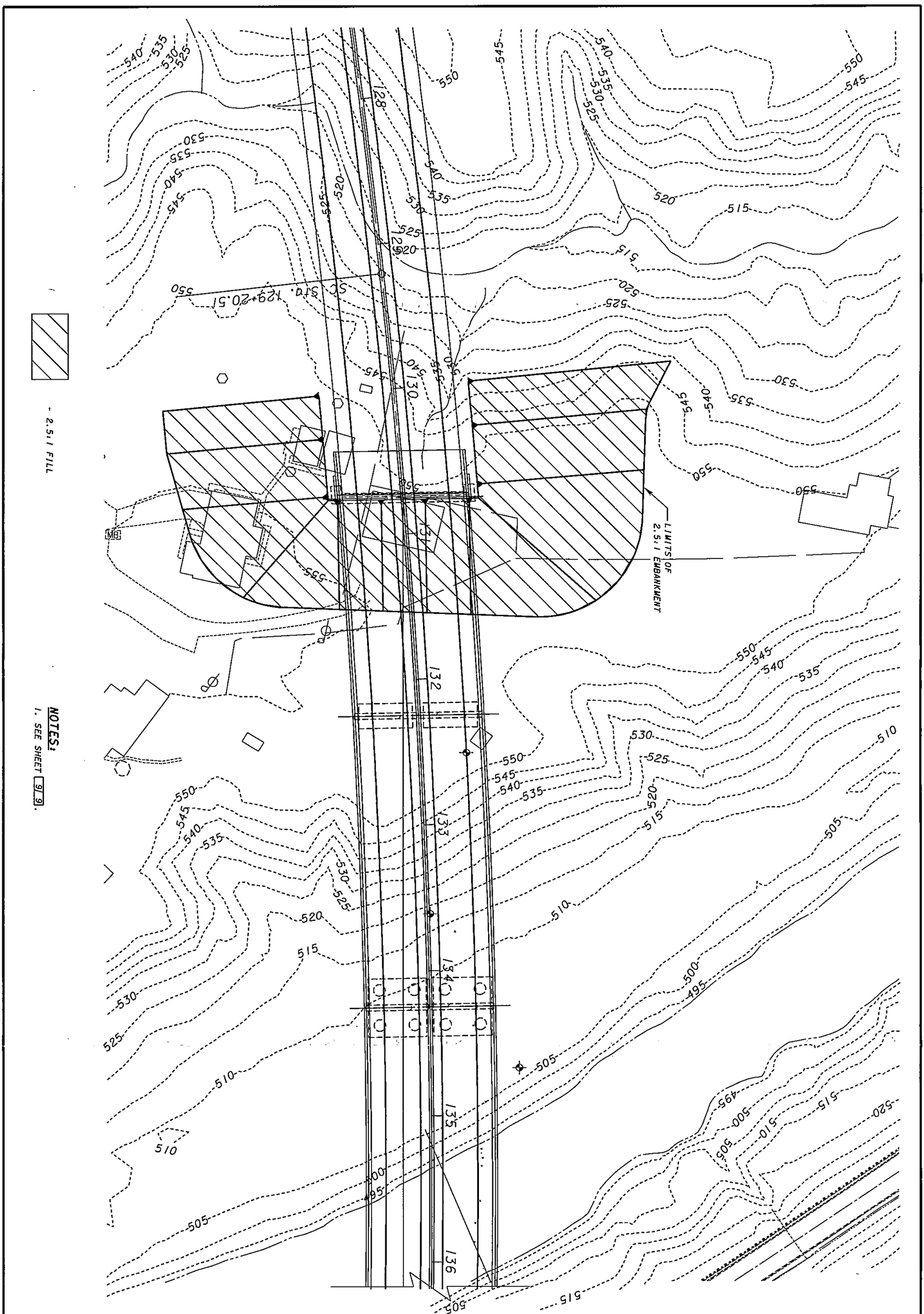
TYPICAL ABUTMENT - ALTERNATIVE 1

BRIDGE NO. SCI-823-XXXX

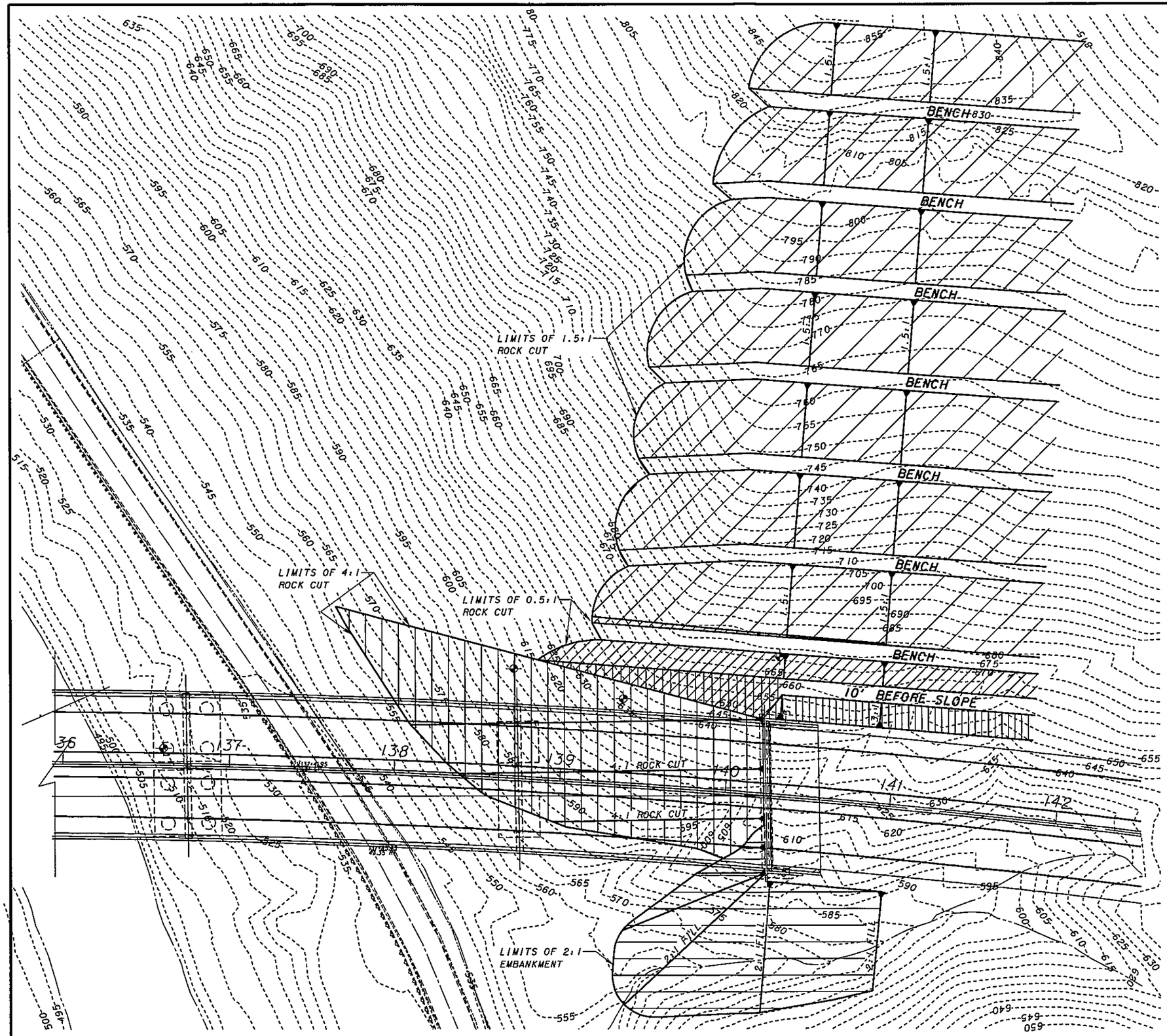
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

7 / 9



8/9	SCI-823-0.00 PID 19415	REAR ABUTMENT EMBANKMENT DETAILS - ALT. 1 BRIDGE NO. SCI-823-XXXX S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER	DESIGNED WSL CHECKED WSL	DRAWN MTN REVISED	REVIEWED JRC DATE 07/12/06 STRUCTURE FILE NUMBER	DESIGN AGENCY TranSystems 5747 PERIMETER DRIVE, SUITE 240 DUBLIN, OHIO 43017



NOTES:

1. ALL FILL AND ROCK CUT DETAILS UP TO END OF APPROACH SLAB HAVE BEEN INCLUDED IN QUANTITY CALCULATIONS FOR COST COMPARISON PURPOSES.

DESIGN AGENCY: Tran Systems, 5747 PERIMETER DRIVE, SUITE 140, DUBLIN, OHIO 43017

DESIGNED	DRAWN	REVISED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED		STRUCTURE FILE NUMBER
MSL			

FWD. ABUT. EMBANKMENT & ROCK CUT DETAILS - ALT. 1

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00

PID 19415

9 / 9

APPENDIX C

Vertical Clearance Calculations

TranSystems

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER LITTLE SCIOTO RIVER PID # 19415

Alternative 1 - 5-105" Web Plate Girders, Five Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	5.99	-0.21564
			Total Adjustment =	**-0.22**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	108.125	9.01
	119.125	9.93

Total Superstructure Depth (ft) = **9.93**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+41.95**
Offset Location @ Critical Point	=	**1.51' LT.**
Profile Grade Elevation at Critical Point	=	611.49
Adjustment for Cross Slopes to Beam CL	=	-0.22
Top of Deck Elevation @ Critical Point	=	**611.27**
Total Superstructure Depth	=	-9.93
Bottom of Beam Elevation @ Critical Point	=	**601.34**
Approximate Top of Existing Ground @ Critical Point	=	**535.72**
Actual Vertical Clearance	=	***65.62***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER LITTLE SCIOTO RIVER **PID #** 19415

Alternative 1 - 5-105" Web Plate Girders, Five Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	35.85	=	-1.29
				=	0.00
					0
			Total Adjustment	=	**-1.29**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	108.125	9.01		
	119.125	9.93		
		Total Superstructure Depth (ft)	=	**9.93**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+85.43**
Offset Location @ Critical Point	=	**43.35' RIGHT**
Profile Grade Elevation at Critical Point	=	613.23
Adjustment for Cross Slopes to Beam CL	=	-1.29
Top of Deck Elevation @ Critical Point	=	**611.94**
Total Superstructure Depth	=	-9.93
Bottom of Beam Elevation @ Critical Point	=	**602.01**
Approximate Top of Existing Ground @ Critical Point	=	**536.78**
Actual Vertical Clearance	=	***65.23***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER LITTLE SCIOTO RIVER **PID #** 19415

Alternative 2a - 5~140" Web Plate Girders, Three Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	5.61	-0.20196
			Total Adjustment =	**-0.20**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	146	12.17
	157	13.09

Total Superstructure Depth (ft) = **13.09**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+41.69**
Offset Location @ Critical Point	=	**1.89' LEFT**
Profile Grade Elevation at Critical Point	=	611.48
Adjustment for Cross Slopes to Beam CL	=	-0.20
Top of Deck Elevation @ Critical Point	=	**611.28**
Total Superstructure Depth	=	-13.09
Bottom of Beam Elevation @ Critical Point	=	**598.19**
Approximate Top of Existing Ground @ Critical Point	=	**535.72**
Actual Vertical Clearance	=	***62.47***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER LITTLE SCIOTO RIVER **PID #** 19415

Alternative 2a - 5~140" Web Plate Girders, Three Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	35.66	=	-1.28
				=	0.00
					0
			Total Adjustment	=	**-1.28**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	144.625	12.05		
	155.625	12.97		
		Total Superstructure Depth (ft)	=	**12.97**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+85.30**
Offset Location @ Critical Point	=	**43.16' RIGHT**
Profile Grade Elevation at Critical Point	=	613.22
Adjustment for Cross Slopes to Beam CL	=	-1.28
Top of Deck Elevation @ Critical Point	=	**611.94**
Total Superstructure Depth	=	-12.97
Bottom of Beam Elevation @ Critical Point	=	**598.97**
Approximate Top of Existing Ground @ Critical Point	=	**536.77**
Actual Vertical Clearance	=	***62.20***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER LITTLE SCIOTO RIVER **PID #** 19415

Alternative 2b - 5~125" Web Plate Girders, Three Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	5.61	-0.20196
			Total Adjustment =	**-0.20**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	129.5	10.79
	140.5	11.71

Total Superstructure Depth (ft) = **11.71**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+41.69**
Offset Location @ Critical Point	=	**1.89' LEFT**
Profile Grade Elevation at Critical Point	=	611.48
Adjustment for Cross Slopes to Beam CL	=	-0.20
Top of Deck Elevation @ Critical Point	=	**611.28**
Total Superstructure Depth	=	-11.71
Bottom of Beam Elevation @ Critical Point	=	**599.57**
Approximate Top of Existing Ground @ Critical Point	=	**535.72**
Actual Vertical Clearance	=	***63.85***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER LITTLE SCIOTO RIVER PID # 19415

Alternative 2b - 5~125" Web Plate Girders, Three Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	35.66	=	-1.28
				=	0.00
					0
			Total Adjustment	=	**-1.28**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	128.75	10.73		
	139.75	11.65		
		Total Superstructure Depth (ft)	=	**11.65**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+85.30**
Offset Location @ Critical Point	=	**43.16' RIGHT**
Profile Grade Elevation at Critical Point	=	613.22
Adjustment for Cross Slopes to Beam CL	=	-1.28
Top of Deck Elevation @ Critical Point	=	**611.94**
Total Superstructure Depth	=	-11.65
Bottom of Beam Elevation @ Critical Point	=	**600.29**
Approximate Top of Existing Ground @ Critical Point	=	**536.77**
Actual Vertical Clearance	=	***63.52***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER LITTLE SCIOTO RIVER PID # 19415

Alternative 3a - 5~117" Web Plate Girders, Three Span | **Point Location: A**

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	5.77	-0.20772
			Total Adjustment =	**-0.21**

Superstructure Depth

Comment	Depth (in)	Depth (ft)	
Deck Thickness:	9	0.75	
Haunch:	2	0.17	
Girder or Beam Depth:	122.625	10.22	
	133.625	11.14	
		Total Superstructure Depth (ft) =	**11.14**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+41.80**
Offset Location @ Critical Point	=	**1.73' LEFT**
Profile Grade Elevation at Critical Point	=	611.48
Adjustment for Cross Slopes to Beam CL	=	-0.21
Top of Deck Elevation @ Critical Point	=	**611.27**
Total Superstructure Depth	=	-11.14
Bottom of Beam Elevation @ Critical Point	=	**600.13**
Approximate Top of Existing Ground @ Critical Point	=	**535.72**
Actual Vertical Clearance	=	***64.41***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER LITTLE SCIOTO RIVER PID # 19415

Alternative 3a - 5~117" Web Plate Girders, Three Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	35.58	=	-1.28
				=	0.00
					0
			Total Adjustment	=	**-1.28**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	121.8125	10.15		
	132.8125	11.07		
		Total Superstructure Depth (ft)	=	**11.07**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+85.24**
Offset Location @ Critical Point	=	**43.08 RIGHT**
Profile Grade Elevation at Critical Point	=	613.22
Adjustment for Cross Slopes to Beam CL	=	-1.28
Top of Deck Elevation @ Critical Point	=	**611.94**
Total Superstructure Depth	=	-11.07
Bottom of Beam Elevation @ Critical Point	=	**600.87**
Approximate Top of Existing Ground @ Critical Point	=	**536.77**
Actual Vertical Clearance	=	***64.10***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 **Structure**
Description S.R. 823 OVER LITTLE SCIOTO RIVER **PID #** 19415

Alternative 3b - 5~103" Web Plate Girders, Three Span | ***Point Location: A***

Adjstment for Cross Slope

Comment	Grade		Offset	
Profile grade line to critical pt.:	-0.036	x	5.77	-0.20772
			Total Adjustment =	**-0.21**

Superstructure Depth

Comment	Depth (in)	Depth (ft)
Deck Thickness:	9	0.75
Haunch:	2	0.17
Girder or Beam Depth:	108.5	9.04
	119.5	9.96

Total Superstructure Depth (ft) = **9.96**

Vertical Clearance at Critical Point

Station @ Critical Point	=	**137+41.80**
Offset Location @ Critical Point	=	**1.73' LEFT**
Profile Grade Elevation at Critical Point	=	611.48
Adjustment for Cross Slopes to Beam CL	=	-0.21
Top of Deck Elevation @ Critical Point	=	**611.27**
Total Superstructure Depth	=	-9.96
Bottom of Beam Elevation @ Critical Point	=	**601.31**
Approximate Top of Existing Ground @ Critical Point	=	**535.72**
Actual Vertical Clearance	=	***65.59***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

TranSystems

Made By PJP Date 07/03/06 Job No. P403030064
Checked By MTN Date 07/05/06 Sheet No.

VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER LITTLE SCIOTO RIVER PID # 19415

Alternative 3b - 5~103" Web Plate Girders, Three Span | ***Point Location: B***

Adjstment for Cross Slope

Comment	Grade		Offset		
Shoulder:	-0.036	x	35.58	=	-1.28
				=	0.00
					0
			Total Adjustment	=	**-1.28**

Superstructure Depth

Comment	Depth (in)	Depth (ft)		
Deck Thickness:	9	0.75		
Haunch:	2	0.17		
Girder or Beam Depth:	107.25	8.94		
	118.25	9.86		
		Total Superstructure Depth (ft)	=	**9.86**

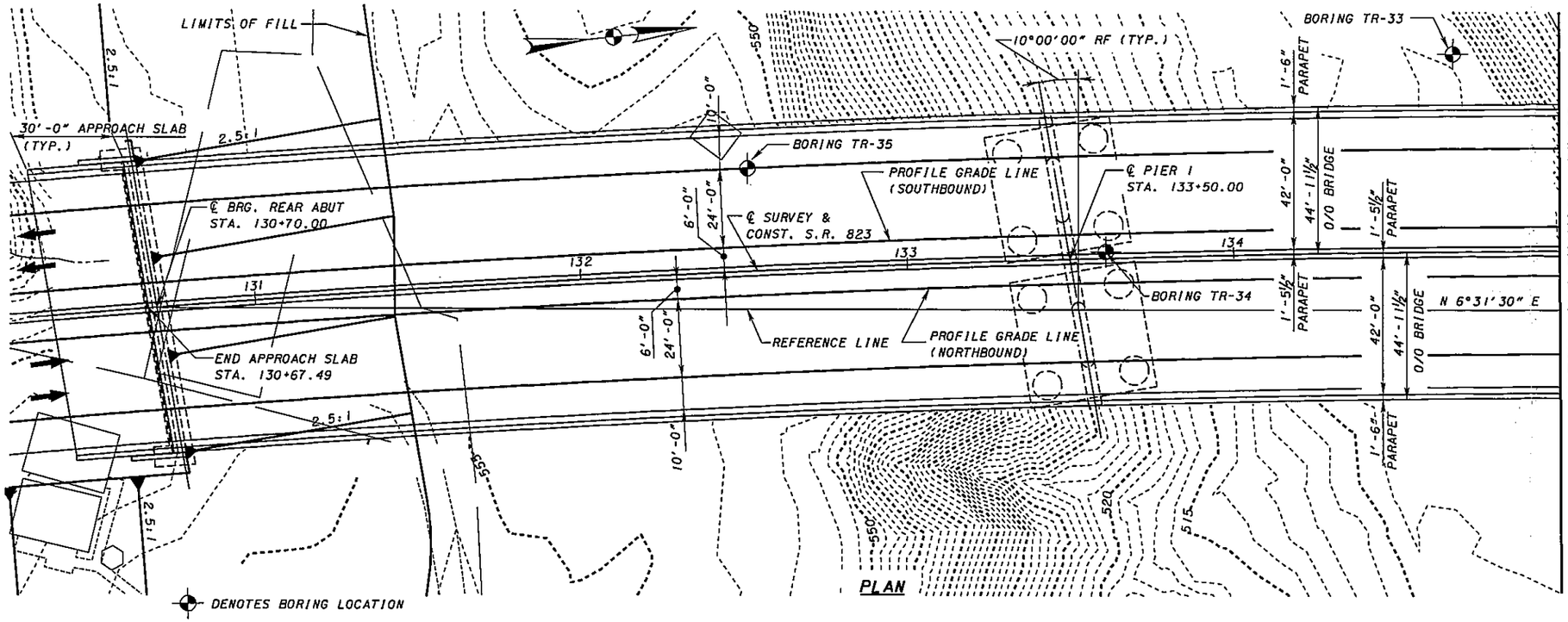
Vertical Clearance at Critical Point

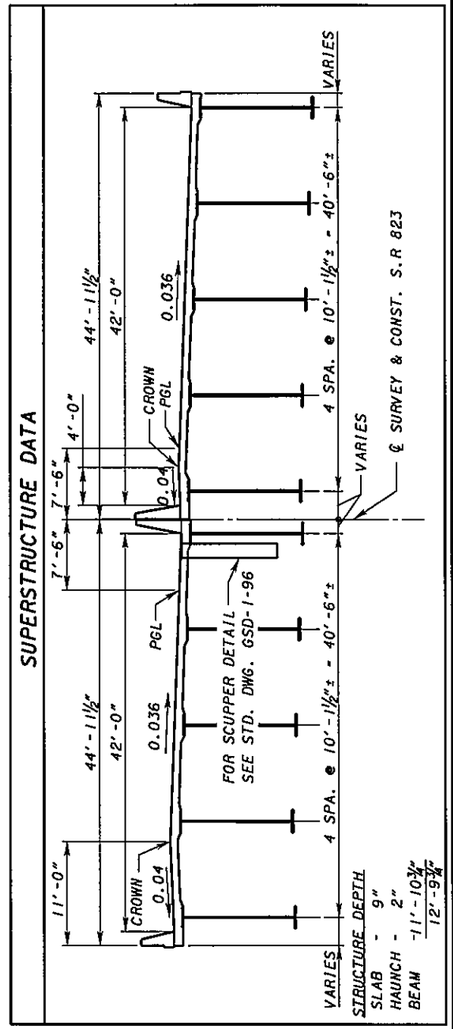
Station @ Critical Point	=	**137+85.24**
Offset Location @ Critical Point	=	**43.08 RIGHT**
Profile Grade Elevation at Critical Point	=	613.22
Adjustment for Cross Slopes to Beam CL	=	-1.28
Top of Deck Elevation @ Critical Point	=	**611.94**
Total Superstructure Depth	=	-9.86
Bottom of Beam Elevation @ Critical Point	=	**602.08**
Approximate Top of Existing Ground @ Critical Point	=	**536.77**
Actual Vertical Clearance	=	***65.31***
Preferred Vertical Clearance	=	*17.0*
Required Vertical Clearance	=	*16.5*

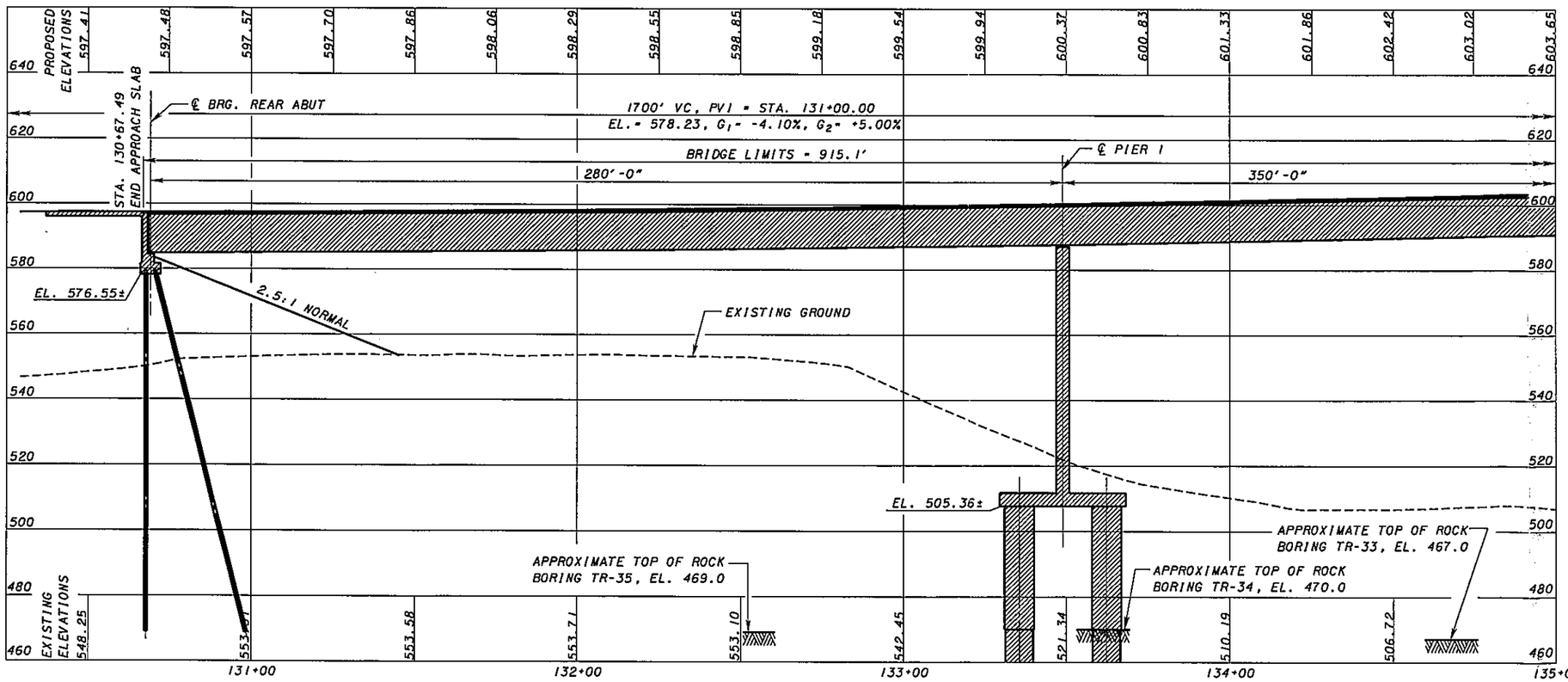
APPENDIX D

Preliminary Structure Site Plan

TranSystems







ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W, DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 280'-0", 350'-0", 280'-0" C/C BEARINGS

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

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

SKEW: 10°00'00" RF WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TranSystems, 512 KINNEY DRIVE, SUITE 200, DUBLIN, OHIO 43017

DESIGNED MSL | DRAWN CAS | REVIEWED JRC | DATE 07/12/06

CHECKED MSL | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT. 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

1 / 7

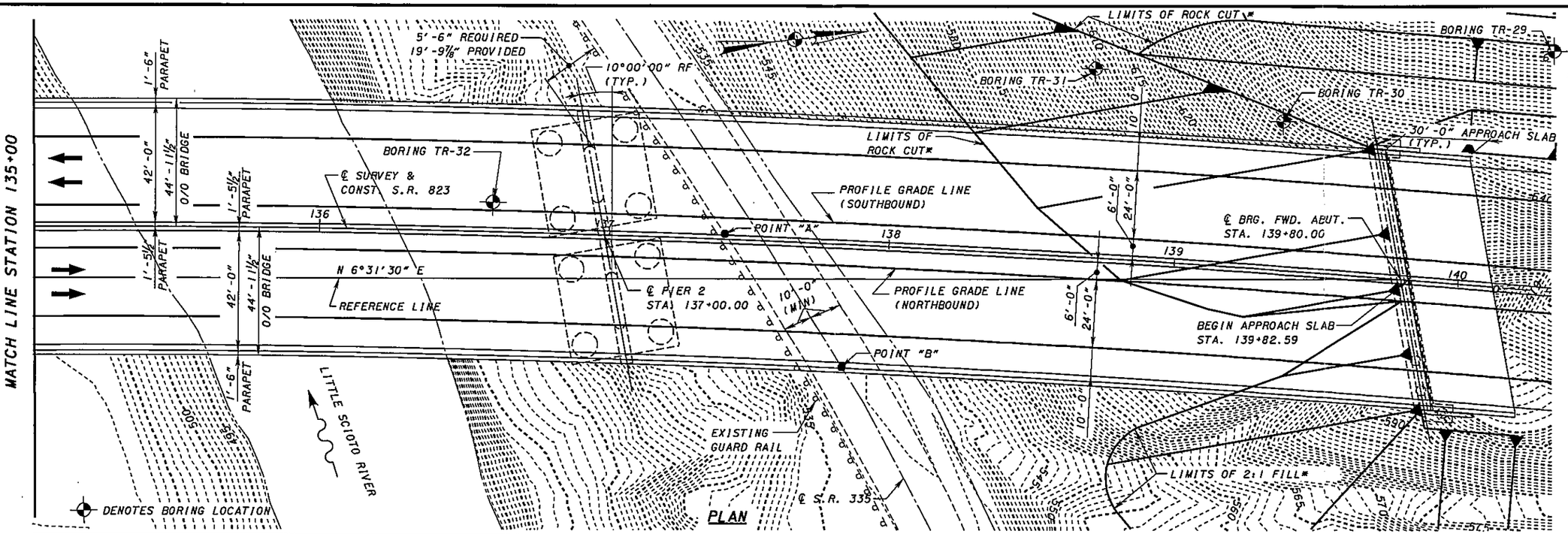


TABLE OF VERTICAL CLEARANCES		
LOCATION	"A"	"B"
PROPOSED	62.47'±	62.20'±
REQUIRED	17.0'	17.0'

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
HW_{100} = 508.1	HW_{100} = 508.2
Q_{100} = 15,167 CFS	Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS	V_{100} = 7.7 FPS
HW_{50} = 506.8	HW_{50} = 506.8
Q_{50} = 13,337 CFS	Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS	V_{50} = 7.3 FPS

HORIZ. CURVE DATA

P.I. = STA. 148+19.77
Δ = 38°41'31" (RT)
Dc = 1°00'00"
R = 5729.58'
Ls = 225.00'
θ = 1°07'30"
LT = 150.00'
ST = 75.00'
x = 224.99'
y = 1.47'
k = 112.50'
p = 0.37'
Δc = 36°26'31" (RT)
Lc = 3644.19'
Ts = 2124.26'
Es = 343.27'
e_{MAX} = 0.036
T.S. = STA. 126+95.51
S.C. = STA. 129+20.51
C.S. = STA. 165+64.71
S.T. = STA. 167+89.71

ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

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

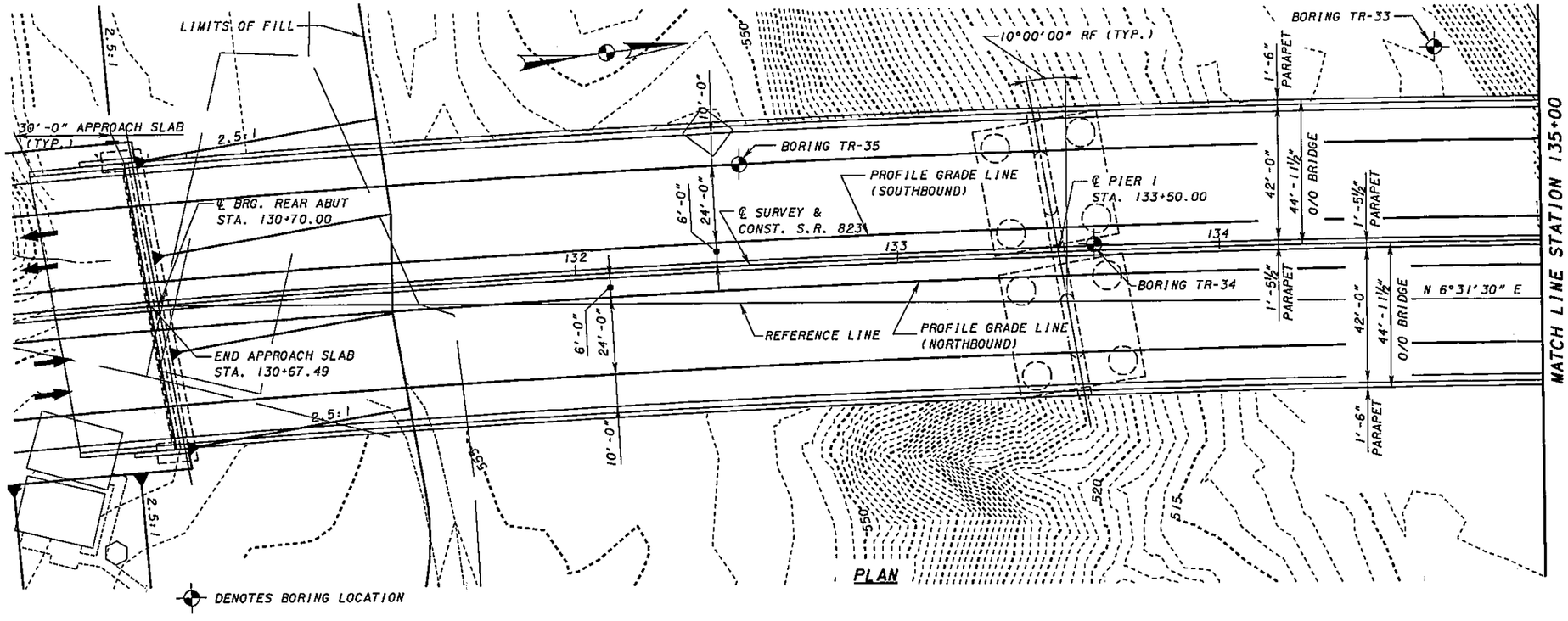
DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

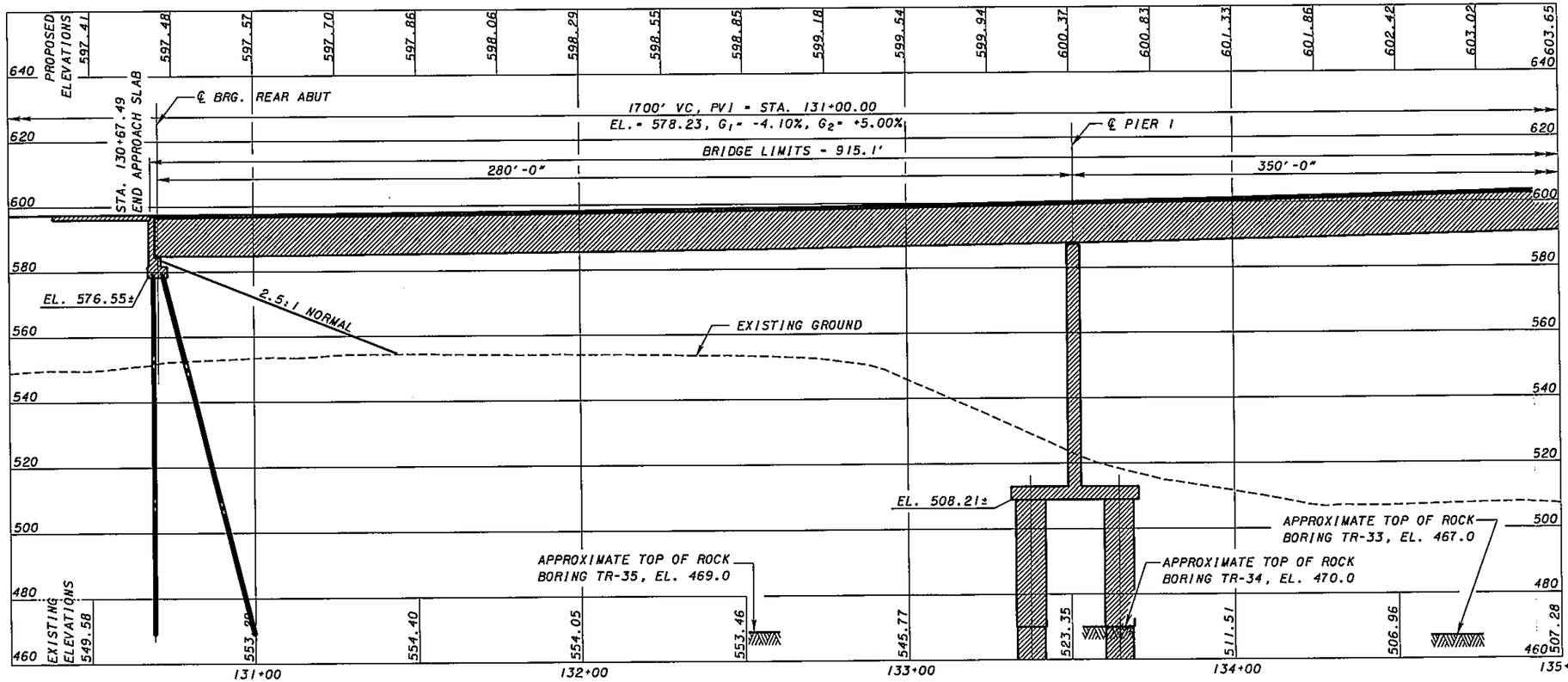
SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

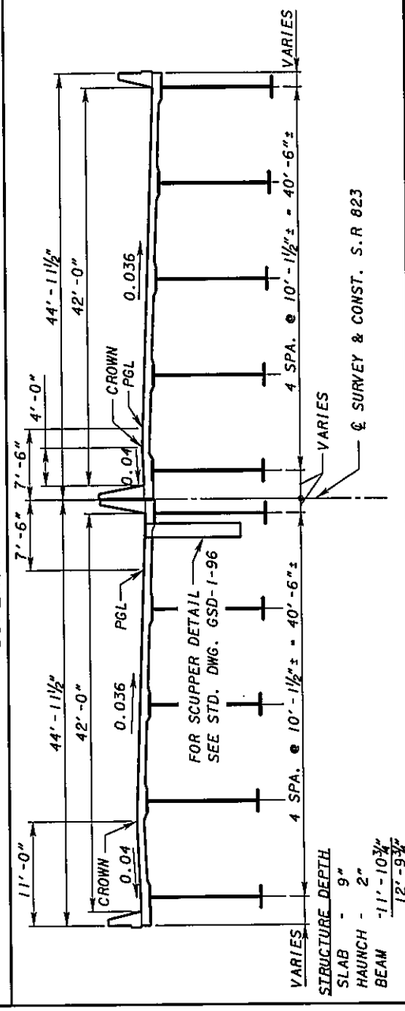
2 / 7





ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

SUPERSTRUCTURE DATA



PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS STEEL PLATE GIRDER A709 GRADE 50W, DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 280'-0", 350'-0", 280'-0" C/C BEARINGS

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

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

SKEW: 10°00'00" RF WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: Tran Systems, 5747 PERIMETER DRIVE, SUITE 190, DUBLIN, OHIO 43017

REVISED	DATE
JRC	07/12/06
STRUCTURE FILE NUMBER	

DRAWN	DESIGNED	CHECKED
CAS	WSL	MSL
REVISED		

SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT 2A

BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

3 / 7

MATCH LINE STATION 135+00

1'-6" PARAPET
42'-0"
44'-11½" O/O BRIDGE
1'-5½" PARAPET

5'-6" REQUIRED
19'-9⅞" PROVIDED
10°00'00" RF (TYP.)

BORING TR-32
℄ SURVEY & CONST. S.R. 823
136
N 6°31'30" E
REFERENCE LINE
℄ PIER 2
STA. 137+00.00
POINT "A"
POINT "B"
10'-0" (MIN)
PROFILE GRADE LINE (SOUTHBOUND)
PROFILE GRADE LINE (NORTHBOUND)
138
139
140
LIMITS OF ROCK CUT*
BORING TR-29
BORING TR-30
BORING TR-31
LIMITS OF ROCK CUT*
30'-0" APPROACH SLAB (TYP.)
℄ BRG. FWD. ABUT. STA. 139+80.00
BEGIN APPROACH SLAB STA. 139+82.59
6'-0"
24'-0"
8'-0"
10'-0"
LIMITS OF 2:1 FILL*
LITTLE SCIOTO RIVER
EXISTING GUARD RAIL
℄ S.R. 335
DENOTES BORING LOCATION
PLAN

* SEE SHEET 7 7 FOR FILL & ROCK CUT DETAILS.

PROPOSED ELEVATIONS: 604.32 | 605.02 | 605.75 | 606.51 | 607.31 | 608.14 | 609.01 | 609.91 | 610.84 | 611.80 | 612.80 | 613.84 | 614.90 | 616.00 | 617.13 | 618.30 | 619.50 | 620.73 | 621.98 | 623.23 | 624.48

1700' VC, PVI - STA. 131+00.00
EL. = 578.23, G_1 = -4.10%, G_2 = 5.00%

BRIDGE LIMITS = 915.1'
350'-0"
280'-0"

℄ BRG. FWD. ABUT.
VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00
BEGIN APPROACH SLAB STA. 139+82.59

℄ PIER 2
BORING TR-29**
BORING TR-30**
BORING TR-31**
EL. 601.32±
EL. 589.00±
4:1 (NORMAL, ROCK CUT)
EL. 503.94±
MINIMUM VERTICAL CLEARANCE (SEE TABLE)
EXISTING GROUND
℄ S.R. 335
EXISTING GUARD RAIL (TO REMAIN)
OHIO RIVER 100 YEAR STORM WATER EL. 538.0±
100 YEAR STORM WATER EL. 508.2
50 YEAR STORM WATER EL. 506.8
ORDINARY HIGH WATER EL. 498.6
℄ LITTLE SCIOTO RIVER
APPROXIMATE TOP OF ROCK BORING TR-32, EL. 472.0

**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31

EXISTING ELEVATIONS: 492.53 | 492.54 | 505.76 | 525.66 | 535.87 | 541.88 | 568.48 | 590.39 | 604.63 | 603.51

135+00 | 136+00 | 137+00 | 138+00 | 139+00 | 140+00

660 | 640 | 620 | 600 | 580 | 560 | 540 | 520 | 500 | 480 | 460

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	62.47'±	62.20'±
REQUIRED	17.0'	17.0'

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
HW_{100} = 508.1	HW_{100} = 508.2
Q_{100} = 15,167 CFS	Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS	V_{100} = 7.7 FPS
HW_{50} = 506.8	HW_{50} = 506.8
Q_{50} = 13,337 CFS	Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS	V_{50} = 7.3 FPS

HORIZ. CURVE DATA

P.I. - STA. 148+19.77
Δ = 38°41'31" (RT)
Dc = 1°00'00"
R = 5729.58'
Ls = 225.00'
Θ = 1°07'30"
LT = 150.00'
ST = 75.00'
x = 224.99'
y = 1.47'
k = 112.50'
p = 0.37'
Δc = 36°26'31" (RT)
Lc = 3644.19'
Ts = 2124.26'
Es = 343.27'
e_{MAX} = 0.036
T.S. - STA. 126+95.51
S.C. - STA. 129+20.51
C.S. - STA. 165+64.71
S.T. - STA. 167+89.71

ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

DESIGN AGENCY: Tram Systems, 5747 PERIMETER DRIVE, SUITE 200, DUBLIN, OHIO 43017

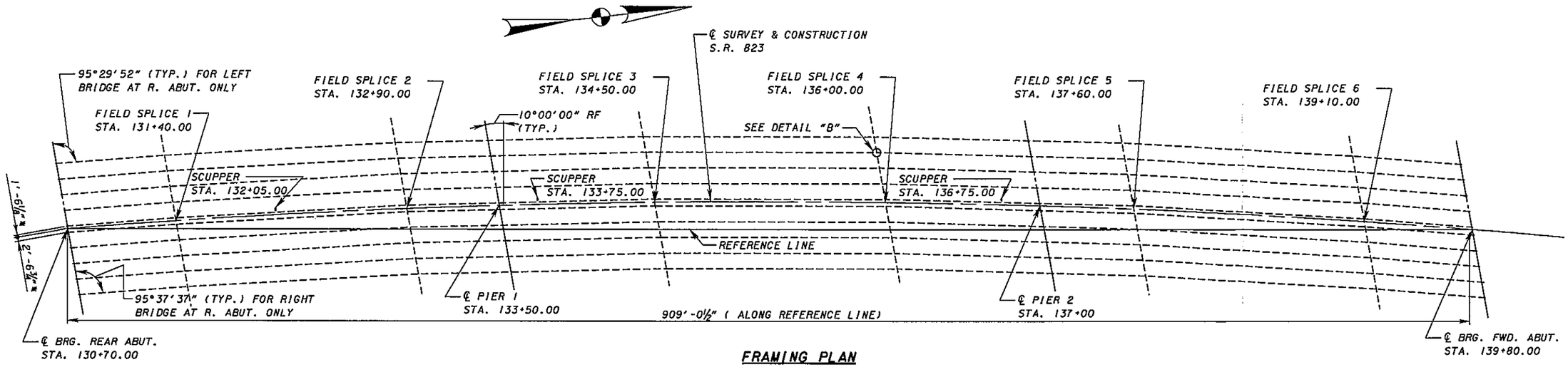
DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

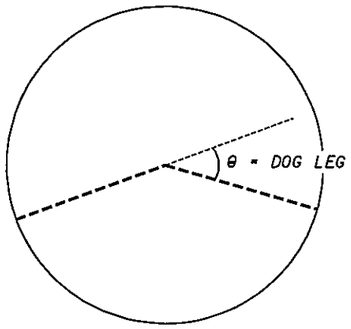
PRELIMINARY SITE PLAN - ALT. 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

4 | 7



FRAMING PLAN



DETAIL "B"

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 130+70.00	N/A
SPLICE 1	STA. 131+40.00	1.30°
SPLICE 2	STA. 132+90.00	1.70°
℄ PIER 1	STA. 133+50.00	N/A
SPLICE 3	STA. 134+50.00	1.50°
SPLICE 4	STA. 136+00.00	1.50°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+60.00	1.70°
SPLICE 6	STA. 139+10.00	1.30°
℄ BRG. FWD. ABUT.	STA. 139+80.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	70.71'	4 SPACES @ 10'-2 1⅞16"± = 40.9353'
SPLICE 1	SPLICE 2	149.96'	4 SPACES @ 10'-2½"± = 40.8353'
SPLICE 2	SPLICE 3	160.01'	4 SPACES @ 10'-2"± = 40.6731'
SPLICE 3	SPLICE 4	150.00'	4 SPACES @ 10'-1½"± = 40.5000'
SPLICE 4	SPLICE 5	159.96'	4 SPACES @ 10'-0⅞"± = 40.2996'
SPLICE 5	SPLICE 6	150.05'	4 SPACES @ 10'-0⅛"± = 40.0386'
SPLICE 6	℄ BRG. FWD. ABUT	70.15'	4 SPACES @ 9'-11⅜"± = 39.8154'

* GIRDER SPACINGS ARE NORMAL TO GIRDER CENTERLINE

LEFT (SOUTHBOUND BRIDGE)

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 130+70.00	N/A
SPLICE 1	STA. 131+40.00	1.14°
SPLICE 2	STA. 132+90.00	1.88°
℄ PIER 1	STA. 133+50.00	N/A
SPLICE 3	STA. 134+50.00	1.35°
SPLICE 4	STA. 136+00.00	1.67°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+60.00	1.56°
SPLICE 6	STA. 139+10.00	1.46°
℄ BRG. FWD. ABUT.	STA. 139+80.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	70.72'	4 SPACES @ 10'-2¾"± = 40.9263'
SPLICE 1	SPLICE 2	149.95'	4 SPACES @ 10'-2½"± = 40.8380'
SPLICE 2	SPLICE 3	160.08'	4 SPACES @ 10'-2"± = 40.6568'
SPLICE 3	SPLICE 4	150.00'	4 SPACES @ 10'-1½"± = 40.5000'
SPLICE 4	SPLICE 5	160.06'	4 SPACES @ 10'-0 13⁄16"± = 40.2754'
SPLICE 5	SPLICE 6	150.07'	4 SPACES @ 10'-0⅛"± = 40.0335'
SPLICE 6	℄ BRG. FWD. ABUT	70.91'	4 SPACES @ 9'-11⅜"± = 39.7807'

RIGHT (NORTHBOUND) BRIDGE

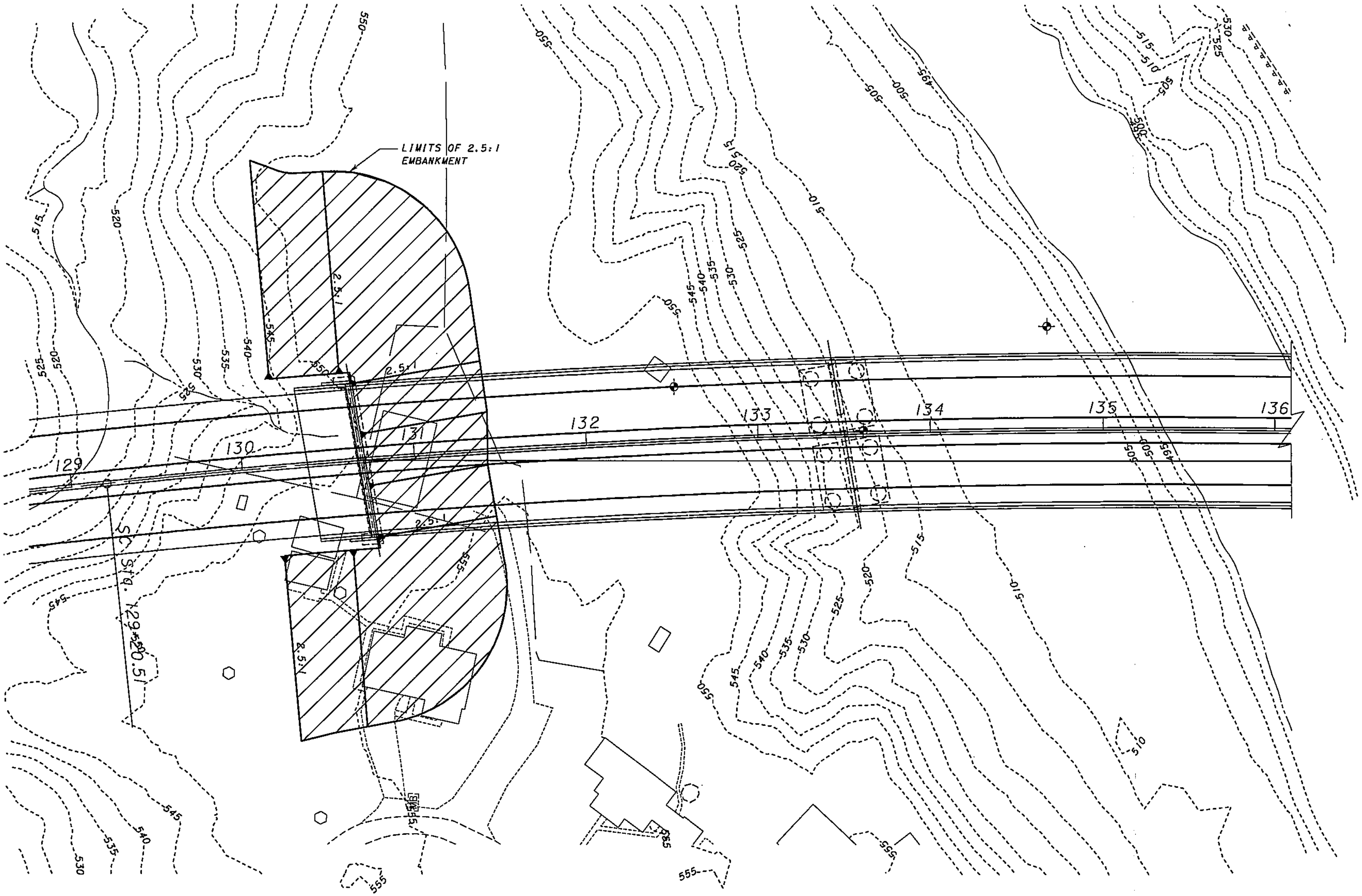
DESIGN AGENCY: Tram Systems, 519 KINNEAR DRIVE, SUITE 140, DUBLIN, OHIO 43017

DESIGNED MSL | DRAWN MTN | REVISED JRC 07/12/06 | CHECKED MSL | STRUCTURE FILE NUMBER

FRAMING PLAN ALTERNATIVE 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

5 / 7



▨ - 2.5:1 FILL

NOTES:

1. SEE SHEET 7/7.

REAR ABUTMENT EMBANKMENT - ALT 2A

BRIDGE NO. SCI-823-XXXX

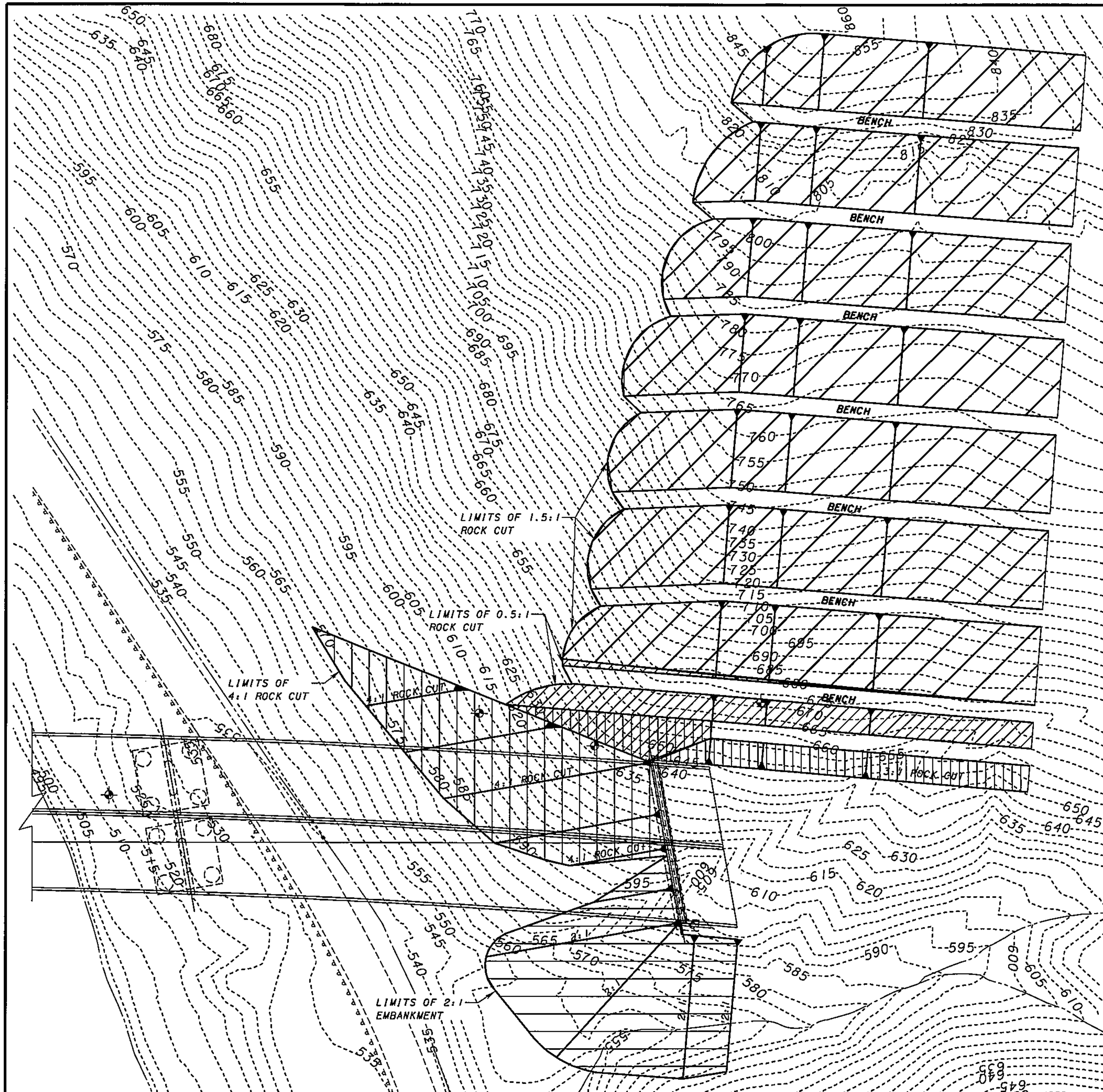
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

DESIGN AGENCY
TranSystems

SCI-823-0.00
PID 19415

6 / 7



- 3:1 ROCK CUT
- 1.5:1 ROCK CUT
- 0.5:1 ROCK CUT
- 2:1 FILL
- 4:1 ROCK CUT
- TRANSITION AREA FROM 0.5:1 ROCK CUT TO 4:1 ROCK CUT

NOTES

1. ALL FILL AND ROCK CUT DETAILS UP TO END OF APPROACH SLAB HAVE BEEN INCLUDED IN QUANTITY CALCULATIONS FOR COST COMPARISON PURPOSES.

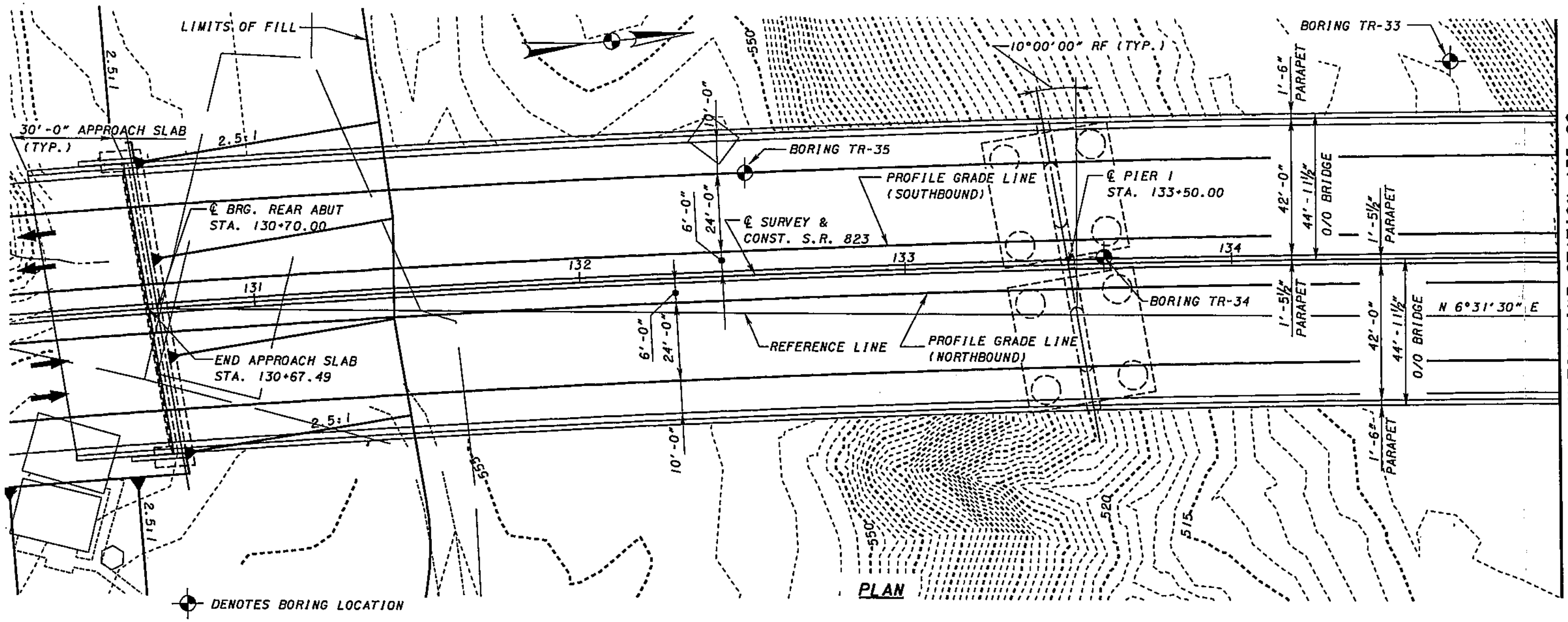
FORWARD ABUTMENT EMBANKMENT & CUT DETAILS - ALT 2A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

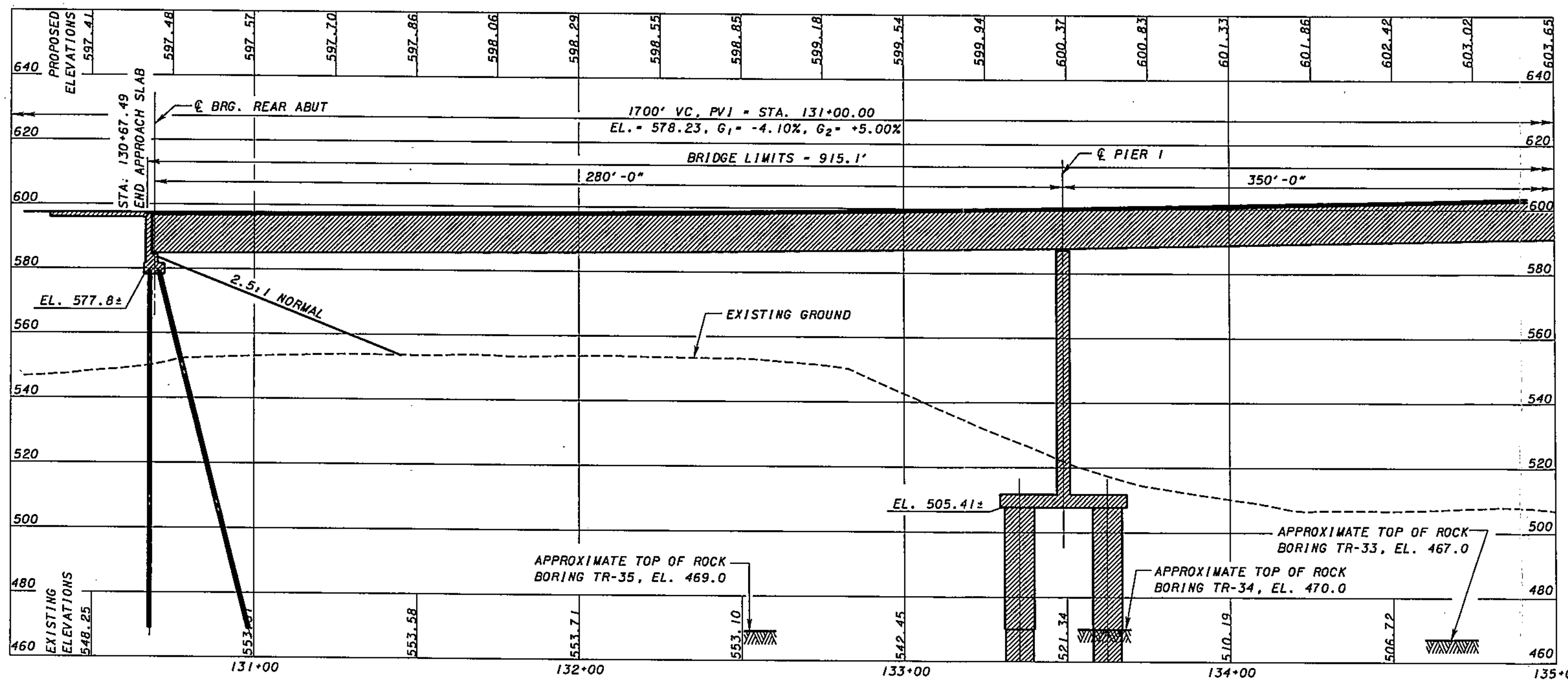
DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

DESIGN AGENCY: TranSystems

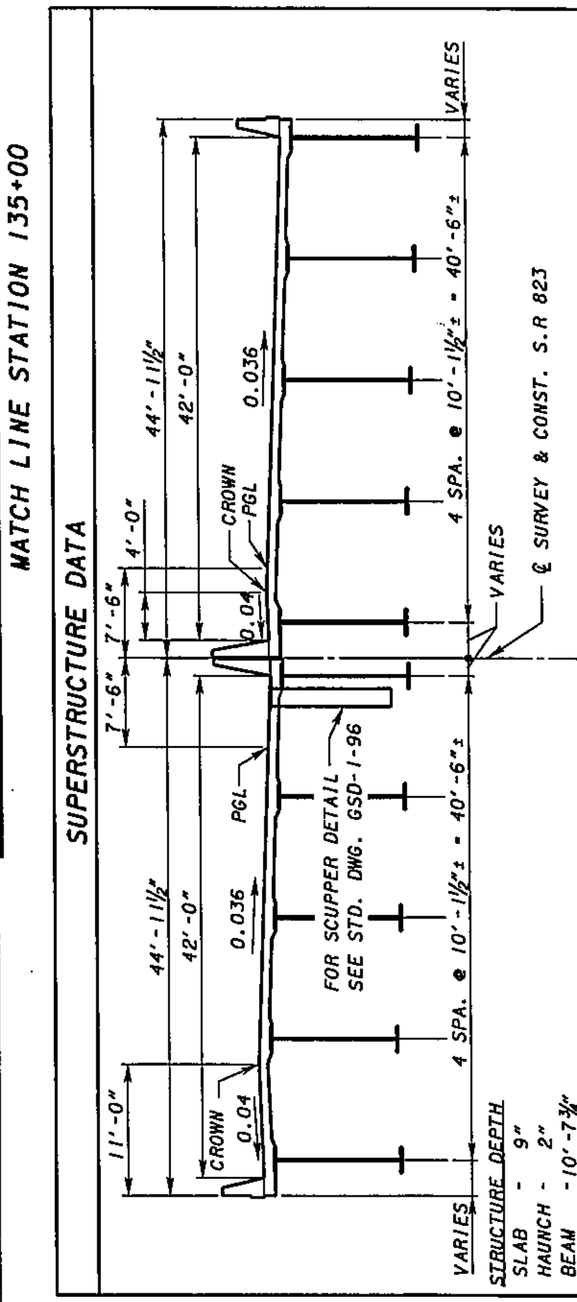
SCI-823-0.00
PID 19415

7 / 7





ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE



PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS HYBRID STEEL PLATE GIRDER A709 GRADE 50W (WEB), GRADE 70W (FLANGES), DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 280'-0", 350'-0", 280'-0" C/C BEARINGS

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

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

SKEW: 10°00'00" RF WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TranSystems

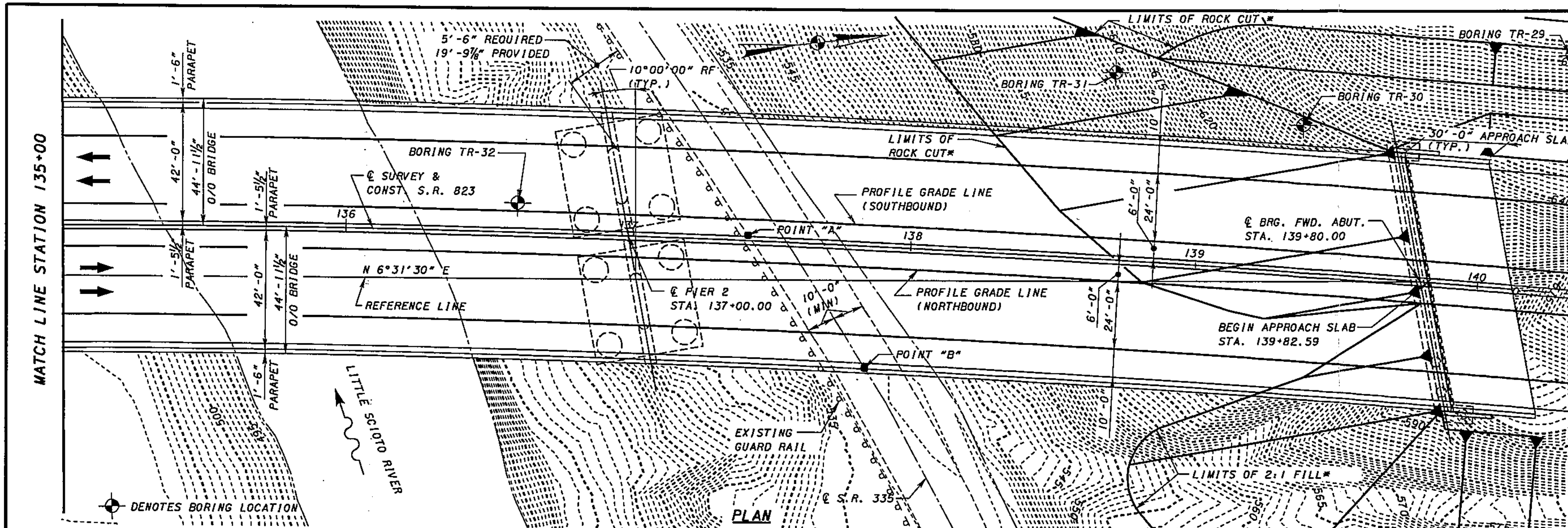
DESIGNED MSL | CHECKED MSL | DRAWN CAS | REVISED | REVIEWED JFC | DATE 07/12/06 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT. 2B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

1 / 7


MATCH LINE STATION 135+00
5'-6" REQUIRED
19'-9⅞" PROVIDED
10°00'00" RF (TYP.)
LIMITS OF ROCK CUT*
BORING TR-29
BORING TR-31
BORING TR-30
BORING TR-32
LIMITS OF ROCK CUT*
30'-0" APPROACH SLAB (TYP.)
℄ SURVEY & CONST. S.R. 823
PROFILE GRADE LINE (SOUTHBOUND)
POINT "A"
N 6°31'30" E
REFERENCE LINE
℄ PIER 2 STA. 137+00.00
10'-0" (MIN)
PROFILE GRADE LINE (NORTHBOUND)
℄ BRG. FWD. ABUT. STA. 139+80.00
BEGIN APPROACH SLAB STA. 139+82.59
POINT "B"
EXISTING GUARD RAIL
LITTLE SCIOTO RIVER
℄ S.R. 335
LIMITS OF 2:1 FILL*
DENOTES BORING LOCATION
1'-6" PARAPET
42'-0"
44'-11½" O/O BRIDGE
1'-5½" PARAPET
6'-0"
24'-0"
10'-0"
PLAN

* SEE SHEET 7/7 FOR FILL & ROCK CUT DETAILS.

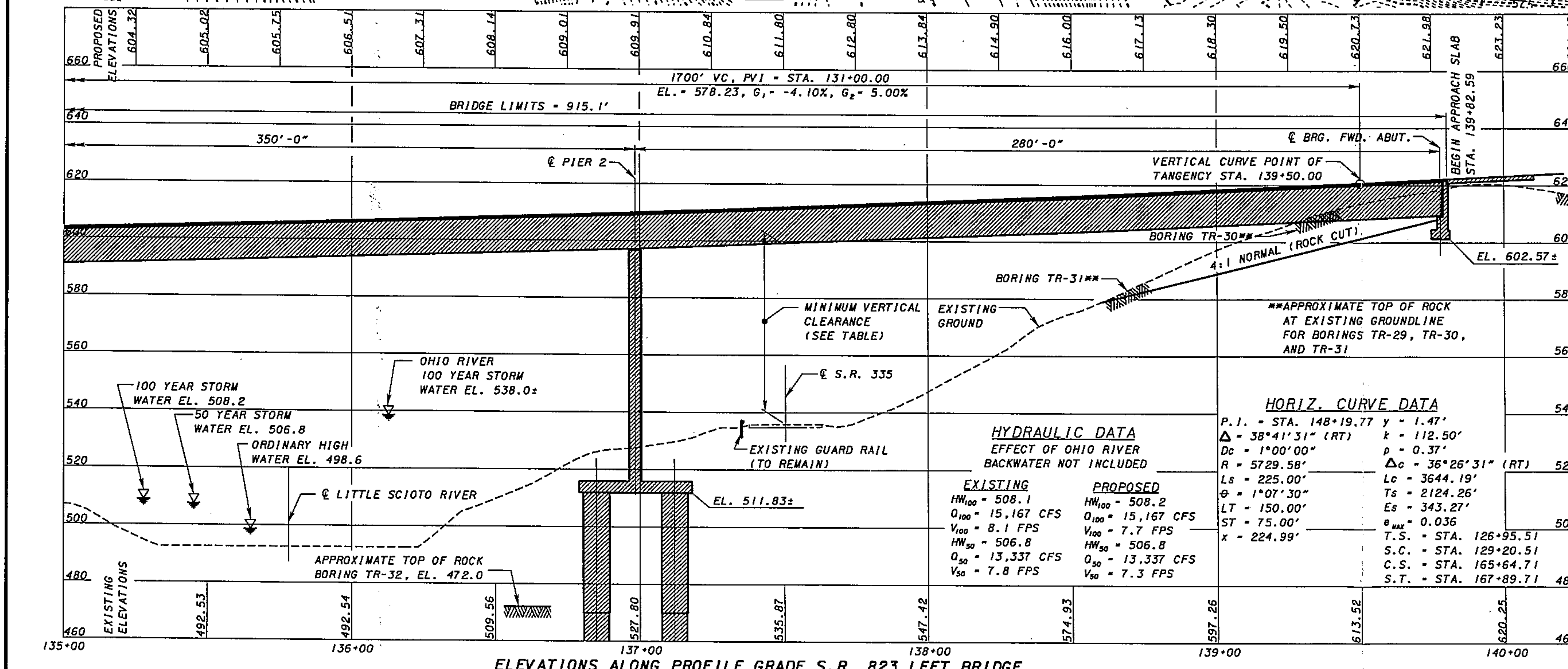

PROPOSED ELEVATIONS
604.32
605.02
605.75
606.51
607.31
608.14
609.01
609.91
610.84
611.80
612.80
613.84
614.90
616.00
617.13
618.30
619.50
620.73
621.98
623.23
624.48
1700' VC, PVI - STA. 131+00.00
EL.- 578.23, G1- -4.10%, G2- 5.00%
BRIDGE LIMITS - 915.1'
350'-0"
280'-0"
℄ BRG. FWD. ABUT.
BEGIN APPROACH SLAB STA. 139+82.59
℄ PIER 2
VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00
BORING TR-29**
BORING TR-30**
4:1 NORMAL (ROCK CUT)
EL. 602.57±
BORING TR-31**
MINIMUM VERTICAL CLEARANCE (SEE TABLE)
EXISTING GROUND
**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31
OHIO RIVER 100 YEAR STORM WATER EL. 538.0±
℄ S.R. 335
100 YEAR STORM WATER EL. 508.2
50 YEAR STORM WATER EL. 506.8
ORDINARY HIGH WATER EL. 498.6
EXISTING GUARD RAIL (TO REMAIN)
℄ LITTLE SCIOTO RIVER
EL. 511.83±
APPROXIMATE TOP OF ROCK BORING TR-32, EL. 472.0
HYDRAULIC DATA
EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED
EXISTING
HW100 - 508.1
Q100 - 15,167 CFS
V100 - 8.1 FPS
HW50 - 506.8
Q50 - 13,337 CFS
V50 - 7.8 FPS
PROPOSED
HW100 - 508.2
Q100 - 15,167 CFS
V100 - 7.7 FPS
HW50 - 506.8
Q50 - 13,337 CFS
V50 - 7.3 FPS
HORIZ. CURVE DATA
P.I. - STA. 148+19.77
Δ - 38°41'31" (RT)
Dc - 1°00'00"
R - 5729.58'
Ls - 225.00'
θ - 1°07'30"
LT - 150.00'
ST - 75.00'
x - 224.99'
y - 1.47'
k - 112.50'
p - 0.37'
Δc - 36°26'31" (RT)
Lc - 3644.19'
Ts - 2124.26'
Es - 343.27'
e MAX - 0.036
T.S. - STA. 126+95.51
S.C. - STA. 129+20.51
C.S. - STA. 165+64.71
S.T. - STA. 167+89.71
EXISTING ELEVATIONS
492.53
492.54
509.56
527.80
535.87
547.42
574.93
597.26
613.52
620.25
135+00
136+00
137+00
138+00
139+00
140+00
660
640
620
600
580
560
540
520
500
480
460
ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	63.85' ±	63.52' ±
REQUIRED	17.0'	17.0'

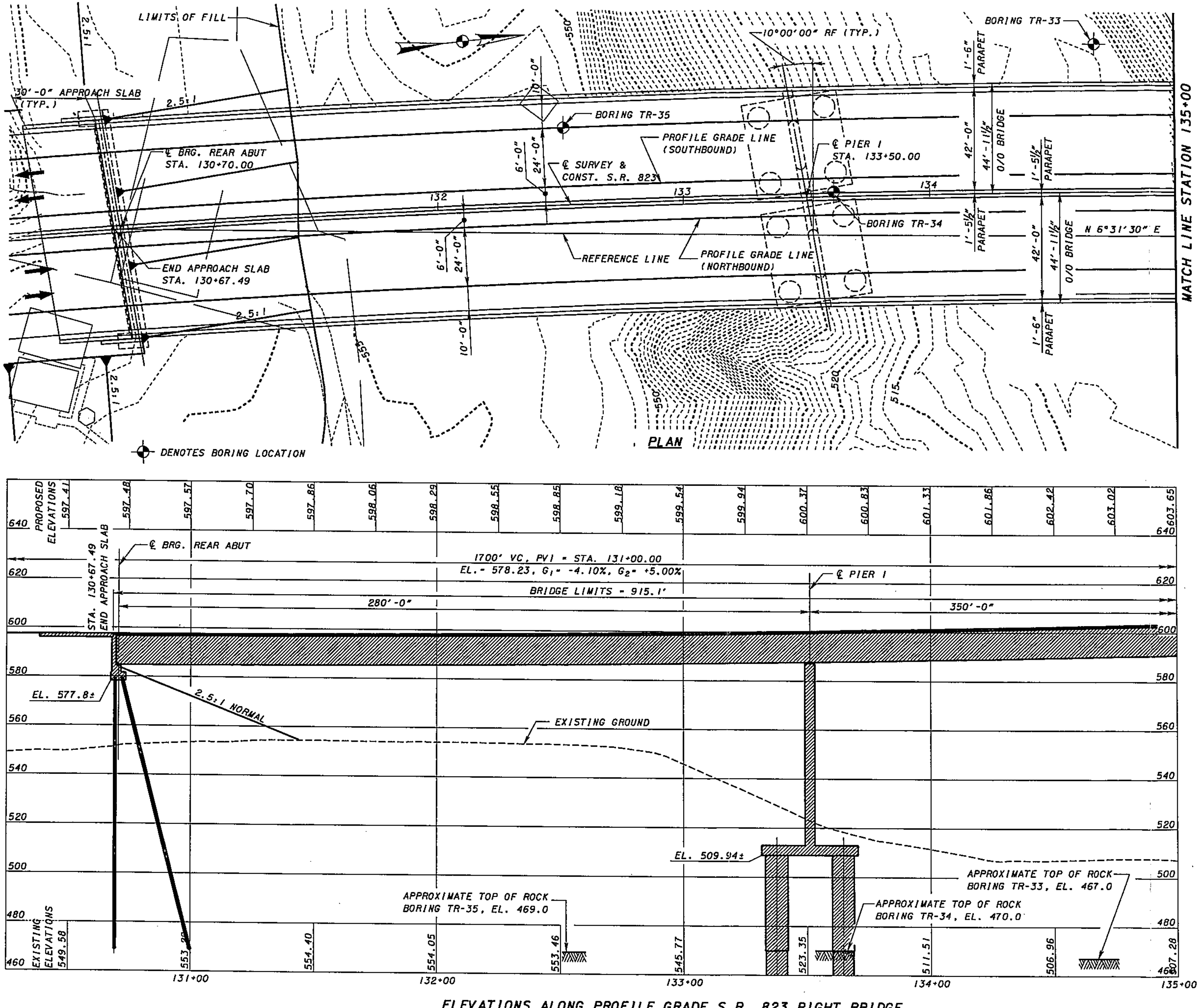
DESIGN AGENCY: Systems

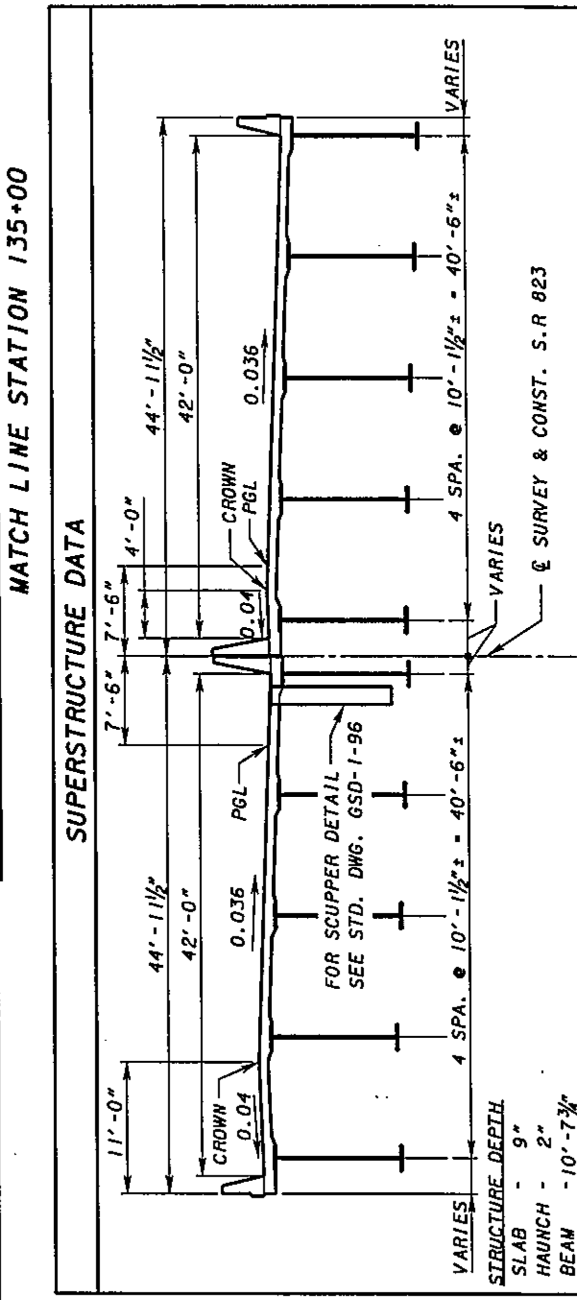
DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED		STRUCTURE FILE NUMBER
MSL			

SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT. 2B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415





PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS HYBRID STEEL PLATE GIRDER A709 GRADE 50W (WEB), GRADE 70W (FLANGES), DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 280'-0", 350'-0", 280'-0" C/C BEARINGS

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

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

SKEW: 10°00'00" RF WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: Transystems

DESIGNED MSL	DRAWN CAS	REVIEWED JRC	DATE 07/12/06
CHECKED MSL	REVISED	STRUCTURE FILE NUMBER	

SCIOTO COUNTY STA. 130+67.49 STA. 139+82.59

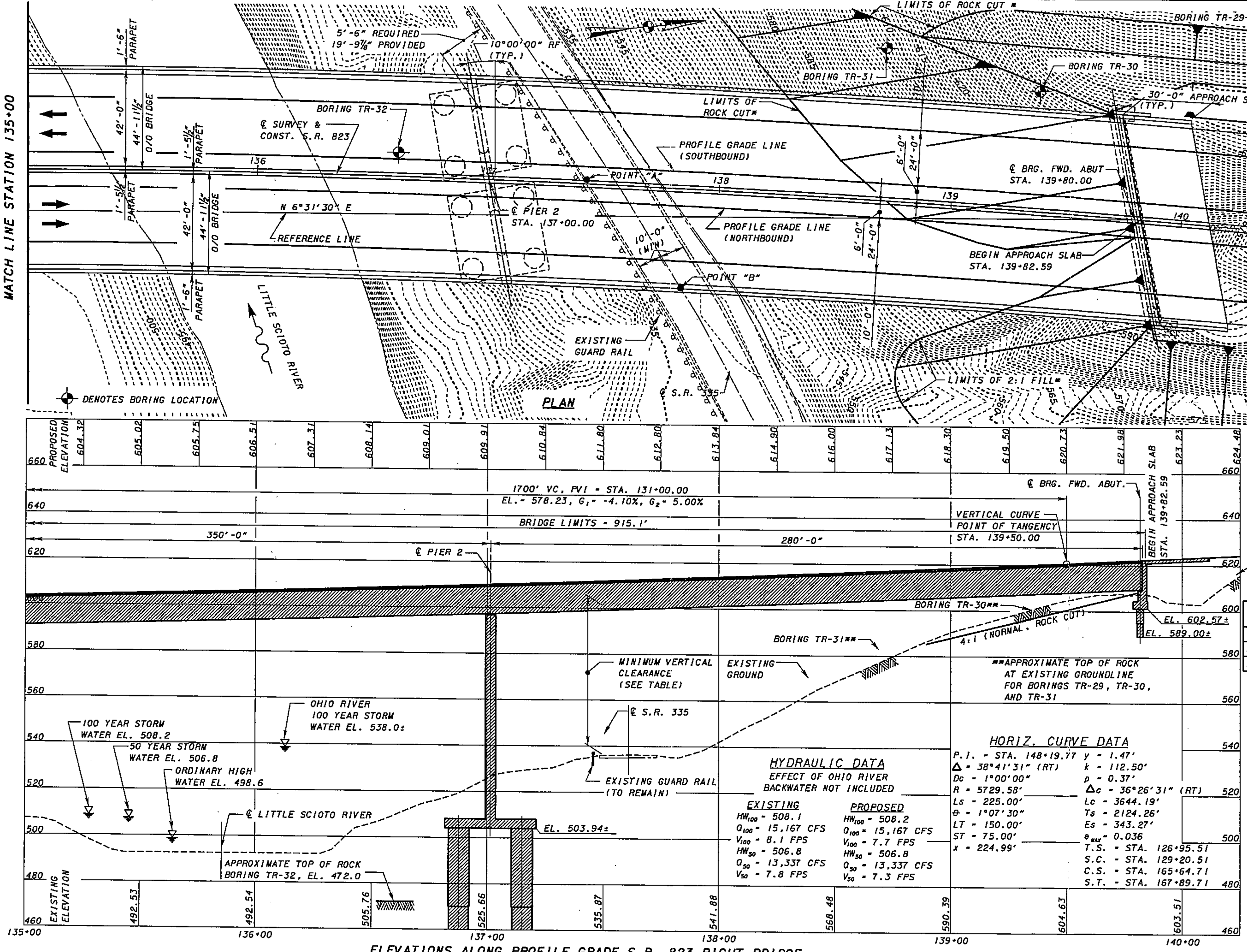
PRELIMINARY SITE PLAN - ALT 2B

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00 PID19415

3 / 7



ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

* SEE SHEET 7/7 FOR FILL & ROCK CUT DETAILS.

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	63.85'±	63.52'±
REQUIRED	17.0'	17.0'

DESIGN AGENCY: TranSystems

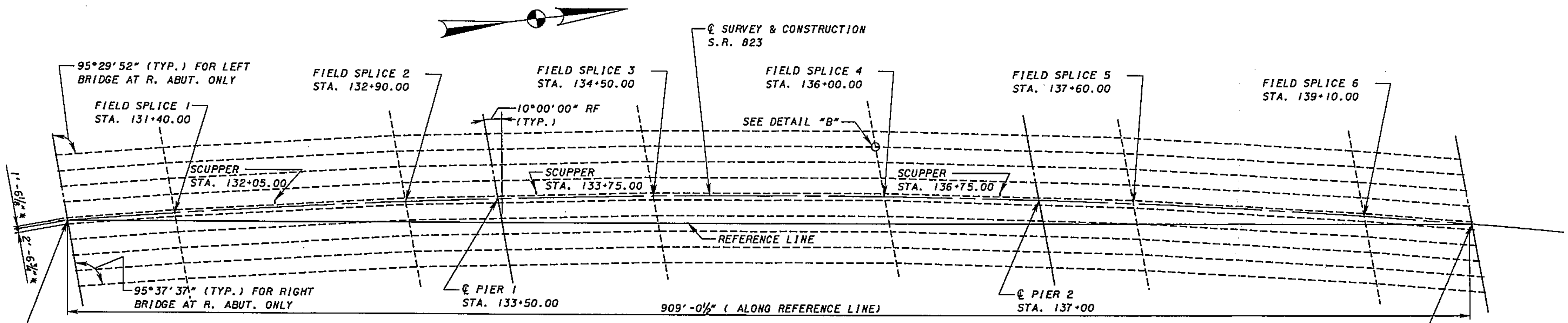
DESIGNED	CHECKED	DRAWN	REVISED	REVIEWED	DATE
MSL	MSL	MTN		JRC	07/12/06

STRUCTURE FILE NUMBER

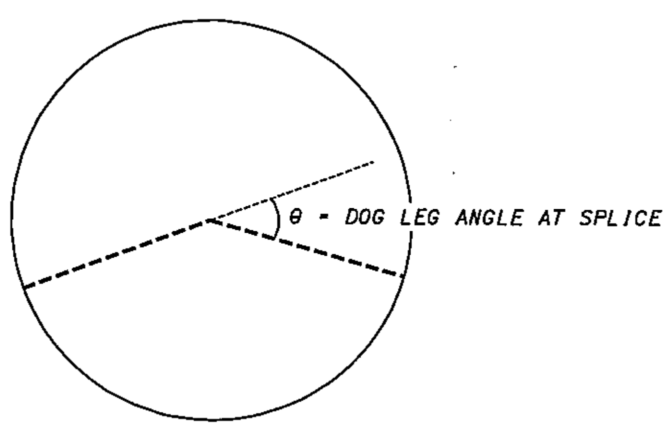
SCIOTO COUNTY
STA. 130+67.49
STA. 139+82.59

PRELIMINARY SITE PLAN - ALT. 2B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415



FRAMING PLAN



DETAIL "B"

LEFT (SOUTHBOUND BRIDGE)

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 130+70.00	N/A
SPLICE 1	STA. 131+40.00	1.30°
SPLICE 2	STA. 132+90.00	1.70°
℄ PIER 1	STA. 133+50.00	N/A
SPLICE 3	STA. 134+50.00	1.50°
SPLICE 4	STA. 136+00.00	1.50°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+60.00	1.70°
SPLICE 6	STA. 139+10.00	1.30°
℄ BRG. FWD. ABUT.	STA. 139+80.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	70.71'	4 SPACES @ 10'-2 13/16"± = 40.9353'
SPLICE 1	SPLICE 2	149.96'	4 SPACES @ 10'-2½"± = 40.8353'
SPLICE 2	SPLICE 3	160.01'	4 SPACES @ 10'-2"± = 40.6731'
SPLICE 3	SPLICE 4	150.00'	4 SPACES @ 10'-1½"± = 40.5000'
SPLICE 4	SPLICE 5	159.96'	4 SPACES @ 10'-0⅞"± = 40.2996'
SPLICE 5	SPLICE 6	150.05'	4 SPACES @ 10'-0⅛"± = 40.0386'
SPLICE 6	℄ BRG. FWD. ABUT	70.15'	4 SPACES @ 9'-11⅜"± = 39.8154'

* GIRDER SPACINGS ARE NORMAL TO GIRDER CENTERLINE

RIGHT (NORTHBOUND) BRIDGE

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 130+70.00	N/A
SPLICE 1	STA. 131+40.00	1.14°
SPLICE 2	STA. 132+90.00	1.88°
℄ PIER 1	STA. 133+50.00	N/A
SPLICE 3	STA. 134+50.00	1.35°
SPLICE 4	STA. 136+00.00	1.67°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+60.00	1.56°
SPLICE 6	STA. 139+10.00	1.46°
℄ BRG. FWD. ABUT.	STA. 139+80.00	N/A

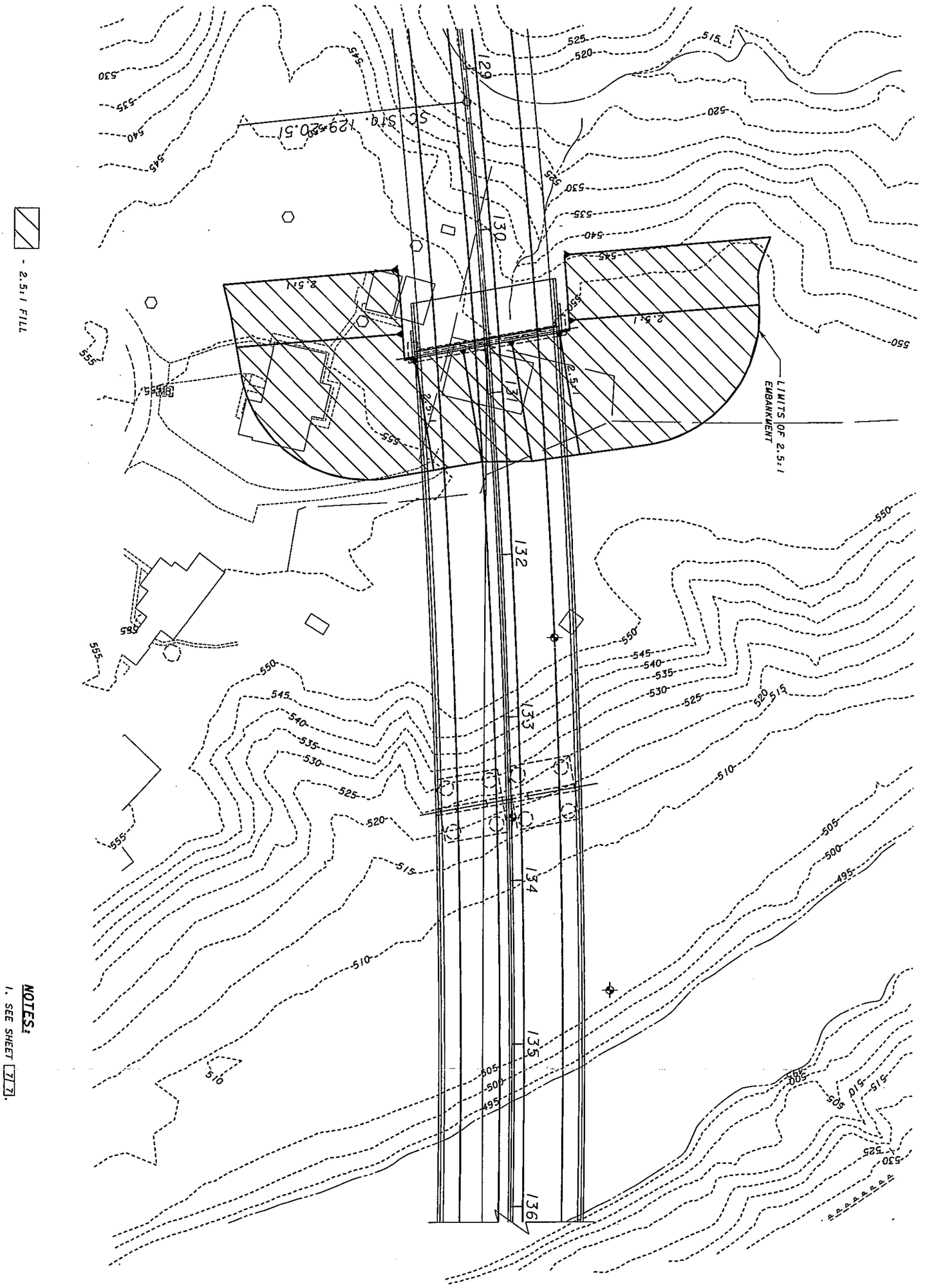
FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	70.72'	4 SPACES @ 10'-2¾"± = 40.9263'
SPLICE 1	SPLICE 2	149.95'	4 SPACES @ 10'-2½"± = 40.8380'
SPLICE 2	SPLICE 3	160.08'	4 SPACES @ 10'-2"± = 40.6568'
SPLICE 3	SPLICE 4	150.00'	4 SPACES @ 10'-1½"± = 40.5000'
SPLICE 4	SPLICE 5	160.06'	4 SPACES @ 10'-0 13/16"± = 40.2754'
SPLICE 5	SPLICE 6	150.07'	4 SPACES @ 10'-0⅛"± = 40.0335'
SPLICE 6	℄ BRG. FWD. ABUT	70.91'	4 SPACES @ 9'-11⅜"± = 39.7807'

DESIGN AGENCY: Systems
DESIGNED MSL | CHECKED MSL | DRAWN MTN | REVISED | REVIEWED JRC | DATE 07/12/06 | STRUCTURE FILE NUMBER

FRAMING PLAN ALTERNATIVE 2B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

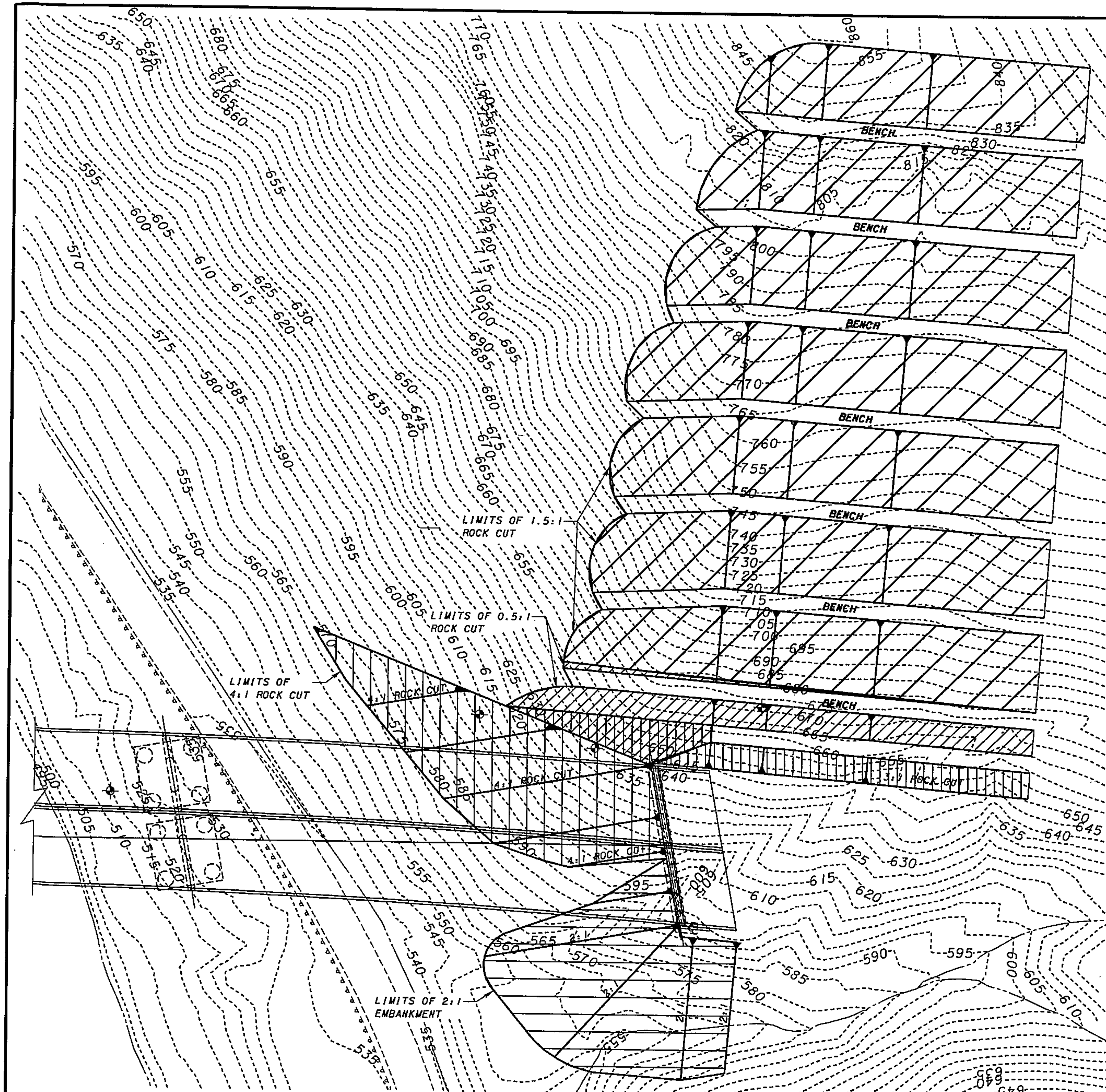
5 / 7



NOTES:

1. SEE SHEET 7 / 7.

6 / 7	SCI-823-0.00 PID 19415	REAR ABUTMENT EMBANKMENT - ALT 2B BRIDGE NO. SCI-823-XXXX S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER	DESIGNED MSL	DRAWN MTN	REVIEWED JRC	DATE 07/12/06	DESIGN AGENCY Triad Systems 5747 PERIMETER DRIVE, SUITE 240 DUBLIN, OHIO 43017
			CHECKED MSL	REVISED	STRUCTURE FILE NUMBER		



- 3:1 ROCK CUT
- 1.5:1 ROCK CUT
- 0.5:1 ROCK CUT
- 2:1 FILL
- 4:1 ROCK CUT
- TRANSITION AREA FROM 0.5:1 ROCK CUT TO 4:1 ROCK CUT

NOTES

1. ALL FILL AND ROCK CUT DETAILS UP TO END OF APPROACH SLAB HAVE BEEN INCLUDED IN QUANTITY CALCULATIONS FOR COST COMPARISON PURPOSES.

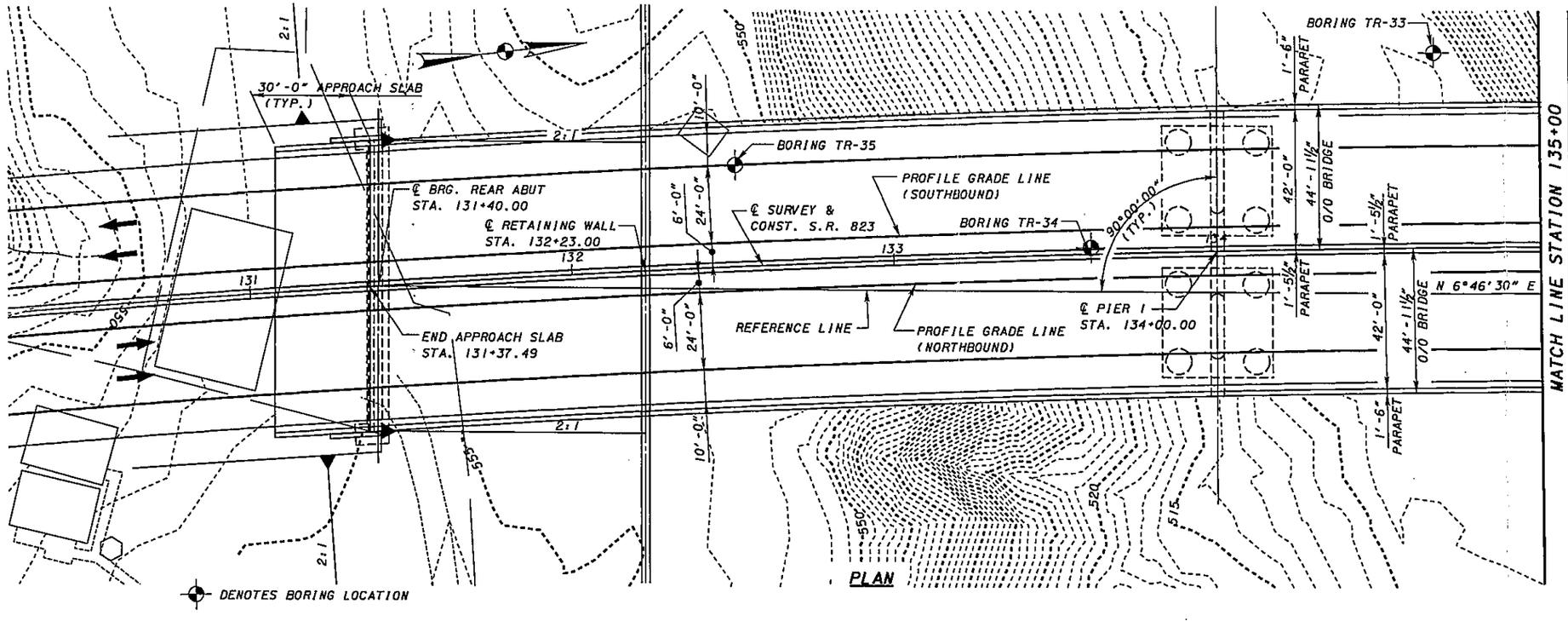
FWD. ABUT. EMBANKMENT & ROCK CUT DETAILS - ALT 2B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

DESIGNED MSL	DRAWN MTN	REVIEWED JRC	DATE 7/12/06
CHECKED MSL	REVISED	STRUCTURE FILE NUMBER	

DESIGN AGENCY: Trans Systems, 5747 PERIMETER DRIVE, SUITE 240, DUBLIN, OHIO 43017

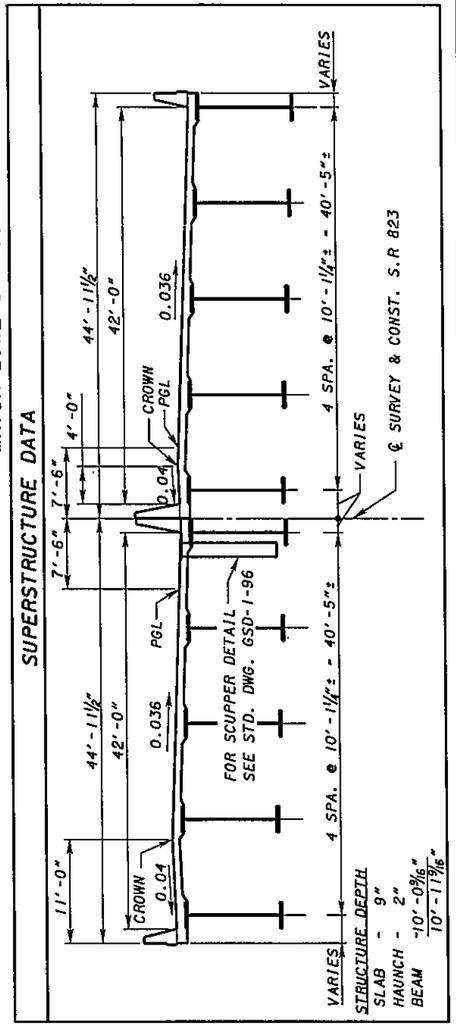
SCI-823-0.00
PID 19415

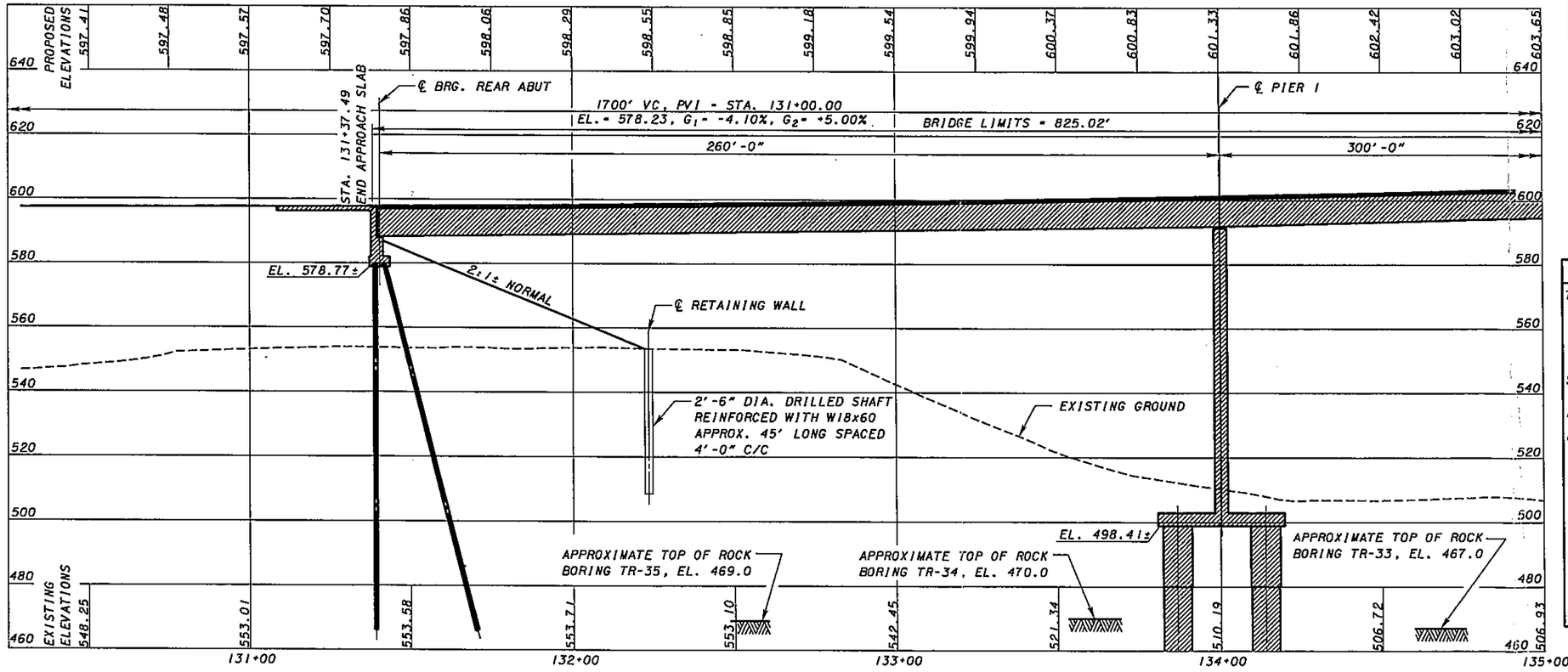
7 / 7



MATCH LINE STATION 135+00

SUPERSTRUCTURE DATA





ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS STEEL PLATE GIRDERS A709 GRADE 50W, DOG LEGGED AT SPLICES WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 260'-0", 300'-0", 260'-0" C/C BEARINGS

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

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

SKEW: 90° WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: Tran Systems, 510 KOHEKA DRIVE, SUITE 100, DUBLIN, OHIO 43017

DESIGNED MSL | DRAWN MTN | REVIEWED JRC | DATE 07/12/06

CHECKED MSL | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

PRELIMINARY SITE PLAN - ALT. 3A

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

1 / 7

MATCH LINE STATION 135+00

5'-6" REQUIRED
15'-0½" PROVIDED

1'-6" PARAPET
42'-0"
44'-1½"
O/O BRIDGE
1'-5½" PARAPET

℄ SURVEY & CONST. S.R. 823

BORING TR-32

90.00° (TYP.)

136

N 6°46'30" E

REFERENCE LINE

℄ PIER 2
STA. 137+00.00

10'-0" (MIN.)

POINT "A"

PROFILE GRADE LINE (SOUTHBOUND)

138

PROFILE GRADE LINE (NORTHBOUND)

POINT "B"

LITTLE SCIOTO RIVER

EXISTING GUARD RAIL

℄ S.R. 335

LIMITS OF 2:1 FILL*

15'-0" REQUIRED
25'-10½" PROVIDED

LIMITS OF ROCK CUT*

BORING TR-31

BORING TR-29

BORING TR-30

30'-0" APPROACH SLAB (TYP.)

6'-0"
24'-0"

℄ BRG. FWD. ABUT.
STA. 139+60.00

139

BEGIN APPROACH SLAB
STA. 139+62.51

10'-0"

595

590

585

* SEE SHEET 7 7 FOR FILL AND ROCK CUT DETAILS

DENOTES BORING LOCATION

PLAN

PROPOSED ELEVATIONS: 604.32, 605.02, 605.75, 606.51, 607.31, 608.14, 609.01, 609.91, 610.84, 611.80, 612.80, 613.84, 614.90, 616.00, 617.13, 618.30, 619.50, 620.73, 621.98, 623.23, 624.48

1700' VC, PVI - STA. 131+00.00
EL. = 578.23, G_1 = -4.10%, G_2 = 5.00%

BRIDGE LIMITS - 825.02'

300'-0" | 260'-0"

℄ PIER 2

℄ BRG. FWD. ABUT.

STA. 139+62.51 BEGIN APPROACH SLAB

VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00

BORING TR-29**

BORING TR-30**

4:1 NORMAL (ROCK CUT)

EL. 595.50±

BORING TR-31**

**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31

MINIMUM VERTICAL CLEARANCE (SEE TABLE)

℄ S.R. 335

OHIO RIVER
100 YEAR STORM
WATER EL. 538.0±

100 YEAR STORM
WATER EL. 508.2

50 YEAR STORM
WATER EL. 506.8

ORDINARY HIGH
WATER EL. 498.6

EXISTING GROUND

EXISTING GUARD RAIL (TO REMAIN)

EL. 515.71±

℄ LITTLE SCIOTO RIVER

APPROXIMATE TOP OF ROCK
BORING TR-32, EL. 472.0

EXISTING ELEVATIONS: 492.53, 492.54, 509.56, 527.80, 535.87, 547.42, 574.93, 597.26, 613.52, 620.25

660 640 620 600 580 560 540 520 500 480 460

135+00 136+00 137+00 138+00 139+00 140+00

ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	64.4'±	64.1'±
REQUIRED	17.0'	17.0'

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
HW_{100} = 508.1	HW_{100} = 508.2
Q_{100} = 15,167 CFS	Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS	V_{100} = 8.1 FPS
HW_{50} = 506.8	HW_{50} = 506.8
Q_{50} = 13,337 CFS	Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS	V_{50} = 7.7 FPS

HORIZ. CURVE DATA

P.I. - STA. 148+19.77	y = 1.47'
Δ = 38°41'31" (RT)	k = 112.50'
Dc = 1°00'00"	p = 0.37'
R = 5729.58'	Δc = 36°26'31" (RT)
Ls = 225.00'	Lc = 3644.19'
θ = 1°07'30"	Ts = 2124.26'
LT = 150.00'	Es = 343.27'
ST = 75.00'	e_{MAX} = 0.036
x = 224.99'	T.S. - STA. 126+95.51
	S.C. - STA. 129+20.51
	C.S. - STA. 165+64.71
	S.T. - STA. 167+89.71

DESIGN AGENCY: Ian Systems, 317 FOURTH AVENUE, SUITE 210, HUNTINGTON, WV 25701

REVIEWED	DATE
JRC	07/12/06

STRUCTURE FILE NUMBER

DRAWN	REVISED
MTN	

DESIGNED	CHECKED
MSL	MSL

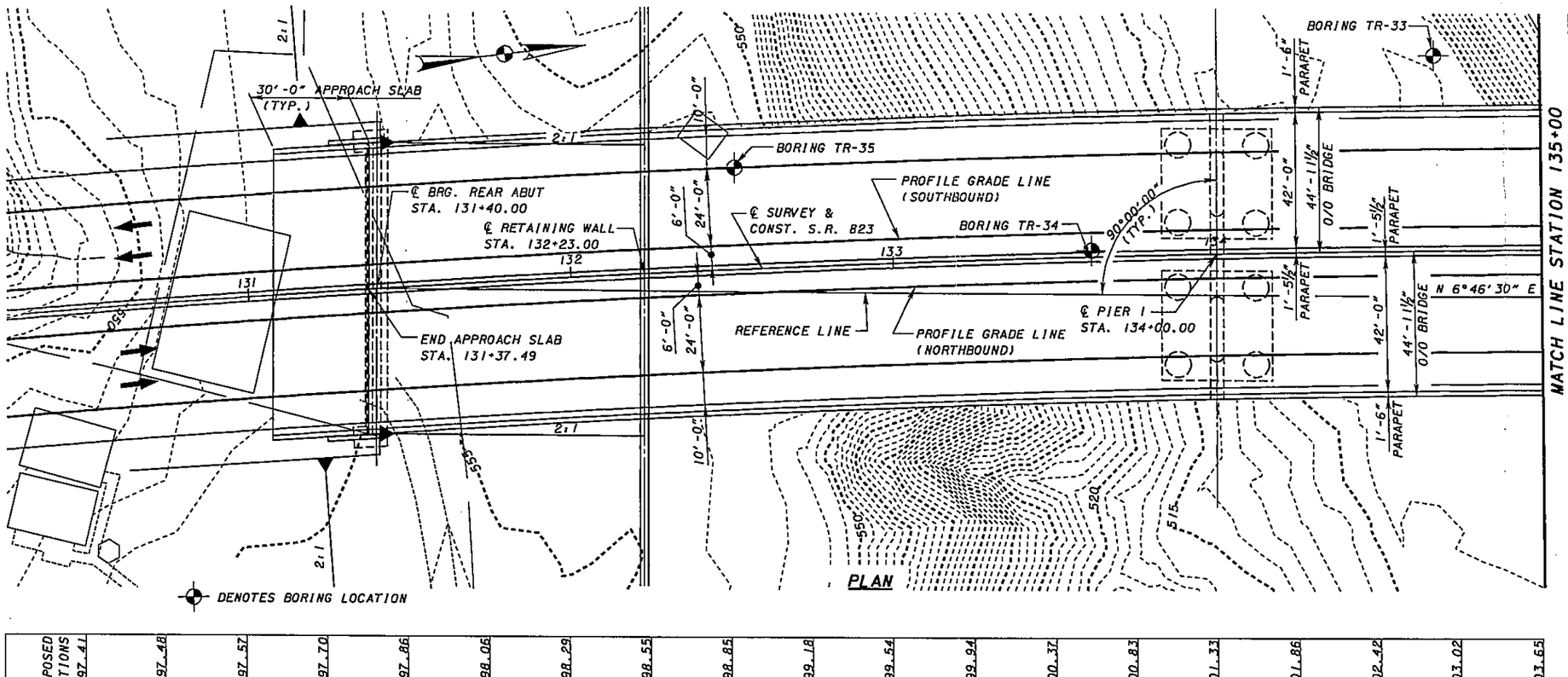
SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

PRELIMINARY SITE PLAN - ALT 3A

BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

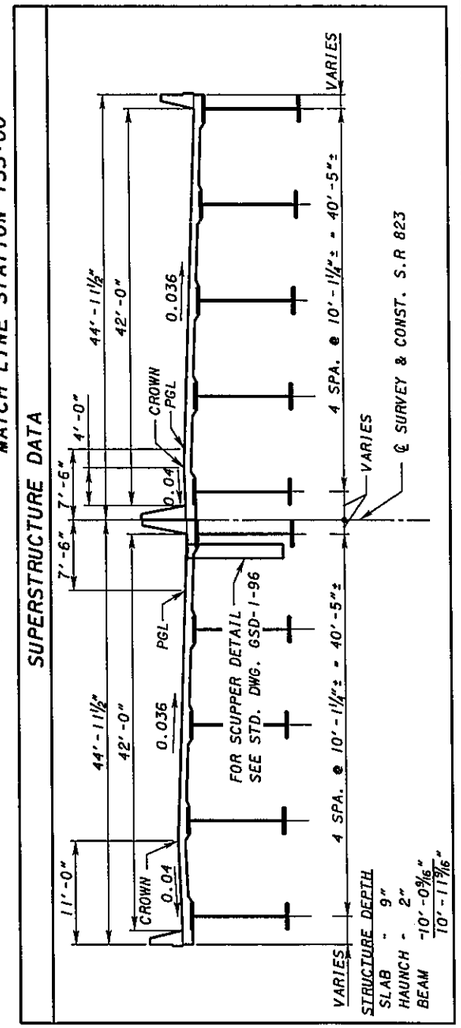
2 7



ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

MATCH LINE STATION 135+00

SUPERSTRUCTURE DATA



PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS STEEL PLATE GIRDERS A709 GRADE 50W, DOG LEGGED AT SPLICES WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 260'-0", 300'-0", 260'-0" C/C BEARINGS

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

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

SKEW: 90° WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: Tran Systems, 345 KINNEY DRIVE, SUITE 210, WORTH, OHIO 43077

DESIGNED MSL | DRAWN MTN | REVISED JRC 07/12/06 | STRUCTURE FILE NUMBER

CHECKED MSL | REVISED

SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

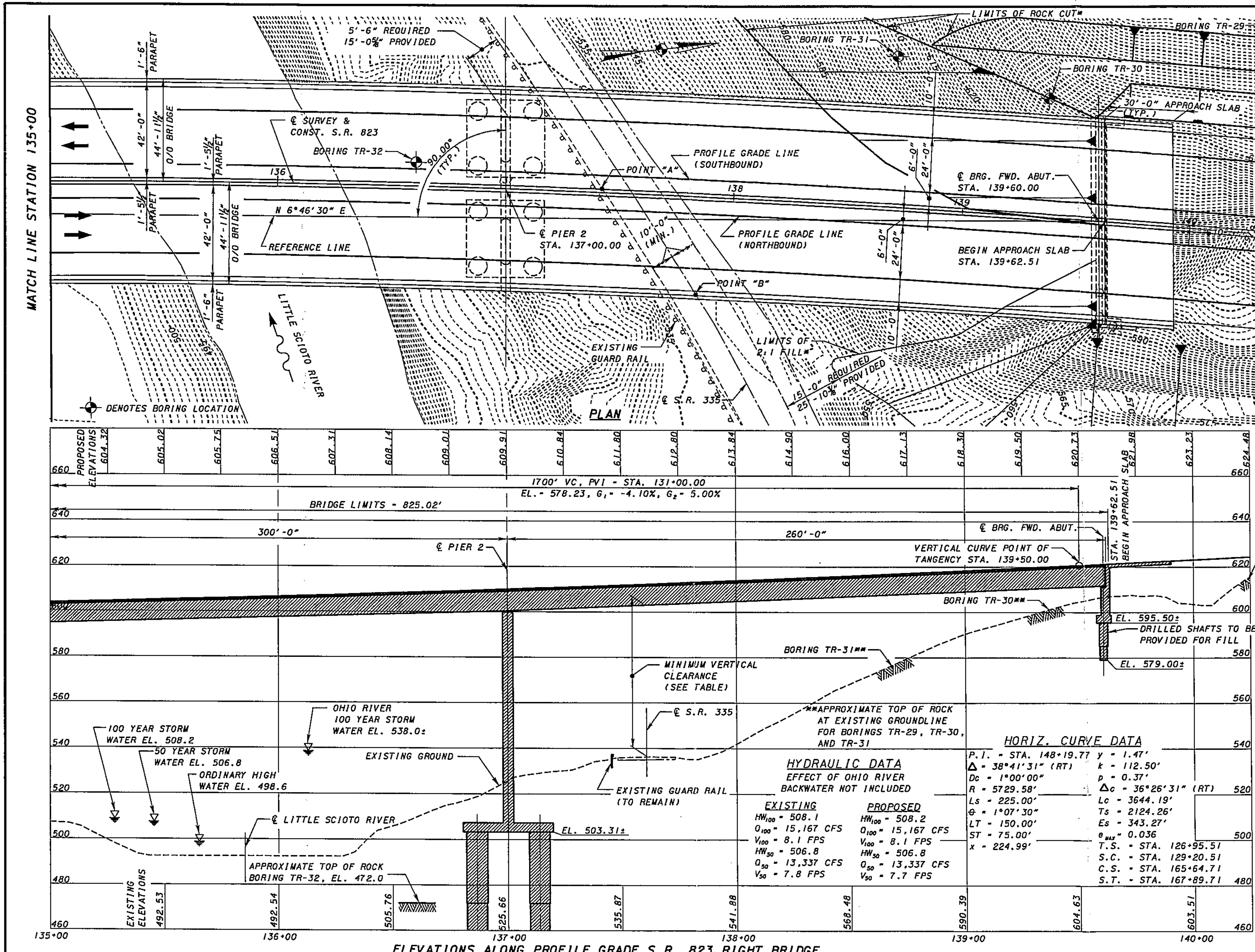
PRELIMINARY SITE PLAN - ALT. 3A

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

3 / 7


MATCH LINE STATION 135+00
LIMITS OF ROCK CUT*
BORING TR-29
BORING TR-31
BORING TR-30
5'-6" REQUIRED
15'-0⅝" PROVIDED
1'-6" PARAPET
42'-0"
44'-11½" O/O BRIDGE
1'-5½" PARAPET
℄ SURVEY & CONST. S.R. 823
BORING TR-32
90.00° (TYP.)
136
POINT "A"
PROFILE GRADE LINE (SOUTHBOUND)
138
139
N 6°46'30" E
REFERENCE LINE
℄ PIER 2 STA. 137+00.00
10'-0" (MIN.)
PROFILE GRADE LINE (NORTHBOUND)
POINT "B"
30'-0" APPROACH SLAB (TYP.)
℄ BRG. FWD. ABUT. STA. 139+60.00
BEGIN APPROACH SLAB STA. 139+62.51
6'-0"
24'-0"
10'-0"
LITTLE SCIOTO RIVER
EXISTING GUARD RAIL
LIMITS OF 2:1 FILL*
15'-0" REQUIRED
25'-10⅜" PROVIDED
℄ S.R. 335
DENOTES BORING LOCATION
PLAN
PROPOSED ELEVATIONS
604.32
605.02
605.75
606.51
607.31
608.14
609.01
609.91
610.84
611.80
612.80
613.84
614.90
616.00
617.13
618.30
619.50
620.73
621.98
623.23
624.48
1700' VC, PVI - STA. 131+00.00
EL.- 578.23, G1 - -4.10%, G2 - 5.00%
BRIDGE LIMITS - 825.02'
300'-0"
260'-0"
℄ BRG. FWD. ABUT.
STA. 139+62.51 BEGIN APPROACH SLAB
℄ PIER 2
VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00
BORING TR-29**
BORING TR-30**
EL. 595.50±
DRILLED SHAFTS TO BEDROCK PROVIDED FOR FILL
BORING TR-31**
EL. 579.00±
MINIMUM VERTICAL CLEARANCE (SEE TABLE)
OHIO RIVER 100 YEAR STORM WATER EL. 538.0±
℄ S.R. 335
**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31
100 YEAR STORM WATER EL. 508.2
50 YEAR STORM WATER EL. 506.8
ORDINARY HIGH WATER EL. 498.6
EXISTING GROUND
EXISTING GUARD RAIL (TO REMAIN)
℄ LITTLE SCIOTO RIVER
EL. 503.31±
APPROXIMATE TOP OF ROCK BORING TR-32, EL. 472.0
HYDRAULIC DATA
EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED
EXISTING
HW100 = 508.1
Q100 = 15,167 CFS
V100 = 8.1 FPS
HW50 = 506.8
Q50 = 13,337 CFS
V50 = 7.8 FPS
PROPOSED
HW100 = 508.2
Q100 = 15,167 CFS
V100 = 8.1 FPS
HW50 = 506.8
Q50 = 13,337 CFS
V50 = 7.7 FPS
HORIZ. CURVE DATA
P.I. = STA. 148+19.77
Δ = 38°41'31" (RT)
Dc = 1°00'00"
R = 5729.58'
Ls = 225.00'
θ = 1°07'30"
LT = 150.00'
ST = 75.00'
x = 224.99'
y = 1.47'
k = 112.50'
p = 0.37'
Δc = 36°26'31" (RT)
Lc = 3644.19'
Ts = 2124.26'
Es = 343.27'
θmax = 0.036
T.S. = STA. 126+95.51
S.C. = STA. 129+20.51
C.S. = STA. 165+64.71
S.T. = STA. 167+89.71
EXISTING ELEVATIONS
492.53
492.54
505.76
525.66
535.87
541.88
568.48
590.39
604.63
603.51
660
640
620
600
580
560
540
520
500
480
460
135+00
136+00
137+00
138+00
139+00
140+00
ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

* SEE SHEET 7/7 FOR FILL AND ROCK CUT DETAILS

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	64.4'±	64.1'±
REQUIRED	17.0'	17.0'

DESIGN AGENCY: TranSystems

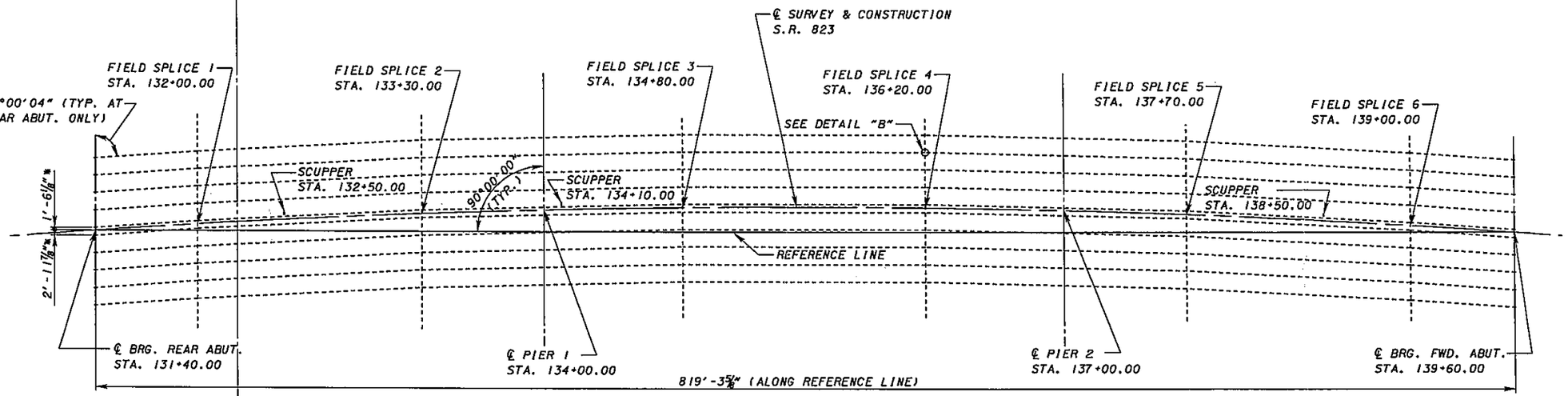
DESIGNED	CHECKED	DRAWN	REVISED	REVIEWED	DATE
MSL	MSL	MTN		JRC	07/12/06

STRUCTURE FILE NUMBER

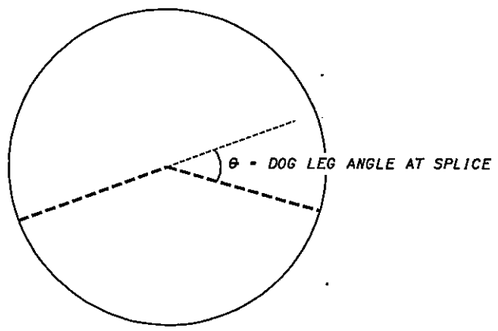
SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

PRELIMINARY SITE PLAN - ALT 3A
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415



FRAMING PLAN



DETAIL "B"

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 131+40.00	N/A
SPLICE 1	STA. 132+00.00	1.00°
SPLICE 2	STA. 133+30.00	1.60°
℄ PIER 1	STA. 134+00.00	N/A
SPLICE 3	STA. 134+80.00	1.40°
SPLICE 4	STA. 136+20.00	1.40°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+70.00	1.60°
SPLICE 6	STA. 139+00.00	1.00°
℄ BRG. FWD. ABUT.	STA. 139+60.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	60.76'	4 SPACES @ 10'-1 3/16"± = 40.4014'
SPLICE 1	SPLICE 2	130.01'	4 SPACES @ 10'-1 5/16"± = 40.4445'
SPLICE 2	SPLICE 3	149.99'	4 SPACES @ 10'-1 7/16"± = 40.4879'
SPLICE 3	SPLICE 4	140.00'	4 SPACES @ 10'-1 1/2"± = 40.5000'
SPLICE 4	SPLICE 5	149.99'	4 SPACES @ 10'-1 7/16"± = 40.4879'
SPLICE 5	SPLICE 6	130.01'	4 SPACES @ 10'-1 5/16"± = 40.4445'
SPLICE 6	℄ BRG. FWD. ABUT	60.76'	4 SPACES @ 10'-1 3/16"± = 40.4014'

* GIRDER SPACINGS ARE NORMAL TO GIRDER CENTERLINE

NOTES:

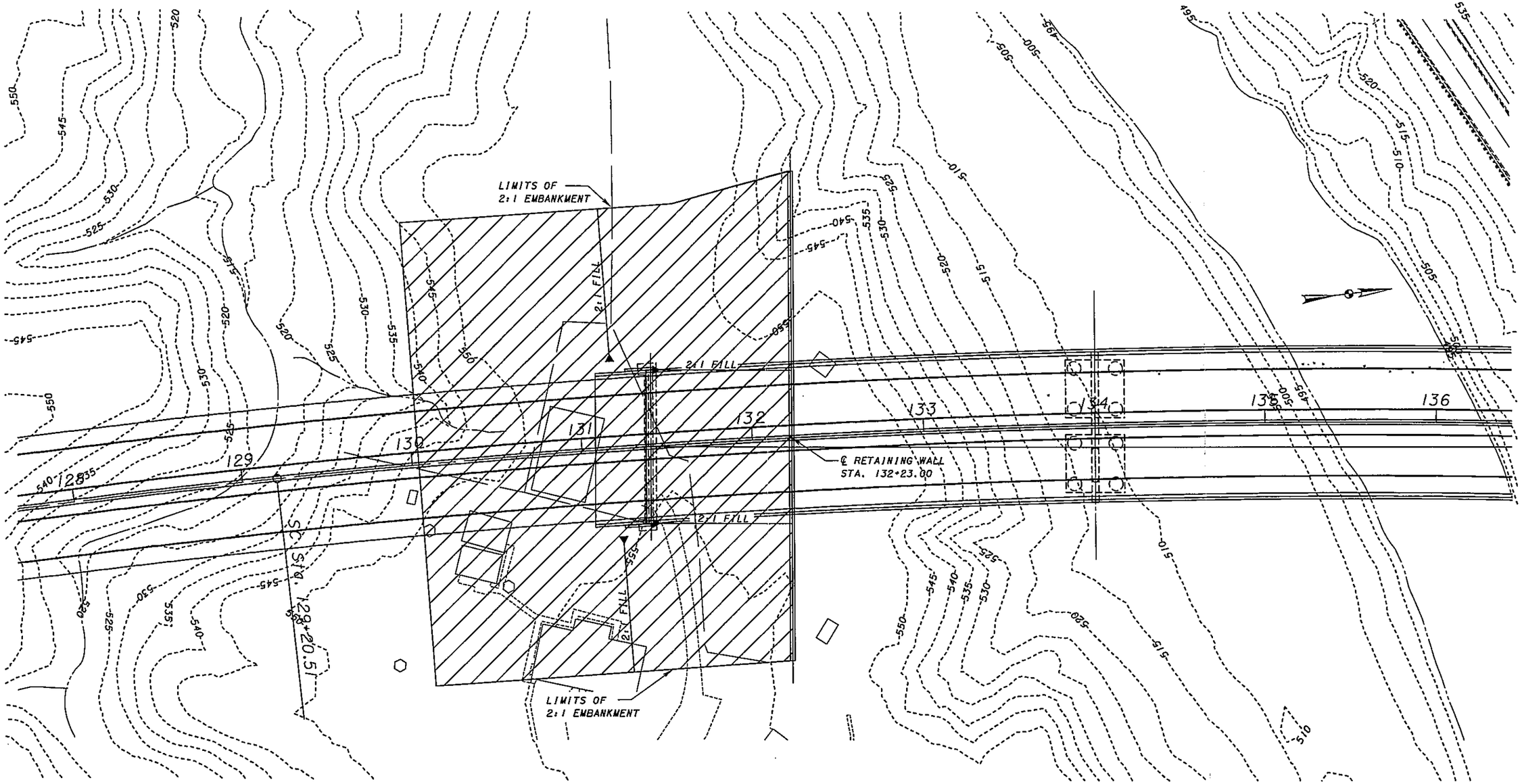
1. θ, GIRDER LENGTH, AND GIRDER SPACING IN TABLES ABOVE APPLY TO BOTH THE LEFT RIGHT BRIDGE.

DESIGN AGENCY
Systems
DATE 07/12/06
REVISED JRC
STRUCTURE FILE NUMBER
DRAWN MTN
REVISED
DESIGNED WSL
CHECKED WSL

FRAMING PLAN - ALTERNATIVE 3A
BRIDGE NO. SCI-823-0.00
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

5 / 7



- 2:1 FILL

NOTES:

1. SEE SHEET 7/7.

DESIGN AGENCY: Team Systems, 510 KENNETH DRIVE, SUITE 210, DUBLIN, OHIO 43017

DESIGNED	DRAWN	REVISED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

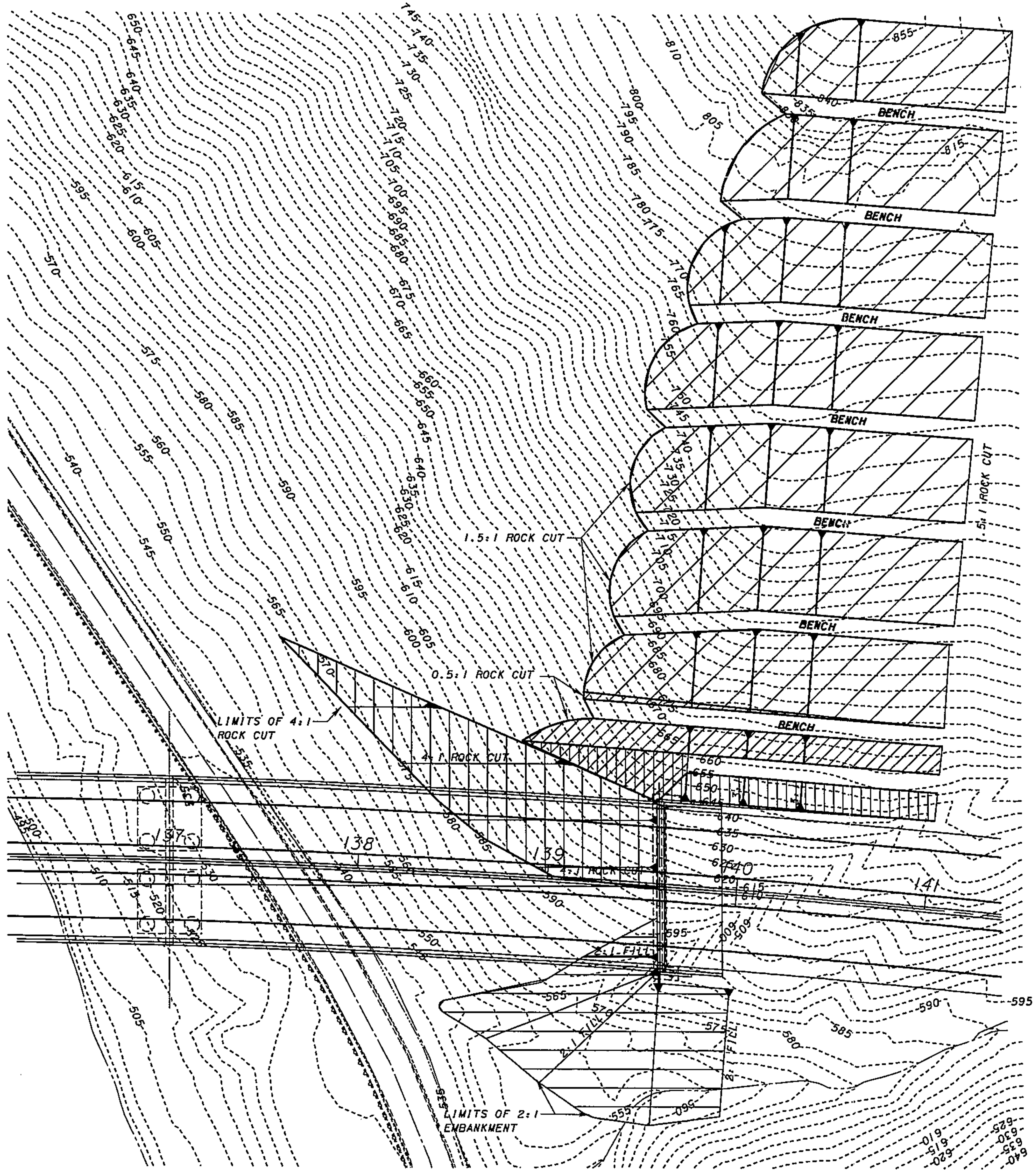
REAR ABUTMENT EMBANKMENT DETAILS - ALT. 3A

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

6/7



- 3:1 ROCK CUT
- 1.5:1 ROCK CUT
- 0.5:1 ROCK CUT
- 2:1 FILL
- 4:1 ROCK CUT
- TRANSITION AREA FROM 0.5:1 ROCK CUT TO 4:1 ROCK CUT

NOTES:

1. ALL FILL AND ROCK CUT DETAILS UP TO END OF APPROACH SLAB HAVE BEEN INCLUDED IN QUANTITY CALCULATIONS FOR COST COMPARISON PURPOSES

DESIGN AGENCY: Systems, 5747 PERIMETER DRIVE, SUITE 240, DUBLIN, OHIO 43017

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

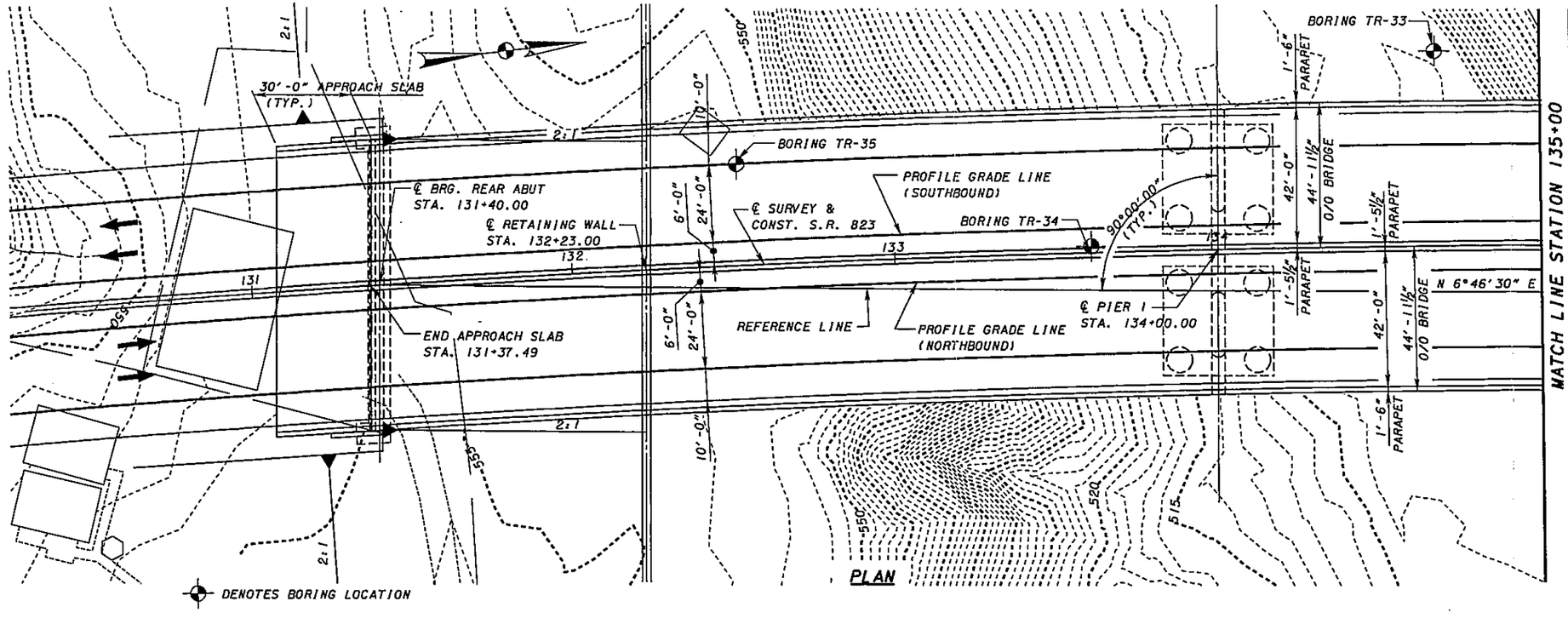
FWD. ABUT. EMBANKMENT & ROCK CUT DETAILS - ALT. 3A

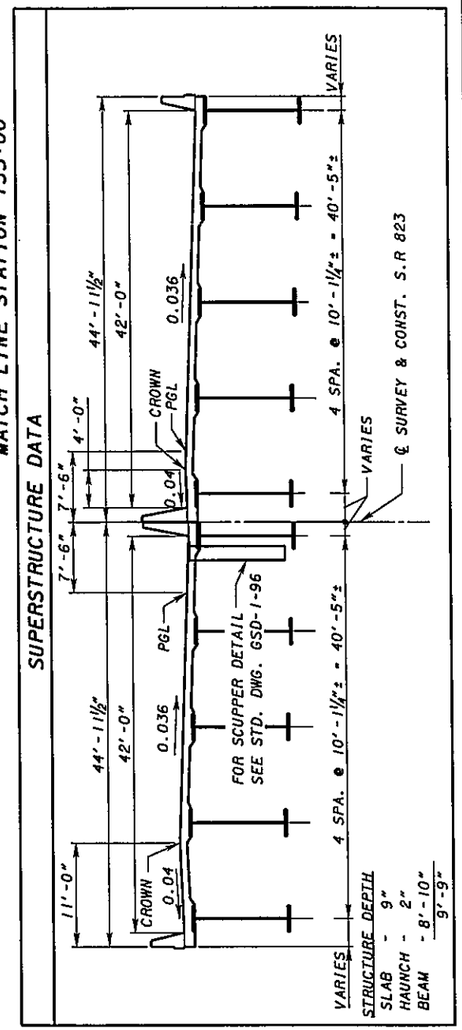
BRIDGE NO. SCI-823-XXXX

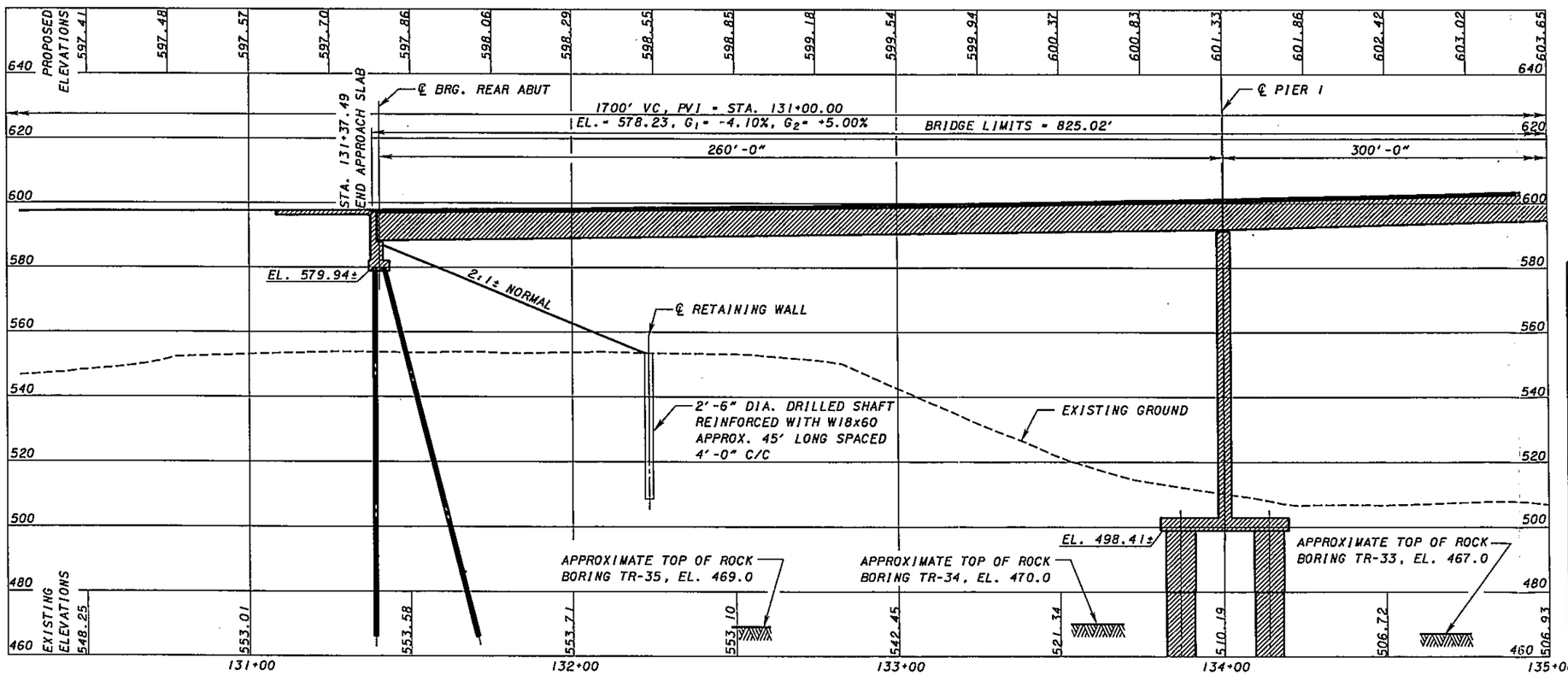
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00

PID 19415







ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS HYBRID STEEL PLATE GIRDER A709 GRADE 50W (WEB), GRADE 70W (FLANGES), DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 260'-0", 300'-0", 260'-0" C/C BEARINGS

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

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

SKEW: 90° WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: Team Systems, 510 HEINZ DRIVE, SUITE 140, DUBLIN, OHIO 43017

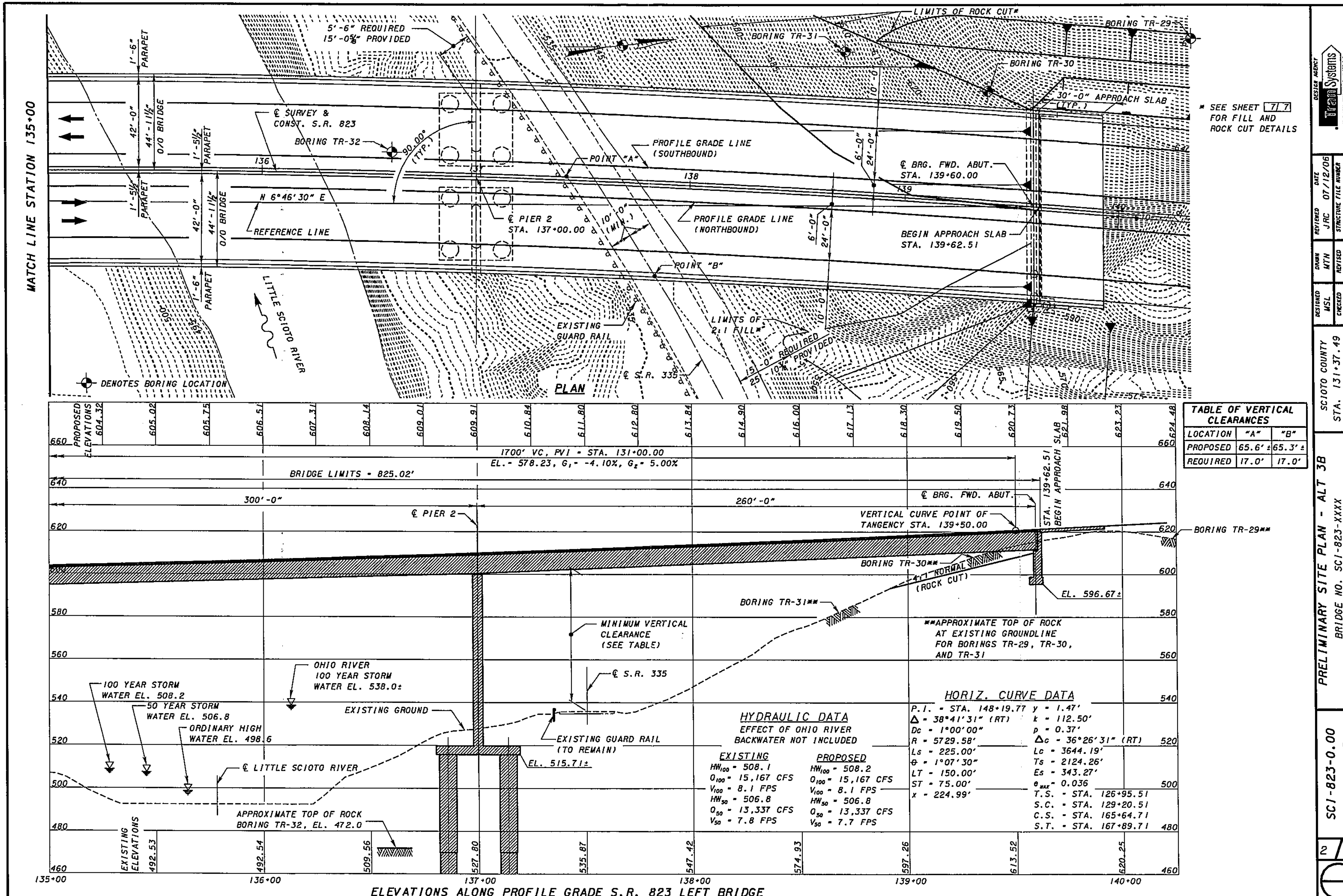
DESIGNED MSL | DRAWN MTN | CHECKED MSL | REVISED | REVISED JRC | DATE 07/12/06 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

PRELIMINARY SITE PLAN - ALT. 3B
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

1 / 7



MATCH LINE STATION 135+00
PLAN
5'-6" REQUIRED
15'-0⅝" PROVIDED
LIMITS OF ROCK CUT*
BORING TR-29
BORING TR-31
BORING TR-30
BORING TR-32
℄ SURVEY & CONST. S.R. 823
90.00° (TYP.)
PROFILE GRADE LINE (SOUTHBOUND)
POINT "A"
POINT "B"
N 6°46'30" E
REFERENCE LINE
℄ PIER 2 STA. 137+00.00
10'-0" (MIN.)
PROFILE GRADE LINE (NORTHBOUND)
30'-0" APPROACH SLAB (TYP.)
℄ BRG. FWD. ABUT. STA. 139+60.00
BEGIN APPROACH SLAB STA. 139+62.51
* SEE SHEET 7/7 FOR FILL AND ROCK CUT DETAILS
1'-6" PARAPET
42'-0"
44'-1½" O/O BRIDGE
1'-5½" PARAPET
LITTLE SCIOTO RIVER
EXISTING GUARD RAIL
LIMITS OF 2:1 FILL*
15'-0" REQUIRED
25'-10⅜" PROVIDED
℄ S.R. 335
6'-0"
24'-0"
DENOTES BORING LOCATION
PROPOSED ELEVATIONS
604.32 605.02 605.75 606.51 607.31 608.14 609.01 609.91 610.84 611.80 612.80 613.84 614.90 616.00 617.13 618.30 619.50 620.73 621.98 623.23 624.48
1700' VC, PVI = STA. 131+00.00
EL. = 578.23, G1 = -4.10%, G2 = 5.00%
BRIDGE LIMITS = 825.02'
300'-0"
260'-0"
℄ PIER 2
℄ BRG. FWD. ABUT.
STA. 139+62.51 BEGIN APPROACH SLAB
VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00
BORING TR-29**
BORING TR-30**
4:1 NORMAL (ROCK CUT)
EL. 596.67±
BORING TR-31**
**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31
MINIMUM VERTICAL CLEARANCE (SEE TABLE)
℄ S.R. 335
OHIO RIVER 100 YEAR STORM WATER EL. 538.0±
100 YEAR STORM WATER EL. 508.2
50 YEAR STORM WATER EL. 506.8
ORDINARY HIGH WATER EL. 498.6
EXISTING GROUND
EXISTING GUARD RAIL (TO REMAIN)
EL. 515.71±
℄ LITTLE SCIOTO RIVER
APPROXIMATE TOP OF ROCK BORING TR-32, EL. 472.0
EXISTING ELEVATIONS
492.53 492.54 509.56 527.80 535.87 547.42 574.93 597.26 613.52 620.25
135+00 136+00 137+00 138+00 139+00 140+00
660 640 620 600 580 560 540 520 500 480 460

ELEVATIONS ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	65.6'±	65.3'±
REQUIRED	17.0'	17.0'

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING
HW_{100} = 508.1
Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS
HW_{50} = 506.8
Q_{50} = 13,337 CFS
V_{50} = 7.8 FPS

PROPOSED
HW_{100} = 508.2
Q_{100} = 15,167 CFS
V_{100} = 8.1 FPS
HW_{50} = 506.8
Q_{50} = 13,337 CFS
V_{50} = 7.7 FPS

HORIZ. CURVE DATA

P.I. = STA. 148+19.77
Δ = 38°41'31" (RT)
Dc = 1°00'00"
R = 5729.58'
Ls = 225.00'
θ = 1°07'30"
LT = 150.00'
ST = 75.00'
x = 224.99'
y = 1.47'
k = 112.50'
p = 0.37'
Δ_c = 36°26'31" (RT)
Lc = 3644.19'
Ts = 2124.26'
Es = 343.27'
e_{MAX} = 0.036
T.S. = STA. 126+95.51
S.C. = STA. 129+20.51
C.S. = STA. 165+64.71
S.T. = STA. 167+89.71

DESIGN AGENCY: TranSystems
DESIGNED MSL | CHECKED MSL | DRAWN MTN | REVISED | REVIEWED JRC | DATE 07/12/06 | STRUCTURE FILE NUMBER

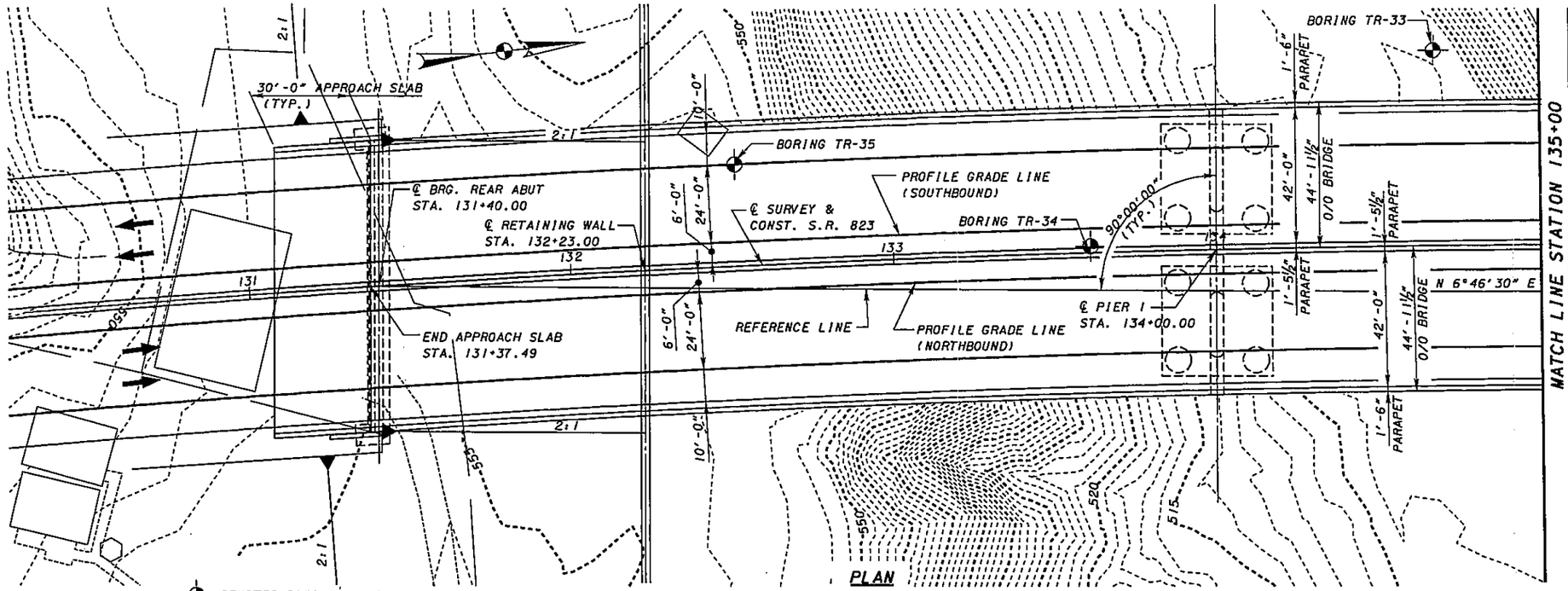
SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

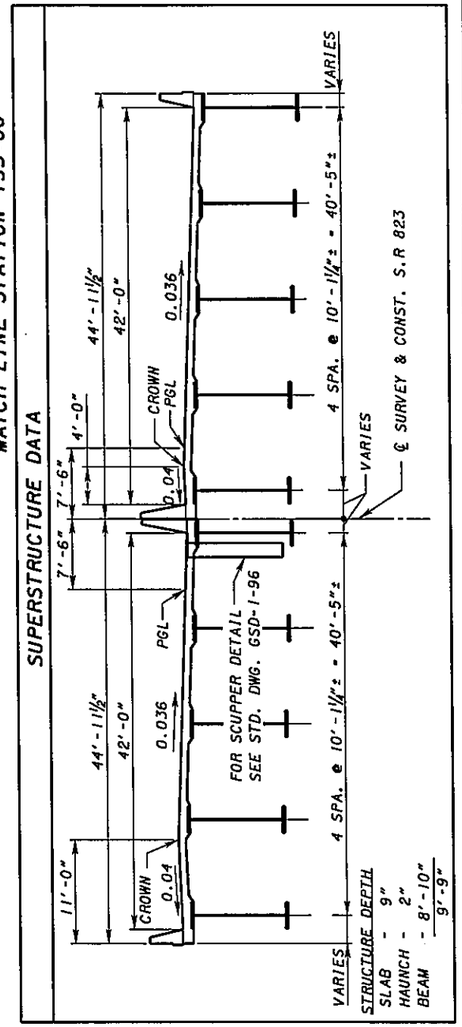
PRELIMINARY SITE PLAN - ALT 3B

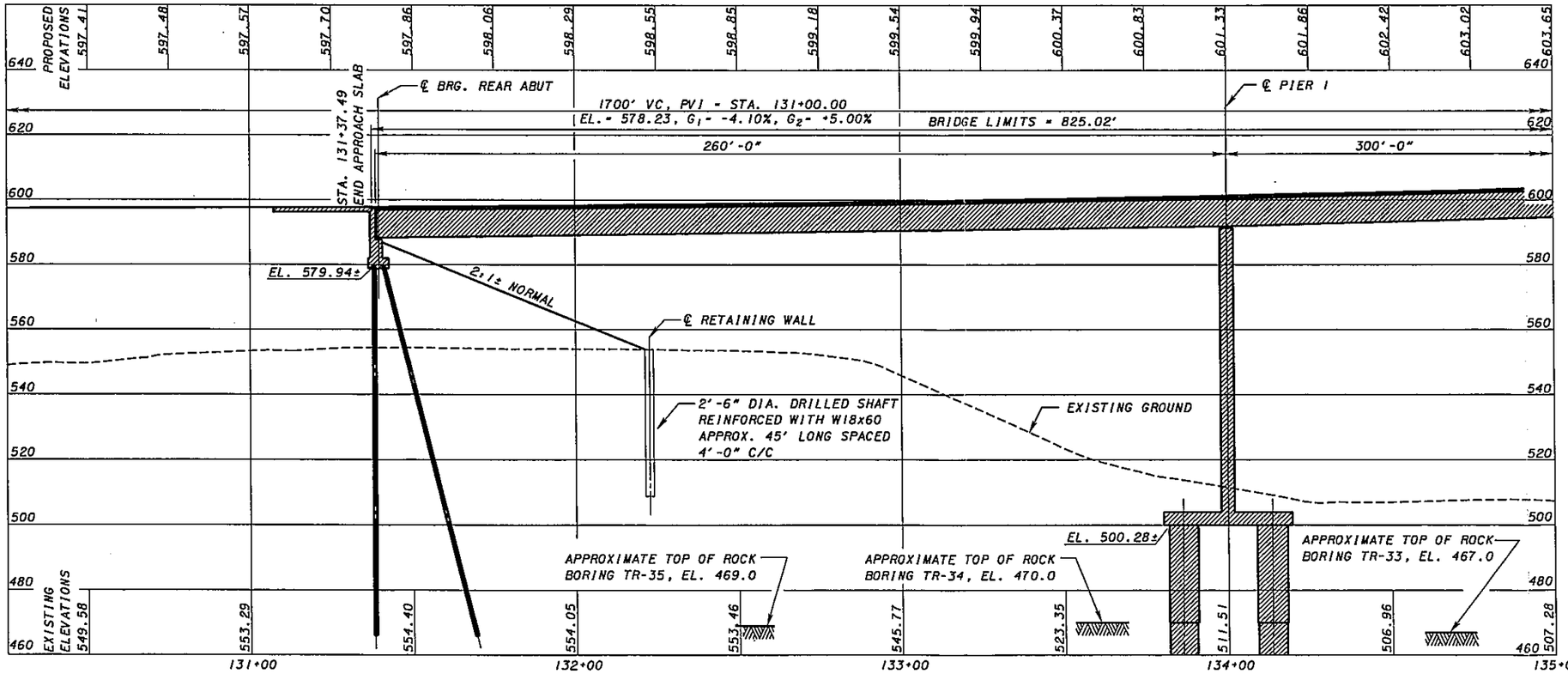
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

2 / 7







ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

PROPOSED STRUCTURE

TYPE: 3 SPAN CONTINUOUS HYBRID STEEL PLATE GIRDER A709 GRADE 50W (WEB), GRADE 70W (FLANGES), DOG LEGGED AT SPLICES, WITH COMPOSITE REINFORCED CONCRETE DECK ON STUB ABUTMENTS AND T-TYPE PIERS.

SPANS: 260'-0", 300'-0", 260'-0" C/C BEARINGS

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

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

SKEW: 90° WITH RESPECT TO REFERENCE LINE (ALSO SEE FRAMING PLAN)

CROWN: 0.036 FT/FT

ALIGNMENT: Dc = 1°00'00"

WEARING SURFACE: MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

DESIGN AGENCY: TranSystems, 314 W. TENTH ST., SUITE 140, AUSTIN, OHIO 43107

DESIGNED MSL | DRAWN MTN | REVIEWED JRC | DATE 07/12/06

CHECKED MSL | REVISED | REVISED | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

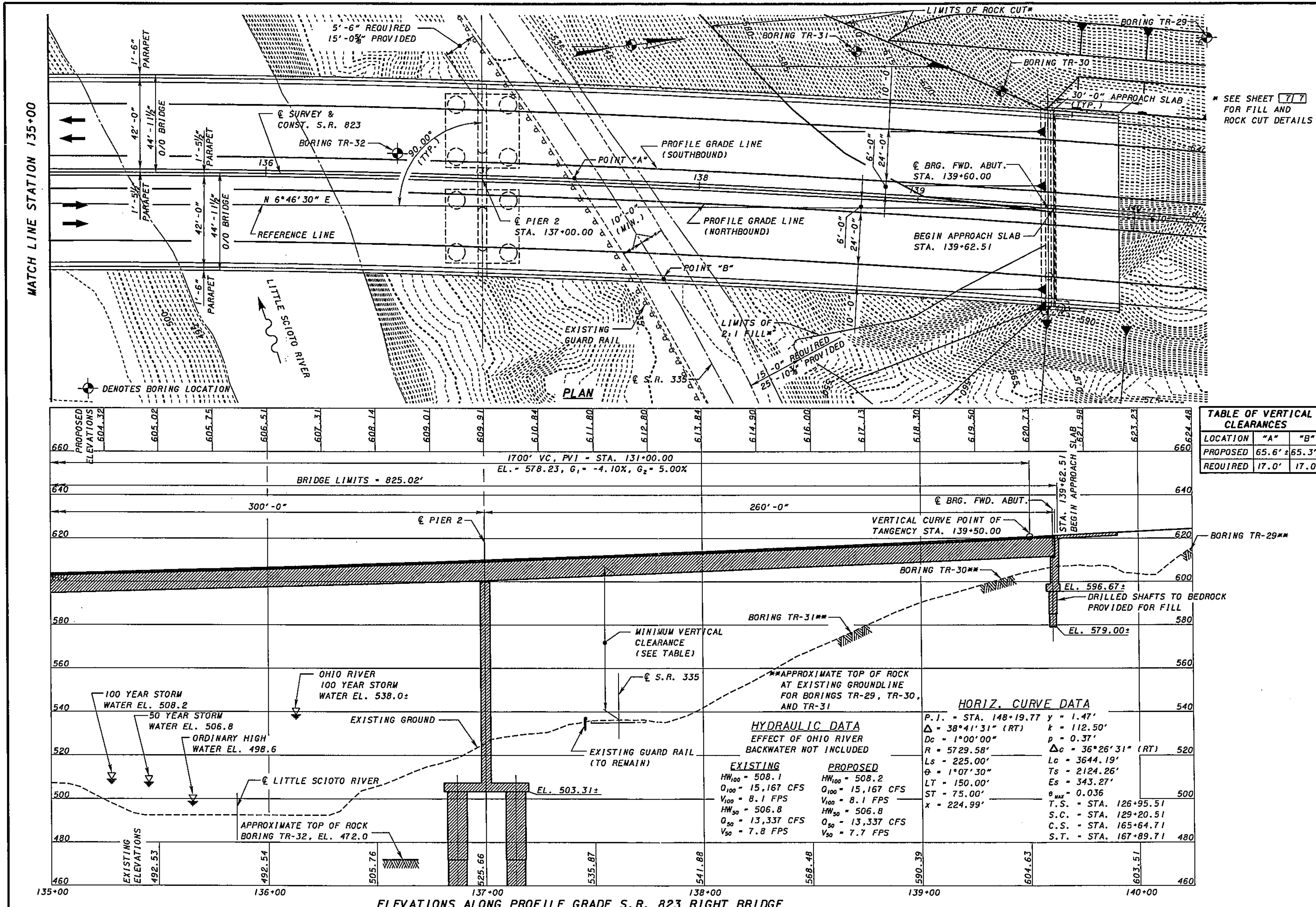
PRELIMINARY SITE PLAN - ALT. 3B

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415

SHEET 3 OF 7



MATCH LINE STATION 135+00
LIMITS OF ROCK CUT*
BORING TR-29
BORING TR-31
BORING TR-30
BORING TR-32
5'-6" REQUIRED
15'-0⅝" PROVIDED
1'-6" PARAPET
42'-0"
44'-11½" O/O BRIDGE
1'-5½" PARAPET
℄ SURVEY & CONST. S.R. 823
90.00° (TYP.)
PROFILE GRADE LINE (SOUTHBOUND)
POINT "A"
N 6°46'30" E
REFERENCE LINE
℄ PIER 2
STA. 137+00.00
10'-0" (MIN.)
PROFILE GRADE LINE (NORTHBOUND)
POINT "B"
6'-0"
24'-0"
30'-0" APPROACH SLAB (TYP.)
℄ BRG. FWD. ABUT.
STA. 139+60.00
BEGIN APPROACH SLAB
STA. 139+62.51
* SEE SHEET 7/7 FOR FILL AND ROCK CUT DETAILS
LIMITS OF 2:1 FILL*
15'-0" REQUIRED
25'-10⅜" PROVIDED
EXISTING GUARD RAIL
℄ S.R. 335
LITTLE SCIOTO RIVER
DENOTES BORING LOCATION
PLAN
PROPOSED ELEVATIONS
604.32
605.02
605.75
606.51
607.31
608.14
609.01
609.91
610.84
611.80
612.80
613.84
614.90
616.00
617.13
618.30
619.50
620.73
621.98
623.23
624.48
1700' VC, PVI - STA. 131+00.00
EL.- 578.23, G_1 - -4.10%, G_2 - 5.00%
BRIDGE LIMITS - 825.02'
300'-0"
260'-0"
℄ PIER 2
℄ BRG. FWD. ABUT.
STA. 139+62.51 BEGIN APPROACH SLAB
VERTICAL CURVE POINT OF TANGENCY STA. 139+50.00
BORING TR-29**
BORING TR-30**
EL. 596.67±
DRILLED SHAFTS TO BEDROCK PROVIDED FOR FILL
EL. 579.00±
BORING TR-31**
MINIMUM VERTICAL CLEARANCE (SEE TABLE)
℄ S.R. 335
OHIO RIVER 100 YEAR STORM WATER EL. 538.0±
100 YEAR STORM WATER EL. 508.2
50 YEAR STORM WATER EL. 506.8
ORDINARY HIGH WATER EL. 498.6
EXISTING GROUND
EXISTING GUARD RAIL (TO REMAIN)
℄ LITTLE SCIOTO RIVER
EL. 503.31±
APPROXIMATE TOP OF ROCK BORING TR-32, EL. 472.0
EXISTING ELEVATIONS
492.53
492.54
505.76
525.66
535.87
541.88
568.48
590.39
604.63
603.51
135+00
136+00
137+00
138+00
139+00
140+00
ELEVATIONS ALONG PROFILE GRADE S.R. 823 RIGHT BRIDGE

TABLE OF VERTICAL CLEARANCES

LOCATION	"A"	"B"
PROPOSED	65.6' ±	65.3' ±
REQUIRED	17.0'	17.0'

**APPROXIMATE TOP OF ROCK AT EXISTING GROUNDLINE FOR BORINGS TR-29, TR-30, AND TR-31

HYDRAULIC DATA

EFFECT OF OHIO RIVER BACKWATER NOT INCLUDED

EXISTING	PROPOSED
HW_{100} - 508.1	HW_{100} - 508.2
Q_{100} - 15,167 CFS	Q_{100} - 15,167 CFS
V_{100} - 8.1 FPS	V_{100} - 8.1 FPS
HW_{50} - 506.8	HW_{50} - 506.8
Q_{50} - 13,337 CFS	Q_{50} - 13,337 CFS
V_{50} - 7.8 FPS	V_{50} - 7.7 FPS

HORIZ. CURVE DATA

P.I. - STA. 148+19.77
Δ - 38°41'31" (RT)
Dc - 1°00'00"
R - 5729.58'
Ls - 225.00'
θ - 1°07'30"
LT - 150.00'
ST - 75.00'
x - 224.99'
y - 1.47'
k - 112.50'
p - 0.37'
Δ_c - 36°26'31" (RT)
Lc - 3644.19'
Ts - 2124.26'
Es - 343.27'
e_{MAX} - 0.036
T.S. - STA. 126+95.51
S.C. - STA. 129+20.51
C.S. - STA. 165+64.71
S.T. - STA. 167+89.71

DESIGN AGENCY: TranSystems, 5747 PERIMETER DRIVE, SUITE 240, DUBLIN, OHIO 43017

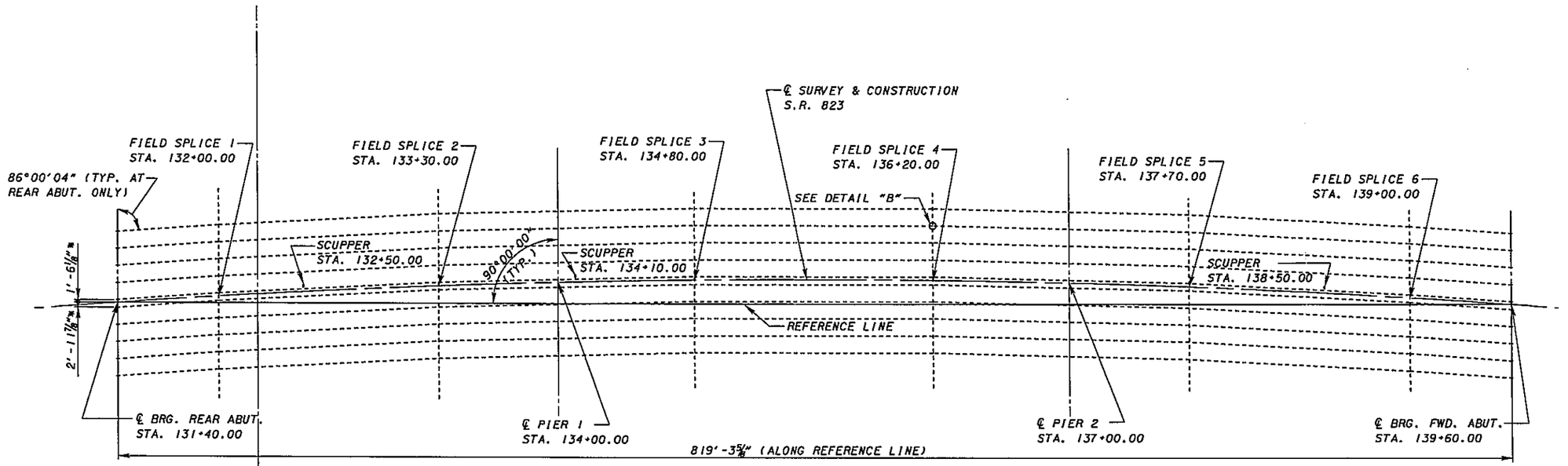
DESIGNED MSL | CHECKED MSL | DRAWN MTN | REVISED | REVIEWED JRC | DATE 07/12/06 | STRUCTURE FILE NUMBER

SCIOTO COUNTY
STA. 131+37.49
STA. 139+62.51

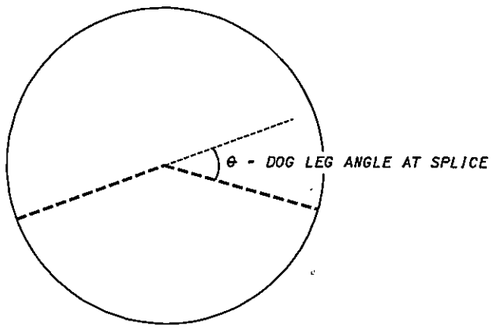
PRELIMINARY SITE PLAN - ALT 3B

BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID19415



FRAMING PLAN



DETAIL "B"

LOCATION	STATION	θ
℄ BRG. R. ABUT.	STA. 131+40.00	N/A
SPLICE 1	STA. 132+00.00	1.00°
SPLICE 2	STA. 133+30.00	1.60°
℄ PIER 1	STA. 134+00.00	N/A
SPLICE 3	STA. 134+80.00	1.40°
SPLICE 4	STA. 136+20.00	1.40°
℄ PIER 2	STA. 137+00.00	N/A
SPLICE 5	STA. 137+70.00	1.60°
SPLICE 6	STA. 139+00.00	1.00°
℄ BRG. FWD. ABUT.	STA. 139+60.00	N/A

FROM	TO	GIRDER LENGTH	GIRDER SPACING*
℄ BRG. R. ABUT	SPLICE 1	60.76'	4 SPACES @ 10'-1 3/16"± = 40.4014'
SPLICE 1	SPLICE 2	130.01'	4 SPACES @ 10'-1 5/16"± = 40.4445'
SPLICE 2	SPLICE 3	149.99'	4 SPACES @ 10'-1 7/16"± = 40.4879'
SPLICE 3	SPLICE 4	140.00'	4 SPACES @ 10'-1 1/2"± = 40.5000'
SPLICE 4	SPLICE 5	149.99'	4 SPACES @ 10'-1 7/16"± = 40.4879'
SPLICE 5	SPLICE 6	130.01'	4 SPACES @ 10'-1 5/16"± = 40.4445'
SPLICE 6	℄ BRG. FWD. ABUT	60.76'	4 SPACES @ 10'-1 3/16"± = 40.4014'

* GIRDER SPACINGS ARE NORMAL TO GIRDER CENTERLINE

NOTES:

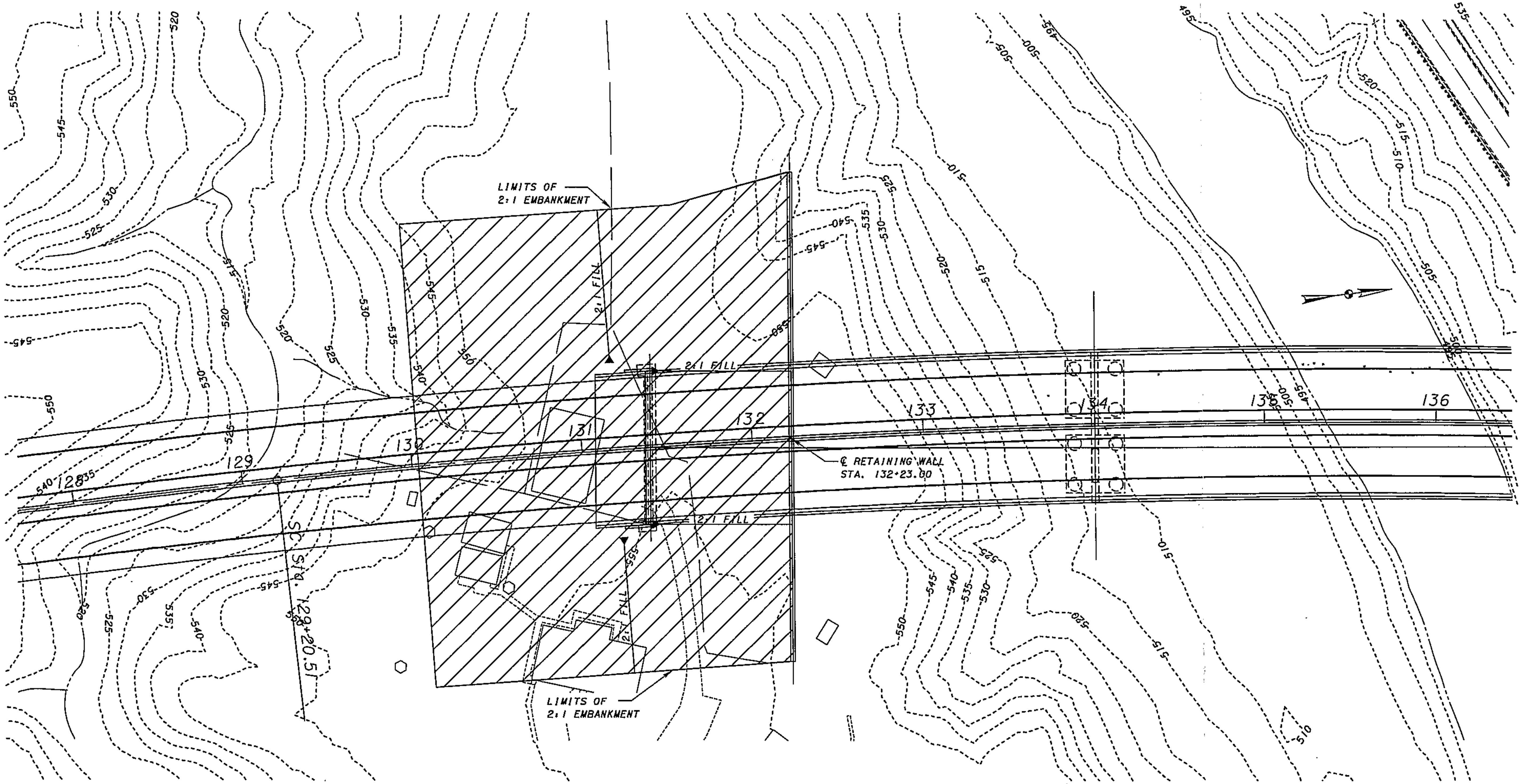
1. θ, GIRDER LENGTH, AND GIRDER SPACING IN TABLES ABOVE APPLY TO BOTH THE LEFT RIGHT BRIDGE.

DESIGN AGENT: Ivan Smith Consultants, Inc.
REVIEWED JRC DATE 07/12/06
DRAWN MTN REVISED
DESIGNED WSL CHECKED WSL
STRUCTURE FILE NUMBER

FRAMING PLAN - ALTERNATIVE 3B
BRIDGE NO. SCI-823-0.00
S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00
PID 19415

5 / 7



▨ - 2:1 FILL

NOTES:

1. SEE SHEET [7/7].

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED	REVISED	STRUCTURE FILE NUMBER	
MSL			

DESIGN AGENCY

REAR ABUTMENT EMBANKMENT DETAILS - ALT. 3B

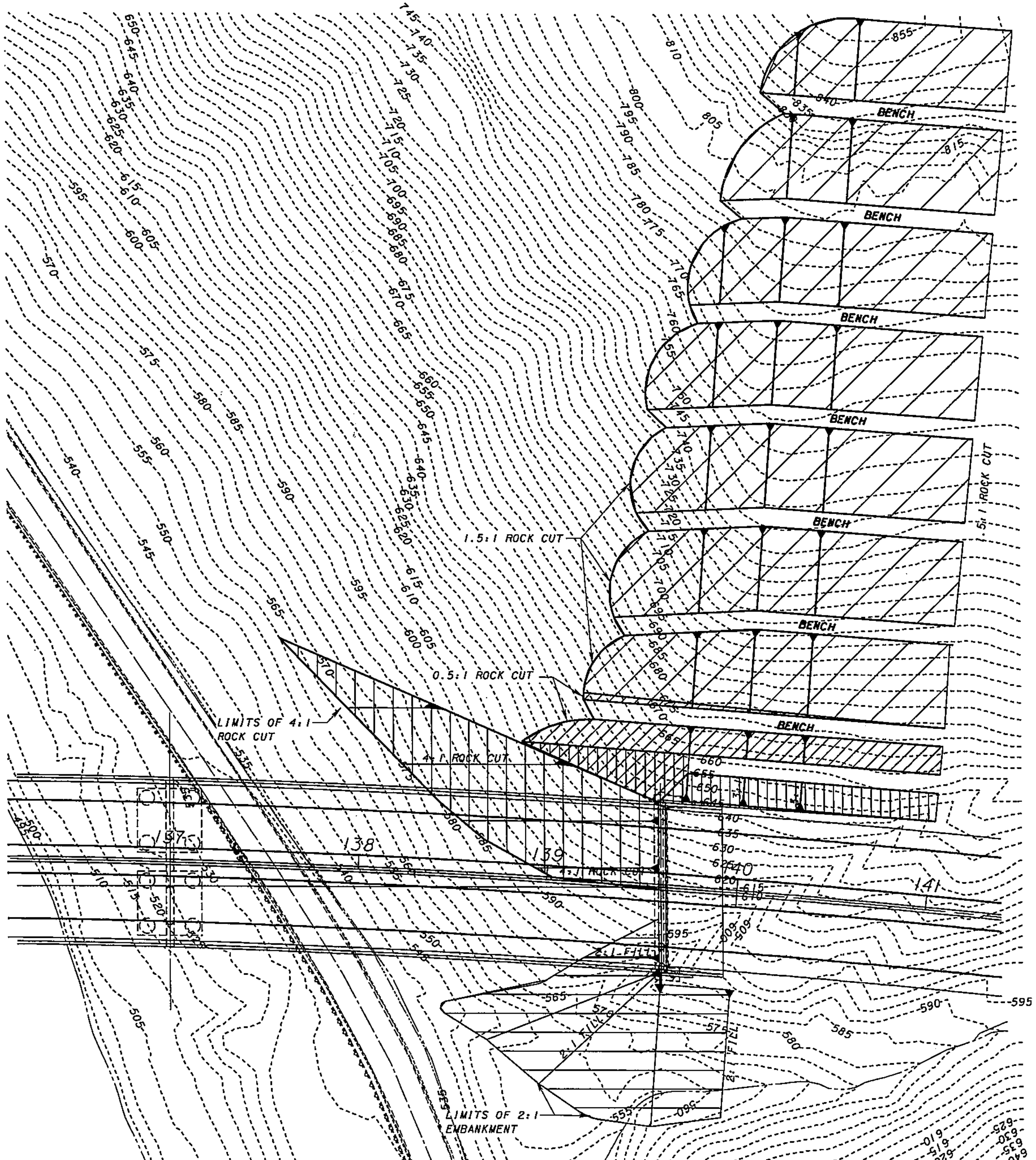
BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00

PID 19415

6 / 7



- 3:1 ROCK CUT
- 1.5:1 ROCK CUT
- 0.5:1 ROCK CUT
- 2:1 FILL
- 4:1 ROCK CUT
- TRANSITION AREA FROM 0.5:1 ROCK CUT TO 4:1 ROCK CUT

NOTES:

1. ALL FILL AND ROCK CUT DETAILS UP TO END OF APPROACH SLAB HAVE BEEN INCLUDED IN QUANTITY CALCULATIONS FOR COST COMPARISON PURPOSES

DESIGN AGENCY: TranSystems, 5747 PERIMETER DRIVE, SUITE 240, DUBLIN, OHIO 43017

DESIGNED	DRAWN	REVIEWED	DATE
MSL	MTN	JRC	07/12/06
CHECKED MSL	REVISED	STRUCTURE FILE NUMBER	

FWD. ABUT. EMBANKMENT & ROCK CUT DETAILS - ALT. 3B

BRIDGE NO. SCI-823-XXXX

S.R. 823 OVER S.R. 335 & LITTLE SCIOTO RIVER

SCI-823-0.00

PID 19415

APPENDIX E

Preliminary Geotechnical Report & Foundation Recommendations

TranSystems

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 Little Scioto River (Highland Bend)**
Preliminary Structural Foundation Recommendations
Project SCI-823-0.00
DLZ Job No.: 0121-3070.03

Dear Mr. Parsons:

This letter reports the findings of the subsurface exploration and preliminary foundation recommendations for the proposed structure SCI-823-0.00 over SR 335 and the Little Scioto River within the Highland Bend area.

It is anticipated that the proposed structure will be a six-span, elevated bridge with embankment fills at the rear abutment, and rock cut at the forward abutment. The existing grade at the proposed new bridge location varies greatly. It is anticipated that the rear abutment and Piers 1, 2, and 3 will be located along or within the Little Scioto River floodplain, which is primarily composed of glacial lacustrine and alluvial deposits. Piers 4, 5, and the forward abutment, will be above SR 335, located on the steeply sloping hillside rising up from the Little Scioto River floodplain. The anticipated alignment is located along the western edge of a large drainage feature with the area immediately above SR 335 being a rock cut section with sandstone exposed. The entire hillside has relatively thin overburden along the entire slope face. It is anticipated that the SCI-823-0.00 mainline will require an embankment constructed south of the rear abutment to an approximate height of 55 feet. The forward abutment will be located in a cut section within the hillside. At the present time the anticipated forward abutment will be located in a 57-foot cut section along the mainline with an 80-foot cut for the left backslope.

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 proposed structure.

Field Exploration

A total of seven borings, TR-29 through TR-35, were drilled at the proposed structure between February 22, 2005 and March 11, 2005. The borings were drilled to depths between 59 and 100.5 feet. All 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.

Generally, two types of subsurface conditions were encountered along the proposed structure. From SR 335 north the subsurface conditions consisted of shallow overburden underlain by sandstone. South of SR 335 the subsurface conditions consisted of thick overburden underlain by bedrock.

Borings TR-29, 30 and 31, which were drilled along the steep hillside north of SR 335, encountered between 5 and 6inches of topsoil, underlain by residual soils or decomposed bedrock. Generally, this material was removed prior to drilling during creation of a working platform. Bedrock samples collected at or near the surface generally consisted of sandstone. The upper 9 to 20 feet of the sandstone was soft to medium hard and highly weathered to decomposed. Twenty feet of rock core was collected from each boring, except at TR-29, which had 80 feet of rock core collected due to the anticipated cut depth. Recovery of the core samples ranged from 25 to 100%, and RQD values ranged from 0 to 100% with an average RQD of 84%.

The borings drilled within the Little Scioto floodplain (TR-32, 33, 34, and 35) encountered topsoil at the ground surface to depths of 3 to 4 inches. Beneath the topsoil, natural soils generally consisting of cohesive material were encountered. Granular soils were encountered beneath the cohesive soils on top of bedrock. The cohesive soils encountered ranged from sandy silt (A-4a) to clay (A-7-6), and were generally stiff to very stiff. The granular soils ranged from sandy silt (A-4a), gravel with sand and silt (A-2-4), and fine sand (A-3). The granular soils were generally very loose to medium dense. Bedrock was encountered between 34 and 80 feet below

the ground surface, which was generally a medium hard to hard sandstone that was slightly broken to intact. Twenty feet of rock core was collected from each boring. Recovery of the core samples ranged from 80 to 100%, and RQD values ranged from 70 to 100% with an average RQD of 94%.

Seepage was not observed within the borings drilled along the hillside, and there were no recorded water levels in the borings prior to coring. Water levels recorded at completion of the drilling ranged from 5.3 to 48.7 feet below ground surface. Seepage was detected in all of the borings within the floodplain ranging in depth from 4.0 to 30.0 feet below the ground surface. Seepage was generally detected within granular layers. Water levels recorded prior to coring ranged from 7.0 to 50.0 feet below the ground surface with levels at completion of drilling ranged from 3.0 to 15.0 feet below the ground surface. However, the final water levels included drilling water and may not be representative of the actual groundwater conditions. It should be noted that the majority of the subsurface materials encountered had high silt contents with high moistures. This type of material will produce water seepage if an excavation is allowed to remain open. Groundwater levels may vary seasonally, and water levels within the floodplain may be influenced by the level of the Little Scioto River, especially areas immediately adjacent to the river.

Conclusions and Recommendations

It appears that no single foundational element is best suited for support of all the anticipated substructures. The following is a brief discussion of the recommendations for each substructure.

For the substructure elements that are to be located along the steep hillside above SR 335 (forward abutment, and Piers 4 and 5), it appears that spread footing bearing on bedrock will be the best-suited foundation type. Competent bedrock was encountered at shallow depths at the pier locations and the forward abutment will be located in a rock cut section. The footings should be embedded into the bedrock. If an alternative foundation type is required due to lateral or uplift loads, a drilled shaft type foundation can be used. Either drilled shafts with rock sockets or H-piles with pre-bored sockets into bedrock can be utilized.

For the substructure elements to be located adjacent to the Little Scioto River, Pier 2 and 3, it appears that drilled shafts socketed into bedrock will be the best-suited foundation type. Bedrock was encountered at a relatively shallow depth. It is assumed that the scour analysis will indicate that the overburden soils will be scoured to top of rock. Therefore no bearing support can be assumed from these layers.

For the substructure elements to be located south of the Little Scioto River, Pier 1 and the rear abutment, it appears that driven H-piles or drilled shafts to rock will be the best-suited foundation type for support. Due to the size of the structure, if H-piles are used it is anticipated that HP 14X73 H-piles, with a 95-ton capacity, will be used. If high lateral or uplift loads are anticipated, drilled shafts or H-piles socketed into bedrock may be required.

For either drilled shafts or H-pile rock sockets, the actual rock socket lengths will need to be determined based upon actual loading conditions. The upper three feet of the rock socket should be neglected during design. Recommendations for the length of the rock sockets can be provided once the anticipated loads are determined.

The following table summarizes the site conditions and foundation recommendations at each anticipated substructure element.

Foundation Recommendations

Boring Number	Structural Element	Existing Ground Surface Elevation* (Feet)	Approximate Bearing Elevation* (Feet)	Recommended Foundation Type	Allowable Bearing Capacity
TR-29	Forward Abutment	685	623	Spread Footing	20 TSF
TR-30	Pier 5	625	620	Spread Footing	15 TSF
TR-31	Pier 4	580	575	Spread Footing	15 TSF
TR-32	Pier 3	512	470	Drilled Shafts	20 TSF
TR-33	Pier 2	505	467	Drilled Shafts	20 TSF
TR-34	Pier 1	525	483**	H-Piles**	N/A
			480	Drilled Shafts	20 TSF
TR-35	Rear Abutment	552	472**	H-Piles**	N/A
			469	Drilled Shafts	20 TSF

*Existing ground surface elevation was estimated from the established topographic mapping.
** Tip Elevation for an HP 14X73, 95 ton, driven H-pile.

Additionally, since the SCI-823-0.00 mainline will be located on a relatively large embankment through the Highland Bend area, and could be potentially underlain by compressible soils, the abutment locations may need special construction procedures, additional foundation considerations, and/or an additional loads added to the design loads to account for negative skin friction associated with embankment settlement.

It should be noted that if driven H-piles are selected, special pile-driving techniques may be required. Wet silts and fine sands, such as those encountered within this area, tend to produce exaggerated blow counts during pile driving, due to increased pore pressures during driving, which do not reflect the actual load carrying ability of the strata. Piles should be driven to the design capacity, allowed to sit at least 24 hours to allow pore pressures to dissipate, then re-driven to ensure that the design capacity has been achieved. If the design capacity has not been achieved, the pile should be re-driven until the design capacity has been achieved with confirmation after 24 hours.

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

Because of the many geotechnical factors across the anticipated structure location, such as, large potential lateral loads, large embankment heights, depths of relatively compressible soils, and potential for differential settlement, a detailed evaluation of all geotechnical parameters will need to be considered for the final design. It is strongly recommended that we discuss the proposed foundation design after TranSystems has had a chance to review these recommendations.

Grain-size analyses were performed for scour evaluation since the proposed structure location is located along the Little Scioto River. The following table outlines the D_{85} and D_{50} particle sizes from the grain-size analysis. The laboratory data sheets for the grain-size analyses are attached.

Grain-size Data For Scour

Boring Number	Existing Ground Surface Elevation (Feet)*	Sample Depth (Feet)	ODOT Classification	D_{85} (mm)	D_{50} (mm)
TR-32	512	5.0-6.5	A-4b	0.127	0.0259
TR-32	512	7.5-9.0	A-4b	0.0761	0.0213
TR-32	512	10.0-11.5	A-4b	0.171	0.0339
TR-32	512	12.5-14.0	A-6a	0.0912	0.0133
TR-32	512	15.0-16.5	A-4b	0.0561	0.0166
TR-32	512	17.5-19.0	A-4b	0.0624	0.0172
TR-32	512	20.0-21.5	A-4b	0.0534	0.0161
TR-32	512	22.5-24.0	A-4b	0.117	0.0226
TR-32	512	25.0-26.5	A-4b	0.545	0.312
TR-32	512	27.5-29.0	A-4b	0.152	0.0416
TR-32	512	30.0-31.5	A-4b	0.141	0.0389
TR-32	512	35.0-36.5	A-4a	0.264	0.0921
TR-33	505	1.5-3.0	A-4b	0.0882	0.0219
TR-33	505	4.0-5.5	A-4a	0.193	0.0295
TR-33	505	6.5-8.0	A-4b	0.0845	0.0175
TR-33	505	9.0-10.5	A-4b	0.0793	0.0206
TR-33	505	11.5-13.0	A-4b	0.0696	0.0150
TR-33	505	14.0-15.5	A-4b	0.0425	0.0148
TR-33	505	16.5-18.0	A-4b	0.184	0.0331
TR-33	505	19.0-20.5	A-4b	0.202	0.0413
TR-33	505	21.5-23.0	A-2-4	0.483	0.146

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

Closing

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

Sincerely,

DLZ OHIO, INC.

P. Paul Painter
Engineering Geologist

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

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Boring Location Plan
Boring Logs TR-29, TR-30, TR-31, TR-32, TR-33, TR-34, TR-35
Grain-size data sheets

cc: File

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GENERAL INFORMATION
DRILLING PROCEDURES AND LOGS OF BORINGS

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

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

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

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

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

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

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

LEGEND – BORING LOG TERMINOLOGY

Explanation of each column, progressing from left to right

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

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

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

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

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

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

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

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

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

9. Soil Description

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

   Granular Soils – Compactness

Term	Blows/Foot Standard Penetration
Very Loose	0 – 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	over 50

   Cohesive Soils – Consistency

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

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

   c. Texture is based on the Ohio Department of Transportation Classification System. Soil particle size definitions are as follows:

Description		Size	Description		Size
Boulders		Larger than 8"	Sand	– Coarse	2.0 mm to 0.42 mm
Cobbles		8" to 3"		– Fine	0.42 mm to 0.074 mm
Gravel	– Coarse	3" to ¾"	Silt		0.074 mm to 0.005 mm
	– Fine	¾" to 2.0 mm	Clay		smaller than 0.005 mm

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

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

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

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

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

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

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

10. Rock Hardness and Rock Quality Designation

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

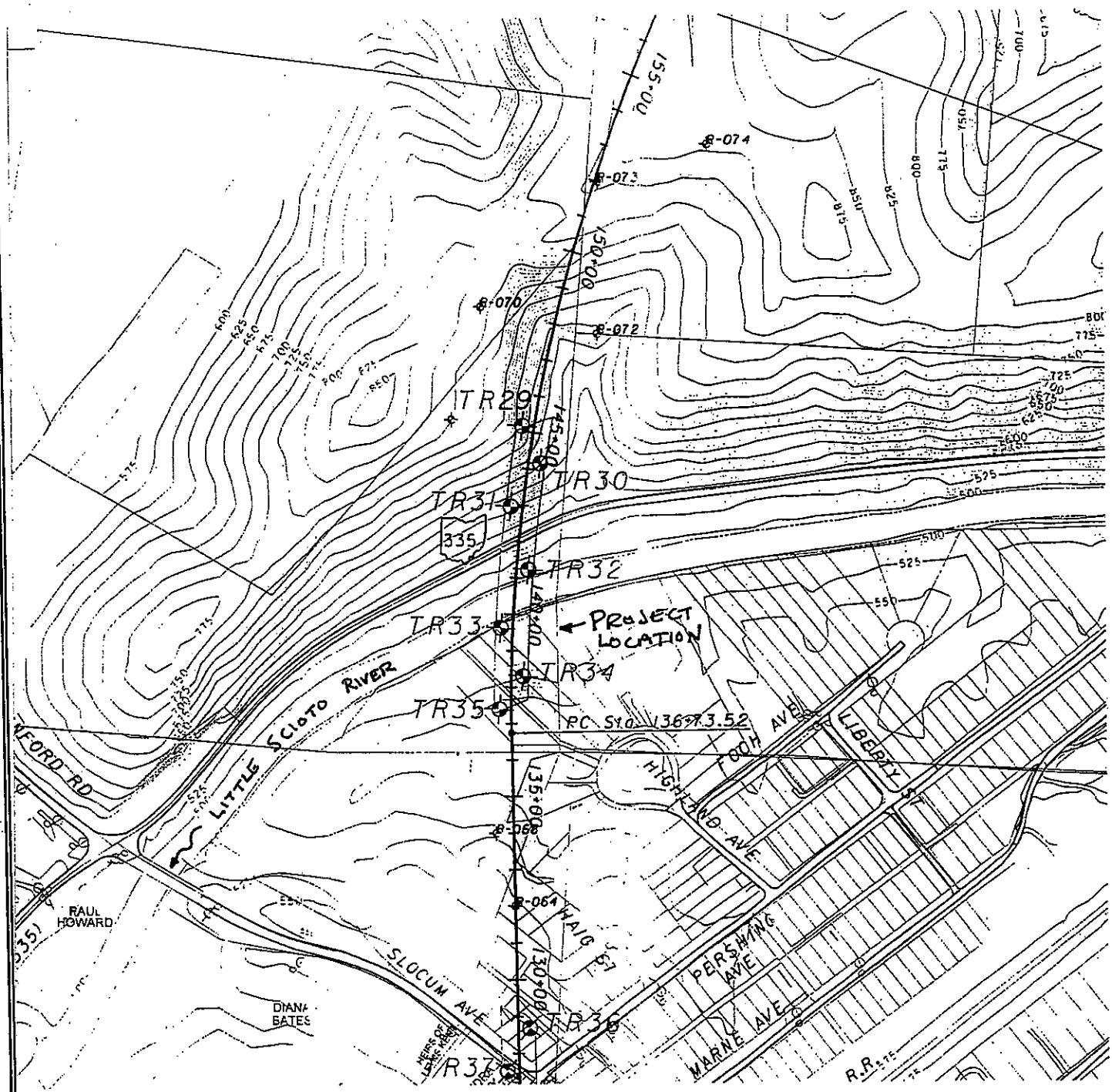
Term	Description
Very Soft	Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb)
Soft	Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes under pressure of pressed hammer)
Medium Hard	Resists pencil point, but can be scratched with a knife blade. (Breaks easily under single hammer blow, but with crumbly edges.)
Hard	Can be deformed or broken by light to moderate hammer blows. (Breaks under one or two strong hammer blow, but with resistant sharp edges.)
Very Hard	Can be broken only by heavy and in some rocks repeated hammer blows.

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

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

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

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



Source: Topographic Mapping provided by TranSystems Corporation, Dated 2004

NORTH

DLZ
ENGINEERS · ARCHITECTS · SCIENTISTS

SITE PLAN

Little Scioto River Crossing
SCI-823 over SR 335 & Little Scioto
SCI-823-0.00

FIGURE 1.

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

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

LOG OF: Boring TR-29 | Location: Forward Abutment - Little Scioto Crossing | Date Drilled: 3/8/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
48.7 (after 48 hrs.)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
0	685.0						Soft brown SANDSTONE; very fine to fine grained, decomposed, argillaceous, thinly bedded, very broken. @ 0.0'-0.4', Topsoil - 5"; 3' drilling bench cut on hillside.							
5		Core 120"	Rec 30"	RQD 0%	R-1									
9.5	675.5						Soft to medium hard brown and gray SANDSTONE; very fine to fine grained, highly weathered to decomposed, argillaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle clay filled fractures.							
10		Core 36"	Rec 36"	RQD 64%	R-2									
15							@ 15.4'-15.5', high angle rust stained fracture.							
17.6	667.4	Core 120"	Rec 120"	RQD 92%	R-3		Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
20							@ 21.0',22.0',22.3', low angle clay filled fractures.							
25							@ 27.5'-28.1', high angle rust stained fracture.							
							@ 28.2', low angle rust stained fracture.							
		Core 120"	Rec 120"	RQD 92%	R-4									
30														

FILE: 0121-3070-03 [3/31/2005 2:29 PM]

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

LOG OF: Boring TR-29 | *Location:* Forward Abutment - Little Scioto Crossing | *Date Drilled:* 3/8/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
48.7 (after 48 hrs.)

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	STANDARD PENETRATION (N) / Natural Moisture Content, % / Blows per foot
30	655.0						Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
35		Core 120"	Rec 120"	RQD 100%	R-5		@ 31.1',34.6',35.3', low angle clay filled fractures.							
40														
45		Core 120"	Rec 120"	RQD 100%	R-6									
50							@ 53.9'-54.4',58.2'-59.5', high angle rust stained fractures.							
55		Core 120"	Rec 120"	RQD 82%	R-7		@ 56.2',56.9', low angle rust stained fractures.							
59.6	625.4													

PL — LL

Blows per foot - ○ (10 20 30 40)

FILE: 0121-3070-03 [3/31/2005 2:29 PM]

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

LOG OF: Boring TR-29 | Location: Forward Abutment - Little Scioto Crossing | Date Drilled: 3/8/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
48.7 (after 48 hrs.)

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	STANDARD PENETRATION (N) / Natural Moisture Content, % - ● / PL — LL / Blows per foot - ○ (10 20 30 40)
60	625.0						Hard gray SANDSTONE interbedded with SHALE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
65		Core 120"	Rec 120"	RQD 100%	R-8		Hard gray SANDSTONE interbedded with SHALE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
70														
75														
80		Core 120"	Rec 120"	RQD 100%	R-9									
85.0	600.0	Core 24"	Rec 24"	RQD 100%	R10		Bottom of Boring - 85.0'							
90														

FILE: 0121-3070-03 [3/31/2005 2:29 PM]

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

LOG OF: Boring TR-30 | Location: Pier 5 - Little Scioto Crossing | Date Drilled: 3/8/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
12.2' (Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ 10 20 30 40
0	625.0	Core 120"	Rec 120"	RQD 62%	R-1		Soft to medium hard gray and brown SANDSTONE; very fine to fine grained, highly weathered to decomposed, argillaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle clay filled fractures. @ 0.0'-0.4', Topsoil - 5"; 3.2' drilling bench cut on hillside. @ 1.0'-1.3',5.0'-5.1', broken zones. @ 3.6'-3.9', clay filled zone. @ 3.9'-4.7', high angle clay filled fracture.							
10														
11.0	614.0	Core 120"	Rec 120"	RQD 100%	R-2		Medium hard gray SANDSTONE interbedded with SHALE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded. @ 11.9',15.9',16.8',18.8' low angle clay filled fractures.							
20.0	605.0						Bottom of Boring - 20.0'							
30														

FILE: 0121-3070-03 [3/28/2005 8:52 AM]

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

LOG OF: Boring TR-31 | Location: Pier 4 - Little Scioto Crossing | Date Drilled: 3/8/05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
5.3' (Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N)
0	580.0	Core 120"	Rec 110"	RQD 50%	R-1		Soft to medium hard brown SANDSTONE; very fine to fine grained, highly weathered to decomposed, argillaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle clay filled fractures. @ 0.0'-0.5', Topsoil - 6"; 4' drilling bench cut on hillside. @ 0.0'-0.9', lost recovery. @ 0.9'-2.0', broken zones. @ 5.1'-5.4',6.8'-7.0',7.7'-7.9' high angle clay filled fractures.							Natural Moisture Content, % - ● PL ⊢——⊣ LL Blows per foot - ○ 10 20 30 40
9.8	570.2	Core 120"	Rec 116"	RQD 96%	R-2		Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded. @ 10.4'-10.5', broken zone. @ 11.0'-11.4',11.9'-12.1',15.2' rust stained zones. @ 11.2', low angle rust stained fracture. @ 19.6'-20.0', lost recovery.							
20.0	560.0						Bottom of Boring - 20.0'							
30														

FILE: 0121-3070-03 [3/28/2005 8:52 AM]

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

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

LOG OF: Boring TR-32 | Location: Pier 3 - Little Scioto Crossing | Date Drilled: 3/10/05

WATER OBSERVATIONS: Water seepage at: 4.0'-11.0', 26.5'-38.0'
Water level at completion: 7.0' (Prir to coring)
3.0' (Including drilling water)

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	STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot
0	512.0	1 2 3	18	1			Loose brown SILT (A-4b), little fine sand; moist to wet.							
		1 1 1	16	2			@ 4.0', gray.							
5		2 2 4	15	3				0	0	--	26	58	16	
		3 3 4	17	4				0	0	--	15	69	16	
10		4 12 8	18	5			@ 10.0'-12.5', medium dense, trace coarse sand.	1	5	--	24	58	12	Non-Plastic
12.5	499.5	4 5 7	16	6			Stiff gray SILT AND CLAY (A-6a), little fine to coarse sand; moist.	0	3	--	15	49	33	
15.0	497.0	5 5 5	16	7			Loose gray SILT (A-4b), trace fine sand; moist to wet.	0	1	--	9	66	25	
		3 3 3	17	8				0	1	--	11	63	26	
20		WOH 3 3	15	9				0	0	--	8	67	25	
		3 4 3	18	10			@ 22.0', little fine to coarse sand, trace gravel.	2	2	--	18	55	23	
25		1 4 6	18	11				7	9	--	14	58	12	Non-Plastic
		2 2 4	18	12			@ 27.0', some fine sand. trace gravel.	0	1	--	33	56	11	Non-Plastic
30														

STANDARD PENETRATION (N) scale: 10 20 30 40

FILE: 0121-3070-03 [3/28/2005 8:52 AM]

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

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

LOG OF: Boring TR-32 | Location: Pier 3 - Little Scioto Crossing | Date Drilled: 3/10/05

WATER OBSERVATIONS: Water seepage at: 4.0'-11.0', 26.5'-38.0'
Water level at completion: 7.0' (Prir to coring)
3.0' (Including drilling water)

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	STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot
30	482.0	1 1 1	17	13			Loose gray SILT (A-4b), some fine sand; moist to wet.	0	1	--	31	56	12	Non-Plastic
33.0	479.0						Medium dense gray SANDY SILT (A-4a), trace gravel; wet.							
35		2 8 13	18	14				3	3	--	51	37	7	Non-Plastic
38.0	474.0						Medium hard to hard gray SANDSTONE; very fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
40		Core 120"	Rec 120"	RQD 100%	R-1									
45							@ 39.6',42.0',43.1', low angle fractures.							
							@ 40.1'-40.4', clay filled zone.							
50														
55		Core 120"	Rec 120"	RQD 100%	R-2									
59.0	453.0						Bottom of Boring - 59.0'							
60														

FILE: 0121-3070-03 [3/28/2005 8:52 AM]

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

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

LOG OF: Boring TR-33 | Location: Pier 2 - Little Scioto Crossing | Date Drilled: 2/23/05 to 2/24/05

WATER OBSERVATIONS: Water seepage at: 5.5'-34.0'
Water level at completion: 15.0' (Prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) / Natural Moisture Content, % / PL / LL / Blows per foot
0	505.0						Very soft brown SILT (A-4b), little fine sand; wet.							
		WOH WOH 1	12	1		0.25		0	0	--	18	62	20	
3.0	502.0						Very soft brown SANDY SILT (A-4a), some fine sand; wet.							
		1 WOH 1	16	2		0.25		0	1	--	32	47	20	
5														
5.5	499.5						Very soft brown SILT (A-4b), little fine sand; wet.							
		WOH WOH WOH	3	3		0.25		0	0	--	17	60	23	
							@ 8.0'-10.0', very loose.							
		WOH WOH 1	18	4				0	0	--	16	66	18	Non-Plastic
10														
		WOH WOH 1	18	5		0.25		0	0	--	14	60	27	
							@ 13.0'-16.0', trace fine sand.							
		WOH 1 2	18	6		0.5		0	0	--	4	73	23	
15							@ 16.0', some fine sand.							
		WOH WOH 1	18	7		0.25		0	0	--	32	51	17	
							@ 18.5', very loose to loose.							
		WOH 2 2	18	8		--		0	0	--	36	50	14	Non-Plastic
20														
21.0	484.0						Medium dense gray GRAVEL WITH SAND AND SILT (A-2-4); wet.							
		2 9 7	18	9				7	10	--	54	22	6	Non-Plastic
23.5	481.5						Loose gray FINE SAND (A-3), trace silt; wet.							
		2 2 2	18	10										
25														
		1 2 3	18	11										
28.5	476.5						Loose gray SANDY SILT (A-4a); moist to wet.							
		2 4		12										
30														

FILE: 0121-3070-03 [3/31/2005 3:32 PM]

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

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

LOG OF: Boring TR-33 | Location: Pier 2 - Little Scioto Crossing | Date Drilled: 2/23/05 to 2/24/05

WATER OBSERVATIONS: Water seepage at: 5.5'-34.0'
Water level at completion: 15.0' (Prior to coring)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ 10 20 30 40
30	475.0	6					Loose gray SANDY SILT (A-4a); moist to wet.							
34.0	471.0	50/1	0	13										50+
34.7	470.3	Core 42"	Rec 42"		R-1		Medium hard to hard gray SANDSTONE; very fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded. @ 34.6', 30° fracture.							
36.1	468.9						Hard gray SHALE; slightly weathered, arenaceous, laminated to thinly bedded, moderately fractured.							
40		Core 60"	Rec 60"		R-2		Hard gray SANDSTONE; very fine grained, slighty weathered, argillaceous, micaceous, thinly bedded to thickly bedded. @ 41.9', clay seam. @ 42.4', low angle fracture.							
45		Core 60"	Rec 60"		R-3									
50		Core 60"	Rec 60"		R-4									
		Core 18"	Rec 18"		R-5									
54.0	451.0						Bottom of Boring - 54.0'							
55														
60														

FILE: 0121-3070-03 [3/31/2005 3:32 PM]

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

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

LOG OF: Boring TR-34 | Location: Pier 1 - Little Scioto Crossing | Date Drilled: 2/24/05 to 3/2/05

WATER OBSERVATIONS: Water seepage at: 30.0'-38.0'
Water level at completion: 20.0' (Prior to coring)
6.0' (Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	525.0												
0.6	524.4	1 2 2	16	1		2.5	Topsoil - 7" Very stiff brown SANDY SILT (A-4a); damp.						
2.0	523.0	4 5 7	18	2		4.0	Hard brown SILTY CLAY (A-6b), trace fine sand; damp.						
5		4 5 8	18	3		4.5	@ 6.0', contains occasional very thin gray seams with dissication cracking.						
		3 6 8	18	4		4.5+							
10.0	515.0	3 6 9	18	5		4.5+	Hard brown and gray CLAY (A-7-6); varved; damp. @ 12.0', very stiff; damp to moist.						
		2 3 4	18	6		2.25							
15		2 5 7	18	7		3.25							
17.0	508.0	2 5 7	18	8		2.25	Very stiff gray SANDY SILT (A-4a); slightly organic; damp.						
20		2 4 6	0	9		---							
22.0	503.0	3 6 8	18	10		3.75	Very stiff gray CLAY (A-7-6); damp.						
25.0	500.0	4 6 8	18	11		2.25	Very stiff grayish brown SILTY CLAY (A-6b), trace fine sand; slightly organic; damp.						
		3 6 9	0	12		---							
30													

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

FILE: 0121-3070-03 [3/31/2005 3:30 PM]

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

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

LOG OF: Boring TR-34 | Location: Pier 1 - Little Scioto Crossing | Date Drilled: 2/24/05 to 3/2/05

WATER OBSERVATIONS: Water seepage at: 30.0'-38.0'
Water level at completion: 20.0' (Prior to coring)
6.0' (Including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay	STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot
	495.0													
30.0	495.0	2 1 2	0	13			Very loose gray FINE SAND (A-3); wet.							
35		0 1 2	18	14										
38.0	487.0						Medium dense gray GRAVEL WITH SAND AND SILT (A-2-4); moist.							
40		10 12 50/4	14	15										62
41.3	483.7	Core 12"	Rec 12"	RQD 75%	R-1		Soft to medium hard gray SANDSTONE interbedded with SHALE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
45		Core 60"	Rec 60"	RQD 70%	R-2		@ 42.2',43.6',44.7', low angle clay filled fractures. @ 47.1',47.2',47.6', low angle clay filled fractures. @ 44.2'-44.4',45.0'-45.1',46.7' high angle clay filled fractures.							
48.0	477.0						Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
50		Core 60"	Rec 60"	RQD 100%	R-3									
55		Core 60"	Rec 60"	RQD 97%	R-4		@ 53.4',53.5', low angle clay filled fractures.							
60		Core 48"	Rec 48"	RQD 100%	R-5									

FILE: 0121-3070-03 [3/31/2005 3:30 PM]

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

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

LOG OF: Boring TR-34 | Location: Pier 1 - Little Scioto Crossing | Date Drilled: 2/24/05 to 3/2/05

WATER OBSERVATIONS: Water seepage at: 30.0'-38.0'
Water level at completion: 20.0' (Prior to coring)
6.0' (Including drilling water)

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	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40
60	465.0						Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
62.0	463.0						Bottom of Boring - 62.0'							
65														
70														
75														
80														
85														
90														

FILE: 0121-3070-03 [3/31/2005 3:30 PM]

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

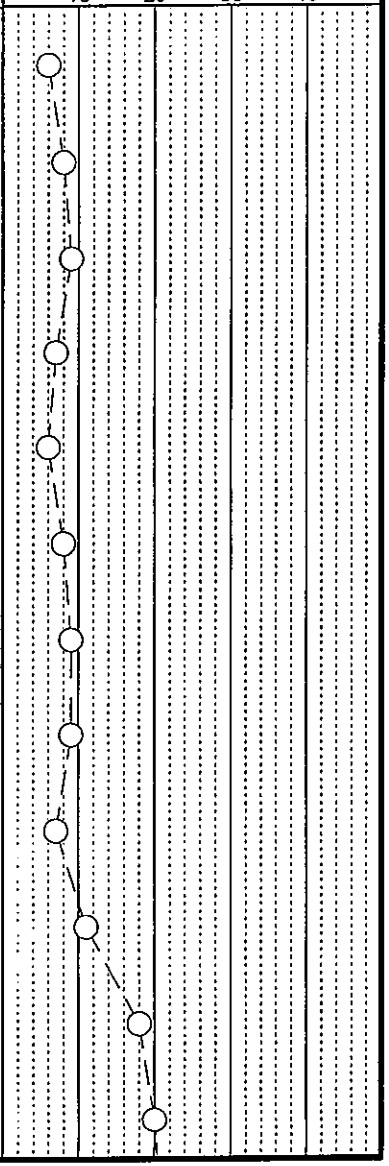
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-35 | Location: Rear Abutment - Little Scioto Crossing | Date Drilled: 2/22/05 to 2/23/05

WATER OBSERVATIONS: Water seepage at: 7.0'-22.0', 63.0'-76.5'
Water level at completion: 50.0' (Prior to coring)
7.4' (including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
0	552.0												
0.3	551.7	1 2 4	18	1		3.75	Topsoil - 4" Very stiff brown SANDY SILT (A-4a); contains roots; damp.						
		3 3 5	18	2		2.0	@ 2.5', stiff; moist. @ 3.5', wet seam.						
5		3 5 4	18	3		1.75							
7.0	545.0	2 3 4	18	4		0.75	Medium stiff to stiff brown SILT (A-4b); moist to wet.						
10		1 2 4	18	5		1.75							
		2 4 4	18	6		1.0							
15		2 3 6	18	7		3.0	@ 15.0'-17.5', very stiff.						
		1 3 6	18	8		1.25	@ 15.0'-17.5', brownish gray.						
20		2 3 4	18	9		1.25							
22.0	530.0	2 4 7	18	10		2.75	Very stiff gray CLAY (A-7-6), trace fine sand; varved; damp.						
25		4 8 10	18	11		4.25	@ 25.0', hard.						
		5 8 12	18	12		4.0							
30													

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



FILE: 0121-3070-03 [3/31/2005 2:28 PM]

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

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

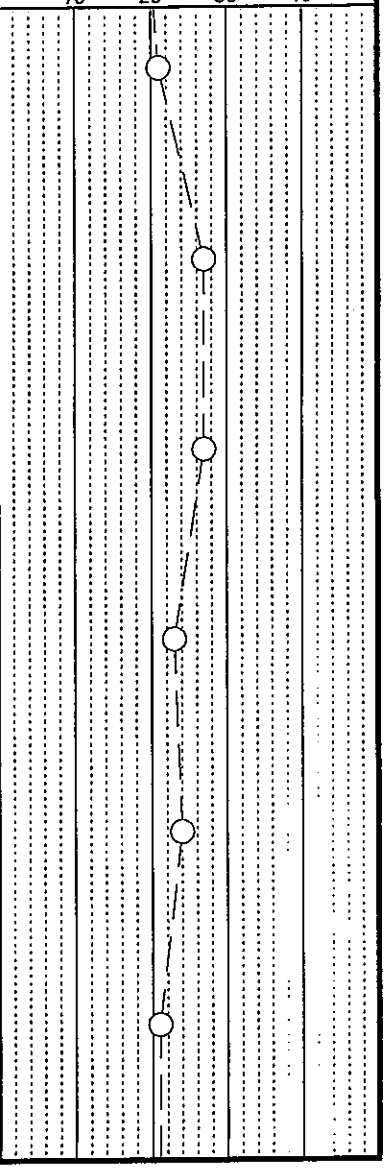
LOG OF: Boring TR-35 | Location: Rear Abutment - Little Scioto Crossing | Date Drilled: 2/22/05 to 2/23/05

WATER OBSERVATIONS: Water seepage at: 7.0'-22.0', 63.0'-76.5'
Water level at completion: 50.0' (Prior to coring)
7.4' (including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION
30	522.0	6 8 13	18	13		4.5+	Hard gray CLAY (A-7-6), trace fine sand; varved; damp.
35		7 11 16	18	14		4.5+	
40		4 12 15	18	15		4.5+	
45		7 9 14	18	16		4.5+	
50		7 10 14	18	17		4.5+	
55.0	497.0	5 8 13	18	18		3.75	Very stiff to hard dark gray SANDY SILT (A-4a), trace fine sand; slightly organic, contains very thin fine grained sand seams; damp to moist.
60							

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

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



FILE: 0121-3070-03 [3/31/2005 2:28 PM]

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

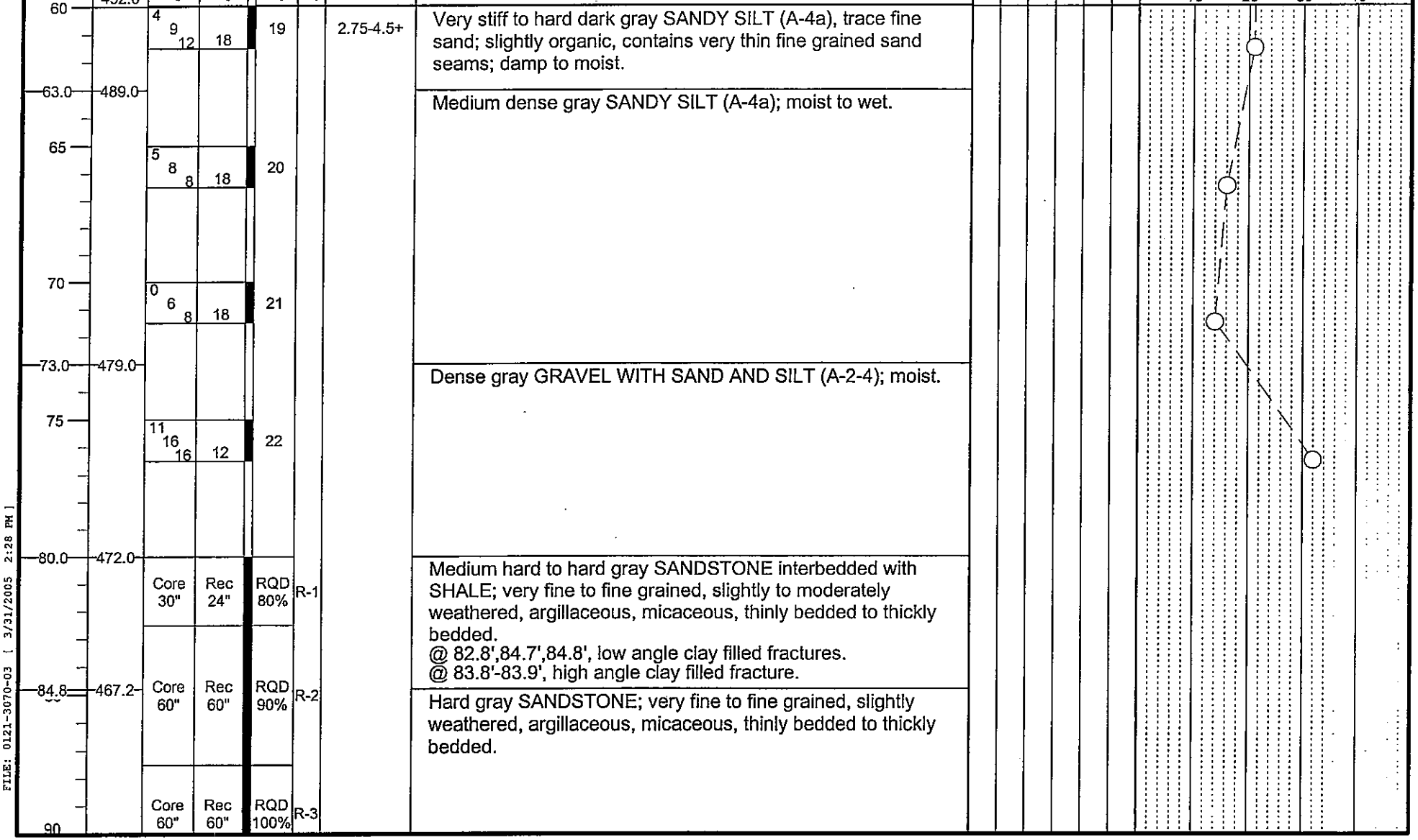
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

LOG OF: Boring TR-35 | Location: Rear Abutment - Little Scioto Crossing | Date Drilled: 2/22/05 to 2/23/05

WATER OBSERVATIONS: Water seepage at: 7.0'-22.0', 63.0'-76.5'
Water level at completion: 50.0' (Prior to coring)
7.4' (including drilling water)

Depth (ft)	Elev. (ft)	Blows per 6"	Recovery (in)	Sample No. Drive	Sample No. Press / Core	Hand Penetrometer (tsf)	DESCRIPTION	GRADATION % Aggregate	% C. Sand	% M. Sand	% F. Sand	% Silt	% Clay
60	492.0	4 9 12	18	19		2.75-4.5+	Very stiff to hard dark gray SANDY SILT (A-4a), trace fine sand; slightly organic, contains very thin fine grained sand seams; damp to moist.						
63.0	489.0						Medium dense gray SANDY SILT (A-4a); moist to wet.						
65		5 8 8	18	20									
70		0 6 8	18	21									
73.0	479.0						Dense gray GRAVEL WITH SAND AND SILT (A-2-4); moist.						
75		11 16 16	12	22									
80.0	472.0	Core 30"	Rec 24"	RQD 80%	R-1		Medium hard to hard gray SANDSTONE interbedded with SHALE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded. @ 82.8',84.7',84.8', low angle clay filled fractures. @ 83.8'-83.9', high angle clay filled fracture.						
84.8	467.2	Core 60"	Rec 60"	RQD 90%	R-2		Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.						
90		Core 60"	Rec 60"	RQD 100%	R-3								

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



FILE: 0121-3070-03 [3/31/2005 2:28 PM]

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

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

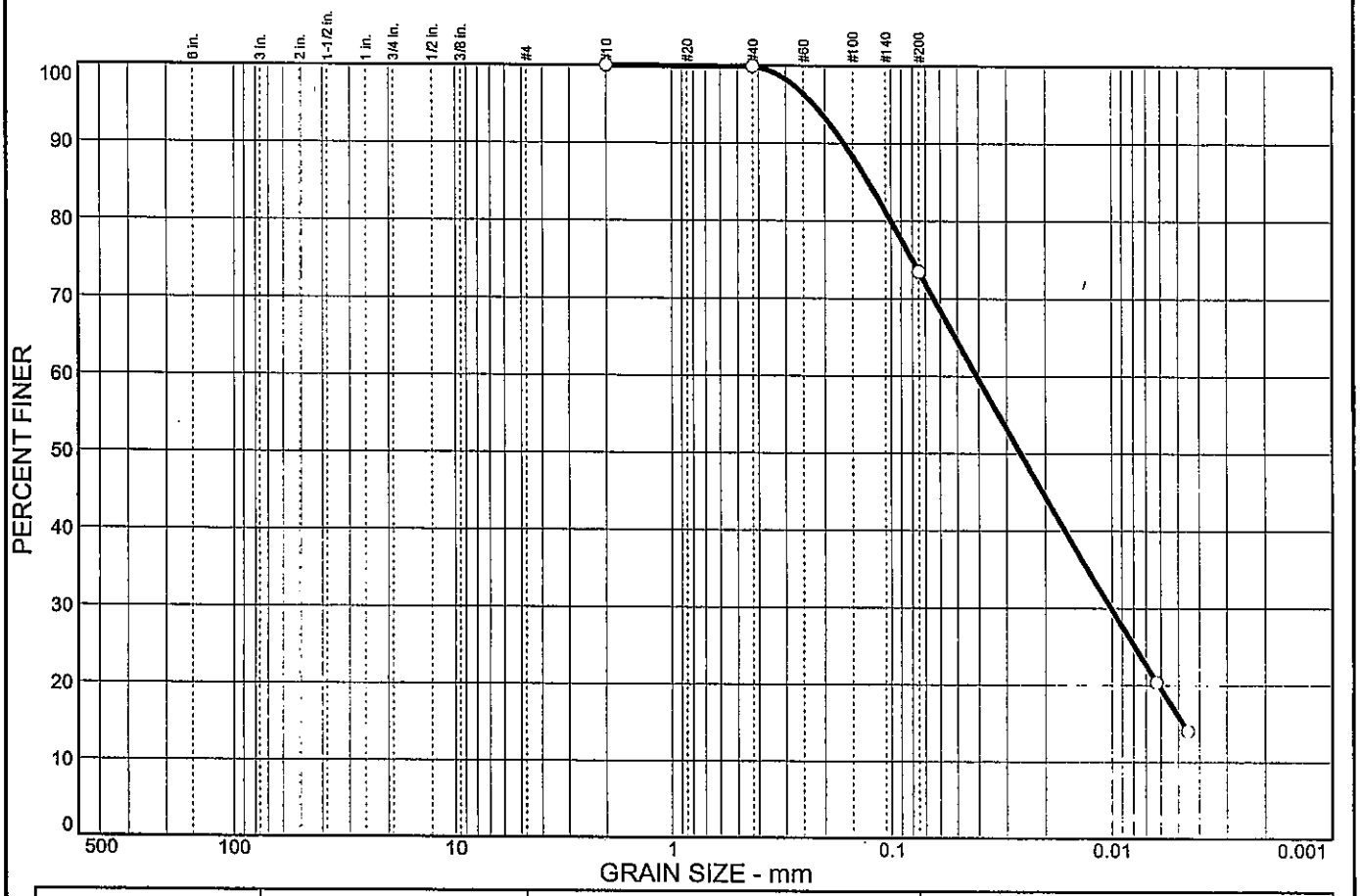
LOG OF: Boring TR-35 | Location: Rear Abutment - Little Scioto Crossing | Date Drilled: 2/22/05 to 2/23/05

WATER OBSERVATIONS: Water seepage at: 7.0'-22.0', 63.0'-76.5'
Water level at completion: 50.0' (Prior to coring)
7.4' (including drilling water)

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	STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢⊣ LL Blows per foot - ○ 10 20 30 40
90	462.0						Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, thinly bedded to thickly bedded.							
95		Core 60"	Rec 60"	RQD 100%	R-4		@ 91.1', low angle clay filled fracture.							
100		Core 36"	Rec 36"	RQD 100%	R-5									
100.5	451.5						Bottom of Boring - 100.5'							
105														
110														
115														
120														

FILE: 0121-3070-03 [3/31/2005 2:28 PM]

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	26.4	57.5	16.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.9		
#200	73.5		

* (no specification provided)

Soil Description

Silty clay with sand

Atterberg Limits

PL= 19 LL= 23 PI= 4

Coefficients

D_{85}= 0.127 D_{60}= 0.0409 D_{50}= 0.0259
D_{30}= 0.0101 D_{15}= 0.0048 D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(1)

Remarks

Moisture Content= 23.8%

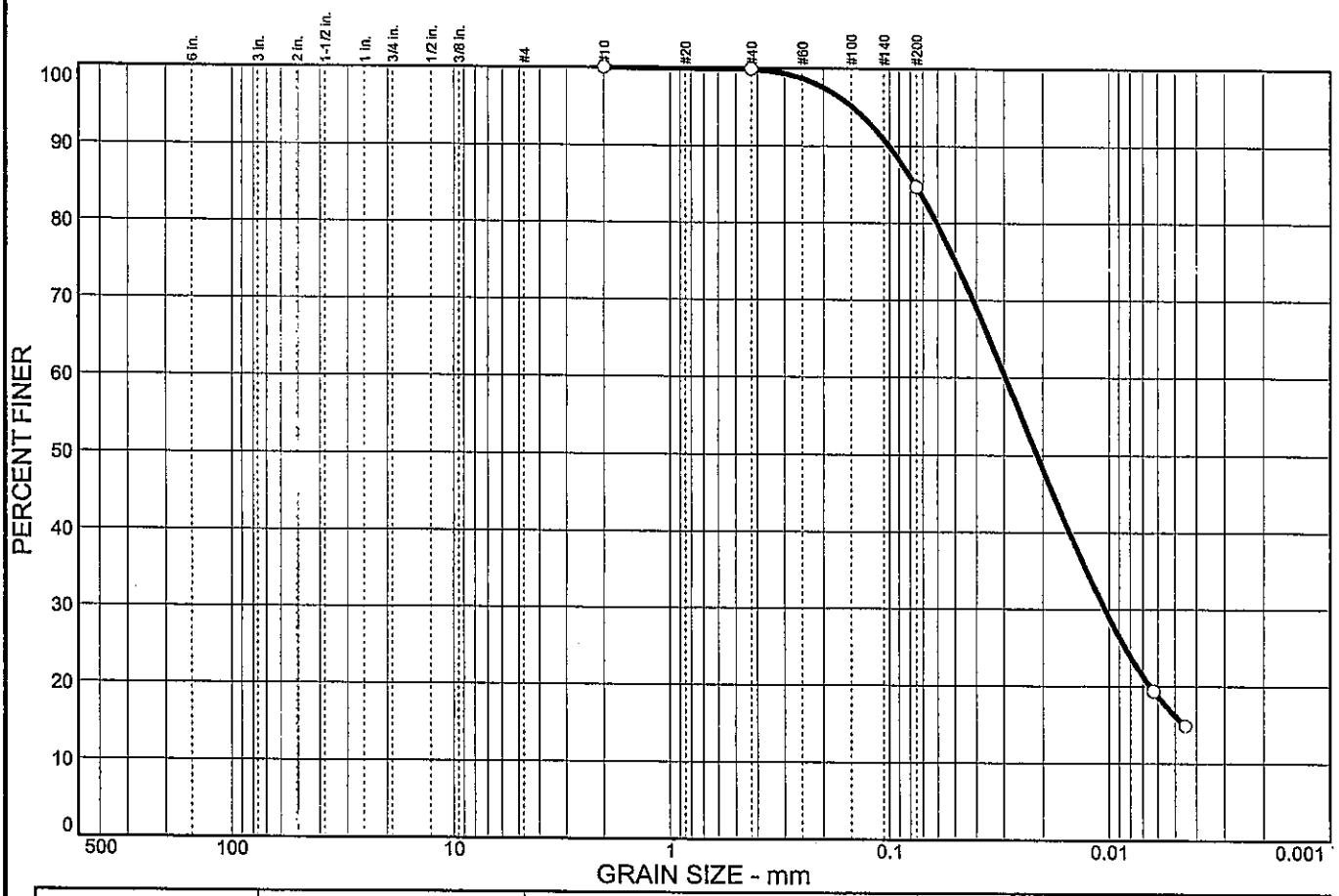
Sample No.: 3 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 5

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	0.0	0.0	0.1	15.2	68.5	16.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.9		
#200	84.7		

* (no specification provided)

Soil Description

Silty clay with sand

Atterberg Limits

PL= 19 LL= 24 PI= 5

Coefficients

D_{85}= 0.0761 D_{60}= 0.0296 D_{50}= 0.0213
D_{30}= 0.0105 D_{15}= 0.0045 D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(2)

Remarks

Moisture Content= 24.9%

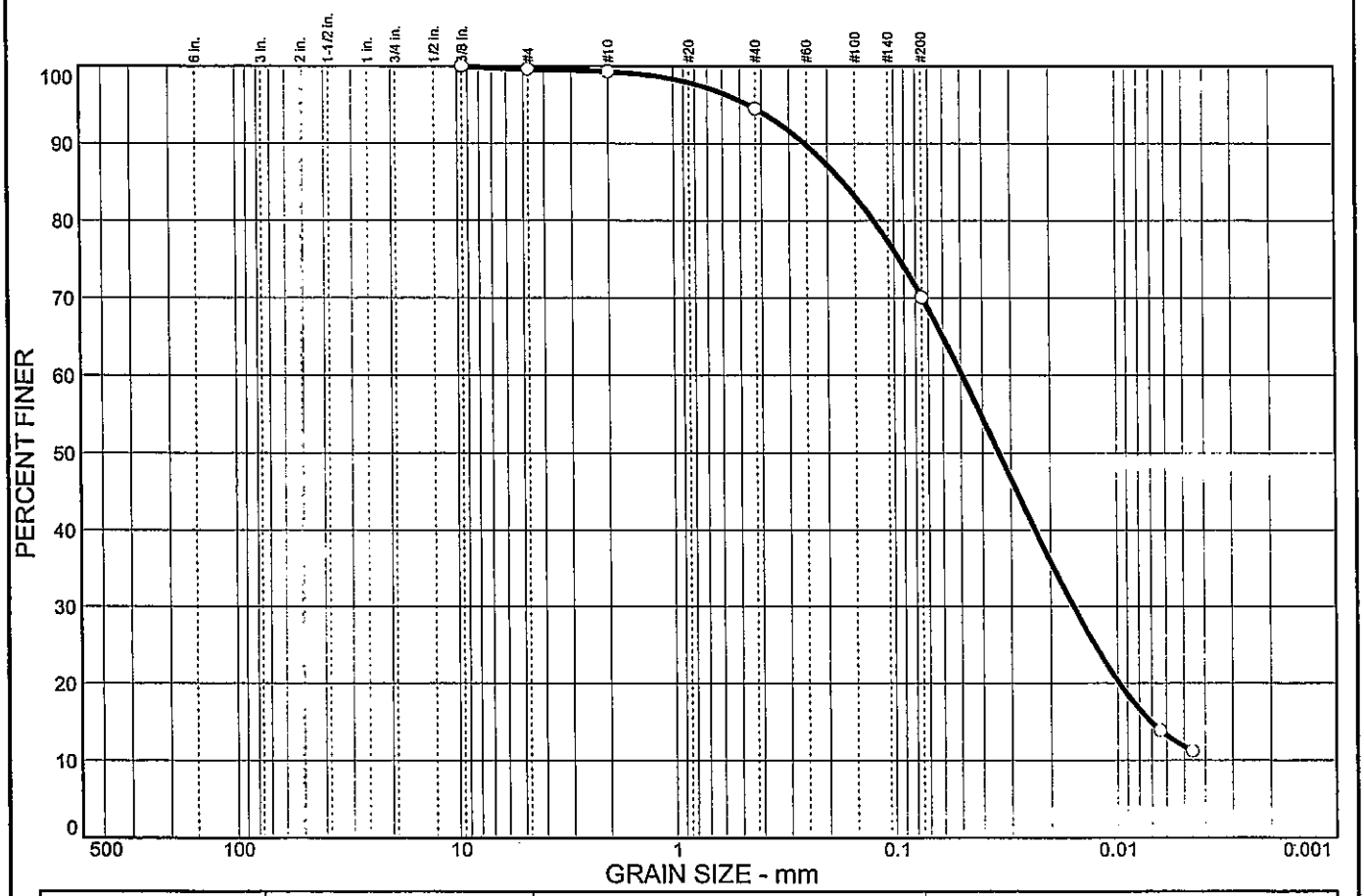
Sample No.: 4 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 7.5

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	0.4	0.3	4.8	24.4	58.3	11.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375 in.	100.0		
#4	99.6		
#10	99.3		
#40	94.5		
#200	70.1		

* (no specification provided)

Soil Description

Silt with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.171 D_{60}= 0.0495 D_{50}= 0.0339
D_{30}= 0.0157 D_{15}= 0.0071 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 16.8%

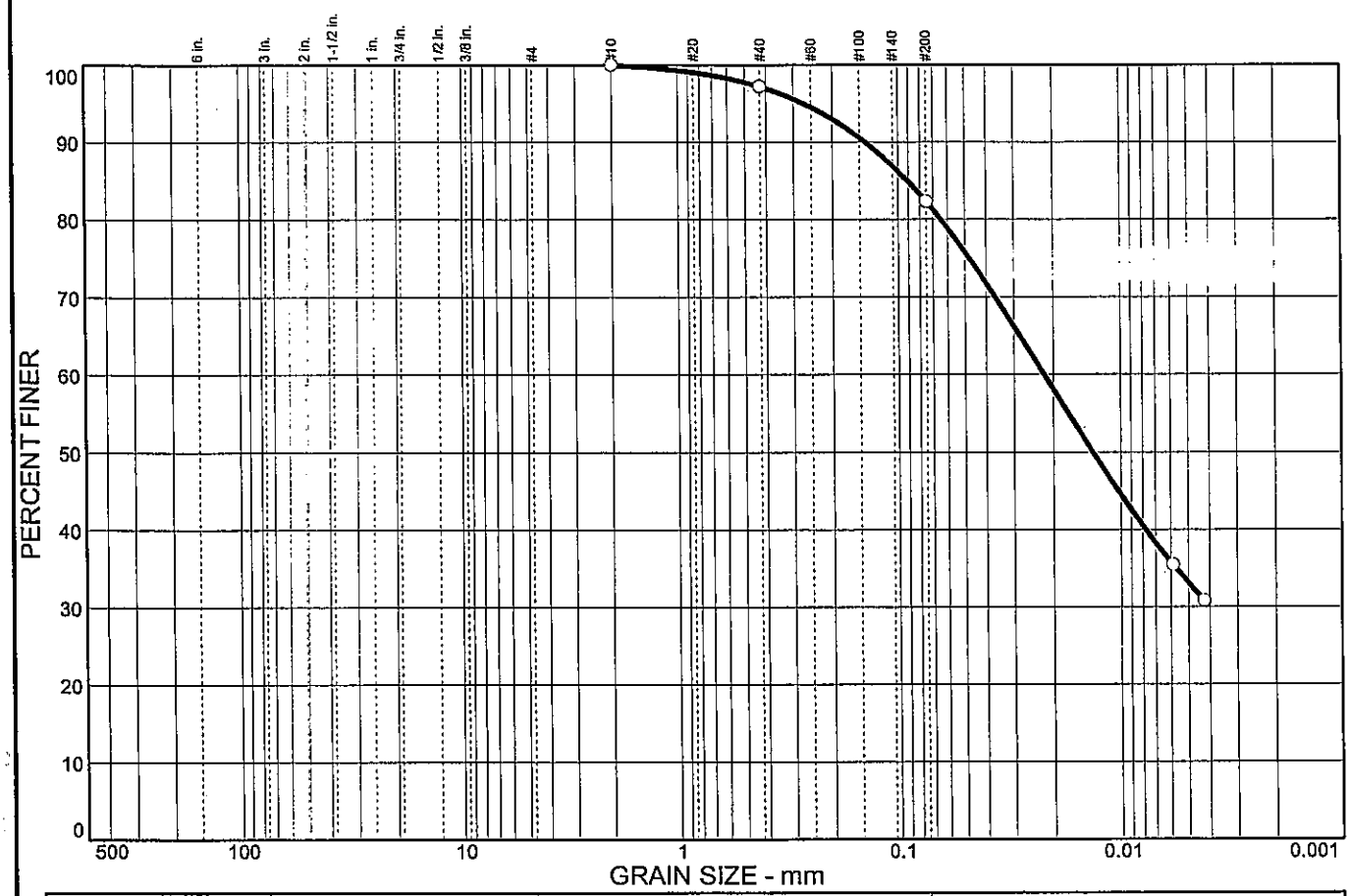
Sample No.: 5 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 10

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	14.9	49.2	33.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	97.2		
#200	82.3		

* (no specification provided)

Soil Description

Lean clay with sand

Atterberg Limits

PL= 17 LL= 30 PI= 13

Coefficients

D_{85}= 0.0912 D_{60}= 0.0220 D_{50}= 0.0133
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-6(9)

Remarks

Moisture Content= 21.7%

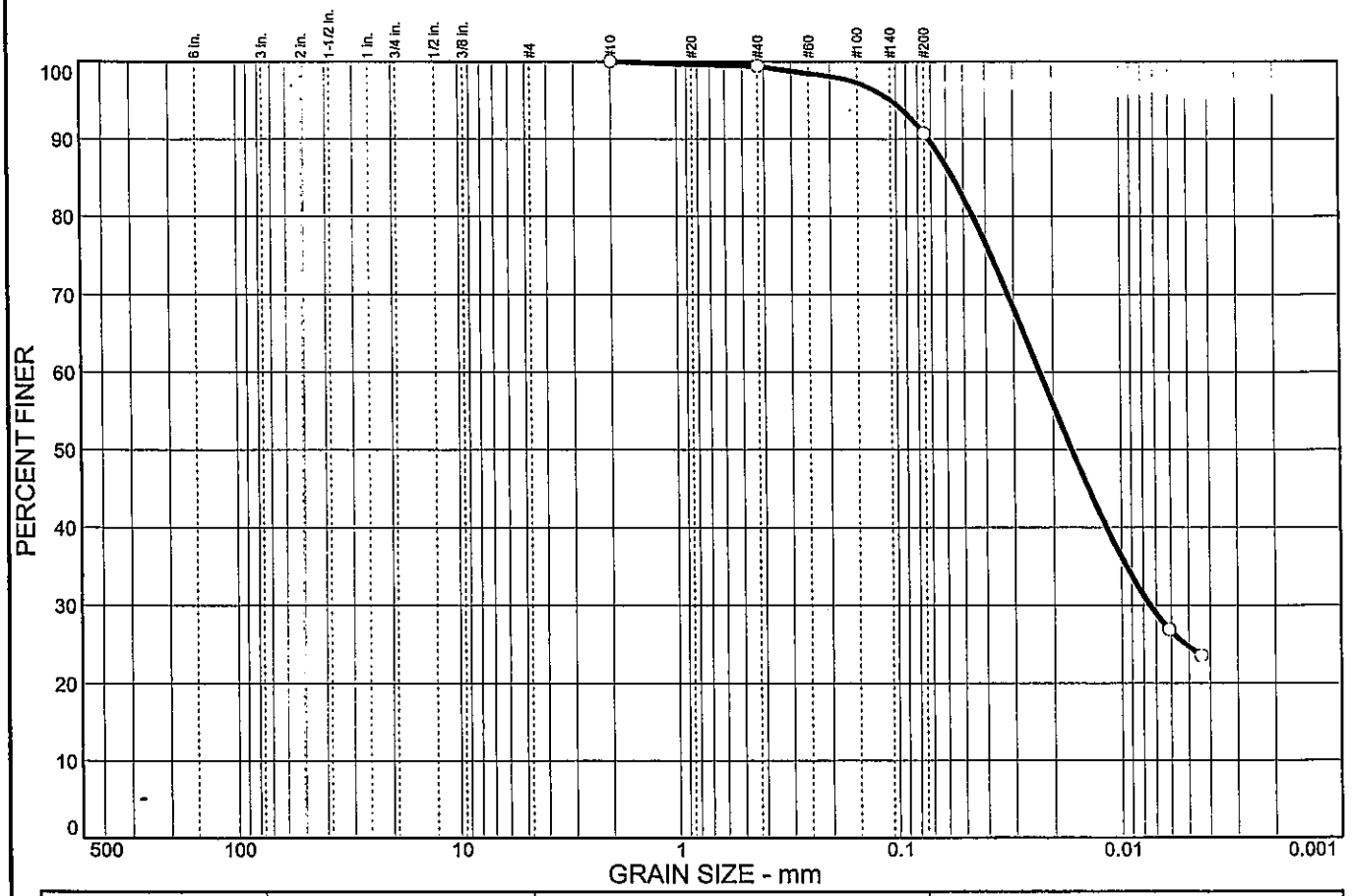
Sample No.: 6 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 12.5

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	0.0	0.0	0.6	8.7	65.9	24.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.4		
#200	90.7		

* (no specification provided)

Soil Description

Lean clay

Atterberg Limits

PL= 17 LL= 27 PI= 10

Coefficients

D_{85}= 0.0561 D_{60}= 0.0230 D_{50}= 0.0166
D_{30}= 0.0074 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(8)

Remarks

Moisture Content= 21.2%

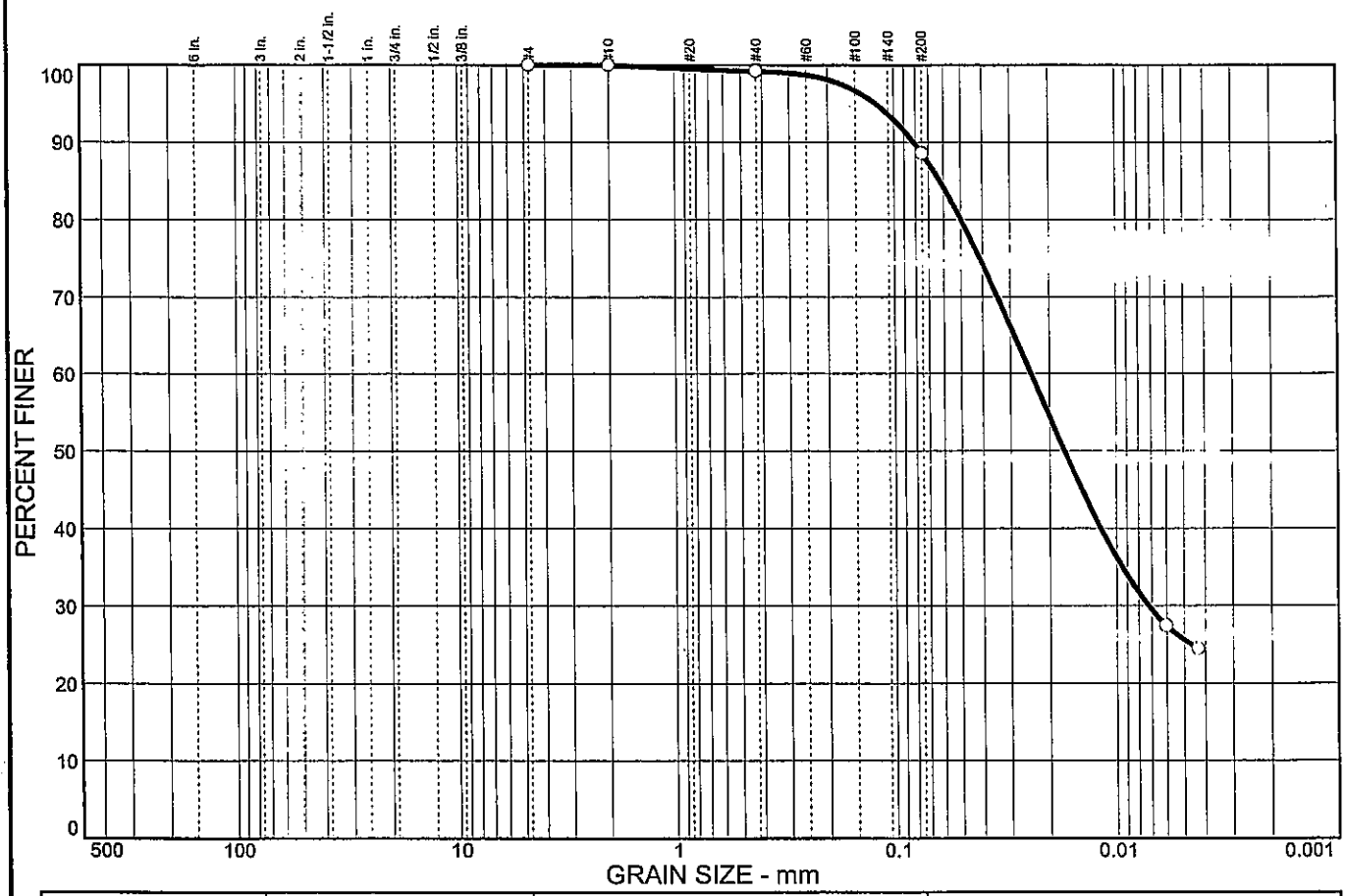
Sample No.: 7 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 15

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	0.8	10.6	63.0	25.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#40	99.2		
#200	88.6		

* (no specification provided)

Soil Description

Lean clay

Atterberg Limits

PL= 18 LL= 26 PI= 8

Coefficients

D_{85}= 0.0624 D_{60}= 0.0243 D_{50}= 0.0172
D_{30}= 0.0072 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(6)

Remarks

Moisture Content= 21.6%

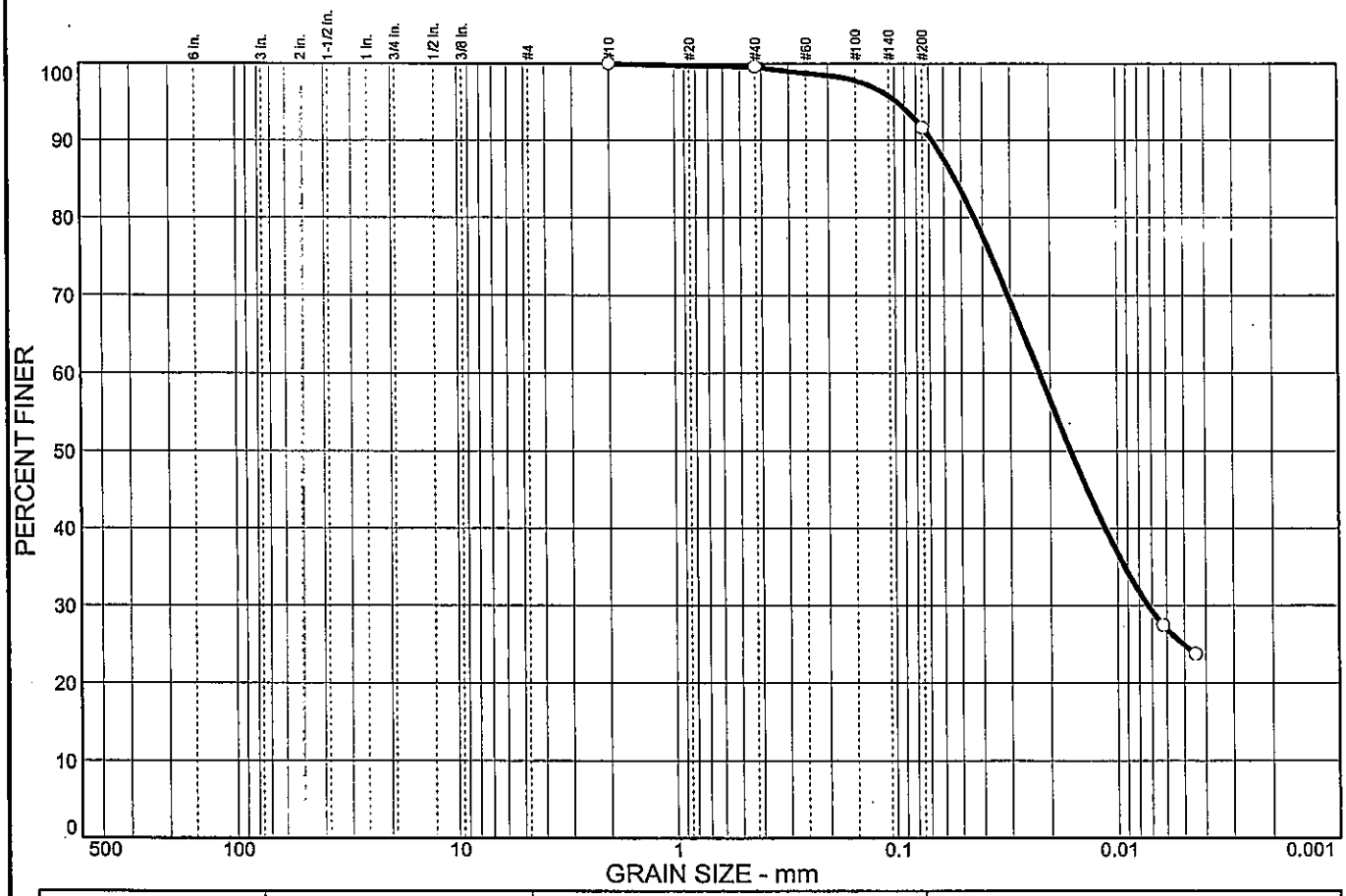
Sample No.: 8 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 17.5

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	0.0	0.0	0.4	7.9	66.8	24.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.6		
#200	91.7		

* (no specification provided)

Soil Description

Silty clay

Atterberg Limits

PL= 20 LL= 27 PI= 7

Coefficients

D_{85}= 0.0534 D_{60}= 0.0223 D_{50}= 0.0161
D_{30}= 0.0073 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(5)

Remarks

Moisture Content= 25.5%

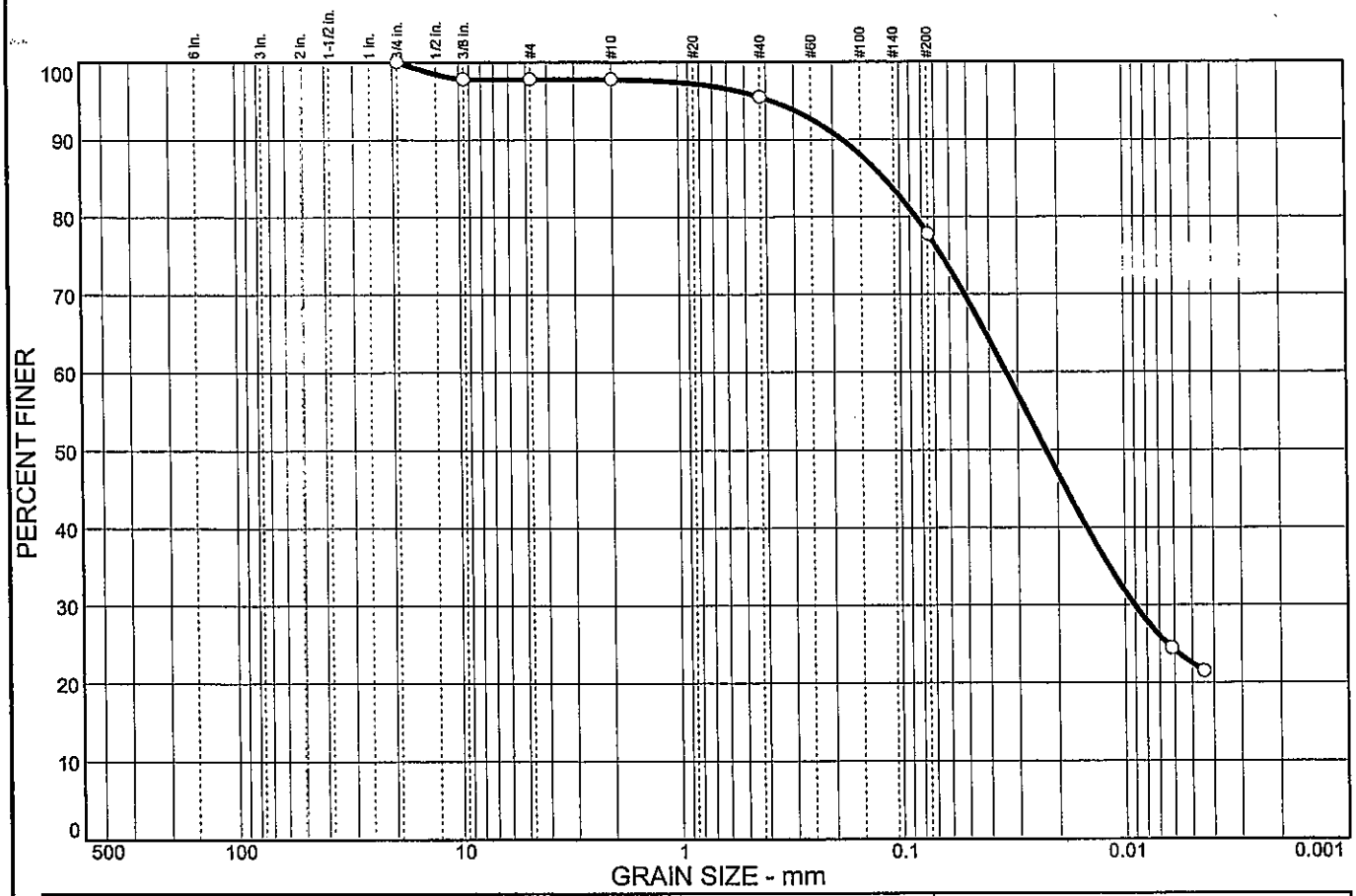
Sample No.: 9 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 20

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	2.2	0.0	2.3	17.7	55.3	22.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75 in.	100.0		
0.375 in.	97.8		
#4	97.8		
#10	97.8		
#40	95.5		
#200	77.8		

* (no specification provided)

Soil Description

Silty clay with sand

Atterberg Limits

PL= 18 LL= 25 PI= 7

Coefficients

D_{85}= 0.117 D_{60}= 0.0338 D_{50}= 0.0226
D_{30}= 0.0091 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(3)

Remarks

Moisture Content= 20.0%

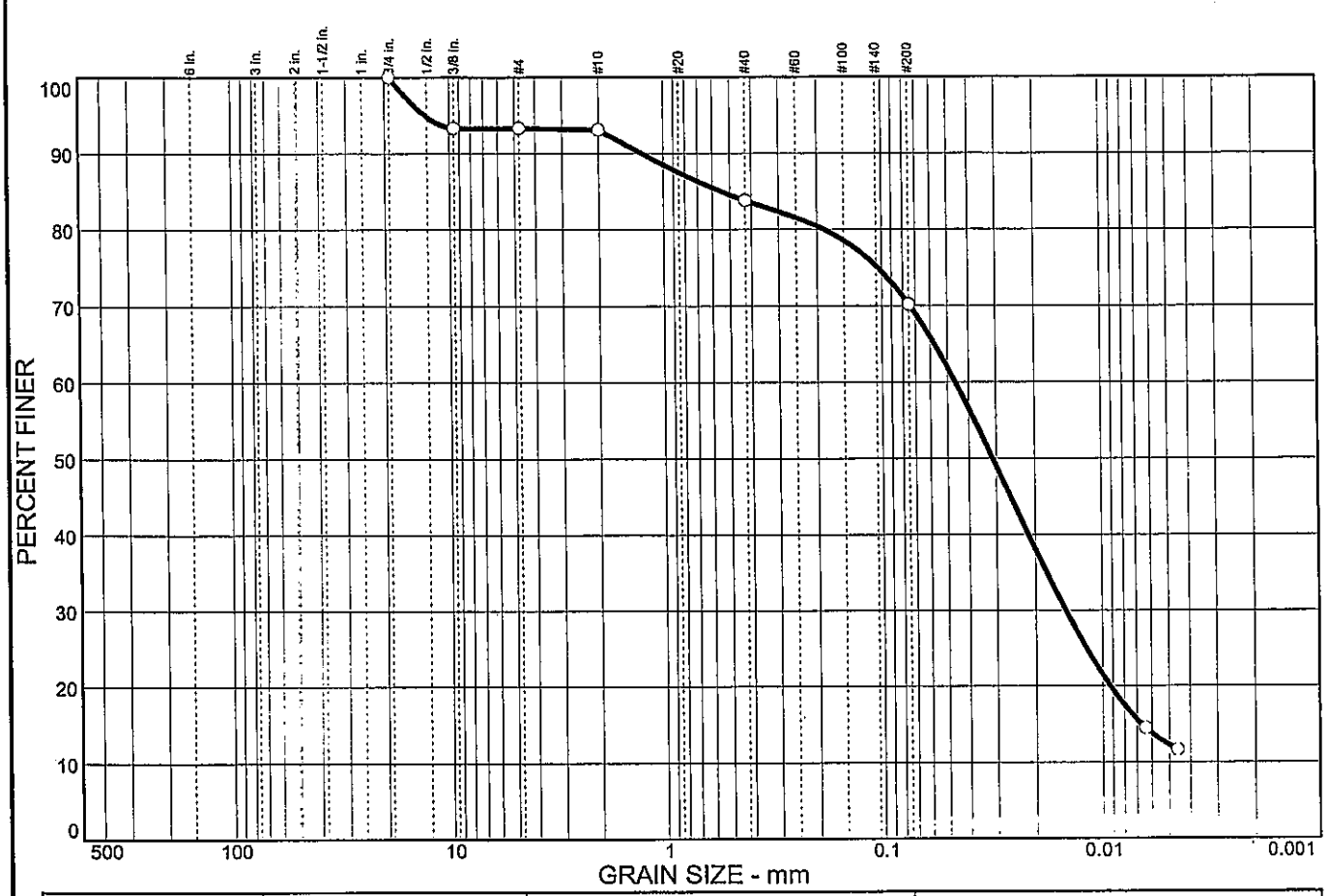
Sample No.: 10 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 22.5

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	6.7	0.2	9.3	13.6	57.9	12.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75 in.	100.0		
0.375 in.	93.3		
#4	93.3		
#10	93.1		
#40	83.8		
#200	70.2		

* (no specification provided)

Soil Description

Silt with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.545 D_{60}= 0.0462 D_{50}= 0.0312
D_{30}= 0.0146 D_{15}= 0.0067 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 15.6%

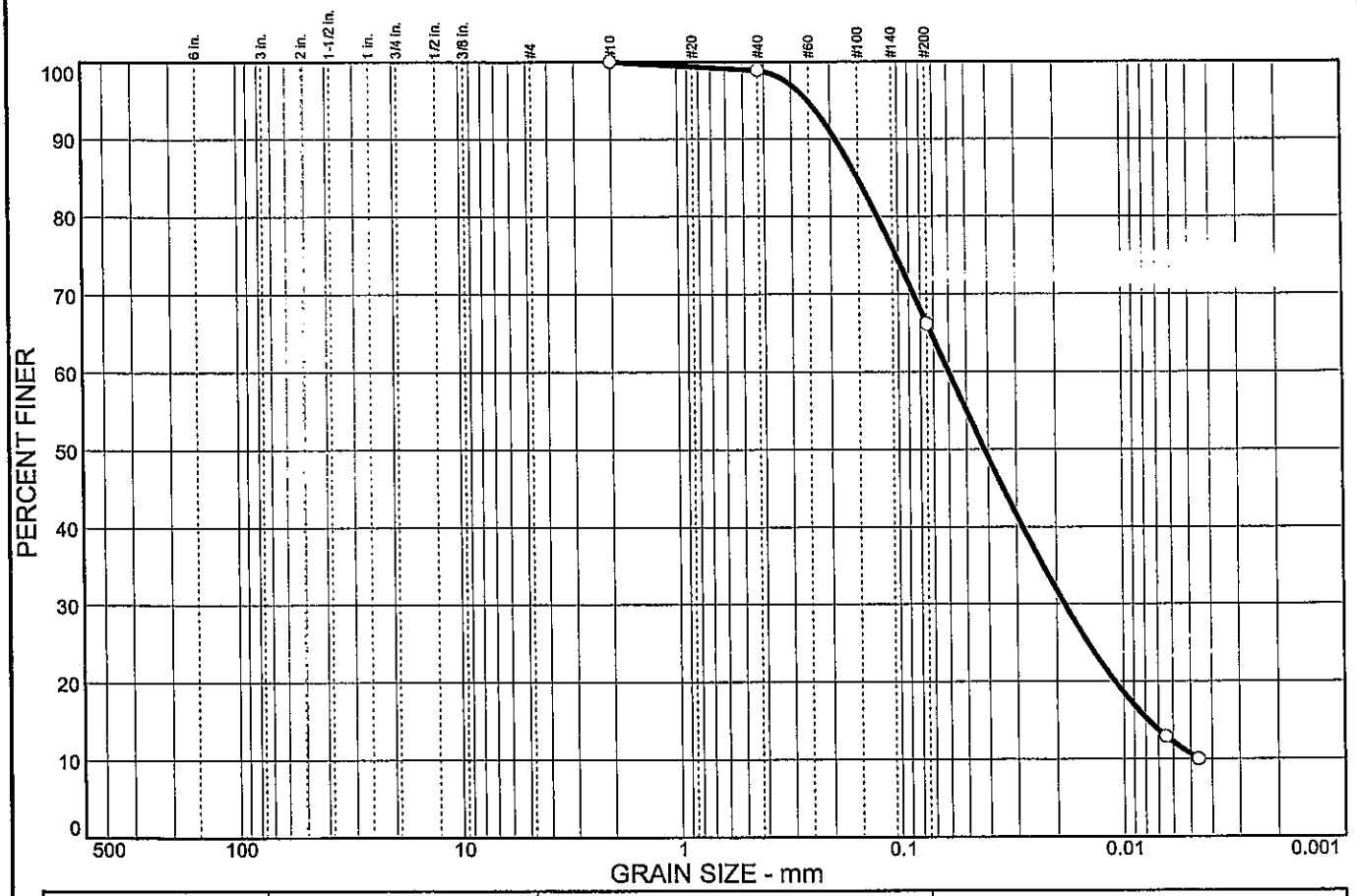
Sample No.: 11 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 25

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	1.1	32.7	55.5	10.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	98.9		
#200	66.2		

* (no specification provided)

Soil Description

Sandy silt

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.152 D_{60}= 0.0601 D_{50}= 0.0416
D_{30}= 0.0184 D_{15}= 0.0078 D_{10}= 0.0046
C_u= 13.06 C_c= 1.22

Classification

USCS= ML AASHTO= A-4(0)

Remarks

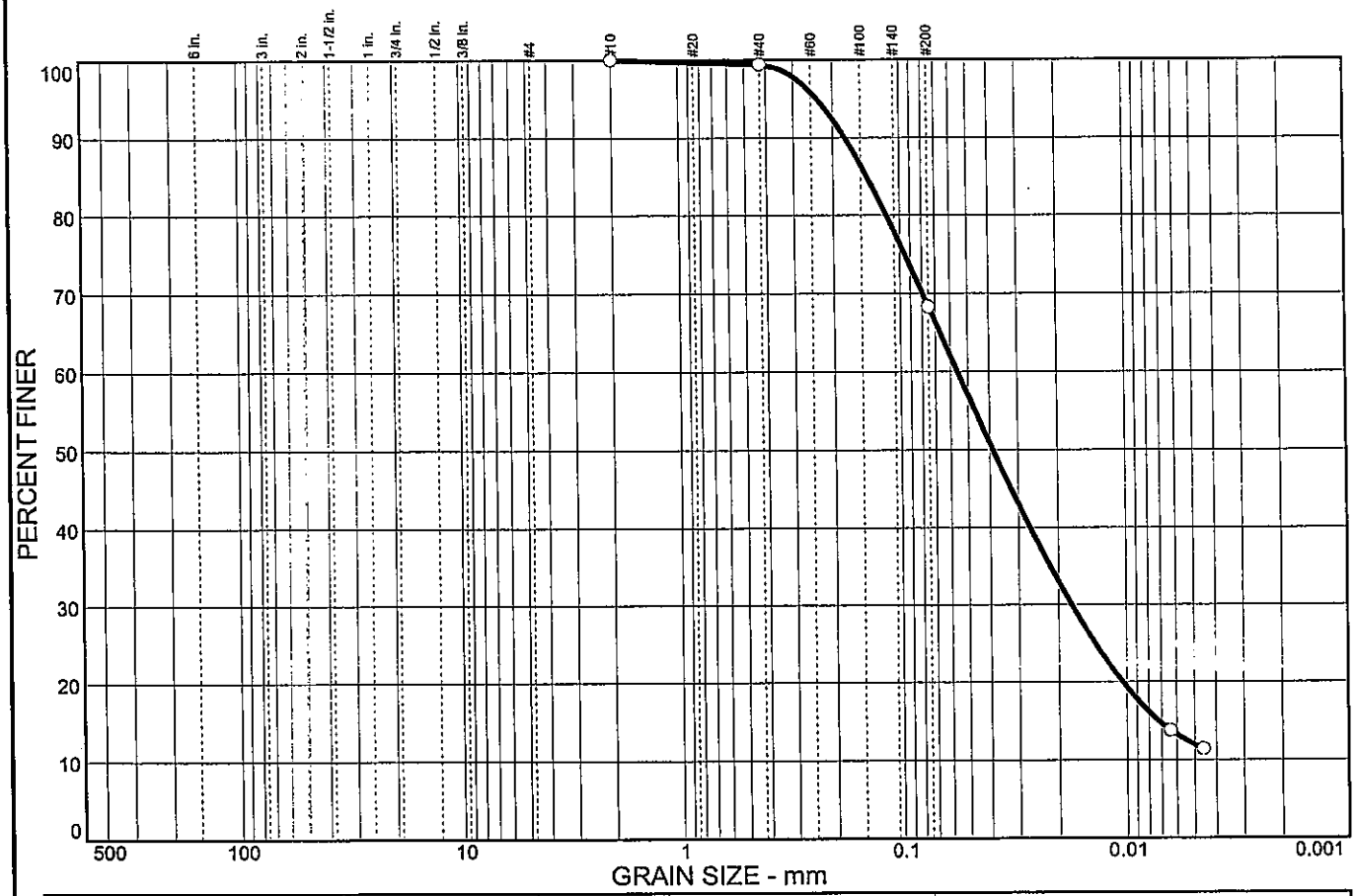
Moisture Content= 24.2%

Sample No.: 12 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 27.5

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	0.0	0.0	0.6	31.1	56.3	12.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.4		
#200	68.3		

* (no specification provided)

Soil Description

Sandy silt

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.141 D_{60}= 0.0558 D_{50}= 0.0389
D_{30}= 0.0175 D_{15}= 0.0072 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 24.9%

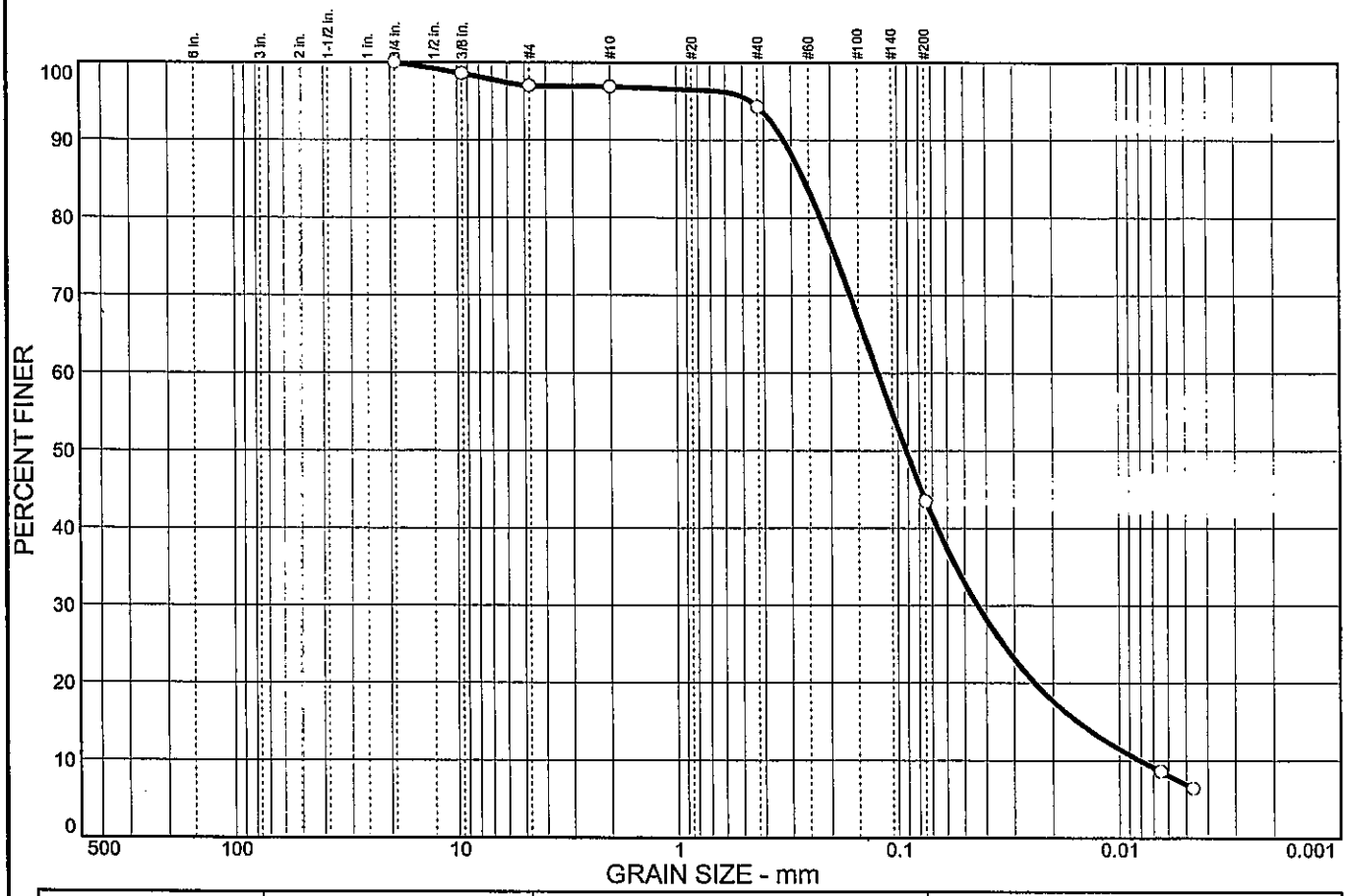
Sample No.: 13 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 30

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	3.0	0.1	2.6	50.8	36.6	6.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.75 in.	100.0		
0.375 in.	98.6		
#4	97.0		
#10	96.9		
#40	94.3		
#200	43.5		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.264 D_{60}= 0.123 D_{50}= 0.0921
D_{30}= 0.0439 D_{15}= 0.0154 D_{10}= 0.0081
C_u= 15.24 C_c= 1.94

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Moisture Content= 24.6%

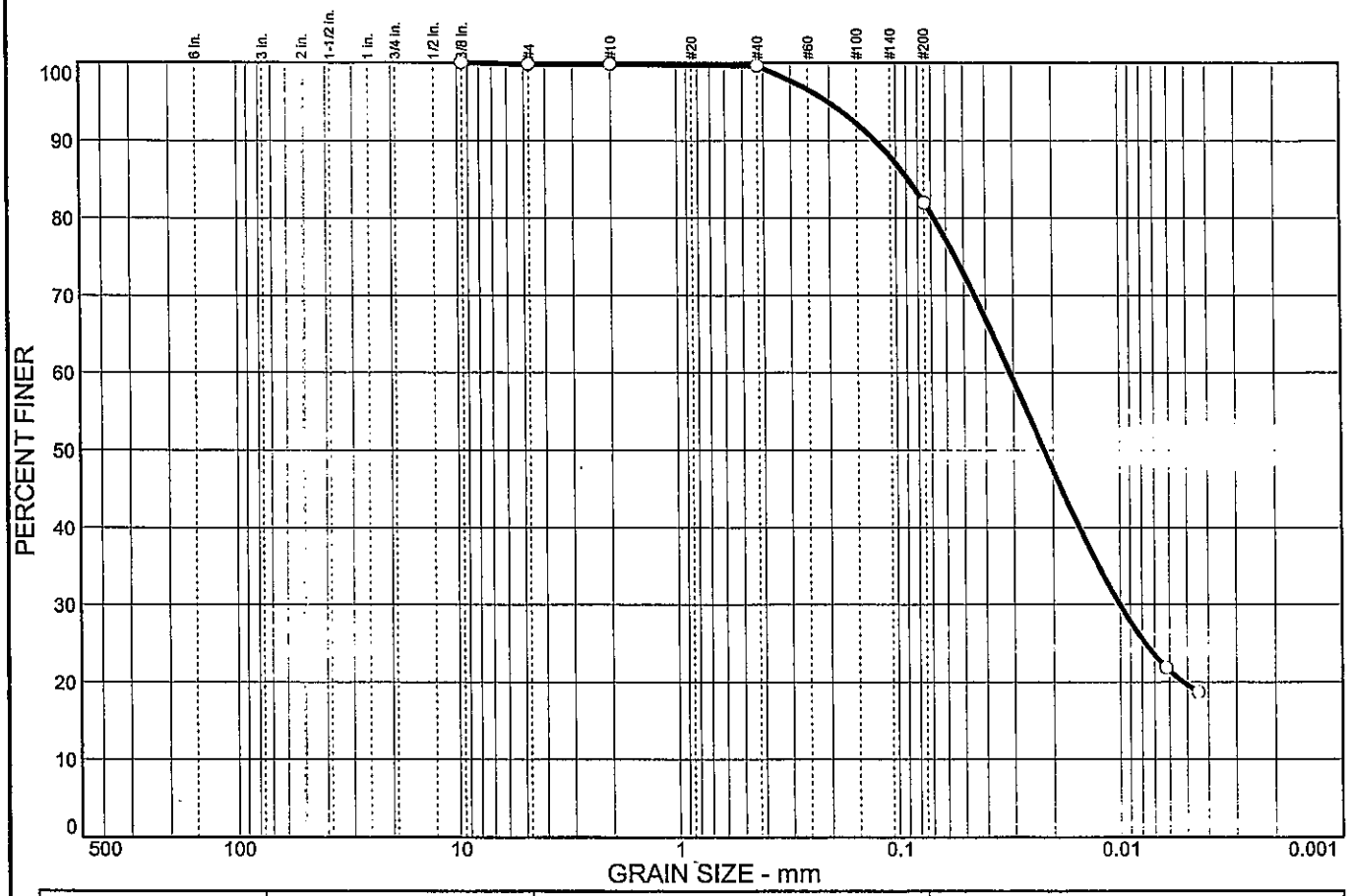
Sample No.: 14 **Source of Sample:** TR-32 **Date:** 3/25/05
Location: **Elev./Depth:** 35

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	0.2	0.0	0.2	17.6	62.3	19.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375 in.	100.0		
#4	99.8		
#10	99.8		
#40	99.6		
#200	82.0		

* (no specification provided)

Soil Description

Lean clay with sand

Atterberg Limits

PL= 21 LL= 29 PI= 8

Coefficients

D_{85}= 0.0882 D_{60}= 0.0312 D_{50}= 0.0219
D_{30}= 0.0100 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(5)

Remarks

Moisture Content= 30.2%

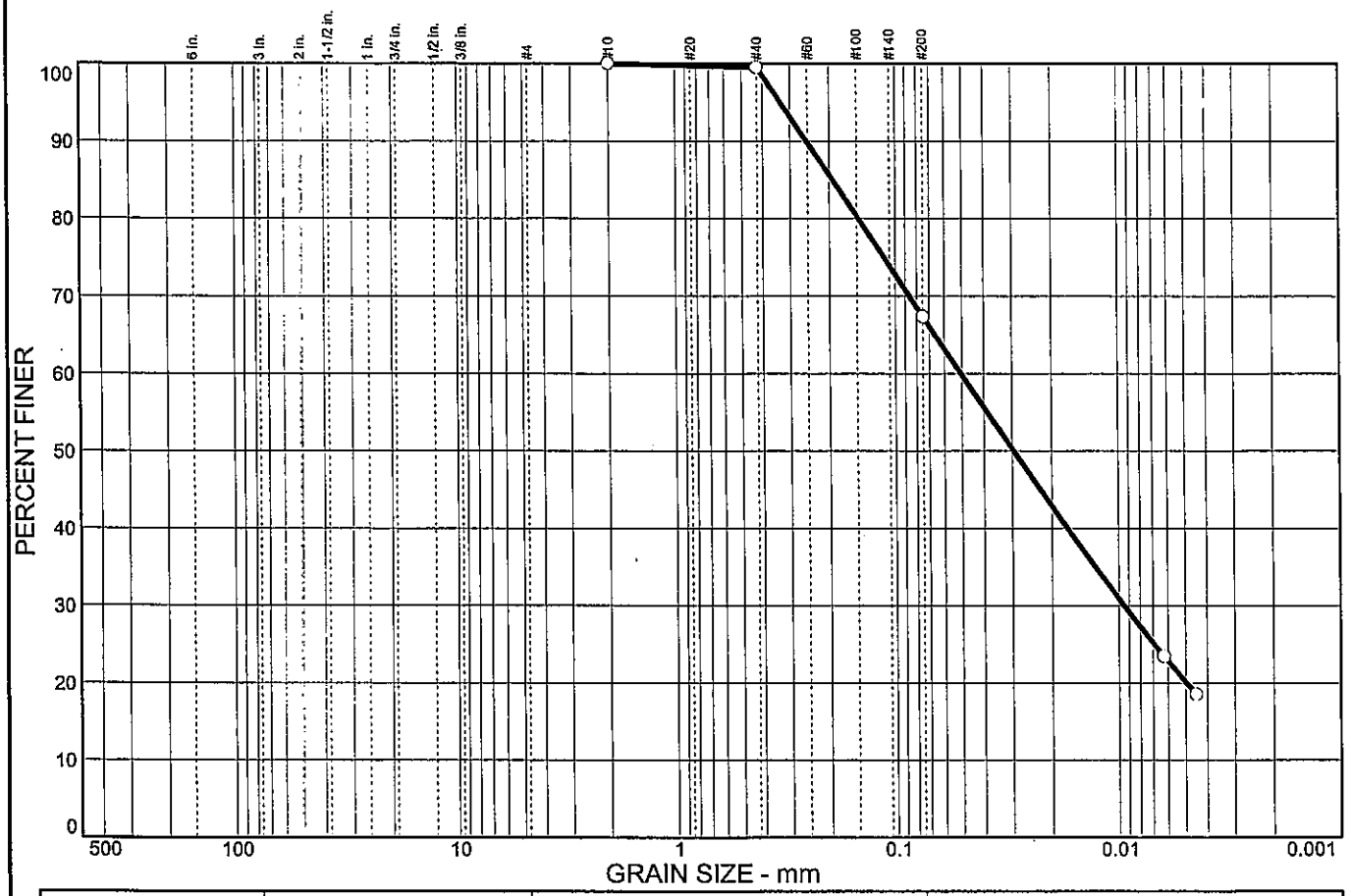
Sample No.: 1 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 1.5

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	0.0	0.0	0.5	32.1	47.2	20.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.5		
#200	67.4		

* (no specification provided)

Soil Description

Sandy silty clay

Atterberg Limits

PL= 18 LL= 23 PI= 5

Coefficients

D_{85}= 0.193 D_{60}= 0.0505 D_{50}= 0.0295
D_{30}= 0.0094 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(1)

Remarks

Moisture Content= 26.1%

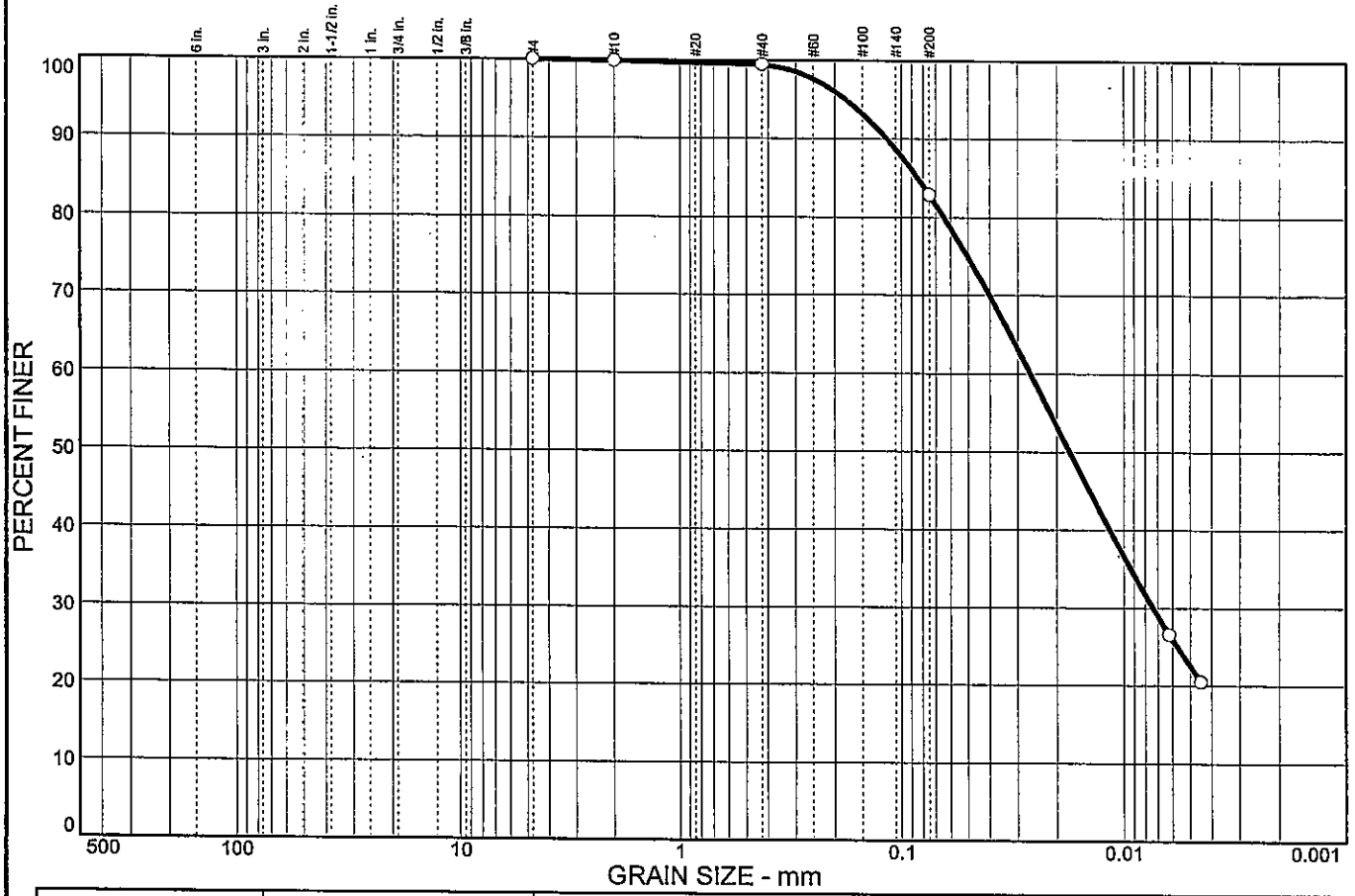
Sample No.: 2 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 4.0

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	0.1	0.4	16.6	60.4	22.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	99.5		
#200	82.9		

* (no specification provided)

Soil Description

Silty clay with sand

Atterberg Limits

PL= 19 LL= 25 PI= 6

Coefficients

D_{85}= 0.0845 D_{60}= 0.0264 D_{50}= 0.0175
D_{30}= 0.0074 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(3)

Remarks

Moisture Content= 27.3%

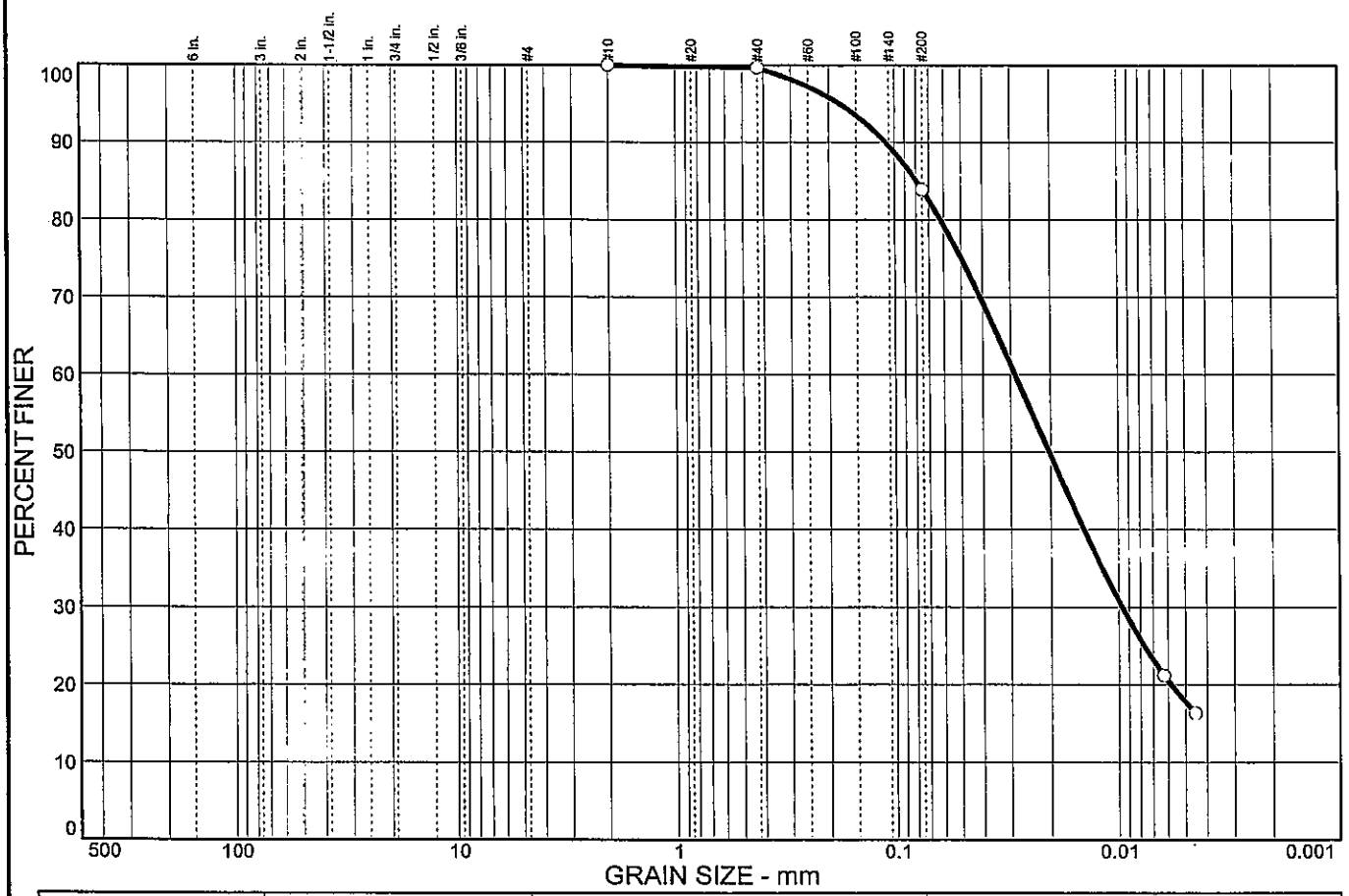
Sample No.: 3 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 6.5

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	0.0	0.0	0.3	15.8	66.1	17.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.7		
#200	83.9		

* (no specification provided)

Soil Description

Silt with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.0796 D_{60}= 0.0287 D_{50}= 0.0203
D_{30}= 0.0096 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 32.3%

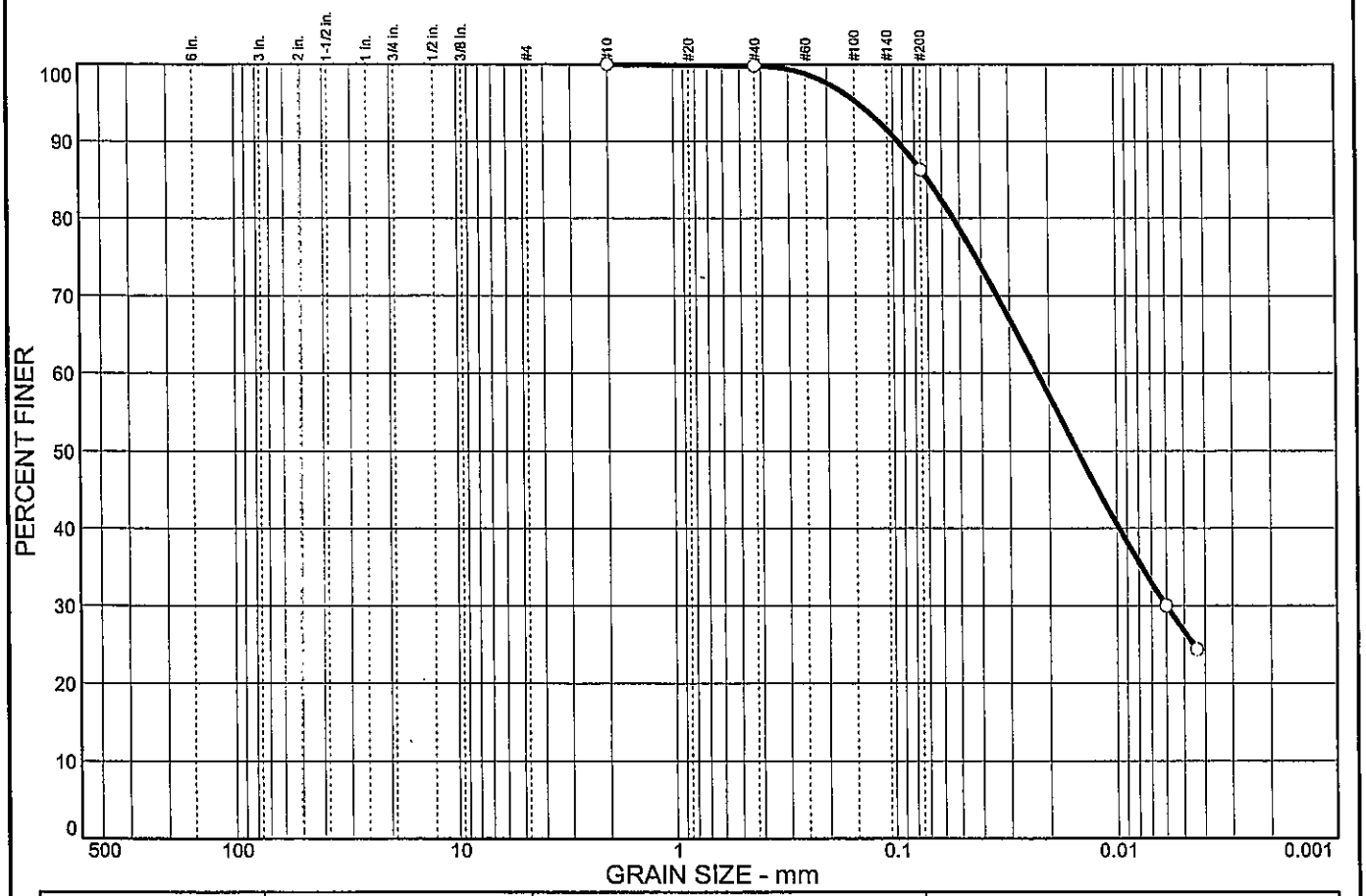
Sample No.: 4 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 9

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	0.2	13.5	59.6	26.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.8		
#200	86.3		

* (no specification provided)

Soil Description

Lean clay

Atterberg Limits

PL= 20 LL= 28 PI= 8

Coefficients

D_{85}= 0.0696 D_{60}= 0.0225 D_{50}= 0.0150
D_{30}= 0.0060 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-4(6)

Remarks

Moisture Content= 32.8%

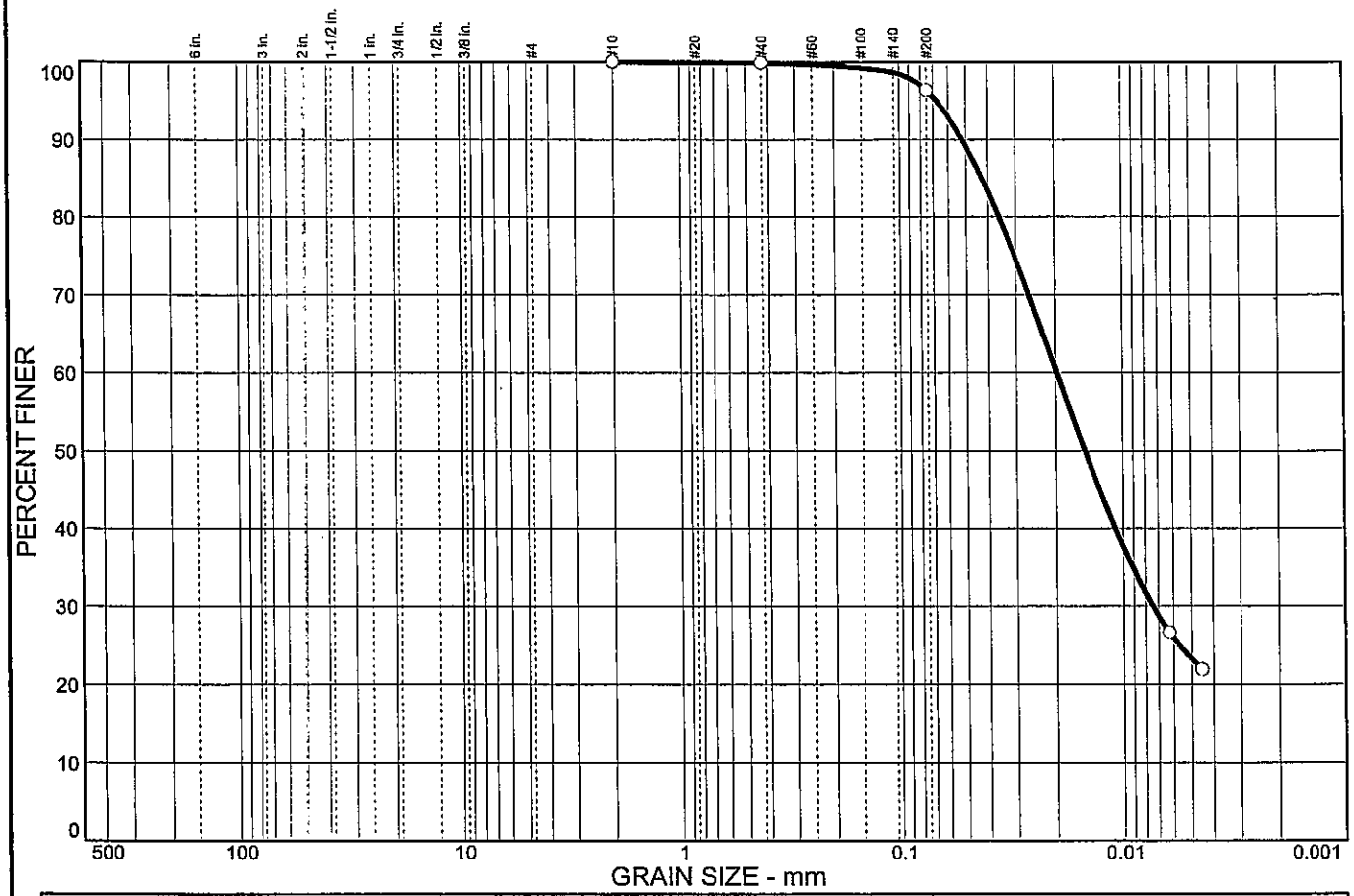
Sample No.: 5 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 11.5

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	0.0	0.0	0.1	3.5	73.2	23.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.9		
#200	96.4		

* (no specification provided)

Soil Description

Silty clay

Atterberg Limits

PL= 21 LL= 28 PI= 7

Coefficients

D_{85}= 0.0425 D_{60}= 0.0197 D_{50}= 0.0148
D_{30}= 0.0074 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(6)

Remarks

Moisture Content= 34.3%

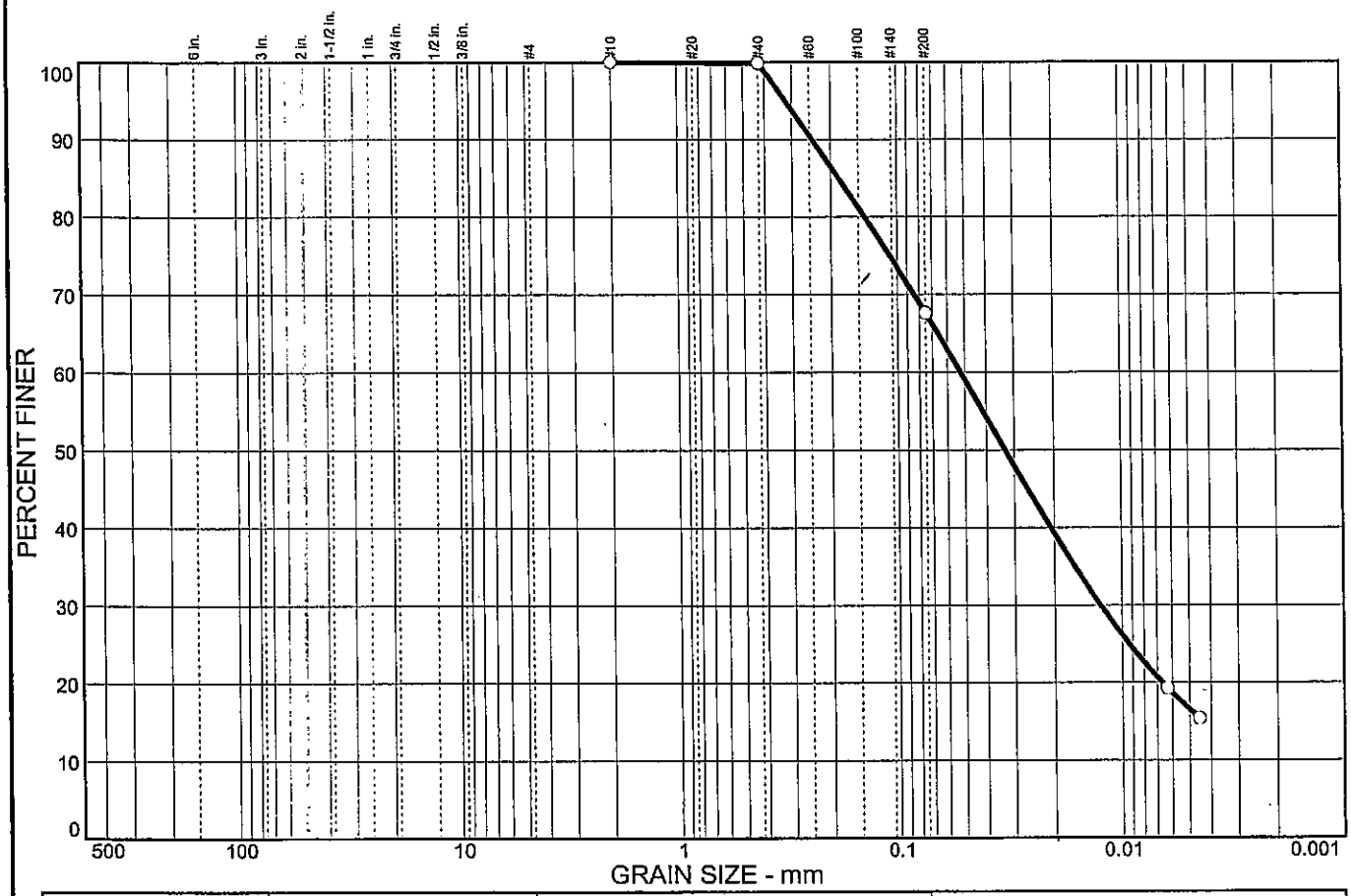
Sample No.: 6 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 14

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	0.1	32.3	51.0	16.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.9		
#200	67.6		

* (no specification provided)

Soil Description

Sandy silt

Atterberg Limits

PL= 18 LL= 20 PI= 2

Coefficients

D_{85}= 0.184 D_{60}= 0.0524 D_{50}= 0.0331
D_{30}= 0.0124 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 29.4%

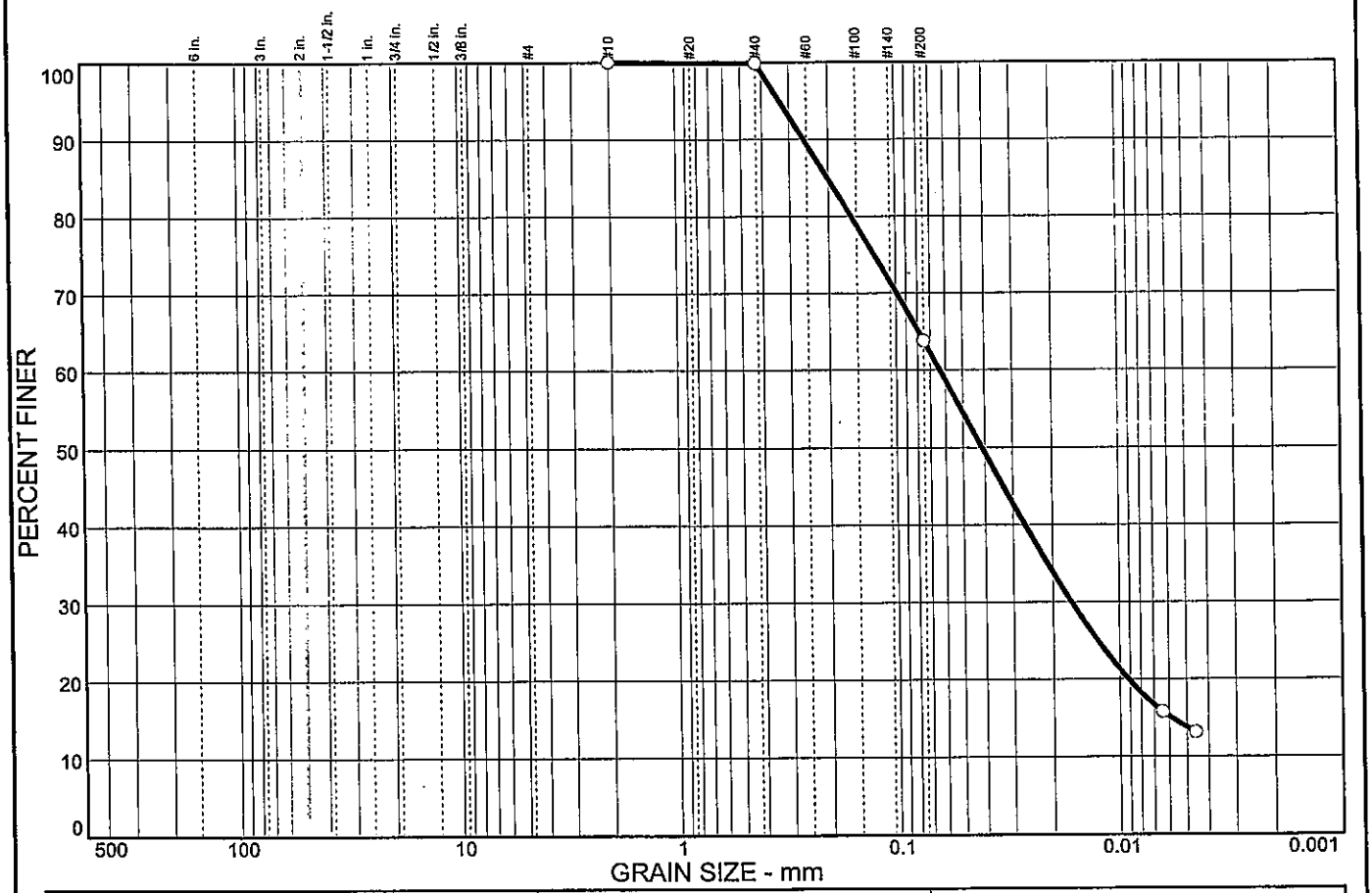
Sample No.: 7 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 16.5

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	0.0	0.0	0.1	36.1	50.0	13.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.9		
#200	63.8		

* (no specification provided)

Soil Description

Sandy silt

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.202 D_{60}= 0.0635 D_{50}= 0.0413
D_{30}= 0.0165 D_{15}= 0.0058 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Moisture Content= 28.4%

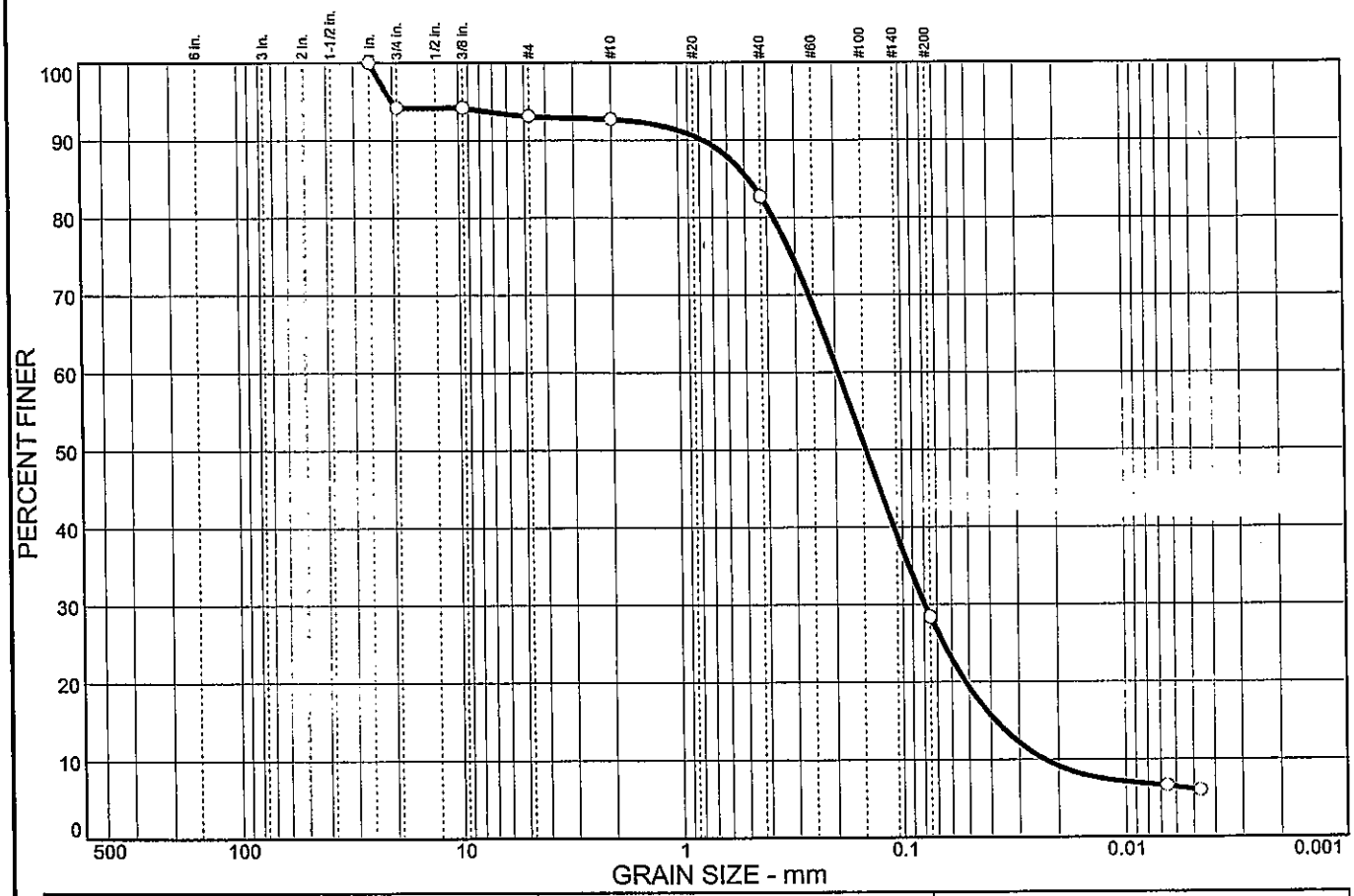
Sample No.: 8 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 19.0

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	5.8	1.1	0.4	10.0	54.3	22.3	6.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.00 in.	100.0		
0.75 in.	94.2		
0.375 in.	94.2		
#4	93.1		
#10	92.7		
#40	82.7		
#200	28.4		

* (no specification provided)

Soil Description

Silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{85}= 0.483 D_{60}= 0.194 D_{50}= 0.146
D_{30}= 0.0795 D_{15}= 0.0381 D_{10}= 0.0230
C_u= 8.44 C_c= 1.41

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Moisture Content= 21.8%

Sample No.: 9 **Source of Sample:** TR-33 **Date:** 3/21/05
Location: **Elev./Depth:** 21.5

DLZ

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

Project No: 0121-3070.03 **Figure**

APPENDIX F

Scupper Justification

TranSystems

Scupper Justification

Due to horizontal curvature at the site, attempts to optimize girder splice locations, and dog-legging of the girders at the splices, beam locations were set to allow placement of scuppers, thereby fixing the possible locations of scuppers. The scuppers are located where the centerline of girder is typically 18" away from the fascia of the slab. A calculation was performed for the spread at the downhill end of the bridge. This calculation included all of the uphill drainage area (see attached worksheets). An additional 100 feet was added to the bridge length to accommodate the uphill placement of the approach slab and catch basins. This calculation for the respective bridges revealed that the spread for the Left shoulder of the Left bridge and the Left Shoulder of the Right bridge did not exceed allowable maximums (the spreads are within the shoulder limits). The spread for the Right shoulder of the Right bridge was calculated to be 10.8'. Since the shoulder is 12' wide this spread was determined to be acceptable. Intuitively, if a shoulder for the longer five span bridge did not need scuppers, the shorter three span bridges would not need them. However, as a check, both shoulders of all bridge alternatives were checked for spread.

Scupper Justification of Five Span Structure (Alternative 1)

Spread calculations show that for the Left bridge, the Left shoulder runoff does not exceed the maximum spread. Spread Calculations for the Right shoulder of the left bridge show the spread at the downhill end of the bridge. Table 1 displays the results of the spread analysis.

TABLE 1 (Five Span)

Bridge	Lt. Side Q (cfs)	Lt. Side Spread (ft)	Rt. Side Q (cfs)	Rt. Side Spread (ft)
Left	1.3	6.4	3.7	10.1 use scuppers
Right	0.6	4.8	4.4	10.8

Scupper Justification of Three Span Structure (Alternatives 2A, 2B)

Spread calculations show that for the Left bridge, the Left shoulder runoff does not exceed the maximum spread. Spread Calculations for the Right shoulder of the left bridge show the spread at the down hill end of the bridge. Table 2 displays the results of the spread analysis.

TABLE 2 (Three Span)

Bridge	Lt. Side Q (cfs)	Lt. Side Spread (ft)	Rt. Side Q (cfs)	Rt. Side Spread (ft)
Left	1.1	6.1	3.5	9.8 use scuppers
Right	0.6	4.8	4.4	10.7

Scupper Justification of Three Span Structure with Drilled Shaft Retaining Wall (Alternatives 3A, 3B)

Spread calculations show that for the Left bridge, the Left shoulder runoff does not exceed the maximum spread. Spread Calculations for the Right shoulder of the left bridge show the spread at the downhill end of the bridge. Table 3 displays the results of the spread analysis.

TABLE 3 (Three Span with Retaining Wall)

Bridge	Lt. Side Q (cfs)	Lt. Side Spread (ft)	Rt. Side Q (cfs)	Rt. Side Spread (ft)
Left	1.17	6.15	3.5	9.8 use scuppers
Right	0.61	4.82	4.41	10.7

Form LD-40
(Revised Ju 1999)

GUTTER SPREAD & INLET CAPACITY

Sheet..........of......
Project No. 19415
State...... OH

Done by...... HJS ......Date 7/5/2006
Checked by......Date......
Design Frequency...... 10 ......years
Time to First Inlet... 10 min.......
Allowable Spread...... 6' ......ft.
Max. Allowable Depth...... 0.457 ......ft.

5 Span Left Bridge Right Side Scupper Bypass, Little Scioto River Bridge

1 Reference No.	2 Station	3 Location	4 Coefficient of Runoff (C)	5 Rainfall Intensity (I)	6 Drainage Area Acres (A)	7 Discharge cfs (Q)	8 Previous Inlet By-Pass Col. 27 (Qp)	9 Total Discharge Col. 7 & 8 (Qt)	10 Longitudinal Grade ft/ft	11 Cross Slope ft/ft	12 Depth @ Curb (y) ft	13 SPREAD ft	14 Combined Grate & Curb: Width of Flow Outside of Grate ft	15 Depth Outside Edge of Grate ft	16 Qa: flow outside of Grate cfs	17 Q: flow at end of Grate cfs	18 Actual Length of Grate ft	19 Curb Opening Inlets: Local Depression (a) ft	20 Qa/La	21 La = 100% Pick up Length ft	22 L/La	23 a/y Col. 19/12	24 Q/Qa Col. 9/16	25 Flow over side of grate cfs	26 Total Flow Intercepted cfs	27 Carry over to next flow cfs	28 % PICK UP	29 Inlets in Sump: Q Gutter In Sump cfs	30 Allowable Depth ft	31 Height of Opening ft	32 D. Allow/Opening Col. 30/31	33 Q/L Needed	34 Q/L (for Grate Only)	35 (L) Length Needed ft	Remarks
	130+50	LB RT	0.9	5.4	.70	3.7	/	3.7	.0028	.0400	.36	10.1																							TOO MUCH SPREAD ADD SCUPPERS
																																			TOO MUCH
	132+00	LB RT	0.9	5.4	.54	2.6	/	2.6	.0200	.0400	0.22	6.1																							Too Much Spread try Sta. 137+12
	137+12	LB RT	0.9	5.4	0.29	1.43	/	1.43	.0372	.0400	0.16	4.4	2.15	0.08	0.22		1.25	.083	0.11	2.0	0.83	0.52	0.81	.18	1.39	.04	97								
							.04																												
	133+46	LB RT	0.9	5.4	0.27	1.34		1.38	.0172	.0400	.18	5.0	2.25	.11	0.29		1.25	.083	.047	1.6	.78	.46	.90	.26	1.35	.03	98								
							.03																												
	131+81	LB RT	0.9	5.4	0.13	0.61		.64	.0092	.0400	.15	4.2	1.95	.07	.08		1.25	.083	.045	1.8	.70	.5	.81	.06	.62	.02	91								
							.02																												
	130+50	LB RT	0.9	5.4	0.10	.49		.51	.0028	.0400	.17	4.8	2.6	.09	0.10		1.25	.083	.04	2.5	0.50	.49	.13	.07	.48	.03	94								

Form LD-40
(Revised Ju[illegible] 1999)

GUTTER SPREAD & INLET CAPACITY

Sheet..........of......

Done by.......*HJS*.......Date.*6/9/2006*

Project No..*19415*

Checked by.......................Date........

Allowable Spread.......*6*.......ft.

State..*OH*........

Design Frequency.......*10*.......years

Max. Allowable Depth..*0.467*.......ft.

Time to First Inlet....*10 min*.......

Left Bridge Rt Side *Scupper Bypass Little Scioto River Bridge* *3-Span*

1 Reference No.	2 Station	3 Location	4 Coefficient of Runoff	5 Rainfall Intensity	6 Drainage Area Acres	7 Discharge cfs	8 Previous Inlet By-Pass Col. 27	9 Total Discharge Col. 7 & 8	10 Longitudinal Grade	11 Cross Slope	12 Depth @ Curb (y)	13 SPREAD	14 Width of Flow Outside of Grate	15 Depth Outside Edge of Grate	16 Qa: flow out-side of Grate	17 Q: flow at end of Grate	18 Actual Length of Grate	19 Local Depression (a)	20 Qa/La	21 La = 100% Pick up Length	22 L/La	23 a/y Col. 19/12	24 Q/Qa Col. 9/16	25 Flow over side of grate	26 Total Flow Intercepted	27 Carry over to next flow	28 % PICK UP	29 Q Gutter In Sump	30 Allowable Depth	31 Height of Opening	32 D. Allow/Opening Col. 30/31	33 Q/L Needed	34 Q/L (for Grate Only)	35 (L) Length Needed	Remarks
			C	I	A	Q	Qp	Qt	ft/ft	ft/ft	ft	ft	ft	ft	cfs	cfs	ft	ft		ft				cfs	cfs	cfs		cfs	ft	ft				ft	
	136+75	median	0.9	5.4	.34	1.66	/	1.66	.0360	.0360	0.17	4.6	2.35	.085	0.27			.083	0.039	1.44	0.86	4.88	0.83	0.22	1.61	.05	97								
	133+75	median	0.9	5.4	0.23	1.12	.05	1.17	.0200	.0360	0.16	4.54	2.29	.082	0.19			.083	.091	2.1	.60	0.52	.79	.15	1.13	.04	97								
	130+75	median	0.9	5.4	0.23	1.12	.04	1.16	.0036	.0360		6.24																							too Wide Place scupper Sta 132+05.
	132+05	median	0.9	5.4	.13	.63	.04	.67	.0104	.0360	0.15	4.1	1.85	.07	.08			.083	.039	2.5	5	0.55	0.67	0.12	.67	/	100								
	130+75	median	0.9	5.4	0.18	.49	/	.49	.0028	.0360	0.17	4.7	OK																						

Form LD-40
(Revised July 1999)

GUTTER SPREAD & INLET CAPACITY

Sheet.........of........

Project No. 19415

State. OHIO

Done by........ HJS .... Date 6/23/2004

Checked by........................ Date........

Design Frequency........ 10 .... years

Time to First Inlet.... 10 min ....

Allowable Spread........ 6 .... ft.

Max. Allowable Depth... 0.467 .... ft.

Left Side bridge Scupper Calcs for 3 span option with Retaining Wall Option

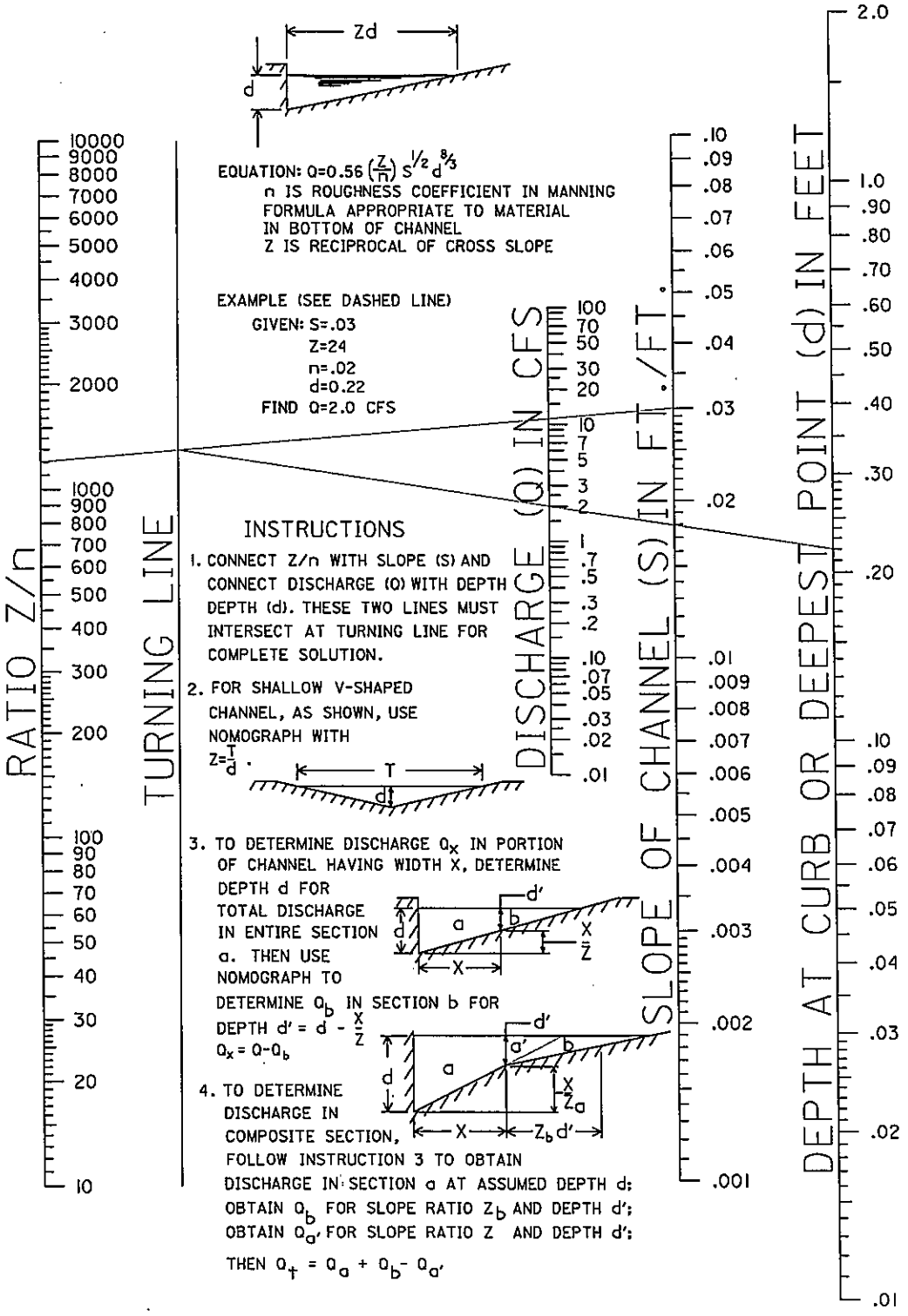
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
													COMBINED GRATE & CURB					CURB OPENING INLETS										INLETS IN SUMP							
Reference No.	Station	Location	Coefficient of Runoff	Rainfall Intensity	Drainage Area Acres	Discharge cfs	Previous Inlet By-Pass Col. 27	Total Discharge Col. 7 & 8	Longitudinal Grade	Cross Slope	Depth @ Curb (y)	SPREAD	Width of Flow Outside of Grate	Depth Outside Edge of Grate	Qa: flow outside of Grate	Q: flow at end of Grate	Actual Length of Grate	Local Depression (a)	Qa/La	La = 100% Pick up Length	L/La	a/y Col. 19/12	Q/Qa Col. 9/16	Flow over side of grate	Total Flow Intercepted	carry over to next flow	% PICK UP	Q Gutter In Sump	Allowable Depth	Height of Opening	D. Allow/Opening Col. 30/31	Q/L Needed	Q/L (for Grate Only)	(L) Length Needed	Remarks
			C	I	A	Q	Qp	Qt	ft/ft	ft/ft	ft	ft	ft	ft	cfs	cfs	ft	ft		ft				cfs	cfs	cfs		cfs	ft	ft				ft	
	38+50	Median	0.9	5.4	.15	.73	/	.73	.0452	.0360	0.12	3.26	1.01	.04	.03			0.083	.019	1.57	.80	.69	.99	.03	.73	/	100								
	132+50	Median	0.9	5.4	.46	2.26		2.26	.0032	.0360	0.23	6.26	Too Wide Add Scupper [illegible] 34+10																						
	134+10	Median	0.9	5.4	.33	1.62	.01	1.63	.002	.0360	0.18	5.1	2.85	0.10	.35			0.083	.045	7.8	0.56	.237	.81	.28	1.56	.07	96								
							.07																												
	132+50	Median	0.9	5.4	.12	.61	.07	.68	0.0032	.0360	0.14	4.0	1.15	.06	.07			.083	.027	2.2	.568	.59	.72	.05	.16	.02	97								

Revised July, 1999

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

1103-1

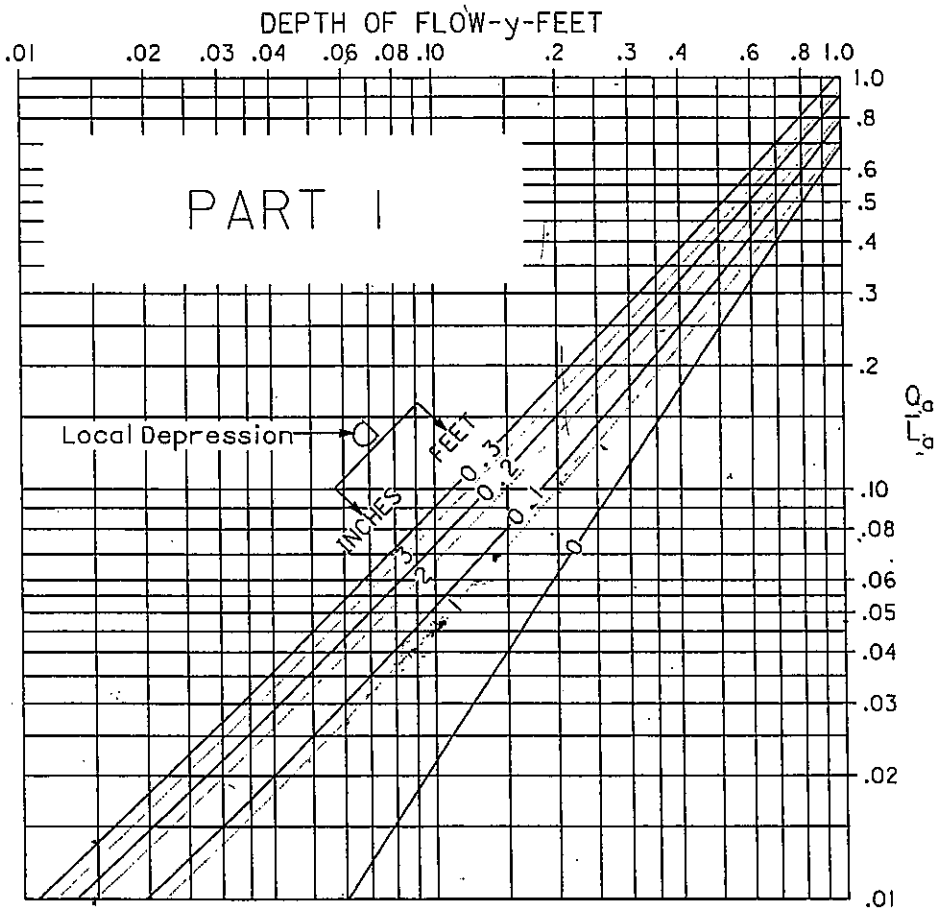
REFERENCE SECTION
1103.4



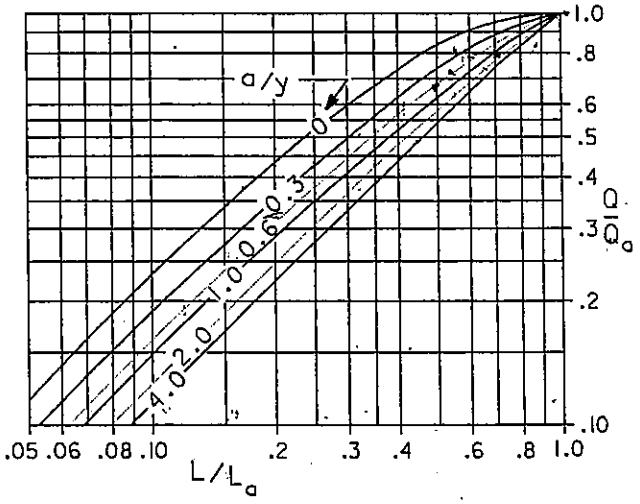
CAPACITY OF CURB OPENING INLETS ON CONTINUOUS GRADE

1103-2

REFERENCE SECTION
1103.6



PART 2



Worksheet for 5sp-LT_LT-Brdg_Lil-Scio-Scpprs Alternative 1

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	1.29	ft³/s
Gutter Width	9.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	6.37	ft
Flow Area	0.81	ft²
Depth	0.25	ft
Gutter Depression	0.00	ft
Velocity	1.59	ft/s

Messages

Notes

Q=CiA
Q=0.9*5.4*(11*1050/43560)
Q=1.29cfs

Shoulder width 9.5'. Spread equals 6.4'. Therefore no scupper required on left outside shoulder.

Worksheet for 5sp-RT_LT-Brdg_Lil-Scio-Scpprs Alternative 1

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	3.70	ft³/s
Gutter Width	6.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	10.10	ft
Flow Area	1.84	ft²
Depth	0.36	ft
Gutter Depression	0.00	ft
Velocity	2.01	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(1000*33/43560)
Q=3.7cfs s=0.0028'/'
At full length of bridge plus approach slabs and transition curb,
spread equals 10.1 feet. Exceeds shoulder, use scuppers.

Solve for 6' width or less. Check spread at 712' of length. Sta.133+88
Q=CiA Q=0.9*5.4*(712*33/43560)
Q=2.6cfs s=0.0200'/' Spread = 6.14', too much.

Solve for 6' width or less. Check spread at 388' of length. Sta.137+12
Q=CiA Q=0.9*5.4*(388*33/43560)
Q=1.43cfs s=0.0372'/' Spread = 4.4'. OK. Check 133+88

Sta.133+88
Q=CiA Q=0.9*5.4*(324*33/43560)
Q=1.12cfs s=0.0200'/' Spread = 4.6'
OK check at
end of bridge.

130+50
Q=CiA Q=0.9*5.4*(338*33/43560)
Q=1.24cfs s=0.0028'/' Spread = 6.7'
Too much add scupper at Sta. 133+46.Take out scupper at 133+88

133+46
Q=CiA Q=0.9*5.4*(366*33/43560)

Worksheet for 5sp-RT_LT-Brdg_Lil-Scio-Scpprs Alternative 1

Messages

Q=1.34cfs s=0.0172'/' Spread = 4.9'
Spread OK.Check spread at Sta.
130+50

Worksheet for 5sp-LT_RT-Brdg_Lil-Scio-Scpprs Alternative 1

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	0.61	ft^3/s
Gutter Width	5.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	4.81	ft
Flow Area	0.46	ft^2
Depth	0.19	ft
Gutter Depression	0.00	ft
Velocity	1.32	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(1000*5.5/43560)
Q=0.61cfs s=0.0028'/'
Solve for 5.5' or less. 4.82' of spread.
No Scupper needed.

Worksheet for 5sp-RT_RT-Brdg_Lil-Scio-Scpprs Alternative 1

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	4.41	ft^3/s
Gutter Width	12.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	10.79	ft
Flow Area	2.10	ft^2
Depth	0.39	ft
Gutter Depression	0.00	ft
Velocity	2.10	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*
(1000*39.5/43560) Q=4.41cfs
s=0.0028
Spread = 10.8'. No scuppers
needed.

Worksheet for 3sp-LT_LT-Brdg_Lil-Scio-Scpprs Alternative 2

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	1.26	ft³/s
Gutter Width	9.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	6.32	ft
Flow Area	0.80	ft²
Depth	0.25	ft
Gutter Depression	0.00	ft
Velocity	1.58	ft/s

Messages

Notes

Q=CiA
Q=0.9*5.4*(11*1000/43560)
Q=1.26cfs

Shoulder width 9.5'. Spread equals 6.33'. Therefore no scupper required on left outside shoulder.

Worksheet for 3sp-RT_LT-Brdg_Lil-Scio-Scpprs Alternative 2

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	3.50	ft^3/s
Gutter Width	6.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	9.90	ft
Flow Area	1.76	ft^2
Depth	0.36	ft
Gutter Depression	0.00	ft
Velocity	1.99	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(1000*33/43560)
Q=3.5cfs s=0.0028'/'
At full length of bridgeplus approach slabs and transition curb,
spread equals 9.9 feet. Exceeds shoulder, use scuppers.

Solve for scupper location as per beam layout. Check spread at 450' of length. Sta.136+75
Q=CiA Q=0.9*5.4*(450*33/43560)
Q=1.66cfs s=0.0360'/' Spread = 4.6', Qbypass=.05cfs

Check spread at Sta.133+75
Q=CiA Q=0.9*5.4*(300*33/43560)
Q=1.17cfs s=0.0200'/' Spread = 4.54', Qbypass=0.04cfs

Solve for spread at end of bridge.
Sta. 130+75
Q=CiA Q=0.9*5.4*(300*33/43560)
Q=1.17cfs s=0.0036'/' Spread = 6.2', Too much add scupper at Sta. 132+05

Solve for spread at end of bridge.
Sta. 130+75
Q=CiA Q=0.9*5.4*(300*33/43560)
Q=1.17cfs s=0.0036'/' Spread = 6.2', Too much add scupper at Sta. 132+05

Worksheet for 3sp-RT_LT-Brdg_Lil-Scio-Scpprs Alternative 2

Messages

Worksheet for 3sp-LT_RT-Brdg_Lil-Scio-Scpprs Alternative 2

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	0.61	ft³/s
Gutter Width	5.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	4.81	ft
Flow Area	0.46	ft²
Depth	0.19	ft
Gutter Depression	0.00	ft
Velocity	1.32	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(1000*5.5/43560)
Q=0.61cfs s=0.0028'/'
Solve for 5.5' or less. 4.82' of spread.
No Scupper needed.

Worksheet for 3sp-RT_RT-Brdg_Lil-Scio-Scpprs Alternative 2

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	4.41	ft³/s
Gutter Width	12.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	10.79	ft
Flow Area	2.10	ft²
Depth	0.39	ft
Gutter Depression	0.00	ft
Velocity	2.10	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*
(1000*39.5/43560) Q=4.41cfs
s=0.0028
Spread = 10.8'. No scuppers
needed.

Worksheet for Ret Wall 3sp-RT_LT-Brdg_Lil-Scio-Scpprs Alternative 3

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	3.40	ft^3/s
Gutter Width	6.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	9.79	ft
Flow Area	1.72	ft^2
Depth	0.35	ft
Gutter Depression	0.00	ft
Velocity	1.97	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(920*33/43560)
Q=3.4cfs s=0.0028'/'
At full length of bridgeplus approach slabs and transition curb,
spread equals 9.8 feet. Exceeds shoulder, use scuppers.

Solve for scupper location as per beam layout. Check spread at Sta.138+50
Q=CiA Q=0.9*5.4*(300*33/43560)
Q=.95cfs s=0.0452'/' Spread = 3.6', Qbypass=.01cfs

Check spread at Sta.132+50
Q=CiA Q=0.9*5.4*(600*33/43560)
Q=2.29cfs s=0.0132'/' Spread = 6.26', Too wide put scupper at Sta. 134+10

Sta. 134+10
Q=CiA Q=0.9*5.4*(440*34/43560)
+.01 Q=1.63cfs s=0.0212'/' Spread = 5.1', 96% capture.
Qbypass=0.07cfs
Add Scupper at Sta. 132+50

Sta. 132+50
Q=CiA Q=0.9*5.4*(160*34/43560)
+.07 Q=0.68cfs s=0.0132'/' Spread = 5.1', 96% capture.
Qbypass=0.07cfs

Worksheet for Ret Wall 3sp-LT_LT-Brdg_Lil-Scio-Scpprs Alternative 3

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	1.17	ft^3/s
Gutter Width	9.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	6.14	ft
Flow Area	0.75	ft^2
Depth	0.25	ft
Gutter Depression	0.00	ft
Velocity	1.55	ft/s

Messages

Notes

Q=CiA
Q=0.9*5.4*(11*950/43560)
Q=1.17cfs

Shoulder width 9.5'. Spread equals 6.15'. Therefore no scupper required on left outside shoulder.

Worksheet for Ret Wall 3sp-LT_RT-Brdg_Lil-Scio-Scpprs Alternative 3

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	0.56	ft^3/s
Gutter Width	5.50	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	4.66	ft
Flow Area	0.43	ft^2
Depth	0.19	ft
Gutter Depression	0.00	ft
Velocity	1.29	ft/s

Messages

Notes

Q=CiA Q=0.9*5.4*(920*5.5/43560)
Q=0.56cfs s=0.0028'/'
Solve for 5.5' or less. 4.7' of spread.
No Scupper needed.

Worksheet for Ret Wall 3sp-RT_RT-Brdg_Lil-Scio-Scpprs Alternative 3

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00280	ft/ft
Discharge	4.05	ft^3/s
Gutter Width	12.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.04	ft/ft
Roughness Coefficient	0.015	

Results

Spread	10.45	ft
Flow Area	1.97	ft^2
Depth	0.38	ft
Gutter Depression	0.00	ft
Velocity	2.06	ft/s

Messages

Notes	Q=CiA Q=0.9*5.4*(920*39.5/43560) Q=4.05cfs s=0.0028 Spread = 10.5'. No scuppers needed.