July 1, 2002

BRIDGE TYPE STUDY

CUY-77-1111
CSXT over I-77

PID 13564

CSXT Bridge

Submitted to

Ohio Department
of Transportation
District 12

Submitted by

Baker

Baker and Associates
A Unit of Michael Baker Corporation
25054

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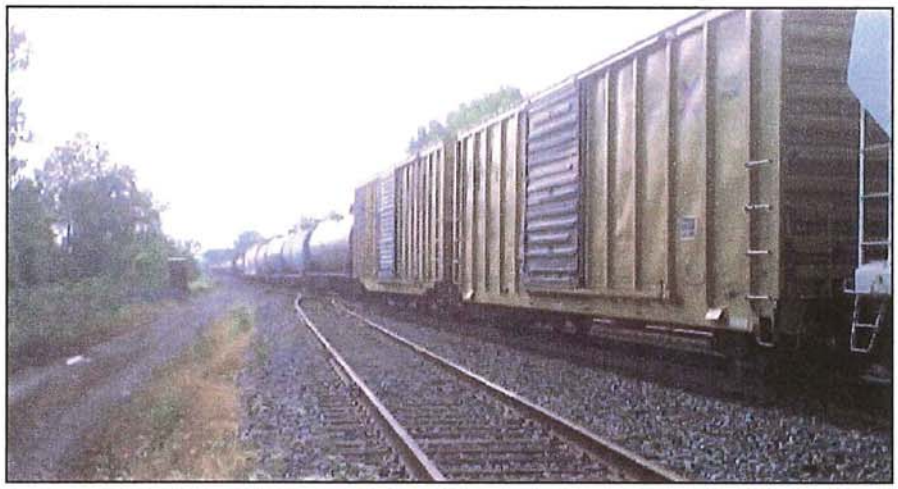
Appendices



I. Introduction

Baker and Associates has been retained by the Ohio Department of Transportation to prepare the preliminary design and plans for the replacement of the bridge carrying the CSXT Chicago/ Buffalo Mainline over I-77. The bridge is located in Cuyahoga Heights, south of Cleveland, in Cuyahoga County (See Figure 1). Before plans can be developed, a structure type must be determined. The purpose of this report is to determine the most appropriate type of structure for this location based on maintaining train traffic, minimizing impacts to traffic on I-77, and minimizing project costs.

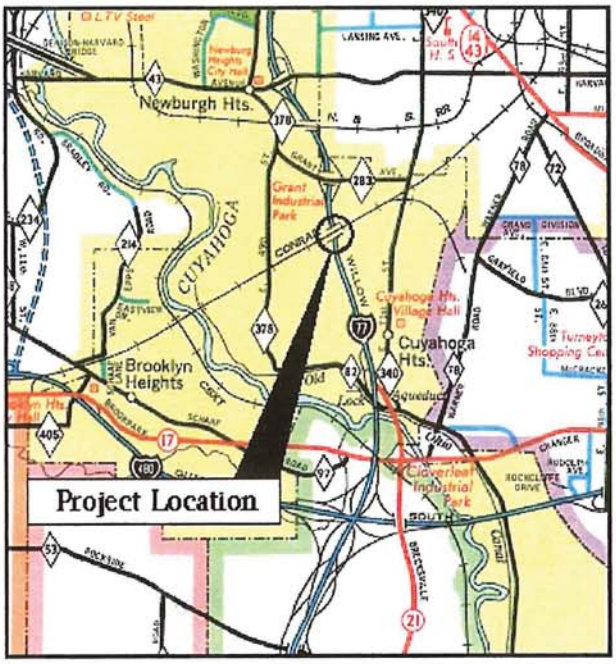


Figure 1 - Location Map

A. Existing Structure

The original structure was constructed in 1942 and consists of two spans with built-up steel deck girders, a reinforced concrete deck slab with ballast, supported on reinforced concrete full height abutments and pier, founded on cast-in-place piles.

Today, the existing structure has a minimum vertical under clearance of approximately 16'-0" over the southbound lanes.

The existing width of the structure varies from approximately 71'-3" to 77'-9" measured out-to-out of the fascia girders. The fascia girders are much deeper than the interior girders, providing a trough to retain the rail track ballast material. A handrail atop the fascia girders is also provided (See Figure 2a).

B. Design Criteria

The proposed structure and any track work will be designed according to the Ohio Department of Transportation *Location and Design Manuals*, the Ohio Department of Transportation *Bridge Design Manual*, AASHTO

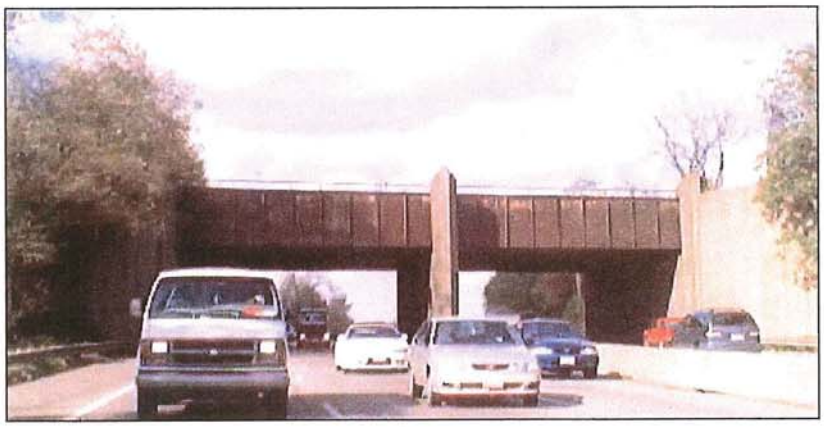


Figure 2a - Elevation of Existing Structure Looking North

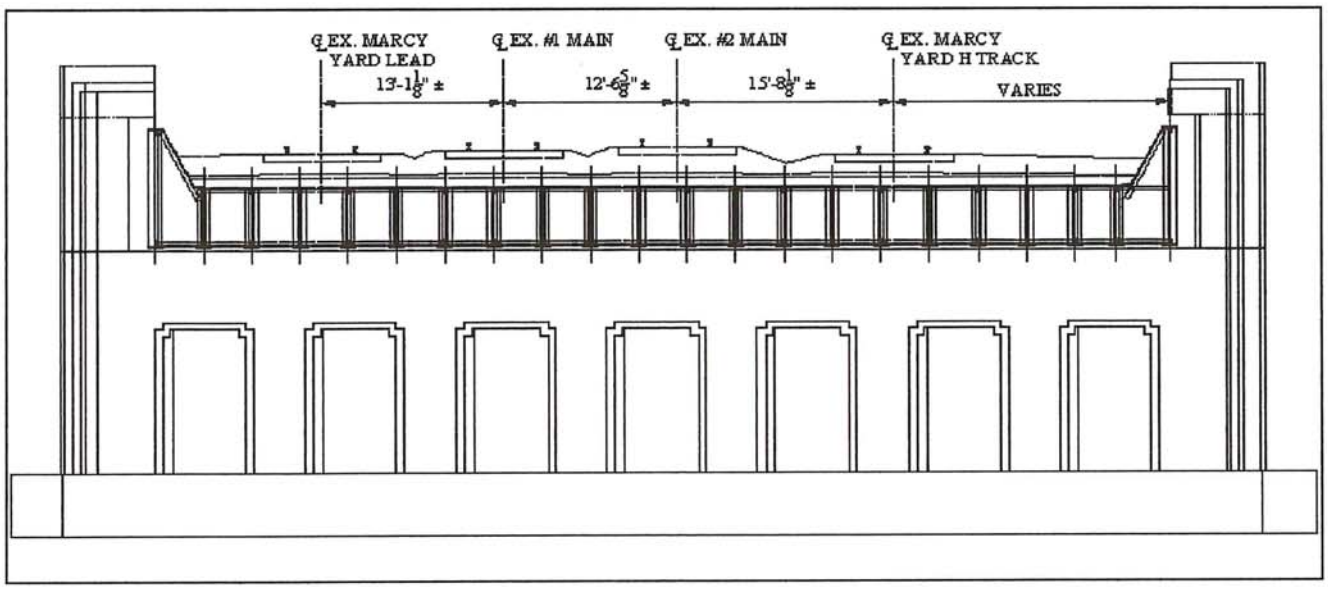


Figure 2b- Existing Transverse Section

Standard Specifications for Highway Bridges, CSX Transportation *Criteria for Ballast Deck Railroad Bridges* and AREMA *Manual for Railway Engineering*.

Based on preliminary discussions between ODOT and CSXT personnel, all current CSXT design criteria will need to be met in the proposed design. Appendix A depicts the necessary design requirements for this project.

C. Evaluation Criteria

The relative difference between the options comes down to the construction costs. The following table shows the general cost per item that is used to determine the total construction cost used for determining our recommendation. (See Table 1).

Item	Unit	Unit Price
Deck Girder	S.F.	$450.00
Through Girder	S.F.	$630.00
Truss	S.F.	$810.00
Structure Removal	S.F.	$30.00
Mainline Tracks	T.F.	$125.00
Yard Tracks	T.F.	$100.00
Track Removal	T.F.	$15.00
Main Track Switch	Each	$100,000.00
Main Track Signal	Each	$100,000.00
Yard Track Switch	Each	$75,000.00
Ballast	Ton	$22.00
Subballast	Ton	$22.00
Embankment	C.Y,	$6.00
Cut & Throws - Main	Each	$50,000.00
Cut & Throws - Yard	T.F.	$50.00
Inspection	Lump Sum	$150,000.00
Flagging	Day	$600.00
Relocate Pole HTW	Each	$200,000.00
HBD (estimated)	Each	$500,000.00

Table 1 – Unit Prices

D. Subsurface Conditions and Foundation Recommendations

A subsurface investigation was performed by Prime Engineering and Architecture Inc. The preliminary results of their borings are included in Appendix B. Based on the results of this investigation, Prime Engineering and Architecture Inc. recommends 14-inch diameter, 70-ton piles for the abutment foundations. The poor quality of soil, limitations on footing

size, and unacceptable settlements warrant the use of piles. Upon approval of the preferred structure type, a foundation analysis will be performed for the design loads, and an appropriate pile length will be specified in the Stage I plans.

E. Substructure

The options considered for the substructure included full height cast-in-place abutments and mechanically stabilized earth walls (MSE) with stub abutments. Both options minimize span length, but differ in excavation requirements. Full height cast-in-place abutments require less excavation behind the abutment resulting in less interruption to the existing tracks above. MSE walls with stub abutments rely on the friction interaction between the soil and the wall anchors. To develop the friction necessary to retain a soil load with railroad live loading, these anchors would have to be quite long.

To blend the transverse slope along the rails with the transverse slopes along I-77, 45-degree wingwalls will be provided. The railroads generally used curved wingwalls to avoid live load impacts through the soil onto the walls. Curved wingwalls are expensive and difficult to build. 45-degree wingwalls however, are the most economical shape to bring two slopes together. The abutments will be constructed long enough to prevent the live load from impacting the wingwalls.

Though MSE walls with stub abutments are a viable option, CSXT prefers not to use MSE walls as the primary method of supporting rail structures. Therefore, the optimal substructure type is a full height cast-in-place abutment founded on 14-inch diameter piles with 45-degree turn-back wingwalls.

F. Replacement Options

The Scope-of-Services, included in Appendix C, specifies the following three replacement options: replacing the bridge with current alignment detouring all train traffic, replacing the bridge with a permanent relocated alignment, and replacing the bridge while using a temporary runaround while maintaining three tracks. The end result is to develop the most economical structure that will carry the Marcy Yard Lead, #1 Main, and #2 Main across the bridge. Since construction cost is a deciding factor, the structure types being evaluated have CSXT required walkways on both sides in lieu of an access road on the south side of the bridge, as recommended in the Value Engineering Report. Each of these options are evaluated and discussed below.

II. Detour Option

This option involves detouring all train traffic away from the site and removing and replacing the bridge along its existing alignment. The Scope-of-Service requires a single span superstructure of 127'-6" measured perpendicular to the centerline of I-77 from toe of abutment barrier to toe of abutment barrier. This requirement, along with the structure's skew, results in a span of 142'-0". The superstructure types investigated to carry the

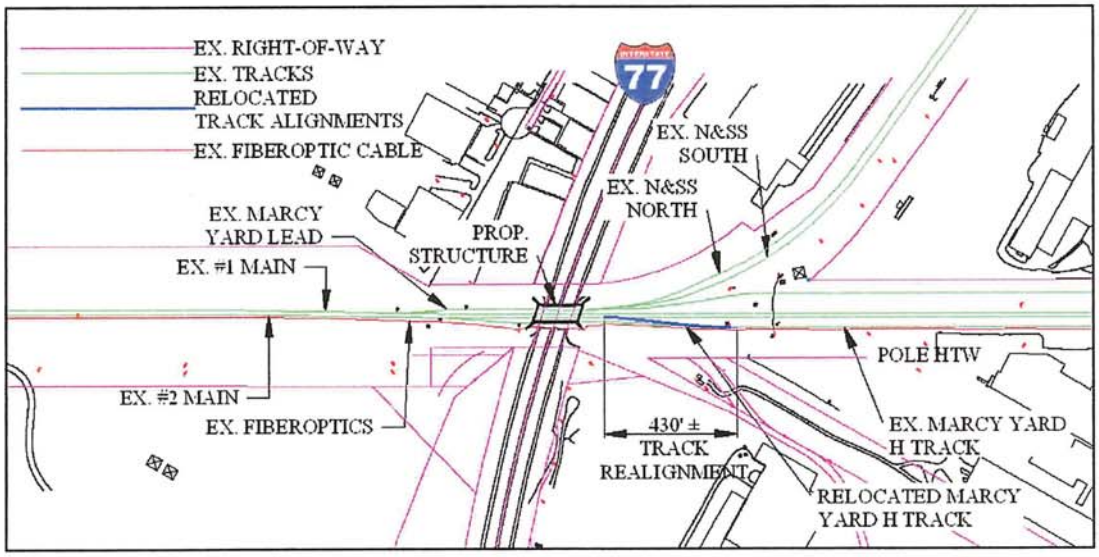


Figure 3 – Detour Option Track Layout

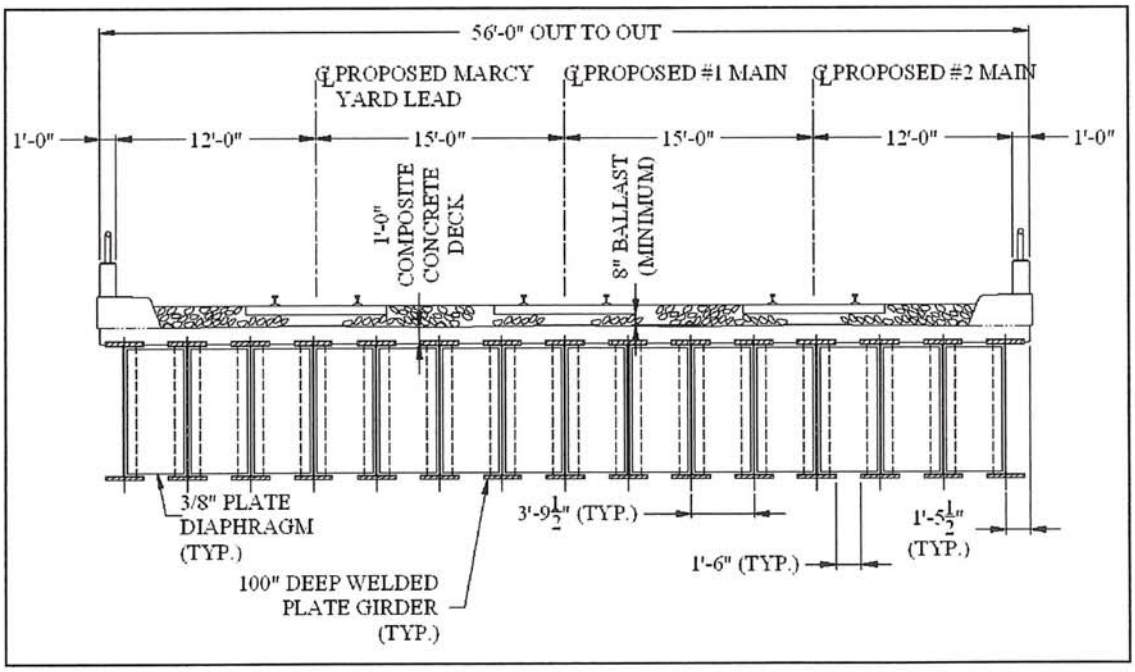


Figure 4 – Deck Girder Transverse Section

proposed Marcy Yard Lead, proposed #1 Main, and proposed #2 Main are deck girder, through girder, and through truss. The Marcy Yard H Track will be permanently relocated to the east side of the proposed structure. The Fiber optic cable located south of the bridge will need to be relocated or maintained. (See Figure 3).

A. Deck Girder Option

The deck girder superstructure consists of 15 welded steel plate girders with a 12" composite concrete deck and an out-to-out dimension of 56'-0". (See Figure 4). This width is based on CSXT requirements of 15'-0" center of track to center of track and a 12'-0" offset from the center of outside track to the inside of parapet to allow for a walkway. CSXT requires walkways on both sides of the structure. These walkways form a trough to retain the ballast under the rails. The parapet and walkways are cast into the 12" composite deck.

It is beneficial to have redundant primary members. In this case, there are 15 plate girders carrying the loads of 3 sets of tracks. CSXT requires Coopers E-80 loading with full diesel impact to be applied to the composite girder and Coopers E-65 loading with full diesel impact on the steel alone. The resulting girder depth was 100". Deflection from the Coopers E-65 loading governed the depth of girder required. Since structural deflection is not a function of the yield stress of the steel, the use of 70-ksi steel provided no advantage and therefore, is not recommended.

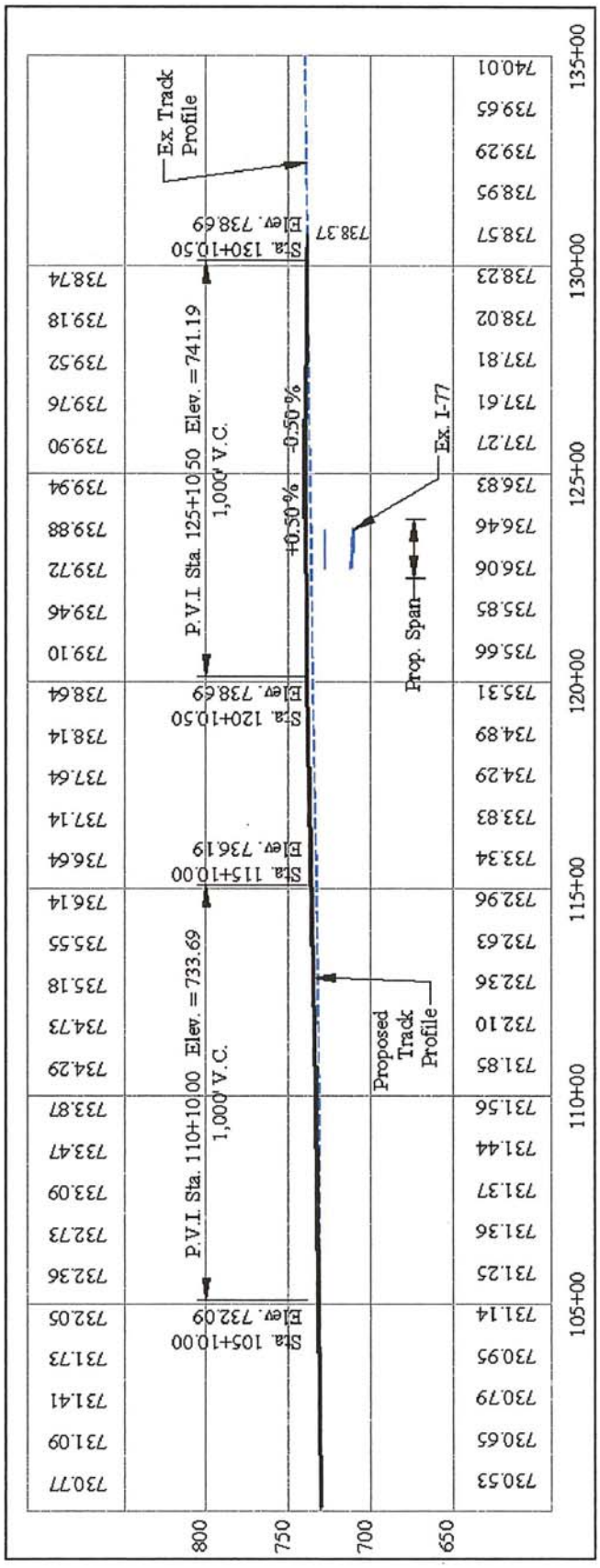


Figure 5 – Profile – Detour Option

In order to achieve the minimum vertical clearance on I-77, this girder depth would require the existing rail profiles to be raised approximately 3'-8". (See Figure 5). This will require approximately 6,500 L.F. of track work to maintain the vertical criteria maximum of 0.50% on the mainline tracks.

B. Through Option - Girder or Truss

CSXT criteria restricts a through girder bridge to having two sets of tracks; therefore, two structures are required for this option. Using the same CSXT clearances as the deck girder option, the minimum structure widths result in 39'-0" centerline girder to centerline girder and 24'-0" centerline girder to centerline girder. (See Figure 6). A minimum of 1'-6" is required between the two bridges to allow future inspection. Each structure contains a steel plate decking system supported by floorbeams. The floor beams are attached to the girders with angles and knee braces. These knee braces support a steel plate trough to retain the ballast under the rails.

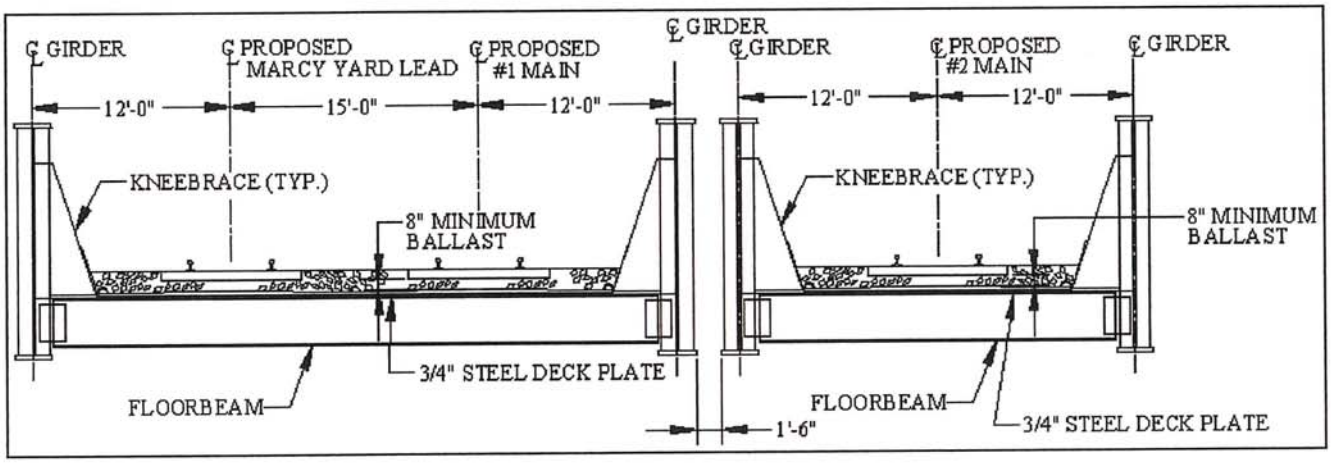


Figure 6 – Through Girder Transverse Section

A ¾" steel plate deck is required for a maximum clear distance between floor beams of 2'-4". This results in a tight spacing and large quantity of floor beams. The depth of the floor beams is less than that of the deck girder option. The floorbeams themselves provide for the beneficial redundancy. The longitudinal girders however are the primary load carrying members and are non-redundant. Each floor beam transmits a portion of the track loading to the longitudinal girders. The girder depth is governed by the deflection based on the same loading condition mentioned in the deck girder option.

The depth of the girders does not affect the minimum vertical clearance or existing rail profile. The requirement of two structures however, results in 1,000 L.F. horizontal track re-alignment due to the shift south of the #2 Main onto the second structure. The horizontal track work on the yard tracks can be reduced by approximately 1,500 L.F. using existing track spacing, as opposed to the 15'-0" track centers required for new construction.

The through truss superstructure consists of two trusses with the ability to carry two sets of tracks each. One truss with three sets of tracks would result in a floorbeam depth greater than the existing structure depth. Each truss would have a minimum horizontal clear distance of 42'-0" and a minimum vertical clear distance of 23'-0" from the top of the high rail. (See Figure 7). A minimum of 4'-0" is required between the two trusses to allow adequate construction and future inspection clearance. Like the deck girder option, the truss would have a concrete deck with ballast retainers and walkways supported by stringers. The stringers would transmit the load from the deck to the floorbeams. Unlike the through girder option, the floorbeams would connect at the panel points of the truss resulting in fewer beams carrying more load. Panel points would be spaced 16'-0" to 20'-0".

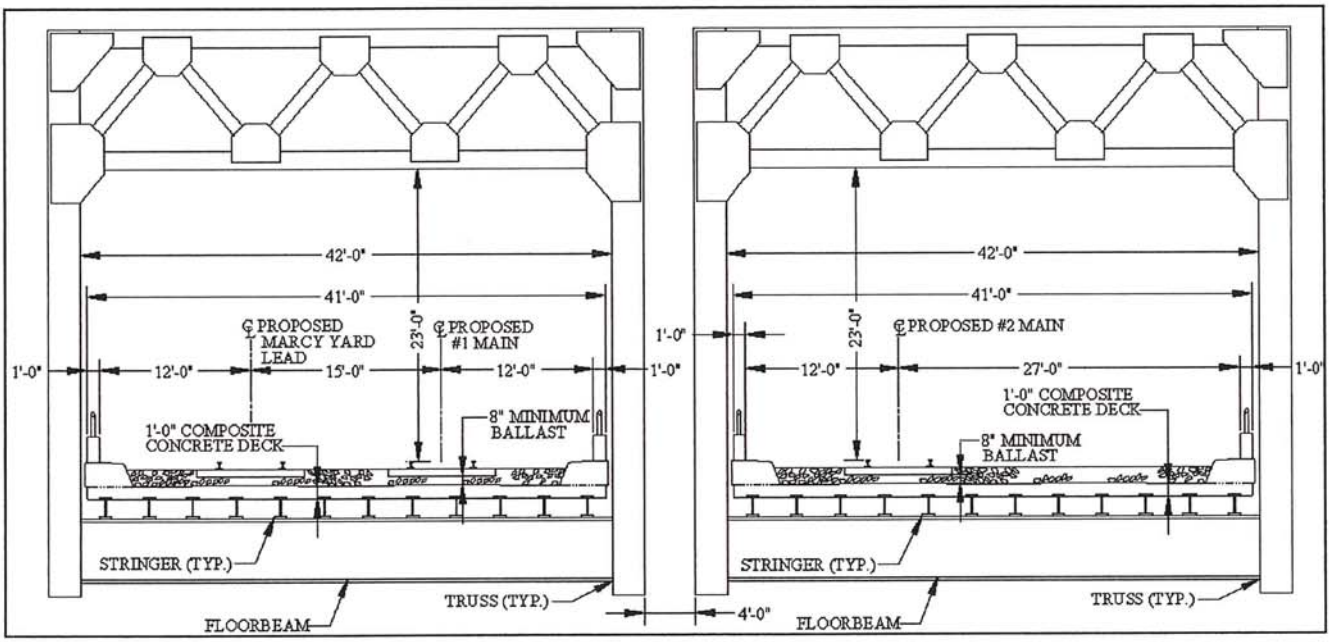


Figure 7 – Through Truss Transverse Section

The floor beams of the truss would be shallow enough to not affect the existing profile of the rails and maintain the minimum vertical clearance. Like the through girder option, the horizontal alignment would be adjusted to satisfy minimum CSXT requirements for track clearance.

C. Optimal Detour Option

The optimal detour option should minimize both impacts and construction costs. A cost estimate is provided in Appendix D. To simplify the evaluation, the costs are broken down into structure and costs associated with track (track, switches, signals, ballast, embankment, and relocations).

The costs associated with the deck girder are as follows: 8,139 SQ.FT. structure @ $450 / SQ.FT. = $3.7 million and cost associated with 6,416 L.F. track = $1.8 million.

The costs associated with the through girder are as follows: 9,157 SQ.FT. structure @ $630 / SQ.FT. = $5.8 million and cost associated with 1,911 L.F. track = $0.9 million.

The costs associated with the through truss are as follows: 13,371 SQ.FT. structure @ $810 / SQ.FT. = $10.9 million and cost associated with 2,111 L.F. track = $0.9 million.

Based on the information above and the cost estimate, the deck girder option is approximately $5.5 million plus the cost for CSXT to detour train traffic off site. This option is the most cost effective; therefore, for comparison its relative cost is $0. The through girder option is an additional $1.2 million. The through truss option requires an additional $6.3 million dollars. The redundant nature of the deck girder bridge, the cost difference, and the ease of fabrication and construction further qualifies it as the most appropriate option.

III. Permanent Relocation Option

This option involves relocating the entire structure with a new alignment south of the existing bridge. The horizontal clearance on I-77 is the same 127'-6" as mentioned in the detour option. This requirement, along with the structure's skew on the new alignment, results in a span of 141'-6". Since I-77 is on a downward grade going south, the vertical clearance over I-77 is increased. A high-tension wire (HTW) pole located approximately 22' from the centerline of the #2 Main may need to be relocated prior to construction as well as the existing fiber optic cable south of the bridge. All 6 tracks will be permanently relocated as shown. (See Figure 8). As with the detour option, three structure types were investigated.

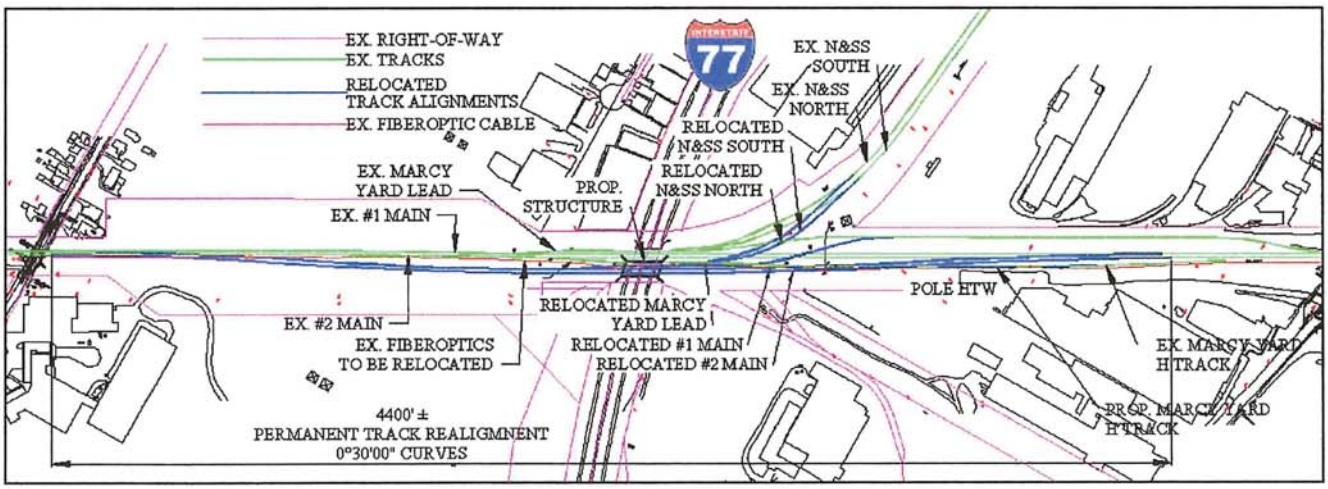


Figure 8 - Relocation Option – Track Layout

A. Deck Girder Option

This option has the same transverse section and clearance issues as the detour option. (See Figure 4). The structure will shift approximately 56' to the south requiring new horizontal and vertical alignments.

The new horizontal alignments involve approximately 11,800 L.F. of track work. The new vertical alignment was designed to provide a 0.50% maximum grade on the mainline tracks, to maintain a minimum vertical clearance of 16'-0", and to provide for adequate drainage over the structure. The tracks would have 15'-0" track centers as required by CSXT.

The new alignment will require a significant amount of embankment construction and depending on the slope requirements, some Right-of-Way acquisition will be necessary. An example cross-section has been included to show the "worst-case" scenario at a 2:1 slope. A profile was included to show areas of significant fill. (See Figure 9 & 10).

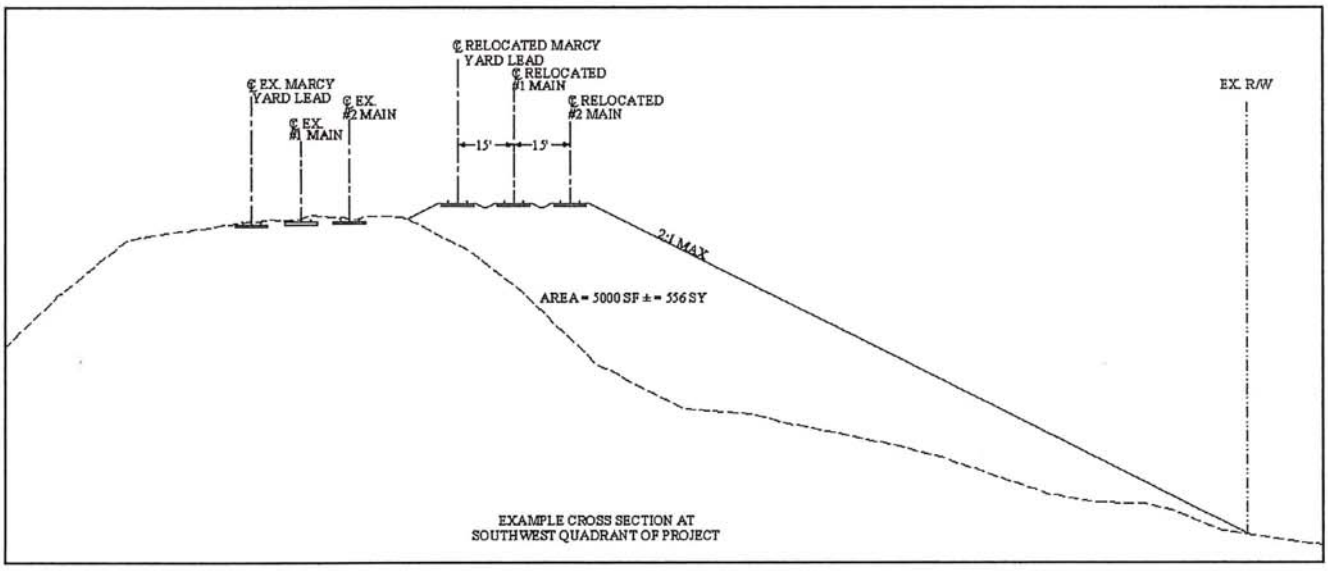


Figure 9 - Example Cross-Section in Embankment Area

B. Through Option Girder or Truss

This option uses the same through girder transverse section as the detour option. (See Figures 6 & 7). These options require the same amount of embankment construction and potential Right-of-Way acquisition. As in the detour option, the shift of the #2 Main onto a separate structure results in extra track work.

C. Optimal Permanent Relocation Option

The optimal permanent relocation option should minimize construction costs. As with the detour option, the evaluation is broken down into structure cost and costs associated with track.

The costs associated with the deck girder are as follows: 8,139 SQ.FT. structure @ $450 / SQ.FT. = $3.7 million and cost associated with 11,847 L.F. track = $5.0 million.

The costs associated with the through girder are as follows: 9,157 SQ.FT. structure @ $630 / SQ.FT. = $5.8 million and cost associated with 12,847 L.F. track = $5.1 million.

The costs associated with the through truss are as follows: 13,371 SQ.FT. structure @ $810 / SQ.FT. = $10.9 million and cost associated with 13,047 L.F. track = $5.1 million.

Based on the information above and the cost estimate, the deck girder option is approximately $8.6 million. This option is the most cost effective; therefore, its relative cost is $0. The through girder option is an additional $2.3 million. The through truss option requires an additional $7.4 million dollars. The redundant nature of the deck girder bridge, the cost difference, and the ease of fabrication and construction further qualifies it as the most appropriate option.

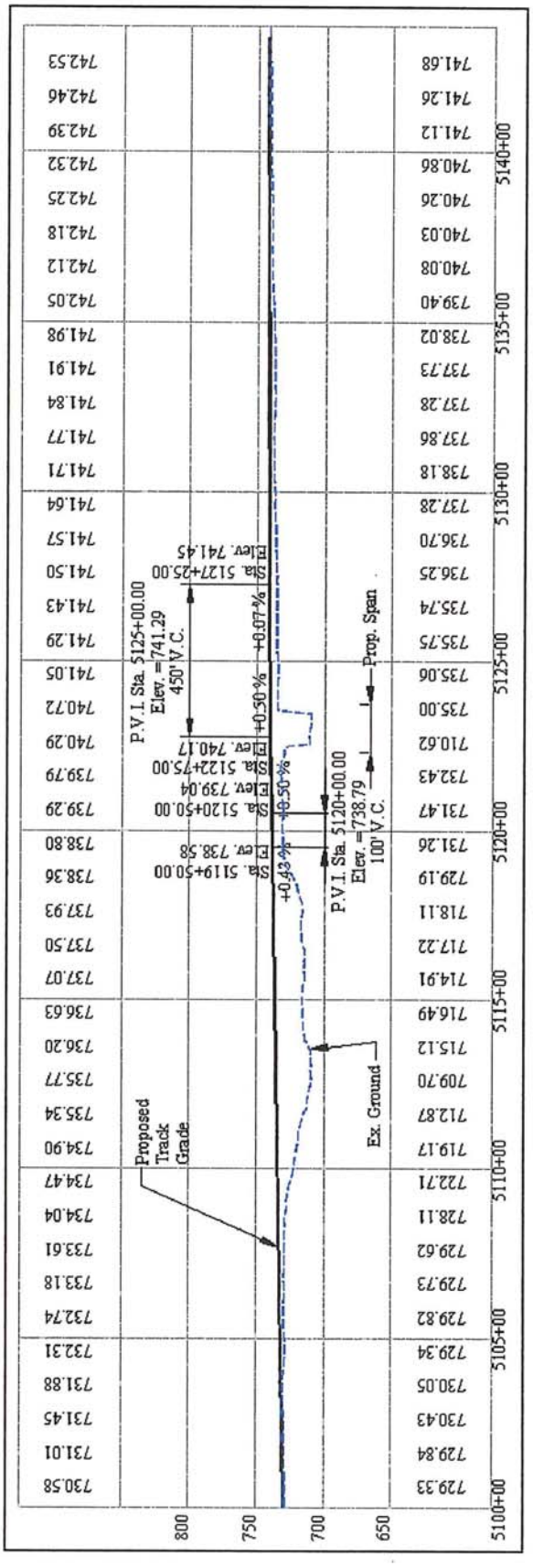


Figure 10 – Profile – Relocation Option

IV. Temporary Runaround Option

This option involves replacing the bridge along its existing alignment while temporarily re-routing train traffic. As with the other two options, the horizontal clearance of I-77 required is 127'-6". This requirement, along with the structure's skew, results in a span of 142'-1". As with the other options, three structure types were evaluated.

A. Deck Girder Options

The deck girder option can be achieved several ways including the construction of a temporary bridge to maintain traffic, constructing the proposed bridge for maintaining traffic and rolling it into place, and building a double wide structure using part-width construction.

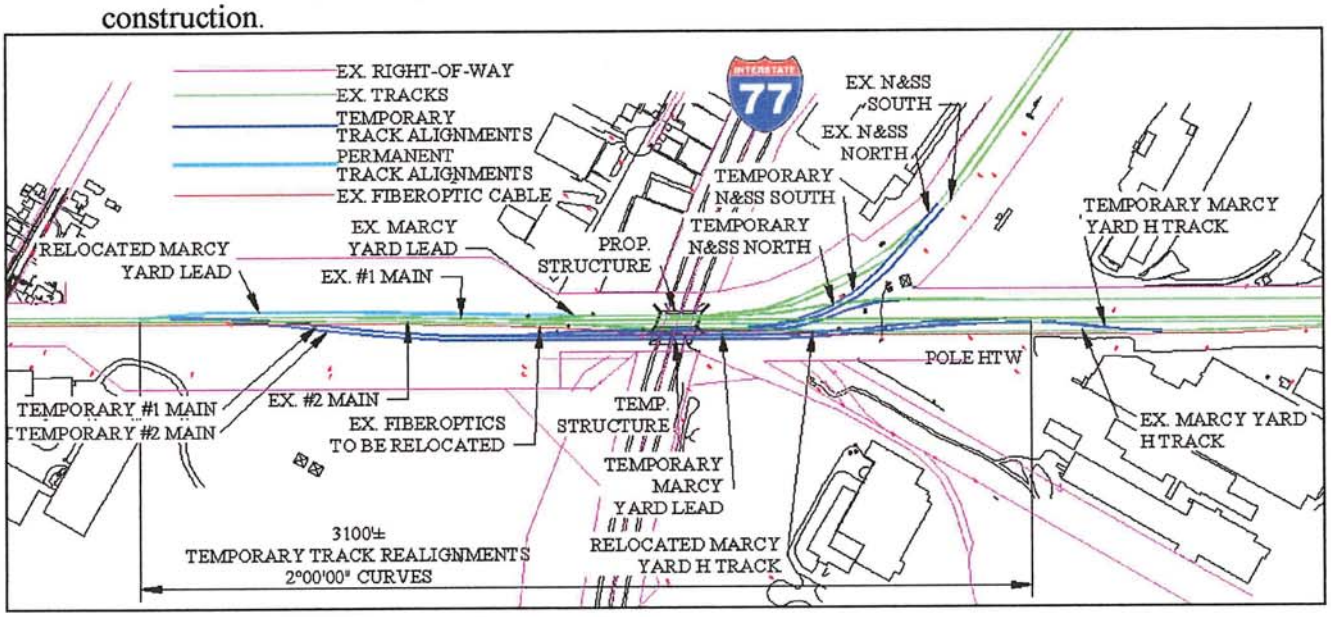


Figure 11 - Temporary Option – Remove Temporary Structure

1. Temporary Structure

This option involves the construction of a temporary bridge to the south of the existing bridge. CSXT requires the temporary structure to maintain permanent requirements for track clearance. As a result, the temporary superstructure has the same transverse section as the detour and relocation options. Train traffic will be routed onto the temporary bridge while the existing bridge is demolished. Temporary horizontal realignment is required along with raising the profile. The proposed bridge with the same transverse section as the temporary bridge will be constructed along the existing alignment. Train traffic will be routed back to the original alignment and the temporary bridge will be removed. As with the detour option, trackwork could be minimized with the existing 13'-0" track spacings. (See Figure 11). Approximately 18,000 L.F. of track work will be required at 15'-0" track centers as opposed to 11,200 L.F. at 13'-0" track centers.

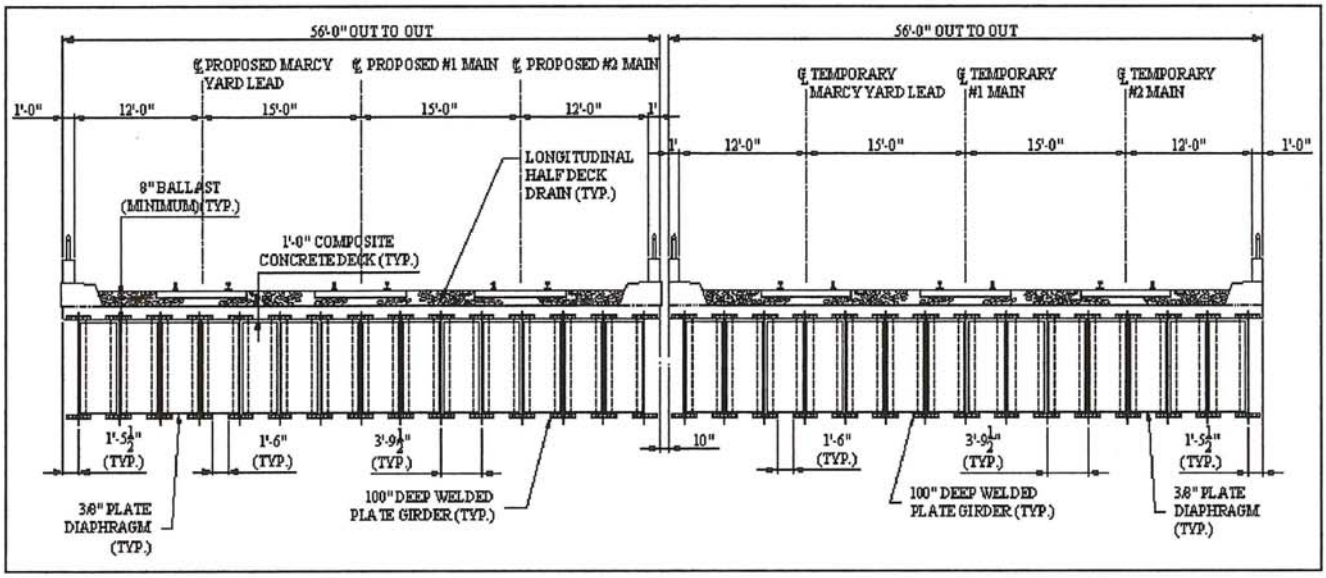


Figure 12– Transverse Section – Temporary Structure Option – Remove Temporary Structure

2. Roll In Superstructure

This option involves the construction of the proposed bridge to the south with the same transverse section as the detour option. The train traffic will be routed onto the new bridge with a temporary re-alignment while the existing bridge is demolished. The abutments will be extended north to allow the superstructure to be rolled into place. A temporary closure of rail traffic would be required to roll the superstructure north to its proposed alignment and re-align the tracks. The transverse section for this option is identical to that of the relocation option. (See

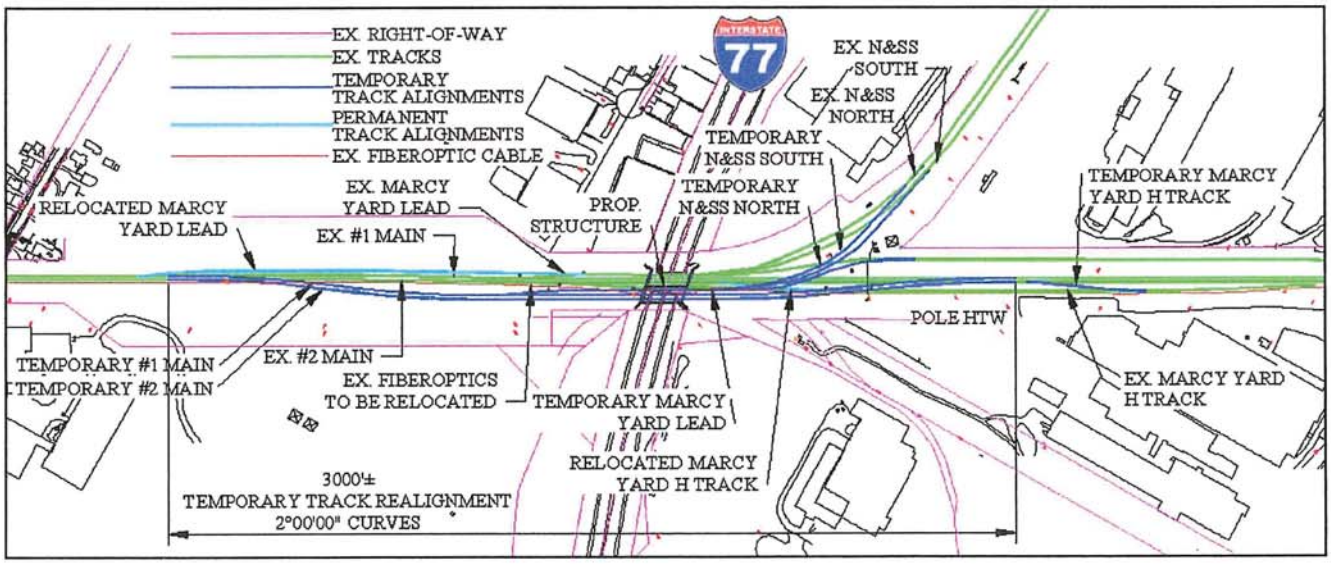


Figure 13 – Temporary Option – Roll In Superstructure

Figure 13). Approximately 18,000 L.F. total track work will be necessary to provide 16'-0" vertical clearance and 15'-0" track centers.

3. Part-Width Construction

This option involves part-width construction for the proposed bridge. Phase A removes the Marcy Yard H track from the existing structure. Phase B calls for the removal of a portion of the existing structure on the south side. The southern portion of the proposed bridge will be constructed using 15'-0" track spacings. The three remaining tracks will be routed onto the southern half of the bridge. During Phase C, the northern portion of the existing bridge will be demolished. The northern portion of the proposed bridge will be constructed allowing 15'-0" track spacings, and the temporary tracks will be re-routed to the proposed alignment. The temporary portion of the structure will remain in tack to allow future work and serve as maintenance access. (See Figure 14). The same approximate total track work as the roll in structure is required for this option.

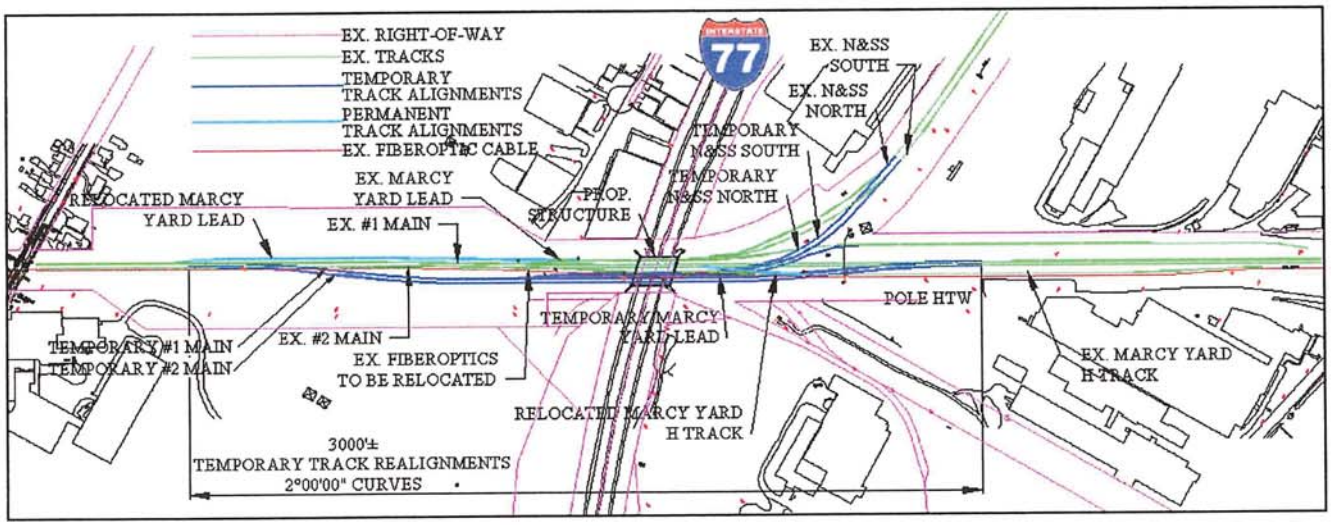


Figure 14 – Temporary Option – Part-Width Construction

The resulting structure width becomes 106'-0" out-to-out with a girder depth of 100". (See Figure 15). The girder spacing was governed by the cutline of the existing structure and part-width construction.

B. Through Option Girder or Truss

This option is similar to the deck girder option in regards to the methods of temporarily detouring train traffic to the south.

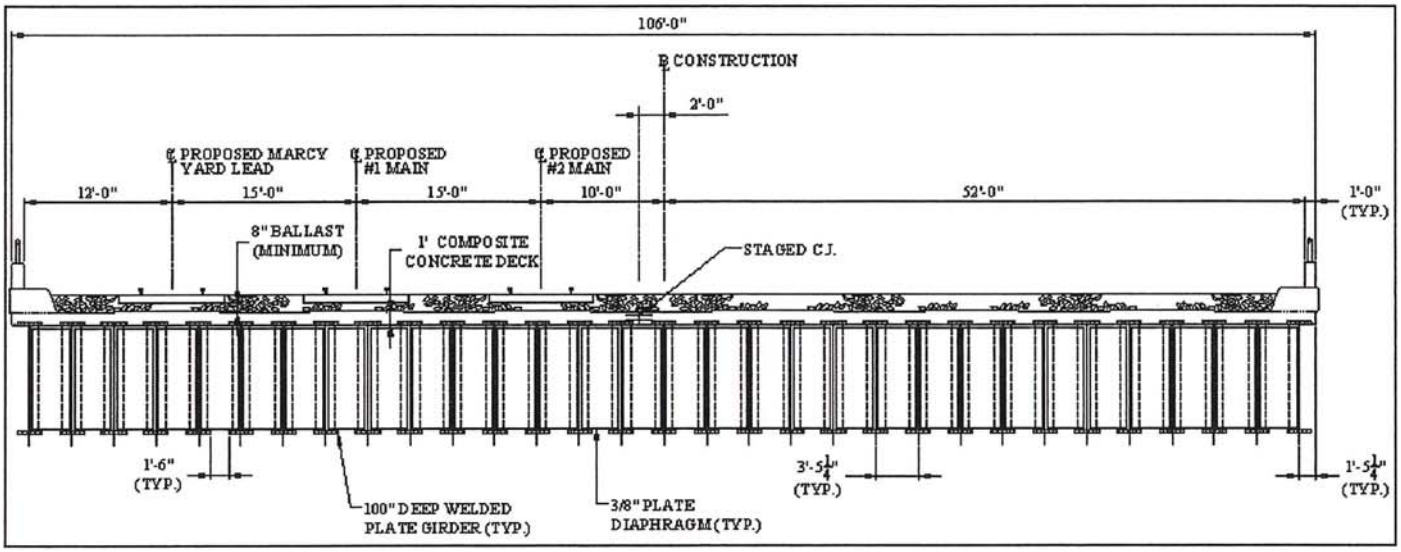


Figure 15 – Transverse Section – Temporary Structure Option – Part-Width Construction

A temporary structure could be used during the construction of the through girder or truss. The temporary structure type would be a multi-girder bridge removed after the construction of the through girder or truss bridges.

Like the deck girder option, the through girder and truss superstructures could be constructed to the south and rolled into place.

Due to the non-redundant nature of the through girder and truss, part-width construction is not possible.

C. Optimal Temporary Run-Around Option

The most appropriate structure type for each of the temporary runaround options mentioned above is the deck girder. As with the previous options, the evaluation is broken down into structure cost and costs associated with track.

Temporary Structure
The costs associated with the deck girder are as follows: 16,278 SQ.FT. structure @ $450 / SQ.FT. = $7.3 million and cost associated with 18,157 L.F. track = $6.2 million.

The costs associated with the through girder are as follows: 9,157 SQ.FT. structure @ $630 / SQ.FT. + 8,139 SQ.FT. temporary structure @ $450 / SQ.FT.= $9.4 million and cost associated with 12,307 L.F. track = $5.5 million.

The costs associated with the through truss are as follows: 13,371 SQ.FT. structure @ $810 / SQ.FT. + 8,139 SQ.FT. temporary structure @ $450 / SQ.FT. = $14.5 million and cost associated with 12,507 L.F. track = $5.6 million.

Roll In Superstructure
The costs associated with the deck girder are as follows: 8,139 SQ.FT. structure @ $450 / SQ.FT. = $3.7 million and cost associated with 18,157 L.F. track = $5.9 million.

The costs associated with the through girder are as follows: 9,157 SQ.FT. structure @ $630 / SQ.FT. = $5.8 million and cost associated with 12,307 L.F. track = $5.2 million.

The costs associated with the through truss are as follows: 13,371 SQ.FT. structure @ $810 / SQ.FT. = $10.9 million and cost associated with 12,507 L.F. track = $5.2 million.

Part-Width Construction
The costs associated with the deck girder are as follows: 15,406 SQ.FT. structure @ $450 / SQ.FT. = $6.9 million and cost associated with 18,157 L.F. track = $5.9 million.

The most appropriate structure type for the temporary runaround options mentioned above is the deck girder option and is given a relative cost of $0. For the temporary structure option, the through girder was an additional $1.4 million and the through truss was an additional $6.6 million. For the roll in structure option, the through girder was an additional $1.4 million and the through truss was an additional $6.5 million.

Based on the information above and the cost estimate, the roll in deck girder option is approximately $9.6 million. This option is the most cost effective; therefore, its relative cost is $0. The temporary structure option is an additional $3.9 million. The part-width construction option requires an additional $3.2 million dollars.

V. Recommendations

The costs associated with the recommended structure type are as follows: the detour deck girder option is approximately $5.5 million plus the cost for CSXT to detour train traffic off site, the permanent relocation deck girder option is approximately $8.6 million, and the roll in deck girder option is approximately $9.6 million + the roll in cost. The permanent relocation option is the most economical.

The impacts for maintaining train traffic play a significant roll in the recommendation. Detouring train traffic off site is the least economic option. The roll in option will have significant down time during the roll in phase and for the cut-and-throws. The optimal choice is to maintain train traffic on the existing structure while construction occurs. The permanent relocation option has the least impacts.

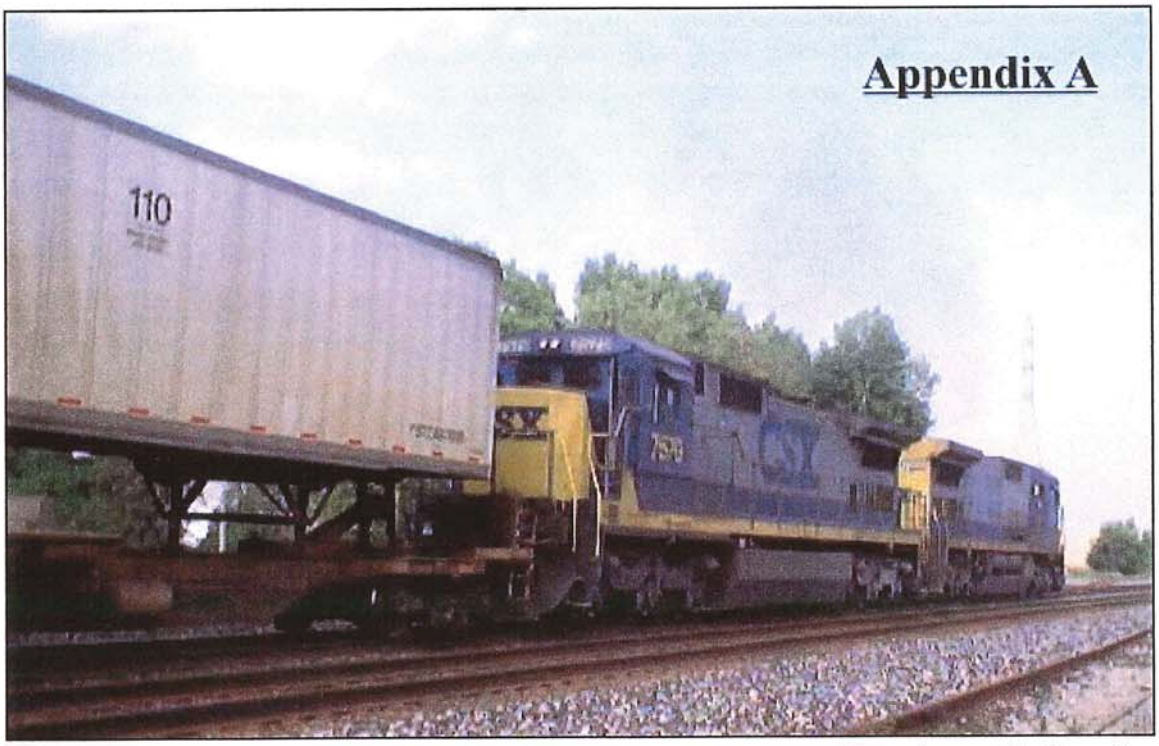
Based on the conclusions from the detour option, permanent relocation option, and the temporary runaround options, the recommended structure type and option to carry the CSXT Chicago/ Buffalo Mainline over I-77 is a single span composite deck girder superstructure constructed on a permanent realignment. (See Appendix E for preliminary plan sheets). The superstructure will be supported by full height abutments founded on 14" cast-in-place concrete piles. This type of structure is also recommended in the AREMA *Manual for Railway Engineering* when spans range from 50'-0" to 150'-0".

The proposed structure will be relocated south of the existing bridge. In order to implement this option, CSXT has to approve the permanent realignment of their mainlines. This realignment is similar to the one currently being performed over Bagley Road in Berea.

Alternate		Structure Type	Total Construction Cost	
Detour		Deck Girder	$5,500,000.00	+ CSXT cost to detour trains during construction
		Through Girder	$6,700,000.00	+ CSXT cost to detour trains during construction
		Truss	$11,800,000.00	+ CSXT cost to detour trains during construction
Permanent		Deck Girder	$8,700,000.00	
		Through Girder	$10,900,000.00	
		Truss	$16,000,000.00	
Temporary	Temporary Full Width Remove Half	Deck Girder	$13,500,000.00	
		Through Girder	$15,000,000.00	
		Truss	$20,200,000.00	
	Roll In	Deck Girder	$9,600,000.00	
		Through Girder	$11,000,000.00	
		Truss	$16,100,000.00	
	Part-Width Construction	Deck Girder	$12,900,000.00	

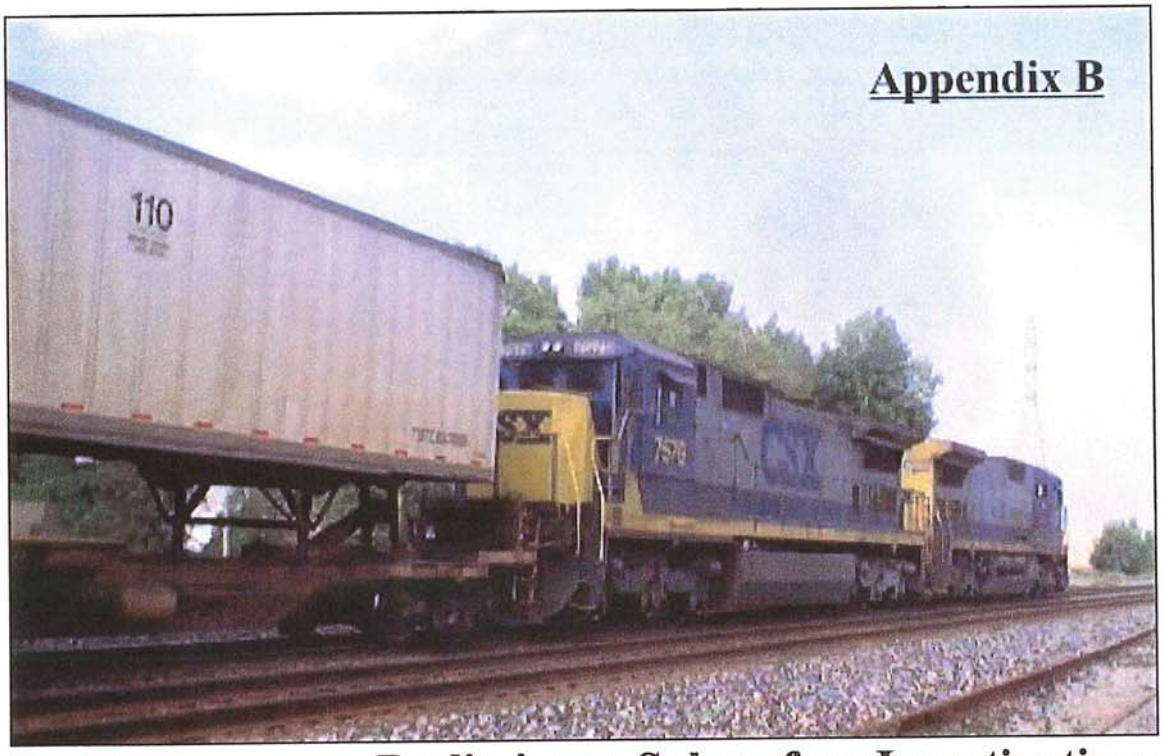
Table 2 – Total Construction Cost Comparison (See Appendix D)

Appendix A



Design Criteria

Item	CSXT #1 Main and #2 Main	Marcy Yard Lead	Marcy Yard, H Track	Ref.	Detour	Relocation	Temporary		
							Full Width Remove Temp. Half	Roll In	Full Width Keep Temp. Half
Highway Classification	Railroad	Railroad	Railroad						
Legal Speed (Obs/Posted)	50	15	15						
Design Speed	50	15	15						
Current ADT	70								
Single Span Length (CL Brg to CL Brg)					142'-0"	141'-6"	142'-1"	142'-1"	142'-1"
CL Brg. To Face of Abutment	2'-2"								
Horizontal Clearance on I-77	130'min face/face abutment normal to CL I-77								
Bridge Width Out-to-Out					56'-0"	56'-0"	2 @ 56'-0" w/10" Clear	56'-0"	106'-0"
Deck	Composite: 12" Min. Reinforced Concrete. Noncomposite: 8" Min. Reinforced concrete			CSXT					
Ex. Structure File No.	1806270								
Prop. Structural File No.	To Be Assigned								
Loading	Composite: Cooper E80 w/ Full Diesel Impact and Alternate Live Load. Cooper E65 w/ Full Diesel Impact for Steel Alone. Noncomposite: Cooper E80 w/ Full Diesel Impact and Alternate Live Load.			CSXT					
Vertical Clearance - Existing & Proposed	16'-0" SB/ 16'-6" NB								
Vertical Curve - Length in 100' Sta.	= (Diff in Grade)/(Rate of Change)	100' min	100' min	CSXT					
Vertical Curve Rate (R) - Sag	0.05'/Station	50 x grade diff	50 x grade diff	CSXT					
Vertical Curve Rate (R) - Crest	0.10'/Station	40 x grade diff	40 x grade diff	CSXT					
Simple Curve Length	100'	50'	50'	CSXT					
Simple Tangent Length	300'	300'	300'	CSXT					
Turnout Size	No. 10	No. 10	No. 10	CSXT					
Maximum Permanent Curve Degree	00°30'00"	10°00'00"	10°00'00"	CSXT					
Maximum Temporary Curve Degree	02°00'00"	10°00'00"	10°00'00"	CSXT					
Minimum Curve Radius	2864.93'	573.68'	478.34'	CSXT					
Tangent Between Perm. Reverse Curves	300'	100'/60' min	100'/60' min	CSXT					
Tangent Between Temp. Reverse Curves	100'	100'/60' min	100'/60' min	CSXT					
Maximum Grade	0.50%	2.50%	2.50%	CSXT					
Track Centers	15'	15'	15'	CSXT					
Parapet Offset from Track Center	12'	12'	12'	CSXT					
Spiral Length	31'/0.5" S.E.	31'/0.5" S.E.	31'/0.5" S.E.	CSXT					
Superelevation (SE)	2"	0"	0"	CSXT					



Preliminary Subsurface Investigations

PRIME ENGINEERING
& ARCHITECTURE, INC.

- Architecture
- Civil
- Geotechnical & Material Testing
- Highways & Bridges
- Structures

January 28, 2002

Mr. Robert B. Parker, P.E.
Baker and Associates
The Euclid Ninth Tower
2000 E. 9th Street, Suite 1220
Cleveland, Ohio 44115

Reference: **Subsurface Exploration Report for ODOT Bridge No. CUY-77-11.11**
CSXT Bridge over I-77 (ODOT PID No. 13564)
Cuyahoga Heights, Cuyahoga County, Ohio
PE&A Project No. G01037

Dear Mr. Adamczyk:

Enclosed please find our Subsurface Exploration Report for the above referenced project. Our services included field exploration, laboratory testing, engineering analysis, and related design and construction recommendations. Full-size plans prepared in accordance with applicable Ohio Department of Transportation Specifications will be submitted under a separate cover. It is important that the items under "**Limitations**" be precisely followed and complied with.

We appreciate the opportunity of working with you on this project and we invite you to contact us at (330) 666-5432, when we can be of further assistance.

Respectfully,

PRIME ENGINEERING
& ARCHITECTURE, INC.

Stephen E. Mileski
Project Manager

Walid I. Najjar, P.E.
Principal

SEM/sm
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G01037CSXTBridgeRpt/SEM:1-28-02

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APPENDICES

1.0 INTRODUCTION

This report has been prepared for the replacement of Bridge No. CUY-77-11.11 (CSXT Bridge over I-77) in Cuyahoga Heights, Cuyahoga County, Ohio. It represents the intent of Baker and Associates (BA), the design engineer, and the Ohio Department of Transportation (ODOT), the owner, to secure subsurface information at selected locations in accordance with ODOT's "*Specifications for Subsurface Investigations*," and to obtain recommendations regarding geotechnical factors pertaining to design and construction of this project.

This report has been developed based on the field exploration program, laboratory testing, and information secured for site-specific studies. It must be noted that, as with any exploration program, the site exploration identifies actual subsurface conditions only at those locations where samples were obtained. The data derived through sampling and laboratory testing is reduced by geotechnical engineers and geologists who then render an opinion regarding the overall subsurface conditions and their likely reaction on the site. The actual site conditions may differ from those inferred to exist. Therefore, although a fair amount of subsurface data has been assembled during this exploration, this report may not provide all of the geotechnical data needed for construction of this project. This report was prepared using English units.

1.1 Project Description

This project involves the replacement of Bridge No. CUY-77-11.11 in Cuyahoga County, Ohio. The existing structure carries CSXT rail lines over I-77 in the Village of Cuyahoga Heights. The proposed structure will consist of a two-span, steel I-beam bridge.

The proposed number and approximate locations of the structural test borings were provided to Prime Engineering & Architecture, Inc. (PE&A) by BA in a test boring location map of the project site. The test boring locations were marked in the field by PE&A personnel. The Site Location Map is shown in Figure 1.1.

N

Scale 1 : 24000

SOURCE:
U.S. GEOLOGICAL SURVEY
CLEVELAND SOUTH QUADRANGLE
OHIO - CUYAHOGA CO.
PHOTOREVISED 1984

FIGURE 1.1
SITE LOCATION MAP

PRIME ENGINEERING & ARCH., INC.
ODOT Bridge No. CUY-77-11.11
Village of Cuyahoga Heights, Ohio

PE&A Project No. G01037

1.2 Scope of Services

In accordance with our proposal, the scope of services to be provided by PE&A was limited to the following tasks:

Task I - Reconnaissance and Planning, which primarily consisted of reviewing the site geology, performing a site reconnaissance, applying for railroad insurance, marking the test boring locations at the site, applying for an ODOT road work permit, and notifying the Ohio Utilities Protection Service (OUPS), CSXT and any additional municipalities or utility companies which might have lines in the area of the proposed test borings.

Task II - Test Boring and Sampling Program, which primarily consisted of providing traffic control, advancing the test borings, conducting field tests, sampling the subsurface materials, and preparing field drilling logs. Our scope of services included advancing a total of three (3) structural test borings with one (1) located behind each abutment and one (1) located in the vicinity of the center pier. Our scope of services also included advancing a total of four (4) railroad test borings with two (2) located to the east and two (2) located to the west of the existing structure spaced at approximate 200 foot intervals. The test borings were advanced to the required depths in accordance with the ODOT *Specifications for Subsurface Investigations*

Task III - Testing Program, which consisted of performing soil classification and engineering properties tests on selected soil samples and classifying the soils in accordance with the ODOT Soil Classification System.

Task IV - Subsurface Exploration Report, which included the following:

- A brief description of the project and our exploration methods
- Typed drilling logs
- Laboratory test results
- A description of subsurface soil and groundwater conditions
- Recommendations and discussions pertaining to allowable soil bearing capacity and type of foundation, earthwork considerations, CBR values, groundwater management, and construction monitoring
- Preparation of full-size plans on Mylars

The scope of services did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report or on the boring logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the client's information.

2.0 GEOLOGIC SETTING

The project site lies on the glaciated, Erie Lake Plain at an approximate elevation of 712 feet. The site lies on a buried valley in which lacustrine deposits, glacial drift and alluvial deposits may extend as deep as 800 feet below the footings of the structure. The Wisconsin ice sheet covered the region depositing drift material generally of variable thickness. The local, near-surface subsoils consist primarily of man-placed fill soils. Based on information obtained from the Ohio Geological Survey, bedrock in the vicinity of the site is expected to consist of Devonian-age shales at an elevation approximating sea level.

This soil and bedrock information has been obtained from the *Geology of Water in Ohio* issued in 1943 (reprinted in 1968), *Physiographic Regions of Ohio* printed in April 1998, the *Soil Survey of Cuyahoga County, Ohio* issued in December 1980, and the *Cleveland South Quadrangle*, photorevised in 1984.

3.0 SUBSURFACE EXPLORATION

3.1 Exploratory Test Borings

In order to explore the subsurface conditions at the project site, drilling, sampling, and field testing operations were performed in July through October 2001. A total of three (3) structural test borings (CSXS-1 through CSXS-3) were advanced for bridge design purposes, one (1) behind each bridge abutment and one (1) adjacent to the center pier. In addition, a total of four (4) railroad test borings (CSXR-1 through CSXR-4) were advanced for railroad design purposes. One (1) located approximately 400 feet west of I-77, one (1) located approximately 200 feet west of I-77, one (1) located approximately 200 feet east of I-77, and one (1) located approximately 400 feet east of I-77, all along the south side of the existing rails.

Test boring CSXS-1 was advanced approximately 30 feet west of the bridge along the south side of the existing CSXT rails to a depth of 120 feet. Test boring CSXS-2 was advanced approximately five (5) feet north of the center pier of the bridge through the northbound passing lane of I-77 to a depth of 125.5 feet. And test boring CSXS-3 was advanced approximately 30 feet east of the bridge along the south side of the existing CSXT rails to a depth of 120.0 feet. The railroad test borings were each advanced to a depth of 20 feet. Refer to Figure 2.1 – Approximate Test Boring Location Map for test boring locations.

The test borings were advanced in accordance with accepted ASTM procedures. The approximate test boring locations were selected by BA and marked in the field by PE&A personnel. At the time of test boring location selection, the vertical soil sampling intervals were determined based on the needs for replacing the existing structure. The Ohio Utility Protection Service (OUPS), local utility companies, and CSXT were notified of the proposed drilling operations. The boring locations were then finalized after considering underground utility locations. CME-55 and Mobile B-57 truck-mounted drill rigs were mobilized to advance the test borings using 3.25 inch inside diameter hollow stem augers (HSA). Representative disturbed samples of the soil were collected using a standard 2.0 inch outside diameter split barrel sampler driven into the soil by means of a 140 pound hammer falling freely through a distance of 30 inches. (*Standard Penetration Test, ASTM D 1586*). The sample depths included in the test boring logs indicate the top of each sample. The test borings were monitored for the presence of groundwater during and upon completion of drilling operations

The stations, offsets and elevations at the drilled test boring locations were provided to PE&A by Wade-Trim. The stations and offsets for the test boring locations are relative to the centerline of the existing I-77. The surface elevations at the test boring locations are presented in Table 4.4.1 and on the typed drilling logs. The typed drilling logs are included in Appendix A.

3.2 Sample Analysis

All soil samples obtained during the drilling and sampling operations were returned to PE&A's geotechnical soils laboratory in Akron, Ohio. Upon arrival, the samples were visually examined and classified by a geotechnical engineer and a geologist to verify the classifications made in the field and to note any additional characteristics, which may not have been observed in the field.

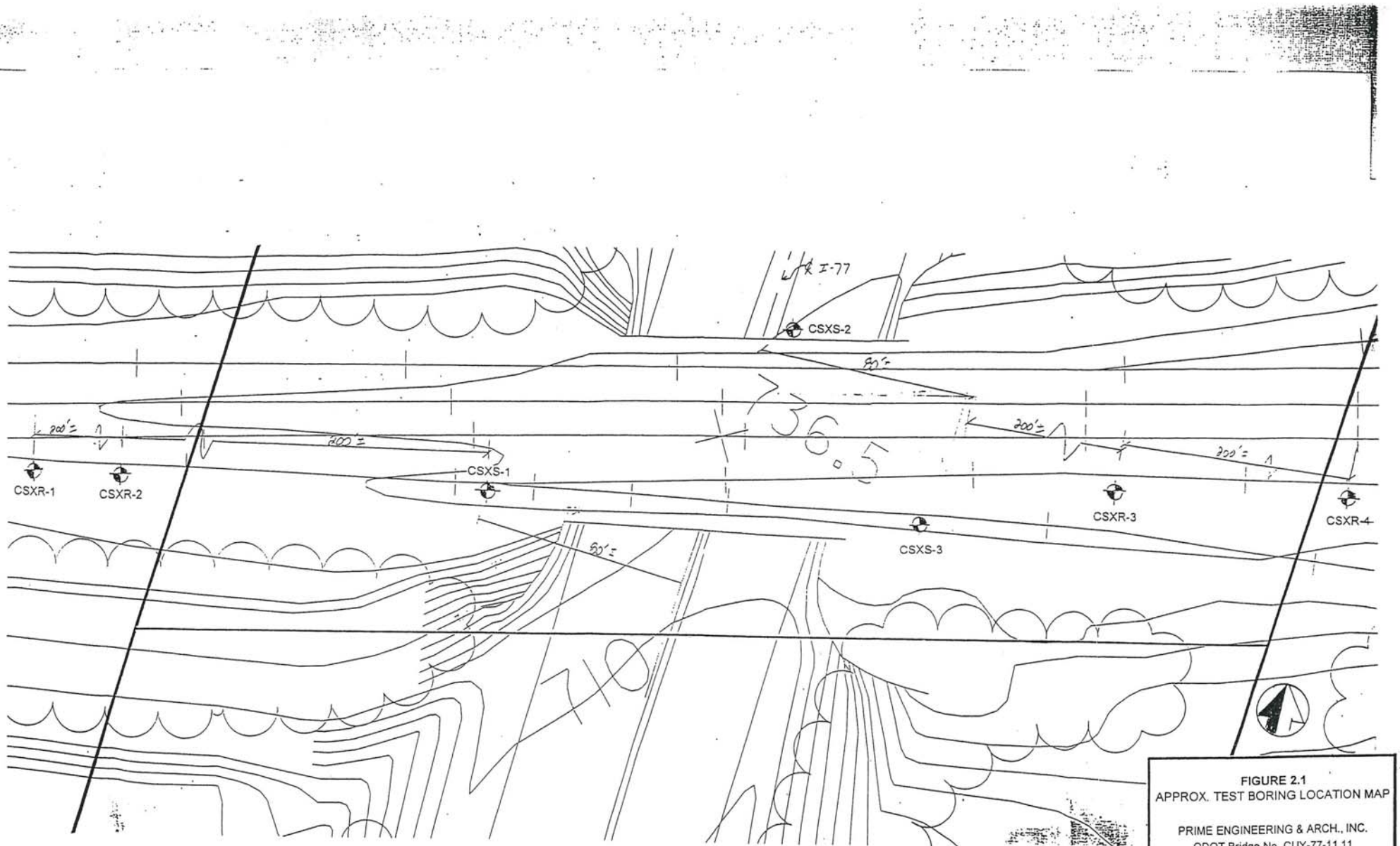


FIGURE 2.1
APPROX. TEST BORING LOCATION MAP

PRIME ENGINEERING & ARCH., INC.
ODOT Bridge No. CUY-77-11.11
(CSXT Bridge over I-77)

PE&A Project No. G01037

Moisture content determination tests were performed on all soil samples as per ODOT specifications. Additional soil tests were performed on selected samples. Both classification and engineering property tests were performed to obtain various parameters for use in design and construction of the proposed structure. The test results are included in Appendix B. Upon completion of the laboratory testing, all samples were placed in unheated storage at PE&A's Akron facility. Unless otherwise requested in writing, the samples will be discarded 90 days after the submission of this report.

The ODOT Soil Classification System was used to classify the tested and visually inspected subsurface materials, consequently, most soil classifications located throughout this report are followed by their corresponding ODOT Classification Symbol. Laboratory testing was performed in accordance with standards set by the American Society for Testing Materials (ASTM). The test methods employed by PE&A's soil laboratory are listed as "Laboratory Test Standards" in Appendix B.

4.0 SURFICIAL AND SUBSURFACE CONDITIONS

4.1 Site Reconnaissance

The project site was originally examined by PE&A personnel in March 2001. The project site is located in Cuyahoga Heights, Ohio at the CSXT overpass over I-77. The existing bridge is a two-span structure measuring approximately 100 feet in length. The concrete of the abutments and piers exhibited some spalling and cracking and the steel I-beams of the bridge deck exhibited considerable oxidation. No settlement or slope stability concerns were observed at this site.

4.2 Subsurface Soil Conditions

In general, the natural subgrade soils encountered in the structural test borings consisted of cohesive fine grained soils and non-cohesive granular and fine grained soils. These soils consisted of cohesive and non-cohesive sandy silt (A-4a), silt and clay (A-6a), cohesive and non-cohesive silt (A-4b), silty clay (A-6b), coarse and fine sand (A-3a), and fine sand (A-3). All of the test borings except for CSXS-2 were advanced through embankment fill ranging in thickness from approximately 12.5 feet to approximately 23.5 feet. The embankment fill consisted primarily of crushed rock (railroad bedding) overlying shale fragments with sand, silt and clay (A-2-6). Coarse and fine sand (A-3a), slag (A-1-b), clay (A-7-6), silt (A-4b), sandy silt (A-4a), and silt and clay (A-6a) were also encountered in lesser quantities within the embankment fill.

The moisture contents of the granular and/or non-cohesive samples were found to range from six (6) to 27%. The moisture contents of the tested natural cohesive soils ranged from 17 to 31%. **Eight of the 11 cohesive soil samples tested for Atterberg limits contained natural moisture contents greater than their plastic limits and the remaining three (3) of the 11 cohesive samples contained natural moisture contents equal to their plastic limits. All of these samples contained natural moisture contents below their liquid limits. If the moisture content of a soil is above its liquid limit, the soil is in a liquid state and has no shear strength. If the moisture content of a soil is less than its liquid limit but greater than its plastic limit the soil is in a plastic state and deformation may occur under certain surcharge loading.** The moisture contents and Atterberg limit results of the tested soil samples are included in the laboratory test results in Appendix B.

The relative consistencies of the cohesive soils were found to range from "medium stiff" to "hard" but were primarily "very stiff". The relative densities of the non-cohesive/granular soils were found to range from "very loose" to "very dense" but were primarily "medium dense". These relative consistencies and densities were derived from the Standard Penetration Test (SPT) values obtained during drilling operations. The typed drilling logs located in Appendix A of this report display the SPT values associated with each sampling interval.

4.3 Bedrock Conditions

Based on published information obtained from the USGS, the top of bedrock below the project site is located at an elevation approximating sea level or 700 to 800 feet below the surface. The test borings for this project were advanced to a maximum depth of 125.5 feet below the existing ground surface, well above the expected top of rock elevation at the site. Bedrock was not encountered in the test borings and is not expected to be encountered during construction of the proposed structure.

4.4 Groundwater Conditions

The groundwater levels were measured at the test boring locations during and upon completion of the drilling operations. The results of these measurements are summarized in Table 4.4.1. It should be noted that the groundwater elevations are subject to seasonal fluctuations. Groundwater monitoring wells are essential to accurately define the elevation and seasonal fluctuations of the groundwater table over time. However, the installation of such monitoring wells was not included in the scope of services for this project.

Table 4.4.1 - GROUNDWATER INFORMATION

Test Boring Number	Station & Offset	Surface Elevation (ft)	Depth to Groundwater (ft)		Groundwater Elevation (ft)	
			During Drilling	Upon Completion	During Drilling	Upon Completion
CSXR-1	57+47.88, 432.84' Lt.	732.00	Dry	Dry	--	--
CSXR-2	57+89.60, 237.02' Lt.	731.64	Dry	Dry	--	--
CSXS-1	58+46.73, 72.20' Lt.	733.56	70.0	Caved at 40.0*	666.0	696.0*
CSXS-2	59+56.06, 9.62' Rt.	711.57	32.0	Caved at 17.0*	680.0	695.0*
CSXS-3	58+90.55, 72.82' Rt.	734.65	70.0	Caved at 81.0*	666.0	655.0*
CSXR-3	59+38.95, 241.22 Rt.	735.09	Dry	Dry	--	--
CSXR-4	60+02.00, 437.56' Rt.	735.50	Dry	Dry	--	--

* Elevation/depth at which borehole caves is assumed to be where groundwater exists
Note: Stations, offsets and elevations provided by Wade-Trim

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the findings of the field exploration program, laboratory testing, and subsequent engineering analysis, the following sections have been prepared to address geotechnical aspects related to the design and construction of this project.

5.1 Foundation Systems

The preliminary bridge information provided to PE&A indicates that a two-span bridge is proposed for the replacement structure. Provided below are deep foundation recommendations for the proposed structure.

5.1.1 C.I.P.R.C. (Cast-In-Place Reinforced Concrete) Pile Foundations

C.I.P.R.C. (Cast-In-Place Reinforced Concrete) piles are recommended for supporting the bridge loads. Such piles derive their load bearing capacity primarily from a combination of frictional resistance and end bearing. The estimated maximum design load per pile, effective pile lengths, and the pile tip elevations are provided in Table 5.1.1. Note that variations in the lengths of the piles are a result of the variations in subsurface conditions encountered at each associated test boring. Based on information provided to us by BA, we have also provided an estimated maximum design load for each of the existing 12-inch diameter pipe piles that support the structure loads at the center pier.

Table 5.1.1 – Estimated C.I.P.R.C. Pile Design Parameters

Substructure Unit	Associated Test Boring	Test Boring Surface Elevation (ft)	C.I.P.R.C. Pile Diameter	Maximum Design Load (tons/pile)	Estimated Effective Pile Length (ft)	Estimated Pile Tip Elevations (ft)	Estimated Top of Pile Elevations (ft)
West Abutment	CSXS-1	733.56	14 inch	70	50	654.5	704.5
Center Pier	CSXS-2	711.57	14 inch	70	70	634.5	704.5
Center Pier	CSXS-2	711.57	12 inch (existing piles)	14.6	29	675.5	704.5
East Abutment	CSXS-3	734.65	14 inch	70	50	654.5	704.5

Note: The Design Load values include a factor of safety of 3.0.
Note: The top of pile elevations were provided by Baker and Associates personnel.
Note: The Pile Tip Elevations & Effective Pile Lengths will change if the Top of Pile Elevations change.
Note: The above design load of 14.6 tons/pile for the existing 12" diameter piles is made assuming that the piles are undamaged and in good condition.
Note: Surface elevations were provided by Wade-Trim.

It is important to note that the actual length of the piles required to develop the indicated design load may be greater or less than the estimated length. This estimated length has been presented in Table 5.1.1 for preliminary design purposes only. Consistent with good engineering practices, the actual length of each pile should be determined in the field based on pile load tests and/or dynamic pile bearing capacity calculations. It is recommended that at least two test piles be driven prior to ordering piles for the entire project to check the safe design loads by the use of a recognized dynamic pile driving formula and to observe the piles during the driving operations.

The actual bearing capacity of the piles will depend upon their type, diameter, and length. The proposed pile lengths provided in Table 5.1.1, may need to be adjusted based on actual field conditions. PE&A personnel should be retained to monitor actual subsurface conditions revealed during construction. Accurate records of the final tip elevations and driving resistance should be maintained during the pile driving operations.

The abutment and pier footings must be placed a minimum of 3.5 feet below the surfaces of the embankment and/or pavement to protect against frost penetration and heave. It is recommended that the piles be spaced a minimum of three pile diameters on center and be designed and placed in accordance with the ODOT Item 507 – "Bearing Piles".

5.2 Lateral Earth Pressures and Foundation Drainage

Active lateral earth pressures exerted by soils can be approximated by an equivalent fluid weighing 40 pcf above the water table and 80 pcf below the water table, provided that freely draining, porous material is placed behind the abutments as described later in this section. Passive pressure developed at the face of the pile caps should not be taken into account in resisting lateral forces. The available passive earth resistance is not considered adequate to resist lateral forces.

Abutment drainage shall be provided in accordance with the ODOT Item - "Drainage of Structures." Porous backfill should be placed a minimum of two (2) feet in thickness normal to the abutments. It is suggested that filter fabric, ODOT Item 712.09, Type A, be placed between Item 518 porous backfill material and Item 203 embankment material. This will ensure that fine particles from within the embankment do not migrate into the voids of the porous backfill.

If piles are used for the structure foundations, battered piles may be installed in order to safely transmit lateral forces exerted on the abutments by retained earth and traffic loads to the bearing strata. The path of the battered piles must be checked to see that the piles remain within the right-of-way and do not interfere with piles from the existing abutments, foundations of adjacent buildings, or underground utility lines.

5.3 Groundwater Management

Based on the groundwater conditions encountered in the test borings, no unusual groundwater conditions should be encountered during construction, however minor pumping may be required in excavations due to seasonal fluctuations in perched water tables. Where excavations extend below groundwater, major pumping or dewatering may be required, however this may not occur at this location. Please note that the groundwater levels during construction may vary due to seasonal fluctuations and groundwater may appear where it was not previously encountered during this investigation.

5.4 Pavement Design Parameters

During construction of the project, the proposed pavement will be constructed either on the existing subgrade soils or on engineered fill materials. The following general alternatives have been prepared for your consideration based on soils encountered within 3.0 feet of proposed subgrade along the project site.

5.4.1 Pavement Design Parameters along I-77

Pavement on the Existing Subgrade Soils: If the pavement is constructed on the existing soils, it is anticipated that on-site, non-cohesive sandy silt with slag (A-4a) soils will be encountered along Interstate 77. **If silt (A-4b) soils are encountered, we recommend that they be removed to 3.0 feet or deeper below proposed subgrade. If elastic clay (A-7-5) soils are encountered, we recommend that they be removed to 2.0 feet or deeper below proposed subgrade.** The subgrade CBR values and the resilient modulus of subgrade soils were estimated based on the ODOT subgrade resilient modulus estimation method, illustrated in 203-3, "Pavement, Design and Rehabilitation Manual". This estimation was prepared based on the "worst case" sandy silt with slag (A-4a) soils encountered within 3.0 feet of proposed subgrade of I-77.

If the pavement is constructed on the existing "worst case" sandy silt with slag (A-4a) soil along I-77, then an average estimated Group Index value of 1.0 can be obtained. The following design parameters are recommended using this Group Index value of 1.0:

CBR	11.0
Soil Support Value (SSV)	6.0
Resilient Modulus	13,200 psi
Modulus of Subgrade Reaction (K)	215 pci

The calculated pavement thickness using the CBR value listed above should be compared with the thickness of the existing pavement along I-77. The proposed pavement should be designed using similar or slightly higher "Structural Numbers" than the existing pavement. In order to obtain better performance of the pavement, a thicker granular base and/or subbase should be considered. Appropriate drainage, such as edge drains or underdrain systems are strongly recommended within poor drainage areas to minimize subgrade weakening resulting from excessive moisture penetration.

Pavement on Engineered Fill: If the pavement is constructed on engineered fill materials having a minimum thickness of three (3) feet, the soil parameters derived from the actual fill materials may be used for the pavement design. Based on our exploration findings, the majority of on-site soils may be used for pavement design in accordance with Item 203 - "Roadway Excavation and

Embankment" of "ODOT Construction and Material Specifications." Representative samples of proposed borrow materials should be tested and CBR values should be derived prior to construction. In order to lower the costs of pavement construction, granular borrow material with a higher CBR value should be considered as a priority selection to be used in the upper 3.0 feet of the proposed subgrade.

It should be noted that the recommended pavement design parameters are based on the subsurface soil conditions encountered at the test boring locations. Actual conditions away from, or between, the test boring locations may vary.

5.5 Earthwork and Railroad Embankment Construction Monitoring

All earthwork operations should be conducted in accordance with ODOT's "Construction and Materials Specifications," Item 203 - "Roadway Excavation and Embankment" or in accordance with CSXT embankment specifications, whichever are more stringent. Prior to railway construction, all existing concrete, topsoil, and any debris should be removed or stripped from the site. Once the excavation is cut to the proposed subgrade, all subgrade areas should be subjected to proof rolling. Any areas that exhibit an unacceptable subgrade reaction, local soft/loose soil zones, and areas of unacceptable material, must be undercut to a minimum depth of two (2) feet below the proposed subgrade.

All removed soils should be replaced with compacted, engineered-fill materials. All fill material must be approved by a qualified geotechnical engineer prior to placement. Excluding the silt (A-4b) soils encountered during our subsurface investigation, all on-site soils free of organics, boulders and man made inclusions can be considered for use as fill-borrow for embankment construction. The fill materials should be placed in lifts of eight (8) inches in thickness (loose measure) and be compacted to a 100% of the maximum dry density of the fill as determined by the Standard Proctor Test (ASTM D 698) or Modified Proctor Test (ASTM D 1557) whichever conforms to ODOT/CSXT specifications for embankment construction.

The moisture content of the selected backfill should be within 2% (±) of the optimum moisture content as determined by the Standard/Modified Proctor Test. A sufficient number of in-place density tests must be performed on each lift of all fill placed during construction. The tests should be performed by a qualified soil technician under the supervision of PE&A or another geotechnical engineering firm and in accordance with the appropriate ASTM procedures.

Silt (A-4b) and elastic clay (A-7-5) soils may be present across the project site beyond the range of the test borings. If silt (A-4b) is encountered during construction along subgrade, we recommend the removal of these soils to a minimum depth of 3.0 feet below proposed subgrade. If elastic clay (A-7-5) is encountered during construction along subgrade, we recommend the removal of these soils to a minimum depth of 2.0 feet below proposed subgrade. Unsuitable soils such as topsoil or highly organic soils and/or highly compressible soils should be removed prior to the pavement construction to 3.0 feet below bottom of the proposed pavement. The extent of unsuitable soil removal should be determined in the field based on the findings during construction. All removed soils should be replaced with compacted, engineered-fill materials as recommended in the preceding paragraphs.

Excavation into soils can be performed using a construction backhoe, trencher, or other conventional equipment. Use a two horizontal to one vertical slope, or flatter, for the proposed cut or fill soil slopes. In order to minimize any surface erosion, the embankment should be seeded in accordance with ODOT Item 659 - "Seeding and Mulching" as soon as practical after completion of embankment construction.

6.0 LIMITATIONS

This report is subject to the following conditions and limitations:

6.1 The subsurface conditions described are based on an examination of the soil samples at the sampling intervals. Varying soil deposits, including fill material, may exist between the sampling intervals and between the test boring locations. Variation in subsurface conditions from those indicated in this report may become apparent during the earthwork and/or installation of the foundations. Such variations may require changes and/or modifications in our recommendations. Such changes may cause time delays and/or additional costs. Owners must be made aware of these limitations and must incorporate them in the design budget and scheduling of the project.

6.2 The design of the proposed project does not vary from the technical information provided and specified in this report. All changes in the design must be reviewed by our geotechnical engineers. PE&A cannot assume any responsibility for interpretations made by others of the subsurface conditions and their behavior based on this report.

6.3 All earthwork and foundation construction must be performed under the supervision of a Professional Engineer in accordance with ODOT Construction Specifications.

6.4 The subsurface exploration for this project is strictly from a geotechnical standpoint. An environmental site assessment was not included in the scope of these geotechnical services.

6.5 All sheeting, shoring, and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration (OSHA).

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXR-1

STA. & OFFSET: 57+47.88, 432.84' Lt.

ELEVATION: 732.00ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 9/27/01 DATE COMPLETED: 9/27/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during or upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(ROD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LL	PL	PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK (Railroad Bedding)													
730.5	1.5		Loose, reddish brown, weathered SHALE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), moist. (embankment fill)	1	1.0	3 2 3	5	--	12							VISUAL
				2	3.5	3 4 3	7	--	11							VISUAL
				3	6.0	3 3 3	6	2.0	10							VISUAL
				4	8.5	3 4 4	8	--	10							VISUAL
721.0	11.0		Very loose to loose, brown GRAVEL WITH SAND (A-1-b), little silt and clay, moist. (embankment fill)	5	11.0	2 2 2	4	--	10	NP	NP	NP	33	51	16	A-1-b
				6	13.5	2 2 2	4	--	14							VISUAL
				7	16.0	2 3 3	6	--	12							VISUAL
713.5	18.5		Medium stiff, brown, cohesive SILT (A-4b), some clay, trace rock fragments, trace sand, moist. (possible natural soil)	8	18.5	2 4 3	7	0.5	23							VISUAL
712.0	20.0		TERMINATION DEPTH = 20.0 FEET.													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXR-2

STA. & OFFSET: 57+89.60, 237.02' Lt.

ELEVATION: 731.64ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 9/27/01 DATE COMPLETED: 9/27/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during or upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK (Railroad Bedding)													
728.4	3.2		Loose, reddish brown, weathered SHALE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), moist. (embankment fill)	1	3.5	4 3 6	9	--	10							VISUAL
				2	6.0	3 3 5	8	--	10							VISUAL
				3	8.5	3 3 4	7	--	13							VISUAL
720.6	11.0		Stiff to medium stiff, brown, cohesive SILT (A-4b), some clay, trace sand, moist. (embankment fill)	4	11.0	2 6 9	15	4.5+	22							VISUAL
				5	13.5	4 4 5	9	4.0	24							VISUAL
				6	16.0	3 3 5	8	1.5	25	28	20	8	0	2	66/32	A-4b
				7	18.5	2 2 3	5	1.0	24							VISUAL
711.6	20.0		TERMINATION DEPTH = 20.0 FEET.													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow-Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-1

STA. & OFFSET: 58+46.73, 72.20' Lt.

ELEVATION: 733.56ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 10/1/01 DATE COMPLETED: 10/3/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 40.0 feet upon completion of drilling operations.

GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LL	PL	PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK FRAGMENTS (Railroad Bedding)													
730.4	3.2		Medium dense, brown COARSE AND FINE SAND (A-3a), little slag, some silt and clay, moist. (railroad embankment fill)	1	3.5	10 10 9	19	3.25	20							VISUAL
728.1	5.5		Very stiff to hard, brown, cohesive SANDY SILT (A-4a), little gravel, trace slag, moist. (railroad embankment fill)	2	6.0	5 9 10	19	4.25	17							VISUAL
				3	8.5	8 9 19	28	4.5	15							VISUAL
				4	13.5	6 12 13	25	4.5	16							VISUAL
			Note: Encountered a concrete slab from 17.0 to 18.4 feet.	5	18.5	15 12 19	31	3.5	21							VISUAL
710.1	23.5		Stiff to very stiff, gray SILT AND CLAY (A-6a), trace to no sand, moist. (natural soil)	6	23.5	6 6 12	18	1.5	22							VISUAL
				7	28.5	6 7 9	16	2.5	20							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-1

STA. & OFFSET: 58+46.73, 72.20' Lt.

ELEVATION: 733.56ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 40.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Stiff to very stiff, gray SILT AND CLAY (A-6a), trace to no sand, moist. (natural soil) *(continued)*	8	31.0	4 6 9	15	1.0	24							VISUAL
				9	33.5	5 5 6	11	1.0	24	30	18	12	0	1	99	A-6a
				10	36.0	5 8 12	20	1.0	23							VISUAL
				11	38.5	5 6 9	15	1.75	26	33	20	13	0	0	100	A-6a
				12	41.0	5 7 12	19	2.0	23							VISUAL
				13	43.5	8 10 14	24	3.25	24							VISUAL
				14	46.0	5 8 11	19	1.25	24							VISUAL
685.6	48.0		Very stiff, gray SILTY CLAY (A-6b), moist.	15	48.5	4 5 14	19	1.25	25	37	21	16	0	0	100	A-6b
				16	53.5	5 9 16	25	1.25	24							VISUAL
676.6	57.0		Medium dense, brown COARSE AND FINE SAND (A-3a), little gravel, little silt, moist.	17	58.5	ST ST	ST	--	9							VISUAL
				18	63.5	10 10 14	24	--	6							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-1

STA. & OFFSET: 58+46.73, 72.20' Lt.

ELEVATION: 733.56ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 40.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
665.1	68.5		Medium dense to very dense, brown to gray, non-cohesive SANDY SILT (A-4a), trace to no gravel, moist to wet. Note: Wet at 70.0 feet during drilling.	19	68.5	4 11 17	28	--	20							VISUAL
				20	73.5	10 26 32	58	--	20	NP	NP	NP	0	45	43/12	A-4a
654.6	79.0		Dense to very dense, gray, non-cohesive SILT (A-4b), little to some clay, trace sand, moist.	21	78.5	17 32 36	68	3.75	17							VISUAL
				22	83.5	23 16 16	32	2.0	19							VISUAL
				23	88.5	14 25 38	63	2.5	19	NP	NP	NP	0	1	79/20	A-4b
640.6	93.0		Hard to very stiff, gray SILT AND CLAY (A-6a), trace sand, moist.	24	93.5	ST ST		--								VISUAL
				25	98.5	10 14 17	31	3.25	19							VISUAL
				26	103.5		31	4.25	18							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-1

STA. & OFFSET: 58+46.73, 72.20' Lt.

ELEVATION: 733.56ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 40.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Hard to very stiff, gray SILT AND CLAY (A-6a), trace sand, moist. *(continued)*			9 15 16									
				27	108.5	10 32 16 16	2.5	20							VISUAL
				28	113.5	9 25 9 16	2.5	22							VISUAL
				29	118.5	9 23 8 15	3.75	21							VISUAL
613.6	120.0		TERMINATION DEPTH = 120.0 FEET												

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-2

STA. & OFFSET: 59+56.06, 9.62' Rt.

ELEVATION: 711.57ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 7/18/01 DATE COMPLETED: 7/19/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

Ohio TestBor, Inc. using a Mobile B-57 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 32.0 feet during drilling. Bore hole caved at 17.0 feet upon completion of drilling operations.

GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LL	PL	PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
711.0	0.6		ASPHALT (7 inches)													
710.2	1.4		CONCRETE (10 inches)													
			Medium dense, brown and gray, non-cohesive SANDY SILT (A-4a), with slag and wood pieces, moist. (roadbase)	1	2.0	17 37 50	87	1.25	22							VISUAL
				2	3.5	22 55	55	--	66							VISUAL
706.1	5.5		Medium stiff to stiff, gray, cohesive SILT (A-4b), some clay, trace sand, moist. (natural soil)	3	6.0	3 2 3	5	2.25	24	27	18	9	0	2	59/39	A-4b
				4	8.5	3 4 5	9	1.5	24							VISUAL
				5	13.5	3 4 6	10	1.5	23							VISUAL
693.6	18.0		Stiff, gray SILT AND CLAY (A-6a), moist.	6	18.5	2 5 6	11	1.25	26							VISUAL
				7	24.0	3 6 8	14	1.25	27	34	20	14	0	0	100	A-6a
				8	29.0	3 3 6	9	0.5	31							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-2

STA. & OFFSET: 59+56.06, 9.62' Rt.

ELEVATION: 711.57ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

Ohio TestBor, Inc. using a Mobile B-57 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 32.0 feet during drilling. Bore hole caved at 17.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Stiff, gray SILT AND CLAY (A-6a), moist. *(continued)*													
679.6	32.0		Medium dense, gray, non-cohesive SILT (A-4b), little to some clay, moist.	9	34.0	4 6 9	15	0.75	26							VISUAL
				10A	39.0	16 16 22	38	2.5	21							VISUAL
671.6	40.0		Medium dense, gray FINE SAND (A-3), trace silt, moist.	10B	40.0			--	19							VISUAL
				11	44.0	9 9 14	23	--	20	NP	NP	NP	0	91	9	A-3
				12	49.0	10 12 10	22	--	24							VISUAL
657.6	54.0		Very dense to medium dense, gray, non-cohesive SILT (A-4b), some to no sand, little to "and" clay, moist.	13	54.0	24 35 43	78	1.75	20	NP	NP	NP	0	30	53/16	A-4b
				14	59.0	3 11 15	26	0.75	20							VISUAL
				15A	64.0	5 6 9	15	1.0	23							VISUAL
				15B	65.0			1.25	21							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-2

STA. & OFFSET: 59+56.06, 9.62' Rt.

ELEVATION: 711.57ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

Ohio TestBor, Inc. using a Mobile B-57 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 32.0 feet during drilling. Bore hole caved at 17.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Very dense to medium dense, gray, non-cohesive SILT (A-4b), some to no sand, little to "and" clay, moist. *(continued)*	16	69.0	10 9 9 — 18	2.75	20							VISUAL
				17	74.0	6 6 7 — 13	2.0	21							VISUAL
				18	79.0	11 9 9 — 18	1.25	21							VISUAL
				19	84.0	3 6 8 — 14	0.5	27	NP	NP	NP	0	0	54/46	A-4b
				20	89.0	4 8 11 — 19	1.25	24							VISUAL
				21	94.0	7 12 17 — 29	3.0	21							VISUAL
614.6	97.0		Very stiff to stiff, gray SILT AND CLAY (A-6a), trace gravel, trace sand, moist.	22	99.0	7 10 17 — 27	2.25	20							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-2

STA. & OFFSET: 59+56.06, 9.62' Rt.

ELEVATION: 711.57ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

Ohio TestBor, Inc. using a Mobile B-57 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 32.0 feet during drilling. Bore hole caved at 17.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Very stiff to stiff, gray SILT AND CLAY (A-6a), trace gravel, trace sand, moist. *(continued)*	23	104.0	8 11 19	30	1.0	23	34	19	15	9	8	84	A-6a
				24	109.0	4 5 7	12	1.5	28							VISUAL
				25	114.0	5 7 10	17	0.5	27							VISUAL
595.1	116.5		Medium dense, gray, non-cohesive SILT (A-4b), "and" clay, moist.	26	119.0	6 8 9	17	0.75	26							VISUAL
				27	124.0	7 6 8	14	0.5	26	NP	NP	NP	0	0	56/43	A-4b
586.1	125.5		TERMINATION DEPTH = 125.5 FEET													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-3

STA. & OFFSET: 58+90.55, 72.82' Rt.

ELEVATION: 734.65ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 9/28/01 DATE COMPLETED: 10/1/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 81.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK FRAGMENTS (Railroad Bedding)												
731.7	3.0		Loose, reddish brown SHALE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), moist. (railroad embankment fill)	1	3.5	8 (8 4 4)	--	19							VISUAL
				2	6.0	9 (4 4 5)	3.0	15							VISUAL
				3	8.5	7 (4 3 4)	4.25	9							VISUAL
723.7	11.0		Stiff, brown and gray, cohesive SANDY SILT (A-4a), little sand, trace gravel, moist. (railroad embankment fill)	4	13.5	14 (4 6 8)	2.5	25							VISUAL
716.2	18.5		Loose, gray, non-cohesive SILT (A-4b), little fine sand, little clay, moist. (natural soil)	5	18.5	8 (4 3 5)	1.5	23							VISUAL
711.2	23.5		Medium stiff to hard, gray SILT AND CLAY (A-6a), trace sand, moist.	6	23.5	8 (6 3 5)	1.75	22							VISUAL
				7	28.5	9 (5 5 4)	2.25	19							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-3

STA. & OFFSET: 58+90.55, 72.82' Rt.

ELEVATION: 734.65ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 81.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LL	PL	PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Medium stiff to hard, gray SILT AND CLAY (A-6a), trace sand, moist. *(continued)*	8	31.0	6 6 12	18	3.25	20							VISUAL
				9	33.5	4 6 10	16	1.5	21							VISUAL
				10	36.0	3 7 11	18	1.25	21							VISUAL
				11	38.5	4 9 13	22	2.0	23	30	19	11	0	0	100	A-6a
				12	41.0	ST ST	ST		24							VISUAL
				13	43.5	5 7 17	24	2.0	22							VISUAL
				14	46.0	5 10 19	29	2.5	22							VISUAL
				15	48.5	6 10 14	24	2.25	22	36	22	14	0	0	100	A-6a
				16	53.5	5 8 12	20	1.25	24							VISUAL
				17	58.5	9 18 41	59	3.5	18							VISUAL
671.2	63.5		Dense, brown COARSE AND FINE SAND (A-3a), some silt, moist.	18	63.5	10 20 17	37	--	12							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-3

STA. & OFFSET: 58+90.55, 72.82' Rt.

ELEVATION: 734.65ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 81.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
666.2	68.5		Very dense to medium dense, gray, non-cohesive SILT (A-4b), little to some clay, trace to no sand, wet to moist. Note: Wet at 68.5 feet during drilling.	19	68.5	8 16 23	39	0.5	18	NP	NP	NP	0	54	37/9	A-4a
				20	73.5	25 43 50/0.3	50+	4.25								VISUAL
				21	78.5	9 11 17	28	3.5	18							VISUAL
				22	83.5	8 11 16	27	2.5	18	NP	NP	NP	0	0	58/42	A-4b
648.7	86.0		Hard to very stiff, gray SILT AND CLAY (A-6a), trace to no sand, moist.	23	88.5	12 13 14	27	3.25	19							VISUAL
				24	93.5	10 14 15	29	3.75	18							VISUAL
				25	98.5	11 31 21	52	4.0	17							VISUAL
				26	103.5		34	3.5	23							VISUAL

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXS-3

STA. & OFFSET: 58+90.55, 72.82' Rt.

ELEVATION: 734.65ft

PROJECT: CUY-77-11.11 (CSX Bridge)

PROJECT No.: G01037

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was encountered at 70.0 feet during drilling. Bore hole caved at 81.0 feet upon completion of drilling operations.

▼ GROUNDWATER DURING DRILLING

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			Hard to very stiff, gray SILT AND CLAY (A-6a), trace to no sand, moist. *(continued)*			13 18 18										
				27	113.5	4 8 12	20	1.25	21							VISUAL
				28	118.5	8 11 14	25	3.5	18							VISUAL
614.7	120.0		TERMINATION DEPTH = 120.0 FEET													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXR-3

STA. & OFFSET: 59+38.95, 241.22' Rt.

ELEVATION: 735.09ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 9/27/01 DATE COMPLETED: 9/27/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during or upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK (Railroad Bedding)												
732.1	3.0		Medium dense, black SLAG (A-1-b), moist. (embankment fill)	1	3.5	10 7 5 — 12	--	60							VISUAL
730.1	5.0		Medium dense, reddish brown, weathered SHALE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), moist. (embankment fill)	2	6.0	5 9 9 — 18	--	11							VISUAL
				3	8.5	5 6 9 — 15	3.5	12							VISUAL
724.1	11.0		Medium stiff to very stiff, brown CLAY (A-7-6), trace sand, moist. (embankment fill)	4	11.0	2 2 6 — 8	1.0	22	41	22	19	0	2	98	A-7-6
				5	13.5	9 7 9 — 16	3.0	21							VISUAL
				6	16.0	7 8 9 — 17	4.0	21							VISUAL
				7	18.5	5 7 9 — 16	2.5	21							VISUAL
715.1	20.0		TERMINATION DEPTH = 20.0 FEET.												

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger

PRIME ENGINEERING & ARCHITECTURE INC.

TEST BORING No.: CSXR-4

STA. & OFFSET: 60+02.00, 437.56' Rt.

ELEVATION: 735.50ft

CLIENT: Baker and Associates

PROJECT: CUY-77-11.11 (CSX Bridge) PROJECT No.: G01037

LOCATION: Cuyahoga Heights, Ohio

DATE STARTED: 9/27/01 DATE COMPLETED: 9/27/01

SAMPLER DIAM: 2.0" TYPE: SS HAMMER WT.: 140lb FALL: 30"

CASING DIAM: 3.25" TYPE: HSA OTHER:

DRILLING INFORMATION:

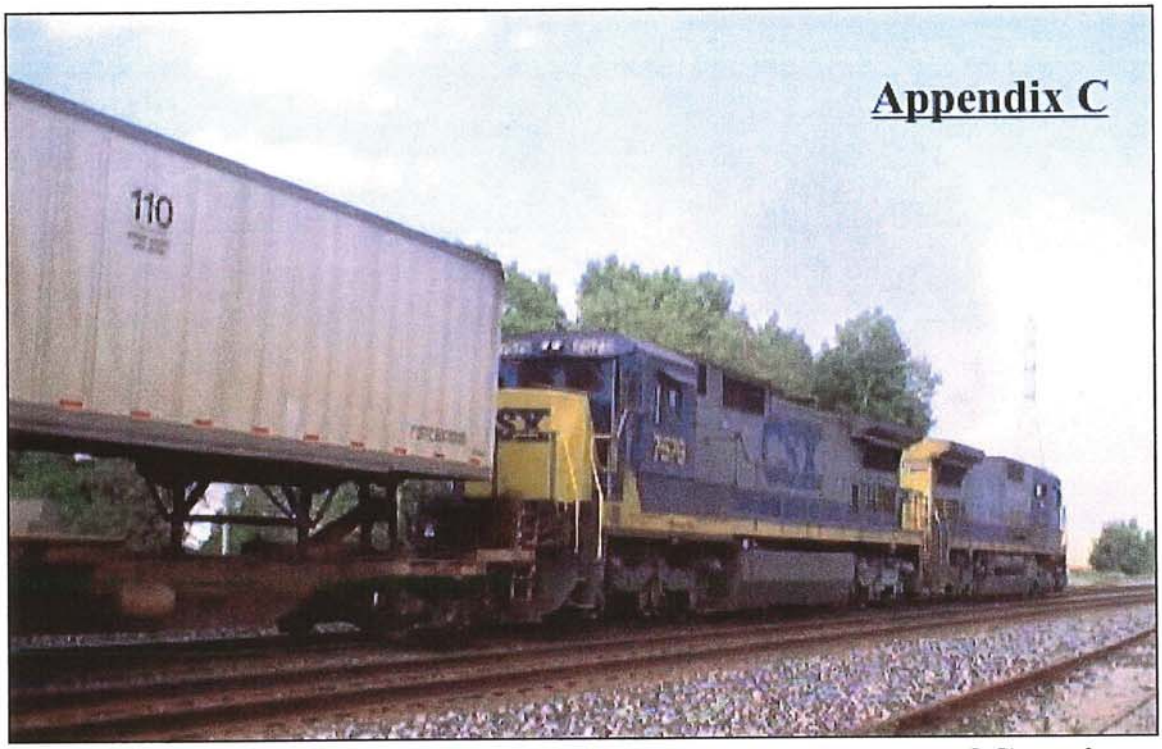
North America Drilling, Inc. using a CME 55 Truck-Mounted Drill Rig

GROUNDWATER INFORMATION:

Groundwater was not encountered during or upon completion of drilling operations.

ELEV (ft.)	DEPTH (ft.)	Soil/ Rock Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE DEPTH	BLOWS/6 INCHES	N-VALUE (BLOWS/FT) OR REC%/(RQD%)	PENETROMETER (tons/ft²)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (%) LL	PL	PI	AGGREGATE (%)	COARSE AND FINE SAND (%)	SILT AND CLAY COMBINED(%) OR SILT(%)/CLAY(%)	CLASSIFICATION SYMBOL
			CRUSHED ROCK (Railroad Bedding)													
732.1	3.4		Loose, black SLAG (A-1-b), moist. (embankment fill)	1	3.5	2 5 5	10	--	42							VISUAL
730.5	5.0		Medium dense, reddish brown, weathered SHALE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), moist. (embankment fill)	2	6.0	8 8 7	15	--	10							VISUAL
				3	8.5	6 5 7	12	--	9							VISUAL
				4	11.0	3 5 6	11	--	14							VISUAL
723.0	12.5		Very stiff to stiff, brown SILT AND CLAY (A-6a), trace sand, moist. (possible natural soil)	5	13.5	5 7 11	18	2.5	22	37	22	15	0	4	96	A-6a
				6	16.0	5 6 9	15	2.0	22							VISUAL
				7	18.5	4 5 5	10	3.5	25							VISUAL
715.5	20.0		TERMINATION DEPTH = 20.0 FEET.													

NOTES/REMARKS: SS = Split Spoon, HSA = Hollow Stem Auger



Scope of Services

I. Introduction:

A. Contract Breakdown Overview: The current understanding of contract components is outlined below:

Part 1 – Data Gathering/ Bridge Type Studies/ Stage 1 Development
(Cost plus fixed fee)
Part 2 – Bridge Replacement Design & Plan Preparation -Stage II/ III
(Lump Sum)
Part 3 – Additional Parts as required

B. Current MIS: ***(task is complete)***
~~The Baker team understands the Cleveland Akron Canton Corridor Major Investment Study (MIS) is currently underway. The current MIS schedule will identify a preferred highway solution for I-77 by August, 2001. The MIS will be completed December, 2001.~~

II. Common Project Tasks:

The project will contain several tasks listed below which will be performed over most/ all of the specific bridges of the I-77 corridor. For scoping purposes, it is beneficial to identify common project tasks in lieu of breaking down into very small detail.

A. Roadway Plans/ Utility Coordination *(task is ongoing)*

Baker will develop the roadway sheets required for the Stage 1 Submission. Sheets will include: title, schematic, and sign inventory. *Horizontal alignments will be developed/shown for overpasses and I-77; Ramp alignments will not be developed/shown.* ~~Utilities plans will be developed by Ralph Tyler Companies and incorporated in this task.~~ *Baker will mail Stage I plans to utilities listed by OUPS for these bridges.*

A.1. Design Exceptions: (task is ongoing)

Baker will identify design exceptions.

B. I-77 Base Mapping /Survey Activities:

Aerial Photography and Base Mapping: ODOT will provide aerial photography, base mapping, and development of the GEOPAK TIN for the project. Baker understands that for the current project limits, a three (3) month period is required to deliver the final aerial products mentioned above. Assuming a Notice to Proceed date of May 1, 2001, the schedule currently shows delivery of the base mapping and GEOPAK TIN by July 1, 2001.

Mainline I-77 Survey: This task will be performed by the Baker design team and include the following:

- Horizontal Control Traverse through existing Control on the I-77 Centerline Sta. 41+00 to Sta. 141+00 [from ODOT centerline plat - 1972] ***(task is complete)***
- Vertical Control Bench Circuit using ODOT Datum between Sta. 41+00 to Sta. 141+00 ***(task is complete)***
- Reference Ties ***(task is complete for Fleet, Harvard, Grant. Outstanding on CSX and NSR)***
- Survey Traverse Points for data collection ***(task is complete)***
- Mainline Alignment ***(task is complete)***
- Reference Points and Bench Marks ***(task is complete)***
- Sanitary Sewer and Drainage Structure Survey ***(task is complete)***
- Aerial Mapping Topo ***Editing (task is not complete, to be finalized once stage 1 is approved)***
- Cross Sections Before and After Bridges (4 per structure) ***(task is complete)***
- United Rentals for I-77 Traffic Control ***(task is complete)***
- United Rentals Sub-Consultant Coordination ***(task is complete)***

C. I-77 Maintenance of Traffic

Conceptual ~~Detour~~ *Signalization* Plan- Local Streets/ Sign Inventory *(task is ongoing)*
Traff-Pro Consultants, Inc. will conduct a field view to determine the existing signing on I-77 within the project limits and the signing on the surrounding roadways. Traff-Pro Consultants, Inc. will coordinate with ODOT to gather the plans that include the existing signing information. Traff-Pro Consultants, Inc. will place the existing sign information on a schematic plan drawing. This information will consist of the sign message, location and size (if available).

Considering the existing signing, Traff-Pro Consultants, Inc. will develop a ***conceptual*** ~~detour~~ *signalization* plan for each construction stage.

Conceptual Maintenance of Traffic Plan*(task is ongoing)*
Baker will develop one overall conceptual Maintenance of Traffic Plan at a scale of 1"=40' or 1"=50' for the I-77 corridor. The plan will be used to initiate coordination with ODOT and the railroad companies. *The initial basic concept in maintaining traffic on Interstate 77 is as follows:*

> *Phase 1 - No shifting of I-77 traffic during the removal of bridge superstructures. (temporary closures may be required, to be handled through MOT notes)*

Phase 2 - Right shoulder closure northbound and southbound to remove and construct the bridge abutments.

Phase 3 - Temporary closure of the left shoulders and lane to remove the existing bridge piers located in the median. (to be handled by MOT notes and Standard Drawings)

This plan assumes the following phased construction methods for the three bridge types described below:

- Roadway bridges: ~~Close the bridge to traffic during construction and detour traffic along the surrounding roadway network~~. *Part-width construction / maintain 1 lane of traffic in each direction during construction.*
- Newburgh & South Shore Railroad bridges: ~~Use two existing rail bridges for train traffic during the construction of the two proposed Newburgh & South Shore Railroad bridge structures. After the proposed rail structures are completed, eliminate the existing two railroad bridges.~~ *Conceptual Maintenance of Rail Plans were developed with the Original Stage 1 Plans to accommodate the construction of the four Newburgh and South Shore Bridges. The approved concept will be validated with the revisions to the Stage 1 submittal, and then fully developed in the final plan package. A new switch will be constructed west of East 49th Street along the Birmingham Steel site. Plan and Profile sheets will be developed as some of the detour route will be on a new alignment. New alignment will be provided at the location of the new switch and at the front of the Birmingham Steel site, where the curve radius will be improved. The alignment will match that shown on the conceptual Maintenance of Rail Plans. The design will be in accordance with Norfolk Southern standards.*
- CSX Railroad bridge: ~~Construct a portion of the proposed railroad bridge in the initial stages of construction adjacent to the existing bridge. Temporarily re-align the railroad track onto the newly constructed portion. Eliminate the existing bridge structure and construct the remaining portion of the proposed bridge structure.~~ Three separate options will be investigated. These include: *1.–Detour train traffic and replace the bridge on the existing alignment, 2. construct a new bridge on a new alignment and permanently realign the tracks, or 3. provide a temporary run-around while replacing the bridge on the existing alignment.*

~~Baker will determine how each of these three concepts will coincide with the Maintenance of Traffic on Interstate 77. The initial basic concept in maintaining traffic on Interstate 77 is as follows:~~

~~Phase 1 - No shifting of I-77 traffic during the removal of bridge superstructures.~~

~~Phase 2 - Right shoulder closure northbound and southbound to construct the proposed bridge abutments.~~

~~Phase 3 - Closure of the northbound left shoulder and closure of southbound left lane to construct the bridge piers located in the median.~~

~~Phase 4 - Right shoulder closure northbound and southbound to complete construction activities such as removal of the existing Newburgh & South Shore Railroad bridge abutments.~~

~~Phase 5 - Closure of the left shoulder northbound and southbound for construction activities such as removal of the existing Newburgh & South Shore Railroad bridge piers located in the median.~~

~~The goal of the maintenance of traffic design is to maintain three lanes of traffic in each direction on Interstate 77 as much as possible. The initial maintenance of traffic concept meets this goal with the exception of Phase 3. The narrow existing shoulder width does not allow traffic to be shifted onto a full width shoulder while median construction is occurring. Therefore, the left lane may need to be closed during this phase.~~

~~Lane tapers and lane shifts will be designed to accommodate the existing posted speed limit.~~

Conceptual plans will be submitted to ODOT for their approval.

D. Project Meetings *(task is ongoing)*
This task provides for Baker personnel to attend project meetings as required to complete the Part 1 design.

Public Involvement Meetings/ Aesthetic Support Meetings *(task is ongoing)*
Baker team members will attend local community meetings to update the local public officials on project status and ascertain local concerns. ODOT personnel will lead the community meetings while the design team will provide technical support. Handouts, project display boards, and photos will be provided by the design team to facilitate project understanding. Assume three (3) meetings will be conducted, two (2) project team members, and a total 4 hour duration per each meeting.

MIS Coordination Meetings *(task is complete)*
~~Baker will attend and participate in two (2) MIS Coordination Meetings as determined by ODOT to maintain coordination between the MIS and final bridge design. It is assumed one person will attend 2 meetings, and estimated 4 hours per meeting.~~

~~Baker will share collected traffic data from the I-77 project with the MIS team as requested by ODOT.~~

ODOT Progress Meetings: *(task is ongoing)*
Assume 2 additional meetings with 3 persons. Includes meeting preparation and brief meeting minutes. Includes one kick-off meeting and one final meeting to present final conclusions.

Design Working Meetings: *(task is ongoing)* Informal working meetings between ODOT and the design team will be used to coordinate technical issues with the appropriate disciplines. Assume 2 additional meetings with 3 persons.

Special Purpose Meetings: *(task is ongoing)* Assume 4 meetings with 3 persons to be used to resolve any additional issues not included elsewhere in this scope.

E. Project Management *(task is ongoing)*

Project Management: Baker will perform the project in a timely manner and make all submissions as required by ODOT. The work will include invoice preparation, accounting, secretarial work, in-house meetings and administration functions performed by Officers, Department Heads and the Project Manager.

The Project Manager will serve as the liaison with ODOT and will be responsible for the overall coordination of the project team and work effort. He will be responsible and accountable for completion of the project within the budget and schedule as well as seeing that all work efforts are consistent with the quality and standards of ODOT.

The overall project schedule will be monitored and tracked during preliminary design. Updated schedules will be provided to the Department's Project Manager with invoices.

Baker will perform comprehensive documentation of all meetings, phone conversations, and design development which will be monitored, compiled and recorded. All applicable material from these meetings and conversations will be incorporated into the design to keep the project up-to-date and current.

QA/ QC Reviews: ***(task is ongoing)***
Before submissions, Baker will conduct a peer review and a cross-discipline review of the information to be submitted. A peer review is a review by a Baker staff member of the same level of experience as the project manager or discipline leader who has not had any involvement in the project. It is a review by a "fresh pair of eyes." Our cross-discipline reviews are reviews of a particular discipline's work by the other disciplines: it ensures that the design has been coordinated throughout the disciplines.

F. Part 2 Scope Development *(task is ongoing)*

This task will develop the Part 2 Scope – Bridge Replacement Design & Plan Preparation , Stage II/ III as the Part 1 portion of the contract concludes.

III. Detailed Scope – Bridge CUY-77-1111 CSXT over I-77

Scope of Work Description:

Railroad: *(task is ongoing)*

~~Prepare~~ *For each of the options,* preliminary horizontal ~~detour~~ track plans using English units and CSXT design criteria *will be prepared.* This plan will accommodate the construction of a new railroad bridge over I-77. ~~using partial width construction method. The detour tracks will be south of the existing tracks and will consist of two main tracks and one yard lead track crossing I-77. Temporary connections will be designed from the yard lead to the yard tracks.~~ Three options will be investigated for maintaining rail traffic during bridge construction: 1) detour rail traffic and build the new bridge at the current location. 2) build the new bridge on a new alignment south of the existing alignment and permanently relocate the tracks to the new alignment and 3) provide a temporary runaround, and build the new bridge in the existing alignment. C*onnections will be designed from the yard lead to the yard tracks. The turnout that connects to the Marcy Yard H track to the main tracks will be relocated east of the existing railroad bridge.* ~~The turnout that connects to the siding on the south side of the main tracks will be relocated east of the existing railroad bridge.~~

The design speed for the main tracks will be 50 mph and 15 mph for the siding and yard tracks. The minimum horizontal clearance between the center of the relocated yard lead track and the construction zone for the new railroad bridge will be 12 feet. The length of the track ~~detour~~ *realignment* is approximately ~~3000~~ *4500* feet, *while the estimate for track relocation is 12,300 feet.*

The plan will be prepared based on the location of the existing tracks and facilities provided by the field survey. The plan scale will be 1 inch = 50 feet. The proposed alignments will show stationing for all PI, TS, SC, CS, and ST.

1. PI - Point of Intersection
2. TS - Tangent to Spiral
3. SC - Spiral to Curve
4. CS - Curve to Spiral
5. ST - Spiral to Tangent

We have assumed eight mainline curves. The following curve data will be shown in tabular format.

1. Design speed in miles per hour
2. The station of the PI
3. I - Angle at the intersection of the tangents
4. D - Degree of curve of the central circular curve
5. R - Radius of the central circular curve
6. L - Length of the spiral
7. SE – superelevation (in inches)
8. Lc - Length of the circular curve
9. TS station
10. ST station

Temporary connections from the detoured main tracks to the Marcy yard tracks, the Newburgh & South Shore interchange tracks, and unnamed side track on the south side of the main tracks will be designed using CSXT design criteria. The plan will show the turnout size, point of switch, point of intersection for the turnout and the beginning station, end station and PI station for connecting curves. The following curve date will be shown in tabular format:

1. D - Degree of curve of the central circular curve
2. R - Radius of the central circular curve
3. I - Angle at the intersection of the tangents
4. L - Length of the circular curve
5. T - Length of tangent
6. PC, PT, PI stations

We have assumed four turnouts and eight connecting curves will be required.

For each alternate, a typical section of the temporary rail run-around will be developed to aid the railroad in understanding the relative horizontal location of the temporary tracks. Additionally, four-cross sections will be developed, two east of the bridge and two west of the bridge, to depict the construction of the embankment necessary to support the temporary run-around.

Conceptual plans will be developed for inclusion in the Bridge Type Study and Maintenance of Rail Operations report submitted to ODOT and the Railroad. Comments from these reviews will be included in preliminary rail plans submitted as part of the Stage I submittal.

Field Survey:

The following field Survey information will be obtained for this project:

- Establish Baselines, Centerline of ROW, and Railroad Alignment ***(task is complete)***
- Reference Ties
- Cross Sections at (4 per structure) on I-77 ***(task is complete)***
- Top of Rail at 50' intervals on Railroad ***(task is complete)***
- Sanitary Sewer and Drainage Structure Survey ***(task is complete)***
- Full Topo Survey above bridge on Railroad ***(task is complete)***
- Full Topo Survey under bridge on I-77 ***(task is complete)***
- Aerial Mapping Topo Editing
- Set two (2) Benchmarks for each bridge replacement ***(task is complete)***
- Provide Survey Ties back to existing monumentation for all benchmarks and bridge control survey points
- Vertical Clearances at Lane Lines at the fascia of each bridge (included with cross sections) ***(task is complete)***
- Bridge Substructures, Piers, Face of Abutments ***(task is complete)***

- Track Rail Elevations and Locations [xyz] at 50' intervals for both rails on each track. ***(task is complete)***
- Establish Centerlines of Existing Tracks ***(task is complete)***
- Top of Rail, frogs, switches, signs, etc. [locations and elevations] ***(task is complete)***
- Drainage Survey & Existing Utilities within Railroad ROW ***(task is complete)***

The limits of the field survey are defined by the areas submitted to District personnel.

Right-of –Way: ***(task is complete)***

Existing property information in and around the area of this bridge will be gathered and shown in the base mapping. Additionally, the railroad property deeds will be researched to establish necessary future right-of-way work for the project.

Bridge: ***(task is ongoing)***

A bridge Type Study will be prepared for the CSX crossing over I-77 with the following constraints:

- Maintain Railroad traffic – Three through tracks including the two main line tracks and the Marcy Yard lead on the north. Maintain access to Marcy Yard and the Newburgh & South Shore Interchange.
- Maintain I-77 traffic - attempt to maintain 3 lanes at all times
- Provide for a ~~preferred 76'-0" or a minimum of 70'-0"~~ *single span of 127'-6"* (measured perpendicular to centerline of I-77) toe of *abutment* ~~median~~ barrier to toe of abutment barrier on I-77 below the bridge. (130'-0" face to face of abutments).
- Provide a minimum vertical clearance of ~~16'-0"~~ *15'-6"* in each direction, with a preferred vertical clearance of 16'-0". Address Vertical clearance considerations in the type study.
- Provide new structure to carry two mainline tracks, one siding and an access road. Total structure width dependant on maintenance of rail traffic, and railroad requirements.
- *Type study will consider replacing bridge with current alignment, while closing train traffic, replacing bridge while using a temporary runaround maintaining 3 tracks, and replacing bridge with a new alignment.*
- ~~Type study will consider using a non-redundant, single-span bridge to eliminate pier work in the median of I-77. Other s~~Structural considerations include deck girders, through girders, and truss option using high performance steel (70 KSI), and prestressed concrete I-beams, if appropriate. *The recommended superstructure will be founded on full height abutments with cast-in-place piles, full height abutments with spread footings, or full height abutments on drilled shafts.*

The Bridge Type Study will be submitted with the Maintenance of Rail Operations Report to ODOT for approval. Any comments from ODOT will be incorporated into the report, and the revised report submitted to CSX for approval.

Subsurface Investigations: ***(task is complete)***

Three structural test borings will be conducted in the vicinity of the existing bridge. One boring will be performed behind each of the existing abutment , and one along the center Median of I-77 near the existing pier.

Four railway borings will be conducted, two west of the bridge and two east of the bridge, along the south side of the rail right of way. These boring will be advanced 20 feet to obtain subsurface data for the design of the temporary rail run-around.

Type Study Deliverables: (task is ongoing)

- *Narrative*
- *Construction Cost Comparison*
- *Foundation Recommendations*
- *Geotechnical Report*

Each alternate will have the following: (task is ongoing)

- *Schematic Plan*
- *Typical Sections*
- *Conceptual M.O.W.*
- *Cross Sections*
- *Site Plan*
- *Abutment Section*
- *Transverse Section*
- *Miscellaneous Details*
- *Construction Sequencing*

Stage I Plan Submittal *Deliverables*: *(task is ongoing)*

Upon approval of the Bridge Type Study/Maintenance of Rail Operations Report, Stage I plans will be developed. The anticipated plan sheets for the Stage I submission include:

- *Title Sheet*
- *Plan & Profile Sheets*
- ~~Preliminary Rail Run-Around Plan~~ *Conceptual M.O.W.* (3 sheets)
- *Schematic Plans*
- Typical Section (2 Sheets)
- Cross Sections (2 Sheets)
- Bridge Site Plan
- *Removal Details (2 Sheets)*
- *Abutment Section*
- *Bearing Details*
- *Framing Plan*

- Joint Details
- Transverse Section
- Construction Sequencing

~~-Miscellaneous Details~~

Upon submission of Stage I, a utility coordination mailing will be sent.

IV. Detailed Scope – Bridge CUY-77-1143 Grant Avenue over I-77

Scope of Work Description:

Roadway: ***(task is ongoing)***

Roadway plans will be developed to accommodate the replacement of the Grant Avenue bridge over I-77. The bridge will be replaced using *part-width construction* ~~a full closure, with detour.~~

It is anticipated that the proposed profile will *be raised higher than* ~~closely match~~ the existing profile. Any adjustments to the profile will be tied into the existing pavement as soon as possible off the bridges. Any adjustments necessary to the existing ramps will performed through overlay operations

Maintenance of Traffic: (task is ongoing)

The maintenance of traffic for Grant Ave. will be in two phases, accommodating the part width construction. This will include closing portions of the ramps for vertical realignment, and limiting movements at Grant Ave. Temporary ramp closures or part-width construction may be necessary for paving operations. Additionally, temporary signals will be designed to keep the signal heads centered over traffic, and the phases adjusted to provide the optimal traffic flow through the reduced lane area (signals designed by Traffpro).

Drainage: ***(task is ongoing)***

Preliminary drainage design will be performed to eliminate scuppers on the bridges. Additionally, any new drainage structures will be tied to the existing I-77 median storm sewer (30" conduit). No proposed storm sewers are to be tied into the historic storm sewer system (Burke Brook) on the east-side of I-77, along the northbound on-ramp from Grant Avenue. This existing Burke Brook sewer is outside the existing L/A (on Copper and Brass property).

Traffic Data Collection: ***(task is complete)***

Traffic data collection will include conducting manual turning movement and classification counts (in 15-minute intervals) at the following intersections in order to isolate AM, Mid-Day and PM weekday peak hours.

1. Grant Avenue & I-77 northbound on/off ramps
2. Grant Avenue & I-77 southbound on/off ramps

These weekday counts will be taken from:

6:30 AM to 9:30 AM
11:00 AM to 1:00 PM
3:00 PM to 6:00 PM
on a single typical weekday (Tuesday, Wednesday or Thursday) of a non-holiday week.

The time and length of these count periods are based on capturing the actual peak hours within these periods.

All volumes will be summarized on a schematic figure.

The summarized traffic volumes will be submitted to ODOT for approval. ODOT will coordinate with Central Office for certification and approval of the volumes.

It is assumed that automatic traffic recorder (ATR) vehicular volume counts are not required for this project and are not included in this scope of work.

Site Inventory A site inventory will be performed at each intersection indicating the existing geometry, traffic control devices and intersection data. This information will consist of information such as:

1 Widths of roadways
2 Distances between intersections
3 Turning bay lengths
4 Lane configurations
5 Approximate grades of approach roadways
6 Existing traffic signal phasing and timings

A site inventory form will be produced for each of the above listed intersections summarizing the collected information.

~~**Volume Distribution** After approval of the exiting traffic volumes are received, the existing volumes will be re-distributed along the surrounding roadway network to accommodate the following construction scenario:~~

~~1.Construct the Fleet Avenue and Grant Avenue bridges during the initial stage. Close the Fleet Avenue and Grant Avenue bridges over I-77. The I-77 northbound off ramp at Fleet Avenue will be closed during this stage. However, the signal will remain in operation at this intersection to accommodate Independence Road and~~

~~49th Street traffic. The traffic that typically travels through the closed roadway areas will be distributed to adjacent roadway and interchange areas.~~

~~2.Construct the Harvard Avenue bridge during the following stage. Close Harvard Avenue bridge over I-77. The traffic that typically travels over the Harvard Avenue bridge will be distributed to adjacent interchange areas.~~

~~These re-distributed existing volumes will be used to analyze the traffic operations during construction.~~

~~**Capacity Analysis** Synchro computer software will be used to evaluate the traffic capacity of the following study intersections:~~

~~1.Grant Avenue & I-77 northbound on/off ramps~~
~~2.Grant Avenue & I-77 southbound on/off ramps~~

~~The results of the analyses will be described in terms of level of service. The capacity analysis will evaluate the intersection traffic operation efficiency given the conditions. Also, the analysis will determine the appropriate signal timings, phasing and sequencing during construction. Capacity analyses for the AM, Mid-Day and PM weekday peak hours will be conducted for the Aduring construction≅ condition only. Capacity analyses for existing conditions, opening day conditions and design year conditions are not included as part of this scope of work.~~

~~The most effective signal timings and phasing will be determined for each intersection.~~

Field Survey: ***(task is complete)***

The following field Survey information will be obtained for this project:

- Establish Baselines, Centerline of ROW, Alignment of Grant Ave., and the Alignment of the I-77 Ramps
- Reference Ties
- Cross Sections (4 per structure) on I-77
- Cross Sections at 50' intervals on Grant Avenue and Ramps to 50' beyond ROW
- Sanitary Sewer and Drainage Structure Survey
- Full Topo Survey above bridge on Grant Avenue and ramps including buildings
- Full Topo Survey under bridge on I-77
- Aerial Mapping Topo and TIN Editing
- Grant Avenue Interchange Ramps – four
- Set two (2) Benchmarks for each bridge replacement
- Provide Survey Ties back to existing monumentation for all benchmarks and bridge control survey points

- Vertical Clearances at Lane Lines at the fascia of each bridge
- Bridge Substructures, Piers, Face of Abutments

The limits of the field survey are defined by the areas submitted to District personnel.

Right-of –Way:

Existing property information in and around the area of this bridge will be gathered and shown in the base mapping to evaluated potential property impacts.

Bridge: *(task is ongoing)*

A bridge Type Study will be prepared for the Grant Avenue crossing over I-77 with the following constraints:

- ~~Detour traffic during construction.~~ *Part-width construction / maintain 1 lane of traffic in each direction during construction.*
- Maintain 3-lanes of traffic on I-77.
- Provide for a ~~preferred 76'-0" or a minimum of 70'-0"~~ *single span of 127'-6"* (measured perpendicular to centerline of I-77) toe of ~~median~~ *abutment* barrier to toe of abutment barrier on I-77 below the bridge. (130'-0" face to face of abutments)
- Provide a minimum vertical clearance of 15~~6~~'-6~~0~~" in each direction, with a preferred vertical clearance of 16'-0" (options to be considered in type study)~~.~~
- Maintain existing ramp horizontal alignment.
- Provide new structure with 52' (f/f curbs) wide roadway, two, six-foot sidewalks, and a 6'-0" high vandal protective fence.

~~The feasibility of reusing the existing pier footings will be investigated.~~

- Type study will consider using high performance steel (70 KSI), and prestressed concrete I-beams, *and a tied down steel superstructure* ~~if appropriate.~~ *The recommended superstructure will be founded on full height abutments with cast-in-place piles, full height abutments on spread footings, or full-height abutments with drilled shafts.*

The Bridge Type Study will be combined with the Fleet Avenue and Harvard Avenue Type Studies and submitted to ODOT for approval, prior to commencing with TS&L plan development.

Subsurface Investigations: *(task is complete)*

Three structural test boring will be conducted in the vicinity of the existing bridge. One boring will be performed behind each of the existing abutment , and one along the center median of I-77 near the existing pier.

Two roadway borings will be conducted, one west of the bridge and one east of the bridge, in the existing roadway. These boring will be advanced 10 feet to obtain subsurface data for the design of the pavement, as well as to determine existing pavement composition.

Type Study Deliverables: *(the type study for Grant Ave will be combined with the type studies form Harvard and Fleet Avenues)*

- *Narrative*
- *Construction Cost Comparison*
- *Foundation Recommendations*
- *Geotechnical Report*
- *Clearance Narrative*
- *Site Plan*
- *Abutment Section*
- *Superstructure Alternatives*
- *Transverse Section*

Stage I Plan Submittal *Deliverables*: *(task is ongoing)*

Upon approval of the Bridge Type Study, Stage I plans will be developed. The anticipated plan sheets for the Stage I submission include:

- Plan & Profile Sheets (2 sheets)
- *Conceptual M.O.T. (2 sheets)*
- *Preliminary Traffic Control Plan*
- *Preliminary Utility Plan*
- Typical Sections
- *Approach Slab Plan*
- Bridge Site Plan
- Transverse Section
- Miscellaneous Details

Upon submission of Stage I plans, a utility coordination mailing will be sent.

V. Detailed Scope – Bridge CUY-77-1169/1171/1178/1182 Newburgh & South Shore Railroad over I-77

Scope of Work Description:

Railroad: ***(task is ongoing)***

~~Prepare preliminary horizontal detour track plans and preliminary permanent track relocation plans using English units and Norfolk Southern design criteria. These plans will accommodate the construction of two new railroad bridges over I-77. The northern bridge will be constructed first. Truck traffic will be maintained on existing Bridge No. CUY-77-1182 until the new structure is built. Two-way, one-lane traffic will be maintained. The truck traffic volume is low, therefore the NSR is willing to have one lane for both eastbound and westbound movement during construction of the new Northern Bridge.~~

Preliminary horizontal detour track plans and permanent track relocation plans were submitted during Part 1 of the contract. The Part 1 Study resulted in the track structures remaining on existing alignment, while the access bridge is realigned perpendicular to the centerline of I-77. The profiles of the rail structures have been revised slightly to accommodate acceptable vertical clearances. The Plans have been prepared through Stage 1 level of detail. The alignments approved during Part 1 will be maintained as long as they are consistent with the proposed span lengths. The scope of this contract is to revise the Stage 1 submittal based on the new span lengths. All track within the limits of the improvement will be upgraded from existing 90 lb. rail to 115 lb. rail.

To maintain the mainline track, a new switch will be added approximately 3,500 feet west of I-77. This switch will connect the mainline track to the northern siding along the American Steel and Wire Company. Rail traffic will then be maintained across Bridge No. CUY-77-1171 and reconnect with the mainline using the existing switch east of I-77.

Once the new northern structures are ~~is~~ completed, rail traffic and two-way, two-lane truck traffic will be maintained across the new bridges.

After the new Northern Bridges are ~~is~~ in place, the southern structure can be removed. The mainline track will be maintained using the new Northern Bridge. Rail accessibility to the existing businesses can be maintained using the newly constructed switch to the west and the existing switch to the east. Any temporary track built to maintain rail traffic will remain.

The design speed for all track work will be 10 mph. The minimum horizontal clearance between the center of the relocated yard lead track and the construction zone for the new railroad bridge will be 12 feet. To accommodate the profile adjustment and possible horizontal adjustments, the length of the track detour will be approximately 2,500 feet for the northern structure and 1,500 feet for the southern structure.

The plans will be prepared based on the location of the existing tracks and facilities provided by the field survey. The plan scale will be 1 inch = 50 feet. The proposed alignments will show stationing for all PI, TS, SC, CS, and ST.

1. PI – Point of Intersection
2. TS – Tangent to Spiral
3. SC – Spiral to Curve
4. CS – Curve to Spiral
5. ST – Spiral to Tangent

The following curve data will be shown in tabular format.

1. Design speed in miles per hour
2. The station of the PI
3. I – Angle at the intersection of the tangents
4. D – Degree of curve of the central circular curve
5. R – Radius of the central circular curve
6. L – Length of the spiral
7. SE – Superelevation (in inches)
8. Lc – Length of the circular curve
9. TS station
10. ST station

All track in the project limits shall consist of 115 lb. rail. Approximately 500 feet of rail will be upgraded from the existing 90 lb.rail to the 115 lbs. rail.

The alignments for the permanent track will be determined through studies during this phase of the project. The mainline tracks on the Northern Structure can be shifted to the south to avoid the CEI tower at the northwest corner of the bridge. The profile can be raised approximately 1 foot; however, raising the profile beyond 1 foot will require extensive replacement.

The rail alignment for the Southern Structure will have a few alternatives. All efforts will be made to avoid the First Energy tower just east of I-77 between the two structures. It is possible to keep one track at the southern structure location. The rail would reconnect to existing just north of the Precision Engineering Building. Provisions will be made for a new siding entering into the Williams Building.

A second alternative would be to maintain the location of the north bridge. However, providing a turnout into the building at that location appears to be difficult.

A third alternative would be to relocate the First Energy tower.

Conceptual plans will be developed for inclusion in the Bridge Type Study and Maintenance of Rail Operations report submitted to ODOT and the Railroad. Comments from these reviews will be included in preliminary rail plans submitted as part of the Stage I submittal.

Roadway:

The access bridge will be realigned perpendicular to the centerline of I-77. Truck traffic will be maintained on existing Bridge No. CUY-77-1182 until the new structure is built. Two-way, one-lane traffic will be maintained. The truck traffic volume is low, therefore the NSR is willing to have one lane for both eastbound and westbound movement during construction of the new Northern Bridge.

Field Survey:

The following field survey information will be obtained for the project:

- Establish Baselines, Centerline of ROW, and Railroad Alignment ***(task is complete)***
- Reference Ties
- ROW ***(task is complete)***
- Full Topo Survey above bridges on Railroad ***(task is complete)***
- Full Topo Survey under bridge on I-77 ***(task is complete)***
- Set two (2) Benchmarks for each bridge replacement ***(task is complete)***
- Provide Survey Ties back to existing monumentation for all benchmarks and bridge control survey points ***(task is complete)***
- Vertical Clearances at Lane Lines at the fascia of each bridge ***(task is complete)***
- Bridge Substructures,-Piers, Face of Abutments ***(task is complete)***
- Track Rail Elevations and Locations [xyz] at 50' intervals for both rails on each track. ***(task is complete)***
- Establish Centerlines of Existing Tracks ***(task is complete)***
- Top of Rail, frogs, switches, signs, etc. [locations and elevations] ***(task is complete)***
- Drainage Survey and Existing Utilities within Railroad ROW. ***(task is complete)***
- Railroad Flagmen for Railroad Traffic Control ***(task is complete)***
- Railroad Flagmen Coordination ***(task is complete)***

Some additional field survey will be needed at the location along the realigned CUY-77-1182 structure to better determine the structure profile and tie down points. Survey will also be required at the areas that are on new alignment. Reference ties and benchmarks will also be required. (This area of required survey information will be determined in Part 1 for inclusion in Part 2 of this contract)

Right-of-Way: ***(task is complete)***

Existing property information in and around the area of these bridges will be gathered and shown in the base mapping. Additionally, the railroad property deeds will be researched to establish necessary future right-of-way work for the project.

Bridge: ***(task is ongoing)***

~~A bridge Type Study will be prepared for the Newburgh and South Shore Railroad (NSR) crossings over I-77 with the following constraints.~~

- ~~Replace the four existing structures with the two proposed structures as requested by ODOT.~~
- ~~Maintain Railroad traffic~~
  - ~~For the construction of the Northern Bridge, maintain railroad traffic across Bridge No. CUY-77-1171 and maintain truck traffic across Bridge No. CUY-77-1182.~~
  - ~~For the construction of the Southern Bridge, maintain railroad and truck traffic across the new Northern Bridge.~~
- ~~Provide a new Northern Structure to carry one set of tracks and a two-lane truck access road. The total structure width will be approximately 54'.~~
- ~~Provide a new Southern Structure to carry two sets of tracks. The total structure width will vary.~~
- ~~Assuming the NSR approves the use of continuous through girder structure, the Type Study will consider a 10' western shift of the median pier as requested by ODOT.~~
- ~~The FirstEnergy Towers will be taken into consideration when the locations of the new bridges are studied.~~
- ~~Maintain I-77 traffic – attempt to maintain three lanes at all times.~~
- ~~Provide for a preferred 80'-0" (measured perpendicular to centerline of I-77) toe of median barrier to toe of abutment barrier on I-77 below the bridges.~~
- ~~Provide a minimum vertical clearance of 15'-0" in each direction.~~

The Bridge Type Study and the Type, Size and Location (TS&L) plans were submitted on these Newburgh & South Shore bridges over I-77 during Part 1 of the contract. Based on our recommendation and ODOT and Newburgh & South Shore concurrence, three (3) Railroad bridges were selected to replace the existing three (3) structures. The Access Bridge will be replaced with a structure with an alignment perpendicular to the centerline of I-77. These structures will be re-evaluated based on the revised span lengths and a revised Stage 1 submission made. Upon approval of the Stage 1 plans, Final Plans will be prepared based on the following criteria:

- *Replace the three Railroad structures (CUY-77-1169/1171/1178) at the location identified on the TS&L sheets.*

- *A minimum of 16'-0" vertical clearance is to be provided in each direction. This requirement will be attained using the direct fixation method shown in the TS&L plans for bridge no's.CUY-77-1171 & 1178.*
- *Provide for a preferred 127'-6" feet opening (measured perpendicular to centerline I-77) toe of abutment barrier to toe of abutment barrier. (130'-0" face to face of abutments)*
- *The structure widths will be as shown on the TS&L Plans.*
- *The structure type will be as shown on the TS&L Plans*
- *Maintain 3-lanes of traffic in each direction on I-77.*

Maintain Railroad Traffic as shown on the Conceptual Maintenance of Rail scheme previously approved by ODOT & Newburgh & South Shore.

Type study for the Access Bridge will consider using prestressed concrete I-beams, high performance steel (70 KSI), and a tied down steel superstructure. The recommended superstructure will be founded on full height abutments with cast-in-place piles, full height abutments with spread footings, or full height abutments with drilled shafts for the east abutment. The west abutment will be shared with bridge CUY-77-1178. The access bridge portion of the abutment will have a reduction in reinforcement due to the reduction in loading.

~~The Bridge Type Study will be submitted with the Maintenance of Rail Operations Report to ODOT for approval. Any comments from ODOT will be incorporated into the report, and the revised report submitted to NSR for approval.~~

NSR Rail Yard Drainage: *(task is ongoing)*

A Storm Water Management Report will be made to address the flooding between Bridge Nos. CUY-77-1169 and CUY-77-1171. The water will be collected at the top of I-77 slope in NSR rail yard and outletted into the existing I-77 median storm drainage system.

Subsurface Investigations: *(task is ongoing)*

Three structural test boring will be conducted in the vicinity of the existing Bridge Nos. CUY-77-1171 and CUY-77-1178. One boring will be performed behind each of the existing abutments, and one along the center median of I-77 near the existing pier.

Additional rail borings may be required depending on the relocation of the existing rail. These borings will be advanced 20 feet to obtain subsurface data for the design of the rail.

Additional soil borings will be required at the location of Bridge 1169. One boring shall be performed behind each of the existing abutments for a total of two (2).

Retaining Wall: (task is ongoing)

A retaining wall structure will be required between the access road east abutment and the adjacent railroad bridge 1178 east abutment. The retaining wall justification study and TS&L plans will be included in the Stage 2 submission.

Temporary Sheeting: (task is ongoing)

We are anticipating temporary sheeting to be required at the rear abutment wingwalls of bridges CUY-77-1178 and 1182 to also maintain the foundation of the existing First Energy Tower during construction. Also, temporary sheeting are required at the proposed retaining wall between bridges CUY-77-1169 and 1171 to maintain the foundation of the existing First Energy Tower during construction. This sheeting will be designed and detailed in the construction plans.

Stage I Plan Submittal: ***(task is ongoing)***
Upon approval of the Bridge Type Study/Maintenance of Rail Operations Report, Stage I plans will be developed. The anticipated plan sheets for the Stage I submission include:

- Preliminary Rail Alignments and Profile
- Typical Sections
- Cross Sections
- Bridge Site Plan
- Transverse Sections
- Construction Sequencing
- Preliminary Substructure Details
- Preliminary Superstructure Details

VI. Detailed Scope – Bridge CUY-77-1212 Harvard Avenue over I-77

Scope of Work Description:

Roadway: ***(task is ongoing)***

Roadway plans will be developed to accommodate the replacement of the Harvard Avenue bridge over I-77. The bridge will be replaced using ~~a full closure, with detour~~ *part-width construction.*

It is anticipated that the proposed profile will *be raised higher than* ~~closely match~~ the existing profile. Any adjustments to the profile will be tied into the existing pavement as soon as possible off the bridges. Any adjustments necessary to the existing ramps will performed through overlay operations.

Maintenance of Traffic: ***(task is ongoing)***

The maintenance of traffic for Harvard Ave. will be in two phases, accommodating the part width construction. This will include closing portions of the ramps for vertical realignment, and limiting movements at Harvard Ave. Temporary ramp closures or part-width construction may be necessary for paving operations. Since the final construction plans for Harvard Avenue will not be prepared at this time, temporary signals will ***NOT*** *be designed. Any existing traffic and/or signal information obtained today may not be relevant when the bridge is actually constructed.*

Drainage: ***(task is ongoing)***

Preliminary drainage design will be performed to eliminate existing scuppers on the bridges.

Traffic Data Collection: ***(task is complete)***

Traffic data collection will include conducting manual turning movement and classification counts (in 15-minute intervals) at the following intersections in order to isolate AM, Mid-Day and PM weekday peak hours.

1. Harvard Avenue & I-77 northbound on/off ramps
2. Harvard Avenue & I-77 southbound on/off ramps
3. Harvard Avenue & Washington Park Boulevard (49th Street)

These weekday counts will be taken from:

6:30 AM to 9:30 AM
11:00 AM to 1:00 PM
3:00 PM to 6:00 PM
on a single typical weekday (Tuesday, Wednesday or Thursday) of a non-holiday week.

The time and length of these count periods are based on capturing the actual peak hours within these periods.

All volumes will be summarized on a schematic figure.

The summarized traffic volumes will be submitted to ODOT for approval. ODOT will coordinate with Central Office for certification and approval of the volumes.

It is assumed that automatic traffic recorder (ATR) vehicular volume counts are not required for this project and are not included in this scope of work.

Site Inventory A site inventory will be performed at each intersection indicating the existing geometry, traffic control devices and intersection data. This information will consist of information such as:

1. Widths of roadways
2. Distances between intersections
3. Turning bay lengths
4. Lane configurations
5. Approximate grades of approach roadways
6. Existing traffic signal phasings and timings

A site inventory form will be produced for each of the above listed intersections summarizing the collected information.

~~**Volume Distribution** After approval of the exiting traffic volumes are received, the existing volumes will be re-distributed along the surrounding roadway network to accommodate the following construction scenario:~~

~~1.Construct the Fleet Avenue and Grant Avenue bridges during the initial stage. Close the Fleet Avenue and Grant Avenue bridges over I-77. The I-77 northbound off ramp at Fleet Avenue will be closed during this stage. However, the signal will remain in operation at this intersection to accommodate Independence Road and 49th Street traffic. The traffic that typically travels through the closed roadway areas will be distributed to adjacent roadway and interchange areas.~~

~~2.Construct the Harvard Avenue bridge during the following stage. Close Harvard Avenue bridge over I-77. The traffic that typically travels over the Harvard Avenue bridge will be distributed to adjacent interchange areas.~~

~~These re-distributed existing volumes will be used to analyze the traffic operations during construction.~~

~~**Capacity Analysis** Synchro computer software will be used to evaluate the traffic capacity of the following study intersections:~~

~~1.Harvard Avenue & I-77 northbound on/off ramps~~
~~2.Harvard Avenue & I-77 southbound on/off ramps~~
~~3.Harvard Avenue & Washington Park Boulevard (49th Street)~~

~~The results of the analyses will be described in terms of level of service. The capacity analysis will evaluate the intersection traffic operation efficiency given the conditions. Also, the analysis will determine the appropriate signal timings, phasing and sequencing during construction. Capacity analyses for the AM, Mid-Day and PM weekday peak hours will be conducted for the Aduring construction≅ condition only. Capacity analyses for existing conditions, opening day conditions and design year conditions are not included as part of this scope of work.~~

~~The most effective signal timings and phasing will be determined for each intersection.~~

Field Survey: *(task is complete)*

The following field Survey information will be obtained for this project:

- Establish Baselines, Centerline of ROW, Alignment of Harvard Ave., and the Alignment of the I-77 Ramps
- Reference Ties
- Cross Sections (4 per structure) on I-77
- Cross Sections at 50' intervals on Harvard Avenue and Ramps to 50' beyond ROW
- Sanitary Sewer and Drainage Structure Survey
- Full Topo Survey above bridge on Harvard Avenue and ramps including buildings
- Full Topo Survey under bridge on I-77
- Aerial Mapping Topo Editing
- Harvard Avenue Interchange Ramps – four
- Set two (2) Benchmarks for each bridge replacement
- Provide Survey Ties back to existing monumentation for all benchmarks and bridge control survey points
- Vertical Clearances at Lane Lines at the fascia of each bridge
- Bridge Substructures, Piers, Face of Abutments

The limits of the field survey are defined by the areas submitted to District personnel.

Right-of –Way: *(task is complete)*

Existing property information in and around the area of this bridge will be gathered and shown in the base mapping to evaluated potential property impacts.

Bridge: *(task is ongoing)*

A bridge Type Study will be prepared for the Harvard Avenue crossing over I-77 with the following constraints:

- . *Part-width construction / maintain 1 lane of traffic in each direction during construction.*
- Maintain 3-lanes of traffic on I-77.
- Provide for *single span of 127'-6"* (measured perpendicular to centerline of I-77) toe of ~~median~~ *abutment* barrier to toe of abutment barrier on I-77 below the bridge. (130'-0" face to face of abutments)
- Provide a minimum vertical clearance of ~~15'-0"~~ 15'-6" in both directions ~~southbound and 16'-0" northbound,~~ with a preferred clearance of 16'-0" (Address Vertical clearance considerations in the type study)
- Maintain existing ramp horizontal alignment.
- Provide new structure with 76' (f/f curbs) wide roadway, two, six-foot sidewalks, *1'-6" wide splash barriers,* and a 6'-0" high vandal protective fence.

- ~~The feasibility of reusing the pier footings will be investigated.~~
- Type study will consider using high performance steel (70 KSI), and prestressed concrete I-beams, *and a tied down steel superstructure . The recommended superstructure will be founded on full height abutments with cast-in-place piles, full height abutments on spread footings, or full-height abutments with drilled shafts.*

The Bridge Type Study will be combined with Fleet Avenue and Grant Avenue Type Studies and submitted to ODOT for approval, prior to commencing with TS&L plan development.

Subsurface Investigations: ***(task is complete)***
Three structural test boring will be conducted in the vicinity of the existing bridge. One boring will be performed behind each of the existing abutment , and one along the center median of I-77 near the existing pier.

Two roadway borings will be conducted, one west of the bridge and one east of the bridge, in the existing roadway. These boring will be advanced 10 feet to obtain subsurface data for the design of the pavement, as well as to determine existing pavement composition.

Type Study Deliverables: (task is ongoing)

- *Narrative*
- *Construction Cost Comparison*
- *Foundation Recommendations*
- *Geotechnical Report*
- *Clearance Narrative*
- *Site Plan*
- *Abutment Section*
- *Superstructure Alternatives*
- *Transverse Section*

Stage I Plan Submittal *Deliverables*: *(task is ongoing)*

Upon approval of the Bridge Type Study, Stage I plans will be developed. The anticipated plan sheets for the Stage I submission include:

- *Title Sheet*
- *Schematic Plans*
- Typical Section
- *Conceptual M.O.T. (2 sheets)*
- Plan & Profile Sheets (2 sheets)
- Bridge Site Plan
- *Removal Details (2 Sheets)*
- *Part-width Construction Details*
- *Abutment Cross Section*
- *Bearing Details*

- *Framing Plan*
- *Semi-Integral Diaphragm Cross Section*
- Transverse Section
- ~~Miscellaneous Details~~

VII. Detailed Scope – Bridge CUY-77-1268 Fleet Avenue over I-77

Scope of Work Description:

Roadway: *(task is ongoing)*

Roadway plans will be developed to accommodate the replacement of the Fleet Avenue bridge over I-77. The bridge will be replaced using ~~a full closure, with detour~~ *part-width construction.*

It is anticipated that the proposed profile will ~~closely match~~ *be raised higher than* the existing profile. Any adjustments to the profile will be tied into the existing pavement as soon as possible off the bridges. Any adjustments necessary to the existing ramps will performed through overlay operations.

Drainage: *(task is ongoing)*

Preliminary drainage design will be performed to eliminate existing scuppers on the bridges.

Maintenance of Traffic:

The maintenance of traffic for Fleet Ave. will be in two phases, accommodating the part width construction. This will include closing the I-77 Northbound ramp for the project, to allow local access to and from Independence Street. Due to weight limits on Crete St. and Washington Park, a truck detour route will be required. Temporary ramp closures or part-width construction may be necessary for paving operations. Additionally, temporary signals will be designed to keep the signal heads centered over traffic, and the phases adjusted to provide the optimal traffic flow through the reduced lane area. Permanent pedestrian heads will be added to the signal at Fleet to aid in pedestrian movements through the intersections (signalization designed by Traffpro).

Traffic Data Collection: *(task is complete)*

Traffic data collection will include conducting manual turning movement and classification counts (in 15-minute intervals) at the following intersections in order to isolate AM, Mid-Day and PM weekday peak hours.

1. Fleet Avenue & I-77 northbound on/off ramps / 49th Street / Independence Road

2. Fleet Avenue & Washington Park Boulevard (49th Street) / Crete Avenue
3. Independence Road / Crete Avenue & I-77 southbound off-ramp

These weekday counts will be taken from:

6:30 AM to 9:30 AM
11:00 AM to 1:00 PM
3:00 PM to 6:00 PM
on a single typical weekday (Tuesday, Wednesday or Thursday) of a non-holiday week.

The time and length of these count periods are based on capturing the actual peak hours within these periods.

All volumes will be summarized on a schematic figure.

The summarized traffic volumes will be submitted to ODOT for approval. ODOT will coordinate with Central Office for certification and approval of the volumes.

It is assumed that automatic traffic recorder (ATR) vehicular volume counts are not required for this project and are not included in this scope of work.

Site Inventory A site inventory will be performed at each intersection indicating the existing geometry, traffic control devices and intersection data. This information will consist of information such as:

1. Widths of roadways
2. Distances between intersections
3. Turning bay lengths
4. Lane configurations
5. Approximate grades of approach roadways
6. Existing traffic signal phasing and timings

A site inventory form will be produced for each of the above listed intersections summarizing the collected information.

~~**Volume Distribution** After approval of the exiting traffic volumes are received, the existing volumes will be re-distributed along the surrounding roadway network to accommodate the following construction scenario:~~

~~1.Construct the Fleet Avenue and Grant Avenue bridges during the initial stage. Close the Fleet Avenue and Grant Avenue bridges over I-77. The I-77 northbound off ramp at Fleet Avenue will be closed during this stage. However, the signal will remain in operation at this intersection to accommodate Independence Road and 49th Street traffic. The traffic that~~

~~typically travels through the closed roadway areas will be distributed to adjacent roadway and interchange areas.~~

~~2.Construct the Harvard Avenue bridge during the following stage. Close Harvard Avenue bridge over I-77. The traffic that typically travels over the Harvard Avenue bridge will be distributed to adjacent interchange areas.~~

~~These re-distributed existing volumes will be used to analyze the traffic operations during construction.~~

~~**Capacity Analysis** Synchro computer software will be used to evaluate the traffic capacity of the following study intersections:~~

~~1.Fleet Avenue & I-77 northbound on/off ramps / 49th Street / Independence Road~~
~~2.Fleet Avenue & Washington Park Boulevard (49th Street) / Crete Avenue~~
~~3.Independence Road / Crete Avenue & I-77 southbound off-ramp~~

~~The results of the analyses will be described in terms of level of service. The capacity analysis will evaluate the intersection traffic operation efficiency given the conditions. Also, the analysis will determine the appropriate signal timings, phasing and sequencing during construction. Capacity analyses for the AM, Mid-Day and PM weekday peak hours will be conducted for the Aduring construction≅ condition only. Capacity analyses for existing conditions, opening day conditions and design year conditions are not included as part of this scope of work.~~

~~The most effective signal timings and phasing will be determined for each intersection.~~

Field Survey: ***(task is complete)***

The following field Survey information will be obtained for this project:

- Establish Baselines, Centerline of ROW, Alignment of Fleet Ave., and the Alignment of the I-77 Ramps
- Reference Ties
- Cross Sections (4 per structure) on I-77
- Cross Sections at 50' intervals on Fleet Avenue and Ramps to 50' beyond ROW
- Sanitary Sewer and Drainage Structure Survey
- Full Topo Survey above bridge on Fleet Avenue and ramps including buildings
- Full Topo Survey under bridge on I-77
- Aerial Mapping Topo Editing
- Fleet Avenue Interchange Ramps – three
- Set two (2) Benchmarks for each bridge replacement
- Provide Survey Ties back to existing monumentation for all benchmarks and bridge control survey points

- Vertical Clearances at Lane Lines at the fascia of each bridge
- Bridge Substructures, Piers, Face of Abutments

The limits of the field survey are defined by the areas submitted to District personnel.

Right-of –Way: ***(task is complete)***

Existing property information in and around the area of this bridge will be gathered and shown in the base mapping to evaluated potential property impacts.

Bridge: ***(task is ongoing)***

A bridge Type Study will be prepared for the Fleet Avenue crossing over I-77 with the following constraints:

- ~~Detour traffic during construction.~~ *Part-width construction / maintain 1 lane of traffic in each direction during construction.*
- Maintain 3-lanes of traffic an I-77.
- Provide for a ~~preferred 76'-0" or a minimum of 70'-0"~~ *single span of 127'-6"* (measured perpendicular to centerline of I-77) toe of ~~median~~ *abutment* barrier to toe of abutment barrier on I-77 below the bridge. *(130'-0" face to face of abutments)*
- Provide a minimum vertical clearance of 16'-0" in each direction.
- Maintain existing ramp horizontal alignment.
- Provide new structure with 52' (f/f curbs) wide roadway, two- eight-foot sidewalks, 18-inch wide splash barriers and a 6'-0" high vandal protective fence atop concrete parapets. *The parapets will be connected to the deck to accommodate potential future removal of the sidewalks for bike-lanes.*
- ~~The feasibility of reusing the pier footings will be investigated.~~
- Type study will consider using high performance steel (70 KSI), and prestressed concrete I-beams, *and a tied down steel superstructure. The recommended superstructure will be founded on full height abutments with cast-in-place piles, full height abutments with spread footings, or full height abutments with drilled shafts.*

The Bridge Type Study will be combined with the Grant Avenue and Harvard Avenue Type Studies and submitted to ODOT for approval, prior to commencing with TS&L plan development.

Subsurface Investigations: ***(task is complete)***

Three structural test boring will be conducted in the vicinity of the existing bridge. One boring will be performed behind each of the existing abutment , and one along the center median of I-77 near the existing pier.

Two roadway borings will be conducted, one west of the bridge and one east of the bridge, in the existing roadway. These boring will be advanced 10 feet to obtain subsurface data for the design of the pavement, as well as to determine existing pavement composition.

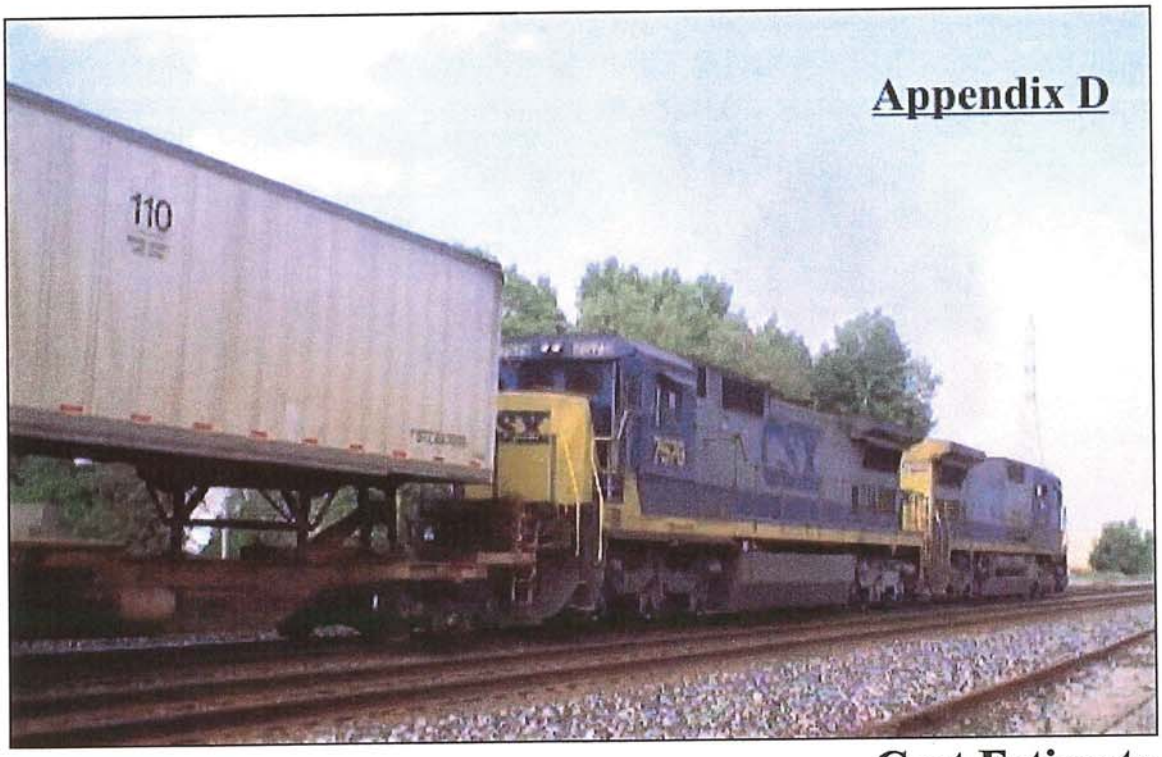
Type Study Deliverables: (task is ongoing)

- *Narrative*
- *Construction Cost Comparison*
- *Foundation Recommendations*
- *Geotechnical Report*
- *Clearance Narrative*
- *Site Plan*
- *Abutment Section*
- *Superstructure Alternatives*
- *Transverse Section*

Stage I Plan Submittal *Deliverables*: *(task is ongoing)*

Upon approval of the Bridge Type Study, Stage I plans will be developed. The anticipated plan sheets for the Stage I submission include:

- Plan & Profile Sheets (2 sheets)
- *Conceptual M.O.T. (2 sheets)*
- *Preliminary Traffic Control Plan*
- Typical Sections
- *Approach Slab Plan*
- Bridge Site Plan
- *Removal Details*
- *Abutment Section*
- *Semi-Integral Diaphragm Section*
- Transverse Section
- *Framing Plan*
- Miscellaneous Details



Cost Estimate

Cost Estimate - Detour Alternates

Item	Unit	Unit Price	Detour					
			Deck Girder		Through Girder		Truss	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Deck Girder	S.F.	$450.00	8139	$3,662,550.00				
Through Girder	S.F.	$630.00			9156	$5,768,280.00		
Truss	S.F.	$810.00					13371	$10,830,510.00
Structure Removal	S.F.	$30.00	7450	$223,500.00	7450	$223,500.00	7450	$223,500.00
Mainline Tracks	T.F.	$125.00	4610	$576,250.00	1400	$175,000.00	1600	$200,000.00
Yard Tracks	T.F.	$100.00	1806	$180,600.00	511	$51,100.00	511	$51,100.00
Track Removal	T.F.	$15.00	7706	$115,590.00	1911	$28,665.00	1911	$28,665.00
Main Track Switch	Each	$100,000.00	1	$100,000.00	0	$0.00	0	$0.00
Main Track Signal	Each	$100,000.00	0	$0.00	0	$0.00	0	$0.00
Yard Track Switch	Each	$75,000.00	3	$225,000.00	1	$75,000.00	1	$75,000.00
Ballast	Ton	$22.00	157	$3,454.00	22	$484.00	22	$484.00
Subballast	Ton	$22.00	157	$3,454.00	22	$484.00	22	$484.00
Embankment	C.Y.	$6.00	0	$0.00	0	$0.00	0	$0.00
Cut & Throws - Main	Each	$50,000.00	4	$200,000.00	4	$200,000.00	4	$200,000.00
Cut & Throws - Yard	T.F.	$50.00	4	$200.00	2	$100.00	2	$100.00
Inspection	Lump Sum	$150,000.00	1	$150,000.00	1	$150,000.00	1	$150,000.00
Flagging	Day	$600.00	8	$4,800.00	6	$3,600.00	6	$3,600.00
Relocate Pole HTW	Each	$200,000.00	0	$0.00	0	$0.00	0	$0.00
HBD (estimated)	Each	$500,000.00	0	$0.00	0	$0.00	0	$0.00
Total Construction Estimate				**$5,500,000.00**		**$6,700,000.00**		**$11,800,000.00**
				+ CSXT cost to detour trains during construction		**+ CSXT cost to detour trains during construction**		**+ CSXT cost to detour trains during construction**

Cost Estimate – Permanent Relocation Alternates

Item	Unit	Unit Price	Permanent Relocation					
			Deck Girder		Through Girder		Truss	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Deck Girder	S.F.	$450.00	8139	$3,662,550.00				
Through Girder	S.F.	$630.00			9156	$5,768,280.00		
Truss	S.F.	$810.00					13371	$10,830,510.00
Structure Removal	S.F.	$30.00	7450	$223,500.00	7450	$223,500.00	7450	$223,500.00
Mainline Tracks	T.F.	$125.00	8416	$1,052,000.00	9416	$1,177,000.00	9616	$1,202,000.00
Yard Tracks	T.F.	$100.00	3431	$343,100.00	3431	$343,100.00	3431	$343,100.00
Track Removal	T.F.	$15.00	12847	$192,705.00	12847	$192,705.00	12847	$192,705.00
Main Track Switch	Each	$100,000.00	1	$100,000.00	1	$100,000.00	1	$100,000.00
Main Track Signal	Each	$100,000.00	1	$100,000.00	1	$100,000.00	1	$100,000.00
Yard Track Switch	Each	$75,000.00	3	$225,000.00	3	$225,000.00	3	$225,000.00
Ballast	Ton	$22.00	277	$6,094.00	277	$6,094.00	277	$6,094.00
Subballast	Ton	$22.00	277	$6,094.00	277	$6,094.00	277	$6,094.00
Embankment	C.Y,	$6.00	275000	$1,650,000.00	275000	$1,650,000.00	275000	$1,650,000.00
Cut & Throws - Main	Each	$50,000.00	4	$200,000.00	4	$200,000.00	4	$200,000.00
Cut & Throws - Yard	T.F.	$50.00	4	$200.00	4	$200.00	4	$200.00
Inspection	Lump Sum	$150,000.00	1	$150,000.00	1	$150,000.00	1	$150,000.00
Flagging	Day	$600.00	8	$4,800.00	8	$4,800.00	8	$4,800.00
Relocate Pole HTW	Each	$500,000.00	1	$200,000.00	1	$200,000.00	1	$200,000.00
HBD (estimated)	Each	$500,000.00	1	$500,000.00	1	$500,000.00	1	$500,000.00
Total Construction Estimate				**$8,700,000.00**		**$10,900,000.00**		**$16,000,000.00**

Cost Estimate – Temporary Full Width Remove Temporary Half Alternates

Item	Unit	Unit Price	Temporary Full Width Remove Temporary Half					
			Deck Girder		Through Girder		Truss	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Deck Girder	S.F.	$450.00	16278	$7,325,100.00	8139	$3,662,550.00	8139	$3,662,550.00
Through Girder	S.F.	$630.00			9156	$5,768,280.00		
Truss	S.F.	$810.00					13371	$10,830,510.00
Structure Removal	S.F.	$30.00	15600	$468,000.00	16396	$491,880.00	19378	$581,340.00
Mainline Tracks	T.F.	$125.00	11245	$1,405,625.00	6835	$854,375.00	7035	$879,375.00
Yard Tracks	T.F.	$100.00	6912	$691,200.00	5472	$547,200.00	5472	$547,200.00
Track Removal	T.F.	$15.00	11007	$165,105.00	11307	$169,605.00	11307	$169,605.00
Main Track Switch	Each	$100,000.00	2	$200,000.00	2	$200,000.00	2	$200,000.00
Main Track Signal	Each	$100,000.00	2	$200,000.00	2	$200,000.00	2	$200,000.00
Yard Track Switch	Each	$75,000.00	6	$450,000.00	6	$450,000.00	6	$450,000.00
Ballast	Ton	$22.00	424	$9,328.00	424	$9,328.00	424	$9,328.00
Subballast	Ton	$22.00	424	$9,328.00	424	$9,328.00	424	$9,328.00
Embankment	C.Y,	$6.00	250000	$1,500,000.00	250000	$1,500,000.00	250000	$1,500,000.00
Cut & Throws - Main	Each	$50,000.00	8	$400,000.00	8	$400,000.00	8	$400,000.00
Cut & Throws - Yard	T.F.	$50.00	10	$500.00	10	$500.00	10	$500.00
Inspection	Lump Sum	$150,000.00	1	$150,000.00	1	$150,000.00	1	$150,000.00
Flagging	Day	$600.00	18	$10,800.00	18	$10,800.00	18	$10,800.00
Relocate Pole HTW	Each	$500,000.00	0	$0.00	0	$0.00	0	$0.00
HBD (estimated)	Each	$500,000.00	1	$500,000.00	1	$500,000.00	1	$500,000.00
Total Construction Estimate				**$13,500,000.00**		**$15,000,000.00**		**$20,200,000.00**

Cost Estimate – Temporary Roll In Alternates

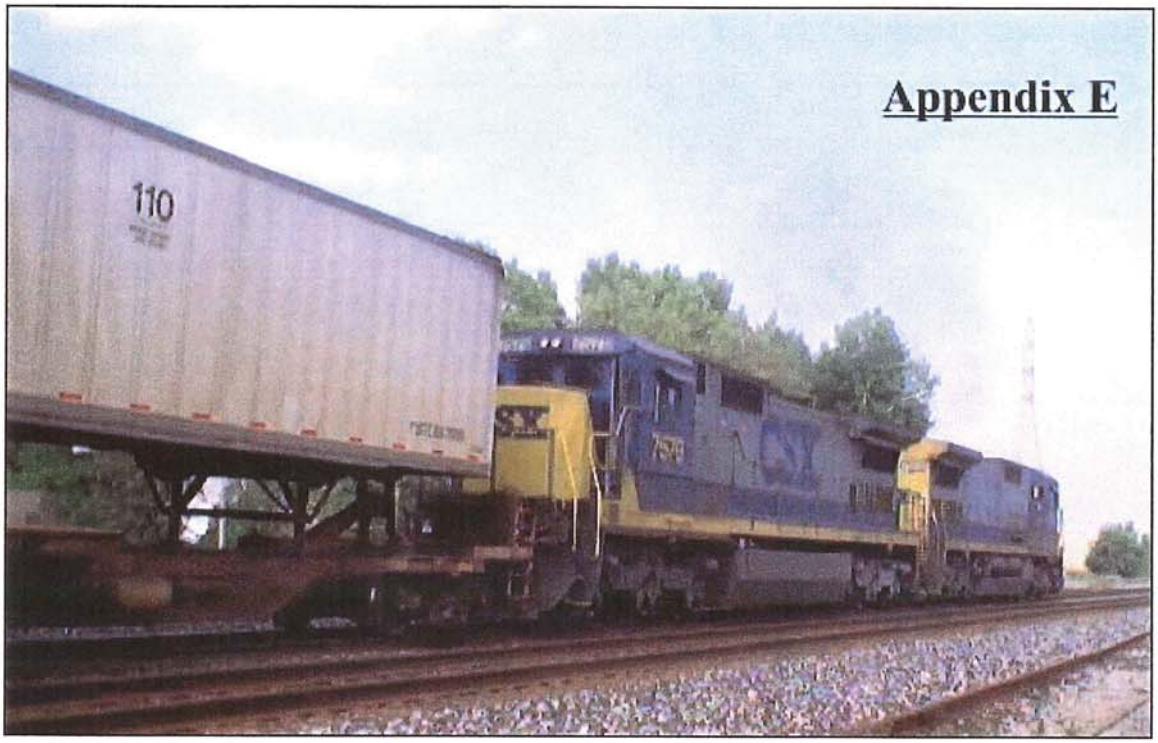
Item	Unit	Unit Price	Temporary Roll In					
			Deck Girder		Through Girder		Truss	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Deck Girder	S.F.	$450.00	8139	$3,662,550.00				
Through Girder	S.F.	$630.00			9156	$5,768,280.00		
Truss	S.F.	$810.00					13371	$10,830,510.00
Structure Removal	S.F.	$30.00	7450	$223,500.00	7450	$223,500.00	7450	$223,500.00
Mainline Tracks	T.F.	$125.00	11245	$1,405,625.00	6835	$854,375.00	7035	$879,375.00
Yard Tracks	T.F.	$100.00	6912	$691,200.00	5472	$547,200.00	5472	$547,200.00
Track Removal	T.F.	$15.00	11007	$165,105.00	11307	$169,605.00	11307	$169,605.00
Main Track Switch	Each	$100,000.00	2	$200,000.00	2	$200,000.00	2	$200,000.00
Main Track Signal	Each	$100,000.00	2	$200,000.00	2	$200,000.00	2	$200,000.00
Yard Track Switch	Each	$75,000.00	6	$450,000.00	6	$450,000.00	6	$450,000.00
Ballast	Ton	$22.00	424	$9,328.00	424	$9,328.00	424	$9,328.00
Subballast	Ton	$22.00	424	$9,328.00	424	$9,328.00	424	$9,328.00
Embankment	C.Y,	$6.00	250000	$1,500,000.00	250000	$1,500,000.00	250000	$1,500,000.00
Cut & Throws - Main	Each	$50,000.00	8	$400,000.00	8	$400,000.00	8	$400,000.00
Cut & Throws - Yard	T.F.	$50.00	10	$500.00	10	$500.00	10	$500.00
Inspection	Lump Sum	$150,000.00	1	$150,000.00	1	$150,000.00	1	$150,000.00
Flagging	Day	$600.00	18	$10,800.00	18	$10,800.00	18	$10,800.00
Relocate Pole HTW	Each	$500,000.00	0	$0.00	0	$0.00	0	$0.00
HBD (estimated)	Each	$500,000.00	1	$500,000.00	1	$500,000.00	1	$500,000.00
Total Construction Estimate				**$9,600,000.00**		**$11,000,000.00**		**$16,100,000.00**

Cost Estimate – Temporary Part-Width Construction Alternates

Item	Unit	Unit Price	Temporary Part-Width Construction Deck Girder	
			Quantity	Item Cost
Deck Girder	S.F.	$450.00	15406	$6,932,700.00
Through Girder	S.F.	$630.00		
Truss	S.F.	$810.00		
Structure Removal	S.F.	$30.00	7450	$223,500.00
Mainline Tracks	T.F.	$125.00	11245	$1,405,625.00
Yard Tracks	T.F.	$100.00	6912	$691,200.00
Track Removal	T.F.	$15.00	11007	$165,105.00
Main Track Switch	Each	$100,000.00	2	$200,000.00
Main Track Signal	Each	$100,000.00	2	$200,000.00
Yard Track Switch	Each	$75,000.00	6	$450,000.00
Ballast	Ton	$22.00	424	$9,328.00
Subballast	Ton	$22.00	424	$9,328.00
Embankment	C.Y,	$6.00	250000	$1,500,000.00
Cut & Throws - Main	Each	$50,000.00	8	$400,000.00
Cut & Throws - Yard	T.F.	$50.00	10	$500.00
Inspection	Lump Sum	$150,000.00	1	$150,000.00
Flagging	Day	$600.00	18	$10,800.00
Relocate Pole HTW	Each	$500,000.00	0	$0.00
HBD (estimated)	Each	$500,000.00	1	$500,000.00
Total Construction Estimate				**$12,900,000.00**

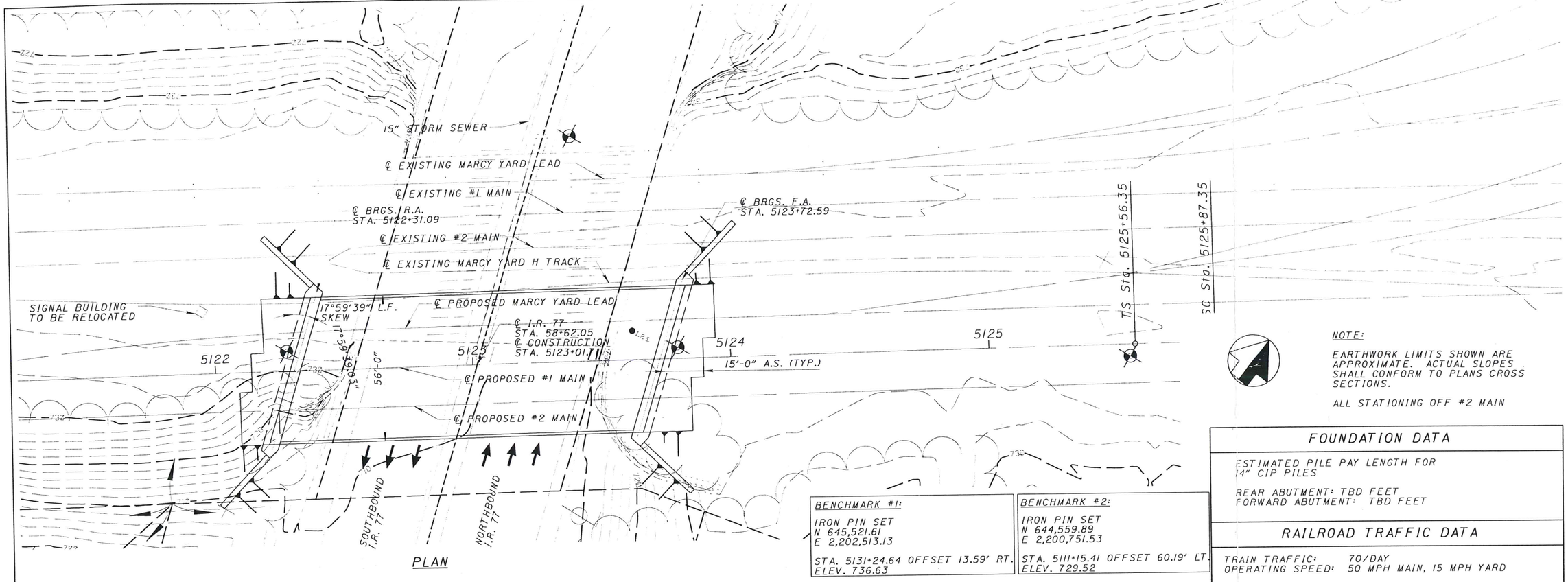
Cost Estimate – Alternate Summary

Alternate		Structure Type	Total Construction Cost
Detour		Deck Girder	$5,500,000.00 + CSXT cost to detour trains during construction
Detour		Through Girder	$6,700,000.00 + CSXT cost to detour trains during construction
Detour		Truss	$11,800,000.00 + CSXT cost to detour trains during construction
Permanent		Deck Girder	$8,700,000.00
Permanent		Through Girder	$10,900,000.00
Permanent		Truss	$16,000,000.00
Temporary	Temporary Full Width Remove Half	Deck Girder	$13,500,000.00
Temporary	Temporary Full Width Remove Half	Through Girder	$15,000,000.00
Temporary	Temporary Full Width Remove Half	Truss	$20,200,000.00
Temporary	Roll In	Deck Girder	$9,600,000.00
Temporary	Roll In	Through Girder	$11,000,000.00
Temporary	Roll In	Truss	$16,100,000.00
Temporary	Part-Width Construction	Deck Girder	$12,900,000.00

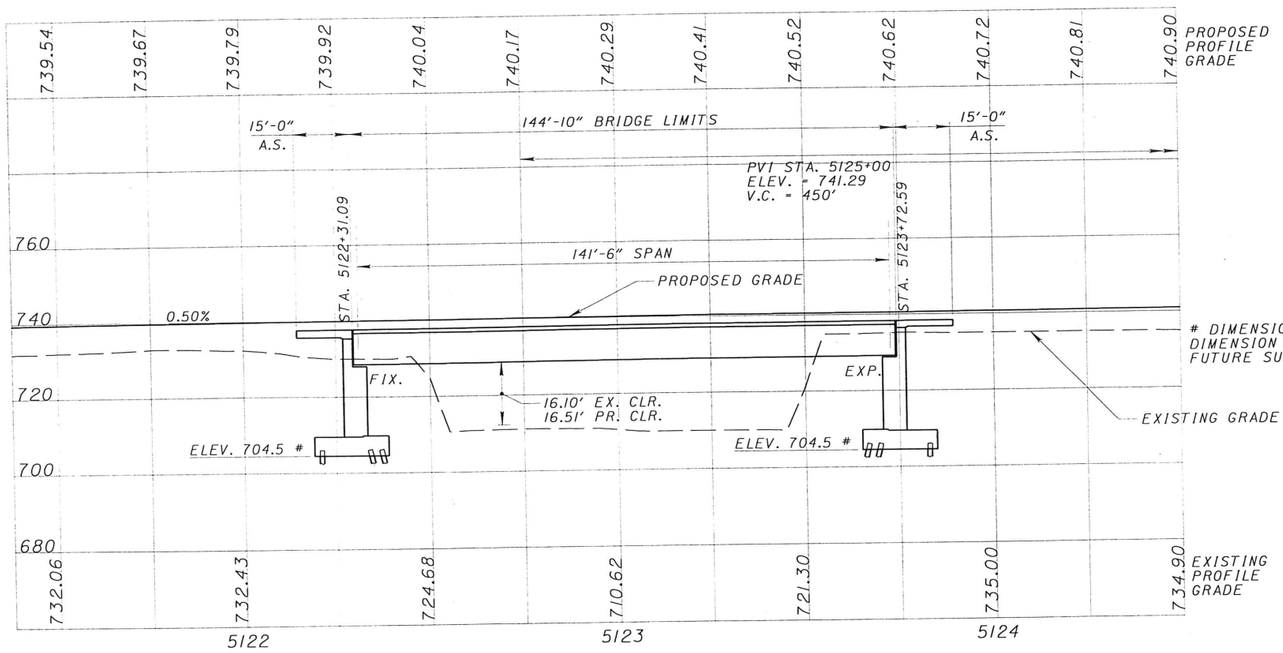


Appendix E

Preliminary Plan Sheets



PLAN



TOP OF RAIL PROFILE CSXT #1 MAIN

DIMENSION OR LENGTH IS APPROXIMATE DIMENSION WILL BE FINALIZED IN FUTURE SUBMISSIONS

LEGEND:

A.S. = APPROACH SLAB
ELEV. = ELEVATION
F.A. = FORWARD ABUTMENT
O/O = OUT TO OUT
R.A. = REAR ABUTMENT
TBD = TO BE DETERMINED

PROPOSED PILE TIP ELEVATIONS:

R.A. TBD
PIER TBD
F.A. TBD

PRELIMINARY

BENCHMARK #1:

IRON PIN SET
N 645,521.61
E 2,202,513.13

STA. 5131+24.64 OFFSET 13.59' RT.
ELEV. 736.63

BENCHMARK #2:

IRON PIN SET
N 644,559.89
E 2,200,751.53

STA. 5111+15.41 OFFSET 60.19' LT.
ELEV. 729.52

FOUNDATION DATA

ESTIMATED PILE PAY LENGTH FOR 14" CIP PILES

REAR ABUTMENT: TBD FEET
FORWARD ABUTMENT: TBD FEET

RAILROAD TRAFFIC DATA

TRAIN TRAFFIC: 70/DAY
OPERATING SPEED: 50 MPH MAIN, 15 MPH YARD

EXISTING STRUCTURE

SFN: 1806270

TYPE: TWO-SPAN SIMPLY SUPPORTED STEEL GIRDER WITH BALLASTED REINFORCED CONCRETE DECK AND SUBSTRUCTURE

SPANS: 48'-7 3/16", 48'-7 3/16" C/C BEARINGS

ROADWAY: VARIES

LOADING: E-72

ALIGNMENT: TANGENT

SKEW: 18°24'± DATE BUILT: 1942

PROPOSED STRUCTURE

TYPE: SINGLE-SPAN SIMPLY SUPPORTED STEEL GIRDER WITH BALLASTED REINFORCED CONCRETE DECK AND SUBSTRUCTURE

SPAN: 141'-6" #

ROADWAY: 56'-0" FACE TO FACE PARAPET

LOADING: COOPER E-80 WITH FULL DIESEL IMPACT AND ALTERNATE LIVE LOAD ON THE COMPOSITE SECTION COOPER E-65 WITH FULL DIESEL IMPACT FOR STEEL ALONE

ALIGNMENT: TANGENT

APPROACH SLABS: 15'

SKEW: 17°59'39" L.F.

SUPERELEVATION: NONE

LATITUDE: N 41°26'03" LONGITUDE: W 81°38'52"

Baker

DESIGNED	DRAWN	REVIEWED	DATE
MKB	MKB		
CHECKED	REVISED	STRUCTURE FILE NUMBER	
SCT		TO BE ASSIGNED	

CUYAHOGA CO.
STA. 5122+31.09
STA. 5123+72.59

SITE PLAN
BRIDGE NO. CUY-77-1111
INTERSTATE ROUTE 77 UNDER CSXT

CUY-77-11.11
VARIOUS

1

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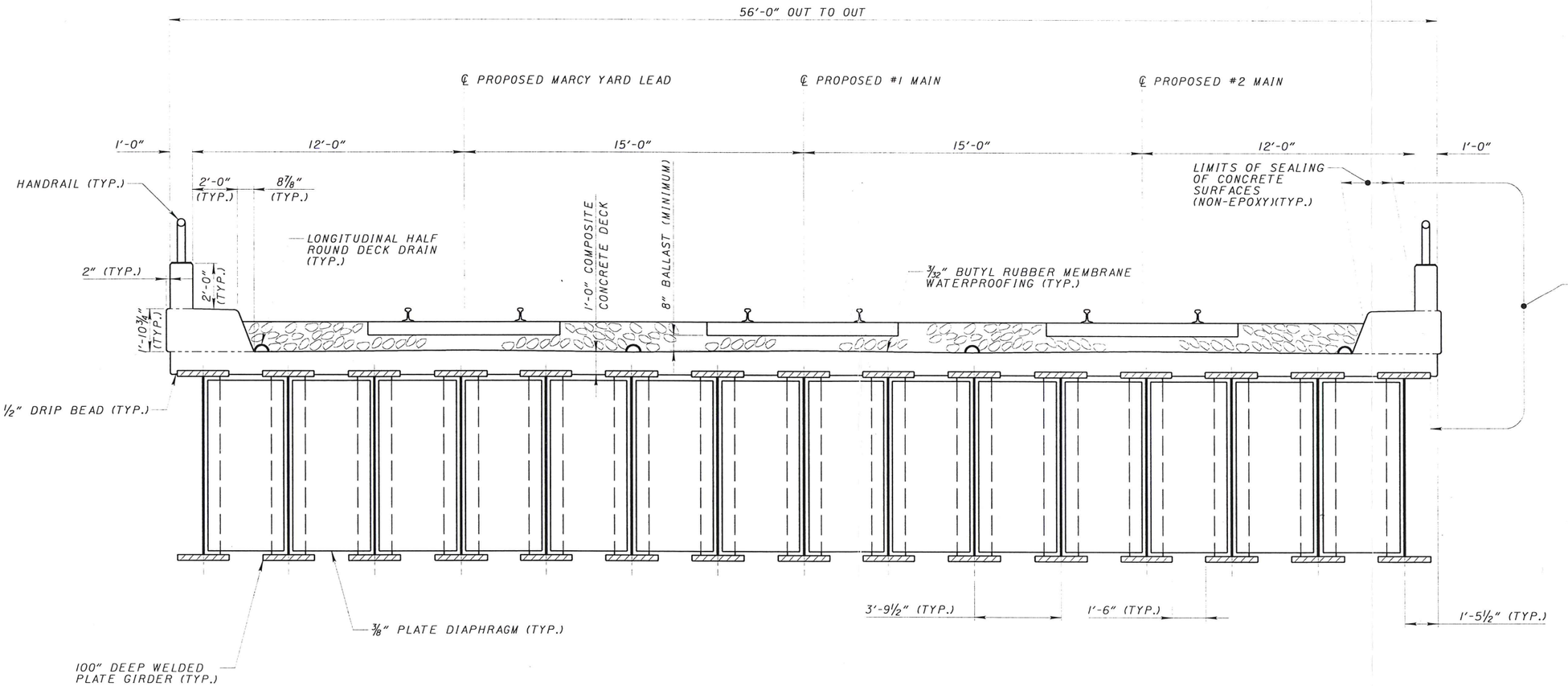

TRANSVERSE SECTION

PERMANENT RELOCATION OPTION

PRELIMINARY

NOTES:

PROVIDE A 1" CROWN AT THE CENTERLINE OF EACH TRACK AND SLOPE DECK TOWARDS HALF ROUND LONGITUDINAL DECK DRAIN.

PROVIDE 3/32" BUTYL RUBBER MEMBRANE WATERPROOFING ON ENTIRE DECK AND BALLAST RETAINERS.

DESIGN AGENCY
Baker
2100 EAST NINTH STREET, SUITE 500
CLEVELAND, OHIO 44115

REVISED	DATE	STRUCTURE FILE NUMBER
		TO BE ASSIGNED

DRAWN	REVISED
MKB	

DESIGNED	CHECKED
MKB	SCT

TRANSVERSE SECTION
BRIDGE NO. CUY-77-1111
I.R. 77 UNDER CSXT RAILROAD

CUY-77-11.11/
VARIOUS

7

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