*Structure Type Study*

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SKT

# Ramp C over Fairground Road

# SCI-823-0.00
# PID No. 19415

Prepared for

**Ohio Department of Transportation**

July 2005

CH2MHILL

*Structure Type Study*

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## 1. Introduction

Four (4) alternatives for construction of the proposed Ramp C bridge over Fairground Road have been evaluated in this Structure Type Study, and are designated (in no particular order) Alternatives 1 through 4. All four alternatives involve construction of the proposed bridge on a single-span layout. Alternatives 1 and 2 consist of a long span bridge deck supported by semi-integral stub abutments on spill through slopes constructed in fill. Alternatives 3 and 4 consist of a short, single-span bridge with tall Mechanically Stabilized Earth (MSE) abutments located outside of the horizontal clear zone. These MSE walls would be continuous and serve as the rear and forward abutment breastwalls for the Ramp C bridge over Fairground Road, as well as for both the adjacent SR-823 Mainline and Ramp B bridges over Fairground Road. Although the Ramp C geometry is horizontally curved at the proposed bridge location, the long spans of Alternatives 1 and 2 allow for the use of a straight prestressed concrete I-beam superstructure and a tangent steel plate girder superstructure, respectively, while the short spans of Alternatives 3 and 4 allow for the use of a straight prestressed concrete I-beam superstructure and a tangent structural steel rolled beam superstructure, respectively. All four alternatives result in variable overhangs to satisfy the horizontal bridge geometry.

A fifth alternative, consisting of a three-span bridge, was also considered; however, the analysis is not presented in this document. As part of the SCI-823-0.00 project, three roadway alignments, SR-823 Mainline, Ramp B, and Ramp C, pass over the existing Fairground Road. Due to the close proximity of the three roadway alignments at the proposed grade separations over Fairground Road, it is important from a construction, maintenance, and overall aesthetic standpoint to use similar structure types for the three bridge. Because the existing Fairground Road is a lightly-traveled, two-lane rural road, the required clear span is relatively short, and single-span alternatives are assumed to provide the most cost-effective structure. This assumption was verified by analyzing a three-span alternative behind spill-through slopes for the SR-823 Mainline bridge over Fairground Road (for details, see separate Structure Type Study for the SR-823 Mainline bridge). The results show that a three-span alternative is excessive in both initial construction and life-cycle maintenance costs. Therefore, three-span structure alternatives have been ruled out as economical structure types for the proposed Ramp C bridge over Fairground Road.

Each alternative was evaluated with regard to estimated construction cost, projected maintenance costs, horizontal and vertical clearances, aesthetics, constructability, and maintenance of traffic. Based on these evaluations, one alternative is recommended for further design development in the Bridge Preliminary Design Report stage.

## 2. Design Criteria

All proposed structure types are in accordance with the most current version of the Ohio Department of Transportation Bridge Design Manual and the 2002 AASHTO Standard Specifications for Highway Bridges, 17th edition.

## 3. Bridge Transverse Section and Alignment

At the proposed bridge location, Ramp C follows a 1°00'00" horizontal curve (5729.58-foot radius) to the right. The proposed section consists of one 16-foot lane, a 6-foot left shoulder, and an 8-foot right shoulder. With two 1'-6" wide single slope outside deflector parapets, the out-to-out deck width is a constant 33'-0" for all alternatives. The Ramp C bridge will be superelevated, with a constant superelevation rate of 2.9 percent across the entire length of the proposed structure.

The proposed Ramp C vertical alignment over Fairground Road consists of a 250-foot sag vertical curve over the entire length of the proposed bridge structure.

The existing Fairground Road will remain on the existing horizontal alignment and vertical grade under the bridge, and will not be constructed as part of the project except as required for restoration after construction of the new bridge.

## 4. Proposed Maintenance of Traffic Solution

The proposed Ramp C alignment will carry traffic exiting westbound SR-823 onto northbound US-23. Because the Ramp C alignment is new construction, maintenance of traffic during construction of the Ramp C bridge over Fairground Road will be limited. With the exception of limited Fairground Road closure for superstructure beam setting, as well as traffic safety precautions throughout bridge construction, no additional maintenance of traffic solutions will need to be investigated.

## 5. Evaluation of Structure Alternatives

### Common Considerations

Construction costs for each alternative have been developed for an identical length of improvement, equal to the length of the longest alternative. Estimated construction costs for each alternative include all proposed work between these limits. The vertical profile of Ramp C is controlled by the crossing over the Norfolk Southern Railway to the west of the proposed structure over Fairground Road. As a result, vertical clearance over Fairground Road greatly exceeds the 17'-0" minimum, and no additional costs associated with profile adjustments are necessary. Other estimated construction costs not included in the cost estimate include provisions for the reconstruction of Fairground Road (if required due to construction impacts) and maintenance of traffic cost differentials.

The existing Fairground Road section is an uncurbed roadway, with an edge of pavement to edge of pavement width of approximately 21'-0" and a design speed of 40 mph. Substructures along Fairground Road for alternatives consisting of spill-through slopes are located outside the minimum preferred horizontal clear zone width of 8'-0". Substructures consisting of abutments behind MSE walls are located outside the minimum preferred horizontal clear zone width of 10'-0" to the face of MSE wall.

### Alternative 1

Alternative 1 consists of a 130.78 foot single-span bridge with rear and forward abutments on steel H-piles behind spill-through 2:1 slopes. Both semi-integral stub abutment faces will be tangent and parallel to the Fairground Road centerline. For Alternative 1, the

superstructure will consist of four straight 72" deep Modified AASHTO Type 4 prestressed concrete beams spaced at 9'-0" on center.

The initial bridge construction cost for Alternative 1 is estimated to be $662,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $233,000, resulting in a total estimated ownership cost of $895,000 in year 2008 dollars.

### Alternative 2

Alternative 2 also consists of a 130.78 foot single-span bridge with rear and forward abutments on steel H-piles behind spill-through 2:1 slopes. Both semi-integral stub abutment faces will be tangent and parallel to the Fairground Road centerline. For Alternative 2, however, the superstructure will consist of four tangent steel plate girders, using Grade 50 steel members spaced at 9'-0" and having a web depth of 52".

The initial bridge construction cost for Alternative 2 is estimated to be $700,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $355,000, resulting in a total estimated ownership cost of $1,055,000 in year 2008 dollars.

### Alternative 3

Alternative 3 consists of a 56.19 foot single-span bridge with rear and forward semi-integral stub abutments behind tall MSE abutment breastwalls constructed outside the minimum preferred Fairground Road lateral clearance. The rear and forward abutment breastwalls will be parallel to the Fairground Road centerline. While it is possible to construct an MSE retaining wall with semi-integral stub abutments on steel H-piles, both the rear and the forward abutments are assumed to be founded on spread footings for this analysis. In the Preliminary Design Report submission, the footing width will need to be sized accordingly to satisfy the maximum bearing pressure of 4,000 psf, as required by the AASHTO specifications and ODOT Bridge Design Manual. For Alternative 3, the superstructure will consist of four tangent 36"-deep AASHTO Type 2 prestressed concrete beams spaced at 9'-0" on center.

The initial bridge construction cost for Alternative 3 is estimated to be $611,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $104,000, resulting in a total estimated ownership cost of $715,000 in year 2008 dollars.

### Alternative 4

Alternative 4 also consists of a 56.19 foot single-span bridge with rear and forward semi-integral stub abutments behind tall MSE abutment breastwalls constructed outside the minimum preferred Fairground Road lateral clearance. The rear and forward abutment breastwalls will be parallel to the Fairground Road centerline. While it is possible to construct an MSE retaining wall with semi-integral stub abutments on steel H-piles, both the rear and the forward abutments are assumed to be founded on spread footings for this analysis. In the Preliminary Design Report submission, the footing width will need to be sized accordingly to satisfy the maximum bearing pressure of 4,000 psf, as required by the AASHTO specifications and ODOT Bridge Design Manual. For Alternative 4, the superstructure will consist of four tangent W24 steel rolled beams, using Grade 50 steel members spaced at 9'-0" on center.

The initial bridge construction cost for Alternative 4 is estimated to be $609,000 in year 2008 dollars. The present value life cycle maintenance costs for this alternative are estimated to be $140,000, resulting in a total estimated ownership cost of $749,000 in year 2008 dollars.

## 6. Recommended Alternative

Four (4) structural solutions (excluding three-span alternatives previously mentioned) for the construction of the proposed Ramp C alignment over Fairground Road have been evaluated in this structure type study. All alternatives provide comparable operational characteristics and meet minimum horizontal clearance requirements. Due to the fact that the proposed Ramp C grade separation structure over the Norfolk Southern Railway west of Fairground Road controls the vertical profile for vertical clearance, no differential costs associated with profile adjustments have been considered in the aforementioned alternatives. Based on lower estimated total ownership costs, **CH2M HILL recommends that the single-span bridge of ALTERNATIVE 3, using tall MSE walls and prestressed concrete I-beams, be constructed for the Ramp B bridge over Fairground Road.**

## 7. Subsurface Conditions and Foundation Recommendation

Subsurface investigations for the SCI-823-0.00 project will be conducted in two, possibly three, phases. The first mobilization is complete, and included all of the proposed pavement and embankment borings, and a limited number of bridge borings. The second mobilization will include the remaining bridge borings (if necessary), and the majority of the proposed MSE retaining wall borings. If required, a third mobilization will target specific boring locations or in-situ testing recommended in the bridge and retaining wall Preliminary Design Report submissions.

Two borings at the Ramp C bridge over Fairground Road were taken during the first mobilization. Based on these initial borings, geotechnical subconsultant DLZ has made preliminary foundation recommendations for the Ramp C structure. Copies of the preliminary report are included with this submission.

The recommended alternative, Alternative 3, consists of semi-integral stub abutments supported behind MSE retaining walls for the single-span bridge. Both abutments are assumed to be supported on spread footings resting directly on the MSE select granular fill to avoid conflicts with the MSE reinforcing straps. If pile foundations are required and used, the piles are envisioned to be HP 14x73 H-pile sections driven to bedrock refusal. The pile spacing is assumed to be 7'-6" to allow for convenient staggering of the piles between MSE reinforcing in 5'-0" standard square wall panels. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock.

Final foundation size, capacity, and possible pile length recommendations will be made upon completion of the remaining bridge and retaining wall borings, and will be included with the bridge Preliminary Design Report submission.

# APPENDIX A

## Cost Comparison Summary

# SCI-823-0.00

## Ramp C Over Fairground Road

**STRUCTURE TYPE STUDY**

Filename: P:\TranSystems\319861\19415\structures documents\Step 7 - Type Study\Bridge SCI823-1595C Ramp C over Fairground\[Structure Cost Comparison.xls]Alternative Summary

By: SKT Date: 7/6/2005

Checked: Date:

## COST COMPARISON SUMMARY

| Alternative No. | Span Arrangement No. Spans | Span Arrangement Lengths | Framing Alternative | Proposed Stringer Section | Total Initial Superstructure Cost | Total Initial Substructure Cost | Total Initial Construction Cost | Superstructure Life Cycle Maintenance Cost | Total Relative Ownership Cost |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 130.78 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 4 Mod. (72") | $305,000 | $171,000 | $662,000 | $233,000 | **$895,000** |
| 2 | 1 | 130.78 | 4 ~ Steel Plate Girders | 52" Web - Grade 50 | $332,000 | $171,000 | $700,000 | $355,000 | **$1,055,000** |
| 3 | 1 | 56.19 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 2 | $134,000 | $287,000 | $611,000 | $104,000 | **$715,000** |
| 4 | 1 | 56.19 | 4 ~ Steel Rolled Beams | W24 - Grade 50 | $133,000 | $287,000 | $609,000 | $140,000 | **$749,000** |

# SCI-823-0.00

## Ramp C Over Fairground Road

**STRUCTURE TYPE STUDY**

Filename: C:\Documents and Settings\NBROWN3\Local Settings\Temporary Internet Files\OLK3E\[Structure Cost Comparison.xls]Alternative Summary
By: SKT Date: 7/6/2005
Checked: Date:

## ALTERNATIVE COST SUMMARY

| Alternative No. | Span Arrangement No. Spans | Lengths | Total Span Length (ft.) | Framing Alternative | Proposed Stringer Section | Subtotal Superstructure Cost | Subtotal Substructure Cost | Approach Roadway Length (1) | Approach Roadway Cost (2, 3) | Structure Incidental Cost (16%) | Structure Contingency Cost (20%) | Roadway Incidental & Contingency Cost (30%) | Total Initial Construction Cost | Superstructure Life Cycle Maintenance Cost | Total Relative Ownership Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 130.78 | 130.78 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 4 Mod. (72") | $305,000 | $171,000 | 0.0 | $0 | $76,000 | $110,000 | $0 | $662,000 | $233,000 | $895,000 |
| 2 | 1 | 130.78 | 130.78 | 4 ~ Steel Plate Girders | 52" Web - Grade 50 | $332,000 | $171,000 | 0.0 | $0 | $80,000 | $117,000 | $0 | $700,000 | $355,000 | $1,055,000 |
| 3 | 1 | 56.19 | 56.19 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 2 | $134,000 | $287,000 | 74.6 | $19,000 | $67,000 | $98,000 | $6,000 | $611,000 | $104,000 | $715,000 |
| 4 | 1 | 56.19 | 56.19 | 4 ~ Steel Rolled Beams | W24 - Grade 50 | $133,000 | $287,000 | 74.6 | $19,000 | $67,000 | $97,000 | $6,000 | $609,000 | $140,000 | $749,000 |

**NOTES:**

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

2. Use 2004 pavement cost = $33.20 /sq. yd. Allow 3.5% escalation for years 2005 - 2008
   2008 Unit Cost = $38.10 /sq. yd.

   Pavement Widths:

| Alternative | Average Rear Approach | Average Fwd. Approach | Combined Average |
|---|---|---|---|
| Alt. 1 | 33.00 ft. | 33.00 ft. | 33.00 ft. |
| Alt. 2 | 33.00 ft. | 33.00 ft. | 33.00 ft. |
| Alt. 3 | 33.00 ft. | 33.00 ft. | 33.00 ft. |
| Alt. 4 | 33.00 ft. | 33.00 ft. | 33.00 ft. |

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

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

5. Roadway incidental cost allowance includes provision for drainage, maintenance of traffic, and traffic control costs.

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

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

| Alternative | Vertical Clearance Provided (ft.) | Profile Adjustment Required (ft.) |
|---|---|---|
| Alt. 1 | 18.70 ft. | 0.00 ft. |
| Alt. 2 | 20.37 ft. | 0.00 ft. |
| Alt. 3 | 21.79 ft. | 0.00 ft. |
| Alt. 4 | 22.87 ft. | 0.00 ft. |

# SCI-823-0.00
## Ramp C Over Fairground Road
### STRUCTURE TYPE STUDY

Filename: C:\Documents and Settings\NBROWN3\Local Settings\Temporary Internet Files\OLK3E\[Structure Cost Comparison.xls]Alternative Summary
By: SKT Date: 7/6/2005
Checked: Date:

## SUPERSTRUCTURE

| Alternative No. | Span Arrangement No. Spans | Lengths | Total Span Length (ft.) | Deck Length (ft.) | Deck Area (sq. ft.) | Deck Volume (cu. yd.) | Deck Concrete Cost | Deck Reinforcing Cost | Approach Slab Cost | Framing Alternative | Proposed Stringer Section | Structural Steel Weight (pounds) | Structural Steel Cost | Prestressed Girder Cost | Initial Superstructure Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 130.78 | 130.78 | 132.78 | 4,400 | 168 | $100,800 | $42,200 | $30,300 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 4 Mod. (72") | 0.0 | $0 | $131,800 | **$305,000** |
| **2** | 1 | 130.78 | 130.78 | 132.78 | 4,400 | 168 | $100,800 | $42,200 | $30,300 | 4 ~ Steel Plate Girders | 52" Web - Grade 50 | 132000.0 | $159,000 | $0 | **$332,000** |
| **3** | 1 | 56.19 | 56.19 | 58.19 | 1,900 | 74 | $44,200 | $18,500 | $30,300 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 2 | 0.0 | $0 | $40,900 | **$134,000** |
| **4** | 1 | 56.19 | 56.19 | 58.19 | 1,900 | 74 | $44,200 | $18,500 | $30,300 | 4 ~ Steel Rolled Beams | W24 - Grade 50 | 47500.0 | $40,300 | $0 | **$133,000** |

**Deck Cross-Sectional Area:**

Parapets:

| | No. | Individual Area (sq. ft.) | Parapet Area (sq. ft.) |
|---|---|---|---|
| Parapets | 2 | 4.26 | 8.52 |
| Median | 0 | 9.29 | 0.00 |

Slab:

| | T (ft.) | Ave. W (ft.) | Slab Area | Haunch & Overhang Area | Total Concrete Area (sq. ft.) |
|---|---|---|---|---|---|
| Alt. 1 | 0.71 | 33.00 | 23.4 | 2.3 | 34.2 |
| Alt. 2 | 0.71 | 33.00 | 23.4 | 2.3 | 34.2 |
| Alt. 3 | 0.71 | 33.00 | 23.4 | 2.3 | 34.2 |
| Alt. 4 | 0.71 | 33.00 | 23.4 | 2.3 | 34.2 |

Note: Deck width measured as average width.
10% of deck area allowed for haunches and overhangs.

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

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Deck | $491.00 | 3.5% | $563.00 |
| Parapets | $615.00 | 3.5% | $706.00 |
| Weighted Average = | | | $599.00 |

Based on parapet and slab percentages of total concrete area

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

Assume 285 lbs of reinforcing steel per cubic yard of deck concrete

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

**Prestressed Concrete Girders**
**Unit Costs:**

| | Year 2004 | | Annual Escalation | Year 2008 | | No. Required |
|---|---|---|---|---|---|---|
| *Alt. 1* | | | | | | |
| **AASHTO Type IV Modified Beams** | | | | | | |
| Type 4 I-Beams (72") | $26,000 | ea. | 3.5% | $29,840 | ea. | 4 |
| Pier Diaphragms | $1,800 | ea. | 3.5% | $2,070 | ea. | 0 |
| Abutment Diaphragms | $1,200 | ea. | 3.5% | $1,380 | ea. | 0 |
| Intermediate Diaphragms | $1,200 | ea. | 3.5% | $1,380 | ea. | 9 |
| *Alt. 3* | | | | | | |
| **AASHTO Type 2 Beams** | | | | | | |
| Type 2 I-Beams (36") | $8,000 | ea. | 3.5% | $9,180 | ea. | 4 |
| Pier Diaphragms | $1,800 | ea. | 3.5% | $2,070 | ea. | 0 |
| Abutment Diaphragms | $1,200 | ea. | 3.5% | $1,380 | ea. | 0 |
| Intermediate Diaphragms | $1,200 | ea. | 3.5% | $1,380 | ea. | 3 |

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

| | Cost Ratio | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|---|
| Rolled Beams - Grade 50 | n/a | $0.74 | 3.5% | $0.85 |
| Plate Girders - Grade 50 | n/a | $1.05 | 3.5% | $1.20 |
| Hybrid Plate Girders - Grade 50/70W | 1.10 | $1.16 | 3.5% | $1.33 |

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

**Reinforced Concrete Approach Slabs (T=15")**
**Unit Cost ($/sq. yd.):**

Length = 25 ft. Ave. Width = 33.00 ft
Area = 92 sq. yd.

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

# SCI-823-0.00
## Ramp C Over Fairground Road
**STRUCTURE TYPE STUDY**

Filename: C:\Documents and Settings\NBROWN3\Local Settings\Temporary Internet Files\OLK3E\[Structure Cost Comparison.xls]Alternative Summary
By: SKT Date: 7/6/2005
Checked: Date:

## 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 Abutment & Wingwall Cost | Temporary Shoring Cost | Initial Substructure Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 130.78 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 4 Mod. (72") | $0 | $0 | $101,000 | $16,600 | $52,900 | $0 | $0 | **$171,000** |
| 2 | 1 | 130.78 | 4 ~ Steel Plate Girders | 52" Web - Grade 50 | $0 | $0 | $101,000 | $16,600 | $52,900 | $0 | $0 | **$171,000** |
| 3 | 1 | 56.19 | 4 ~ P.S. Concrete I-Beams | AASHTO Type 2 | $0 | $0 | $83,100 | $13,600 | $0 | $190,700 | $0 | **$287,000** |
| 4 | 1 | 56.19 | 4 ~ Steel Rolled Beams | W24 - Grade 50 | $0 | $0 | $75,400 | $12,400 | $0 | $199,500 | $0 | **$287,000** |

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

| Component | Volume (cu. yd.) | Year 2004 | Annual Escalation | Year 2008 | Total Cost |
|---|---|---|---|---|---|
| Cap | 0.0 | $421.00 | 3.5% | $483.00 | $0 |
| Columns | 0.0 | $421.00 | 3.5% | $483.00 | $0 |
| Footings | 0.0 | $421.00 | 3.5% | $483.00 | $0 |
| Total Pier Cost | | | | | $0 Each Pier |

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

*Alt. 1 & 2*

| Component | Volume (cu. yd.) | Year 2004 | Annual Escalation | Year 2008 | Total Cost |
|---|---|---|---|---|---|
| Abutment | | | | | |
| Rear | 61.2 | $421.00 | 3.5% | $483.00 | $29,600 |
| Forward | 62.0 | $421.00 | 3.5% | $483.00 | $29,900 |
| Wingwalls | | | | | |
| Rear | 32.8 | $421.00 | 3.5% | $483.00 | $15,800 |
| Forward | 53.3 | $421.00 | 3.5% | $483.00 | $25,700 |

*Alt. 3*

| Component | Volume (cu. yd.) | Year 2004 | Annual Escalation | Year 2008 | Total Cost |
|---|---|---|---|---|---|
| Abutment | | | | | |
| Rear | 54.0 | $421.00 | 3.5% | $483.00 | $26,100 |
| Forward | 53.0 | $421.00 | 3.5% | $483.00 | $25,600 |
| Wingwalls | | | | | |
| Rear | 29.0 | $421.00 | 3.5% | $483.00 | $14,000 |
| Forward | 36.0 | $421.00 | 3.5% | $483.00 | $17,400 |

*Alt. 4*

| Component | Volume (cu. yd.) | Year 2004 | Annual Escalation | Year 2008 | Total Cost |
|---|---|---|---|---|---|
| Abutment | | | | | |
| Rear | 50.0 | $421.00 | 3.5% | $483.00 | $24,200 |
| Forward | 49.0 | $421.00 | 3.5% | $483.00 | $23,700 |
| Wingwalls | | | | | |
| Rear | 27.0 | $421.00 | 3.5% | $483.00 | $13,000 |
| Forward | 30.0 | $421.00 | 3.5% | $483.00 | $14,500 |

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

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

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

**Pile Foundation Unit Cost ($/ft.):** HP14 x 73 Steel Piles, Furnished & Driven

Pier Piles:

| | Number | Top Elev. | Bottom Elev. | Total Pile Length | Total Cost |
|---|---|---|---|---|---|
| Alt. 1 | 0 | 0.0 | 0.0 | 0 | $0 |
| Alt. 2 | 0 | 0.0 | 0.0 | 0 | $0 |
| Alt. 3 | 0 | 0.0 | 0.0 | 0 | $0 |
| Alt. 4 | 0 | 0.0 | 0.0 | 0 | $0 |

Abutment Piles:

| | Number Rear | Number Forward | Top Elevation Rear | Top Elevation Forward | Bottom Elevation Rear | Bottom Elevation Fwd. | Length Per Rear Pile | Length Per Forward Pile | Total Pile Length | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Alt. 1 | 16 | 20 | 582.5 | 579.5 | 554.0 | 545.0 | 30 | 40 | 1,280 | $52,900 |
| Alt. 2 | 16 | 20 | 582.5 | 579.5 | 554.0 | 545.0 | 30 | 40 | 1,280 | $52,900 |
| Alt. 3 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | $0 |
| Alt. 4 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | $0 |

HP14 x 73 Steel Piles, Furnished & Driven

| | Year 2004 Unit Cost | Annual Escalation | Year 2008 |
|---|---|---|---|
| Furnished | $24.41 | 3.5% | $28.00 |
| Driven | $11.57 | 3.5% | $13.30 |
| Total | | | $41.30 |

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

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

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

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

| | Rear Abutment Area (sq. ft.) | Forward Abutment Area (sq. ft.) | Total Cost |
|---|---|---|---|
| Alt. 1 | 0 | 0 | $0 |
| Alt. 2 | 0 | 0 | $0 |
| Alt. 3 | 1,556 | 1,519 | $190,700 |
| Alt. 4 | 1,624 | 1,593 | $199,500 |

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

**SCI-823-0.00**

**Ramp C Over Fairground Road**

**STRUCTURE TYPE STUDY**

Filename: C:\Documents and Settings\NBROWN3\Local Settings\Temporary Internet Files\OLK3E\[Structure Cost Comparison.xls]Alternative Summary

By: SKT Date: 7/6/2005

Checked: Date:

# LIFE CYCLE MAINTENANCE COST

| Alt. No. | Span Arrangement No. Spans | Lengths | Framing Alternative | Structural Steel Painting Cost Per Cycle | Structural Steel Painting Number of Maintenance Cycles | Structural Steel Painting Total Life Cycle Cost | Superstructure Sealing Cost Per Cycle | Superstructure Sealing Number of Maintenance Cycles | Superstructure Sealing Total Life Cycle Cost | Approach Pavement Resurfacing Cost Per Cycle | Approach Pavement Resurfacing Number of Maintenance Cycles | Approach Pavement Resurfacing Total Life Cycle Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 130.78 | 4 ~ P.S. Concrete I-Beams | $0 | 0 | $0 | $11,800 | 2 | $23,600 | $0 | 0 | $0 |
| 2 | 1 | 130.78 | 4 ~ Steel Plate Girders | $73,200 | 2 | $146,400 | $0 | 0 | $0 | $0 | 0 | $0 |
| 3 | 1 | 56.19 | 4 ~ P.S. Concrete I-Beams | $0 | 0 | $0 | $2,400 | 2 | $4,800 | $1,200 | 7 | $8,400 |
| 4 | 1 | 56.19 | 4 ~ Steel Rolled Beams | $20,100 | 2 | $40,200 | $0 | 0 | $0 | $1,200 | 7 | $8,400 |

| 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 | 1 | 130.78 | 4 ~ P.S. Concrete I-Beams | $13,300 | $16,200 | n/a | 1 | $29,500 | $100,800 | $42,200 | n/a | $36,400 | 1 | $179,400 | **$233,000** | **$662,000** | **$895,000** |
| 2 | 1 | 130.78 | 4 ~ Steel Plate Girders | $13,300 | $16,200 | n/a | 1 | $29,500 | $100,800 | $42,200 | n/a | $36,400 | 1 | $179,400 | **$355,000** | **$700,000** | **$1,055,000** |
| 3 | 1 | 56.1875 | 4 ~ P.S. Concrete I-Beams | $5,800 | $7,000 | n/a | 1 | $12,800 | $44,200 | $18,500 | n/a | $15,700 | 1 | $78,400 | **$104,000** | **$611,000** | **$715,000** |
| 4 | 1 | 56.1875 | 4 ~ Steel Rolled Beams | $5,800 | $7,000 | n/a | 1 | $12,800 | $44,200 | $18,500 | n/a | $15,700 | 1 | $78,400 | **$140,000** | **$609,000** | **$749,000** |

**NOTES:**

1. Life cycle maintenance costs assume a 75 -year structure life, and are expressed in present value (2008 construction year) dollars.
2. Bridges are assumed to have semi-integral abutments, therefore no strip seal deck joints will be required.
3. See Superstructure Cost sheet.
4. See Alternative Cost Summary sheet.
5. Assume bridge deck overlay at Year 25 and bridge deck replacement at Year 50.
   Assume superstructures are painted or sealed on a 25-year recurrence interval.
   Assume complete bridge replacement at Year 75.
6. Life cycle maintenance cost differences are assumed to be predominately a function of superstructure maintenance costs. Consequently, substructure lifecycle maintenance costs are not included in this analysis.

**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. 2 | 52 | 4 | 130.78 | 12.00 | 6,103 | 20% | 7,300 |
| Alt. 4 | 24 | 4 | 56.19 | 13.00 | 1,629 | 20% | 2,000 |

Painting Cost per sq. ft.:

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Prep. | $5.00 | 3.5% | $5.74 |
| Prime | $1.25 | 3.5% | $1.43 |
| Intermed. | $1.25 | 3.5% | $1.43 |
| Finish | $1.25 | 3.5% | $1.43 |
| Total | | | $10.03 |

**Superstructure Sealing:**

PS Concrete I-Beam Area:

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 | | | | | 198.31 in. |

36" AASHTO Type 2

| | H | V | Diag. | No. | Total |
|---|---|---|---|---|---|
| Bot. Flange | 18 | | | 1 | 18.00 |
| | | 6 | | 2 | 12.00 |
| Lower Fillets | 6 | 6 | 8.49 | 2 | 16.98 |
| Web | | 15 | | 2 | 30.00 |
| Upper Fillets | 3 | 3 | 4.24 | 2 | 8.49 |
| Top Flange | | 6 | | 2 | 12.00 |
| Total Exposed Perimeter | | | | | 97.47 in. |

PS Concrete Area:

| | No. Stringers | Total Span Length (ft.) | Nominal Exposed Beam Area (sq. ft.) | Secondary Member Allowance | Total Exposed Concrete Area (sq. yd.) |
|---|---|---|---|---|---|
| Alt. 1 | 4 | 130.78 | 8,645 | 10% | 1,060 |
| Alt. 3 | 4 | 56.19 | 1,825 | 10% | 220 |

Sealing Cost per sq. yd.:

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Epoxy-Urethane Sealer | $9.68 | 3.5% | $11.11 |

**Bridge Redecking:**

Bridge Deck Joint Cost per foot:

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Structural Expansion Joint Including Elastomeric Strip Seal | $238.00 | 3.5% | $273.11 |

| | Bridge Width | No. Joints |
|---|---|---|
| Alt. 1 | 33.00 | 0 |
| Alt. 2 | 33.00 | 0 |
| Alt. 3 | 33.00 | 0 |
| Alt. 4 | 33.00 | 0 |

Bridge Deck Removal Cost:

| | Deck Area (3) (sq. ft.) | Year 2008 | Deck Removal Cost |
|---|---|---|---|
| Alt. 1 | 4,400 | $8.28 | $36,400 |
| Alt. 2 | 4,400 | $8.28 | $36,400 |
| Alt. 3 | 1,900 | $8.28 | $15,700 |
| Alt. 4 | 1,900 | $8.28 | $15,700 |

**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 | 4,400 | 489 | 12 | 11 |
| Alt. 2 | 4,400 | 489 | 12 | 11 |
| Alt. 3 | 1,900 | 211 | 5 | 5 |
| Alt. 4 | 1,900 | 211 | 5 | 5 |

Assume 25% of deck area requires removal to depth of 4.5" (3.25" additional removal).

Bridge Deck Joint Gland Replacement Cost per foot:

| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Elastomeric Strip Seal Gland | $59.50 | 3.5% | $68.28 |

Assume gland replacement cost equals 25% of original deck joint construction cost.

**Approach Pavement Resurfacing:**

Resurface Perpetual Asphalt Pavement:

Resurfacing Units Costs:

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

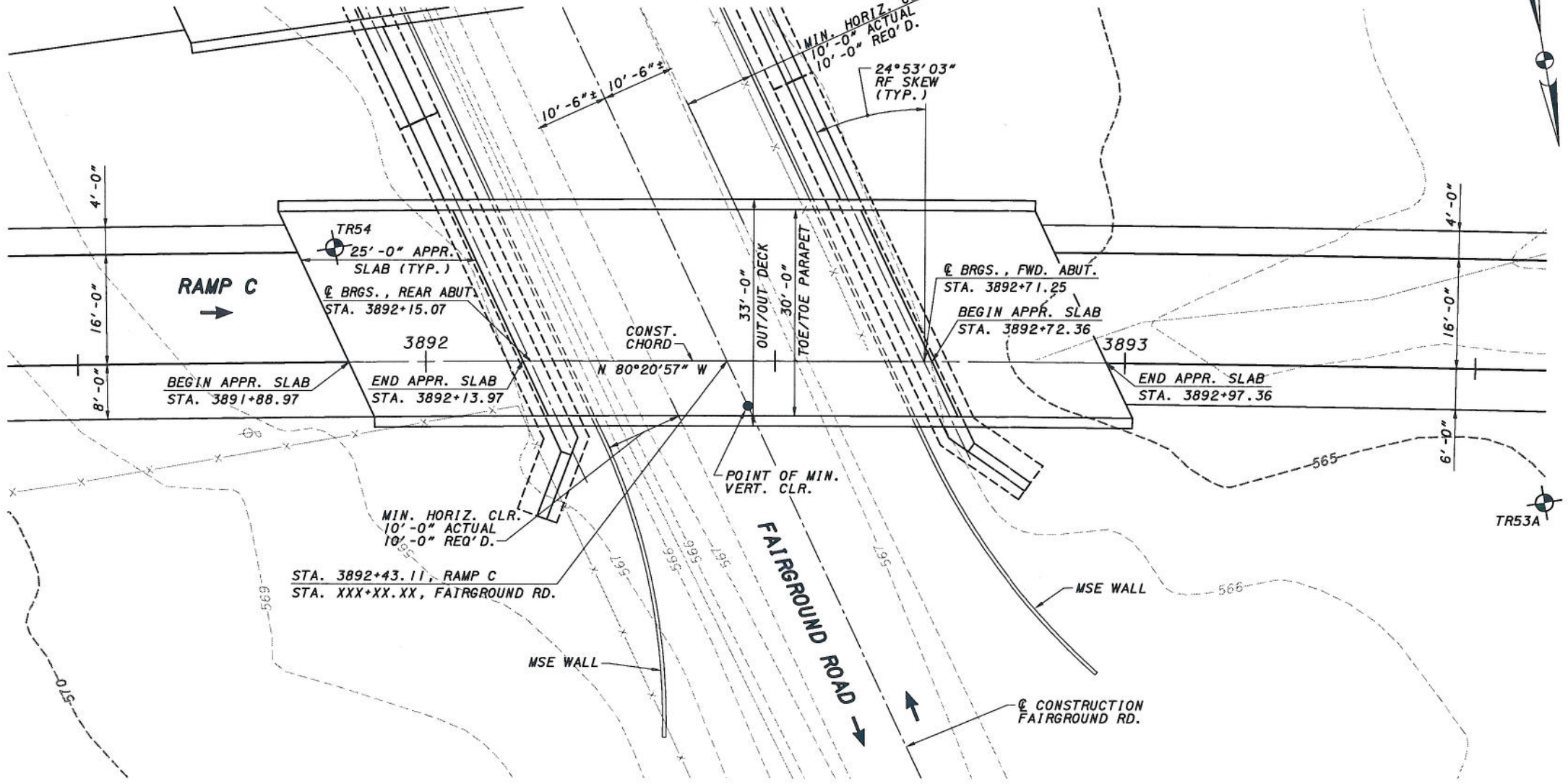
| | Year 2004 | Annual Escalation | Year 2008 |
|---|---|---|---|
| Asphalt Concrete Surface Course, per cu. yd. | $72.00 | 3.5% | $82.62 |

Asphalt Resurfacing Costs:

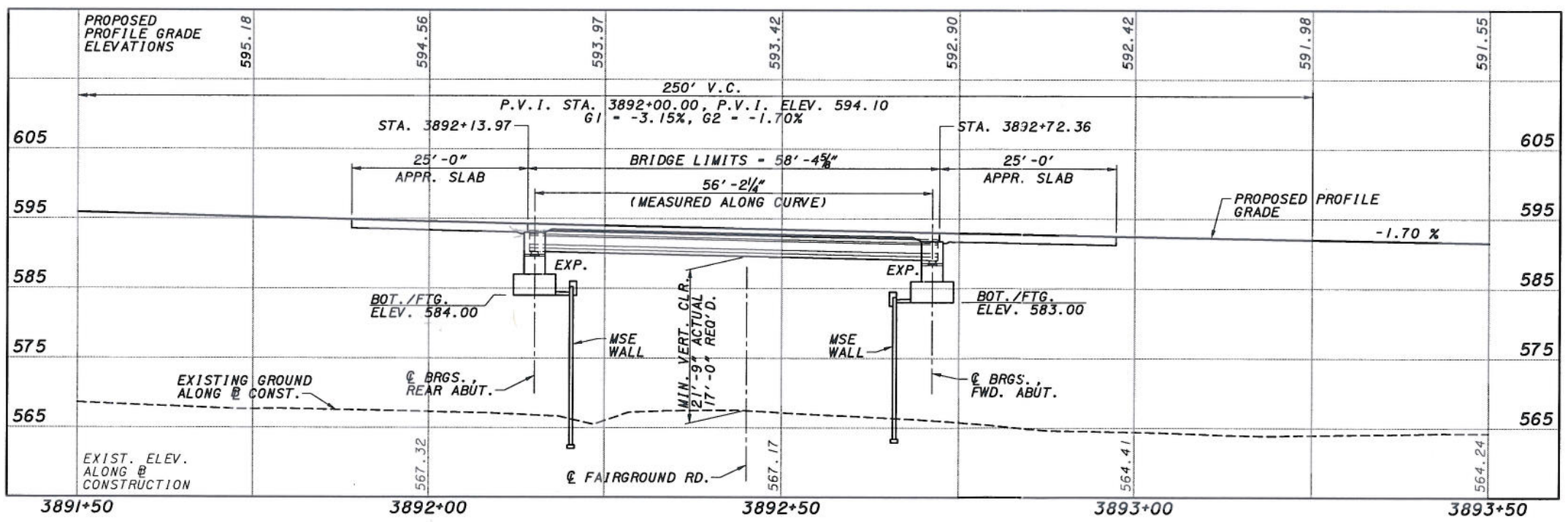
| | Approach Roadway Length (ft.) (4) | Approach Roadway Width (ft.) | Resurfacing Area (sq. yd.) | Wearing Course Thickness (in.) | Wearing Course Volume (cu. yd.) |
|---|---|---|---|---|---|
| Alt. 1 | 0.0 | 33.0 | 0 | 1.50 | 0.0 |
| Alt. 2 | 0.0 | 33.0 | 0 | 1.50 | 0.0 |
| Alt. 3 | 74.6 | 33.0 | 274 | 1.50 | 11.4 |
| Alt. 4 | 74.6 | 33.0 | 274 | 1.50 | 11.4 |

# APPENDIX B

## Preferred Alternative Site Plan and Details




## PLAN




## PROFILE ALONG ℄ CONSTRUCTION, RAMP C

## BENCHMARKS

**CURVE DATA - RAMP C**
P.I. Sta = 3889+21.16
Δ = 9° 37' 49" (RT)
Dc = 1° 00' 00"
R = 5,729.58'
T = 482.65'
L = 963.03'
E = 20.29'

## TRAFFIC DATA

CURRENT ADT (2010) = 6200
DESIGN ADT (2030) = 9400
DESIGN ADTT = 1320

## LEGEND

⌖ INDICATES BORING LOCATION

**NOTE**

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

## PROPOSED STRUCTURE

TYPE: SINGLE SPAN COMPOSITE PRESTRESSED CONCRETE I-BEAMS WITH REINFORCED CONCRETE DECK AND SEMI-INTEGRAL ABUTMENTS ON MSE WALLS

LENGTH OF SPAN: 56'-2¼", MEASURED ALONG ℄ CONSTRUCTION

ROADWAY: 30'-0" TOE/TOE PARAPETS

SIDEWALK: NONE

DESIGN LOADING: HS25 AND THE ALTERNATE MILITARY LOADING, FWS = 60 LB/FT²

SKEW: 24°53'03" RIGHT FORWARD

WEARING SURFACE: MONOLITHIC CONCRETE

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

ALIGNMENT: HORIZONTALLY CURVED (℄ RADIUS = 5729.58')

CROWN: 0.029 FT/FT

LATITUDE: N 38°53'33"

LONGITUDE: W 82°59'52"

DESIGN AGENCY
CH2MHILL
5775 Perimeter Drive, Suite 190
Dublin, Ohio 43017

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| SKT | MWE | GAS | 06/05 |
| CHECKED | REVISED | STRUCTURE FILE NUMBER | |
| DGS | | | |

SCIOTO COUNTY
STA. 3892+13.97
TO STA. 3892+72.36

# SITE PLAN

BRIDGE NO. SCI-823-1595
RAMP C OVER FAIRGROUND ROAD - ALT. 3

SCI-823-0.00

1 / 3

07/13/2005 07:02:21 PM
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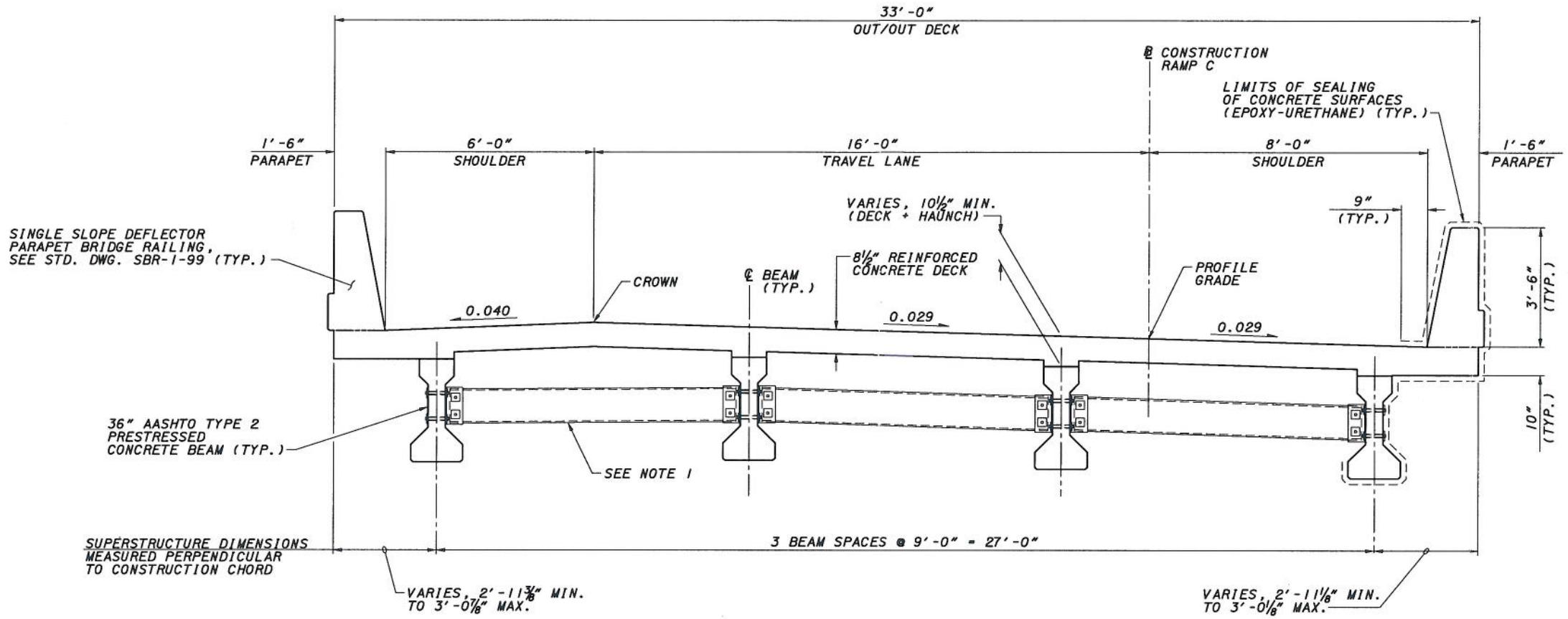
SCI823_COL_Scioto.plt




## TYPICAL TRANSVERSE SECTION

**NOTES:**

1. INTERMEDIATE DIAPHRAGMS MAY BE CAST-IN-PLACE CONCRETE OR GALVANIZED STEEL. FOR DETAILS OF BOTH DIAPHRAGM TYPES, SEE STANDARD CONSTRUCTION DRAWING PSID-1-99.

DESIGNED DGS | DRAWN DGS | REVIEWED GAS | DATE 06/05
CHECKED SKT | REVISED | STRUCTURE FILE NUMBER

DESIGN AGENCY
CH2MHILL
5775 Perimeter Drive, Suite 190
Dublin, Ohio 43017

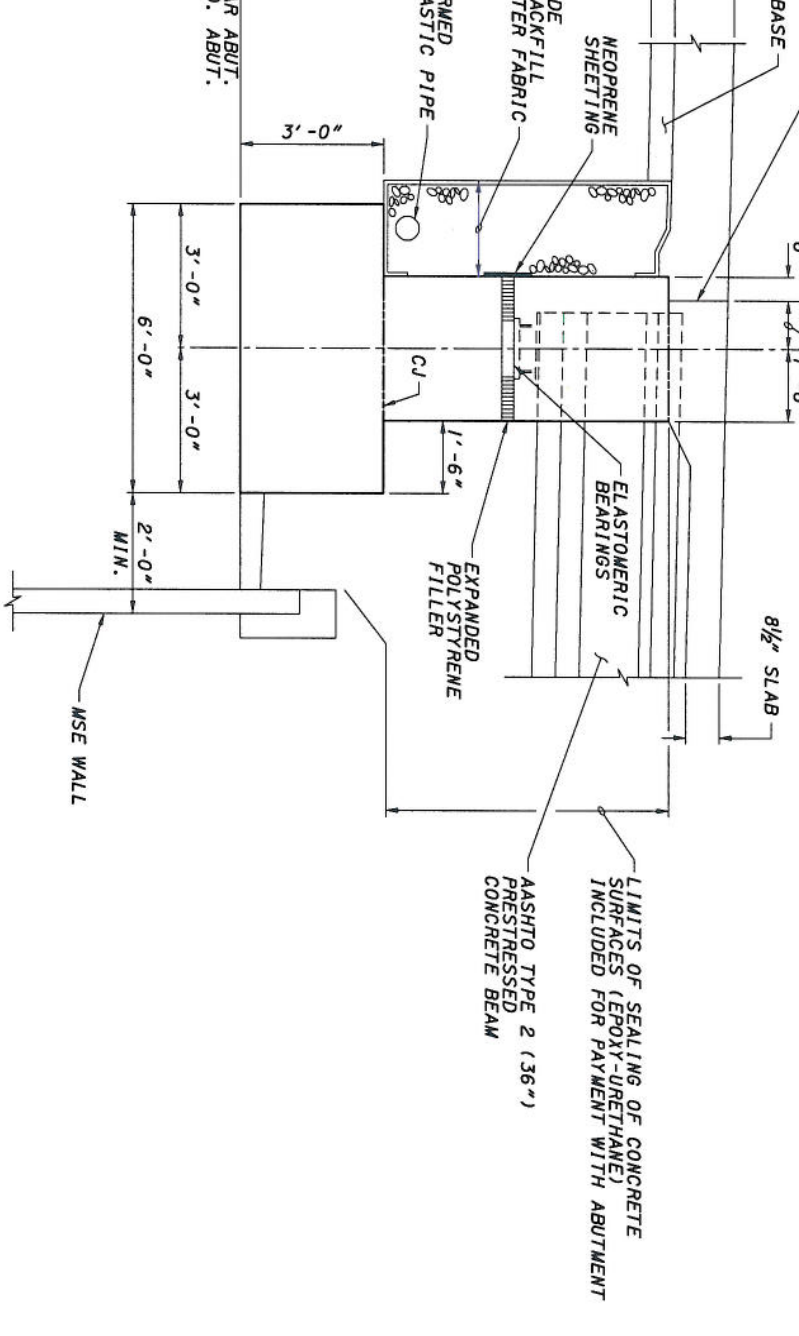
TYPICAL TRANSVERSE SECTION
BRIDGE NO. SCI-823-1595
RAMP C OVER FAIRGROUND ROAD - ALT. 3

SCI-823-0.00

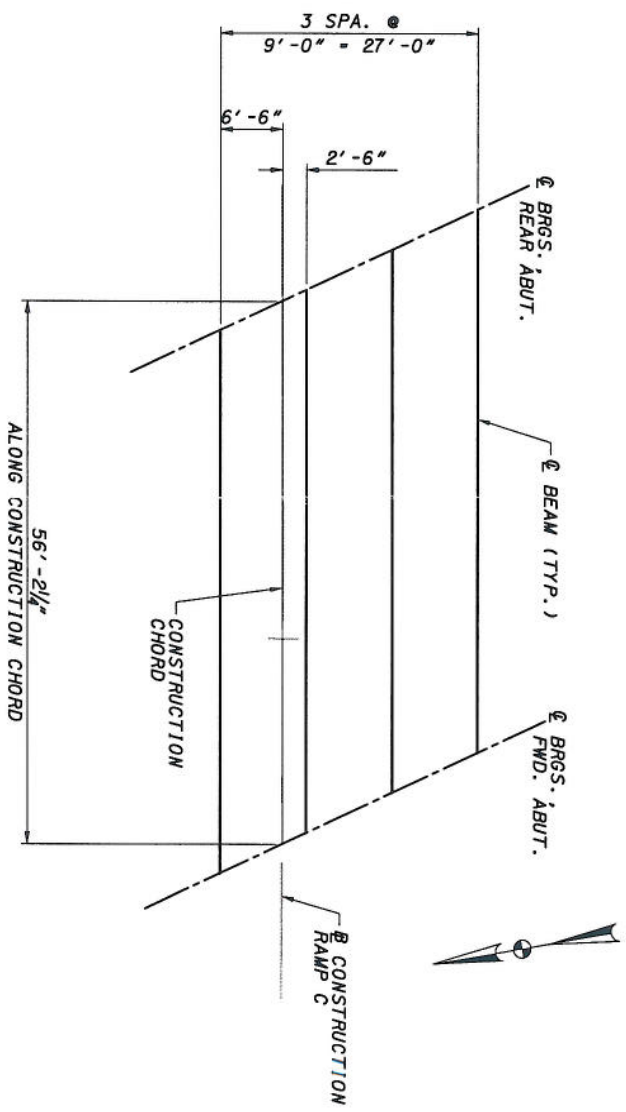
2 / 3

sthompsl
...\823_I595crts003_ch.dgn 07/13/2005 07:02:26 PM SCI823_COL_Scioto.plt

## REAR AND FORWARD ABUTMENT SECTION




## FRAMING PLAN




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3/3 | SCI-823-0.00 | ABUTMENT SECTION AND FRAMING PLAN<br>BRIDGE NO. SCI-823-1595<br>RAMP C OVER FAIRGROUND ROAD - ALT. 3 | DESIGNED DGS<br>CHECKED SKT | DRAWN DGS<br>REVISED | REVIEWED GAS DATE 06/05<br>STRUCTURE FILE NUMBER | DESIGN AGENCY<br>CH2MHILL<br>5775 Perimeter Drive, Suite 190<br>Dublin, Ohio 43017 |

# APPENDIX C

## Vertical Clearance Calculations

# SCI-823-0.00
## RAMP C OVER FAIRGROUND ROAD
### VERTICAL CLEARANCES

Filename: P:\TranSystems\319861\19415\structures documents\Step 7 - Type Study\Bridge SCI823-1595C Ramp C over Fairground\[RampC_Vert_Clr.xls]Alternative 1
By: DGS Date: 6/2/2005
Checked: Date:

LEGEND:
User Input - Not Critical
User Input - Critical to Output

**Alternative 1 - AASHTO Type 4 Modified Concrete I-Beams**

**PROFILE DATA - Fairground Road**

*Use existing pavement elevations as Fairground Road will not be reconstructed in this project*

| POINT | FAIRGROUND ROAD LOCATION | FAIRGROUND ROAD STATION | FAIRGROUND ROAD - EXISTING ELEV. @ POINT |
|---|---|---|---|
| 1 | E/Pavement NB | n/a | 567.41 |
| 2 | Centerline | n/a | 567.56 |
| 3 | E/Pavement SB | n/a | 566.90 |

**PROFILE DATA - RAMP C**

Linear:
PVT Sta. 3884+38.51 PVC Sta. 3890+75.00
PVT Elev. 618.09 PVC Elev. 598.04
g -3.15%

Vertical Curve:
PVC Sta. 3890+75.00 PVI Sta. 3892+00.00 PVT Sta. 3893+25.00
PVC Elev. 598.04 PVI Elev. 594.10 PVT Elev. 591.98
g1 -3.15%
g2 -1.70%
LVC 250

Superelevation Data:

| Station | Left Shoulder | Pavement | Right Shoulder |
|---|---|---|---|
| 3890+75.00 | -4.0% | 2.9% | -2.9% |
| 3893+25.00 | -4.0% | 2.9% | -2.9% |

| POINT | RAMP C LOCATION DESCRIPTION | STA. | OFF.* | RAMP C PG ELEV. | LT. SHOULDER X-SLOPE | PVMT X-SLOPE | RT. SHOULDER X-SLOPE | RAMP C - FINISHED GRADE @ POINT |
|---|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 3892+35.62 | 6.75 | 593.73 | -4.0% | 2.9% | -2.9% | 593.53 |
| 2 | RT. FASCIA BEAM | 3892+46.27 | 6.74 | 593.50 | -4.0% | 2.9% | -2.9% | 593.30 |
| 3 | RT. FASCIA BEAM | 3892+57.92 | 6.72 | 593.25 | -4.0% | 2.9% | -2.9% | 593.05 |

* For Offsets allow positive (+) to denote an offset to the right of the baseline and negative (-) to denote an offset to the left of the baseline

**STRUCTURE DEPTH**

Haunch + Max. Top Flange = 4 in

| POINT | BEAM DESCRIPTION | Slab | Haunch | Top Flange | Web | Bot. Flange | Splice | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | AASHTO TYPE 4 MOD. | 8.50 | 4.00 | 0.0 | 72 | 0.0 | - | 84.50 in |
| 2 | AASHTO TYPE 4 MOD. | 8.50 | 4.00 | 0.0 | 72 | 0.0 | - | 84.50 in |
| 3 | AASHTO TYPE 4 MOD. | 8.50 | 4.00 | 0.0 | 72 | 0.0 | - | 84.50 in |

**VERTICAL CLEARANCE - RAMP C OVER FAIRGROUND RD.**

| POINT | LOCATION | RAMP C - FINISHED GRADE @ POINT | STRUCTURE DEPTH (in.) | BOT. BEAM ELEVATION | FAIRGROUND RD. - FINISHED GRADE @ POINT | VERTICAL CLEARANCE (ft.) | |
|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 593.53 | 84.500 | 586.49 | 567.41 | **19.08** | OK |
| 2 | RT. FASCIA BEAM | 593.30 | 84.500 | 586.26 | 567.56 | **18.70** | OK |
| 3 | RT. FASCIA BEAM | 593.05 | 84.500 | 586.01 | 566.90 | **19.11** | OK |

# SCI-823-0.00
## RAMP C OVER FAIRGROUND ROAD
### VERTICAL CLEARANCES

Filename: P:\TranSystems\319861\19415\structures documents\Step 7 - Type Study\Bridge SCI823-1595C Ramp C over Fairground\[RampC_Vert_Clr.xls]Alternative 1
By: DGS Date: 6/2/2005
Checked: Date:

LEGEND:
User Input - Not Critical
User Input - Critical to Output

**Alternative 2 - 52" Steel Plate Girders**

**PROFILE DATA - Fairground Road**

*Use existing pavement elevations as Fairground Road will not be reconstructed in this project*

| POINT | FAIRGROUND ROAD LOCATION | FAIRGROUND ROAD STATION | FAIRGROUND ROAD - EXISTING ELEV. @ POINT |
|---|---|---|---|
| 1 | E/Pavement NB | n/a | 567.41 |
| 2 | Centerline | n/a | 567.56 |
| 3 | E/Pavement SB | n/a | 566.90 |

**PROFILE DATA - RAMP C**

Linear: PVT Sta. 3884+38.51 PVC Sta. 3890+75.00
PVT Elev. 618.09 PVC Elev. 598.04
g -3.15%

Vertical Curve: PVC Sta. 3890+75.00 PVI Sta. 3892+00.00 PVT Sta. 3893+25.00
PVC Elev. 598.04 PVI Elev. 594.10 PVT Elev. 591.98
g1 -3.15%
g2 -1.70%
LVC 250

Superelevation Data:

| Station | Left Shoulder | Pavement | Right Shoulder |
|---|---|---|---|
| 3890+75.00 | -4.0% | 2.9% | -2.9% |
| 3893+25.00 | -4.0% | 2.9% | -2.9% |

| POINT | RAMP C LOCATION DESCRIPTION | STA. | OFF.* | RAMP C PG ELEV. | LT. SHOULDER X-SLOPE | PVMT X-SLOPE | RT. SHOULDER X-SLOPE | RAMP C - FINISHED GRADE @ POINT |
|---|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA GIRDER | 3892+35.62 | 6.75 | 593.73 | -4.0% | 2.9% | -2.9% | 593.53 |
| 2 | RT. FASCIA GIRDER | 3892+46.27 | 6.74 | 593.50 | -4.0% | 2.9% | -2.9% | 593.30 |
| 3 | RT. FASCIA GIRDER | 3892+57.92 | 6.72 | 593.25 | -4.0% | 2.9% | -2.9% | 593.05 |

* For Offsets allow positive (+) to denote an offset to the right of the baseline and negative (-) to denote an offset to the left of the baseline

**STRUCTURE DEPTH** Haunch + Max. Top Flange = 3 in

| POINT | GIRDER DESCRIPTION | Slab | Haunch | Top Flange | Web | Bot. Flange | Splice | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | 52" PLATE GIRDER | 8.50 | 2.00 | 1.0 | 52 | 1.0 | - | 64.50 in |
| 2 | 52" PLATE GIRDER | 8.50 | 2.00 | 1.0 | 52 | 1.0 | - | 64.50 in |
| 3 | 52" PLATE GIRDER | 8.50 | 2.00 | 1.0 | 52 | 1.0 | - | 64.50 in |

**VERTICAL CLEARANCE - RAMP C OVER FAIRGROUND RD.**

| POINT | LOCATION | RAMP C - FINISHED GRADE @ POINT | STRUCTURE DEPTH (in.) | BOT. GIRDER ELEVATION | FAIRGROUND RD. - FINISHED GRADE @ POINT | VERTICAL CLEARANCE (ft.) | |
|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA GIRDER | 593.53 | 64.500 | 588.16 | 567.41 | **20.75** | OK |
| 2 | RT. FASCIA GIRDER | 593.30 | 64.500 | 587.93 | 567.56 | **20.37** | OK |
| 3 | RT. FASCIA GIRDER | 593.05 | 64.500 | 587.68 | 566.90 | **20.78** | OK |

# SCI-823-0.00
## RAMP C OVER FAIRGROUND ROAD
### VERTICAL CLEARANCES

Filename: P:\TranSystems\319861\19415\structures documents\Step 7 - Type Study\Bridge SCI823-1595C Ramp C over Fairground\[RampC_Vert_Clr.xls]Alternative 1
By: DGS Date: 6/2/2005
Checked: Date:

LEGEND:
User Input - Not Critical
User Input - Critical to Output

**Alternative 3 - AASHTO Type 2 Concrete I-Beams**

**PROFILE DATA - Fairground Road**

*Use existing pavement elevations as Fairground Road will not be reconstructed in this project*

| POINT | FAIRGROUND ROAD LOCATION | FAIRGROUND ROAD STATION | FAIRGROUND ROAD - EXISTING ELEV. @ POINT |
|---|---|---|---|
| 1 | E/Pavement NB | n/a | 567.41 |
| 2 | Centerline | n/a | 567.56 |
| 3 | E/Pavement SB | n/a | 566.90 |

**PROFILE DATA - RAMP C**

Linear: PVT Sta. 3884+38.51 PVC Sta. 3890+75.00
PVT Elev. 618.09 PVC Elev. 598.04
g -3.15%

Vertical Curve: PVC Sta. 3890+75.00 PVI Sta. 3892+00.00 PVT Sta. 3893+25.00
PVC Elev. 598.04 PVI Elev. 594.10 PVT Elev. 591.98
g1 -3.15%
g2 -1.70%
LVC 250

Superelevation Data:

| Station | Left Shoulder | Pavement | Right Shoulder |
|---|---|---|---|
| 3890+75.00 | -4.0% | 2.9% | -2.9% |
| 3893+25.00 | -4.0% | 2.9% | -2.9% |

| POINT | RAMP C LOCATION DESCRIPTION | STA. | OFF.* | RAMP C PG ELEV. | LT. SHOULDER X-SLOPE | PVMT X-SLOPE | RT. SHOULDER X-SLOPE | RAMP C - FINISHED GRADE @ POINT |
|---|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 3892+35.53 | 6.56 | 593.73 | -4.0% | 2.9% | -2.9% | 593.54 |
| 2 | RT. FASCIA BEAM | 3892+46.19 | 6.57 | 593.50 | -4.0% | 2.9% | -2.9% | 593.31 |
| 3 | RT. FASCIA BEAM | 3892+57.84 | 6.55 | 593.25 | -4.0% | 2.9% | -2.9% | 593.06 |

* For Offsets allow positive (+) to denote an offset to the right of the baseline and negative (-) to denote an offset to the left of the baseline

**STRUCTURE DEPTH** Haunch + Max. Top Flange = 3 in

| POINT | BEAM DESCRIPTION | Slab | Haunch | Top Flange | Web | Bot. Flange | Splice | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | AASHTO TYPE 2 | 8.50 | 3.00 | 0.0 | 36 | 0.0 | - | 47.50 in |
| 2 | AASHTO TYPE 2 | 8.50 | 3.00 | 0.0 | 36 | 0.0 | - | 47.50 in |
| 3 | AASHTO TYPE 2 | 8.50 | 3.00 | 0.0 | 36 | 0.0 | - | 47.50 in |

**VERTICAL CLEARANCE - RAMP C OVER FAIRGROUND RD.**

| POINT | LOCATION | RAMP C - FINISHED GRADE @ POINT | STRUCTURE DEPTH (in.) | BOT. BEAM ELEVATION | FAIRGROUND RD. - FINISHED GRADE @ POINT | VERTICAL CLEARANCE (ft.) | |
|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 593.54 | 47.500 | 589.58 | 567.41 | **22.17** | OK |
| 2 | RT. FASCIA BEAM | 593.31 | 47.500 | 589.35 | 567.56 | **21.79** | OK |
| 3 | RT. FASCIA BEAM | 593.06 | 47.500 | 589.10 | 566.90 | **22.20** | OK |

# SCI-823-0.00
## RAMP C OVER FAIRGROUND ROAD
### VERTICAL CLEARANCES

Filename: P:\TranSystems\319861\19415\structures documents\Step 7 - Type Study\Bridge SCI823-1595C Ramp C over Fairground\[RampC_Vert_Clr.xls]Alternative 1
By: DGS Date: 6/2/2005
Checked: Date:

LEGEND:
User Input - Not Critical
User Input - Critical to Output

**Alternative 4 - W24 Steel Rolled Beams**

**PROFILE DATA - Fairground Road**

*Use existing pavement elevations as Fairground Road will not be reconstructed in this project*

| POINT | FAIRGROUND ROAD LOCATION | FAIRGROUND ROAD STATION | FAIRGROUND ROAD - EXISTING ELEV. @ POINT |
|---|---|---|---|
| 1 | E/Pavement NB | n/a | 567.41 |
| 2 | Centerline | n/a | 567.56 |
| 3 | E/Pavement SB | n/a | 566.90 |

**PROFILE DATA - RAMP C**

Linear:
PVT Sta. 3884+38.51 PVC Sta. 3890+75.00
PVT Elev. 618.09 PVC Elev. 598.04
g -3.15%

Vertical Curve:
PVC Sta. 3890+75.00 PVI Sta. 3892+00.00 PVT Sta. 3893+25.00
PVC Elev. 598.04 PVI Elev. 594.10 PVT Elev. 591.98
g1 -3.15%
g2 -1.70%
LVC 250

Superelevation Data:

| Station | Left Shoulder | Pavement | Right Shoulder |
|---|---|---|---|
| 3890+75.00 | -4.0% | 2.9% | -2.9% |
| 3893+25.00 | -4.0% | 2.9% | -2.9% |

| POINT | RAMP C LOCATION DESCRIPTION | STA. | OFF.* | RAMP C PG ELEV. | LT. SHOULDER X-SLOPE | PVMT X-SLOPE | RT. SHOULDER X-SLOPE | RAMP C - FINISHED GRADE @ POINT |
|---|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 3892+35.53 | 6.56 | 593.73 | -4.0% | 2.9% | -2.9% | 593.54 |
| 2 | RT. FASCIA BEAM | 3892+46.19 | 6.57 | 593.50 | -4.0% | 2.9% | -2.9% | 593.31 |
| 3 | RT. FASCIA BEAM | 3892+57.84 | 6.55 | 593.25 | -4.0% | 2.9% | -2.9% | 593.06 |

* For Offsets allow positive (+) to denote an offset to the right of the baseline and negative (-) to denote an offset to the left of the baseline

**STRUCTURE DEPTH** Haunch + Max. Top Flange = 3 in

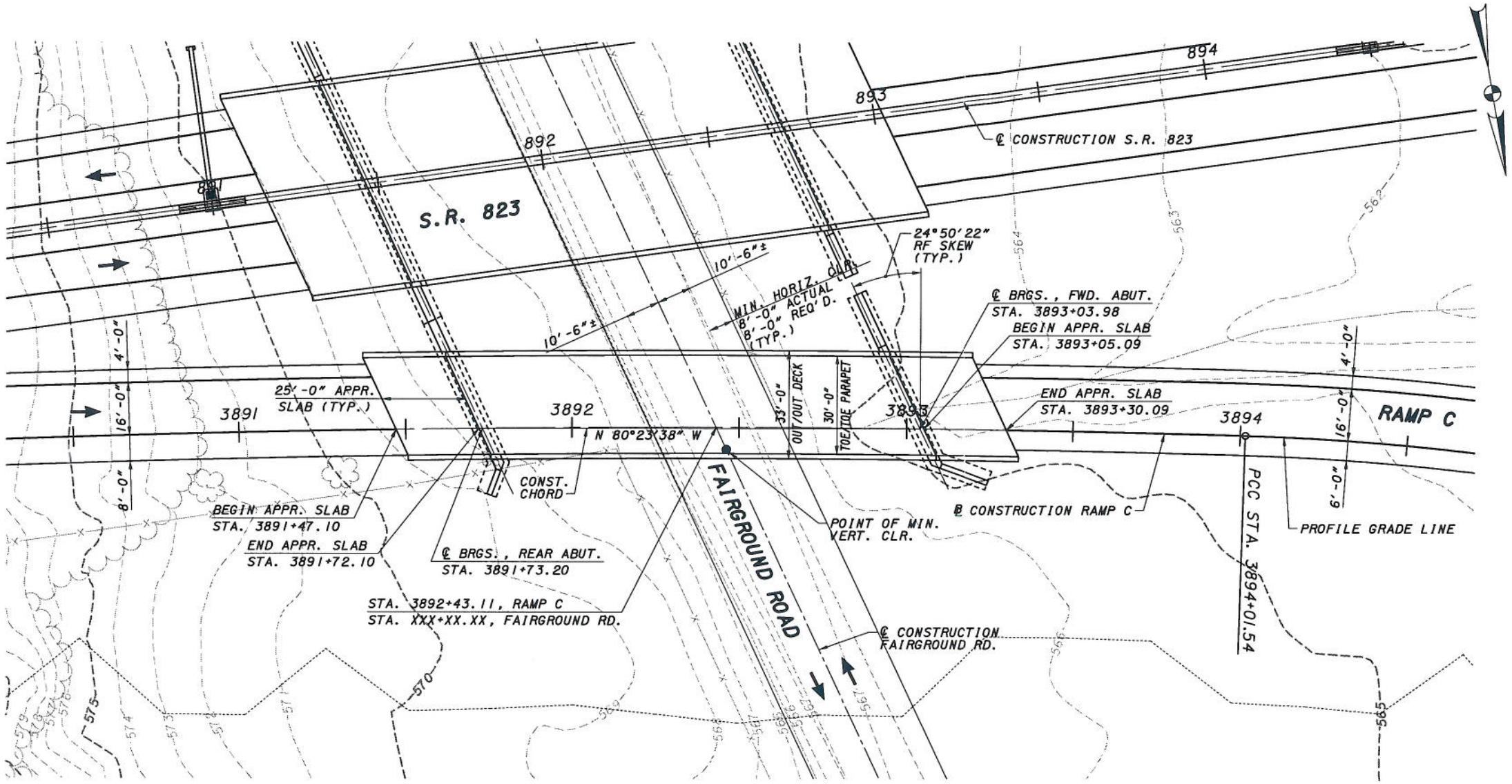
| POINT | BEAM DESCRIPTION | Slab | Haunch | Top Flange | Web | Bot. Flange | Splice | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | W24 ROLLED BEAM | 8.50 | 2.00 | 1.0 | 22 | 1.0 | - | 34.50 in |
| 2 | W24 ROLLED BEAM | 8.50 | 2.00 | 1.0 | 22 | 1.0 | - | 34.50 in |
| 3 | W24 ROLLED BEAM | 8.50 | 2.00 | 1.0 | 22 | 1.0 | - | 34.50 in |

**VERTICAL CLEARANCE - RAMP C OVER FAIRGROUND RD.**

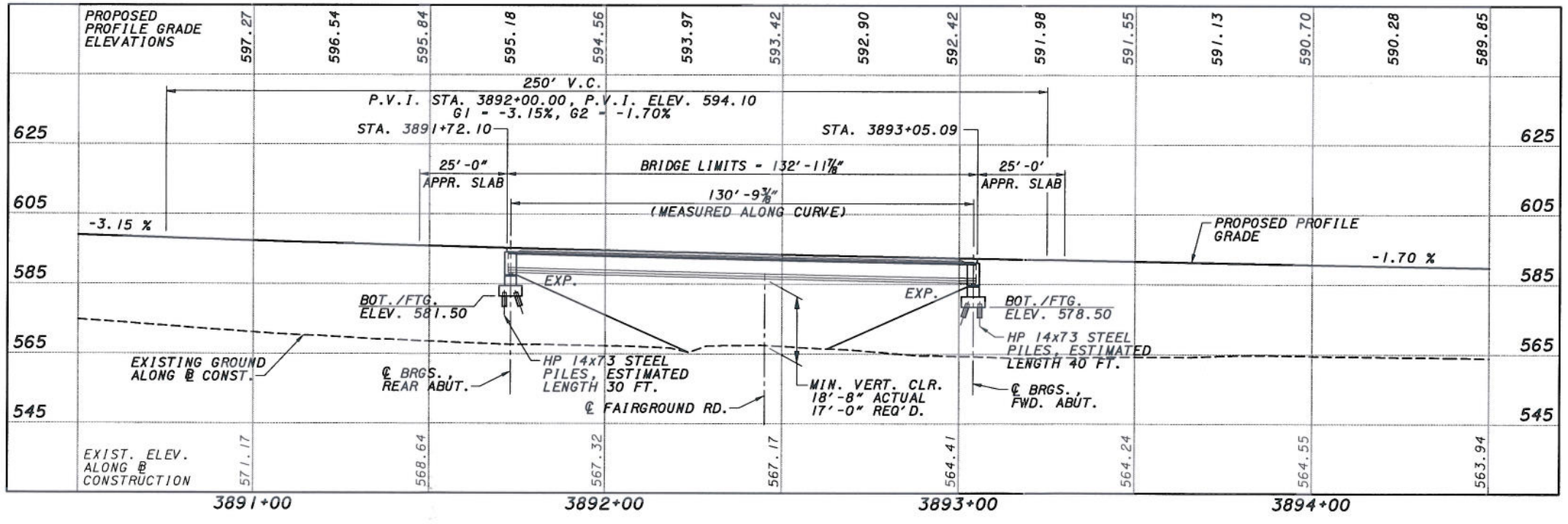
| POINT | LOCATION | RAMP C - FINISHED GRADE @ POINT | STRUCTURE DEPTH (in.) | BOT. BEAM ELEVATION | FAIRGROUND RD. - FINISHED GRADE @ POINT | VERTICAL CLEARANCE (ft.) | |
|---|---|---|---|---|---|---|---|
| 1 | RT. FASCIA BEAM | 593.54 | 34.500 | 590.67 | 567.41 | **23.26** | OK |
| 2 | RT. FASCIA BEAM | 593.31 | 34.500 | 590.43 | 567.56 | **22.87** | OK |
| 3 | RT. FASCIA BEAM | 593.06 | 34.500 | 590.19 | 566.90 | **23.29** | OK |

# APPENDIX D

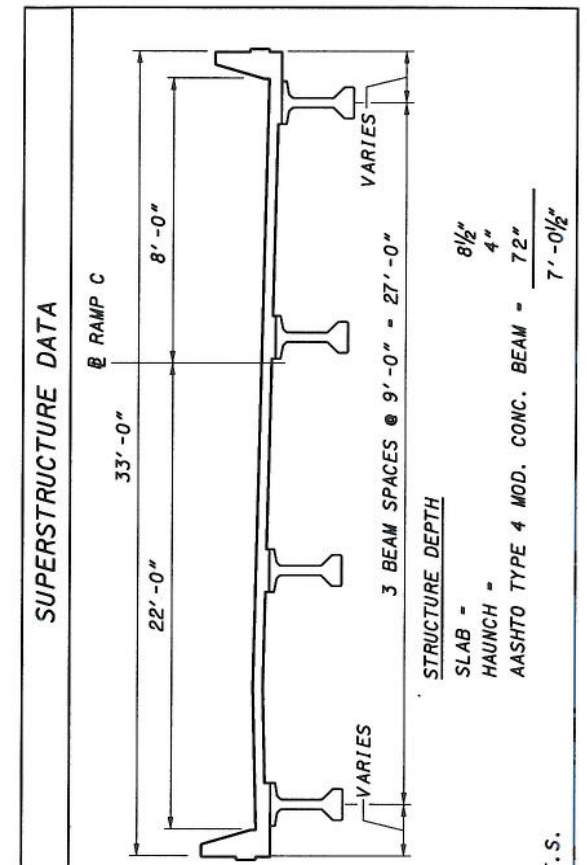
## Preliminary Structure Site Plans




PLAN




PROFILE ALONG ℄ CONSTRUCTION, RAMP C




## PROPOSED STRUCTURE

TYPE: SINGLE SPAN COMPOSITE PRESTRESSED CONCRETE I-BEAMS WITH REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS

LENGTH OF SPAN:

ROADWAY:

SIDEWALK:

DESIGN LOADING:

SKEW:

WEARING SURFACE:

APPROACH SLABS:

ALIGNMENT:

CROWN:

LATITUDE:

LONGITUDE:

DESIGN AGENT
CH2MHILL
5775 Perimeter Drive, Suite 190
Dublin, Ohio 43017

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| SKT | MME | GAS | 06/05 |
| CHECKED | REVISED | STRUCTURE FILE NUMBER | |
| DGS | | | |

SCIOTO COUNTY
STA. 3891+72.10
TO STA. 3893+05.09

# SITE PLAN

BRIDGE NO. SCI-823-1595
RAMP C OVER FAIRGROUND ROAD - ALT. 1

SCI-823-0.00

1 / 1

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SCI823_COL_Scioto.plt
sthompsl
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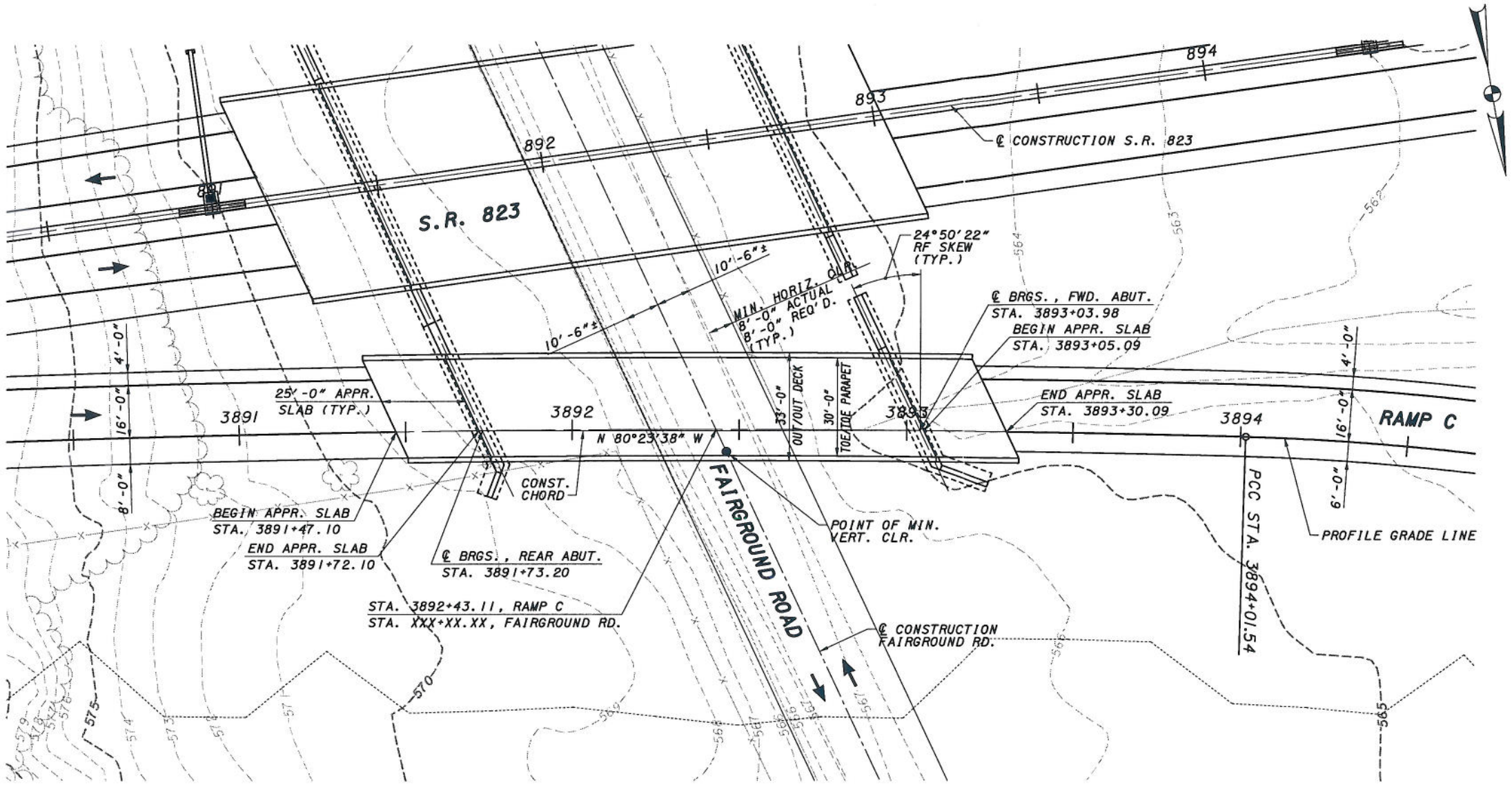
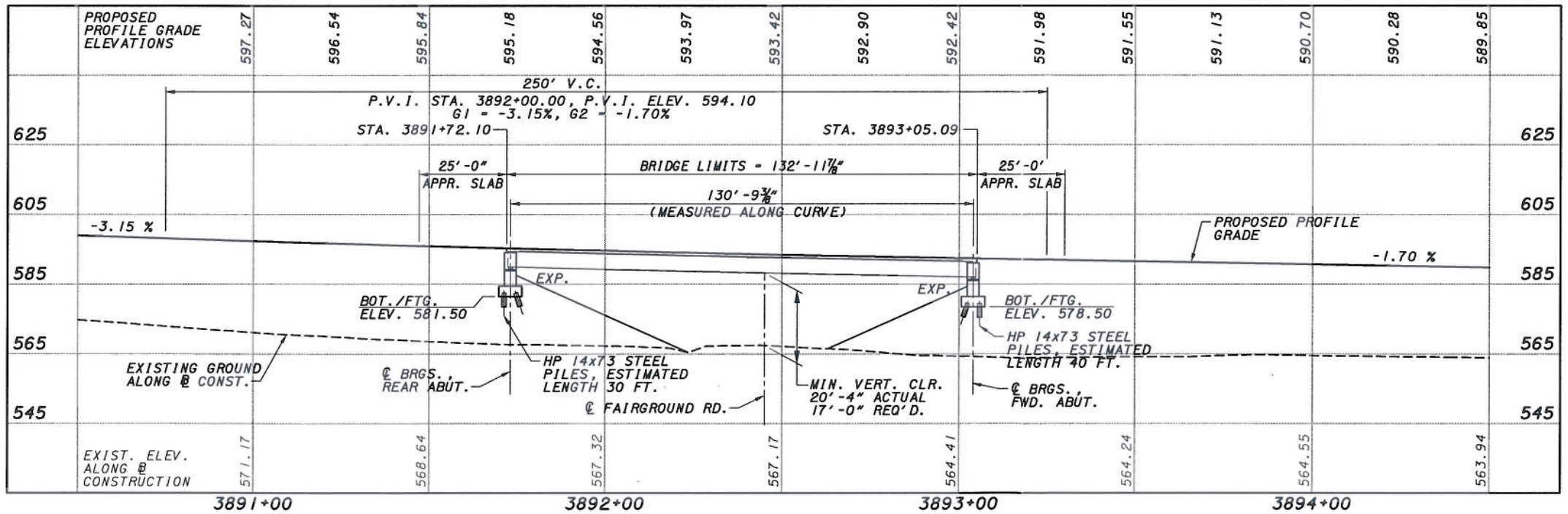
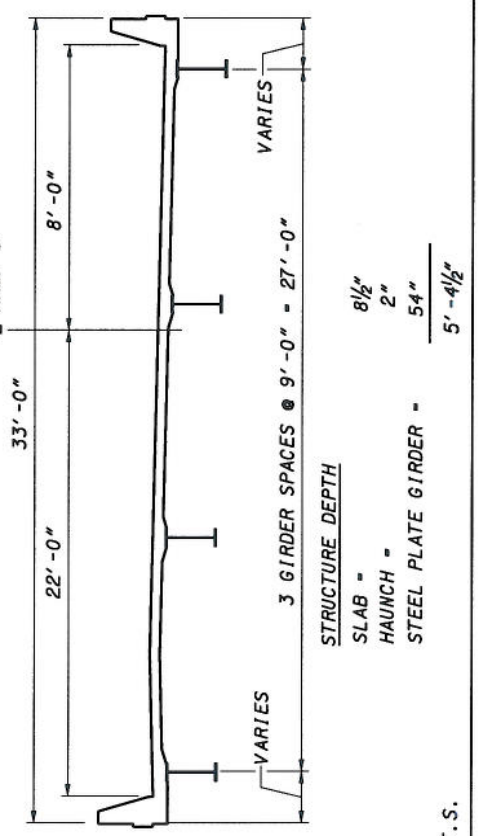



PLAN




PROFILE ALONG ℄ CONSTRUCTION, RAMP C

## SUPERSTRUCTURE DATA




3 GIRDER SPACES @ 9'-0" = 27'-0"

STRUCTURE DEPTH
SLAB - 8½"
HAUNCH - 2"
STEEL PLATE GIRDER - 54"
5'-4½"

N.T.S.

## PROPOSED STRUCTURE

TYPE: SINGLE SPAN COMPOSITE STEEL PLATE GIRDERS (PAINTED ASTM A709, GR 50) WITH REINFORCED CONCRETE DECK ON SEMI-INTEGRAL ABUTMENTS

LENGTH OF SPAN:

ROADWAY:

SIDEWALK:

DESIGN LOADING:

SKEW:

WEARING SURFACE:

APPROACH SLABS:

ALIGNMENT:

CROWN:

LATITUDE:

LONGITUDE:

DESIGN AGENCY
CH2MHILL
5775 Perimeter Drive, Suite 190
Dublin, Ohio 43017

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| SKT | MME | GAS | 06/05 |
| CHECKED | REVISED | STRUCTURE FILE NUMBER | |
| DGS | | | |

SCIOTO COUNTY
STA. 3891+72.10
TO STA. 3893+05.09

# SITE PLAN

BRIDGE NO. SCI-823-1595
RAMP C OVER FAIRGROUND ROAD - ALT. 2

SCI-823-0.00

1 / 1

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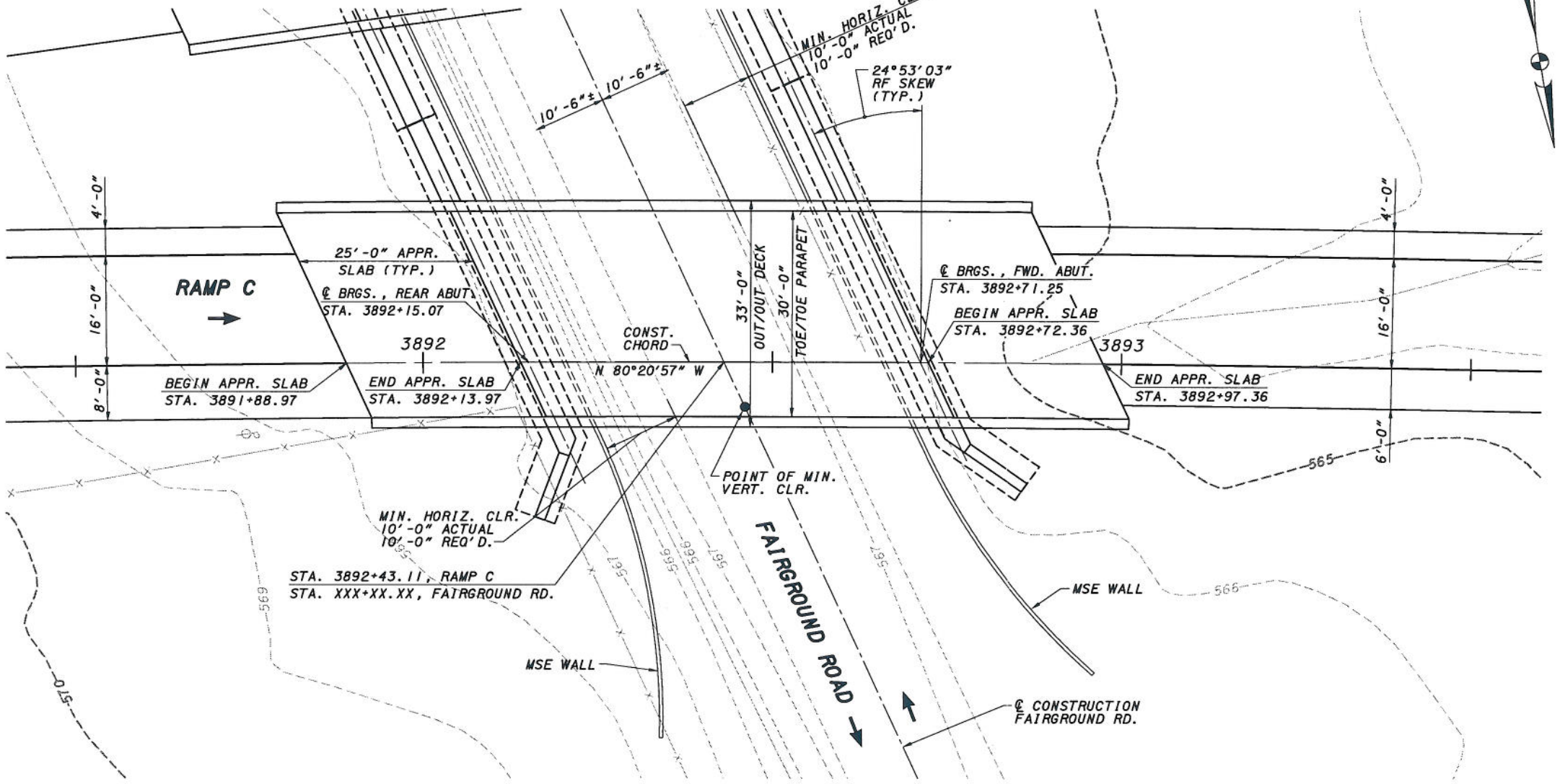
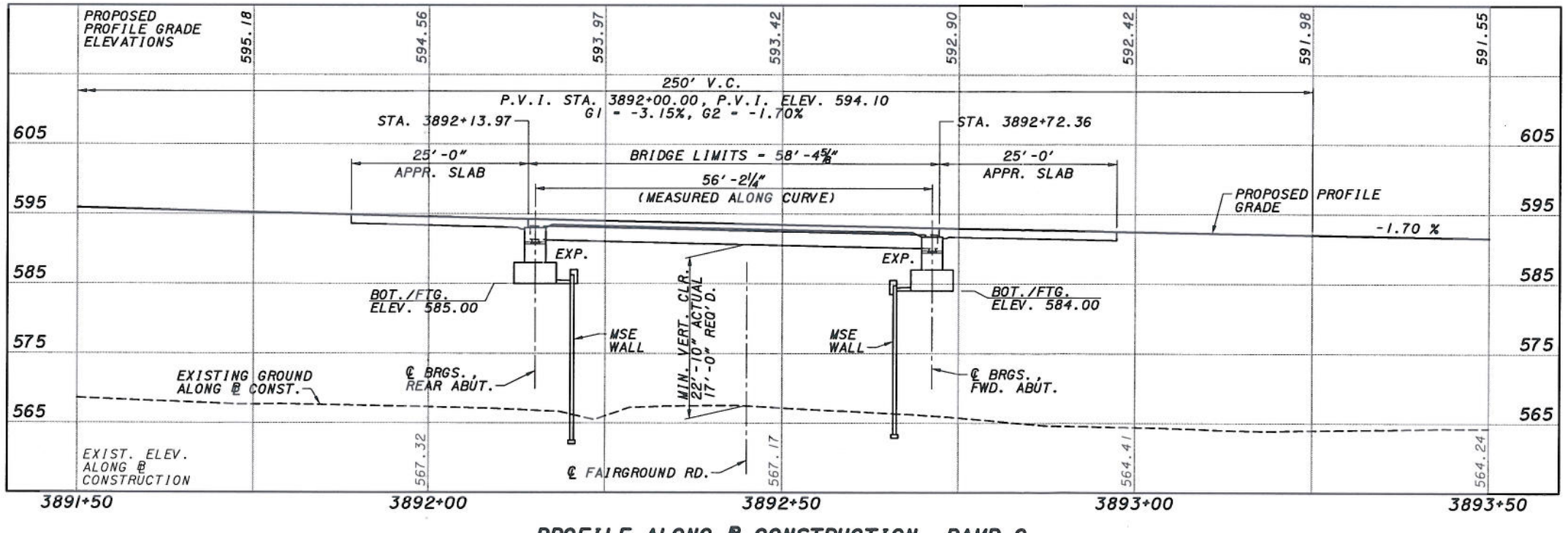
SCI823_COL_Scioto.plt
sthompsl
...823_1595csp002_ch.dgn

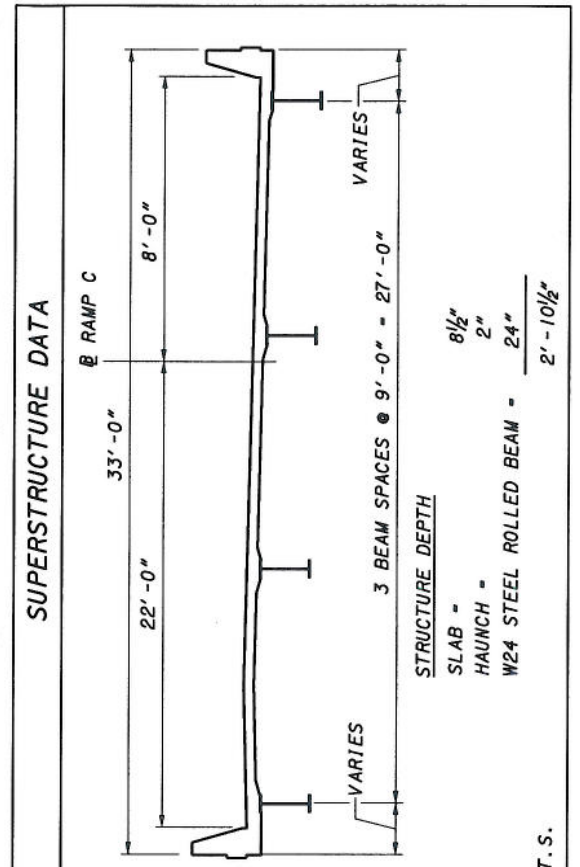



## PLAN




## PROFILE ALONG ℄ CONSTRUCTION, RAMP C

### SUPERSTRUCTURE DATA




### PROPOSED STRUCTURE

TYPE: SINGLE SPAN COMPOSITE STEEL ROLLED BEAMS (PAINTED ASTM A709, GR 50) WITH REINFORCED CONCRETE DECK AND SEMI-INTEGRAL ABUTMENTS ON MSE WALLS

LENGTH OF SPAN:

ROADWAY:

SIDEWALK:

DESIGN LOADING:

SKEW:

WEARING SURFACE:

APPROACH SLABS:

ALIGNMENT:

CROWN:

LATITUDE:

LONGITUDE:

DESIGN AGENCY
CH2MHILL
5775 Perimeter Drive, Suite 190
Dublin, Ohio 43017

| DESIGNED | DRAWN | REVIEWED | DATE |
|---|---|---|---|
| SKT | MME | GAS | 06/05 |
| CHECKED | REVISED | STRUCTURE FILE NUMBER | |
| DGS | | | |

SCIOTO COUNTY
STA. 3892+13.97
TO STA. 3892+72.36

# SITE PLAN

BRIDGE NO. SCI-823-1595
RAMP C OVER FAIRGROUND ROAD - ALT. 4

SCI-823-0.00

-/-

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SCI823_COL_Scioto.pit
sthompsl
...\823_1595csp004_ch.dgn

# APPENDIX E

## Preliminary Foundation Recommendations

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

May 2, 2005

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

Re: **US 23 and SCI-823-0.00 Interchange**
**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 structures at the US 23 and SCI-823-0.00 interchange to be located north of Lucasville, Ohio within the area of the Scioto County Fairgrounds. It is anticipated that six proposed bridges, and MSE walls along Ramps B and C, will be constructed as part of the interchange.

It is our understanding that the western portion of the interchange, Ramp A and Ramp D, will be constructed through earthwork and no structures will be constructed. The existing grade across the proposed interchange location is relatively flat with an elevation range between 530 and 570. Currently, the area has roadways for US 23 and Fairground Road (CR 55) as well as two sets of railroad tracks maintained by CSX Railroad. The area to the west of US 23 is primarily agricultural. It is anticipated that the SCI-823-0.00 mainline and majority of the interchange will require embankment construction with Ramps B and C requiring mostly mechanically stabilized earth (MSE) wall construction. At this time the embankment heights are unknown, however it is anticipated that as much as 50 feet of fill may be required in some areas of embankment and up to 25 feet of fill in areas of MSE wall construction.

The existing area of the proposed interchange is located within the Scioto River valley with the overburden being primarily composed of glacial and alluvial deposits. The following table briefly outlines the anticipated structures, and the attached plan indicated the location of the structures in proximity to existing features.

US 23 – SCI 823 Interchange Structures

| Proposed Structure* | Approximate Location | Anticipated Number of Spans | Existing Grade Elevation** | Borings |
|---|---|---|---|---|
| Mainline Overpass #1 | SCI-823 over Fairgrounds Rd | 1 | 565 – 570 | TR-55A, TR-56 |
| Mainline Overpass #2 | SCI-823 over US 23 & CSX RR. | 3 | 533 – 555 | TR-49A, TR-50A, TR-51, TR-52 |
| Ramp B - #1 | US 23 NB to SCI-823 over CSX RR | 1 | 546 – 540 | TR-60, TR-61 |
| Ramp B - #2 | US 23 NB to SCI-823 over Fairgrounds Rd. | 2 | 564 – 570 | TR-57, TR-58, TR-59A |
| Ramp C - #1 | SCI-823 to US 23 NB over Fairgrounds Rd | 1 | 565 – 568 | TR-53A, TR-54 |
| Ramp C - #2 | SCI-823 to US 23 NB over CSX RR | 2 | 543 – 550 | TR-46, TR-47, TR-48 |

* As indicated on the attached plan.
** Established from established project topographic mapping.

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 sixteen structure borings, TR-46 through TR-48, TR-49A through TR-50A, TR-51, TR-52, TR-53, TR54A, TR-55A, TR-56 through TR-58, TR-59A, TR-60 and TR-61, were drilled at the proposed structures between March 14 and March 21, 2005. It should be noted that

five borings (TR-49, TR-50, TR-53, TR-55, and TR-59) were drilled during 2004, and were not used to prepare these preliminary foundation recommendations. These boring locations were moved due to an adjustment in the project coordinate system. The structure borings were drilled to depths between 25 and 45 feet below the ground surface. 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 a brief discussion of the subsurface conditions at each structure refer to the Conclusions and Recommendations section, or for more detailed information, please refer to the attached Boring Logs.

At the ground surface, topsoil was encountered to depths of 1 to 7 inches. Beneath the topsoil, subsurface materials encountered generally were interbedded granular and cohesive layers. The cohesive soils encountered ranged from sandy silt (A-4a) to silt and clay (A-6b), and ranged in consistency from medium stiff to very stiff. The granular soils encountered ranged from sandy silt (A-4a) to gravel with sand (A-1-b), and ranged in compactness form very loose to very dense. Natural moisture of the cohesive were generally damp to moist, and the granular layers were damp to wet.

Bedrock was encountered in all of the borings ranging in depth from 13.6 to 33.5 feet below the ground surface. The bedrock encountered was either shale that was very soft or soft, siltstone that was medium hard, or sandstone that was medium hard or hard, which was sometimes interbedded with the siltstone. Recovery of the core samples ranged from 70 to 100%, and RQD values ranged from 13 to 92% with an average RQD of 88%.

Seepage was detected in the majority of the borings ranging in depth from 13 to 30 feet below the ground surface. Seepage was generally detected within granular layers. No seepage was detected in Borings TR-53A, TR-54, and TR-56 through TR-58. Water levels recorded prior to coring ranged from dry to 26 feet below the ground surface, and at completion of drilling ranged from 3.5 to 19.0 feet below the ground surface. However, the final water levels include drilling water and may not be representative of the actual groundwater conditions. Groundwater levels may vary seasonally and will most likely be influenced by the Scioto River.

**Conclusions and Recommendations**

It appears that driven H-piles or drilled shafts on bedrock will be the best-suited foundation types for the support of the proposed structures. If high lateral or uplift loads are anticipated drilled shafts extending into bedrock may be needed. The actual design lengths, or rock sockets, will need to be designed based upon actual loading conditions. Spread footing foundations were evaluated for support of the structures. At the abutment locations, spread footing recommendations are based upon the assumption that the embankment fill will be properly placed and compacted in accordance with CMS Item 203: Roadway Excavation and Embankment. The following is a brief discussion of each structure.

**Mainline Overpass - #1**

Overpass #1 will be SCI-823-0.00 over Fairgrounds Road. Borings TR-55A, and TR-56 were drilled for this structure. Generally, these borings encountered cohesive soils at the ground surface consisting of silt and clay (A-6a), and silty clay (A-6b). These cohesive soils extended between 8.0 and 13.0 feet below the ground surface. Granular soils are located underlying the cohesive soils consisting of sandy silt (A-4a) and coarse and fine sand (A-3a). Bedrock was encountered at depths of 14.1 and 18.0 feet below the ground surface.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be considered. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock. It is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. It does not appear reasonable that spread footings extending to bedrock could be used at the abutments. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Mainline Overpass - #1

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* (Feet) | Allowable Bearing Capacity for Drilled Shafts (TSF) | Allowable Bearing Capacity for Spread Footings (TSF)** |
|---|---|---|---|---|---|---|
| TR-55A | Forward Abutment | 565.5 | 547.5 | 543 | 15 | 1.5 |
| TR-56 | Rear Abutment | 569.5 | 555.4 | 552 | 15 | 1.5 |

*Existing ground surface elevation was estimated from the established topographic mapping.
**Assuming spread footings founded on embankment fill.

**Mainline Overpass - #2**

Overpass #2 will SCI-823-0.00 over US 23 and CSX Railroad. Borings TR-49A through TR-52 were drilled for this structure. Topsoil was encountered at the ground surface ranging in depth between 1 and 2 inches, except at TR-49A, which did not encounter any topsoil. TR-50A encountered fill beneath the topsoil to a depth of 3.0 feet. Generally, beneath the topsoil the borings encountered cohesive soils at the ground surface consisting of silt and clay (A-6a), and silty clay (A-6b). ranging in consistency from stiff to hard. These cohesive soils extended between 8.0 and 20.5 feet below the ground surface. Granular soils are located underlying the cohesive soils ranging from sandy silt (A-4a) to gravel with sand (A-1-b). The granular soils were very loose to medium dense in compactness, with the majority of the layers being very loose of loose. Bedrock was encountered between depths of 24.5 and 33.5 feet below the ground surface. The bedrock encountered was shale and sandstone.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be considered. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock. It is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. It does not appear that spread footings extending to bedrock could be used at the abutment or pier locations. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Mainline Overpass - #2

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* (Feet) | Allowable Bearing Capacity for Drilled Shafts (TSF) | Allowable Bearing Capacity for Spread Footings (TSF)** |
|---|---|---|---|---|---|---|
| TR-49A | Forward Abutment | 537.5 | 505.5 | 502 | 20 | 1.5 |
| TR-50A | Pier 2 | 540.0 | 515.5 | 510 | 20 | NA |
| TR-51 | Pier 1 | 545.0 | 519.5 | 514 | 20 | NA |
| TR-52 | Rear Abutment | 558.0 | 524.5 | 521 | 15 | 1.5 |

*Existing ground surface elevation was estimated from the established topographic mapping.
**Assuming spread footings founded on embankment fill.

**Ramp B - #1**

Ramp B-#1 will from US 23 northbound (NB) to SCI-823-0.00 over the CSX railroad. Borings TR-60 and TR-61 were drilled for this structure. A sandy silt (A-4a) fill was encountered at the ground surface in each boring and extended to depths of 3.0 and 5.5 feet below the ground surface. Beneath the fill, Boring TR-60 generally encountered granular soil ranging from sandy silt to coarse and fine sand (A-3a) in very loose to loose compactness to the top of rock at 28.0 feet. Boring TR-61 encountered a very stiff silt and clay (A-6a) to 10.5 feet, which was underlain by a very loose coarse to fine sand (A-3a). Bedrock was encountered at 23 feet below the ground surface. Bedrock encountered in borings was shale.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be considered. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending bedrock. It does not appear reasonable that spread footings extending to bedrock could be used at either abutment due to the depth to bedrock. However, it is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Ramp B - #1

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* (Feet) | Allowable Bearing Capacity for Drilled Shafts (TSF) | Allowable Bearing Capacity for Spread Footings (TSF)** |
|---|---|---|---|---|---|---|
| TR-60 | Forward Abutment | 554 | 526 | 522 | 15 | 1.5 |
| TR-61 | Rear Abutment | 547 | 524 | 520 | 15 | 1.5 |

*Existing ground surface elevation was estimated from the established topographic mapping.
**Assuming spread footings founded on embankment fill.

**Ramp B - #2**

Ramp B-#2 will be from US 23 northbound (NB) to SCI-823-0.00 over Fairground Road. Borings TR-57 through TR-59A were drilled for this structure. Borings TR-57 and TR-58 encountered cohesive soils at the ground surface consisting silt and clay (A-6a) ranging in consistency from stiff to hard. These cohesive soils extended between 14.0 and 8.0 feet below the ground surface, respectively. Granular soils are located underlying the cohesive soils, and at the ground surface at TR-59A, consisting of sandy silt (A-4a) and coarse and fine sand (A-3a). Generally, the granular soils were very loose to medium dense in compactness. Bedrock was encountered between depths of 14.0 and 21.5 feet below the ground surface.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be considered. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock. Spread footings founded on bedrock can be considered at the pier location, if no significant amounts of fill are to be placed. It is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. It does not appear reasonable that spread footings extending to bedrock could be used at the abutments. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Ramp B - #2

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* | Allowable Bearing Capacity for Drilled Shafts (TSF) | Estimated Spread Footing Elevation* | Allowable Bearing Capacity for Spread Footings (TSF) |
|---|---|---|---|---|---|---|---|
| TR-57 | Forward Abutment | 569.5 | 555.5 | 552 | 15 | Unknown | 1.5** |
| TR-58 | Pier | 567.0 | 553.0 | 549 | 15 | 551.0 | 12 |
| TR-59A | Rear Abutment | 564.5 | 543.0 | 538 | 15 | Unknown | 1.5** |

*Existing ground surface elevation was estimated from the established topographic mapping. The Embankment heights at the abutment locations is not know at this time.

**Assuming spread footings founded on embankment fill.

**Ramp C - #1**

Ramp C-#1 is from SCI-823-00 northbound (NB) to US 23 NB over Fairground Road. Borings TR-53A and TR-54 were drilled for this structure. Generally, these borings encountered cohesive soils at the ground surface consisting of sandy silt (A-4a) and silt and clay (A-6a) ranging in consistency from stiff to hard. These cohesive soils extended between 5.5 and 10.5 feet below the ground surface. Coarse and fine sand (A-3a) granular soils are located underlying the cohesive soils, which range from very loose to loose in compactness. Shale bedrock was encountered at depths of 13.6 and 20.5 feet below the ground surface.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be recommended. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock. It is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. It does not appear reasonable that spread footings extending to bedrock could be used at the abutments due to the depth to bedrock. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Ramp C - #1

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* | Allowable Bearing Capacity for Drilled Shafts (TSF) | Allowable Bearing Capacity for Spread Footings (TSF)** |
|---|---|---|---|---|---|---|
| TR-53A | Forward Abutment | 565.5 | 545.0 | 541 | 15 | 1.5 |
| TR-54 | Rear Abutment | 567.5 | 553.9 | 550 | 15 | 1.5 |

*Existing ground surface elevation was estimated from the established topographic mapping.
**Assuming spread footings founded on embankment fill.

**Ramp C - #2**

Ramp C-#2 will be from SCI-823-0.00 northbound (NB) to US 23 NB over the CSX railroad. Borings TR-46 through TR-48 were drilled for this structure. Generally, these borings encountered inter-layered cohesive soils and granular soils. Cohesive layers encountered consisted of sandy silt (A-4a), silt and clay (A-6a), and clay (A-7-6). These layers ranged in consistency from stiff to very stiff. Granular soils encountered consisted of sandy silt (A-4a), coarse and fine sand (A-3a), gravel with sand and silt (A-2-4), and gravel with sand (A-1-b). These layers ranged in compactness from very loose to dense. Shale and sandstone bedrock was encountered at depths of 23.5 and 26.5 feet below the ground surface.

Due to the size of the structure, if H-piles are used, it is recommended that HP 14X73 H-pile sections, with a 95-ton capacity, be recommended. H-piles should be driven to refusal to the top of bedrock. H-piles driven to refusal may be designed based on the full allowable capacity of the pile. An alternative to driven H-piles would be the use of drilled shafts extending to bedrock. It is anticipated that at the abutments, significant amounts of fill will be placed and spread footings within the embankment fills may be considered. It does not appear reasonable that spread footings extending to bedrock could be used at the abutments due to the depth to bedrock. The following table summarizes the site conditions and preliminary foundation recommendations.

Foundation Recommendations – Ramp C - #2

| Boring Number | Structural Element | Existing Ground Surface Elevation* (Feet) | Top of Rock Elevation* (Feet) | Estimated Drilled Shaft Tip Elevation* | Allowable Bearing Capacity for Drilled Shafts (TSF) | Allowable Bearing Capacity for Spread Footings (TSF)** |
|---|---|---|---|---|---|---|
| TR-46 | Forward Abutment | 543.0 | 517.0 | 513 | 20 | 1.5 |
| TR-47 | Pier | 542.0 | 519.0 | 514 | 20 | NR |
| TR-48 | Rear Abutment | 542.0 | 523.5 | 520 | 15 | 1.5 |

*Existing ground surface elevation was estimated from the established topographic mapping.
**Assuming spread footings founded on embankment fill.

## MSE Wall Stability

Several MSE walls are proposed within the interchange, mainly along Ramps B and C. Based upon the borings drilled across the proposed interchange, it appears that global stability will not be an issue for the anticipated wall height. This is based on an assumption of a maximum wall height of 25 feet. Once the wall designs have been finalized the geometries of each wall will need to be evaluated for the global stability, sliding, overturning, and bearing capacity at each location. It should be noted that some settlement may be anticipated at some of the MSE wall locations, and wire-faced MSE walls may be considered if significant settlements are anticipated.

## General Information

Minor amounts of settlement occurring within the very loose to loose granular soils are anticipated during construction of the embankments. Due to the granular nature of the soils, it is assumed that the settlement will occur during the earthwork activities, and will have been completed by the time the full height of the embankment has been constructed.

Because of the many geotechnical factors across the anticipated structure locations, and the design unknowns at this time, 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.

**Closing**

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

Sincerely,

**DLZ OHIO, INC.**

P. Paul Painter

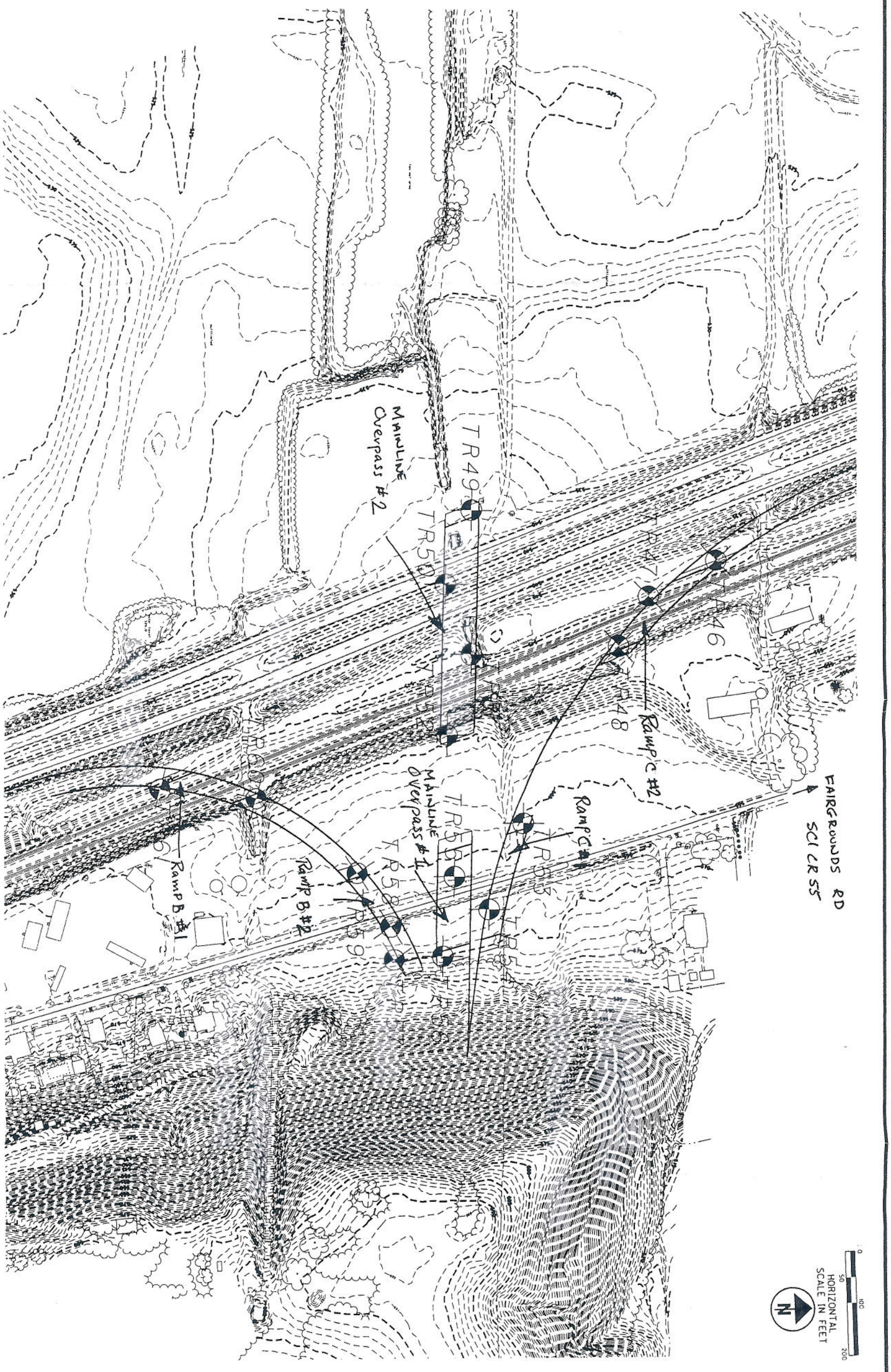
P. Paul Painter
Engineering Geologist

Dorothy A. Adams 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-46 through TR-61

cc: File

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|---|---|---|
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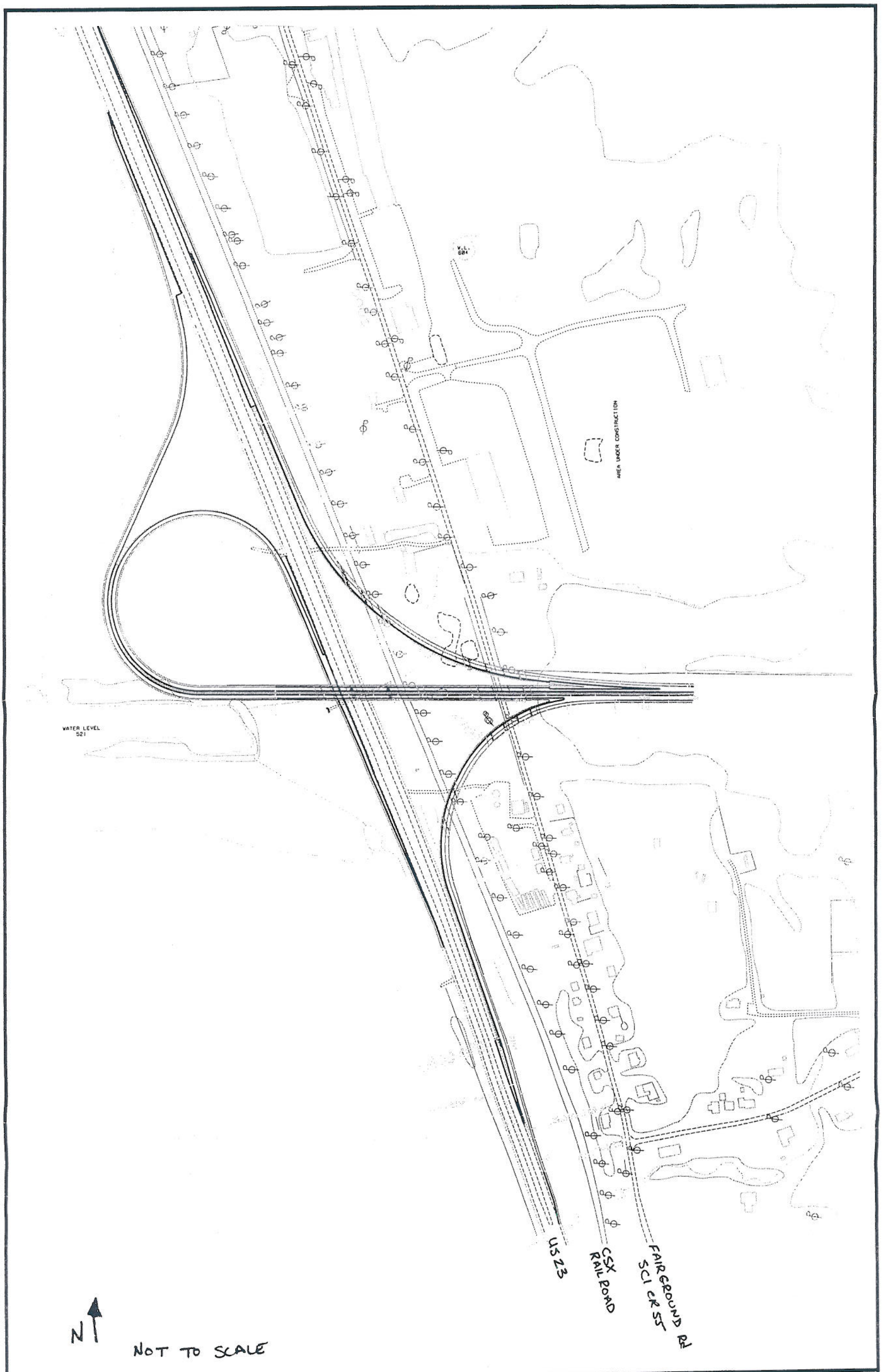


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Ramp Layout

## 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.

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

**LOG OF: Boring TR-46** | Location: Forward Abutment - Ramp C - #2 | Date Drilled: 03/17/05

WATER OBSERVATIONS: Water seepage at: 13.5'-19.0'
Water level at completion: 6.0' (Prior to coring)
5.0' (Including drill water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetrometer (tsf) | DESCRIPTION | % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 543.0 | | | | | | Ground Surface | | | | | | | |
| 0.1 | 542.9 | | | | | | Topsoil - 1" | | | | | | | |
| | | 2 1 1 | 2 | 1 | | | FILL: Very loose brown and black GRAVEL WITH SAND (A-1-b), some silty clay; contains roots; damp. | | | | | | | |
| | | 2 2 2 | 4 | 2 | | | | | | | | | | |
| 5 | | | | | | | | 44 | 19 | -- | 13 | 16 | 8 | |
| 5.5 | 537.5 | | | | | | Stiff brown SILT AND CLAY (A-6a), little fine to coarse gravel, trace fine to coarse sand; damp to moist. | | | | | | | |
| | | 3 3 3 | 18 | 3 | | 2.0 | | | | | | | | |
| 8.5 | 534.5 | | | | | | Medium dense brown and gray GRAVEL WITH SAND (A-1-b), little silty clay; moist. | | | | | | | |
| | | 2 6 6 | 12 | 4 | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| | | 2 11 7 | 11 | 5 | | | | 56 | 15 | -- | 9 | 16 | 4 | Non-Plastic |
| 13.5 | 529.5 | | | | | | Loose brown GRAVEL WITH SAND (A-1-b), trace silt, trace clay; wet. | | | | | | | |
| | | 3 4 3 | 8 | 6 | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| | | 5 4 4 | 12 | 7 | | | @ 18.0', heaving sand. | 33 | 31 | -- | 13 | 20 | 3 | Non-Plastic |
| 19.0 | 524.0 | | | | | | Dense light brown GRAVEL WITH SAND AND SILT (A-2-4), trace clay, trace fine to coarse gravel; moist to wet. | | | | | | | |
| | | 16 15 20 | 14 | 8 | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| | | 14 19 20 | 8 | 9 | | | @ 23.0', gray. | | | | | | | |
| | | 5 5 12 | 14 | 10 | | | | 30 | 11 | -- | 24 | 25 | 9 | |
| 25 | | | | | | | | | | | | | | |
| 26.0 | 517.0 | 50/3 | 3 | 11 | | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, laminated to medium bedded, slightly fractured. | | | | | | | |
| | | | | | | | @ 29.4', very thin clay seam. | | | | | | | |
| 30 | | | | | | | @ 29.8', 30.8', thin clay seam. | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-46** | Location: Forward Abutment - Ramp C - #2 | Date Drilled: 03/17/05

WATER OBSERVATIONS: Water seepage at: 13.5'-19.0'
Water level at completion: 6.0' (Prior to coring)
5.0' (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 | STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL — LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 513.0 | Core 120" | Rec 118" | RQD 83% | R1 | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, laminated to medium bedded, slightly fractured.<br>@ 31.4', very thin clay seam.<br>@ 31.6'-32.0', broken zone with clay and rock fragments.<br>@ 33.4'-33.7', clay layer.<br>@ 33.7'-34.2', cross bedded.<br>@ 35.9', very thin clay seam. | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 37.0 | 506.0 | | | | | | Bottom of Boring - 37.0' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

**LOG OF: Boring TR-47** | Location: Pier location - Ramp C - #2 | Date Drilled: 03/17/05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 18.0' (Prior to coring)
9.0' (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 | 542.0 | | | | | | | | | | | | |
| 0.1 | 541.9 | | | | | | Topsoil - 1" | | | | | | |
| | | 1 2 4 | 10 | 1 | | 1.5 | Stiff brown and gray CLAY (A-7-6), trace fine sand; slightly organic; moist. | | | | | | |
| | | | | | | | @ 3.0', very stiff. | | | | | | |
| 5 | | 2 4 5 | 13 | 2 | | 2.5 | | | | | | | |
| | | | | | | | @ 6.0', hard. | | | | | | |
| 7.0 | 535.0 | 4 6 10 | 15 | 3 | | 4.5 | | 0 | 0 | -- | 2 | 48 | 50 |
| | | | | | | | Medium stiff brown SANDY SILT (A-4a), trace gravel, trace clay; moist to wet. | | | | | | |
| | | 1 3 2 | 10 | 4 | | 0.5 | | | | | | | |
| 10 | | | | | | | | | | | | | |
| | | 2 2 2 | 7 | 5 | | -- | | | | | | | |
| 13.0 | 529.0 | | | | | | | | | | | | |
| | | WOH WOH WOH | 18 | 6 | | | Very loose brown COARSE AND FINE SAND (A-3a), trace clay; wet. | 1 | 2 | -- | 83 | 15 | |
| 15 | | | | | | | | | | | | | |
| | | WOH WOH 1 | 18 | 7 | | | | | | | | | |
| 18.0 | 524.0 | | | | | | | | | | | | |
| | | 11 14 12 | 10 | 8 | | 1.5 | Stiff brown SANDY SILT (A-4a), some gravel; moist. | 30 | 11 | -- | 24 | 22 | 14 |
| 20 | | | | | | | | | | | | | |
| 21.0 | 521.0 | 42 34 17 | 12 | 9 | | -- | Very stiff to hard dark gray SANDY SILT (A-4a), little clay; moist. | 15 | 9 | -- | 35 | 26 | 15 |
| 23.0 | 519.0 | | | | | | | | | | | | |
| | | 4 10 21 | 11 | 10 | | -- | Very soft black SHALE; highly weathered, carbonaceous, laminated, broken, contains silt filled high angle fracture. | 29 | 23 | -- | 31 | 12 | 5 |
| 25 | | | | | | | | | | | | | |
| 26.5 | 515.5 | 50/4 | 4 | 11 | | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, laminated to medium bedded, slightly fractured. | | | | | | |
| | | | | | | | @ 26.7'-28.4',30.0'-30.2', vertical healed fracture. | | | | | | |
| 30 | | | | | | | | | | | | | |

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

Non-Plastic
51
Non-Plastic

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

**LOG OF: Boring TR-47** | Location: Pier location - Ramp C - #2 | Date Drilled: 03/17/05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 18.0' (Prior to coring)
9.0' (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 | STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 512.0 | | | | | | | | | | | | | |
| | | Core 120" | Rec 120" | RQD 74% | R1 | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, laminated to medium bedded, slightly fractured.<br>@ 30.2'-32.4', 34.7'-35.4', high angle bedding.<br>@ 31.8'-32.4, broken zone with thin clay seam.<br>@ 33.1'-33.6', low angle healed fracture.<br>@ 33.1'-33.6', high angle healed fracture.<br>@ 33.7'-34.0', very argillaceous.<br>@ 33.7', Highly weathered fracture. | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 36.5 | 505.5 | | | | | | Bottom of Boring - 36.5' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 ( 5/2/2005 3:15 PM )

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

**LOG OF: Boring TR-48** | Location: Rear Abutment - Ramp C - #2 | Date Drilled: 3/21/05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 8.0' measured inside of augers

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 547.0 | 2 2 3 | 14 | 1 | | | FILL: Loose brown GRAVEL WITH SAND (A-1-b); contains mostly coal fragments and cinders; dry to damp. | | | | | | | |
| 3.0 | 544.0 | WOH WOH WOH | 1 | 2 | | | FILL: Very loose brown SILT AND CLAY (A-6a), little fine to coarse sand; contains roots, coal and cinder fragments; damp. | | | | | | | |
| 6.5 | 540.5 | WOH 2 3 | 16 | 3 | | 2.5 | Very stiff brown and gray SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist. | | | | | | | |
| 10 | | 2 5 7 | 17 | 4 | | 3.5 | | 0 | 0 | -- | 2 | 43 | 55 | |
| | | 2 5 6 | 15 | 5 | | 3.5 | | | | | | | | |
| 13.0 | 534.0 | 1 2 2 | 5 | 6 | | | Very loose brown COARSE AND FINE SAND (A-3a), little to some gravel, trace clay; wet. | | | | | | | |
| 15 | | 1 1 1 | 8 | 7 | | | | 37 | 27 | -- | 17 | 20 | | Non-Plastic |
| 18.0 | 529.0 | 6 6 7 | 10 | 8 | | | Medium dense brown SANDY SILT (A-4a), some gravel, little clay; moist. | 52 | 14 | -- | 15 | 12 | 7 | Non-Plastic |
| 20 | | 2 7 30 | 15 | 9 | | | @ 21.0', trace gravel and trace clay. | | | | | | | |
| 23.5 | 523.5 | 20 15 50 | 12 | 10 | | | Soft to medium hard black SHALE; very fine grained, slightly weathered, very thinly bedded, highly fractured. @ 25.3'-25.6', 26.0'-26.4', broken 27.15'-27.2', sandstone seam. | | | | | | | 65 → |
| 25 | | | | | | | | | | | | | | |
| 30 | | Core 120" | Rec 120" | RQD 97% | R1 | | | | | | | | | |

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

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-48** | Location: Rear Abutment - Ramp C - #2 | Date Drilled: 3/21/05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 8.0' measured inside of augers

| 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 - ○ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29.9 | 517.0<br>517.1 | | | | | | Hard gray SANDSTONE; fine grained, slightly weathered, thinly bedded.<br>@ 32.9' fracture | | | | | | | |
| 35.0 | 512.0 | | | | | | Bottom of Boring - 35.0' | | | | | | | |

10 20 30 40

40 45 50 55 60

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-49A** | Location: Forward Abutment - Mainline Overpass # 2 | Date Drilled: 3/21/05

WATER OBSERVATIONS: Water seepage at: 18.0'-28.0'
Water level at completion: 14.0' measured inside of augers

| 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 | 537.5 | 4 5 7 | 17 | 1 | | 4.5+ | Hard brown SILT AND CLAY (A-6a), little fine to coarse sand, trace gravel; damp. | | | | | | |
| | | 3 4 4 | 16 | 2 | | 4.0 | | | | | | | |
| 5 | | 3 5 5 | 16 | 3 | | 1.5 | @ 6.0', stiff; moist. | | | | | | |
| | | 2 2 3 | 17 | 4 | | 1.0 | | | | | | | |
| 10 | | 3 4 5 | 18 | 5 | | 1.5 | @ 11.0', little gravel. | 23 | 16 | -- | 9 | 30 | 22 |
| 13.0 | 524.5 | WOH 2 2 | 18 | 6 | | | Loose brown SANDY SILT (A-4a), trace to little gravel, trace clay; moist. | 0 | 5 | -- | 16 | 54 | 25 |
| 15 | | | | | | | | | | | | | |
| 15.5 | 522.0 | 1 2 3 | 18 | 7 | | | Loose brown SILT (A-4b); moist. | 0 | 0 | -- | 1 | 67 | 33 |
| 18.0 | 519.5 | WOH WOH WOH | 3 | 8 | | | Very loose brown GRAVEL WITH SAND (A-1-b), trace to little clay; moist to wet. | | | | | | |
| 20 | | 5 9 18 | 12 | 9 | | | @ 21.0', medium dense. | 62 | 16 | -- | 8 | 14 | |
| | | 2 2 6 | 18 | 10 | | | | | | | | | |
| 25 | | 6 5 8 | 13 | 11 | | | | | | | | | |
| | | 10 43 50/4 | 18 | 12 | | | @ 29.0', possible broken sandstone. | | | | | | |
| 30 | | | | | | | | | | | | | |

GRADATION

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

Non-Plastic

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-49A** | Location: Forward Abutment - Mainline Overpass # 2 | Date Drilled: 3/21/05

WATER OBSERVATIONS: Water seepage at: 18.0'-28.0'
Water level at completion: 14.0' measured inside of augers

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 507.5 | | | | | | Very loose brown GRAVEL WITH SAND (A-1-b), trace to little clay (possible broken sandstone); moist to wet. | | | | | | | |
| 32.0 | 505.5 | | | | | | Medium hard gray SANDSTONE; fine grained, slightly weathered, argillaceous, broken, multiple clay seams, low and high angled fractures. | | | | | | | |
| | | 50/2 | 1 | 13 | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | Core 120" | Rec 84" | RQD 13% | R1 | | | | | | | | | |
| 45.0 | 492.5 | | | | | | Bottom of Boring - 45.0' | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-50A** | Location: Pier # 2 - Mainline Overpass # 2 | Date Drilled: 3/22/05

WATER OBSERVATIONS: Water seepage at: 18.0'-25.0'
Water level at completion: 18.0' measured inside of augers

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 540.0 | | | | | | | | | | | | | Natural Moisture Content, % - ● PL ⊢—⊣ LL; Blows per foot - ○ (10 20 30 40) |
| 0.1 | 539.9 | | | | | | Topsoil -1" | | | | | | | |
| | | 3 2 3 | 10 | 1 | | | FILL: Loose dark brown SANDY SILT (A-4a), trace gravel; contains roots; damp. | | | | | | | |
| 3.0 | 537.0 | | | | | | | | | | | | | |
| 5 | | 2 1 2 | 8 | 2 | | 1.0 | Stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; moist. | | | | | | | |
| | | 2 3 3 | 13 | 3 | | 2.0 | @ 6.0'-7.5', little to some gravel. | | | | | | | |
| | | 1 2 3 | 16 | 4 | | 1.5 | | 1 | 4 | -- | 7 | 57 | 33 | |
| 10 | | | | | | | | | | | | | | |
| 10.5 | 529.5 | | | | | | | | | | | | | |
| | | 1 2 3 | 18 | 5 | | 1.25 | Stiff brown SILTY CLAY (A-6b), little gravel, trace fine to coarse sand; moist to wet. | 32 | 20 | -- | 12 | 18 | 18 | |
| | | WOH 2 3 | 18 | 6 | | 1.5 | | | | | | | | |
| 15 | | | | | | | @ 16.0', trace gravel and some fine to coarse sand. | | | | | | | |
| | | 1 1 2 | 18 | 7 | | 1.25 | | | | | | | | |
| 18.0 | 522.0 | | | | | | | | | | | | | |
| | | WOH 1 3 | 16 | 8 | | | Very loose to loose brown COARSE AND FINE SAND (A-3a), trace clay, trace gravel; wet. | 15 | 40 | -- | 23 | 21 | | Non-Plastic |
| 20 | | | | | | | | | | | | | | |
| 21.0 | 519.0 | 2 5 11 | 16 | 9 | | | Medium dense brown GRAVEL WITH SAND (A-1-b), trace clay; wet. | 42 | 24 | -- | 20 | 14 | | Non-Plastic |
| | | 2 7 50 | 18 | 10 | | | | | | | | | | |
| 24.5 | 515.5 | | | | | | Medium hard brownish gray SANDSTONE; highly weathered. | | | | | | | 57 → |
| 25 | | 25 37 50/4 | 10 | 11 | | | | | | | | | | |
| 27.5 | 512.5 | | | | | | Hard gray SANDSTONE; fine grained, slightly weathered, argillaceous, medium bedded. @ 28.1',-28.7', 29.0'-29.1' clay seams | | | | | | | 87 → |
| 30 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-50A** | Location: Pier # 2 - Mainline Overpass # 2 | Date Drilled: 3/22/05

WATER OBSERVATIONS: Water seepage at: 18.0'-25.0'
Water level at completion: 18.0' measured inside of augers

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION | GRADATION % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) Natural Moisture Content, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 510.0 | Core 120" | Rec 117" | RQD 68% | R1 | | Hard gray SANDSTONE; fine grained, slightly weathered, argillaceous, medium bedded.<br>@ 33.3', 34.3'-34.4', 36.2', 37. 2', clay seams<br>@ 30.8'-32.1', high angle fracture. | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 37.5 | 502.5 | | | | | | Bottom of Boring - 37.5' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-51** | Location: Pier # 1 - Mainline Overpass # 2 | Date Drilled: 03/17/05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 21.0' (Prior to coring)
13.0' (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 | STANDARD PENETRATION (N) / Natural Moisture Content, % / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 545.0 | | | | | | | | | | | | | |
| 0.1 | 544.9 | | | | | | Topsoil - 2" | | | | | | | |
| | | 1 2 1 | 7 | 1 | | 2.0 | Stiff dark brown SILT AND CLAY (A-6a), little fine to coarse sand, trace fine to coarse gravel; damp to moist. | | | | | | | |
| 5 | | 1 2 3 | 13 | 2 | | 1.0 | | | | | | | | |
| 5.5 | 539.5 | | | | | | Very stiff brown SILTY CLAY (A-6b), trace fine to coarse sand, trace fine to coarse gravel; damp. | | | | | | | |
| | | 2 3 6 | 8 | 3 | | 3.5 | | | | | | | | |
| 8.0 | 537.0 | | | | | | Very loose to loose brown GRAVEL WITH SAND (A-1-b); damp. | | | | | | | |
| | | 3 3 4 | 10 | 4 | | 2.0 | | | | | | | | |
| 10 | | | | | | | @ 11.0', moist. | | | | | | | |
| | | 1 1 1 | 7 | 5 | | 1.5 | | 43 | 28 | -- | 11 | 7 | 11 | Non-Plastic |
| 13.0 | 532.0 | | | | | | Very loose brown COARSE AND FINE SAND (A-3a), trace fine to coarse gravel, trace clay; wet. | | | | | | | |
| | | WOH WOH WOH | 18 | 6 | | | | 12 | 28 | -- | 45 | 15 | | Non-Plastic |
| 15 | | | | | | | | | | | | | | |
| | | WOH WOH WOH | 18 | 7 | | | | | | | | | | |
| 18.0 | 527.0 | | | | | | Medium dense reddish brown SANDY SILT (A-4a), little gravel; damp to moist. | | | | | | | |
| | | 16 7 8 | 18 | 8 | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| | | 7 14 11 | 14 | 9 | | | | 19 | 19 | -- | 30 | 24 | 8 | Non-Plastic |
| 23.0 | 522.0 | | | | | | Stiff gray CLAY (A-7-6); moist. | | | | | | | |
| | | 1 3 5 | 11 | 10 | | 1.5 | | 0 | 0 | -- | 1 | 43 | 55 | |
| 25 | | | | | | | | | | | | | | |
| 25.5 | 519.5 | 20 50/3 | 8 | 11 | | | Medium hard black SHALE; moderately weathered, pyritic, laminated, broken. | | | | | | | |
| | | | | | | | @ 28.1'-28.2', gray. | | | | | | | |
| 28.6 | 516.4 | | | | | | Hard gray SANDSTONE | | | | | | | |
| 30 | | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 ( 5/2/2005 3:15 PM )

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

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

**LOG OF: Boring TR-51** | Location: Pier # 1 - Mainline Overpass # 2 | Date Drilled: 03/17/05

WATER OBSERVATIONS:
Water seepage at: 13.0'-18.0'
Water level at completion: 21.0' (Prior to coring)
13.0' (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 | STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 515.0 | Core 120" | Rec 116" | RQD 71% | R1 | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, very thinly bedded to medium bedded.<br>@ 28.7'-28.8', pyritic.<br>@ 31.8', very thin clay seam.<br>@ 33.1'-33.3', clay and gravel seam.<br>@ 33.5', fracture.<br>@ 34.5', very thin clay seam.<br>@ 35.5'-36.2', broken zone with clay infilling.<br>@ 36.6'-36.8', highly weathered. | | | | | | | |
| 37.5 | 507.5 | | | | | | Bottom of Boring - 37.5' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-52** | Location: Rear Abutment - Mainline Overpass # 2 | Date Drilled: 03/15/05

WATER OBSERVATIONS: Water seepage at: 23.0'-30.0'
Water level at completion: 27.0' (Prior to coring)
6.0' (including drill water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press / Core | Hand Penetrometer (tsf) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 30 | 528.0 | | | | | | Medium dense brown SANDY SILT (A-4a), trace clay; wet. |
| 33.5 | 524.5 | 22<br>50/5 | 10 | 13 | | | Medium hard black SHALE; moderately weathered, pyritic, laminated, broken. |
| 40 | | Core<br>120" | Rec<br>120" | RQD<br>35% | R1 | | |
| 40.4 | 517.6 | | | | | | Hard gray SANDSTONE; very fine to fine grained, slightly weathered, argillaceous, micaceous, very thinly bedded to medium bedded. |
| 45.0 | 513.0 | | | | | | Bottom of Boring - 45.0' |
| 50 | | | | | | | |
| 55 | | | | | | | |
| 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 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-54** | Location: Rear Abutment - Ramp C - #1 | Date Drilled: 3-16-05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
11.0' (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 | 567.5 | | | | | | | | | | | | |
| 0.2 | 567.3 | | | | | | Topsoil - 3" | | | | | | |
| | | 2 2 2 | 14 | 1 | | 1.0 | Stiff to very stiff brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp. @ 0.0'-2.5', contains roots. | | | | | | |
| | | 2 5 6 | 17 | 2 | | 3.5 | | 0 | 0 | -- | 4 | 61 | 35 |
| 5 | | | | | | | | | | | | | |
| 5.5 | 562.0 | | | | | | Very stiff brown SANDY SILT (A-4a), trace clay; damp. | | | | | | |
| | | 3 5 6 | 18 | 3 | | 2.25 | | 0 | 0 | -- | 12 | 67 | 21 |
| | | 1 3 2 | 11 | 4 | | 2.0 | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 10.5 | 557.0 | | | | | | Loose dark brown COARSE AND FINE SAND (A-3a), trace to little clay, trace gravel; damp. | 8 | 38 | -- | 37 | 18 | |
| | | 1 2 3 | 13 | 5 | | | | | | | | | |
| 13.6 | 553.9 | 7 35 50/4 | 14 | 6 | | | Soft gray SHALE; moderately weathered. | | | | | | |
| 15.0 | 552.5 | | | | | | Medium hard gray SHALE; fine grained, moderately weathered, laminated. @ 15.0'-17.3', broken with high angles fractures and thin clay seams. @ 18.9'-19.0', 20.6'-20.9', high angle fractures. | | | | | | |
| 20 | | Core 120" | Rec 120" | RQD 83% | R-1 | | | | | | | | |
| 22.6 | 544.9 | | | | | | Hard gray SILTSTONE; very fine to fine grained, slightly weathered, argillaceous, medium bedded, slightly fractured. | | | | | | |
| 23.5 | 544.0 | | | | | | Hard gray SHALE; slightly weathered, argillaceous, very thinly bedded. | | | | | | |
| 25.0 | 542.5 | | | | | | Bottom of Boring - 25.0' | | | | | | |
| 30 | | | | | | | | | | | | | |

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

Non-Plastic

85 →

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-55A** | Location: Forward Abutment - Mainline Overpass #1 | Date Drilled: 3-15-05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 18.0' (Prior to coring)
18.0' (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 | 565.5 | 3 5 5 | 10 | 1 | | 4.5+ | Hard gray SILTY CLAY (A-6b); damp. | | | | | | |
| 3.0 | 562.5 | 6 7 7 | 9 | 2 | | 4.5+ | Hard brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp. | | | | | | |
| 5 | | 11 11 9 | 12 | 3 | | 4.5+ | | 22 | 15 | -- | 23 | 21 | 19 |
| 8.0 | 557.5 | 4 5 4 | 14 | 4 | | 3.5 | Very stiff to hard brown SANDY SILT (A-4a), trace gravel; damp. | 5 | 25 | -- | 39 | 16 | 16 |
| 10 | | 5 4 3 | 12 | 5 | | 4.5+ | @ 11.0', hard. | | | | | | |
| 13.0 | 552.5 | 2 2 2 | 15 | 6 | | | Loose brown COARSE AND FINE SAND (A-3a), trace gravel; wet. | 9 | 38 | -- | 41 | 13 | |
| 15 | | 1 2 2 | 7 | 7 | | | | | | | | | |
| 18.0 | 547.5 | 35 50/5 | 12 | 8 | | | Hard gray SHALE interbedded with SANDSTONE; fine grained, highly weathered, very thinly bedded, highly fractured. @ 20.0'-22.0', 26.7'-27.5', 28.3'-28.5', 29.3'-29.6', highly fractured with clay seams. @ 21.0'-21.3', 21.7'-21.9', 26.5'-26.7', 26.9'-22.0', Hard brown sandstone; slightly weathered laminated. | | | | | | |
| 20 | | | | | | | | | | | | | |
| 25 | | Core 120" | | RQD 64% | R-1 | | | | | | | | |
| 30.0 | 535.5 | | | | | | Bottom of Boring - 30.0' | | | | | | |

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

Non-Plastic
Non-Plastic

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-55A** | Location: Forward Abutment - Mainline Overpass #1 | Date Drilled: 3-15-05

WATER OBSERVATIONS: Water seepage at: 13.0'-18.0'
Water level at completion: 18.0' (Prior to coring)
18.0' (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, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 535.5 | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

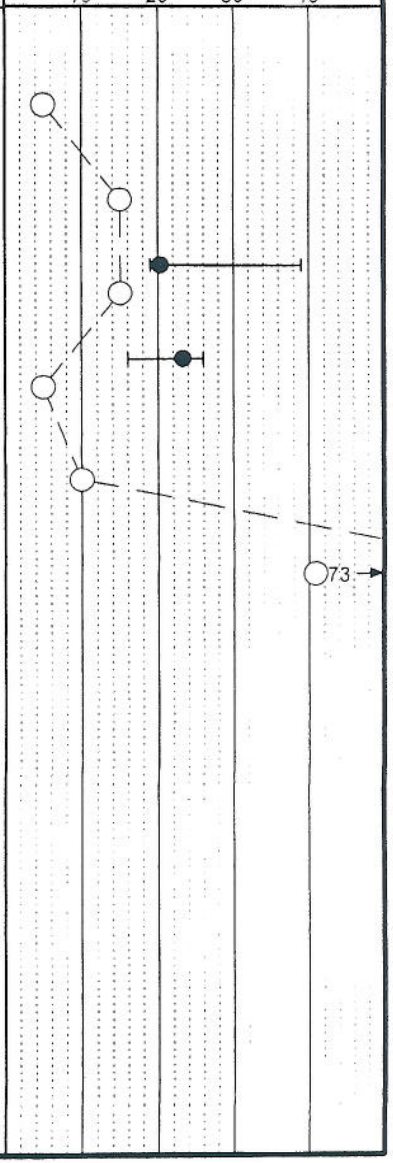
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

**LOG OF: Boring TR-56** | Location: Rear Abutment - Mainline Overpass # 1 | Date Drilled: 3-16-05

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
7.5' (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 | 569.5 | | | | | | | | | | | | |
| 0.2 | 569.3 | | | | | | Topsoil -3" | | | | | | |
| | | 2 2 3 | 15 | 1 | | 2.5 | Very stiff brown SANDY SILT (A-4a), trace clay, trace gravel; damp to moist. | | | | | | |
| 3.0 | 566.5 | | | | | | Hard brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp. | | | | | | |
| | | 4 6 9 | 17 | 2 | | 4.5+ | | | | | | | |
| 5 | | | | | | | | | | | | | |
| | | 4 6 9 | 16 | 3 | | 4.25 | | 0 | 0 | -- | 2 | 58 | 41 |
| 8.0 | 561.5 | | | | | | | | | | | | |
| | | 2 2 3 | 18 | 4 | | | Loose brown and gray SANDY SILT (A-4a), trace clay; damp to moist. | 0 | 1 | -- | 19 | 55 | 25 |
| 10 | | | | | | | | | | | | | |
| | | 2 6 4 | 9 | 5 | | | | | | | | | |
| 14.1 | 555.4 | 8 23 50/4 | 15 | 6 | | | Medium hard grayish brown SILTSTONE interbedded with SHALE; very fine to fine grained, slightly weathered, argillaceous, thinly bedded, highly fractured. | | | | | | |
| 15 | | | | | | | @ 16.4'-17.2', high angle fracture and clay seam. | | | | | | |
| | | | | | | | @ 17.2', gray. | | | | | | |
| | | | | | | | @ 19.2'-19.7', clay seam. | | | | | | |
| 20 | | Core 120" | Rec 120" | RQD 68% | R-1 | | @ 20.4'-20.8', highly broken, clay seam. | | | | | | |
| 25.0 | 544.5 | | | | | | Bottom of Boring - 25.0' | | | | | | |
| 30 | | | | | | | | | | | | | |

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




FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

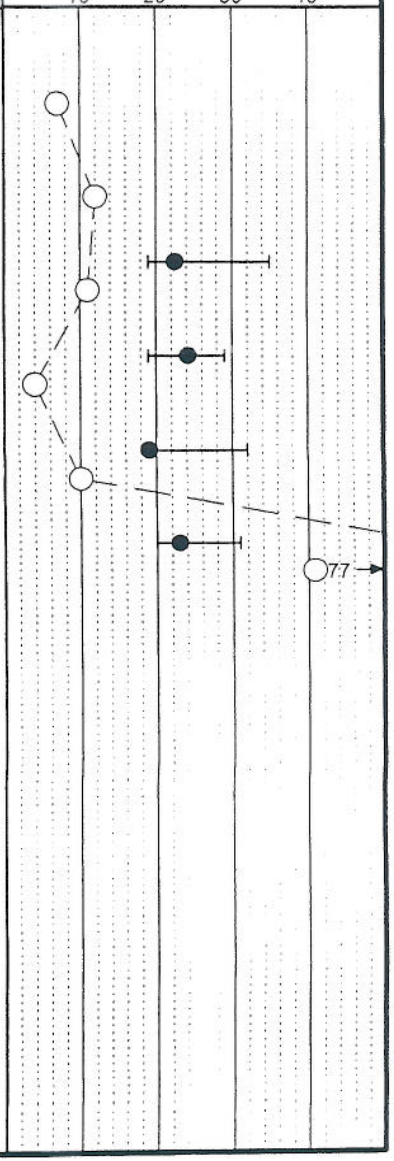
Client: TranSystems, Inc. | Project: SCI-823-0.00 | Job No. 0121-3070.03

**LOG OF: Boring TR-57** | Location: Rear Abutment - Ramp B - #2 | Date Drilled: 3-16-04

WATER OBSERVATIONS: Water seepage at: None
Water level at completion: Dry (Prior to coring)
3.5' (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 | 569.5 | | | | | | | | | | | | |
| 0.3 | 569.2 | | | | | | Topsoil -4" | | | | | | |
| | | 2 3 4 | 14 | 1 | | 4.0 | Very stiff to hard brown SILT AND CLAY (A-6a), trace fine to coarse sand; damp. | | | | | | |
| | | 3 5 7 | 12 | 2 | | 4.5 | | | | | | | |
| 5 | | 4 5 6 | 17 | 3 | | 3.5 | | 0 | 0 | -- | 1 | 64 | 35 |
| 8.0 | 561.5 | | | | | | Stiff brown SILT AND CLAY (A-6a), little fine to coarse sand; damp to moist. | 0 | 0 | -- | 10 | 67 | 23 |
| | | 1 2 2 | 18 | 4 | | 1.0 | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 10.5 | 559.0 | | | | | | Medium dense brown SANDY SILT (A-4a), little gravel, trace clay; damp. | 23 | 15 | -- | 19 | 26 | 17 |
| | | 2 5 5 | 14 | 5 | | | | | | | | | |
| 14.0 | 555.5 | 12 27 50/3 | 13 | 6 | | | Soft to medium hard gray SHALE; moderately weathered, laminated. | 0 | 2 | -- | 4 | 64 | 31 |
| 15 | | | | | | | @ 15.8'-16.3', 19.1'-19.5', clay seams | | | | | | |
| 20 | | Core 120" | Rec 120" | RQD 90% | R-1 | | | | | | | | |
| 20.9 | 548.6 | | | | | | Hard gray SILTSTONE interbedded with SHALE; slightly weathered, laminated. | | | | | | |
| 22.9 | 546.6 | | | | | | @ 22.7'-22.9' high angle fracture<br>Hard gray SHALE; slightly weathered, laminated, slightly fractured. | | | | | | |
| 25.0 | 544.5 | | | | | | Bottom of Boring - 25.0' | | | | | | |
| 30 | | | | | | | | | | | | | |

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




FILE: 0121-3070-03 ( 5/2/2005 3:15 PM )

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

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

**LOG OF: Boring TR-58** | Location: Pier # 1 - Ramp B - #2 | Date Drilled: 3-16-05

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

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetro-meter (tsf) | DESCRIPTION | % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay | STANDARD PENETRATION (N) / Natural Moisture Content, % / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 567.0 | | | | | | | | | | | | | |
| 0.3 | 566.7 | | | | | | Topsoil -4" | | | | | | | |
| | | 1 2 2 | 16 | 1 | | -- | Soft brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp to moist. @ 0.0'-2.5', contains roots. @ 3.5', very stiff to hard, damp. | | | | | | | |
| | | 3 6 8 | 15 | 2 | | 4.25 | | | | | | | | |
| 5 | | 5 6 7 | 18 | 3 | | 3.5 | | 0 | 0 | -- | 6 | 65 | 29 | |
| 8.0 | 559.0 | | | | | | | | | | | | | |
| | | 2 4 3 | 16 | 4 | | | Loose dark brown COARSE AND FINE SAND (A-3a), trace to little clay, trace gravel; damp. | 7 | 34 | -- | 40 | 19 | | Non-Plastic |
| 10 | | 4 4 3 | 15 | 5 | | | | | | | | | | |
| 14.0 | 553.0 | 2 20 50/5 | 16 | 6 | | | Soft to medium hard gray SHALE; moderately weathered, argillaceous, thinly bedded, slightly fractured. @ 15.0'-16.7', broken with clay seams and high angle fractures @ 17.5'-17.8', 19.5'-20.1', clay seams with high angle fractures @ 20.9'-21.0', clay seam. @ 24.2' and 24.4', very thin clay seam. | | | | | | | 70 |
| 15 | | | | | | | | | | | | | | |
| 20 | | Core 120" | Rec 120" | RQD 82% | R-1 | | | | | | | | | |
| 25.0 | 542.0 | | | | | | Bottom of Boring - 25.0' | | | | | | | |
| 30 | | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 ( 5/2/2005 3:15 PM )

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

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

**LOG OF: Boring TR-59A** | Location: Forward Abutment - Ramp B - #2 | Date Drilled: 3-14-05

WATER OBSERVATIONS: Water seepage at: 19'-21.5'
Water level at completion: Dry (Prior to coring)
17.0' (Including drill water)

| Depth (ft) | Elev. (ft) | Blows per 6" | Recovery (in) | Sample No. Drive | Sample No. Press /Core | Hand Penetrometer (tsf) | DESCRIPTION | % Aggregate | % C. Sand | % M. Sand | % F. Sand | % Silt | % Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 564.5 | | | | | | | | | | | | |
| | | 3 3 3 | 14 | 1 | | | Loose dark gray SANDY SILT (A-4a), trace clay, trace gravel; damp. | | | | | | |
| | | 2 2 2 | 12 | 2 | | | @ 3.5', brown; Moist. | 7 | 13 | -- | 26 | 32 | 22 |
| 5 | | | | | | | | | | | | | |
| 5.5 | 559.0 | 2 2 3 | 15 | 3 | | | Very loose to loose brown COARSE AND FINE SAND (A-3a), trace clay, trace silt; moist. | 15 | 36 | -- | 37 | 12 | |
| | | 2 2 1 | 13 | 4 | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 10.5 | 554.0 | 2 2 2 | 16 | 5 | | | Loose brown SANDY SILT (A-4a), little gravel, trace clay; damp to moist. | 14 | 25 | -- | 31 | 9 | 21 |
| | | 1 2 3 | 15 | 6 | | | | | | | | | |
| 15 | | | | | | | | | | | | | |
| | | 2 3 3 | 12 | 7 | | | @ 16.0', little to some clay. | | | | | | |
| | | 0 1 1 | 14 | 8 | | | @ 19.0'-21.5', wet. | | | | | | |
| 20 | | | | | | | | | | | | | |
| 21.5 | 543.0 | 1 36 50 | 12 | 9 | | | Medium hard gray SHALE; slightly weathered. | | | | | | |
| | | 32 50/3 | 9 | 10 | | | | | | | | | |
| 25.0 | 539.5 | | | | | | Medium hard to hard gray SILTSTONE interbedded with SHALE; very fine to fine grained, slightly weathered, argillaceous, thinly bedded, slightly fractured. @ 25.4'-25.7', 28.5', 29.6', clay seams @ 25.9', 26.5-26.7', 27.8', high angle fractures @ 28.6'-29.6', moderately weathered SHALE. | | | | | | |
| 30 | | Core 120" | Rec 119" | RQD 65% | R-1 | | | | | | | | |

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

Non-Plastic

86

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-59A** | Location: Forward Abutment - Ramp B - #2 | Date Drilled: 3-14-05

WATER OBSERVATIONS: Water seepage at: 19'-21.5'
Water level at completion: Dry (Prior to coring)
17.0' (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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 534.5 | | | | | | Medium hard to hard gray SILTSTONE interbedded with SHALE; very fine to fine grained, slightly weathered, argillaceous, thinly bedded, slightly fractured. @ 31.4'-31.7', clay seams with high angle fractures | | | | | | | |
| 33.0 | 531.5 | | | | | | Hard black SHALE; fine grained, slightly weathered, carbonaceous, thinly bedded. @ 33.8'-34.0', high angle fractures and broken. | | | | | | | |
| 35.0 | 529.5 | | | | | | Bottom of Boring - 35.0' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

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

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-60** | Location: Rear Abutment - Ramp B - #1 | Date Drilled: 3-14-05

WATER OBSERVATIONS: Water seepage at: 18'-28'
Water level at completion: 26.0' (Prior to coring)
19.0' (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 | STANDARD PENETRATION (N) / Natural Moisture Content, % / PL — LL / Blows per foot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 554.0 | | | | | | | | | | | | | |
| 0.1 | 553.9 | | | | | | Topsoil -1" | | | | | | | |
| | | 4 8 7 | 12 | 1 | | | FILL: Medium dense brown SANDY SILT (A-4a), little gravel, trace clay; damp. | | | | | | | |
| 3.0 | 551.0 | | | | | | | | | | | | | |
| | | 4 4 4 | 12 | 2 | | | Loose brown COARSE AND FINE SAND (A-3a), little gravel, trace clay; damp. | 33 | 43 | -- | 11 | 13 | | Non-Plastic |
| 5 | | 3 2 2 | 9 | 3 | | | | | | | | | | |
| | | 3 2 3 | 13 | 4 | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 10.5 | 543.5 | | | | | | | | | | | | | |
| | | 3 3 3 | 14 | 5 | | | Loose brown SANDY SILT (A-4a), little gravel, trace clay; damp. | 50 | 20 | -- | 9 | 17 | 4 | Non-Plastic |
| | | 3 3 4 | 1 | 6 | | | @ 13.5', moist. | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| | | 2 3 3 | 14 | 7 | | | | | | | | | | |
| 18.0 | 536.0 | | | | | | | | | | | | | |
| | | 1 1 2 | 17 | 8 | | | Very loose to loose brown COARSE AND FINE SAND (A-3a), trace clay, trace gravel; wet. | 10 | 53 | -- | 20 | 17 | | Non-Plastic |
| 20 | | 4 3 3 | 16 | 9 | | | | | | | | | | |
| 23.0 | 531.0 | | | | | | | | | | | | | |
| | | 7 4 4 | 18 | 10 | | -- | Stiff brown SILT AND CLAY (A-6a), little to some gravel, little fine to coarse sand; wet. | 31 | 27 | -- | 12 | 18 | 12 | |
| 25 | | | | | | | | | | | | | | |
| 25.5 | 528.5 | | | | | | Loose reddish brown FINE SAND (A-3), trace clay; wet. | | | | | | | |
| | | 3 6 4 | 18 | 11 | | | | 7 | 14 | -- | 59 | 21 | | Non-Plastic |
| 28.0 | 526.0 | | | | | | Soft black SHALE; highly weathered. | | | | | | | |
| | | 50/4 | 4 | 12 | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-60** | Location: Rear Abutment - Ramp B - #1 | Date Drilled: 3-14-05

WATER OBSERVATIONS: Water seepage at: 18'-28'
Water level at completion: 26.0' (Prior to coring)
19.0' (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, % - ● PL ⊢—⊣ LL Blows per foot - ○ 10 20 30 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 524.0 | | | | | | Medium hard black SHALE; moderately weathered, carbonaceous, laminated, highly fractured. | | | | | | | |
| | | | | | | | @ 30.0'-32.3', clay seam. | | | | | | | |
| | | | | | | | @ 32.3' hard. | | | | | | | |
| | | Core 120" | Rec 119" | RQD 79% | R-1 | | @ 33.2', 38.0'-38.2', clay seams. | | | | | | | |
| 35 | | | | | | | @ 39.4'-39.8', high angle fracture. | | | | | | | |
| | | | | | | | @ 39.9', Hard gray SANDSTONE. | | | | | | | |
| 40.0 | 514.0 | | | | | | Bottom of Boring - 40.0' | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070.03 ( 5/2/2005 3:15 PM )

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

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

**LOG OF: Boring TR-61** | Location: Forward Abutment - Ramp B - #1 | Date Drilled: 3-16-05

WATER OBSERVATIONS: Water seepage at: 13.5'-23.0'
Water level at completion: 14.0' Prior to coring
9.0' Measured from inside the augers after 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 | 547.0 | | | | | | | | | | | | |
| | | 2 2 2 | 2 | 1 | | | FILL: Loose black SANDY SILT (A-4a), little gravel; organic; dry to damp. | | | | | | |
| | | 3 4 3 | 1 | 2 | | | | 14 | 20 | -- | 26 | 28 | 12 |
| 5 | | | | | | | | | | | | | |
| 5.5 | 541.5 | | | | | | Very stiff light brown SILT AND CLAY (A-6a), trace fine to coarse sand, trace gravel; damp. | | | | | | |
| | | 2 3 3 | 16 | 3 | | 2.5 | | | | | | | |
| | | 1 3 5 | 12 | 4 | | 2.25 | @ 8.5', brown. | 8 | 12 | -- | 12 | 29 | 39 |
| 10 | | | | | | | | | | | | | |
| 10.5 | 536.5 | | | | | | Very loose brown COARSE AND FINE SAND (A-3a); moist. | | | | | | |
| | | 1 2 2 | 13 | 5 | | | @ 10.5'-12.5', little clay | 9 | 47 | -- | 32 | 13 | Non-Plastic |
| | | 0 0 0 | 16 | 6 | | | @ 13.5', wet. | | | | | | |
| 15 | | | | | | | | | | | | | |
| | | 0 0 1 | 18 | 7 | | | @ 18.0', very loose to loose. | | | | | | |
| | | 1 3 2 | 18 | 8 | | | | | | | | | |
| 20 | | | | | | | | | | | | | |
| | | 1 1 3 | 18 | 9 | | | | | | | | | |
| 23.0 | 524.0 | | | | | | Medium hard black SHALE; moderately weathered. | | | | | | |
| | | 50/3 | 3 | 10 | | | | | | | | | |
| 25.0 | 522.0 | | | | | | Hard black SHALE; fine grained, moderately weathered, carbonaceous, thinly bedded, moderately fractured, fissile. @ 25.0'-25.2', 27.5'-27.6', 28.1'-28.2', 29.3'-30.0', high angle fractures | | | | | | |
| 30 | | Core 120" | Rec 114" | RQD 92% | R-1 | | | | | | | | |

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

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]

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

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

**LOG OF: Boring TR-61** | Location: Forward Abutment - Ramp B - #1 | Date Drilled: 3-16-05

WATER OBSERVATIONS: Water seepage at: 13.5'-23.0'
Water level at completion: 14.0' Prior to coring
9.0' Measured from inside the augers after 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 517.0 | | | | | | | | | | | | | |
| 30.5 | 516.5 | | | | | | Hard gray SANDSTONE; fine to medium grained, slightly weathered, thinly to medium bedded.<br>@ 31.2'-31.6', high angle fracture.<br>33.7'-33.9', clay seam. | | | | | | | |
| 35.0 | 512.0 | | | | | | Bottom of Boring - 35.0' | | | | | | | |
| 40 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | | | |

FILE: 0121-3070-03 [ 5/2/2005 3:15 PM ]