TranSystems

SCI-823-0.00 PID 77366

SR 823 over CSXT Railroad

Ohio Department of Transportation
District 9
November 20, 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 a new overpass structure that will carry proposed S.R. 823 bypass over 3 CSX tracks and a service road. As requested by the Scope of Services, a Bridge Type Study report is to be submitted before any plan development. The purpose of this report is to investigate various span arrangements and superstructure and substructure types in order to determine the most appropriate and economical structure type that will meet the project requirements. An initial Bridge Type Study report dated 7/15/2005 was submitted to the Department and comments, dated 9/26/2005, were in turn received by TranSystems. However, since these dates, the entire project has experienced a change in profile and the median width has been reduced. This follow-up Bridge Type Study presents the results of these changes as well as investigation of comments in accordance with the 9/26/2005 ODOT comments. As a result, we have made revisions to the preferred alternative from the 7/15/2005 study. The revised alternative is evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, constructability and maintenance of traffic. Discussion of these alternatives is presented later in this report.

## 2. Design Criteria

The proposed structure will be designed according to the most current version of the Ohio Department of Transportation Bridge Design Manual (BDM) 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 (L&D), Volume One – Roadway Design. Additional railroad clearances are from the *CSX Criteria for Overhead Bridges* dated 10/1/99

## 3. Subsurface Conditions and Foundation Recommendation

DLZ Ohio, Inc. performed the subsurface exploration for the proposed bridge and prepared the Preliminary Bridge Foundation Recommendations. Please reference Appendix D for additional geotechnical information.

In summary, four test borings (TR-39, TR-40, TR-41, and TR-42) were drilled and all of them encountered sandstone bedrock between 90 and 93 feet below the existing ground surface. Beneath the topsoil, generally cohesive soil (sandy silt and clay) were encountered to top of bedrock with intermittent layers of granular soil.

Based on the alternatives considered for this study, it is recommended that driven H-piles, CIP piles or drilled shafts to rock will be best suited foundation types for the support of the proposed structure. For the purpose of this study the substructures were assumed to be founded on friction type H-piles. It is also recommended that if piles are selected in the TS&L stage, special driving techniques may be required due to the large embankment, compressible soils to try to avoid having high down-drag forces that could significantly reduce the load-carrying capacity of the piles. Additional information regarding the calculated settlement and time rate of consolidation are included in the previously submitted DLZ report for the Highland Bend Embankments, dated June 8, 2006. If required, H-piles bearing or socketed into bedrock may be considered pending the preliminary design of the recommended structure in the TS&L stage. HP14x73 friction type piles with a maximum design load of 95 tons are assumed for this Bridge Type Study.

The stability of the spill through slopes has also been investigated by DLZ in their report dated August 25, 2006. The analysis indicates that 2:1 slopes will have adequate factors of safety for stability. The analysis also indicates

that settlement is a concern in this area. Wick drains are recommended for use at this location to accelerate the consolidation. Additional information regarding wick drain construction is available in the DLZ report for the Highland Bend Embankments dated June 8, 2006.

## 4. Roadway

The purpose of this project is to construct a new bypass state route around the town of Portsmouth, Ohio. The proposed alignment will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with US 52 just east of Portsmouth to another interchange with US 23, located north of Portsmouth in Valley Township. For the proposed mainline structure over CSX 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 construction of S.R. 823. Noise Barriers are required on the structures in compliance with the noise analysis and environmental documentation.

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

**Vertical and Horizontal Clearances** – Since the proposed vertical alignment for all overpass structures on this project was dictated by the overall design of the new bypass profile, vertical clearance was not a critical design issue for each alternative proposed herein. CSXT standard clearances for overhead structures are as obtained form the *CSX Criteria for Overhead Bridges* dated 10/1/99:

(1) a minimum vertical clearance of 23'-0" from top of high rail to lowest point of overhead structure in the horizontal clearance area (6' to either side); and,

(2) a horizontal clearance of 25'-0" measured perpendicular from centerline of track to face of pier or abutment (or wall). This 25'-0" distance applies to railroad tracks with ditches.

More than 23'-0" of vertical clearance is provided for all the alternatives considered in this study and the 25'-0" horizontal clearance described above is provided for each alternative as well.

Horizontal clearance of 10' was maintained between the existing service road and the proposed pier to allow for drainage and construction clearance.

**Alignment & Profile:** The proposed horizontal geometry of S.R. 823 is along a tangent alignment across the length of structure. The cross section has a normal crown with a pavement cross slope of 0.016ft/ft carried across the outside shoulder and a median shoulder slope of 0.040ft/ft. The proposed profile grade line is located at the inside edge of pavement which is 7'-6" from the centerline of survey and construction S.R. 823. The profile of S.R. 823 is along a constant sloping grade of -4.10%.

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

A drainage ditch will be required along the toe of the roadway embankment where it intersects the railroad embankment. Details of the ditch will be included in the TS&L submittal and in the railroad coordination package.

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

**Maintenance of Traffic** - Rail traffic will be maintained on the tracks while the new bridge is under construction. It is anticipated that there will be no track closures during construction of the new structure. Some disruptions to the service road traffic may be required during pier construction.

## 5. Proposed Structure Configurations

**Structure:** As per the Scope of Services, we investigated several bridge types and alternatives as part of this type study. Alternatives that were investigated but not advanced for additional consideration are discussed in the alternatives discussion below.

A preliminary bridge construction cost has been prepared for the revised alternative (See Appendix A). The unit prices were based on ODOT's Summary of Contracts Awarded Year 2004 inflated 3.5% each year to the 2008 sale date, unless different unit prices were recommended by ODOT in September 2005. Maintenance costs such as painting, overlays and re-decking were included for each Alternative.

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

| STRUCTURE TYPE ALTERNATIVE TABLE | |
|---|---|
| Structure Type Alternative | 1 |
| Superstructure Type Description | 74" continuous steel plate girder A709 Grade 50W |
| Proposed Beam Spacing | 4 Spaces @ 9'-6" |
| No. of Spans | 3 (140'-195'-140') |
| Abutment Type | Stub with 2:1 spill-through slopes (Conventional Jointed Type) |
| No. of Piers | 2 |
| Pier Type | T-Type Pier |
| Substructure Orientation | 38°00'00" RF |
| Approximate Bridge Length | 475' |
| Approximate Structure Depth<br>Slab<br>Haunch<br>Beam<br><br>Total | <br>8.75"<br>2"<br>74"<br><br>84.75" (7.063') |

**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 three tracks and parallel service road dictated the length of the middle span and end spans lengths set by the 2:1 spill through slopes. We have also evaluated comments received on the initial type study in the following paragraphs.

We have investigated placing a pier in between the tracks and presented this option to URS (CSX's designated reviewer) and they indicated that a pier placed in between the tracks was not an acceptable option. This option was investigated in response to the review comments received on 9/26/05 to open the possibility of using a prestressed girder.

In lieu of a pier in between the tracks, a solution using a concrete superstructure would require the use of post tensioned spliced girders to attain the required span over the tracks. The location of the main tracks is under the splices, at the points of dead load contraflexure, where a temporary bent would typically be placed. The temporary bents over the tracks could likely be eliminated by using strong back splices however the length of the center drop in segment would be approximately 115' to be placed 50'-60' over 3 active tracks. Preliminary construction costs estimates used $125/sf (2008 dollars) to estimate the cost of the post tensioned superstructure and found it to be $2.2 million greater than the steel superstructure. It

was recognized that the $2.2 million increase in initial construction cost was less than the estimated maintenance cost for painting the steel beams; thus, resulting in lower total ownership costs. However, preliminary discussions with OSE staff did not indicate a post tensioned spliced girder would be considered at this location for final design.

We have also investigated relocating the service road that parallels the toe of the railroad embankment. The relocation was investigated in response to the 9/26/05 comments regarding the original type study as an option to reduce the bridge length. The alignments investigated used the existing minimum horizontal clearance (17'± EOP to rail) that occurs west of the structures. The proposed re-alignments also maintained an intersection with Slocum Avenue to the east of the proposed structures. Approximately 80' south of the intersection there is a structure carrying the tracks over Slocum Ave. The existing intersection is at the toe of the 30' tall embankment constructed for the grade separation. Combinations of horizontal alignment and vertical profile that maximized the potential structure savings yielded 2:1 cuts into the railroad embankment that undercut the rails and had steep grades along the service road in excess of 9%. The typical fill section given in the CSX *Criteria for Overhead Bridges* indicates that the sub ballast extends 15' to either side of the CL track so the cuts into this area were considered unacceptable. An alignment and profile with minimal cuts and suitable grades was developed. However, the alignment did not provide for any reduction of the structure length due to some key points on the alignment not improving the clearance. Additional drawings can be provided upon request.

***Alternative 1***

**Span configuration:** This three-span alternative consists of a 140'-0", 195'-0", 140'-0" span, for an overall bridge length of 475'-0" from centerline bearings at abutments. This span arrangement allows for the use of stub abutments and meets the horizontal clearances required at the piers. The spill through slope at the rear span allows for the 2' deep standard ditch as shown in CSX's design criteria. The location of the toe of spill through slope is approximately in the location recommended in the 9/26/05 comments. The spill through slope at the rear span will place fill up against the wingwall of a railroad bridge over the abandoned tracks. Similarly, the grading at the forward span allows for a minimal swale adjacent to the service road. Due to the height of the embankments the pier locations and the toe of the embankment are not the same to provide for more balanced span lengths. The abutments and piers are oriented with a 38°00'00" skew parallel to tracks 1 and 2.

**Substructure:**

I. *Abutments:* The abutments will be conventional or stub type due to the length of the structure being greater than 400', in accordance with the BDM. The abutment will be founded on HP14x73 friction piles. Spill-through slopes will be used to provide the embankment for the approach roadways. The details of the abutments will follow ODOT Standard Construction drawings.

I. *Pier:* The piers will be T-type supported on pile foundations. The recommendation of a T-type pier is consistent with Section 204.5 of the BDM for use at railroads. Additionally the wide stem of a T-type pier is useful to minimize/eliminate slenderness effects anticipated for the 60' & 65' tall piers. It is recommended that one of the piers be a fixed design (i.e. fixed bearings) and designed to resolve reactions associated with constructing the structure on a 4.10% grade. Discussions with OSE staff indicated that it is also important to check the superstructure to substructure connection and that it may be a weak point. We have investigated the horizontal force due to the self weight of the structure and found that it will

add considerably to the longitudinal design forces at the fixed pier. The analysis used supports with stiffness in the longitudinal direction equivalent to preliminary bearing/substructure stiffness. It is recommended that the final design calculate and account for the force in a similar manner.

**Superstructure:** The superstructure for both the left and right bridge of this alternative consists of 5-continuous welded steel plate girders, Grade 50W, with 74" deep webs. The girders were spaced at 9'-6", with 3'-6" overhangs to satisfy the HS-25 (Case I), Alternate Military and 60psf future wearing surface loads. The differential deflections due to the total slab weight were investigated in accordance with Section 302.2.7 of the BDM. The preliminary analysis indicates that a girder design that satisfies the strength requirements has adequate stiffness to limit the differential deflections to the ½" tolerance. The preliminary analysis only considered the weight of the concrete applied to the whole structure and not the pour sequence. It is recommended that the pour sequence also be given consideration in the final girder design. Hybrid girders were not considered due to the stiffness requirements. Expansion devices will be per standard drawing EXJ-4-87. 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 8 3/4".

The initial bridge construction cost for Alternative 1 is estimated to be $6,340,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $4,797,000, resulting in a total estimated ownership cost of $11,137,000 in year 2008 dollars.

## 6. Recommendations:

Based upon the above information and discussions, we recommend **Structure Type Alternative 1**, which consists of 3-span 74" deep Grade 50W plate girders, supported by T-Type Piers and stub abutments on 2:1 spill through slopes. (See Appendix B for the Site Plan and Structure Details).

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

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

b. Lowest life cycle costs.

c. Lowest total ownership costs.

# APPENDIX A

## Cost Summary

TranSystems

# SCI-823-0.00 - PORTSMOUTH BYPASS

## S.R. 823 over CSXT

### STRUCTURE TYPE STUDY

By: PJP Date: 11/10/2006
Checked: JRC Date: 11/20/2006

## 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 Const. Cost | Life Cycle Maintenance Cost | Total Relative Ownership Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 140'-0" - 195'-0" - 140'-0" | 475.00 | 5 Steel Girders /per BRIDGE | 74" Web Grade 50W | $3,194,000 | $1,357,000 | $728,200 | $1,055,800 | $6,340,000 | $4,797,000 | $11,137,000 |

**NOTES:**

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

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

# SCI-823-0.00 - PORTSMOUTH BYPASS

## S.R. 823 over CSXT

### STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUPERSTRUCTURE

By: PJP Date: 11/10/2006
Checked: JRC Date: 11/20/2006

## 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** | 3 | 140'-0" - 195'-0" - 140'-0" | 475.00 | 477.00 | 1593 | $955,900 | $399,600 | $113,400 | $0 | 5 Steel Girders /per BRIDGE | 74" Web Grade 50W | 1482000 | $1,725,300 | $78,400 | **$3,194,000** |

## 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 | 0.73 | 44.96 | 32.8 | 3.3 | 45.1 |
| Right Bridge | 0.73 | 44.96 | 32.8 | 3.3 | 45.1 |

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

**Structural Steel Unit Costs ($/lb.):**

| | Cost Ratio | Year 2005 | Annual Escalation | Year 2008 | |
|---|---|---|---|---|---|
| Rolled Beams - Grade 50 | n/a | $0.95 | 3.5% | $1.09 | |
| Level 4 Plate Girders - Grade 50W | n/a | $1.05 | 3.5% | $1.16 | Straight Girders |
| Level 4 Plate Girders - Grade 70W | n/a | $1.20 | 3.5% | $1.38 | Straight Girders |

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

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Deck | $491.00 | 3.5% | $563.00 |
| Parapets | $651.00 | 3.5% | $747.00 |
| Weighted Average = | | | $600.00 |

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 |

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

**Reinforced Concrete Approach Slabs (T=17")**
**Unit Cost ($/sq. yd.):**

Length = 30 ft. Width = 90 ft
Area = 600 sq. yd.

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

**Approach Roadway**

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

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

| | Cost Ratio | Year 2005 | Annual Escalation | Year 2008 |
|---|---|---|---|---|
| Strip Seal Expansion Joints | 1.00 | $310.00 | 3.5% | $343.70 |

Strip Seal Expansion Joints Length 57 ft.

# SCI-823-0.00 - PORTSMOUTH BYPASS

## S.R. 823 over CSXT

### STRUCTURE TYPE STUDY - STEEL PLATE GIRDER ALTERNATIVE 1 - SUBSTRUCTURE

By: PJP
Checked: JRC

Date: 11/10/2006
Date: 11/20/2006

## SUBSTRUCTURE

| Alternative No. | Span Arrangement No. Spans | Lengths | Framing Alternative | Proposed Stringer Section | Pier Concrete Cost | Pier Reinforcing Cost | Abutment Concrete Cost | Abutment Reinforcing Cost | Pile Foundation Cost | MSE Wall Cost | Additional Crane Cost | Subtotal Substructure Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 140'-0" - 195'-0" - 140'-0" | 5 Steel Girders /per BRIDGE | 74" Web Grade 50W | $406,700 | $92,600 | $216,900 | $35,600 | $605,300 | $0 | $0 | **$1,357,000** |

### 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 | 194 | $421.00 | 3.5% | $483.00 | $93,700 |
| Stem | 426 | $421.00 | 3.5% | $483.00 | $205,760 |
| Footings | 222 | $421.00 | 3.5% | $483.00 | $107,230 |
| Total | 842 | | | | $406,700 |

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

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

**Abutment QC/QA Concrete, Class QSC1 Cost:**

| Component | Volume (cu. yd.) | Year 2004 | Annual Escalation | Year 2008 | Total Cost |
|---|---|---|---|---|---|
| Abutment | 390 | $421.00 | 3.5% | $483.00 | $188,400 |
| Wingwalls | 59 | $421.00 | 3.5% | $483.00 | $28,500 |

Note: 15% of abutment volume allowed for wingwalls.

**Epoxy Coated Reinforcing Steel Unit Cost ($/lb):**

Assume 125 lbs of reinforcing steel per cubic yard of pier concrete.
Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.

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

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

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

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

| | Number of Piles | | Total Pile Length |
|---|---|---|---|
| Alt. 1 | 176 | SEE QUANTITY CALCULATIONS | 17,960 |

**Pile Foundation Unit Cost ($/ft.):**

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

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

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

**Shaft Foundation Unit Cost ($/ft.):**

| Unit Cost | Escalation | 2008 |
|---|---|---|
| $125.00 | 4.5% | $149.00 |

**Cost of Shafts:** $ -

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

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

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

**Additional Crane Cost**

$ -

# SCI-823-0.00 - PORTSMOUTH BYPASS

## S.R. 823 over CSXT

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

By: PJP
Checked: JRC

Date: 11/10/2006
Date: 11/20/2006

**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) | 52 | 3 | 8.4 | 25.20 | 1310 | 3 | 44 | 20.00 | 2640 | 15 | 4 | 25.00 | 1500 | 5450 |
| Pier 2 (Pile) | 52 | 3 | 8.4 | 25.20 | 1310 | 3 | 52 | 20.00 | 3120 | 15 | 4 | 25.00 | 1500 | 5930 |
| Pier 3 | | | | | | | | | | | | | | 0 |
| Pier 4 | | | | | | | | | | | | | | 0 |
| Pier 5 | | | | | | | | | | | | | | 0 |
| Pier 6 | | | | | | | | | | | | | | 0 |
| Pier 7 | | | | | | | | | | | | | | 0 |
| **Total (Cu.Ft.)** | | | | | **2621** | | | | **5760** | | | | **3000** | **11381** |
| **Total (Cu.Yd.)** | | | | | **97** | | | | **213** | | | | **111** | **422** |
| | | | **Qty x 2 (L/R)** | | **194** | | | | **426** | | | | **222** | **844** |

**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 | 57 | 1.75 | 7.8125 | 13.67 | 779 | 3.75 | 3.25 | 12.19 | 695 | 6.25 | 3.25 | 20.313 | 1 | 1158 | 2632 |
| Fwd. Abut | 57 | 1.75 | 7.8125 | 13.67 | 779 | 3.75 | 3.25 | 12.19 | 695 | 6.25 | 3.25 | 20.313 | 1 | 1158 | 2632 |
| **Total (Cu.Ft.)** | | | | | **1559** | | | | **1389** | | | | | **2316** | **5264** |
| **Total (Cu.Yd.)** | | | | | **58** | | | | **51** | | | | | **86** | **195** |
| | | | **Qty x 2 (L/R)** | | **116** | | | | **102** | | | | | **172** | **390** |

**MSE Abutment Wall Quantities**

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

**Pile Quantities**

| Location | Load/girder (Kips) | # Girders | Total Girder Load | Subst Wt (kips) | Pile Cap.(Kips) | No. Piles | Increase Factor | Total Piles | Top Elev. | Bot Elev. | Pile Length | Total Pile Length (Feet) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rear Abut. | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *20* | 637.6 | 492.0 | 150.0 | *3000* |
| Pier 1 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *24* | 582.5 | 505 | 80.0 | *1920* |
| Pier 2 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *24* | 566 | 505 | 65.0 | *1560* |
| Pier 3 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *0* | 0 | 0 | 0.0 | *0* |
| Pier 4 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *0* | 0 | 0 | 0.0 | *0* |
| Pier 5 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *0* | 0 | 0 | 0.0 | *0* |
| Pier 6 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *0* | 0 | 0 | 0.0 | *0* |
| Pier 7 | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *0* | 0 | 0 | 0.0 | *0* |
| Fwd. Abut. | 0 | 0 | 0 | 0 | 140 | 0 | 1 | *20* | 618.05 | 495 | 125.0 | *2500* |
| **Total** | | | | | | | | **88** | | | | **8980** |
| | | | | | | | **Qty x 2 (L/R)** | **176** | | | | **17960** |

**36" Drilled Shafts**

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

**Superstructure Steel Quantities**

| Location | Wt.of girder (lb)/ft | # Girders | Span Length | Total Weight |
|---|---|---|---|---|
| Span 1 | 312 | 10 | 140 | 436800 |
| Span 2 | 312 | 10 | 195 | 608400 |
| Span 3 | 312 | 10 | 140 | 436800 |
| Span 4 | | 0 | 0 | 0 |
| Span 5 | | 0 | 0 | 0 |
| Span 6 | | 0 | 0 | 0 |
| Span 7 | | 0 | 0 | 0 |
| Span 8 | | 0 | 0 | 0 |
| | | | | |
| **Total** | | | 475 | 1482000 |

# SCI-823-0.00 - PORTSMOUTH BYPASS
## S.R. 823 over CSXT
### STRUCTURE TYPE STUDY - LIFE CYCLE COSTS

By: PJP Date: 11/10/2006
Checked: JRC Date: 11/20/2006

## 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 | 3 | 475.00 | 5 Steel Girders /per BRIDGE | $1,352,610 | 2 | $2,705,220 | $0 | 0 | $0 | $0 | 10 | $0 |

| Alt. No. | Span Arrangement No. Spans | Lengths | Framing Alternative | Bridge Deck Overlay (5) Deck Demo & Chipping | Deck Overlay | Deck Joint Gland (2) | Number of Maintenance Cycles | Total Life Cycle Cost | Bridge Redecking (5) Deck Concrete Cost (3) | Deck Reinforcing Cost (3) | Deck Joint Cost (2) | Deck Removal Cost | Number of Maintenance Cycles | Total Life Cycle Cost | Superstructure Life Cycle Maintenance Cost (1) | Total Initial Construction Cost | Total Relative Ownership Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 475 | 5 Steel Girders /per BRIDGE | $129,500 | $157,000 | $17,700 | 1 | $304,200 | $955,900 | $399,600 | $78,400 | $353,600 | 1 | $1,787,500 | **$4,797,000** | **$6,340,000** | **$11,137,000** |

**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 | 74 | 10 | 475.00 | 22.00 | 84,708 | 20% | 101,700 |

Painting Cost per sq. ft.:

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

**Superstructure Sealing:**

PS Concrete I-Beam Area:

*72" Modified AASHTO Type 4*

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

*66" Modified AASHTO Type 4*

| | H | V | Diag. | No. | Total |
|---|---|---|---|---|---|
| Bot. Flange | 26 | | | 1 | 26.00 |
| | | 8 | | 2 | 16.00 |
| Lower Fillets | 9 | 9 | 12.73 | 2 | 25.46 |
| Web | | 40 | | 2 | 80.00 |
| Upper Fillets | 3 | 3 | 4.24 | 2 | 8.49 |
| | 11 | 2 | 11.18 | 2 | 22.36 |
| Top Flange | | 4 | | 2 | 8.00 in. |
| Total Exposed Perimeter | | | | | 186.30 |

| | No. Stringers | Total Span Length (ft.) | Nominal Exposed Beam Area (sq. ft.) | Secondary Member Allowance | Total Exposed Concrete Area (sq. yd.) |
|---|---|---|---|---|---|
| Alt. 2 | 0 | 0.00 | 0 | 10% | 0 |

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 | $310.00 | 3.5% | $343.70 |

| | Bridge Width | No. Joints |
|---|---|---|
| Alt. 1 | 57.00 | 4 |

Bridge Deck Removal Cost:

| | Deck Area (3) (sq. ft.) | Year 2008 | Deck Removal Cost |
|---|---|---|---|
| Alt. 1 | 42,710 | $8.28 | $353,600 |

**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 | 42,710 | 4,746 | 119 | 107 |

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 | $77.50 | 3.5% | $85.93 |

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. Seal Replaced at overlay and complete replacement at re-deck.
3. See Superstructure Cost sheet.
4. See Alternative Cost Summary sheet.
5. Assume bridge deck overlay at Year 25 and bridge deck replacement at Year 50. Assume superstructures are painted or sealed on a 25-year recurrence interval. Assume complete bridge replacement at Year 75.
6. Life cycle maintenance cost differences are assumed to be predominately a function of superstructure maintenance costs. Consequently, substructure lifecycle maintenance costs are not included in this analysis.

**Approach Pavement Resurfacing:**

Resurface Perpetual Asphalt Pavement:

Resurfacing Units Costs:

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

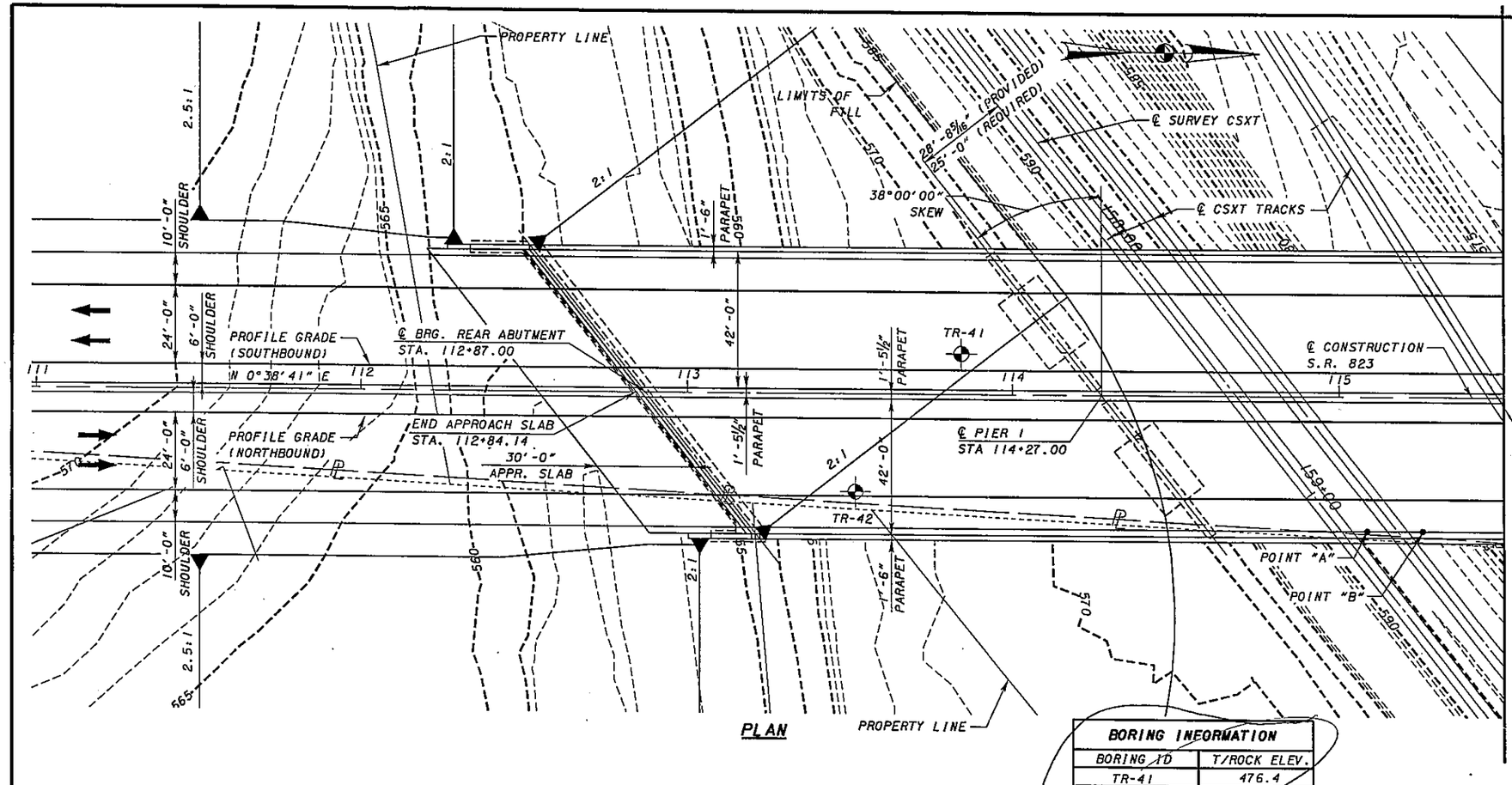
Asphalt Resurfacing Costs:

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

# APPENDIX B

## Preferred Alternative Site Plan and Details

TranSystems



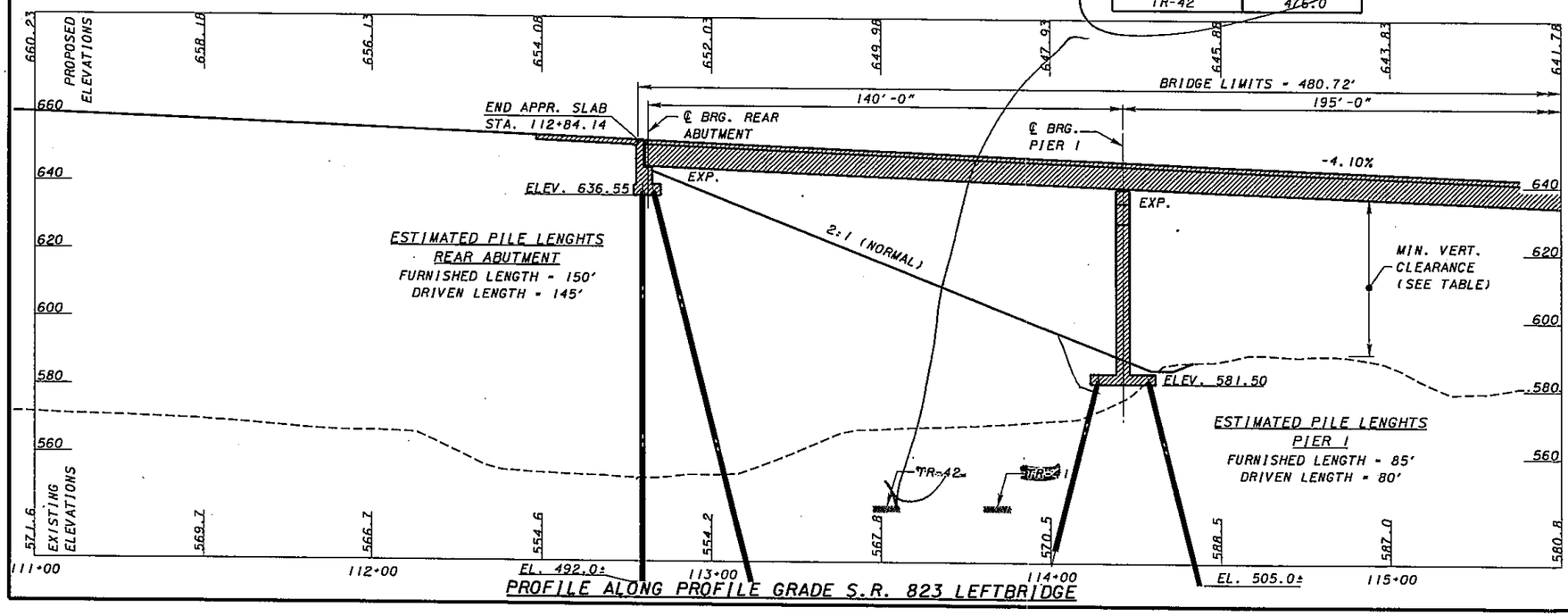

| BORING INFORMATION | |
|---|---|
| BORING ID | T/ROCK ELEV. |
| TR-41 | 476.4 |
| TR-42 | 476.0 |

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

| TABLE OF VERTICAL CLEARANCES | | |
|---|---|---|
| LOCATION | "A" | "B" |
| PROPOSED | 44.69' | 44.15' |
| REQUIRED | 23.0' | 23.0' |

| 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) = 2,968 |
| DESIGN YEAR ADTT (2030) = 4,368 |




**NOTES:**

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

**FOUNDATION DATA:**

ALL NEW PILES SHALL BE HP 14x73 FRICTION PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE.

| PROPOSED STRUCTURE |
|---|
| TYPE: 3 SPAN CONTINUOUS A709 GRADE 50W STEEL PLATE GIRDER WITH COMPOSITE REINFORCED CONCRETE DECK SUPPORTED BY REINFORCED CONCRETE T-TYPE PIERS AND STUB TYPE ABUTMENTS. |
| SPANS: 140'-0" - 195'-0" - 140'-0" C/C BRGS |
| ROADWAY: 2 - 42'-0" T/T OF PARAPETS |
| LOADING: HS-25 (CASE 1) AND ALTERNATE MILITARY LOADING, FUTURE WEARING SURFACE = 60 PSF |
| SKEW: 38°00'00" RF |
| CROWN: 0.016 FT/FT |
| ALIGNMENT: TANGENT |
| WEARING SURFACE: MONOLITHIC CONCRETE |
| APPROACH SLABS: AS-1-81 (30' LONG) |
| LATITUDE: 38°46'06" N |
| LONGITUDE: 82°52'36" W |

DESIGN AGENCY: Tran Systems, 574 COLUMBUS DRIVE, SUITE 140, DUBLIN, OHIO 43017

| DESIGNED | DRAWN | REVISED | CHECKED |
|---|---|---|---|
| PJP | PJP | | MSL |

DATE: 11/20/06
REVIEWED: JRC
STRUCTURE FILE NUMBER

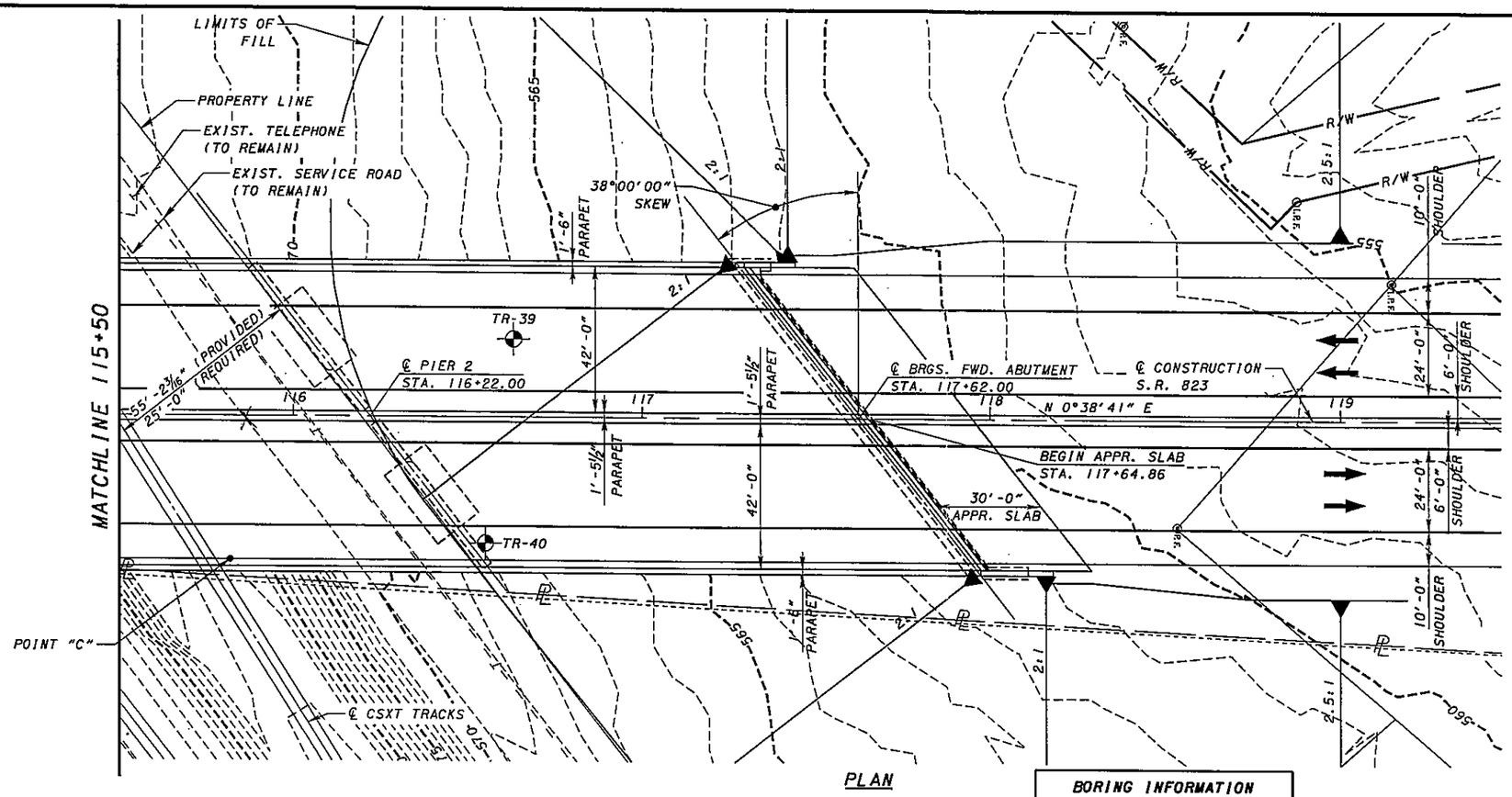
SCIOTO COUNTY
STA. 112+84.14
STA. 117+64.86

# SITE PLAN - ALTERNATIVE 1

BRIDGE NO. SCI-823-0214 L&R
S.R. 823 OVER CSXT RAILROAD

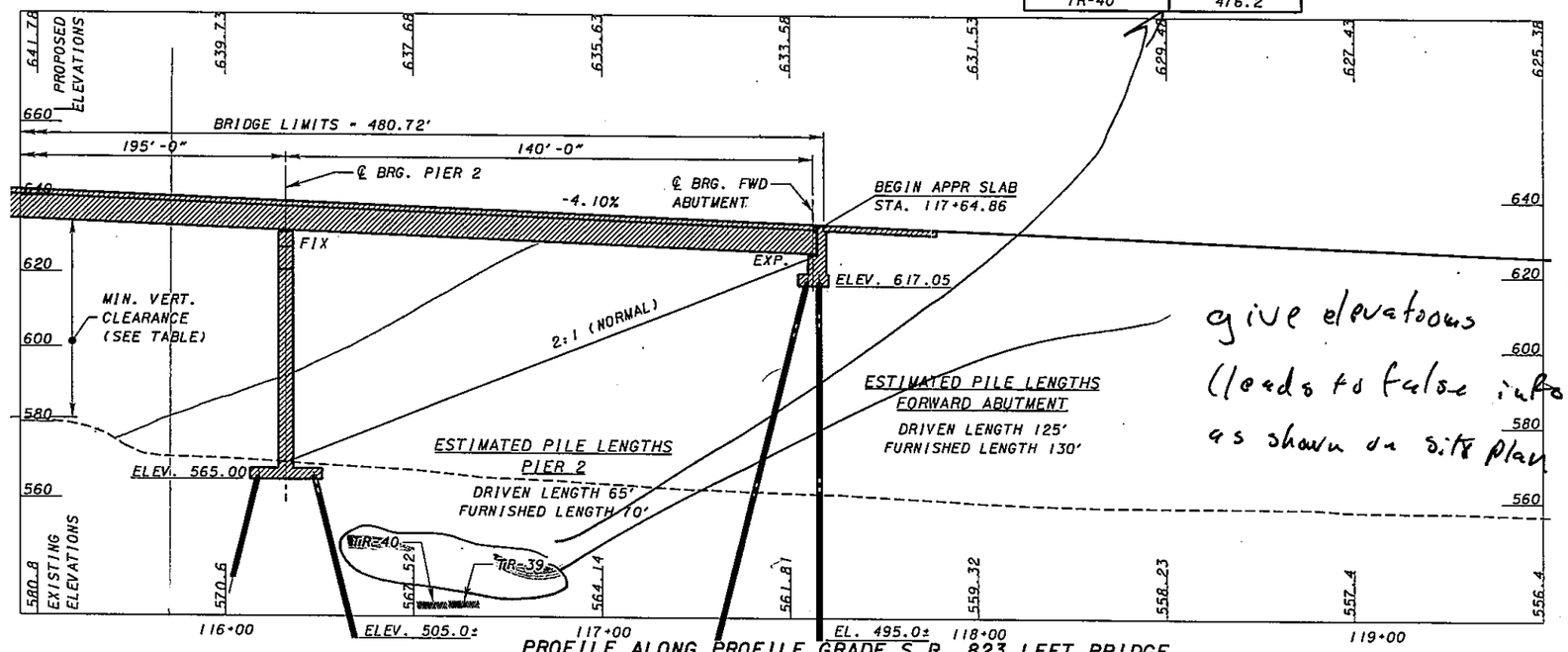
SCI-823-0.00
PID 77366

1 / 4




PLAN

| BORING INFORMATION | |
|---|---|
| BORING ID | T/ROCK ELEV. |
| TR-39 | 474.2 |
| TR-40 | 476.2 |




PROFILE ALONG PROFILE GRADE S.R. 823 LEFT BRIDGE

| TABLE OF VERTICAL CLEARANCES | | |
|---|---|---|
| LOCATION | "C" | |
| PROPOSED | 49.62' | |
| REQUIRED | 23.0' | |

**NOTES:**

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

June 8 2006

64" - 98%

after 95%

Still 5"

embankment stability

Calculate ~~work~~ 60 settlement

~~work~~ 0 Lift

move pier 2 & Road

abut. can go integral/

Semi-integral

give elevations

(leads to false info

as shown on site plan

DESIGN AGENCY: Systems

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| PJP | PJP | JRC | 11/20/06 |
| CHECKED | REVISED | | STRUCTURE FILE NUMBER |
| MSL | | | |

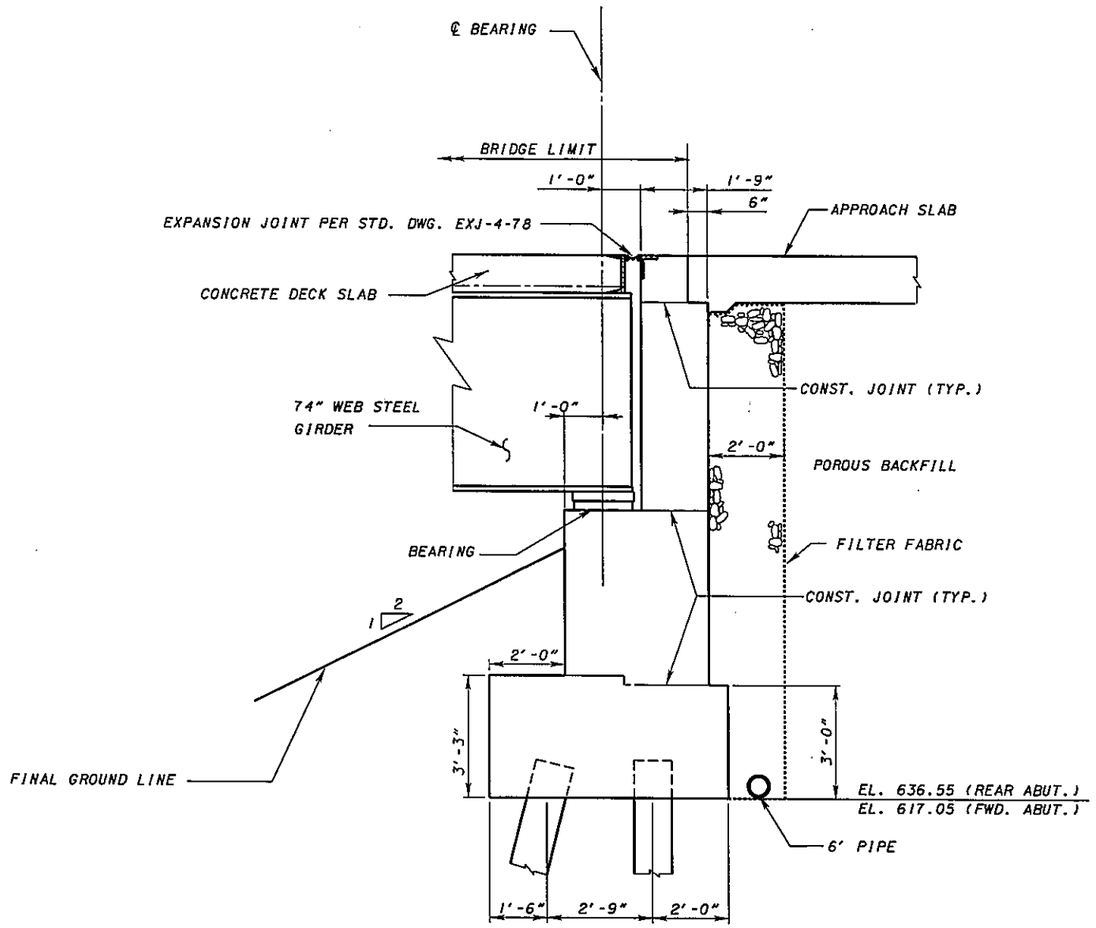
SCIOTO COUNTY
STA. 112+84.14
STA. 117+64.86

SITE PLAN - ALTERNATIVE 1
BRIDGE NO. SCI-823-0214 L&R
S.R. 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 77366

2 | 4

| SUPERSTRUCTURE DEPTH | |
|---|---|
| ITEM | 74" WEB STEEL PLATE GIRDER |
| SLAB (INCLUDING WEARING SURFACE) | 8¾" |
| HAUNCH (BOTTOM OF SLAB TO TOP OF FLANGE) | 2" |
| GIRDER DEPTH | 76" |
| TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (INCH) | 86.75" |
| TOP OF WEARING SURFACE TO BOTTOM OF GIRDER FLANGE (FEET) | 7.229 |




PROPOSED ABUTMENT SECTION

DESIGN AGENCY: Tran Systems, 512 FOUNDERS SQUARE, 900 E. 8TH AVE., KING OF PRUSSIA, PA 19406

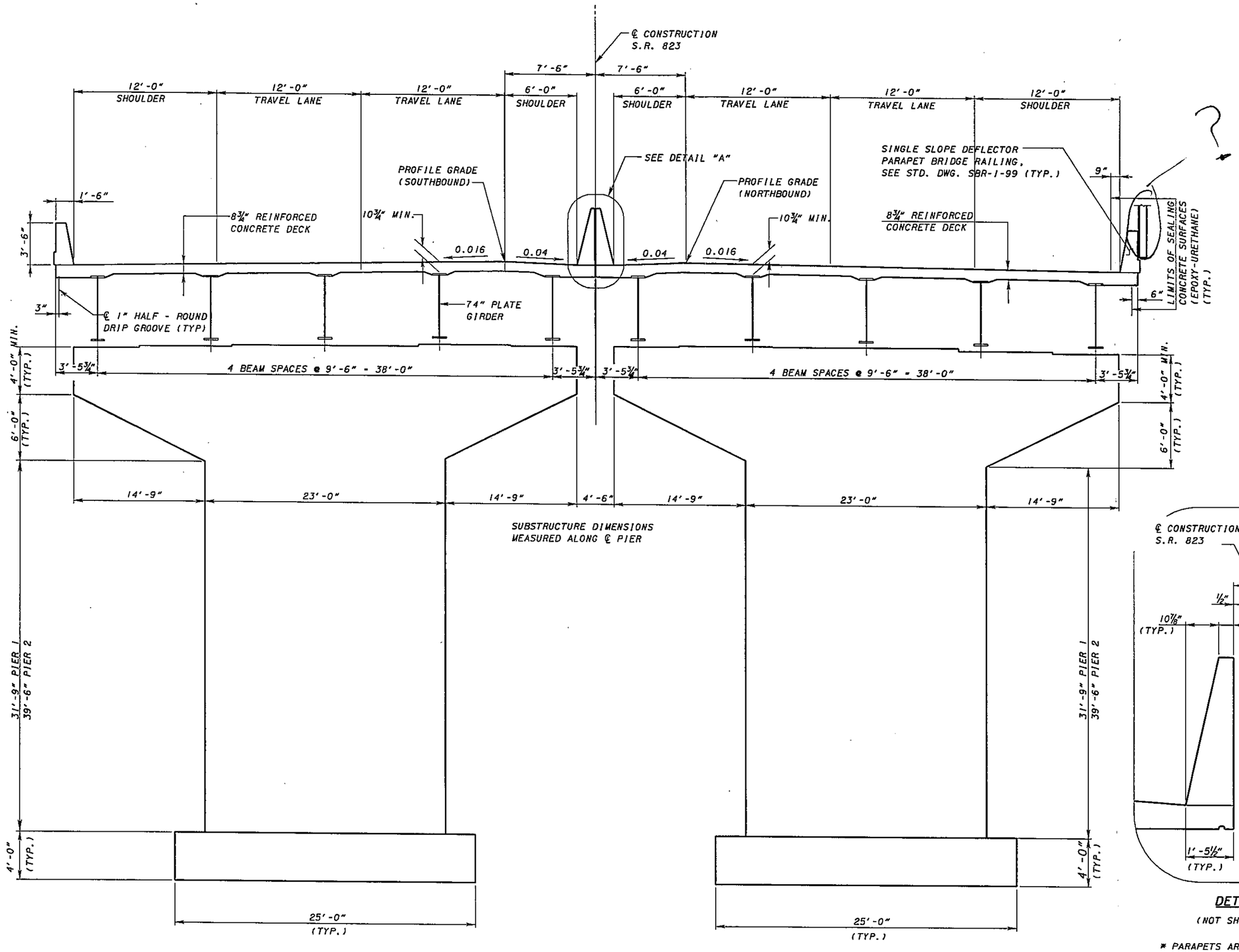
| DESIGNED | DRAWN | REVISED | DATE |
|---|---|---|---|
| PJP | PJP | JRC | 11/20/06 |
| CHECKED | REVISED | | STRUCTURE FILE NUMBER |
| MSL | | | |

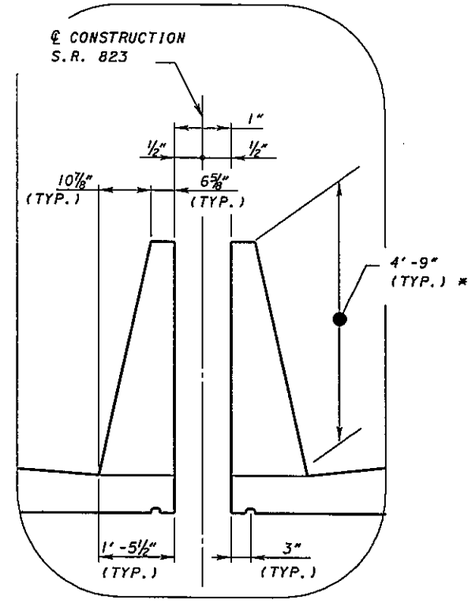
ABUTMENT SECTION - ALTERNATIVE 1

BRIDGE NO. SCI-823-0214 L&R
SR 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 77366

3/4




DETAIL "A"

(NOT SHOWN TO SCALE)

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

DESIGN AGENCY: Trans Systems, 324 POYDRAS STREET, SUITE 140, NEW ORLEANS, LOUISIANA 70130

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| PJP | PJP | JRC | 11/20/06 |
| CHECKED | REVISED | STRUCTURE FILE NUMBER | |
| MSL | | | |

# TRANSVERSE SECTION AND ABUTMENT SECTION

BRIDGE NO. SCI-823-0214 L&R
SR 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 77366

4 / 4

# APPENDIX C

## Vertical Clearance Calculations

TranSystems

TranSystems

Made By PJP Date 11/07/06 Job No. P403030064
Checked By MTN Date 11/20/06 Sheet No.

# VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER CSX PID # 19415

***Alternative 1 - 5-74" Web Steel Plate Girders, Three Span*** | ***Point Location: A***

## *Adjstment for Cross Slope*

| Comment | Grade | | Offset | |
|---|---|---|---|---|
| Profile grade line to critical pt.: | -0.016 | x | 34 | -0.544 |
| | | | Total Adjustment = | **-0.54** |

## *Superstructure Depth*

| Comment | Depth (in) | Depth (ft) |
|---|---|---|
| Deck Thickness: | 8.75 | 0.73 |
| Haunch: | 2 | 0.17 |
| Girder or Beam Depth: | 77.375 | 6.45 |
| | 88.125 | 7.35 |

Total Superstructure Depth (ft) = **7.35**

## *Vertical Clearance at Critical Point*

| | | |
|---|---|---|
| **Station @ Critical Point** | = | **115+08.28** |
| **Offset Location @ Critical Point** | = | **41.5' RIGHT** |
| Profile Grade Elevation at Critical Point | = | 643.49 |
| Adjustment for Cross Slopes to Beam CL | = | -0.54 |
| **Top of Deck Elevation @ Critical Point** | = | **642.95** |
| Total Superstructure Depth | = | -7.35 |
| **Bottom of Beam Elevation @ Critical Point** | = | **635.60** |
| **Approximate Top of Existing Ground @ Critical Point** | = | **590.91** |
| ***Actual Vertical Clearance*** | = | ***44.69*** |
| *Preferred Vertical Clearance* | = | *23.0* |
| *Required Vertical Clearance* | = | *23* |

TranSystems

Made By PJP Date 11/07/06 Job No. P403030064
Checked By MTN Date 11/20/06 Sheet No.

# VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER CSX PID # 19415

***Alternative 1 - 5-74" Web Steel Plate Girders, Three Span*** | ***Point Location: B***

## *Adjstment for Cross Slope*

| Comment | Grade | | Offset | | |
|---|---|---|---|---|---|
| Shoulder: | -0.016 | x | 34 | = | -0.54 |
| | | | Total Adjustment | = | **-0.54** |

## *Superstructure Depth*

| Comment | Depth (in) | Depth (ft) | | |
|---|---|---|---|---|
| Deck Thickness: | 8.75 | 0.73 | | |
| Haunch: | 2 | 0.17 | | |
| Girder or Beam Depth: | 77.375 | 6.45 | | |
| | 88.125 | 7.35 | | |
| | | Total Superstructure Depth (ft) | = | **7.35** |

## *Vertical Clearance at Critical Point*

| | | |
|---|---|---|
| **Station @ Critical Point** | = | **115+25.34** |
| **Offset Location @ Critical Point** | = | **41.5 Rt.** |
| Profile Grade Elevation at Critical Point | = | 642.79 |
| Adjustment for Cross Slopes to Beam CL | = | -0.54 |
| **Top of Deck Elevation @ Critical Point** | = | **642.25** |
| Total Superstructure Depth | = | -7.35 |
| **Bottom of Beam Elevation @ Critical Point** | = | **634.90** |
| **Approximate Top of Existing Ground @ Critical Point** | = | **590.75** |
| ***Actual Vertical Clearance*** | = | ***44.15*** |
| *Preferred Vertical Clearance* | = | *23.0* |
| *Required Vertical Clearance* | = | *23* |

TranSystems

Made By PJP Date 11/07/06 Job No. P403030064
Checked By MTN Date 11/20/06 Sheet No.

# VERTICAL CLEARANCE CALCULATIONS

Job Name SCI-823-0.00 Structure
Description S.R. 823 OVER CSX PID # 19415

**Alternative 1 - 5-74" Web Steel Plate Girders, Three Span** | **Point Location: C**

## Adjstment for Cross Slope

| Comment | Grade | | Offset | | |
|---|---|---|---|---|---|
| Shoulder: | -0.016 | x | 34 | = | -0.54 |
| | | | Total Adjustment | = | **-0.54** |

## Superstructure Depth

| Comment | Depth (in) | Depth (ft) | | |
|---|---|---|---|---|
| Deck Thickness: | 8.75 | 0.73 | | |
| Haunch: | 2 | 0.17 | | |
| Girder or Beam Depth: | 77.375 | 6.45 | | |
| | 88.125 | 7.35 | | |
| | | Total Superstructure Depth (ft) | = | **7.35** |

## Vertical Clearance at Critical Point

| | | |
|---|---|---|
| **Station @ Critical Point** | = | **115+81.73** |
| **Offset Location @ Critical Point** | = | **41.5 Rt.** |
| Profile Grade Elevation at Critical Point | = | 640.48 |
| Adjustment for Cross Slopes to Beam CL | = | -0.54 |
| **Top of Deck Elevation @ Critical Point** | = | **639.94** |
| Total Superstructure Depth | = | -7.35 |
| **Bottom of Beam Elevation @ Critical Point** | = | **632.59** |
| **Approximate Top of Existing Ground @ Critical Point** | = | **582.97** |
| ***Actual Vertical Clearance*** | = | ***49.62*** |
| *Preferred Vertical Clearance* | = | *23.0* |
| *Required Vertical Clearance* | = | *23* |

# APPENDIX D

## Preliminary Geotechnical Report & Spill Through Slope Reccomendations

TranSystems

DLZ

ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

March 25, 2005

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

Re: **SCI-823-0.00 over CSX RR (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 CSX Railroad within the Highland Bend area. It is anticipated that the proposed structure will be a three-span, elevated bridge with embankment fills at both abutments. The existing grade at the proposed new bridge location is relatively flat with an elevation between 569 and 575. The existing CSX Railroad is located on an embankment around elevation 593. It is anticipated that the SCI-823-0.00 mainline will require embankment constructed to approximate heights of 40 to 70 feet. The existing Highland Bend area is located within the Little Scioto River valley with the overburden being primarily composed of glacial and alluvial deposits.

The findings and recommendations presented in this report should be considered preliminary. It is understood that the final number and locations of substructure units have not been determined yet. After the substructure unit locations have been established, the results of the borings should be reviewed to determine if additional exploration is needed to finalize the foundation recommendations for the new structure.

**Field Exploration**

A total of four borings, TR-39 through TR-42, were drilled at the proposed structure between February 2, 2005 and February 22, 2005. The borings were drilled to depths between 112 and 115 feet. The borings were extended into bedrock, which was verified by rock coring. Boring Logs and information concerning the drilling procedures are attached.

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

**Findings**

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

At the ground surface topsoil was encountered at depths of 4 to 9 inches. Beneath the topsoil, generally cohesive soils were encountered to top of bedrock with intermittent layers of granular soil. The cohesive soils encountered ranged from sandy silt (A-4a) to clay (A-7-6), and were generally stiff to hard. The granular soils ranged from sandy silt (A-4a) to fine sand (A-3). The granular soils were generally loose to dense. Generally, the granular layers were encountered just above top of rock.

Bedrock was encountered between 90 and 93 feet below the ground surface, which was generally a medium hard to hard sandstone that was slightly broken to intact. Recovery of the core samples ranged from 80 to 100%, and RQD values ranged from 50 to 100% with an average RQD of 82%.

Seepage was detected in all of the borings ranging in depth from 25 to 93 feet below the ground surface. Seepage was generally detected within granular layers. Water levels recorded at completion of drilling ranged from 3.0 to 12.0 feet. However, the final water levels included drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally.

**Conclusions and Recommendations**

It appears that driven piles will be the best-suited foundation type for the support of the proposed structure. Due to the size of the structure, it is anticipated that HP 14X73 H-pile sections, with a 95-ton capacity, or 16-inch CIP, with a 90-ton capacity, will be used. Drilled shafts or H-piles socketed into bedrock may be considered. The rock sockets will need to be designed based upon actual loading conditions. The following table summarizes the site conditions and foundation recommendations.

**Foundation Recommendations**

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated H-pile Tip Elevation* (HP 14X73 95 Ton capacity) | Estimated CIP Tip Elevation* (16" Dia. 90 Ton capacity) | Estimated Drilled Shaft Tip Elevation* | Allowable Bearing Capacity for Drilled Shafts (TSF) |
|---|---|---|---|---|---|---|---|
| TR-39 | Forward Abutment | 569 | 478 | 495 | 492 | 475 | 20 |
| TR-40 | Pier 2 | 575 | 485 | 505 | 502 | 482 | 20 |
| TR-41 | Pier 1 | 575 | 482 | 505 | 503 | 479 | 20 |
| TR-42 | Rear Abutment | 575 | 482 | 492 | 486 | 479 | 20 |

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

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, and/or an additional load applied to the design loads to account for any negative skin friction associated with the embankment loading.

Spread footings could be considered, but differential settlement concerns would need to be addressed. Pre-loading or other techniques may be necessary if footings are used.

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.

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.

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

**Closing**

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

Sincerely,

**DLZ OHIO, INC.**

P. Paul Painter
Engineering Geologist

Dorothy A. Adams for
Arthur (Pete) Nix, P.E.
Geotechnical Division Manager

Attachments: General Information – Drilling Procedures and Logs of Borings
Legend – Boring Log Terminology
Boring Location Plan
Boring Logs TR-39, TR-40, TR-41, TR-42

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.**

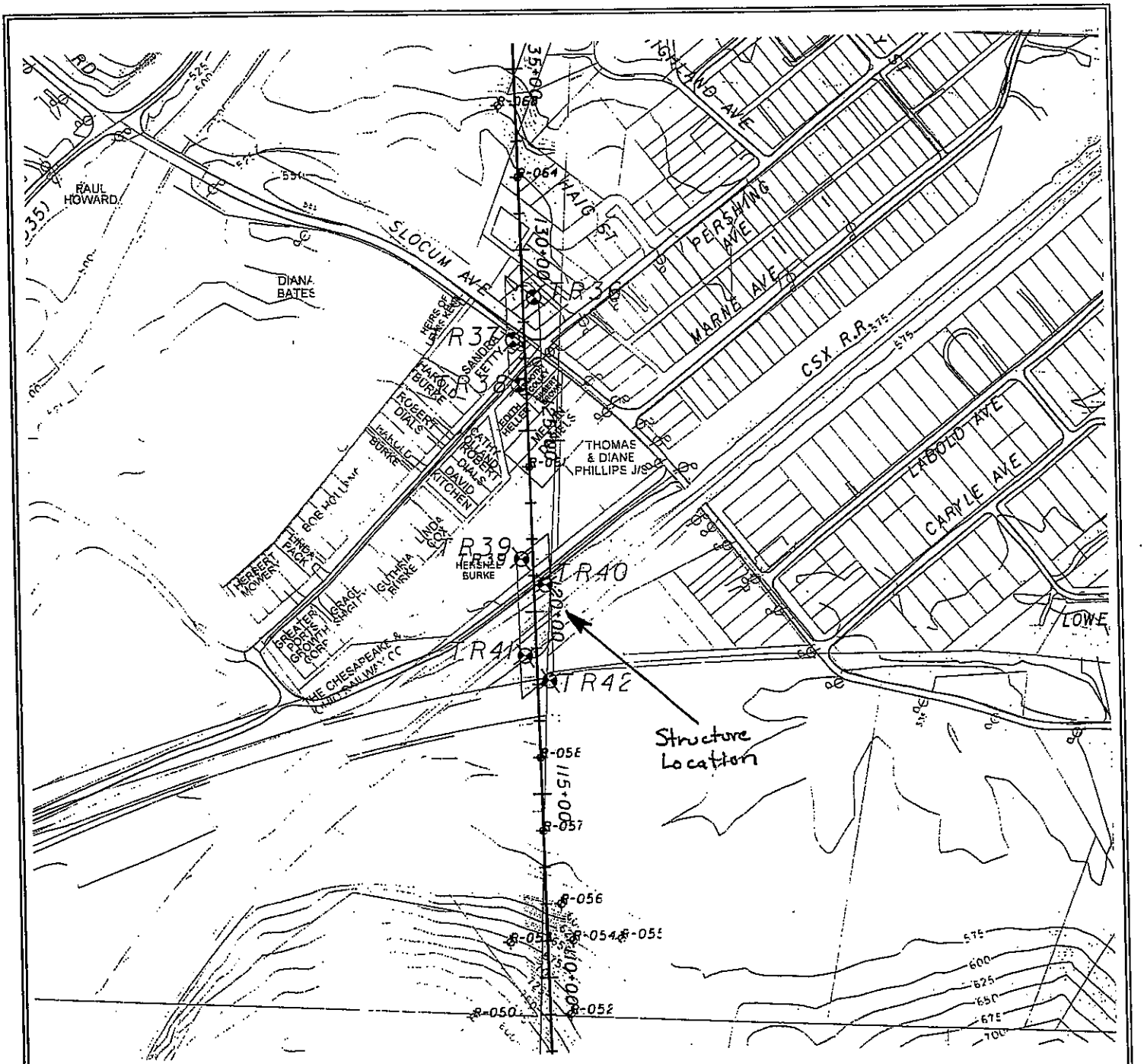
| Term | Description |
|---|---|
| Very Soft | Permits denting by moderate pressure of the fingers. Resembles hard soil but has rock structure. (Crushes under pressure of fingers and/or thumb) |
| Soft | Resists denting by fingers, but can be abraded and pierced to shallow depth by a pencil point. (Crushes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

**CSX RR at Highland Band**
**SCI-823 over CSX RailRoad**
**SCI-823-0.00**

FIGURE 1.

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

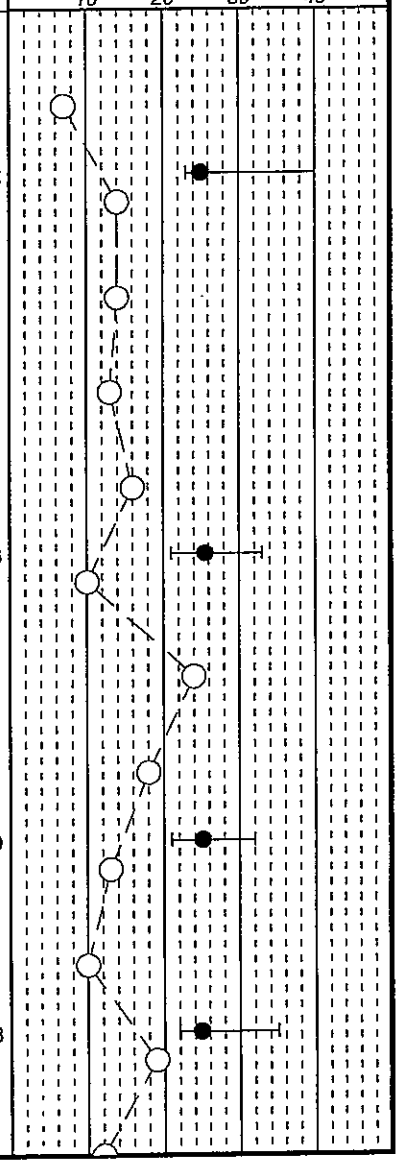
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

**LOG OF: Boring TR-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill 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 | 569.0 | | | | | | | | | | | | |
| 0.3 | 568.7 | | | | | | Topsoil - 4" | | | | | | |
| | | 1 3 4 | 16 | 1 | | 2.25 | Very stiff brown SILTY CLAY (A-6b); damp. @ 0.3'-1.5', contains organics. | | | | | | |
| | | 3 6 8 | 18 | 2 | | 3.5 | | 0 | 0 | -- | 1 | 47 | 52 |
| 5 | | 3 5 9 | 18 | 3 | | 2.25 | | | | | | | |
| 8.0 | 561.0 | | | | | | | | | | | | |
| | | 3 5 8 | 18 | 4 | | 3.25 | Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp. | | | | | | |
| 10 | | 4 7 9 | 16 | 5 | | 2.75 | | | | | | | |
| | | 3 5 5 | 18 | 6 | | 2.75 | | 0 | 0 | -- | 1 | 53 | 46 |
| 15 | | 5 10 14 | 16 | 7 | | 4.0 | @ 16.0'-20.5', very stiff to hard. | | | | | | |
| | | 4 8 10 | 15 | 8 | | 3.75-4.5+ | | | | | | | |
| 20 | | 4 6 7 | 18 | 9 | | 3.25 | | 0 | 0 | -- | 1 | 59 | 40 |
| | | 4 4 6 | 16 | 10 | | 3.0 | | | | | | | |
| 25 | | 6 8 11 | 18 | 11 | | 3.0 | | 0 | 0 | -- | 1 | 46 | 53 |
| | | | | | | | @ 28.0', occasional moist thin A-4b seams. | | | | | | |
| 30 | | 4 6 6 | 18 | 12 | | 3.25 | | | | | | | |

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



FILE: 0121-3070-03 ( 3/31/2005 9:34 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill 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 | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.0 | 539.0 | | | | | | Very stiff brown SILTY CLAY (A-6b); moist. | | | | | | | |
| | | 6 8 10 | 18 | 13 | | 2.25 | | 0 | 0 | -- | 1 | 80 | 19 | |
| 37.0 | 532.0 | | | | | | Loose gray SILT (A-4b), trace fine sand; moist. | | | | | | | |
| | | 5 3 5 | 15 | 14 | | | | 0 | 0 | -- | 1 | 81 | 19 | Non-Plastic |
| | | 3 3 5 | 16 | 15 | | | | | | | | | | |
| 47.0 | 522.0 | | | | | | Medium stiff to stiff gray SILT AND CLAY (A-6a); damp to moist. | | | | | | | |
| | | 3 3 4 | 18 | 16 | | 0.5 | | 0 | 0 | -- | 1 | 57 | 42 | |
| | | 4 5 9 | 18 | 17 | | 1.0 | | | | | | | | |
| 57.0 | 512.0 | | | | | | Hard brownish gray SILTY CLAY (A-6b), trace to little fine sand; damp. | | | | | | | |
| | | 9 16 25 | 18 | 18 | | 4.5+ | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill 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 | 509.0 | | | | | | Hard brownish gray SILTY CLAY (A-6b), trace to little fine sand; damp. | | | | | | |
| | | 12 15 23 | 16 | 19 | | 4.5+ | | 0 | 0 | -- | 3 | 32 | 65 |
| 65 | | | | | | | | | | | | | |
| 67.0 | 502.0 | | | | | | Very stiff gray SILT (A-4b), trace fine sand; slightly organic; damp. | | | | | | |
| | | 11 18 24 | 15 | 20 | | 2.5 | | 0 | 0 | -- | 9 | 60 | 31 |
| 70 | | | | | | | | | | | | | |
| | | 5 10 16 | 16 | 21 | | 3.5 | | | | | | | |
| 75 | | | | | | | | | | | | | |
| 77.0 | 492.0 | | | | | | Medium dense brown SANDY SILT (A-4a), trace gravel; slightly organic; wet. | | | | | | |
| | | 7 8 9 | 18 | 22 | | | | 0 | 3 | -- | 38 | 48 | 11 |
| 80 | | | | | | | | | | | | | |
| | | 12 10 12 | 18 | 23 | | | | | | | | | |
| 85 | | | | | | | | | | | | | |
| 87.0 | 482.0 | | | | | | Dense brown and gray GRAVEL WITH SAND (A-1-b), trace to little silty clay; contains angular sandstone fragments; wet. | | | | | | |
| | | 27 23 17 | 14 | 24 | | | | 41 | 11 | -- | 13 | 27 | 8 |
| 90 | | | | | | | | | | | | | |

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

Non-Plastic

Non-Plastic

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (Including drill 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, % / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 479.0 | | | | | | | | | | | | | |
| 90.5 | 478.5 | | | | | | Dense brown and gray GRAVEL WITH SAND (A-1-b), wet. | | | | | | | |
| 91.0 | 478.0 | | | | | | soft to medium hard gray SANDSTONE; very fine to fine grained, highly weathered to decomposed. | | | | | | | |
| 95 | | Core 60" | Rec 60" | RQD 90% | R-1 | | Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to medium bedded, contains siltstone layers. | | | | | | | |
| 100 | | Core 60" | Rec 56" | RQD 93% | R-2 | | @ 97.7',97.8', low angle fracture. | | | | | | | |
| 105 | | Core 60" | Rec 60" | RQD 100% | R-3 | | @ 100.7'-101.1', highly weathered and broken.<br>@ 101.7'-101.9', limestone layer. | | | | | | | |
| 110 | | Core 60" | Rec 60" | RQD 100% | R-4 | | @ 104.2'-104.5', fine to medium grained clean sandstone. | | | | | | | |
| 112.0 | 457.0 | | | | | | @ 109.2'-109.7', fine to medium grained clean sandstone.<br>@ 111.0'-111.3', limestone layer.<br>@ 111.3'-112.0', fine to medium grained clean sandstone.<br>Bottom of Boring - 112.0' | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (including drill 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 | 575.0 | | | | | | | | | | | | |
| 0.5 | 574.5 | 1 2 4 | 18 | 1 | | 1.5 | Topsoil - 6"<br>Stiff to very stiff brown SILTY CLAY (A-6b), trace fine sand; damp to moist. | | | | | | |
| | | 2 6 6 | 16 | 2 | | 3.5 | | | | | | | |
| 5.0 | 570.0 | 3 5 6 | 18 | 3 | | 1.5 | Stiff brown SILT AND CLAY (A 6a), trace fine sand; damp. | | | | | | |
| | | 4 4 5 | 16 | 4 | | 1.5 | | | | | | | |
| 10 | | 6 8 10 | 18 | 5 | | 2.5 | @ 10.0', very stiff. | | | | | | |
| | | 4 6 10 | 18 | 6 | | 2.5 | | | | | | | |
| 15 | | 2 5 7 | 18 | 7 | | 2.5 | | | | | | | |
| | | 5 8 10 | 18 | 8 | | 4.0 | @ 17.0'-27.0', hard. | | | | | | |
| 20 | | 3 7 12 | 16 | 9 | | 4.5+ | | | | | | | |
| | | 5 7 10 | 18 | 10 | | 4.0 | | | | | | | |
| 25 | | 4 6 8 | 16 | 11 | | 4.5 | | | | | | | |
| | | 5 8 8 | 18 | 12 | | 2.25 | | | | | | | |
| 30 | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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

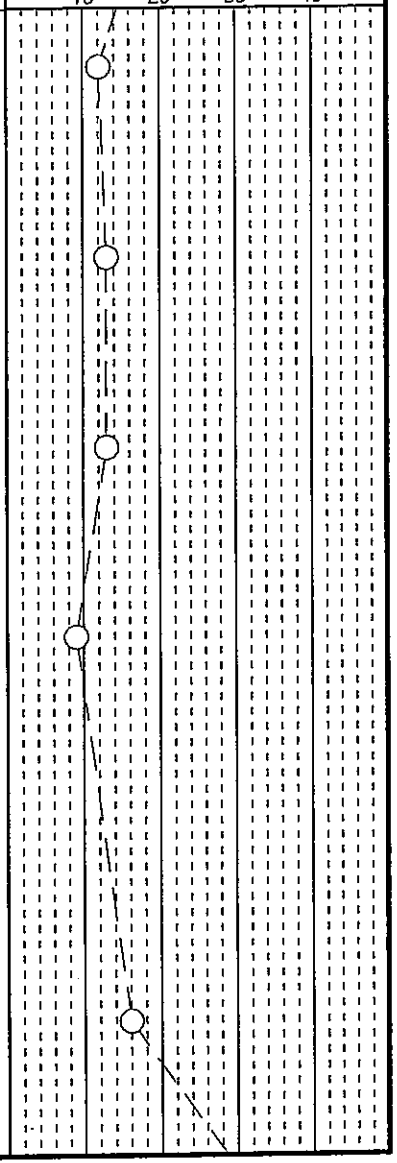
**LOG OF: Boring TR-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 30 | 545.0 | 5 5 7 | 15 | 13 | | 2.0 | Stiff to very stiff brown SILT AND CLAY (A-6a), trace fine sand; damp to moist. |
| 33.0 | 542.0 | | | | | | Stiff to very stiff brown SILT (A-4b), little fine sand, little clay; moist to wet. |
| 35 | | 6 7 6 | 17 | 14 | | 1.5 | |
| 40 | | 4 5 8 | 18 | 15 | | 2.0 | |
| 43.0 | 532.0 | | | | | | Stiff to very stiff gray SILT AND CLAY (A-6a), trace fine sand; damp to moist. |
| 45 | | 4 4 5 | 18 | 16 | | 1.5 | |
| 50 | | WOH WOH 3 | | 17 | | 1.5 | |
| 55 | | 4 8 8 | | 18 | | 3.5 | |
| 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 9:34 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-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 60 | 515.0 | 8 15 19 | 18 | 19 | | 3.0 | Stiff to very stiff gray SILT AND CLAY (A-6a), trace fine sand; damp to moist. |
| 65 | | 5 15 19 | 18 | 20 | | 3.0 | |
| 70 | | 11 16 20 | 16 | 21 | | 4.5+ | |
| 75 | | 4 7 10 | 18 | 22 | | 3.5 | |
| 78.0 | 497.0 | | | | | | Loose to medium dense brown and gray FINE SAND (A-3), trace silty clay; wet. |
| 80 | | WOH WOH 16 | 15 | 23 | | | |
| 85 | | 9 11 14 | 18 | 24 | | | |
| 88.0 | 487.0 | | | | | | Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. |
| 90 | | | | | | | |

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 9:34 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-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (Including drill water).

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 90 | 485.0 | 50/5 | 5 | 25 | | | Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. |
| 95.0 | 480.0 | Core 60" | Rec 58" | RQD 67% | R-1 | | Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, arenaceous, thinly bedded to thickly bedded. |
| 100 | | Core 60" | Rec 60" | RQD 93% | R-2 | | @ 95.5',95.8',99.6', low angle clay filled fractures. |
| 105 | | Core 60" | Rec 49" | RQD 75% | R-3 | | @ 100.8',102.7',103.0', low angle clay filled fractures. |
| 110 | | Core 60" | Rec 60" | RQD 90% | R-4 | | @ 106.7',112.5', low angle clay filled fractures. |
| 115.0 | 460.0 | | | | | | Bottom of Boring - 115.0' |
| 120 | | | | | | | |

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 9:34 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-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 575.0 | | | | | | | | | | | | |
| 0.8 | 574.2 | 2 3 2 | 15 | 1 | | 2.0 | Topsoil 9"<br>Very stiff brown SILT AND CLAY (A-6a), trace fine sand; moist. | | | | | | |
| | | 4 9 11 | 18 | 2 | | 4.0 | | | | | | | |
| 5 | | 4 7 10 | 18 | 3 | | 2.5 | | | | | | | |
| | | 3 4 5 | 18 | 4 | | 2.25 | | | | | | | |
| 10 | | 2 4 6 | 18 | 5 | | 2.5 | | | | | | | |
| | | 4 7 9 | 18 | 6 | | 3.5 | | | | | | | |
| 15 | | 3 4 7 | 18 | 7 | | 3.25 | | | | | | | |
| | | 2 6 8 | 18 | 8 | | 3.5 | | | | | | | |
| 20 | | 2 6 10 | 18 | 9 | | 4.0 | | | | | | | |
| 21.0 | 554.0 | | | | | | Very stiff brown SANDY SILT (A-4a), little clay, trace fine sand; moist. | | | | | | |
| | | 6 7 9 | 18 | 10 | | 3.75 | | | | | | | |
| 25 | | 6 7 8 | 18 | 11 | | 2.5 | | | | | | | |
| | | 2 3 5 | 18 | 12 | | 2.5 | | | | | | | |
| 30 | | 2 5 | | 13 | | 2.5 | | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 545.0 | 7 | 18 | | | | Stiff to very stiff brown SANDY SILT (A-4a), little clay, trace fine sand; moist. | | | | | | |
| 35 | | 3 6 9 | 18 | 14 | | 2.25 | | | | | | | |
| 39.5 | 535.5 | | | | | | | | | | | | |
| 40 | | 5 6 7 | 18 | 15 | | 2.5 | Stiff to very stiff gray SILT AND CLAY (A-6a), little clay, trace fine sand; moist. | | | | | | |
| 45 | | 3 7 9 | 18 | 16 | | 1.5 | | | | | | | |
| 50 | | 3 5 7 | 18 | 17 | | 2.0 | | | | | | | |
| 55 | | 4 5 7 | 18 | 18 | | 2.5 | | | | | | | |
| 60 | | 2 5 | | 19 | | 1.75 | | | | | | | |

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

FILE: 0121-3070-03 ( 3/31/2005 9:34 AM )

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

Job No. 0121-3070.03

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

**LOG OF: Boring TR-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 515.0 | 6 | 18 | | | | Stiff to very stiff gray SANDY SILT (A-4a), little clay, trace fine sand; moist. | | | | | | |
| 65 | | 7 7 10 | 18 | 20 | | 2.0 | @ 64.0'-65.5', trace organics. | | | | | | |
| 68.0 | 507.0 | | | | | | Loose to medium dense gray FINE SAND (A-3), little silty clay; wet. | | | | | | |
| 70.0 | 505.0 | 10 7 8 | 18 | 21 | | NA | Stiff to very stiff gray SANDY SILT (A-4a), little clay, trace fine sand; moist. | | | | | | |
| 75 | | 5 9 14 | 18 | 22 | | 3.0 | | | | | | | |
| 80 | | 3 9 12 | 18 | 23 | | 1.5 | | | | | | | |
| 83.0 | 492.0 | | | | | | Loose to medium dense gray FINE SAND (A-3), little silty clay; wet. | | | | | | |
| 85 | | 10 9 14 | 18 | 24 | | NA | | | | | | | |
| 87.0 | 488.0 | | | | | | Medium dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. | | | | | | |
| 90 | | 10 12 | | 25 | | NA | | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 485.0 | 21 | 17 | | | | Medium dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. | | | | | | | |
| 93.0 | 482.0 | | | | | | Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, micaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle rust stained fractures. @ 95.1'-95.5', broken zone. @ 93.0'-93.7', lost recovery. | | | | | | | |
| 95 | | Core 60" | Rec 48" | RQD 50% | R-1 | | | | | | | | | |
| 95.6 | 479.4 | | | | | | Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded, moderately fractured, with typically low angle clay filled fractures. | | | | | | | |
| 100 | | Core 60" | Rec 60" | RQD 85% | R-2 | | | | | | | | | |
| 105 | | Core 60" | Rec 54" | RQD 67% | R-3 | | @ 103.0'-103.5', lost recovery. @ 103.5'-104.0',106.7'-107.7',1 broken zone. | | | | | | | |
| 110 | | Core 60" | Rec 60" | RQD 90% | R-4 | | | | | | | | | |
| 113.0 | 462.0 | | | | | | Bottom of Boring - 113.0' | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 3/31/2005 9:34 AM ]

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

Job No. 0121-3070.03

Client: TranSystems, Inc.

Project: SCI-823-0.00

**LOG OF: Boring TR-42**

Location: Rear Abutment SCI-823.00 over CSX RR

Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

GRADATION

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

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 575.0 | 1 3 2 | 13 | 1 | | 1.75 | Stiff dark brown SANDY SILT (A-4a), trace gravel; damp. | | | | | | |
| | | 4 4 10 | 18 | 2 | | 2.0 | @ 1.5', Brown; contains roots. | | | | | | |
| 3.5 | 571.5 | | | | | | Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; dry to damp. | | | | | | |
| 5 | | 4 5 8 | 18 | 3 | | 3.5 | | | | | | | |
| | | 2 4 6 | 18 | 4 | | 3.5 | | | | | | | |
| 10 | | 2 4 6 | 18 | 5 | | 3.75 | | | | | | | |
| | | 2 6 7 | 18 | 6 | | 3.25 | | | | | | | |
| 15 | | 4 7 11 | 18 | 7 | | 4.0 | @ 14.0', Hard. | | | | | | |
| | | 4 6 7 | 18 | 8 | | 4.5+ | | | | | | | |
| 20 | | 4 5 9 | 18 | 9 | | 4.5+ | | | | | | | |
| | | 3 5 8 | 18 | 10 | | 3.5 | @ 21.5', Very stiff; damp. | | | | | | |
| 25 | | 3 4 5 | 18 | 11 | | 2.75 | | | | | | | |
| | | 3 4 5 | 18 | 12 | | 3.0 | | | | | | | |
| 30 | | 4 5 | | 13 | | 3.0 | | | | | | | |

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 30 | 545.0 | 7 | 18 | | | | Very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp. |
| 35 | | 4 7 8 | 18 | 14 | | 2.0 | @ 34.0', Moist. |
| 37.0 | 538.0 | | | | | | Hard brownish gray SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist. |
| 40 | | 6 5 11 | 18 | 15 | | 4.5+ | |
| 45 | | 5 6 10 | 18 | 16 | | 3.5 | @ 44.0', Very stiff. |
| 50 | | 3 4 6 | 18 | 17 | | 2.5 | |
| 55 | | 3 3 5 | 18 | 18 | | 1.5 | @ 53.0'-58.0', stiff. |
| 60 | | 4 5 | | 19 | | 3.25 | |

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 9:34 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 515.0 | 7 | 18 | | | | Very stiff brownish gray SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist. | | | | | | |
| 65 | | 4 7 8 | 18 | 20 | | 2.0 | | | | | | | |
| 67.0 | 508.0 | | | | | | Medium dense brown COARSE AND FINE SAND (A-3a), trace gravel; moist. | | | | | | |
| 70 | | 4 10 10 | 18 | 21 | | | | | | | | | |
| 72.0 | 503.0 | | | | | | Medium dense to dense brownish gray SANDY SILT (A-4a), trace clay, trace gravel; dry to damp. | | | | | | |
| 75 | | 7 14 20 | 18 | 22 | | 2.25 | | | | | | | |
| 80 | | 5 7 16 | | 23 | | 3.75 | | | | | | | |
| 85 | | 8 6 9 | 18 | 24 | | | | | | | | | |
| 90 | | 10 14 | | 25 | | | @ 89.0', some gravel. | | | | | | |

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 25.0'-27.6', 35.0', 50.0'-55.0', 70.0'-89.0'
Water level at completion: 25.5' (Prior to coring)

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 485.0 | 23 | 18 | | | | Medium dense to dense brownish gray SANDY SILT (A-4a), some gravel, trace clay; damp. | | | | | | |
| 92.0 | 483.0 | | | | | | Medium hard gray SANDSTONE; moderately weathered, argillaceous. | | | | | | |
| 94.0 | 481.0 | Core 60" | Rec 48" | RQD 75.0% | R1 | | Hard gray SANDSTONE; slightly weathered, arenaceous. @ 94.1', 94.6', 95.1', 96.1', 97.4', 97.8', 100.8' and 101.4', fractured. @ 104.0', 45° degree fracture. @ 102.2', 105.8' and 108.9' clay seem. @ 104.5' to 105.0', 105.9' to 106.8' and 108.3 to 110.9, moderately fractured. | | | | | | |
| 95 | | | | | | | | | | | | | |
| | | Core 60" | Rec 58" | RQD 88.3% | R2 | | | | | | | | |
| 100 | | | | | | | | | | | | | |
| | | Core 60" | Rec 55" | RQD 60.0% | R3 | | | | | | | | |
| 105 | | | | | | | | | | | | | |
| | | Core 60" | Rec 59" | RQD 85.0% | R4 | | | | | | | | |
| 110 | | | | | | | | | | | | | |
| 112.0 | 463.0 | | | | | | Bottom of Boring - 112.0' | | | | | | |
| 115 | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | |

GRADATION

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

FILE: 0121-3070-03 [ 3/31/2005 9:34 AM ]

DLZ

ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

RECEIVED

AUG 29 2006

TranSystems

August 25, 2006

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

Re: **Spill Through Slope Recommendations**
**SR 823 over CSXT Railroad (Highland Bend)**
SCI-823-0.00 Portsmouth Bypass
DLZ Job No.: 0121-3070.03
Document # 0029

Dear Mr. Weeks:

This letter includes the findings of evaluations of spill through slopes on the above-referenced project. The findings included in this letter pertain to the spill through slopes at the intersection of proposed SR 823 and CSXT railroad in the Highland Bend area.

The results of these evaluations are based upon the findings of four preliminary structural borings. Boring logs for borings TR-39, TR-40, TR-41, and TR-42 are attached. After the bridge design is finalized, it may be necessary to drill additional borings in the area of the proposed bridge structure in accordance with ODOT's Specifications for Subsurface Investigations in order to finalize the evaluations.

At the time this letter was prepared, it was understood that the plan location of the bridge structure for proposed SR 823 over CSXT railroad is similar to the location shown on the plan and profile drawings dated July 12, 2005. See attached plan and profile drawing. Furthermore, it is understood that the proposed profile of the planned structure is being modified from the proposed grade indicated on the plan and profile drawing. Using 2H:1V spill through slopes allows the rear and forward abutments to be placed at approximate stations 112+90 and 117+54, respectively. As per the revised profile, the height of the embankment at the rear and forward abutments is 99.9 feet and 69.9 feet, respectively. At this time it is assumed that the excessive height of the embankments in this area prohibits the use of MSE walls. If the use of MSE walls at this location is to be considered, we can provide evaluations and recommendations upon request.

A global stability analysis was performed for the spill through slopes at this bridge location. At the time this letter was prepared, it was assumed that deep foundations would be used to support the structures at this location. Once a foundation type has been selected, DLZ should be informed so that the analyses may be revised as necessary.

A unit weight of 120 pcf and a friction angle of 30 degrees were selected for the fill material used to construct the roadway embankment. If the embankment fill material has properties significantly different from these values, DLZ should be informed so that the analyses may be revised as necessary.

Preliminary global stability analyses were performed for the spill through slopes using a subsurface profile based on boring TR-41, and based upon the height from the rear abutment location of 99.9 feet.

**Spill Through Slopes Evaluation at Station 112+90 (Rear Abutment) and Station 117+54 (Forward Abutment)**

In the area of this proposed structure, boring TR-41 encountered nine inches of topsoil at the surface. Below the topsoil layer, primarily very stiff clay (A-7-6) was encountered to a depth of 21.0 feet below ground surface. Below 21.0 feet, primarily very stiff silt (A-4b) was encountered to a depth of approximately 68.0 feet below ground surface. Below 68.0 feet, primarily stiff to very stiff silt and clay (A-6a) was encountered to a depth of approximately 83.0 feet below ground surface. Below 83.0 feet, primarily medium dense sandy silt (A-4a) was encountered to a depth of approximately 87.0 feet below ground surface, at the top of weathered bedrock. Underlying the soil, this boring generally encountered medium hard to hard, moderately weathered sandstone to the bottom of the boring, at a depth of 113.0 feet.

Using 2H:1V slopes, analyses yielded factors of safety for drained global stability that were adequate. However, undrained global stability factors of safety were below recommended minimum values. Based on previously submitted analyses, staged construction and wick drains will likely be required to maintain stability during construction of the roadway embankments in the Highland Bend area. It is recommended that the spill through slopes at SR 823 over CSXT railroad be constructed in the same sequence as the roadway embankments through Highland Bend. The required waiting period between stages will be determined by the selection of wick drain spacing. Several wick drain spacing options are presented for the roadway embankments in our report; *Proposed Highland Bend Embankments* dated June 8, 2006. The ninety percent consolidation periods for the various spacing options range from 30 to 95 days. The waiting period will allow excess pore water pressures to dissipate enough to accommodate the additional loading of the embankment fill while maintaining undrained stability.

Although analyses indicate that 2H:1V or flatter slopes may be used to construct the spill through slopes near the rear and forward abutments. It should be noted that due to higher fills or more critical soil profiles, the roadway embankments in this area require the use of 2.5H:1V or flatter slopes. (Embankment analyses are contained in the report; *Proposed Highland Bend Embankments*, dated June 8, 2006.) The use of 2H:1V slopes pertains to the spill through slopes for the SR 823 over CSXT Railroad structure location only.

A drawing showing the results of the global stability analyses is also attached.

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

Respectfully submitted,

DLZ OHIO, INC.

Steven J. Riedy
Geotechnical Engineer

Dorothy A. Adams, M.S.C.E., P.E.
Senior Geotechnical Engineer

Encl: As noted

cc: file

M:\proj\0121\3070.03\Stability Analyses\Documents\MSE Wall letters\823 over CSX (Highland Bend)\823 over CSX Highland Bend STS Recommendations 08-25-06 SJR.doc

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

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

**LOG OF: Boring TR-39** | *Location:* Forward Abutment SCI-823.00 over CSX RR | *Date Drilled:* 02/02/05 to 02/03/05

*WATER OBSERVATIONS:* Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 566.2 | | | | | | | | | | | | |
| 0.3 | 565.9 | | | | | | Topsoil - 4" | | | | | | |
| | | 1 3 4 | 16 | 1 | | 2.25 | Very stiff brown SILTY CLAY (A-6b); damp. @ 0.0' to 1.5', contains organics. | | | | | | |
| | | 3 6 8 | 18 | 2 | | 3.5 | | 0 | 0 | – | 1 | 47 | 52 |
| 5 | | | | | | | | | | | | | |
| 5.5 | 560.7 | | | | | | Very stiff to hard brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp. | | | | | | |
| | | 3 5 9 | 18 | 3 | | 2.25 | | | | | | | |
| | | 3 5 8 | 18 | 4 | | 3.25 | | | | | | | |
| 10 | | | | | | | | | | | | | |
| | | 4 7 9 | 16 | 5 | | 2.75 | | | | | | | |
| | | 3 5 5 | 18 | 6 | | 2.75 | | 0 | 0 | – | 1 | 53 | 46 |
| 15 | | | | | | | | | | | | | |
| | | 5 10 14 | 16 | 7 | | 4.0 | | | | | | | |
| | | 4 8 10 | 15 | 8 | | 3.75 | | | | | | | |
| 20 | | | | | | | | | | | | | |
| | | 4 6 7 | 18 | 9 | | 3.25 | | 0 | 0 | – | 1 | 59 | 40 |
| | | 4 4 6 | 16 | 10 | | 3.0 | | | | | | | |
| 25 | | | | | | | | | | | | | |
| | | 6 8 11 | 18 | 11 | | 3.0 | | 0 | 0 | – | 1 | 46 | 53 |
| 28.0 | 538.2 | | | | | | Very stiff brown SILTY CLAY (A-6b), trace fine sand; wet. | | | | | | |
| | | 4 6 6 | 18 | 12 | | 3.25 | | | | | | | |
| 30 | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 536.2 | | | | | | Very stiff brown SILTY CLAY (A-6b), trace fine sand; wet. | | | | | | |
| | | 6 8 10 | 18 | 13 | | 2.25 | | 0 | 0 | – | 1 | 80 | 19 |
| 35 | | | | | | | | | | | | | |
| 37.0 | 529.2 | | | | | | Loose gray SILT (A-4b), trace fine sand; wet. | | | | | | |
| | | 5 3 5 | 15 | 14 | | | | 0 | 0 | – | 1 | 81 | 18 |
| 40 | | | | | | | | | | | | | |
| | | 3 3 5 | 16 | 15 | | | | | | | | | |
| 45 | | | | | | | | | | | | | |
| 47.0 | 519.2 | | | | | | Medium stiff to stiff gray SILT AND CLAY (A-6a); damp to wet. | | | | | | |
| | | 3 3 4 | 18 | 16 | | 0.5 | | 0 | 0 | – | 1 | 57 | 42 |
| 50 | | | | | | | | | | | | | |
| | | 4 5 9 | 18 | 17 | | 1.0 | | | | | | | |
| 55 | | | | | | | | | | | | | |
| 57.0 | 509.2 | | | | | | Hard brownish gray CLAY (A-7-6), trace to little fine sand; damp to moist. | | | | | | |
| | | 9 16 25 | 18 | 18 | | 4.5+ | | | | | | | |
| 60 | | | | | | | | | | | | | |

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

Non-Plastic

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetro-meter (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 506.2 | | | | | | | | | | | | |
| | | 12 15 23 | 16 | 19 | | 4.5+ | Hard brownish gray CLAY (A-7-6), trace fine sand; moist. | 0 | 0 | – | 3 | 32 | 65 |
| 65 | | | | | | | | | | | | | |
| | | 11 18 24 | 15 | 20 | | 2.5 | | | | | | | |
| 70 | | | | | | | | | | | | | |
| 72.0 | 494.2 | | | | | | Very stiff gray SILT (A-4b), trace fine sand; slightly organic; damp. | | | | | | |
| | | 5 10 16 | 16 | 21 | | 3.5 | | 0 | 0 | – | 9 | 60 | 31 |
| 75 | | | | | | | | | | | | | |
| 77.0 | 489.2 | | | | | | Medium dense brown SANDY SILT (A-4a), trace gravel; slightly organic; wet. | | | | | | |
| | | 7 8 9 | 18 | 22 | | | | 0 | 3 | – | 38 | 48 | 11 |
| 80 | | | | | | | | | | | | | |
| 82.0 | 484.2 | | | | | | Medium dense gray FINE SAND (A-3), trace gravel, trace silt; moist. | | | | | | |
| | | 12 10 12 | 18 | 23 | | | | | | | | | |
| 85 | | | | | | | | | | | | | |
| 87.0 | 479.2 | | | | | | Severely weathered brown and gray SANDSTONE argillaceous. | | | | | | |
| | | 27 23 17 | 14 | 24 | | | | 41 | 11 | – | 13 | 27 | 8 |
| 90 | | | | | | | | | | | | | |

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

Non-Plastic (at 80)
Non-Plastic (at 90)

FILE 0121-3070-03 [ 8/25/2006 10:12 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-39** | Location: Forward Abutment SCI-823.00 over CSX RR | Date Drilled: 02/02/05 to 02/03/05

WATER OBSERVATIONS: Water seepage at: 33.5'-50', 73.5'-80'
Water level at completion: 36.0' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 90 | 476.2 | | | | | | Severely weathered brown and gray SANDSTONE argillaceous. |
| 92.0 | 474.2 | Core 60" | Rec 60" | RQD 90% | R-1 | | Medium hard to hard gray SANDSTONE; very fine to fine grained, moderately weathered, argillaceous, thinly bedded to massive, slightly fractured, contains few argillaceous laminations.<br>@ 92.0' to 92.2' and 92.3' to 92.5', filled fracture. |
| 95 | | | | | | | |
| 100 | | Core 60" | Rec 56" | RQD 93% | R-2 | | @ 97.7',97.8', low angle fracture.<br>@ 100.7' to 101.1', highly weathered and broken.<br>@ 101.7' to 101.9', decomposed shale layer. |
| 105 | | Core 60" | Rec 60" | RQD 100% | R-3 | | |
| 110 | | Core 60" | Rec 60" | RQD 100% | R-4 | | @ 111.0' to 111.3', calcareous layer.<br>@ 111.3' to 112.0', fine to medium grained clean sandstone. |
| 112.0 | 454.2 | | | | | | Bottom of Boring - 112.0' |
| 115 | | | | | | | |
| 120 | | | | | | | |

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 [ 8/25/2006 10:12 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-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 567.9 | | | | | | | | | | | | |
| 0.5 | 567.4 | 1 2 4 | 18 | 1 | | 1.5 | Topsoil - 6"<br>Stiff to very stiff brown SILTY CLAY (A-6b), trace fine sand; damp to moist. | | | | | | |
| | | 2 6 6 | 16 | 2 | | 3.5 | | | | | | | |
| 5 | | 3 5 6 | 18 | 3 | | 1.5 | | 0 | 0 | – | 1 | 48 | 51 |
| | | 4 4 5 | 16 | 4 | | 1.5 | | | | | | | |
| 10 | | 6 8 10 | 18 | 5 | | 2.5 | @ 10.0', very stiff. | | | | | | |
| | | 4 6 10 | 18 | 6 | | 2.5 | | | | | | | |
| 15 | | 2 5 7 | 18 | 7 | | 2.5 | | | | | | | |
| 17.0 | 550.9 | | | | | | | | | | | | |
| | | 5 8 10 | 18 | 8 | | 4.0 | Hard brown CLAY (A-7-6), some to "and" silt, trace fine sand; damp to moist. | | | | | | |
| 20 | | 3 7 12 | 16 | 9 | | 4.5+ | | | | | | | |
| | | 5 7 10 | 18 | 10 | | 4.0 | | | | | | | |
| 25 | | 4 6 8 | 16 | 11 | | 4.5 | | | | | | | |
| 27.5 | 540.4 | 5 8 8 | 18 | 12 | | 2.25 | Stiff to very stiff brown SILT (A-4b),"and" clay, trace fine sand, moist. | 0 | 0 | – | 2 | 56 | 42 |
| 30 | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

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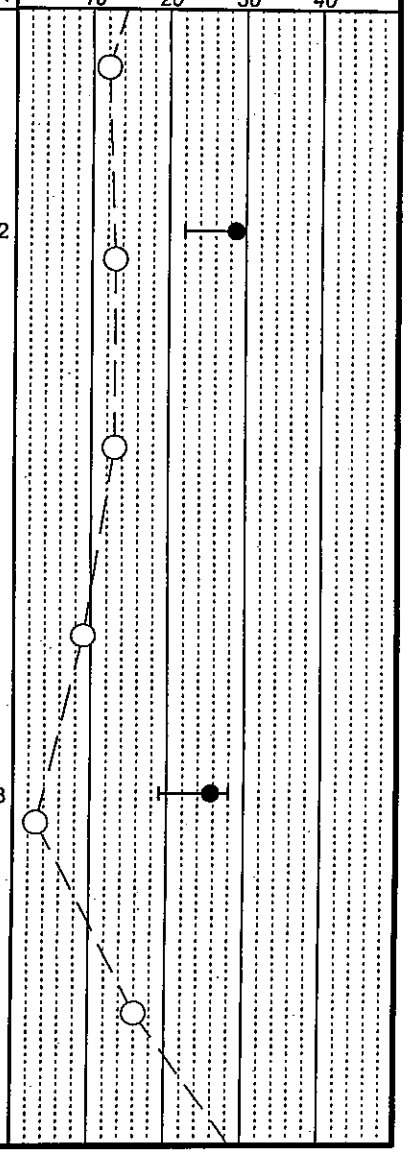
WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 537.9 | 5 5 7 | 15 | 13 | | 2.0 | Stiff to very stiff brown SILT (A-4b), some to "and" clay, trace fine to coarse sand; moist to wet. | | | | | | |
| 35 | | 6 7 6 | 17 | 14 | | 1.5 | | 0 | 2 | – | 2 | 74 | 22 |
| 40 | | 4 5 8 | 18 | 15 | | 2.0 | | | | | | | |
| 45 | | 4 4 5 | 18 | 16 | | 1.5 | | | | | | | |
| 50 | | WOH WOH 3 | 18 | 17 | | 1.5 | @ 50.0', trace gravel. | 1 | 1 | – | 4 | 56 | 38 |
| 55 | | 4 8 8 | 18 | 18 | | 3.5 | | | | | | | |
| 60 | | | | | | | | | | | | | |

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



FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

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

**LOG OF: Boring TR-40** | *Location:* Pier 2 SCI-823.00 over CSX RR | *Date Drilled:* 02/04/05 to 02/09/05

*WATER OBSERVATIONS:* Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60.0 | 507.9 | 8 15 19 | 18 | 19 | | 3.0 | Very stiff to hard gray CLAY (A-7-6), some silt, trace fine sand; damp to moist. | | | | | | | |
| 65 | | 5 15 19 | 18 | 20 | | 3.0 | | | | | | | | |
| 70 | | 11 16 20 | 16 | 21 | | 4.5+ | | | | | | | | |
| 75 | | 4 7 10 | 18 | 22 | | 3.5 | | | | | | | | |
| 78.0 | 489.9 | | | | | | Medium dense gray and brown SILT (A-4b), some fine to coarse sand, little clay, trace gravel; wet. | | | | | | | |
| 80 | | WOH WOH 16 | 15 | 23 | | | | 1 | 2 | – | 25 | 58 | 14 | Non-Plastic |
| 85 | | 9 11 14 | 18 | 24 | | | | | | | | | | |
| 88.0 | 479.9 | | | | | | Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. | | | | | | | |
| 90 | | | | | | | | | | | | | | |

STANDARD PENETRATION (N) scale: 10 20 30 40

FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

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

**LOG OF: Boring TR-40** | Location: Pier 2 SCI-823.00 over CSX RR | Date Drilled: 02/04/05 to 02/09/05

WATER OBSERVATIONS: Water seepage at: 30'-46.5', 75'-95'
Water level at completion: 26.7' (includes drilling water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 477.9 | 50/5 | 5 | 25 | | | Very dense gray COARSE AND FINE SAND (A-3a), little silty clay, trace fine gravel; wet. | | | | | | |
| 95.0 | 472.9 | Core 60" | Rec 58" | RQD 67% | R-1 | | Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, arenaceous, thickly bedded to massive, slightly to moderately fractured. | | | | | | |
| 100 | | Core 60" | Rec 60" | RQD 93% | R-2 | | @ 95.5',95.8',99.6', low angle clay filled fractures. | | | | | | |
| 105 | | Core 60" | Rec 49" | RQD 75% | R-3 | | @ 100.8',102.7',103.0', low angle clay filled fractures. | | | | | | |
| 110 | | Core 60" | Rec 60" | RQD 90% | R-4 | | @ 106.7',112.5', low angle clay filled fractures. | | | | | | |
| 115.0 | 452.9 | | | | | | Bottom of Boring - 115.0' | | | | | | |
| 120 | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

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

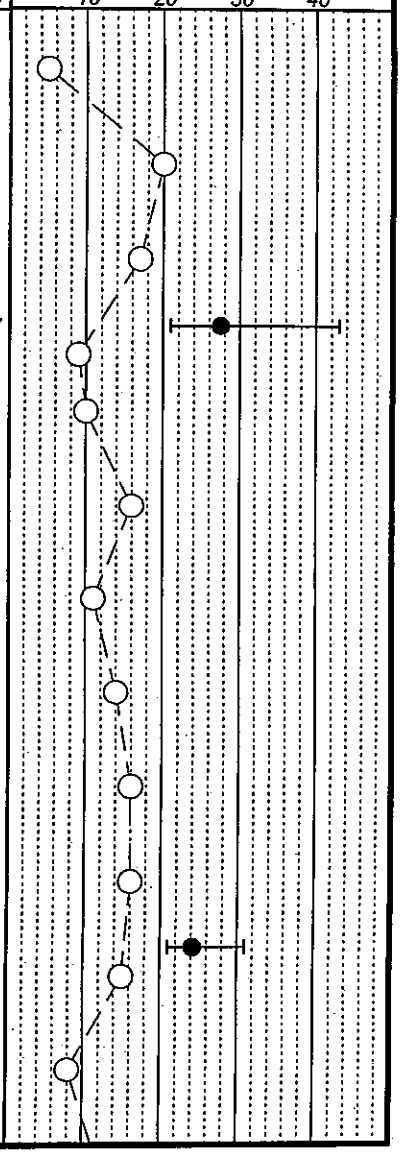
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

**LOG OF: Boring TR-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetro-meter (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 569.4 | | | | | | | | | | | | |
| 0.8 | 568.6 | 2 3 2 | 15 | 1 | | 2.0 | Topsoil 9"<br>Very stiff brown CLAY (A-7-6 ), "and" silt, trace fine sand; moist. | | | | | | |
| | | 4 9 11 | 18 | 2 | | 4.0 | | | | | | | |
| 5 | | 4 7 10 | 18 | 3 | | 2.5 | | | | | | | |
| | | 3 4 5 | 18 | 4 | | 2.25 | | 0 | 0 | -- | 1 | 42 | 57 |
| 10 | | 2 4 6 | 18 | 5 | | 2.5 | | | | | | | |
| | | 4 7 9 | 18 | 6 | | 3.5 | | | | | | | |
| 15 | | 3 4 7 | 18 | 7 | | 3.25 | | | | | | | |
| | | 2 6 8 | 18 | 8 | | 3.5 | | | | | | | |
| 20 | | 2 6 10 | 18 | 9 | | 4.0 | | | | | | | |
| 21.0 | 548.4 | | | | | | Very stiff brown SILT (A-4b), "and" clay, trace fine sand; moist. | | | | | | |
| | | 6 7 9 | 18 | 10 | | 3.75 | | | | | | | |
| 25 | | 6 7 8 | 18 | 11 | | 2.5 | | 0 | 1 | -- | 4 | 55 | 40 |
| | | 2 3 5 | 18 | 12 | | 2.5 | | | | | | | |
| 30 | | 2 5 | | 13 | | 2.5 | | | | | | | |

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



FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

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

**LOG OF: Boring TR-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

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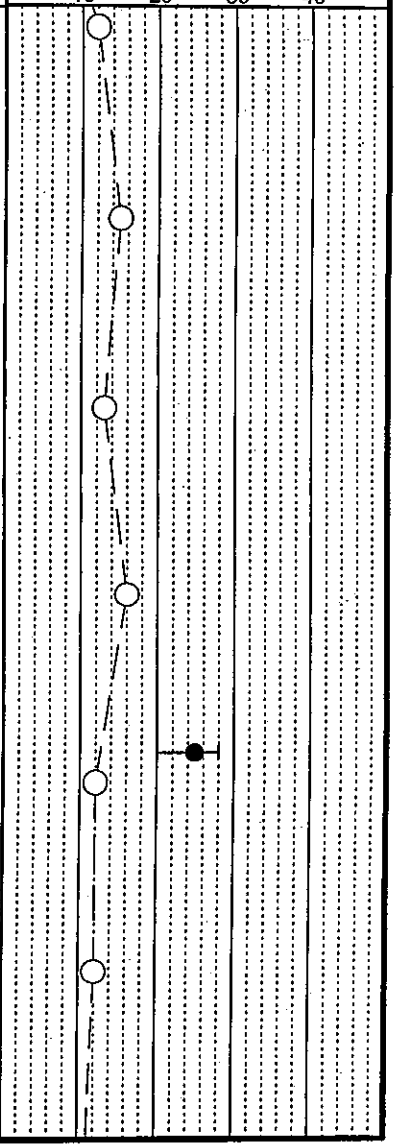
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 539.4 | 7 | 18 | | | | | | | | | | |
| | | 3 6 9 | 18 | 14 | | 2.25 | | | | | | | |
| 39.5 | 529.9 | 5 6 7 | 18 | 15 | | 2.5 | Stiff to very stiff gray SILT (A-4b), some to "and" clay, trace fine sand, moist. | | | | | | |
| 40 | | | | | | | | | | | | | |
| | | 3 7 9 | 18 | 16 | | 1.5 | | | | | | | |
| 45 | | | | | | | | | | | | | |
| | | 3 5 7 | 18 | 17 | | 2.0 | | 0 | 0 | – | 2 | 63 | 35 |
| 50 | | | | | | | | | | | | | |
| | | 4 5 7 | 18 | 18 | | 2.5 | | | | | | | |
| 55 | | | | | | | | | | | | | |
| | | 2 5 | | 19 | | 1.75 | | | | | | | |
| 60 | | | | | | | | | | | | | |

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



FILE: 0121-3070-03 [ 8/25/2006 10:12 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-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 509.4 | 6 | 18 | | | | | | | | | | |
| | | 7 7 10 | 18 | 20 | | 2.0 | @ 64.0' to 65.5', trace organics. | | | | | | |
| 68.0 | 501.4 | | | | | | Loose to medium dense brownish gray FINE SAND (A-3), little silty clay; wet. | | | | | | |
| 70.0 | 499.4 | 10 7 8 | 18 | 21 | | | Stiff to very stiff gray SILT AND CLAY (A-6a), trace fine to coarse sand; damp to moist. | | | | | | |
| 75 | | 5 9 14 | 18 | 22 | | 3.0 | | 0 | 1 | – | 4 | 55 | 40 |
| 80 | | 3 9 12 | 18 | 23 | | 1.5 | | | | | | | |
| 83.0 | 486.4 | | | | | | Loose to medium dense gray SANDY SILT (A-4a), little clay, trace gravel; wet. | | | | | | |
| 85 | | 10 9 14 | 18 | 24 | | | | 7 | 7 | – | 27 | 48 | 11 |
| 87.0 | 482.4 | | | | | | Severely weathered brown SANDSTONE. | | | | | | |
| 90 | | 10 12 | | 25 | | | | 36 | 9 | – | 35 | 16 | 4 |

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

Non-Plastic

Non-Plastic

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-41** | Location: Pier 1 SCI-823.00 over CSX RR | Date Drilled: 2/15/05 to 2/16/05

WATER OBSERVATIONS: Water seepage at: 21.8'-29.5', 69.0'-71.0', 84.0'-93.0'
Water level at completion: 20.2' (Start of Shift 2/16/05 @ 80')
23.5' (prior to coring)

| 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 | 479.4 | 21 | 17 | | | | Severely weathered brown SANDSTONE. | | | | | | | |
| 93.0 | 476.4 | | | | | | | | | | | | | |
| 95 | | Core 60" | Rec 48" | RQD 50% | R-1 | | Medium hard to hard brown and gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, micaceous, thinly bedded to thickly bedded, highly fractured, with typically low angle rust stained fractures. @ 95.1' to 95.5', broken zone. @ 93.0' to 93.7', lost recovery. | | | | | | | |
| 95.6 | 473.8 | | | | | | | | | | | | | |
| 100 | | Core 60" | Rec 60" | RQD 85% | R-2 | | Medium hard to hard gray SANDSTONE; very fine to fine grained, slightly to moderately weathered, argillaceous, micaceous, thinly bedded to thickly bedded, moderately fractured, with typically low angle clay filled fractures. | | | | | | | |
| 105 | | Core 60" | Rec 54" | RQD 67% | R-3 | | @ 103.0' to 103.5', lost recovery. @ 103.5' to 104.0',106.7' to 107.7',1 broken zone. | | | | | | | |
| 110 | | Core 60" | Rec 60" | RQD 90% | R-4 | | | | | | | | | |
| 113.0 | 456.4 | | | | | | Bottom of Boring - 113.0' | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 27.6', 33'-37', 50'-58', 67'-72', 84'-92'
Water level at completion: 25.5' (start of shift 2/22/05)
25.5' (Prior to coring)
25.3' (Including core 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 | 568.0 | 1 3 2 | 13 | 1 | | 1.75 | Stiff dark brown SILT AND CLAY (A-6b), trace fine sand; damp to moist. | | | | | | |
| | | 4 4 10 | 18 | 2 | | 2.0 | @ 1.5', brown. | 0 | 1 | – | 3 | 51 | 45 |
| 3.5 | 564.5 | | | | | | | | | | | | |
| 5 | | 4 5 8 | 18 | 3 | | 3.5 | Very stiff brown CLAY (A-7 6), trace fine to coarse sand; damp to moist. | 0 | 0 | – | 1 | 44 | 55 |
| | | 2 4 6 | 18 | 4 | | 3.5 | @ 6.5', varved. | | | | | | |
| 10 | | 2 4 6 | 18 | 5 | | 3.75 | | | | | | | |
| | | 2 6 7 | 18 | 6 | | 3.25 | | | | | | | |
| 13.5 | 554.5 | | | | | | | | | | | | |
| 15 | | 4 7 11 | 18 | 7 | | 4.0 | Very stiff to hard brown SILTY CLAY (A-6b), trace fine sand; damp to moist. | | | | | | |
| | | 4 6 7 | 18 | 8 | | 4.5+ | | 0 | 0 | – | 1 | 35 | 64 |
| 20 | | 4 5 9 | 18 | 9 | | 4.5+ | | | | | | | |
| | | 3 5 8 | 18 | 10 | | 3.5 | | | | | | | |
| 25 | | 3 4 5 | 18 | 11 | | 2.75 | | | | | | | |
| | | 3 4 5 | 18 | 12 | | 3.0 | @ 27.6', Thin sandy silt seam; wet. | | | | | | |
| 30 | | 4 5 | | 13 | | 3.0 | | | | | | | |

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

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 27.6', 33'-37', 50'-58', 67'-72', 84'-92'
Water level at completion: 25.5' (start of shift 2/22/05)
25.5' (Prior to coring)
25.3' (Including core 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 538.0 | 7 | 18 | | | | Very stiff to hard brown SILTY CLAY (A-6b), trace fine sand; moist. | | | | | | |
| 35 | | 4 7 8 | 18 | 14 | | 2.0 | | | | | | | |
| 37.0 | 531.0 | | | | | | Very stiff to hard gray SILT (A-4b), "and" clay, trace fine to coarse sand; moist. | | | | | | |
| 40 | | 6 5 11 | 18 | 15 | | 4.5+ | | 0 | 0 | – | 0 | 53 | 47 |
| 45 | | 5 6 10 | 18 | 16 | | 3.5 | | | | | | | |
| 50 | | 3 4 6 | 18 | 17 | | 2.5 | @ 49.0', stiff to very stiff; wet. | | | | | | |
| 55 | | 3 3 5 | 18 | 18 | | 1.5 | | | | | | | |
| 60 | | 4 5 | | 19 | | 3.25 | | | | | | | |

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

FILE: 0121-3070-03 ( 8/25/2006 10:12 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

WATER OBSERVATIONS: Water seepage at: 27.6', 33'-37', 50'-58', 67'-72', 84'-92'
Water level at completion: 25.5' (start of shift 2/22/05)
25.5' (Prior to coring)
25.3' (including core 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 508.0 | 7 | 18 | | | | Very stiff to hard gray SILT (A-4b), "and" clay, trace fine to coarse sand; wet. | | | | | | |
| 65 | | 4 7 8 | 18 | 20 | | 2.0 | | 0 | 0 | – | 0 | 74 | 26 |
| 67.0 | 501.0 | | | | | | Medium dense brown SANDY SILT (A-4a), trace gravel, trace clay; wet. | | | | | | |
| 70 | | 4 10 10 | 18 | 21 | | | | 3 | 11 | – | 50 | 36 | |
| 72.0 | 496.0 | | | | | | Very stiff brownish gray SILT AND CLAY (A-6a), trace fine sand; moist to wet. | | | | | | |
| 75 | | 7 14 20 | 18 | 22 | | 2.25 | | 0 | 0 | – | 8 | 57 | 35 |
| 77.0 | 491.0 | | | | | | Medium dense to dense brownish gray SILT (A-4b), "and" clay, trace gravel; moist to wet. | | | | | | |
| 80 | | 5 7 16 | 18 | 23 | | | | | | | | | |
| 85 | | 8 6 9 | 18 | 24 | | | @ 84.0', wet. | | | | | | |
| 88.0 | 480.0 | | | | | | Dense brown GRAVEL WITH SAND (A-1-b), trace silt; wet. | | | | | | |
| 90 | | 10 14 | | 25 | | | | | | | | | |

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

Non-Plastic

FILE: 0121-3070-03 [ 8/25/2006 10:12 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-42** | Location: Rear Abutment SCI-823.00 over CSX RR | Date Drilled: 2-18-05 to 2-22-05

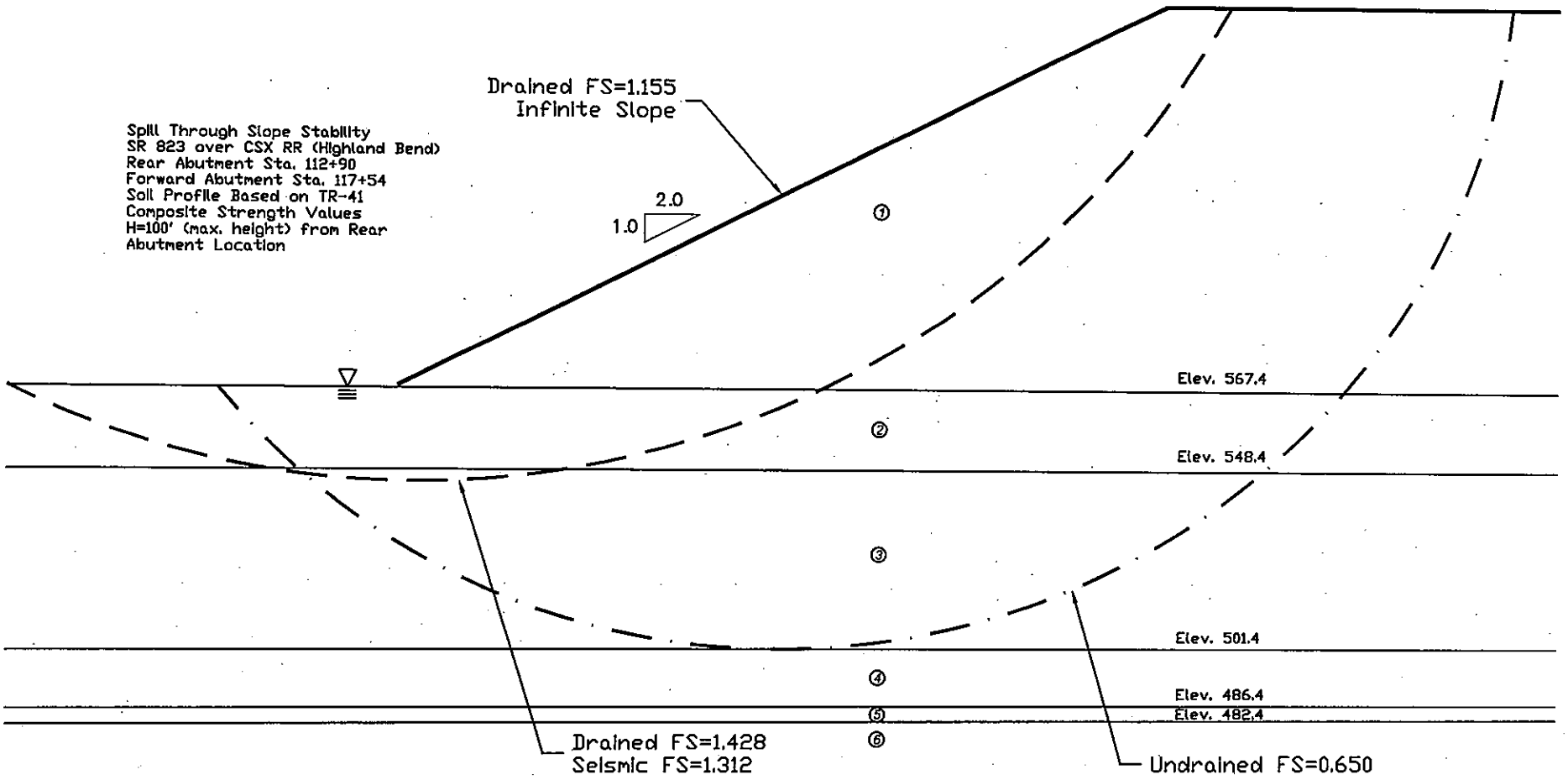
WATER OBSERVATIONS: Water seepage at: 27.6', 33'-37', 50'-58', 67'-72', 84'-92'
Water level at completion: 25.5' (start of shift 2/22/05)
25.5' (Prior to coring)
25.3' (including core water)

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 | 478.0 | 23 | 18 | | | | Dense brown GRAVEL WITH SAND (A-1-b), trace silt; wet. | | | | | | | |
| 92.0 | 476.0 | | | | | | | | | | | | | |
| 94.0 | 474.0 | Core 60" | Rec 48" | RQD 75.0% | R1 | | Medium hard gray SANDSTONE; very fine to fine grained, moderately to highly weathered, argillaceous, micaceous, thickly bedded to massive, highly fractured. | | | | | | | |
| 95 | | | | | | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, massively bedded, moderately to highly fractured. @ 94.1', 94.6', 95.1', 96.1', 97.4', 97.8', 100.8' and 101.4', fractured. | | | | | | | |
| 100 | | Core 60" | Rec 58" | RQD 88.3% | R2 | | @ 104.0', high angle fracture. @ 102.2', 105.8' and 108.9' clay filled fractures. | | | | | | | |
| 105 | | Core 60" | Rec 55" | RQD 60.0% | R3 | | @ 104.3' to 104.5', high angle fracture. @ 104.5' to 105.1', broken. | | | | | | | |
| 110 | | Core 60" | Rec 59" | RQD 85.0% | R4 | | | | | | | | | |
| 112.0 | 456.0 | | | | | | Bottom of Boring - 112.0' | | | | | | | |
| 115 | | | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 8/25/2006 10:12 AM ]

| Material | Consistency | Soil Type | Undrained C (psf) | Undrained Φ (deg) | Drained C' (psf) | Drained Φ' (deg) | γ (pcf) |
|---|---|---|---|---|---|---|---|
| Material 1 | Compacted | Emb. Fill | 0 | 30 | 0 | 30 | 120 |
| Material 2 | Stiff | Clay | 1700 | 0 | 0 | 30 | 125 |
| Material 3 | Stiff | Silt | 1100 | 0 | 0 | 28 | 120 |
| Material 4 | Stiff | Silty Clay | 1500 | 0 | 0 | 29 | 120 |
| Material 5 | M. Dense | Sand | 0 | 34 | 0 | 34 | 115 |
| Material 6 | | Bedrock | 10000 | 45 | 10000 | 45 | 145 |

Spill Through Slope Stability
SR 823 over CSX RR (Highland Bend)
Rear Abutment Sta. 112+90
Forward Abutment Sta. 117+54
Soil Profile Based on TR-41
Composite Strength Values
H=100' (max. height) from Rear Abutment Location



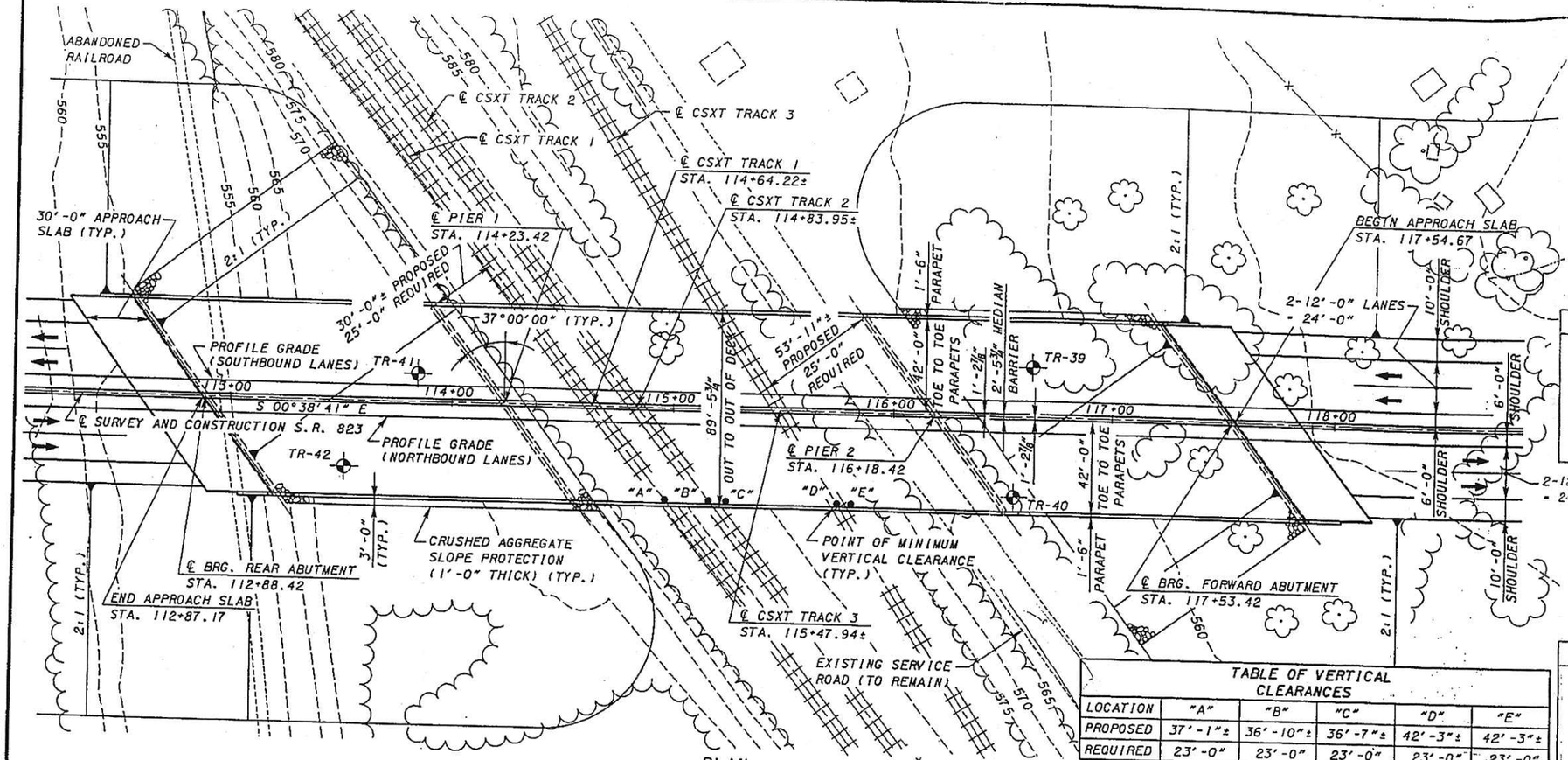

823 OVER CSX RR
DRAINED & UNDRAINED ANALYSIS
PROFILE BASED ON TR-41

SPILL THROUGH SLOPE STABILITY ANALYSIS

SCI-823-0.00

| PROJECT NO. 0121-3070.03 | CALC: SJR | DATE 8/25/06 |
|---|---|---|

M:\proj\0121\3070.03\Stability Analyses\MSE Wall and Embankment Profiles.dwg, 8/25/2006 3:15:53 PM, \\Diztree\Q_geotech\plj5100tn




PLAN

| BORING LOCATIONS | | |
|---|---|---|
| BORING No. | STATION | OFFSET |
| TR-39 | 116+63.48 | 22.42' LT. |
| TR-40 | 116+55.18 | 36.50' RT. |
| TR-41 | 113+84.44 | 12.59' LT. |
| TR-42 | 113+51.70 | 30.30' RT. |

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

| TRAFFIC DATA |
|---|
| (SR 823) |
| CURRENT YEAR ADT (2010) - 21,200 |
| DESIGN YEAR ADT (2030) - 31,200 |
| CURRENT YEAR ADTT (2010) - 2,968 |
| DESIGN YEAR ADTT (2030) - 4,368 |

| TABLE OF VERTICAL CLEARANCES | | | | | |
|---|---|---|---|---|---|
| LOCATION | "A" | "B" | "C" | "D" | "E" |
| PROPOSED | 37'-1"± | 36'-10"± | 36'-7"± | 42'-3"± | 42'-3"± |
| REQUIRED | 23'-0" | 23'-0" | 23'-0" | 23'-0" | 23'-0" |

## PROPOSED STRUCTURE

TYPE: 3-SPAN CONTINUOUS A709 GRADE 50W STEEL PLATE GIRDER WITH A COMPOSITE REINFORCED CONCRETE DECK AND SUBSTRUCTURES SUPPORTED ON PILES

SPANS: 135'-0", 195'-0", 135'-0" ℄ TO ℄ BEARINGS

ROADWAY:

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

SKEW: 37°00'00" RIGHT FORWARD

CROWN: NORMAL - 0.016 FT/FT

ALIGNMENT: TANGENT

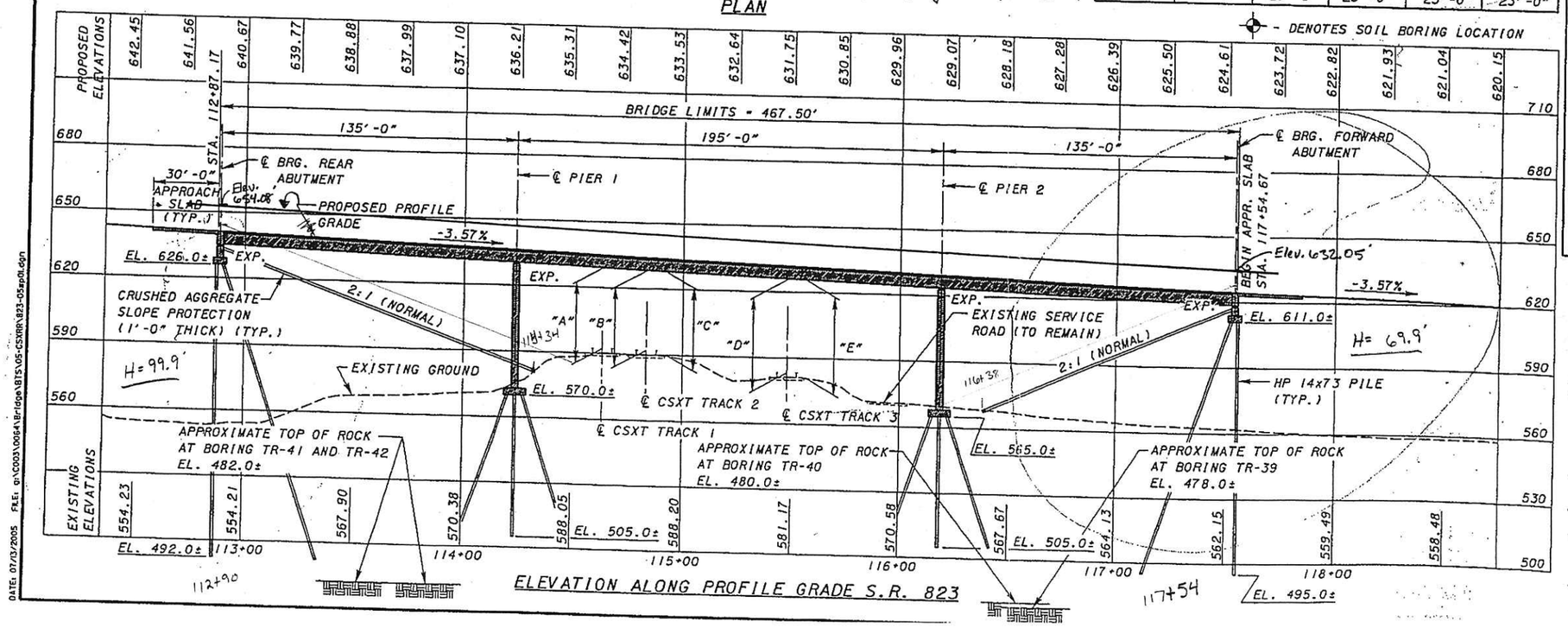
WEARING SURFACE: 1" MONOLITHIC CONCRETE

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

LATITUDE:

LONGITUDE:

STRUCTURE FILE NO.:




ELEVATION ALONG PROFILE GRADE S.R. 823

- DENOTES SOIL BORING LOCATION

NOTES:

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

FOUNDATION DATA:

ALL NEW PILES SHALL BE HP 14x73 FRICTION PILES AND HAVE A MAXIMUM CAPACITY OF 95 TONS PER PILE.

FOUNDATION DATA:

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

DESIGN AGENCY: TRANSYSTEMS CORPORATION, 55 PUBLIC SQUARE, SUITE 800, CLEVELAND, OHIO 44113-1901

DATE 7/12/05

REVIEWED NFF | STRUCTURE FILE NUMBER

DRAWN CAG | REVISED

DESIGNED AK | CHECKED RER

SCIOTO COUNTY
STA. 112+87.17
STA. 117+54.67

PRELIMINARY SITE PLAN - ALTERNATIVE 2
BRIDGE NO. SCI-823-XXXX
S.R. 823 OVER CSXT RAILROAD

SCI-823-0.00
PID 19415

D | 1 | 2

DATE: 07/13/2005 FILE: q:\C003\0064\Bridge\BTS\05-CSXRR\823-05ep01.dgn

**CN-Patrick J. Plews**

**From:** Steven Riedy [sriedy@dlzcorp.com]
**Sent:** Thursday, October 26, 2006 1:36 PM
**To:** CN-Patrick J. Plews
**Subject:** Re: SCI 823 over CSX Highland Bend

Patrick,
Because we do not have any MSE walls in this area, the approach embankments will be constructed in the same manner as the roadway embankments. Based upon the Highland Bend Embankment report dated June 8, 2006, staged construction is recommended. The maximum reported construction stage is 30', as per the results of embankment stability of the roadway embankment from sta 105+00 to 114+00. Similarly, the maximum reported construction stage is 40', as per the results of embankment stability of the roadway embankment from sta 116+00 to 122+00.
A waiting period will most likely be required after the completion of the roadway embankment and prior to driving piles to mitigate downdrag effects on the piles. *Typically*, the subsurface soils will be allowed to consolidate to approximately 90 percent prior to driving piles. It is anticipated (and recommended) that wick drains be used on the roadway embankments areas in this valley. Several spacing options have been presented in our report. The time to 90 percent consolidation will depend upon the spacing selected and the maximum allowable construction stage.
It is very difficult to predict the degree of settlement of the finished embankment when the contractor will be using staged construction. Instrumentation will most likely be used to monitor the settlement and pore water pressures in the foundations soils during construction.
On many projects using wick drains, by the time the last stage is complete, instrumentation indicates that enough settlement has occurred to allow piles to be driven. Conversely, a small waiting period may be required. The amount of time will depend on the wick drain spacing and construction time.
I hope that this is helpful. Please let me know if you need anything else.
Thanks,
Steven

**Steven J. Riedy**
Geotechnical Engineer

**Telephone: (614) 888-0040**
**Cellular Phone: 614-332-9146**
**FAX: (614) 848-6712**
**e-mail: sriedy@dlz.com**

DLZ
ENGINEERS ARCHITECTS SCIENTISTS
PLANNERS SURVEYORS

**6121 Huntley Road • Columbus, Ohio 43229-1003**



pjplews@transystems.com wrote:

Steven-

ODOT has asked us on a number of these structures to identify the construction sequence or any other special recommendations as they relate to settlement/down drag. Is there a waiting period or other special recommendations for the abutment foundation construction for this structure? Please feel free to give me a call if you need some more information.
Thanks

**Patrick J. Plews, PE**
Bridge Engineer
TranSystems
Main 513-621-1981ext 36013

--

# APPENDIX E

## Preliminary Railroad Correspondence

TranSystems

## CN-Patrick J. Plews

**From:** Steve_VanSlyke@URSCorp.com
**Sent:** Thursday, June 22, 2006 3:10 PM
**To:** CN-Patrick J. Plews
**Cc:** david.norris@dot.state.oh.us; Mel_McNichols@csx.com; deborah_baldino@csx.com; Larry_Shaw@URSCorp.com
**Subject:** Fw: Portsmouth, OH - SR 823 - SCI-823-0.00 over CSXT Railroad (2) - ODOT PID# 19415 - OP# OH0472

Patrick

Regarding your points of discussion for CSXT consideration on the Subject project:

1) CSXT will not consider a scenario where there is a pier constructed between the tracks.

2) URS will entertain review of relocating the existing access road to reduce span length as proposed. Prior to approval, CSXT Property Services will need to amend the lease with the agreement holder and will need to review drawings in plan and profile, that also include cross sections along the near track and proposed road realignment. This set should also contain temporary and permanent drainage considerations along the entire access road realignment and tie-ins.

You may forward 3 sets directly to me for my further handling.

Any other progression of project plans - for either proposed structure or right-of-way impacting CSXT should be forward to Mr. Larry Shaw (Address in trailing e-mail) for his handling and distribution to develop the entire project.

Feel free to contact me if any questions or if any further clarification is needed.

Stephen G. VanSlyke
URS Corporation
36 East Seventh Street Suite 2300
Cincinnati, OH 45202

Ph: (513) 419-3509
Fax: (513) 651-3452
Cell: 314-406-1480



----- Forwarded by Steve VanSlyke/Decatur/URSCorp on 06/22/2006 02:55 PM -----

| | | |
|---|---|---|
| Larry Shaw/Indianapolis /URSCorp<br><br>06/13/2006 04:13 PM | steve_vanslyke@urscorp.com | To<br><br>cc |
| | pjplews@transystems.com, david.norris@dot.state.oh.us, | |

richard.behrendt@dot.state.oh.us,
Mel_McNichols@csx.com,
deborah_baldino@csx.com

Subject
Fw: Portsmouth, OH - SR 823 -
SCI-823-0.00 over CSXT Railroad (2)
- ODOT PID# 19415 - OP# OH0472

Steve,
Please contact Patrick Plews, TranSystems (ODOT's design consultant) relative his trailing message. Thanks.
NOTE: in addition to the plan sheet provided by Patrick, I have attached select plan sheets recently received from Rich Behrendt.

NOTE: NEW ADDRESS & PHONE
Larry J. Shaw, P.E.
Program Manager
URS Corporation
One Indiana Square, Suite 2100
Indianapolis, IN 46204

Larry_Shaw@urscorp.com
Tel: 317.532.5481
Fax: 317.532.5499



----- Forwarded by Larry Shaw/Indianapolis/URSCorp on 06/13/2006 03:42 PM -----

<pjplews@transystems.com>

06/02/2006 04:56 PM

To
<larry_shaw@urscorp.com>
cc
<David.Norris@dot.state.oh.us>,
<mdweeks@transystems.com>
Subject
FW: SCI-823-0.00 over CSXT Railroad (2)

Larry-
Per our conversation earlier today attached is a pdf of the site plan that was prepared for one of our preliminary submittals. The proposed site is approximately 0.65 miles south of the crossing of with SR 335. The crossing at SR 335 is identified as AARDOT # 228404E and its milepost is listed as 0003.66.

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I understand that you may not have the contractual issues completely resolved but I wanted to get the information to you. Please contact me once you are sure of the contract and we can discuss the timeline to resolve them.
Thanks

Patrick J. Plews, EI
Bridge Engineer
TranSystems
Main 513-621-1981ext 36013

From: CO-Michael Weeks
Sent: Thursday, June 01, 2006 3:25 PM
To: 'David.Norris@dot.state.oh.us'
Cc: CN-Jon Cox; CN-Michael Lenett
Subject: RE: SCI-823-0.00 over CSXT Railroad (2)

Dave,

We will contact Larry and advise you of our conversation.

Thanks,
Mike

From: David.Norris@dot.state.oh.us [mailto:David.Norris@dot.state.oh.us]
Sent: Thursday, June 01, 2006 3:12 PM
To: CO-Michael Weeks
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Subject: Fw: SCI-823-0.00 over CSXT Railroad (2)

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On our Ross 207 project, we coordinated with him at the following address:

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Indianapolis, IN 46204
Tel: 317-635-0064
Fax: 317-635-0066
email: Larry_Shaw@urscorp.com

--
David A. Norris, PE
ODOT District 9 DDD Engineering Assistant PO Box 467 Chillicothe, OH 45601 Toll Free: (888) 819-8501 Direct Phone: (740)-774-9061
----- Forwarded by David Norris/Administration/D09/ODOT on 06/01/2006 03:04 PM -----

Richard
Behrendt/RealEstate/CEN/ODOT

06/01/2006 02:37 PM

To
David
Norris/Administration/D09/ODOT@ODOT
cc
Subject
Re: Fw: SCI-823-0.00 over CSXT Railroad (2)Link

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I don't need to be involved...I don't believe Larry would have any difficulty discussing this directly w/your consultant as long as he has a set of plans to refer to...

Thanks for checking...

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Program Mgr./State Rail Coordinator
Ohio Department of Transportation
1980 West Broad St.
Columbus, Ohio 43223
Phone: 614-387-3097
FAX: 614-466-0158
email: richard.behrendt@dot.state.oh.us

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Or would you like to be involved?

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----- Forwarded by David Norris/Administration/D09/ODOT on 06/01/2006 02:01 PM -----

<mdweeks@transystems.com>

06/01/2006 01:05 PM

To
<David.Norris@dot.state.oh.us>

cc
<jrcox@transystems.com>, <mslenett@transystems.com>

Subject
FW: SCI-823-XXXX over CSXT Railroad

Dave,

Please see our bridge design team's concerns with OSE's comments on SCI-823 over CSXT. I thought you would probably like to check with Richard Behrendt at Central Office to see

how we should address these questions to CSXT. Let me know if you have questions or if we should pursue this with CSXT directly.

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From: CN-Michael Lenett
Sent: Thursday, June 01, 2006 10:22 AM
To: CO-Michael Weeks
Cc: CN-Jon Cox; CN-Patrick J. Plews
Subject: SCI-823-XXXX over CSXT Railroad

Hi Mike.

Here are the structural questions regarding SCI-823-xxxx over the CSXT Railroad:

1) ODOT comment #2 (dated 9/26//2005) discusses moving the 2:1 embankment slope of the forward abutment, which requires relocating the existing service road. This service road is within CSXT's Right-of-Way.
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Michael S. Lenett, Ph.D.
Senior Bridge Project Engineer
TranSystems
Main 513-621-1981 ext. 36022
Mobile 513-503-4715

## CN-Patrick J. Plews

**From:** Steve_VanSlyke@URSCorp.com
**Sent:** Tuesday, August 01, 2006 1:56 PM
**To:** CN-Patrick J. Plews
**Cc:** CN-Jon Cox; Larry_Shaw@urscorp.com; CO-Michael Weeks
**Subject:** Re: FW: Portsmouth, OH - SR 823 - SCI-823-0.00 over CSXT Railroad (2) - ODOT PID# 19415 - OP# OH0472

Patrick

There are no immediate plans for track expansion at these 2 proposed bridge locations. It appears that the initial design will leave enough room for some anyway.

If further insight or clarification is needed, please call.

Please route all plans requiring engineering review and/or comment to Mr. Larry Shaw. Thanks.

Stephen G. VanSlyke
URS Corporation
36 East Seventh Street Suite 2300
Cincinnati, OH 45202

Ph: (513) 419-3509
Fax: (513) 651-3452
Cell: 314-406-1480



<pjplews@transystems.com>

07/20/2006 11:43 AM

To <steve_vanslyke@urscorp.com>, <Larry_Shaw@urscorp.com>

cc <jrcox@transystems.com>, <mdweeks@transystems.com>

Subject FW: Portsmouth, OH - SR 823 - SCI-823-0.00 over CSXT Railroad (2) - ODOT PID# 19415 - OP# OH0472

Larry and Steve-
According to Jim Shircliff at CSX, engineering addresses any issues of future use for any CSX property. He recommended we verify, with you, that there are no plans for future expansion at the crossings where we have wide R/W corridors and/or abandoned tracks that we are crossing.

Please contact me if this has already been investigated or to discuss any other information you would need.
Thanks

Patrick J. Plews, PE
Bridge Engineer
TranSystems
Main 513-621-1981ext 36013

-----Original Message-----
From: CN-Patrick J. Plews
Sent: Thursday, July 20, 2006 11:33 AM
To: 'jim_shircliff@csx.com'
Cc: CO-Michael Weeks; 'david.norris@dot.state.oh.us'; 'Larry_Shaw@URSCorp.com'
Subject: RE: Portsmouth, OH - SR 823 - SCI-823-0.00 over CSXT Railroad (2) - ODOT PID# 19415 - OP# OH0472

Jim-
Thanks for calling to discuss the proposed crossings and right of way with me this morning. Attached are the plans that I mentioned in our conversation. The first file attached includes the project title sheet and some larger scale plan views. The second file includes drawings showing the property lines at each crossing that our surveyors have determined to date. We have not shown proposed R/W lines but many of the proposed construction features are shown.

The plans indicate property lines that extend well beyond the current track configuration or include abandoned tracks and we would like to verify that the property limits shown are corresponding with your records. I understand that engineering makes the determination of any future use for the property and I will work with URS to determine if this is a possibility at these locations. We would also like to know of any issues that you foresee in the acquisition process in this preliminary design stage.

Please feel free to contact me if you would like more information regarding approximate proposed R/W lines or any other questions. I would suggest that we set up a time at which we can discuss these; perhaps early next week?
Thanks again

Patrick J. Plews, PE
Bridge Engineer
TranSystems
Main 513-621-1981ext 36013

-----Original Message-----
From: Larry_Shaw@URSCorp.com [mailto:Larry_Shaw@URSCorp.com]
Sent: Tuesday, June 13, 2006 4:13 PM
To: steve_vanslyke@urscorp.com
Cc: CN-Patrick J. Plews; david.norris@dot.state.oh.us; richard.behrendt@dot.state.oh.us; Mel_McNichols@csx.com; deborah_baldino@csx.com
Subject: Fw: Portsmouth, OH - SR 823 - SCI-823-0.00 over CSXT Railroad (2) - ODOT PID# 19415 - OP# OH0472

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(See attached file: SR 823 over CSX.pdf)(See attached file: 015-plans(051606)oh0472.pdf)
[attachment "015-plans(051606)oh0472.pdf" deleted by Steve VanSlyke/Decatur/URSCorp]
[attachment "SCI-823-0.00-CSX-BRIDGES-OP#OH0472.pdf" deleted by Steve VanSlyke/Decatur/URSCorp]