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SCI-823-0.00

PID No. 77366

US 52 RAMP A OVER OHIO RIVER RD (CR 503)

PRELIMINARY DESIGN REPORT SUBMITTAL

Prepared for:

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

**JANUARY 14, 2008** 

Prepared by:





### **TranSystems**

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January 14, 2008

Mr. Jawdat Siddiqi, PE Office of Structural Engineering Ohio Department of Transportation 1980 W. Broad Street Columbus, Ohio 43223

SUBJECT:

**Preliminary Design Report Submittal** 

US 52 Ramp A over Ohio River Road (CR 503)

SCI-823-0.00 Portsmouth Bypass

PID#77366

Dear Mr. Siddigi:

Submitted for review and comment is the Preliminary Design Report for US 52 Ramp A over Ohio River Road (CR 503). Included are The TS&L drawings and the Final Geotechnical Report by DLZ, Ohio, dated June 1, 2007. Please find below our disposition to the January 9, 2007 comments by Jeff Crace, PE regarding the STS submittal.

1) We agree that the superstructure should consist of two continuous steel plate girders (A709 grade 50W) made composite with the reinforced concrete deck. The substructure should consist of stub abutments supported on piling with mechanically stabilized embankment and a single integral straddle bent pier.

This structure type has been carried forward to the attached submittal.

We recommend that pier cap option Alternate 3d (integral built-up steel I-shaped option) be utilized for the straddle bent pier. Our experience with this type of pier has been positive, for both construction and maintenance. Note: The estimated cost of the four substructure alternates are all within 2%, therefore cost is not a determining factor.

The integral steel built up I shaped straddle bent has been carried forward to the attached submittal

3) Are the dog leg angles at the splice points required? What is the maximum and minimum overhang without the dog leg splices and with the dog leg splices? We are considering not using a dog leg in the beams if possible; please contact us on this issue once the maximum and minimum overhangs are known.

The dog leg angles have been eliminated. The overhang dimensions with straight girders

were discussed and approved by OSE on 1/18/07.

4) The horizontal clearance should be given from the edge of traveled lane to the toe of the barrier rather than to the face of the MSE wall. The horizontal clearance shown for the ramp B structure over C. R. 503 is 10 feet; the clearance for both structures should match.

This has been revised to 10'-0" on both structures.

5) In the Proposed Structure data block describe how the spans are measured (along the centerline, along the reference chord, etc.)

"(ALONG BASELINE RAMP A)" has been added to the Proposed Structure Data block.

6) The piles supporting the abutments should not be prebored into the bedrock based on the conditions at this location. Standard construction practices should be followed, place pile sleeves, construct the embankment, allow any settlement of the in-situ soils to occur, drive the piles and then construct the abutments.

For some previous locations prebored holes were recommended due to the very minimal overburden at the site and the very long pile sleeves that would have been required. Our experience with piles placed through MSE fill leads us to believe that the contractor would have had difficulties in sustaining the pile sleeves in a vertical position while constructing the embankment. The final recommendation for the pile sleeves also required that the piles be placed prior to the embankment placement. This was possible due to fact that there would have been no settlement as the in-situ soils were to be removed.

DLZ has recommended CIP piles prebored into bedrock due to the low overburden. ?

PIER FOUNDATION IS ON SPREAD FOOTING (RIGHT COLUMN)

7) Include note numbers 25 from section 600 of the ODOT Bridge Design Manual.;

A note similar to note 25 except modified modified as follows to be specific to the MSE wall construction is suggested. Construction Constraints: After the footing and breastwall have been constructed, construct the MSE wall embankments up to the beam seat elevation and from the beam seat up on a 1:1 slope to the subgrade elevation prior to constructing the backwall and setting the beams.

- 8) We agree that the proposed abutments should be supported by steel "H" piles. The pile size should be determined based on the capacity required, the pile depth and the effort required to drive the piles. Piles should be driven to refusal on bedrock.
  - H piles have been specified at the rear abutment and CIP piles prebored into the bedrock at the forward. CIP piles are recommended at the forward abutment due to the low overburden (see pg 13 of DLZ's report).
- 9) Provide the following note in the plans "Prior to constructing the abutment, construct the MSE walls and the bridge approach embankment behind the rear

abutment up to the level of the subgrade elevation for a minimum distance of 200 feet behind the rear abutment. Do not begin excavation for the rear abutment footing until after the above required embankment has been constructed and a \_\_ calendar day waiting period has elapsed. The Engineer may adjust the waiting period based on the settlement platform readings."

The consultant should provide the minimum waiting period required based on an evaluation of the in-situ souls, the consolidation rate and the height of embankment required.

Over excavation of the in-situ soils is recommended by DLZ to satisfy bearing capacity requirements. If the over excavation is preformed as recommended the settlement is assumed to be negligible and monitoring will not be necessary. (see pg. 6-7 of DLZ's 6/1/07 report)

10) Please include the following note in the plans.

Settlement monitoring is <u>not</u> recommended by DLZ in their 6/1/07 since over excavation of soft compressible soils is recommended at the rear abutment and the forward abutment is constructed at or near bedrock.

### ITEM SPECIAL-SETTLEMENT PLATFORMS

**Description:** This item consists of furnishing, constructing, and maintaining settlement platforms and obtaining settlement readings as required by the plans or as directed by the Engineer. At the option and expense of the Contractor, additional settlement platforms may be installed at locations approved by the Engineer. Settlement readings shall be taken weekly during construction and during any specified waiting period. The readings shall be plotted on graph paper presenting deformation (on the negative y-axis) and fill height (on the positive y-axis) versus time (on the x-axis). A copy of each cumulative plot shall be sent to the Office of Geotechnical Engineering, Attention: Geotechnical Design Coordinator, after each settlement reading is recorded.

**Materials:** Sound lumber such as 19mm (3/4-inch) exterior grade plywood shall be used for the base. The pipe shall be 64mm (2-1/2-inch) standard black pipe with threaded fittings as shown on the plans. A steel plate 915mm x 915mm x 3.2mm (36" x 36" x 1/8") may be substituted for the lumber for the platforms, at the Contractor's option.

Construction Methods: The platform shall conform to the details shown on the plans. The platform shall be set on a level surface. The pipe shall be firmly secured to the platform and shall be maintained in a plumb position during the placement of the embankment. The pipe shall be marked at intervals to facilitate measurement of the depth of fill. The Contractor shall stop work in any location where the settlement platform has been disturbed or damaged. Platforms or pipes damaged or

displaced during construction shall be restored to their proper condition at the Contractor's expense.

Prior to paving, the top of the settlement platform pipe shall be cut off 600mm (two feet) below the finished surface of the subgrade or finished ground surface, whichever is applicable.

**Method of Measurement:** The number of settlement platforms to be paid for shall be the actual number of settlement platforms completed, maintained, and accepted by the Engineer.

Basis of Payment: Payment shall be made at the contract unit price each for "Item Special — Settlement Platforms" which is compensation for constructing maintaining, and monitoring the settlement platforms including furnishing all labor, equipment, materials, and incidentals necessary to complete the work. Payment shall not be made for settlement platforms which become useless due to damage caused by the Contractor's operations.

(Note: The attached plan detail must accompany this note.)

## SETTLEMENT PLAFORM NOT TO SCALE 3, -0. 3,-0. 3' X 3' X1/8' 3/4" EXTERIOR GRADE PLYWOOD Ġ 2-1/2" STD. BLACK PIPE CAP -2-1/2" STD. BLACK PIPE THREADED BOTH ENDS - SERIES 15 SCREW END FLANCE -**WASHERS** NOTES: I. SETTLEMENT PLATFORMS SHALL BE PLACED AT THE LOCATION INDICATED IN THE PLANS, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. 3. CONTRACTOR SHALL FURNISH MATERIALS AND LABOR TO EXTEND PIPE UP THROUGH ENTIRE FILL. 4. SETTLEMENT PLATFORMS SHALL BE ANCHORED BY STAKES DRIVEN AT EACH CORNER TO PREVENT OVERTURNING. 2. CONTRACTOR HAS OPTION OF USING EITHER STEEL OR PLYWOOD PLATFORM BASE, DATE: 5-11-1999 W:/Geotech/settnew.dgn 01/17/03 03:19:07 PM

Please don't hesitate to call me or Dr. Michael Lenett (513 621 1981) if there are any questions.  Sincerely,
Michael D. Weeks, P.E., P.S.
Project Manager
Cc: T. Barnitz, P.E.

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### PRELIMINARY DESIGN REPORT

### 1. Introduction

TranSystems is providing engineering services to the Ohio Department of Transportation for the design of new overpass structures that will carry the proposed S.R. 823 ramps over Ohio River Road at the U.S. 52 interchange. This bridge preliminary design report will address the overpass structure on Ramp A, which carries traffic from westbound U.S. 52 to northbound S.R. 823. As requested by the Scope of Services, a Preliminary Design Report is to be submitted as part of Step 8 of the Major PDP process. The purpose of this report is to summarize the structure type selected for final design. A revised Type Study was submitted on October 31, 2006 to incorporate the updated roadway geometry. Following the submittal of the Type Study ODOT requested that hybrid girders and straddle bent piers be investigated for use at this structure. Addendums were prepared to the 10/31/06 Type Study to address these options. Comments were received January 9, 2007 and are incorporated into this submittal.

### 2. Design Criteria

The proposed structure types are designed according to the current version of the Ohio Department of Transportation Bridge Design Manual and the 2002 AASHTO Standard Specifications for Highway Bridges, 17th Edition. Horizontal clearances (clear zone width and horizontal sight distance) and vertical clearances are based on the Ohio Department of Transportation Location and Design Manual, Volume One – Roadway Design.

### 3. Subsurface Conditions and Foundation Recommendation

DLZ Ohio, Inc. performed the subsurface exploration for the proposed Ramp A and prepared bridge foundation recommendations in their report dated June 1, 2007.

In summary, five test borings (B-33, B-34, B-35, B-36, TR-62 and TR-76) were drilled and all encountered bedrock. The depth to bedrock varied across the site from 2' to 13' below existing ground. All borings encountered cohesive and granular soil deposits from hard silt and clay (A-6a) to very dense gravel with sand and silt (A-2-4).

In summary, DLZ recommends three possible solutions for supporting the Ramp A rear abutment:

- 1) pipe piles placed in prebored holes 12 inches larger than the diameter of the pile and a minimum of 5' deep into bedrock;
- 2) drilled shafts socketed a minimum of 5' into competent bedrock; and,
- 3) driven H-piles bearing on bedrock.

DLZ recommends two possible solutions for supporting the Ramp A forward abutment:

- 1) pipe piles placed in prebored holes 12 inches larger than the diameter of the pile and a minimum of 5' deep into bedrock; and,
- 2) drilled shafts socketed a minimum of 5' into competent bedrock.

DLZ recommends that the left pier column be supported on one of the following three options:

- 1) Spread footing bearing on rock,
- 2) Steel H-piles driven to refusal on bedrock; and,
- 3) Single drilled shaft embedded into bedrock.

The recommendation is the same for the right pier column except that driven piles are not feasible due to the shallow depth of bedrock.



MSE wall evaluations were performed by DLZ Ohio, Inc. as well and are presented in 6/1/07 report. The MSE walls were evaluated with respect to bearing capacity, sliding, overturning, global stability and settlement. These wall evaluations reveal that MSE walls can be used at the rear and forward abutment locations. DLZ anticipates that the MSE wall at the forward abutment will bear on bedrock whereas the MSE wall at the rear abutment will bear on compacted granular fill (CMS Item 304). DLZ recommends that a minimum of 4.3' of native soil below the leveling pad, at the rear abutment, be removed and replaced with the compacted granular fill. The under cut is required to satisfy the undrained bearing capacity.

### 4. Roadway

The purpose of this project is to construct a new bypass state route – S.R. 823 – around the town of Portsmouth Ohio. The proposed alignment for S.R. 823 will carry two lanes of traffic, 15 plus miles in either direction, from an interchange with U.S. 52 just east of Portsmouth to another interchange with U.S. 23 north of Portsmouth in Valley Township. The proposed Ramp A bridge over Ohio River Road is part of the U.S. 52-S.R. 823 interchange and will carry northbound traffic from U.S. 52 to S.R. 823. Because this bridge is a ramp bridge, it will consist of one 16'-0" travel lane. The right and left shoulder widths on this bridge will be 8'-0" and 6'-0", respectively. The bridge deck will be 33'-0" out-to-out with 1'-6" right and left straight face deflector parapets (SBR-1-99).

Alignment & Profile: The proposed horizontal geometry for the Ramp A overpass structure is part of a spiral-curve-spiral alignment. The spiral portions of this alignment are well outside the structure limits but will affect the position of the MSE walls at the rear abutment. The parameters that define this alignment are as follows: P.I. = Station 44+55.69,  $\Delta$  (angle of intersection) = 38°05'00" Rt., D<sub>c</sub> (degree of curve) = 2°15'00", R (radius) = 2546.48', L<sub>S1</sub> (length of spiral 1) = 150', L<sub>S2</sub> (length of spiral 2) = 175', Theta 1 = 1°41'15", Theta 2 = 1°58'08", LT1 = 100', LT2 = 116.67, ST1 = 50', ST2 = 58.34', L<sub>C</sub> (length of curve) = 1530.32',Ts1 = 954.36', Ts2 = 966.48', Es (external distance) = 147.91', S.C. = Station 36+51.32, and C.S. = Station 51+81.64. The proposed profile for this same ramp structure is located on the inside edge of pavement which also serves as the baseline construction of Ramp A. This profile lies within a 900' vertical curve with P.V.I. at Station 41+70.00, PVI Elev. = 598.85,  $g_1$  = 5.01% and  $g_2$  = -0.88%.

Because the proposed Ramp A bridge is positioned within a horizontal curve, its deck will be superelevated. The superelevation rate and layout are based on Figure 202-7E of the ODOT Location and Design Manual, Volume One – Roadway Design (using a degree of curve of 2°15' and design speed of 60 mph) and Figure 205 of the ODOT Bridge Design Manual, respectively. Using these design references results in a superelevation rate of 0.056 ft/ft (5.6%) across the ramp travel lane. Furthermore, horizontal and vertical sight distances, in accordance with the design standards, have been provided over the proposed ramp bridge for all alternatives considered. The existing U.S. 52 and Ohio River Road will remain on their current horizontal and vertical alignments.

Several roadways are closely aligned in the proposed U.S. 52-S.R. 823 interchange. These are the existing U.S. 52, the existing Ohio River Road, the proposed Ramp A carrying traffic from westbound U.S. 52 to northbound S.R. 823, and the proposed Ramp B carrying traffic from southbound S.R. 823 to eastbound U.S. 52. The close proximity of these roadways and their differences in elevation at various locations warrant the use of MSE walls to satisfy both grading continuity and safe/proper embankment limits. MSE walls will be required not just along the roadway portions of Ramps A and B, but also at the abutments of the respective overpass structures.

Vertical and Horizontal Clearances –The vertical alignment of the ramp structure is dictated by vertical clearance over existing Ohio River Road. Ohio River Road is classified as an Urban Minor Arterial roadway. According to the ODOT Location and Design Manual, Volume One – Roadway Design, Figure



302-1E, a preferred vertical clearance of 17'-0" (minimum of 16'-6") must be provided over Ohio River Road. The profile has been adjusted since the Type Study submittal to lower elevations and thus reduce construction costs, yet still satisfy vertical clearance requirements. Note that slightly higher clearances are provided at the fracture critical pier caps in use over the roadway. This is similar to the additional clearance provided for a pedestrian bridge over a highway as stipulated in Section 209.10 of the BDM.

Due to the existing and proposed conditions along both edges of Ohio River Road, a horizontal lateral clearance of 11'-8" minimum from edge of traveled way (i.e., edge of traveled lane) to face of obstruction should be maintained. This 11'-8" clearance applies to both edges of Ohio River Road and is derived from the following information:

1. The existing Ohio River Road is classified as an Urban Minor Arterial Street. Field inspection/evaluation of the site identified a posted speed limit of 45 mph. However, Figure 104-2E of the ODOT Location and Design Manual, Volume One — Roadway Design, recommends a design speed of 40-50 mph for an arterial street. Consequently, a design speed of 50 mph is used.;

2. Due to the "urban" conditions at this site, there are no ditches located off of Ohio River Road. In addition, it is intended that Type D barriers will be used/positioned off the sides of Ohio River Road. Using the arterial functional classification for Ohio River Road and a design speed of 50 mph in Figure 301-4E of the ODOT L & D Manual, Volume One (this figure is used to define lane and shoulder widths of urban roadways), the minimum curbed shoulder width for Ohio River Road is 10' which is from edge of traveled lane to toe/face of barrier. Note as well that Figure 302-1E of the ODOT L & D Manual, Volume One points out that for an arterial street, the horizontal lateral clearance under a bridge is a function of Figure 301-4E.

3. Footnote F of Figure 302-1E indicates that, if necessary, the 10' minimum curbed shoulder width may be reduced to 8'. This particular reduction, however, will not take place at the site in question – using a 10' width will ease any future widening of Ohio River Road.

4. According to Figure 302-1E, the horizontal lateral clearance for an arterial street under a new bridge is the sum of the curbed shoulder width (from Figure 301-4E) and barrier clearance. The barrier clearance is obtained from Figure 603-2E of the ODOT L & D Manual, Volume One. For the proposed Type D barriers that are to be used along the outside shoulder edges of Ohio River Road, the minimum barrier clearance is 20" which is also the width of a Type D barrier. Combining the 10' curbed shoulder width and the 20" minimum barrier clearance results in the 11'-8" minimum horizontal clearance.

Drainage De

**Drainage Design** – The profile of the Ramp A overpass structure is on a positive grade and lies within a vertical curve whose high point is beyond the forward abutment. Storm water runoff will drain from this high point towards the bridge. Superelevation due to horizontal curvature will also force drainage toward the right shoulder. However, the skew at which the Ramp A overpass crosses Ohio River Road makes it difficult to position scuppers in the bridge deck, especially along the right shoulder near the rear abutment – scuppers in the bridge deck will drain directly onto Ohio River Road (and its paved shoulders) and any drainage piping/plumbing connected to the bottom of the scuppers cannot be properly supported. Consequently, the collection of storm water runoff will be addressed off the bridge – catch basins will be positioned ahead of the forward abutment to prevent as much runoff as possible from draining onto the structure. Catch basins have been provided outside the limits of the MSE wall supported approach embankments.

**Utilities** - No utilities will be placed on the bridge. However, lighting and ITS conduits will be provided if necessary. An existing waterline on the left side of Ohio River Road will need to be relocated along with an existing underground electrical line on the right side of Ohio River Road



**Maintenance of Traffic** - While the Ramp A overpass is under construction, traffic will be maintained on the existing Ohio River Road. It is anticipated that there will be limited closures during construction, primarily for beam/pier cap setting.

### 5. Proposed Structure Configuration

**Span configuration:** The proposed 2-span structure has span lengths of 116'-85/8" and 116'-85/8" for an overall bridge length of 233'-53/16" which is measured along the baseline construction of Ramp A from centerline bearing rear abutment to centerline bearing forward abutment. The substructures are oriented at a 0°00'00" skew with respect to a reference line that runs from centerline bearing rear abutment to centerline bearing forward abutment. Such a skew is ideal for a horizontally curved structure – it minimizes torsional effects and distortions (and thus differential deflections) on the I-shaped plate girders. MSE walls have been placed to allow for the minimum horizontal clearance using Type D concrete barrier.

### Substructure:

I. <u>Abutments:</u> Abutments will be conventional, or stub-type, at both the rear and forward locations due to the horizontal curvature of the structure. All abutment details will follow ODOT Standard Drawing A-1-69. The forward abutment is founded on 16" diameter pipe piles embedded in 28" diameter rock sockets that are 5' deep into bedrock. The CIP piles with prebored holes were selected due to the low overburden at the location of forward abutment (see DLZ's 6/1/07 report). The rear abutment will be founded on driven HP 14x73 piles, placed in pile sleeves. The abutments are located behind mechanically stabilized earth (MSE) walls and both the abutments and MSE walls are oriented at a 0°00'00" skew with respect to the previously mentioned reference line.

Because the Ramp A overpass is located within a horizontal curve (see Section 4), pipe piles or drilled shafts are best suited to resist any lateral load effects due to this curvature. Furthermore, excessive uplift forces and lateral earth pressures are not anticipated at this site. Based on this information, DLZ's recommendations, and economics, TranSystems consequently believes pipe piles are the best foundation type for the forward abutment and driven H-piles for the rear abutment.

II. Piers: The single pier for the proposed structure cannot be placed on Ohio River Road. Consequently, the pier must be comprised of a cap supported on columns that are positioned off of Ohio River Road. The location of the columns must satisfy the minimum horizontal lateral clearance from edge of traveled lane to face of obstruction using concrete barrier placed at the edge of the 10' shoulders. When both this horizontal lateral clearance and the high skew angle at which the proposed Ramp A bridge crosses Ohio River Road are considered simultaneously, the columns are positioned such that the pier cap must span approximately 60' from centerline of column to centerline of column. To support the superstructure over this 60' span four different type pier cap options were investigated in the addendum to the Type Study. Construction costs for all four of the options presented were very close and ODOT recommended an integral built-up I shaped pier cap based upon their experience with the construction and maintenance of similar caps. Note that a large length of the pier cap will be exposed directly to the elements and potential debris traps are likely to exist at the intersections of the girder and pier cap as well as stiffeners. Consequently, in accordance with FHWA Technical Advisory, Uncoated Weathering Steel in Structures. Grade 50 steel is recommended for use as the integral I-shaped pier caps. Furthermore, using lightly colored contrasting painted steel will also make inspection of the pier cap easier. The girders should be painted a distance of 1 ½ times the depth of the girder to either side of the pier cap.



DLZ has provided recommendations for driven piles, spread footings and single drilled shafts at the left pier. The recommendations at the right pier are similar, however, rock was encountered at a very shallow depth and therefore driven piles are not recommended. Preliminary estimates for each foundation type were calculated and the construction costs estimated. The cost analysis revealed that driven piles had the lowest construction cost at the left pier and a spread footing bearing on rock was the most economical at the right pier. Similar analysis was also preformed at the adjacent US 52 Ramp B structure and driven piles were also recommended at that location. per

Superstructure:

GIRDERS DURING DECK POUR I. Girders and Deck: In order to support an HS-25 (Case I) and Alternate Military Loading as well as a Future Wearing Surface loading of 60 psf, the superstructure for the proposed structure consists of 4-welded steel plate girders, Grade 50W, with 55" deep webs, 18" x 1.00"-1.25" top flanges, and 23" x 1.25" bottom flanges. The plate girders are parallel to the reference chord and the overhang is allowed to vary from 4'-0" to 1'-3" to accommodate the horizontal curvature of the bridge. As shown in the framing plan, the girders are erected with a center-to-center spacing of 9'-3 7/16") The thickness of the deck supported by these girders is 83/4" (which includes a 1" monolithic wearing surface) and deck width is 30'-0" from toe-to-

CHECK ROTATION OF FASCIA

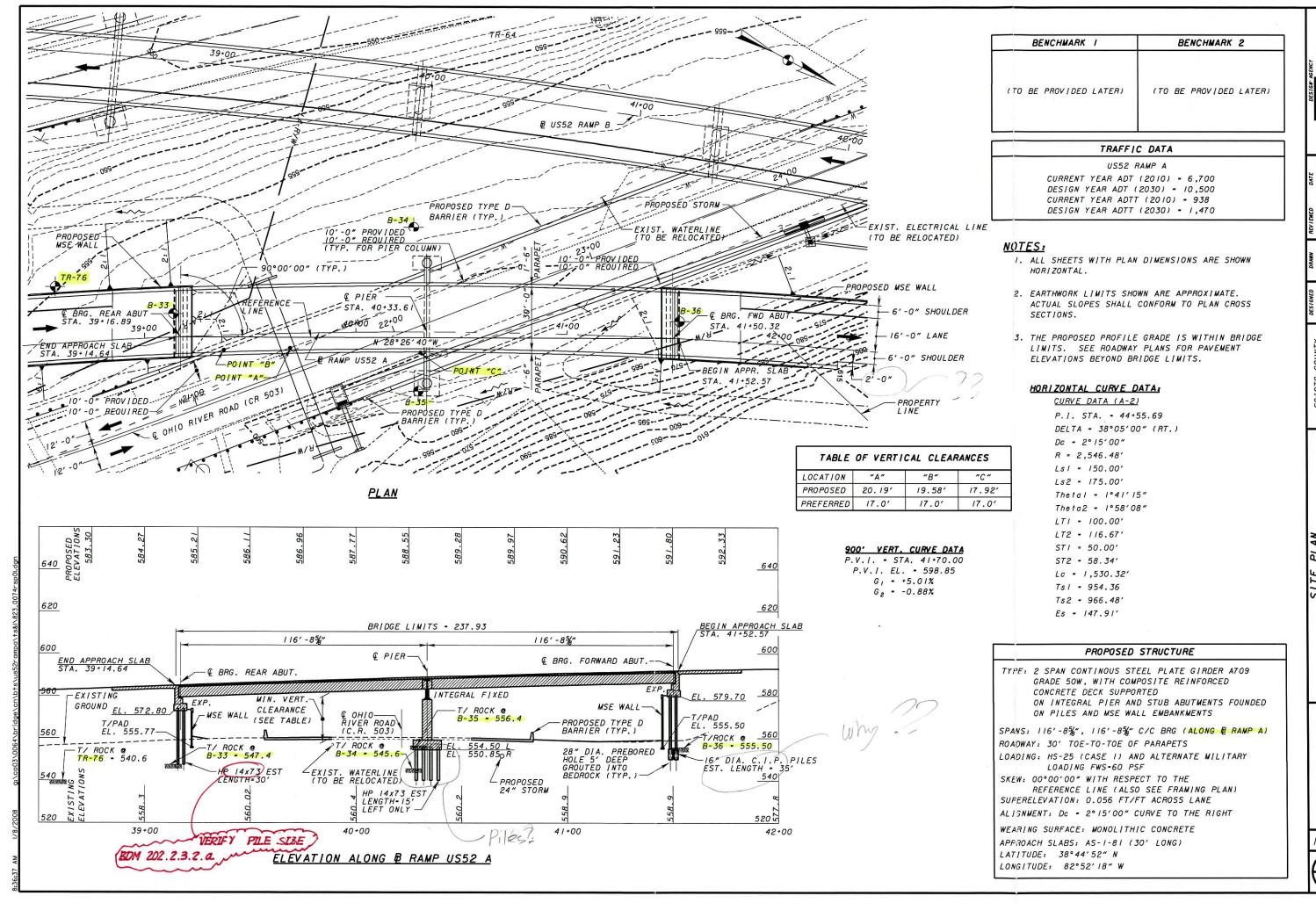
WHY NOT 9'-4" ?

toe of parapet with an overall width of 33'-0".

II. Expansion Devices and Bearings: Since the pier is integral and thus treated as a "fixed" pier, a preliminary evaluation of expansion devices at the abutments uses an expansion length of 116'-85/8". With such a length, Section 306.3.3 of the ODOT Bridge Design Manual and ODOT Standard Drawing EXJ-4-87 reveal that a 3" strip seal expansion joint can be used at both the rear and forward abutment. Note that this result is based on a preliminary evaluation of the bridge system and does not account for horizontal curvature effects. Furthermore, AASHTO Method A reveals that laminated elastomeric bearings can support the vertical reactions, horizontal displacements, and rotational displacements at the abutments due to applied dead and live loads. Accordingly, laminated elastomeric bearings are recommended as the bearing type.







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DESIGN AGENCY

TEAM Systems

STATE PRINCES SOITE 240

BORLIN, DIPLO 43017

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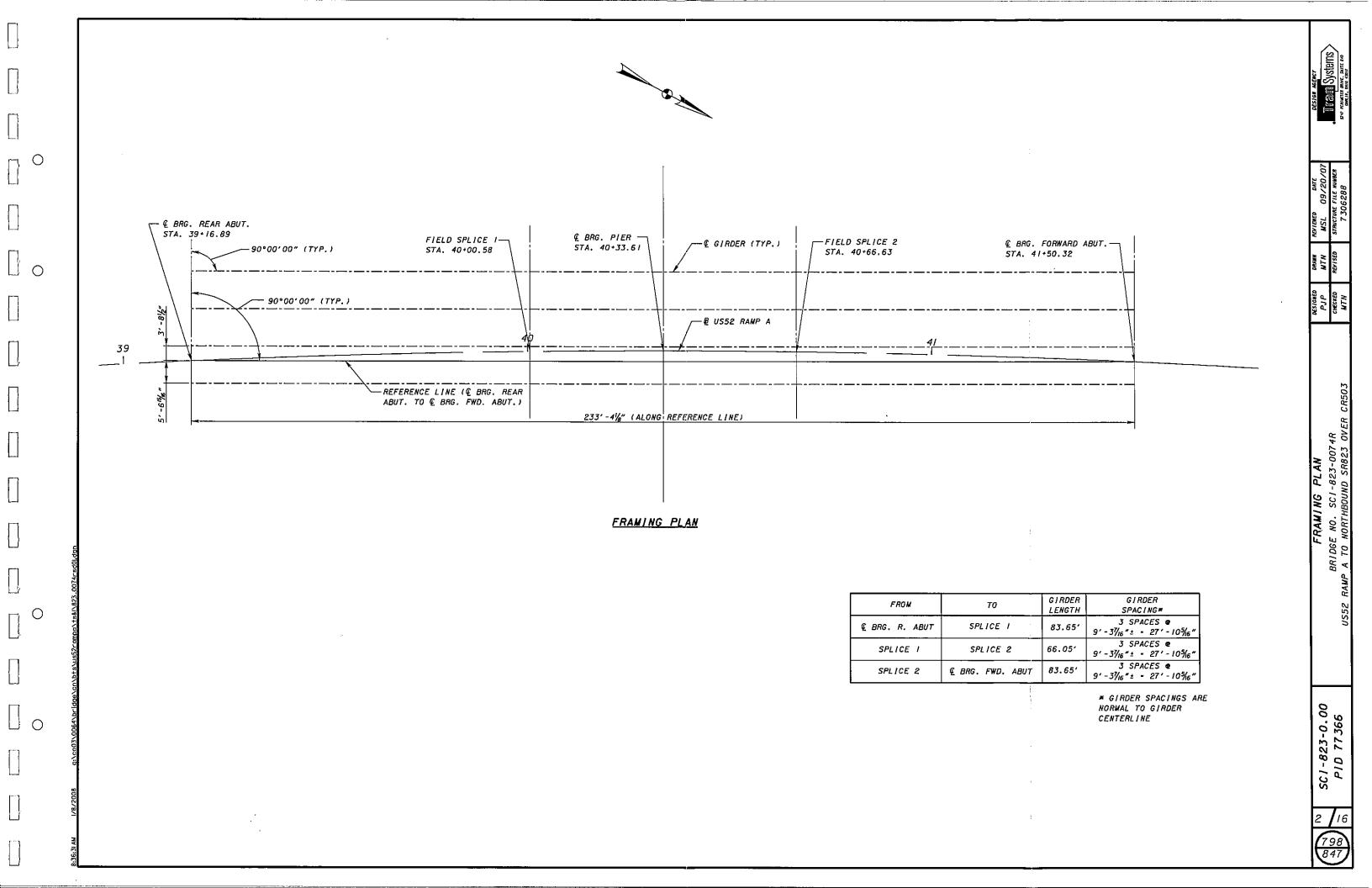
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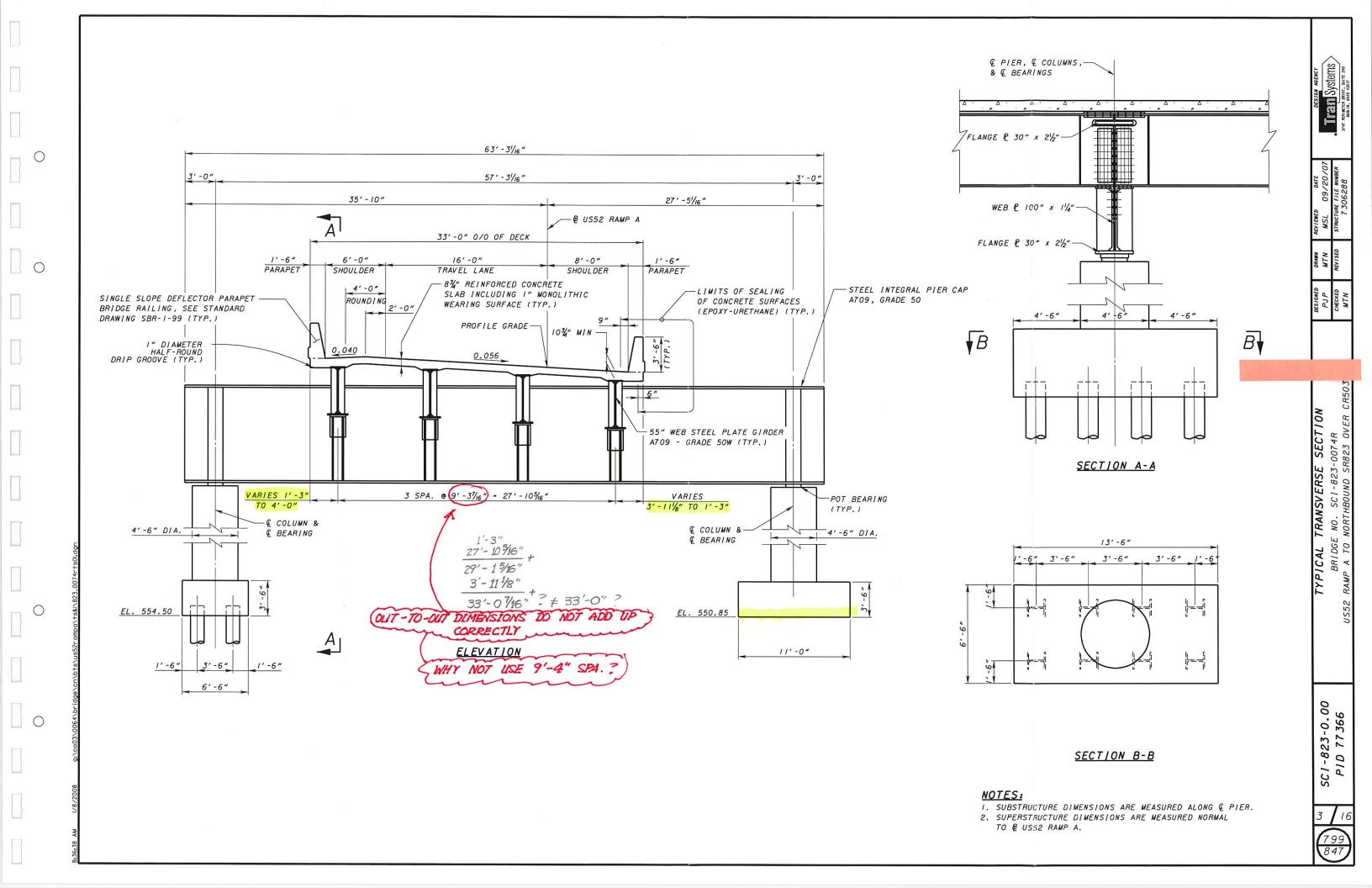
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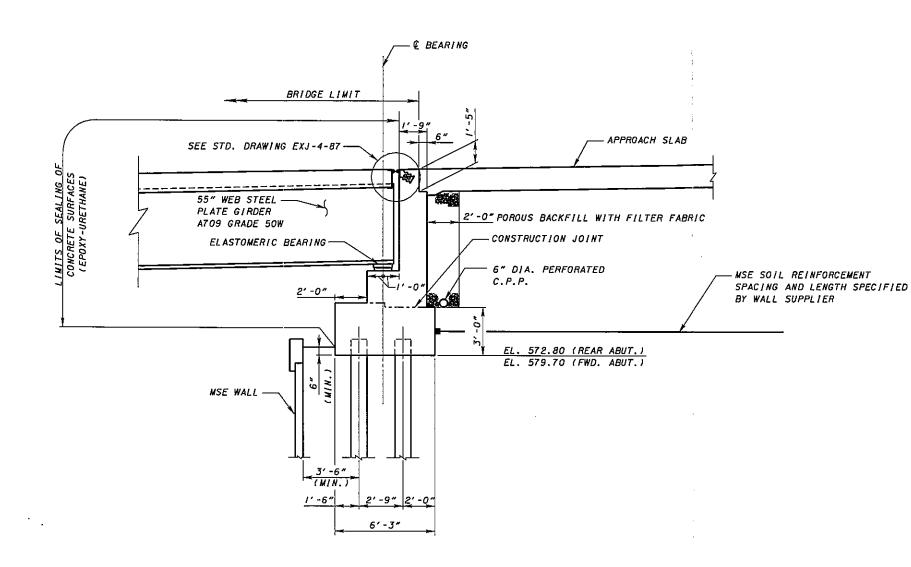
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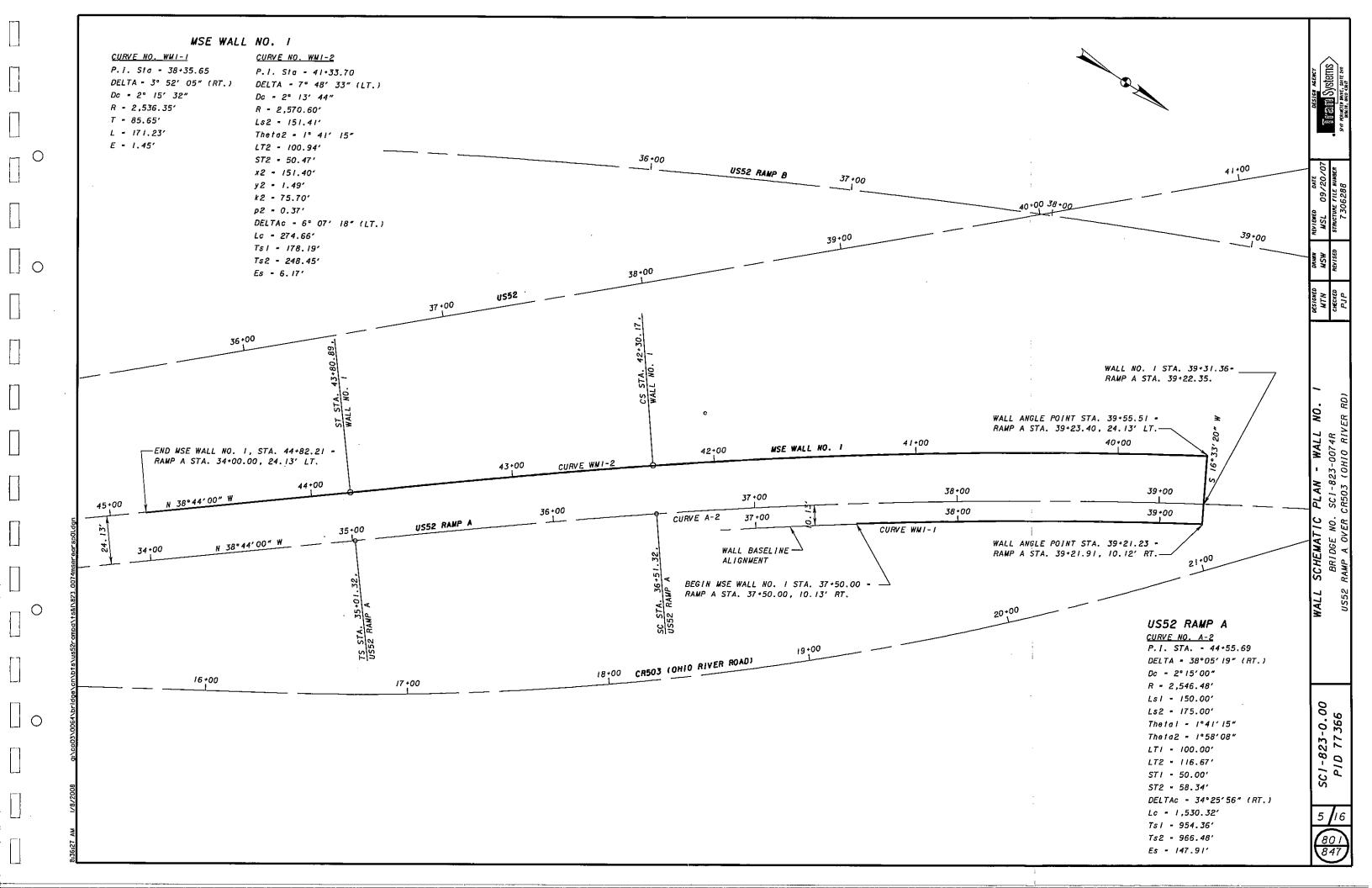


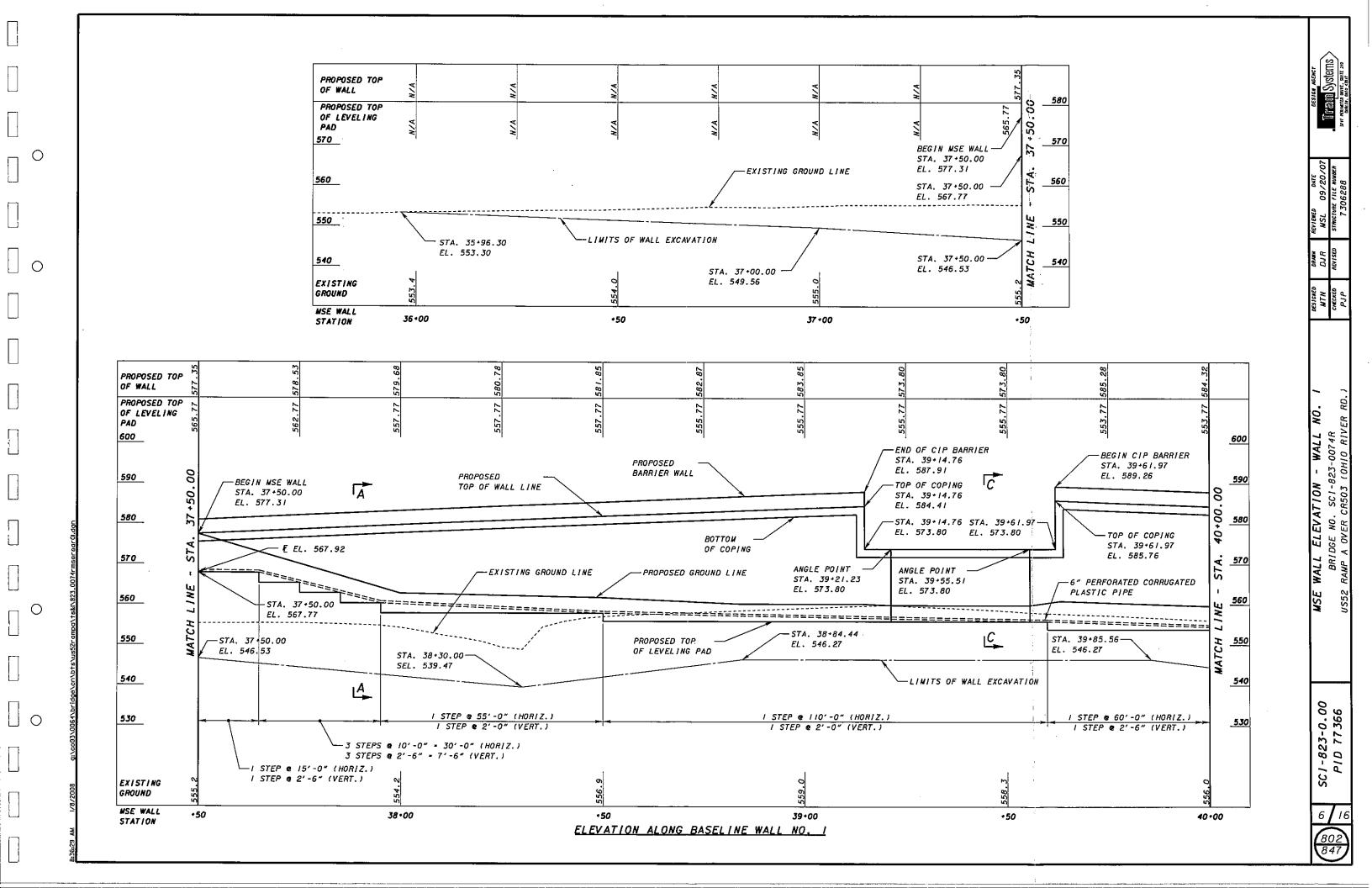


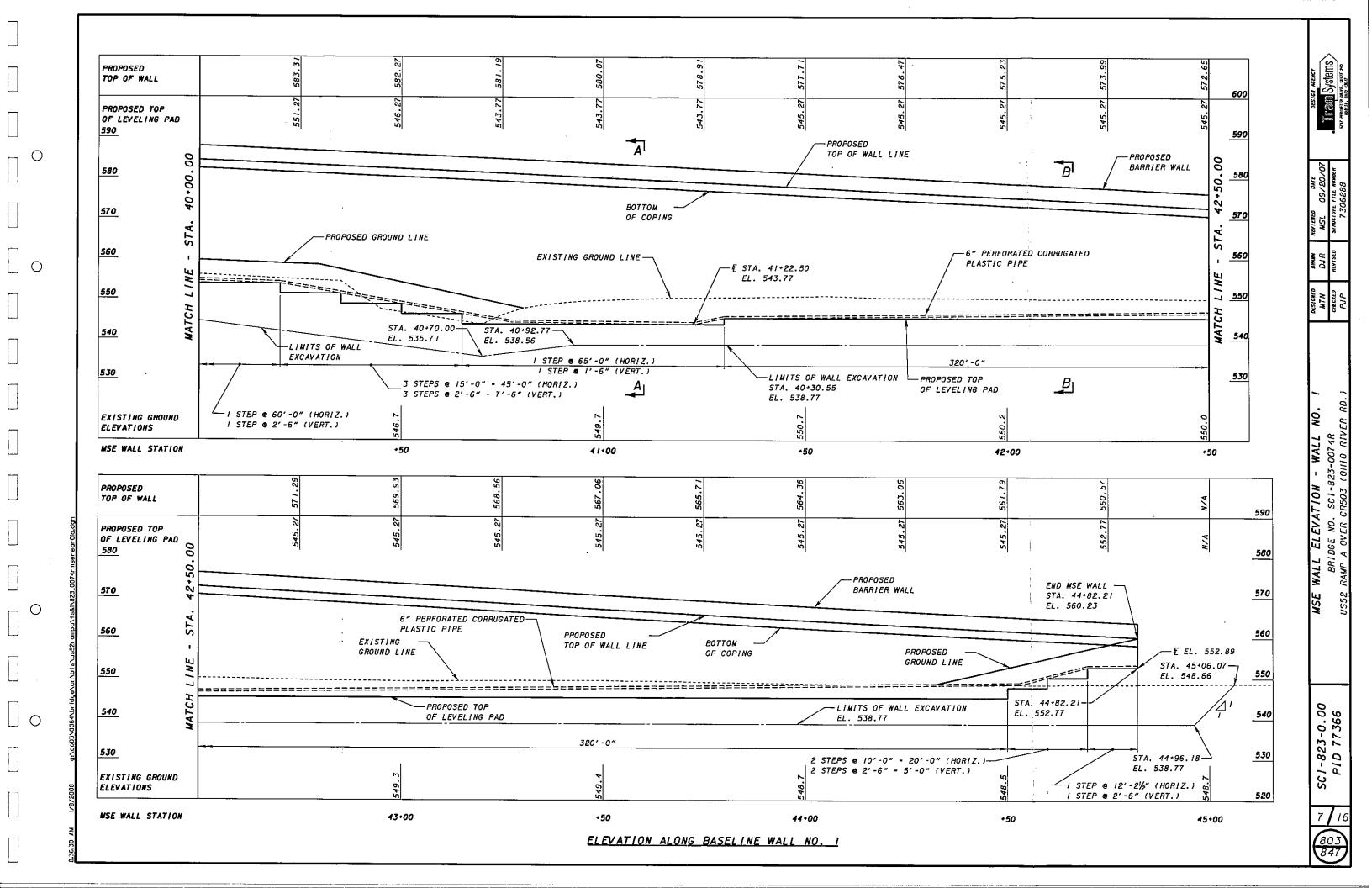
SUPERSTRUCTURE DEPTH 55" WEB STEEL PLATE GIRDER ITEM A709 GRADE 50W SLAB (INCLUDING 8%" WEARING SURFACE) HAUNCH (BOTTOM 21/4 (@ ABUT) 2" (@ PIER) OF SLAB TO TOP OF FLANGE) 57.25" (@ ABUT.) GIRDER DEPTH 57.50" (@ PIER) TOP OF WEARING 68.25" (@ ABUT.) SURFACE TO BOTTOM OF GIRDER FLANGE 68.25" (@ PIER) (INCH) TOP OF WEARING 5.6875' (@ ABUT.) SURFACE TO BOTTOM 5.6875' (@ P|ER) OF GIRDER FLANGE

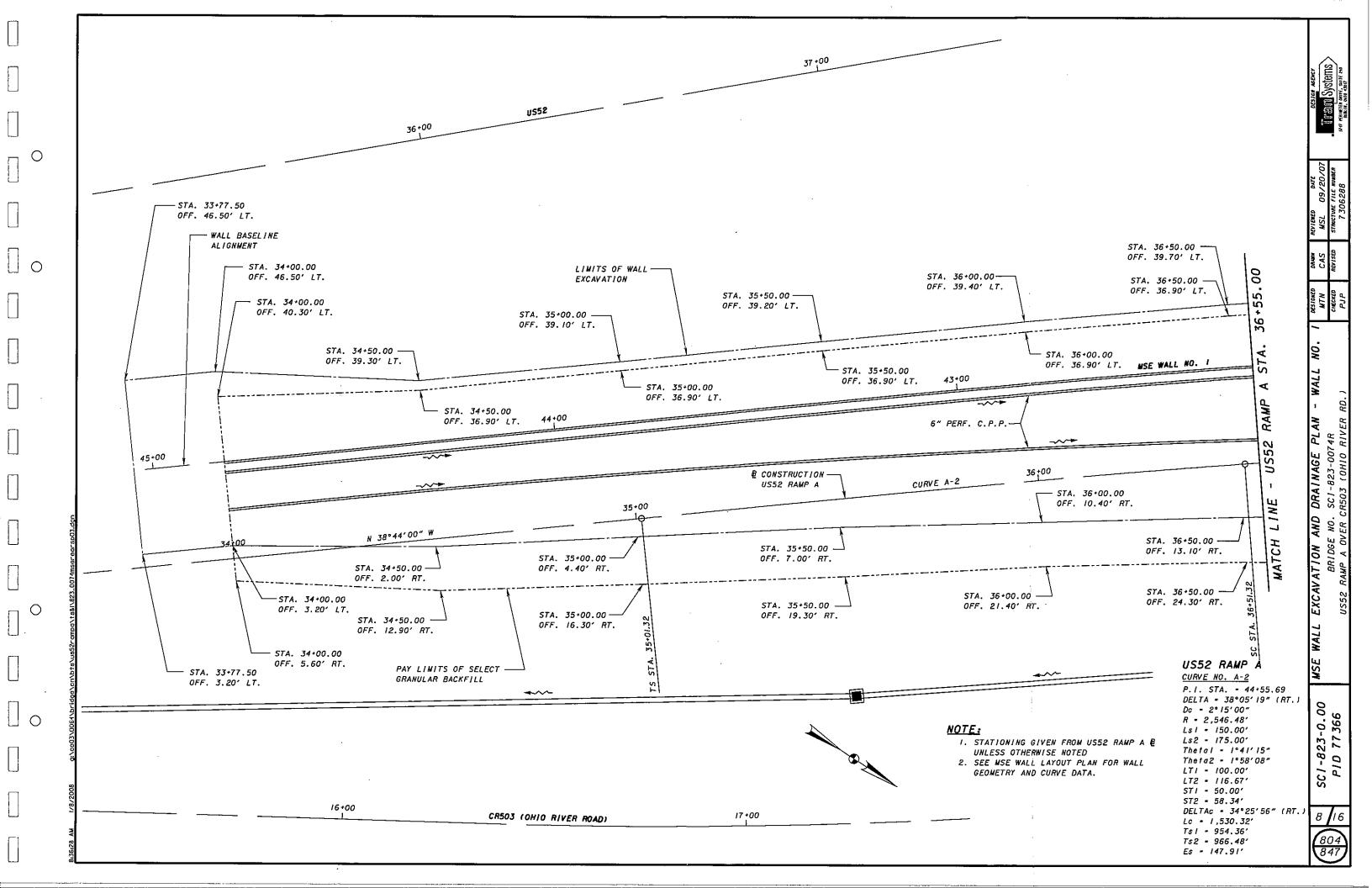


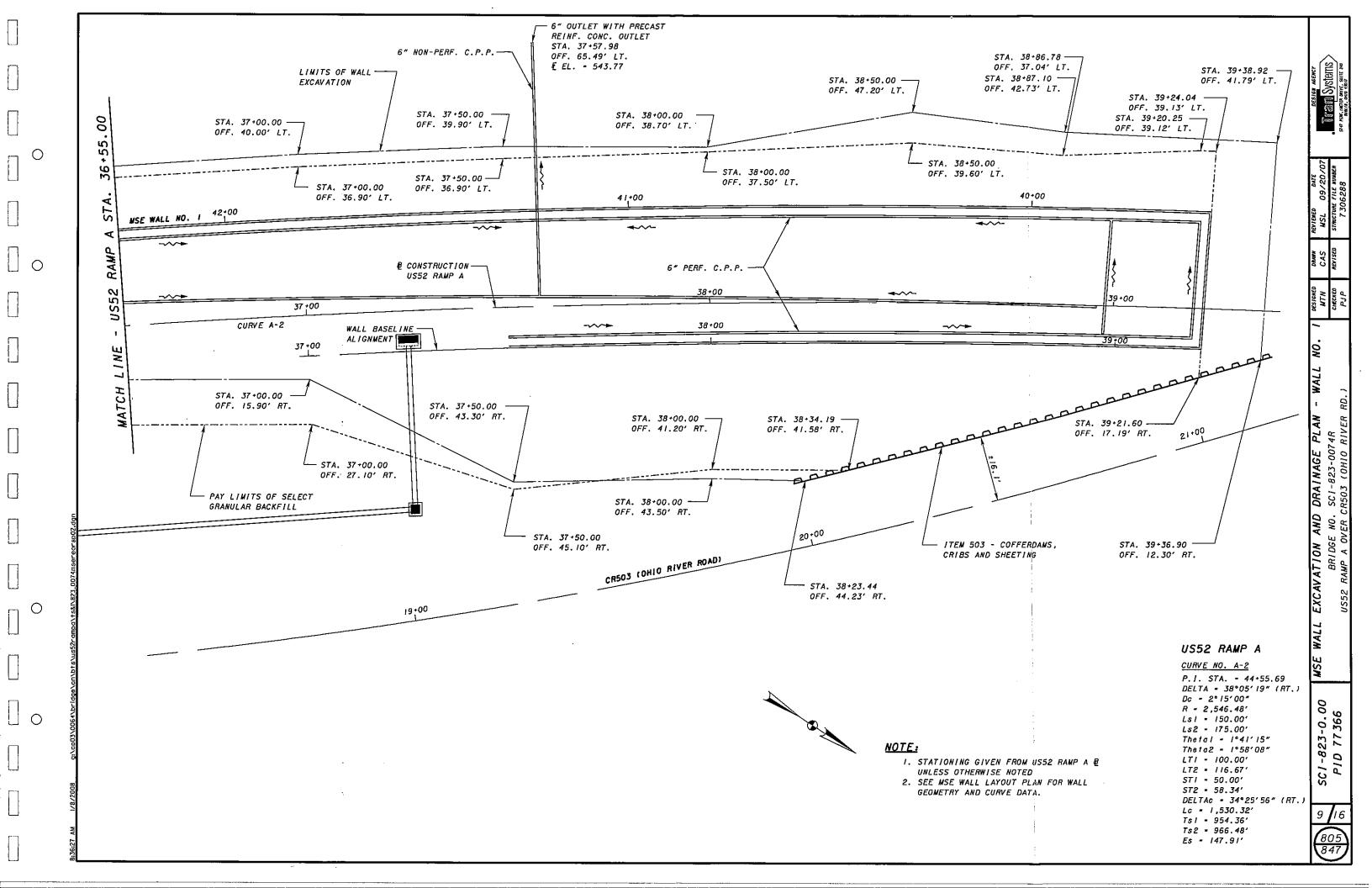
TYPICAL ABUTMENT SECTION

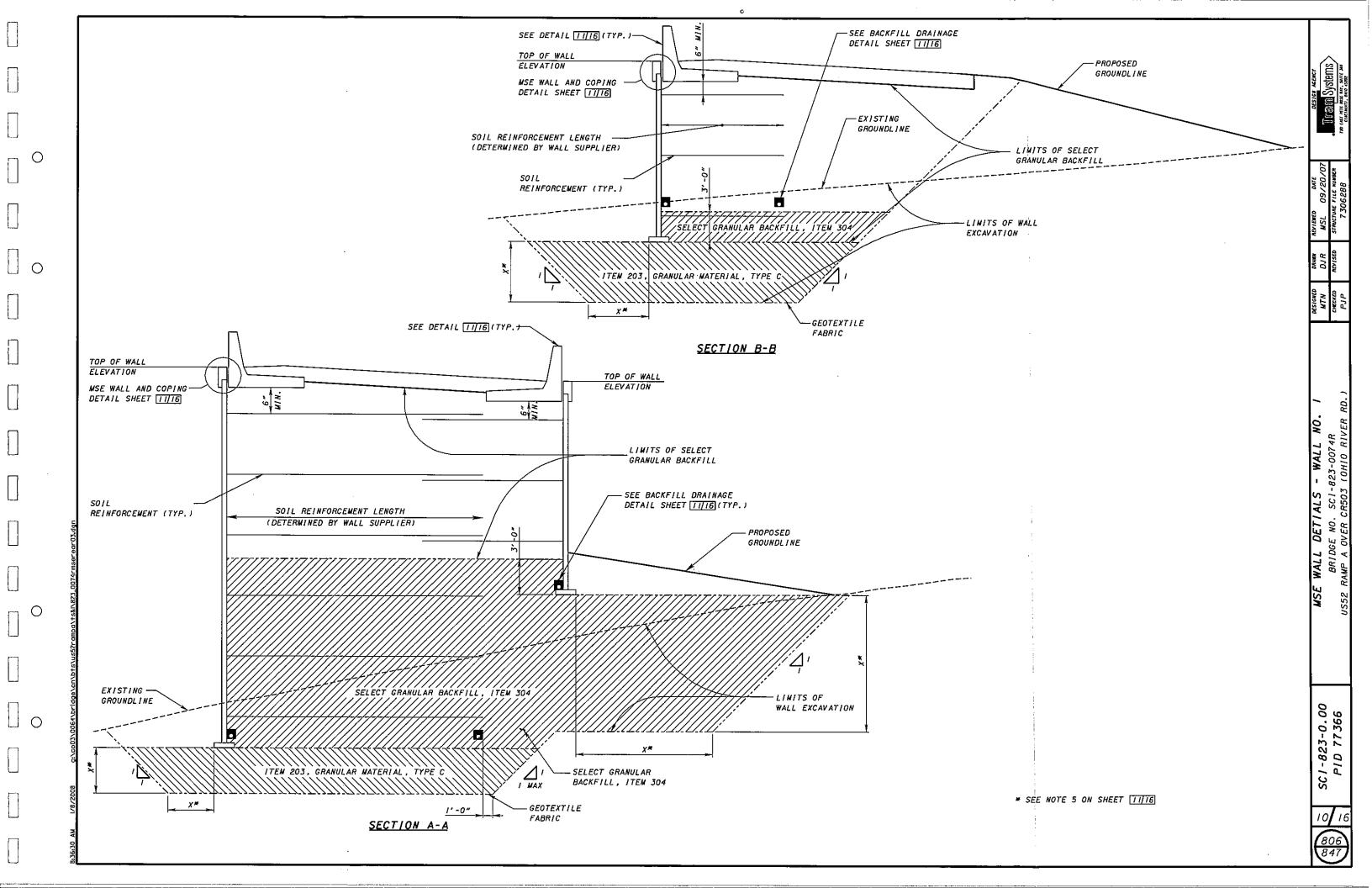


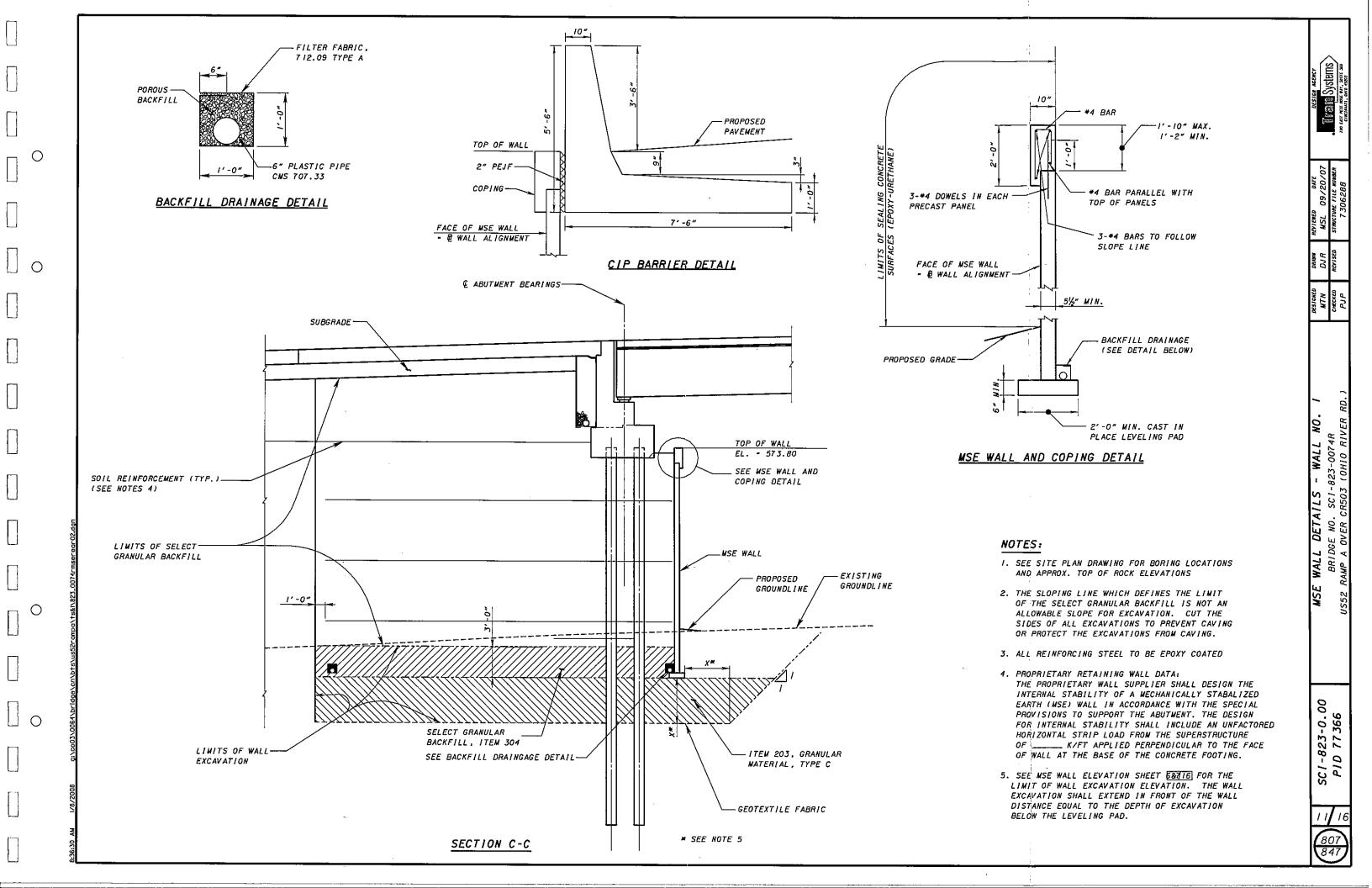


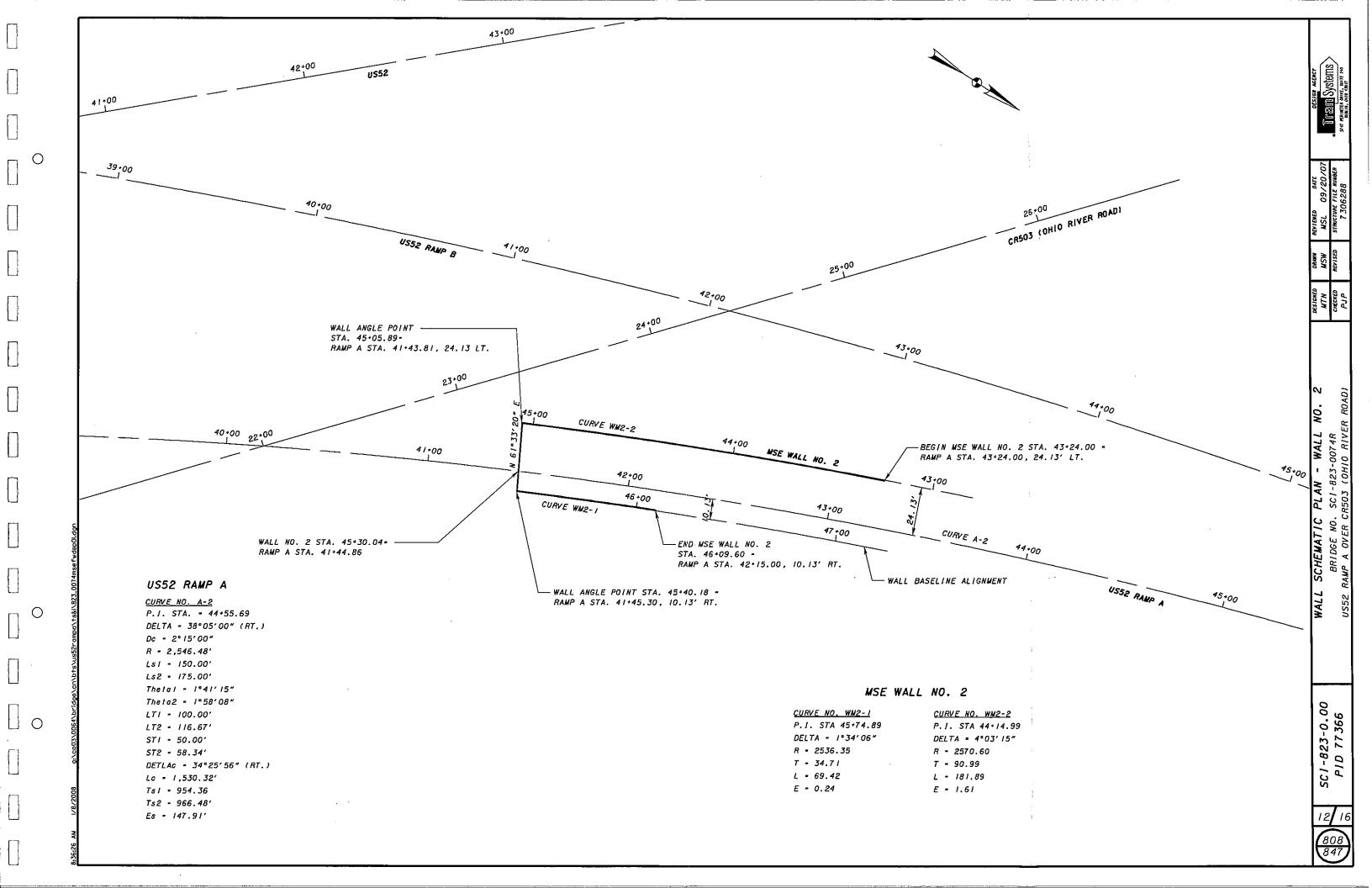


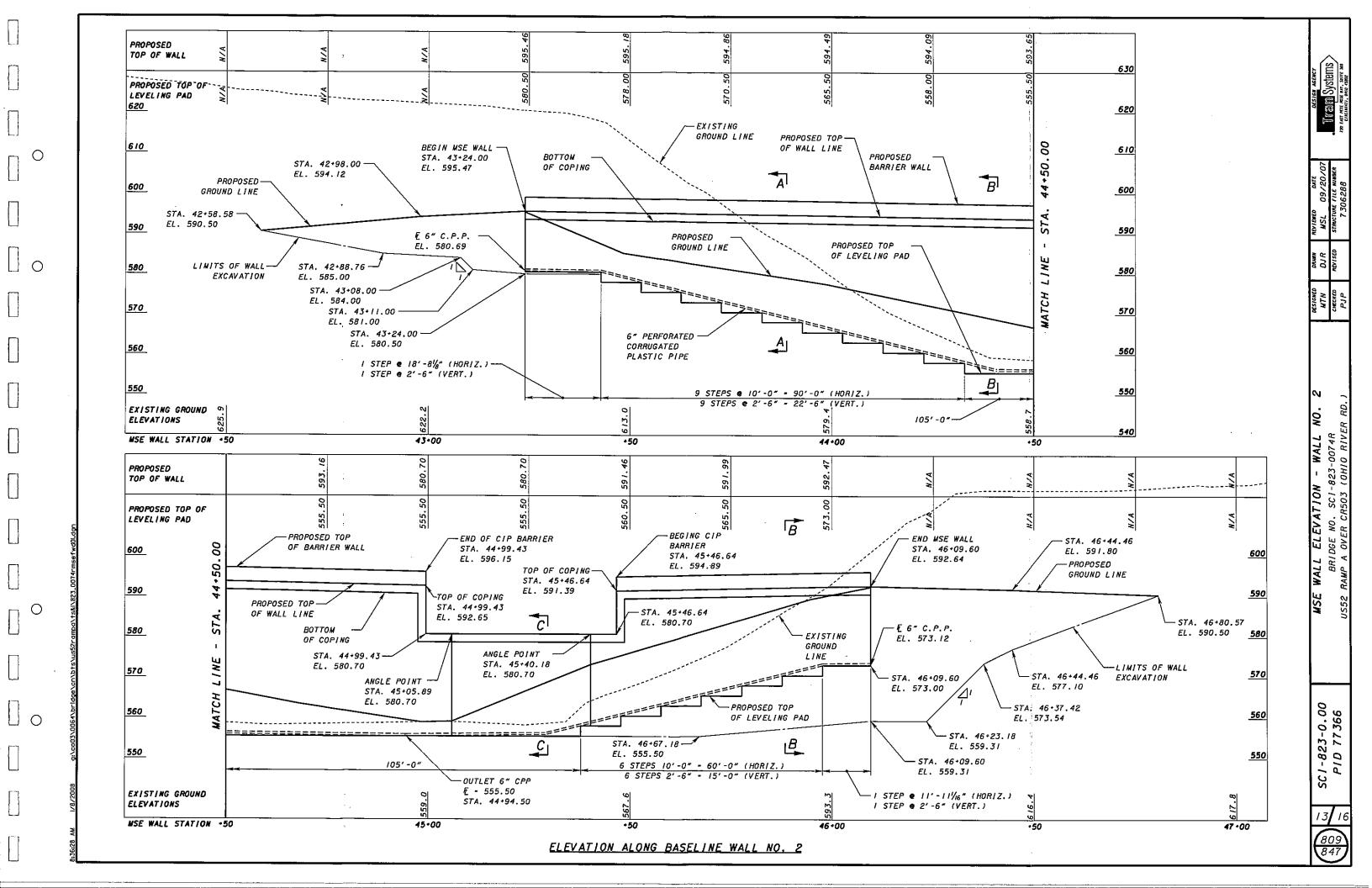


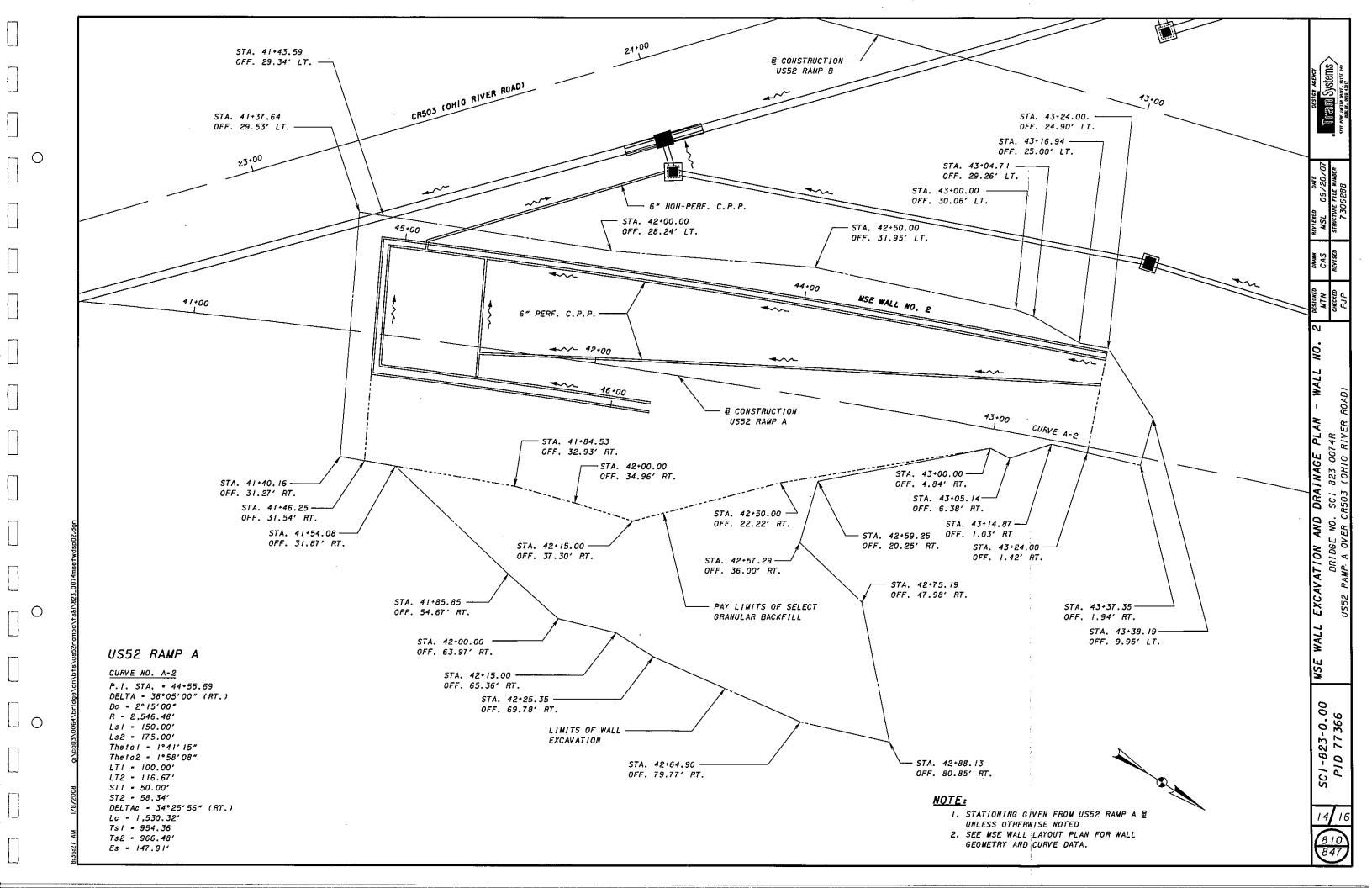


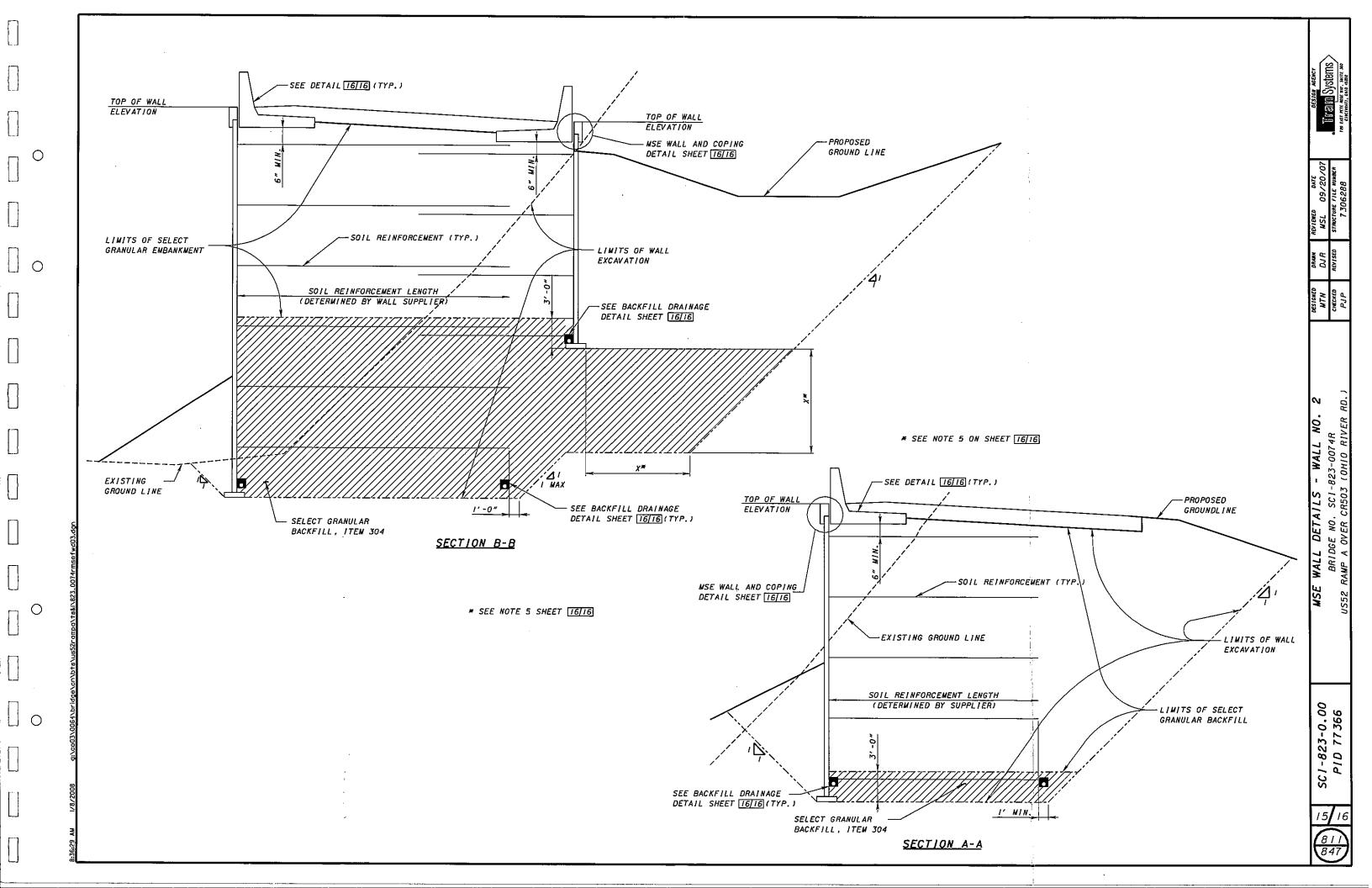


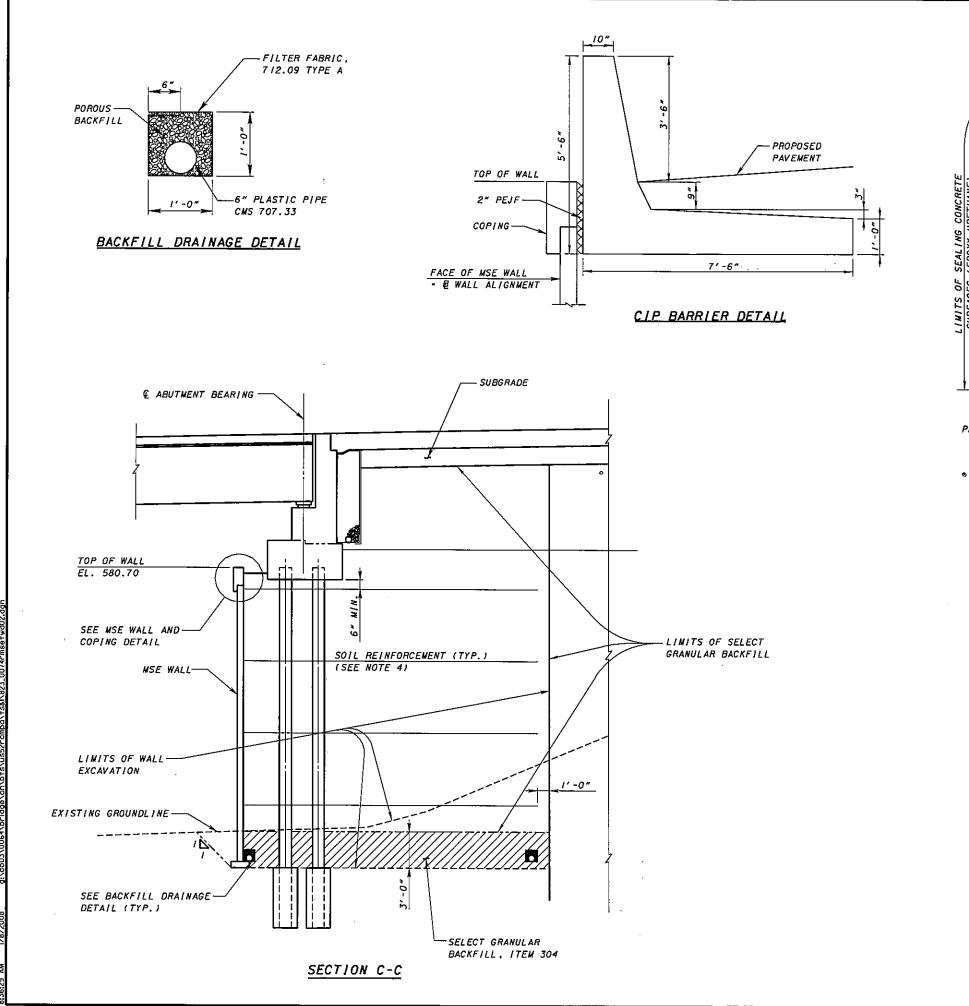




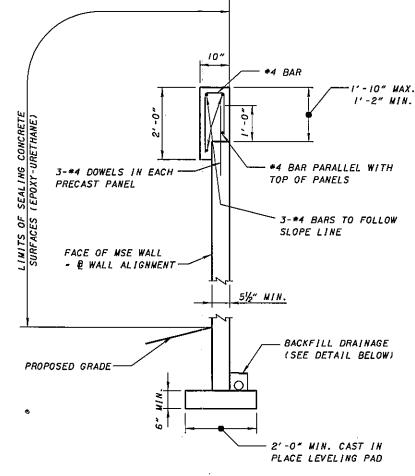








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### MSE WALL AND COPING DETAIL

### NOTES:

- I. SEE SITE PLAN DRAWING FOR BORING LOCATIONS AND APPROX. TOP OF ROCK ELEVATIONS
- 2. THE SLOPING LINE WHICH DEFINES THE LIMIT
  OF THE SELECT GRANULAR BACKFILL IS NOT AN
  ALLOWABLE SLOPE FOR EXCAVATION. CUT THE
  SIDES OF ALL EXCAVATIONS TO PREVENT CAVING
  OR PROTECT THE EXCAVATIONS FROM CAVING.
- 3. ALL REINFORCING STEEL TO BE EPOXY COATED
- 4. PROPRIETARY RETAINING WALL DATA:
  THE PROPRIETARY WALL SUPPLIER SHALL DESIGN THE
  INTERNAL STABILITY OF A MECHANICALLY STABALIZED
  EARTH (MSE) WALL IN ACCORDANCE WITH THE SPECIAL
  PROVISIONS TO SUPPORT THE ABUTMENT. THE DESIGN
  FOR INTERNAL STABILITY SHALL INCLUDE AN UNFACTORED
  HORIZONTAL STRIP LOAD FROM THE SUPERSTRUCTURE
  OF \_\_\_\_\_ K/FT APPLIED PERPENDICULAR TO THE FACE
  OF WALL AT THE BASE OF THE CONCRETE FOOTING.
- 5. WALL EXCAVATION SHALL EXTEND TO THE BOTTOM OF THE LEVELING PAD, AS SHOWN ON THE MSE WALL ELEVATION OR THE TOP OF ROCK. SEE SHEET 1316 FOR MSE WALL ELEVATIONS. THE WALL EXCAVATION SHALL EXTEND A DISTANCE IN FRONT OF THE LEVELING PAD EQUAL TO THE DEPTH OF EXCAVATION BELOW THE LEVELING PAD. THE DEPARTMENT WILL APPROVE WALL EXCAVATION PRIOR TO FOUNDATION PREPARATION.

Train Systems

REVIEWED DATE
MSL 09/20/07
STRUCTURE FILE NUMBER
7306288

TO HATN REVIEWED

TH HTN HSL

TXED REVISED STRUCTU

J.P

DESIGNED NTN CHECKED

> AILS - WALL NO. 2 . SCI-823-0074R

MSE WALL DET BRIDGE W USS2 RAWP A OVEF

SC1-823-0.00 PID 77366

# APPENDIX B Structure Cost Estimate

RAMP A (NB) OVER OHIO RIVER ROAD - US 52 INTERCHANGE,

T,S&L SUBMITTAL

By: PJP Checked: MSL

Date: 7/10/2007 Date: 9/20/2007

### ALTERNATIVE COST SUMMARY

Alternative No.	Span Arra No. Spans	angement Lengths	Total Span Length (ft.)	Framing Alternative	Proposed Stringer Section	Subtotal Superstructure Cost	Subtotal Substructure Cost	Structure Incidental Cost (16%)	Structure Contingency Cost (20%)	Total Alternative Cost	Superstructure Life Cycle Maintenance Cost	Total Relative Ownership Cost
3d	2	116.7 - 116.7	233.43	4~ Steel Plate Girders, Integr.Stl i- girder pier cap	55" Web PG Grade 50W	\$793,000	\$1,884,000	\$428,300	\$0	\$3,110,000	\$0	\$3,110,000

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

<sup>2.</sup> Estimated construction cost does not include existing structure removal (if any), which is common to all alternatives.

### RAMP A (NB) OVER OHIO RIVER ROAD - US 52 INTERCHANGE,

### T,S&L SUBMITTAL

By: PJP Checked: MSL

Date: 7/10/2007 Date: 9/20/2007

### SUPERSTRUCTURE

Alternative No.	Span Arr No. Spans	angement Lengths	Total Span Length (ft.)	Deck Length (ft.)	Deck Volume (cu. yd.)	Deck Concrete Cost	Deck Reinforcing Cost	Approach Slab Cost	Expansio Cos			osed Section	Structural Steel Weight (Pounds)	Structural Steel Cost	Painting of ructural St Cost	Subtotal Superstructur Cost
3d	2	116.7 - 116.7	233.43	235.43	305	\$165,200	\$77,500	\$44,900	\$22	2,600	55" Web PG	Grade 50W	310,800	\$483,100	\$0	\$793,000
							COST SUPPO	RT CALCULAT	TIONS			3.74.76				
Deck Cross-S	Sectional Area	<u>u</u>														
	No Parapets 2	4.26	Parapet Area (sq. ft.) 8.52				Structural Stee Unit Costs (\$/II	<u>b.):</u>	Cost <u>Ratio</u>	Year 2005	Annual <u>Escalation</u>	Year 2007				
Split Media Slab:	n Barriers 0	4.52 <u>T (ft.) W (ft.)</u>	0.00 Slab <u>Area</u>	Haunch & Overhang Area	Total Concrete Area (sq. ft.)		Rolled Beams - C Level 4 Plate Gin Level 5 Plate Gin	ders - Grade 50 ders - Grade 50	n/a n/a n/a	\$1.17 \$1.41 \$1.50	5.0% 5.0% 5.0%	\$1.29 \$1.55 \$1.65	Straight Girders Curved Girders			
							Painting of Str Unit Costs (\$/II	<u>b.):</u>		Year 2006 \$0.70	Annual Escalation 5.0%	Year 2007 \$0.74				
	Alt. 3d	0.73 33.00	24.1	2.4	35.0		Finish Coat Total			\$0.66	5.0%	\$0.70 \$1.44				
1		a allowed for haunches	and overhangs.				Unit Cost (\$/so		th Slabs (T=17' Width = 33							
Unit Cost (\$/c	rete, Class Q: cu. yd):	<u> </u>						Year	Annual	Year						
	Year 2005	Annual <u>Escalation</u>	Year 2007				Approach Slabs	2005 \$185.00	Escalation 5.0%	2007 \$204.00						
Parapets Weighted Aver		5.0% 5.0%	\$579.00 \$424.00 \$541.00													
Based on para of total concret	pet and slab pe e area	centages					Expansion Joi Unit Costs (\$/I	ALCOHOLOGICAL DESCRIPTION OF THE PROPERTY OF T	Cost <u>Ratio</u>	Year 2005	Annual Escalation	Year <u>2007</u>				
Unit Cost (\$/		Steel steel per cubic yard of c	leck concrete				Modular Expansi Strip Seal Expan		1.00 1.00	\$910.00 \$310.00	5.0% 5.0%	\$1,003.28 \$341.78				
	Year 2005	Annual Escalation	Year 2007													
Deck Reinforcing	\$0.81	5.0%	\$0.89													
							<u> </u>									

## RAMP A (NB) OVER OHIO RIVER ROAD - US 52 INTERCHANGE, T,S&L SUBMITTAL

SUBSTRUCTURE

By: PJP Checked: MSL Date: 7/10/2007

Date: 9/20/2007

Alternative No.	Span Arr No. Spans	rangement Lengths	Framing Alternative	Proposed Stringer Section	Pier Concrete Cost	Pier Reinforcing Cost	Abutment Concrete Cost	Abutment Reinforcing Cost	Pile Foundation Cost	Abutment & Wingwall Cost	Drilled Shaft Foundation Cost	Pier Cap	Subtotal Substructure Cost
3d	2	116.7 - 116.7	4~ Steel Plate Girders, Integr.Stl I-girder pier cap	55" Web PG Grade 50W	\$27,600	\$6,200	\$46,600	\$16,100	\$38,200	\$1,562,600	\$0	\$186,900	\$1,884,000

		A CONTRACTOR OF THE PROPERTY O	COSTS	UPPORT CALCULA	ATIONS							
Pier QC/QA Concrete, Class QSC1 Cost				Pile Foundation Unit	Cost (\$/ft.):	16" (	Dia. Piles, Furnished & D	)riven	Pile Foundation Unit Cost	<u>(\$/ft.):</u>	HP 14x73 Piles, Furnished & Driv	ven
Alt 3d Volume omponent (cu. yd.)	Year 2005	Annual Year Escalation 2007			Number of Piles			Total Furn. Length	Numb	er of Piles		Total <u>Le</u>
olumns 30 potings 26 otal Cost \$0 \$0 \$27,600	\$575.00 \$300.00	5.0% \$634.00 5.0% \$331.00		Alternates 3d	12	SEE QUANTITIES	S CALCULATION	420	. 2	) S	EE QUANTITY CALCULATIONS	
butment QC/QA Concrete, Class QSC1 Cost:				Pile Foundation Unit	Cost (\$/ft.):	Year 2005 Unit Cost	Annual Escalation	Year 2007	Pile Foundation Unit Cost	(\$/ft.): Year Unit	2005 Annual <u>Cost</u> <u>Escalation</u>	Year <u>2007</u>
					Furnished Driven	\$26.47 \$14.65	5.0% 5.0%	\$29.20 \$16.20	Fumi Dri	en #	## 5.0% ## 5.0%	\$29.20 \$10.60
				Shaft Foundation Ur	Total nit Cost (\$/ft.):	60"	Drilled Shaft	\$45.40	То	ial		\$39.80
Alternate 2, 3a-d Volume Year Annual	Year	Total			Number of Shafts				Total Shaft <u>Length</u>			
Component         (cu. yd.)         2005         Escalation           Abutment         101         \$420.00         5.0%	2007 \$463.00	Cost \$46,600		Into Bedrock Above Rock	0	SEE QUANTITIES			0 0			
				Shaft Foundation U	The second secon							
Epoxy Coated Reinforcing Steel			60" Into Rock	<u>Unit Cost</u> \$775.00	Escalation 5.0%	<u>2007</u> \$854.00		Temporary Unit Costs	Shoring and Support			
Unit Cost (\$/lb): Assume 125 lbs of reinforcing steel per cubic yard of pier concrete. Assume 90 lbs of reinforcing steel per cubic yard of abutment concrete.			60" Above Rock	\$575.00 Cost of Shafts:	5.0% \$ -	\$634.00		<u>Diffit Costs</u>	Temp. Shoring Area (sq. ft.)	Temp. Girder Support (lump sur	<u>m)</u>	
Year Annual Year 2005 <u>Escalation</u> 2007								Alt. 1 Alt. 2		s - s -		
Pier \$0.81 5.0% \$0.89 Abutment \$0.81 5.0% \$0.89		Steel Stradle Bent Pier Cap Complnent	Weight	Year 2006	Annual Escalation	Year 2007	Total Cost		Year 2004 Unit Cost	Annual Escalation	Year <u>2007</u>	
		Level 6 Structural Steel - Grade 50  MSE Abutment Unit Cost (\$/sq. ft.):	58,950	\$1.65	5.0%	\$1.73	\$102,000	Temporary Shoring Cofferdam	\$22.50 \$32.00	5.0% 5.0%	\$26.00 \$37.00	
		Total Area (sq. ft.)	Year 2005 <u>Unit Cost</u>	Annual Escalation	Year 2007		Painting of Structure Unit Costs (\$/lb.		Year 2006	Annual Escalation	Year <u>2007</u>	
		Alt 3d 25,785	\$55.00	5.0%	\$60.60		Intermediate Coat		\$0.70	5.0%	\$0.74	
	(A) (A)	Note: MSE wingwall lengths include full leng	th required for ramp				Finish Coat Total		\$0.66	5.0%	\$0.70 \$1.44	
								and the second		8,950 <b>4,900</b>		

## RAMP A (NB) OVER OHIO RIVER ROAD - US 52 INTERCHANGE, T,S&L SUBMITTAL

By: PJP Checked: MSL

	ALIA TOWN		DAY FIS	STR-6/23	AT THE R	Pier	Quant	ities /	Alternate	3a						
Di1			C	ар				Colu	ımn				Foo	ting		Total Volume
Pier Location	Length	Width	Depth	Area	Volume	Dia.	Height	Area	# Column	Volume	Width	Depth	Area	# Footing	Volume	Total Volume
Pier 1	0	0	0	0.00	0	4.5	20	15.90	2	636	8	3.5	64	2	448	1084
Total (Cu.Ft.)					0					636					448	1084
Total (Cu.Yd.)			-		0					24					17	40

STATISTICS OF THE	3376.28	<b>但是1.1</b> 50		New York	Zanani.	Pier	Quant	ities	Alternate	3b					TO SHOW	
Di			C	ар				Colu	ımn				Foo	ting		Total Volume
Pier Location	Length	Width	Depth	Area	Volume	Dia.	Height	Area	# Column	Volume	Width	Depth	Area	# Footing	Volume	Total volume
Pier 1	0	0	0	0.00	0	4.5	18	15.90	2	572	8	4.5	64	2	576	1148
Total (Cu.Ft.)					0					572					576	1148
Total (Cu.Yd.)					0					21					21	43

		E OF THE				Pier	Quant	ities /	Alternate	3с	医影片				Glories)	
Pier Location	Longth		C	ар				Colu	ımn				Foo	ting		Total Volume
Tank Tended Market	Lengui	Width	Depth	Area	Volume	Dia.	Height	Area	# Column	Volume	Width	Depth	Area	# Footing	Volume	Total Volume
Pier 1	0	0	0	0.00	0	4.5	23	15.90	2	731	9.36	4.5	87.6	2	788	1520
Total (Cu.Ft.)					0					731					788	1520
Total (Cu.Yd.)					0					27					29	56

200 00 00 00 00		B) E1 22 23				Pier	Quant	ities .	Alternate	3d	STREET, STREET	े स्टिक्ट	ASTONE .		ALTER GRADE	
Disal sestion	Lameth		C	ар				Colu	ımn				Foo	ting		Total Volume
	Length	Width	Depth	Area	Volume	Dia.	Height	Area	# Column	Volume	Width	Depth	Area	# Footing	Volume	Total Volume
Pier 1	0	0	0	0.00	0	4.5	25.5	15.90	2	811	10	3.5	100	2	700	1511
Total (Cu.Ft.)			S		0					811					700	1511
Total (Cu.Yd.)					0					30					26	56

	To a contract of		200	gela restat		Abutm	ent Qu	antitie	s -Alter	nate 1	CONT. C.	Residen	ANGE	NAME OF THE OWNER.		
	Length		Bac	kwall				Beam	Seat				Foo	ting		Total Volume
Abut Location	(feet)	Width	Depth	Area	Volume	Width	Height	Area		Volume	Width	Depth	Area	# Footing	Volume	rotal volume
Rear Abut	39.1	1.75	12.5	21.88	855	4.75	2	9.50		371	6.75	3	20.3	1	792	2019
Fwd. Abut	37.2	1.75	12.5	21,88	814	4.75	2	9.50		353	6.75	3	20.3	1	753	1920
Total (Cu.Ft.)					1669				T	725					1545	3939
Total (Cu.Yd.)					62					27					57	146

IIICIII VVAII			
Height			Volume
20	39	780	
18	956	17208	
18	1020	18360	
22	39	858	
28	131	3668	
28	82	2296	
		42200	
	Height 20 18 18 22 28	W   Height   Length     20   39     18   956     18   1020     22   39     28   131	20 39 780 18 956 17208 18 1020 18360 22 39 858 28 131 3668

Tei	mporary C	offerd	ams	
Location		٧	Vall	
	Height	Length	width	Area
Pier 3	0	0	0	0
Pier 4	0	0	0	0
Pier 4 Pier 5	0	0	0	0
Total (Sq.Ft.)				0

	Auto de				Abu	ıtment	Quant	ities -	Alternate 2, 3a-c				2000		
	Length		Backwal					Beam S	Seat		Footing		ting Total Volu		Total Volume
Abut Location	(feet)	Width	Depth	Area	Volume	Width	Height	Area	Volume	Width	Depth	Area	# Footing	Volume	
Rear Abut	33.05	1.75	6.05	10.59	350	3.75	2.5	9.38	310	6.5	3.25	21.1	1	698	1358
Fwd. Abut	33.05	1.75	6.05	10.59	350	3.75	2.5	9.38	310	6.5	3.25	21.1	1	698	1358
Total (Cu.Ft.)					700				620					1396	2716
Total (Cu.Yd.)					26				23	1				52	101

About Location	Wall						
Abut Location	Height	Length	Area				
Abut Location	Wall						
	Height	Length	Area	Volume			
Rear Abut							
RA Wing (L)							
RA Wing (R)							
Fwd Abut			4				
FA Wing (L)							
FA Wing (R)							
Total (Sq.Ft.)			25785				

Ten	porary C	offerd	ams	
Location		٧	Vall	
Location	Height	Length	width	Area
Pier 3	0	0	0	0
Pier 4	0	Length	0	#VALUE!
Pier 5	0	0	0	
Total (Sg.Ft.)				#VALUE!

Date: 7/10/2007 Date: 9/20/2007

Pile Quantities All Alternates								
Location	Total Piles	Top Elev.	Bot Elev.	Pile Length	Total Pile Length (Ft)			
Rear Abut.	12	573.8	547.4	30.0	360	14x		
Pier 1 L	8	555.5	544.6	15.0	120	14×		
Fwd. Abut.	12	580.7	549.4	35.0	420	16"		
Total	32				900	1		

	Сар Туре	Steel Weight	Concrete Volume (Cu. Yd.)	Post-Tensioning (Linear Ft.)
Alt. 3a	Stl.I-girder	60000		
Alt. 3b	Stl. Box Girder	72300		
Alt. 3c	Conc. Integral		95.0	530
Alt. 3d	Stl. I-gird Int	58950		

Superstructure Steel Quantities - Alt 1									
Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight					
Span 1	1078	4	218	940016					
Span 1 Span 2	0	0	0	C					
Total				940016					

Superstructure Steel Quantities - Alt 3a									
Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight					
Span 1	330	4	118	155388					
Span 2	330	4	118	155388					
Total				310775					

Superstructure Steel Quantities - Alt 3c								
Location	Wt.of girder (lb)/ft	# Girders	Span Length	Total Weight				
Span 1	330	4	118	155388				
Span 2	330	4	118	155388				
Total				310775				

Superstructure Steel Quantities - Alt 2									
Location	Wt.of girder	# Girders	Span Length	Total Weight					
Span 1	706	4	235	664770					
Span 1 Span 2	0	0	0	C					
Total				664770					

Superstructure Steel Quantities - Alt 3b									
Location	Wt.of girder	# Girders	Span Length	Total Weight					
Span 1	330	4	118	155388					
Span 2	330	4	118	155388					
Total				310775					

Superstructure Steel Quantities - Alt 3d									
Location	Wt.of girder	# Girders	Span Length	Total Weight					
Span 1	330	4	118	155388					
Span 2	330	4	118	155388					
Total				310775					