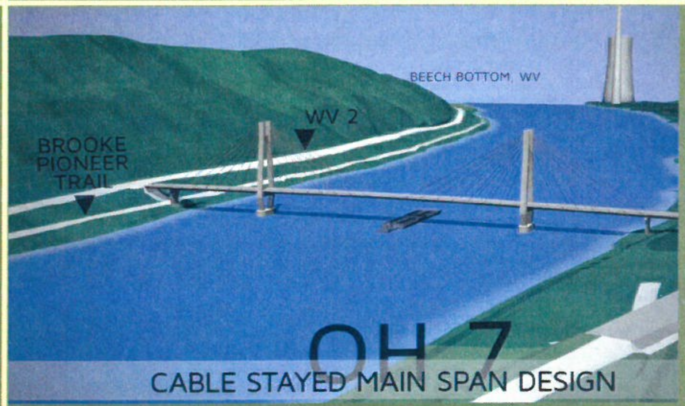
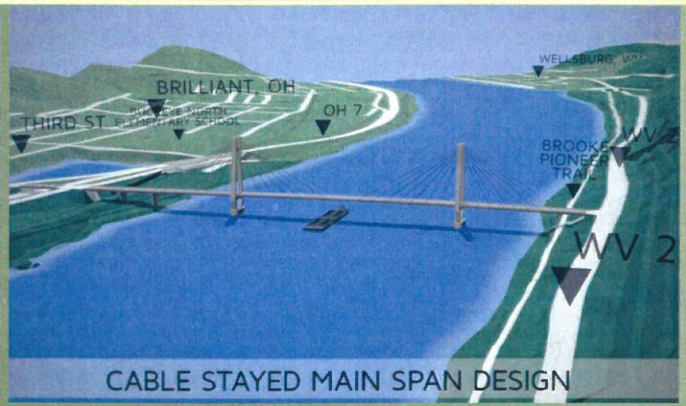


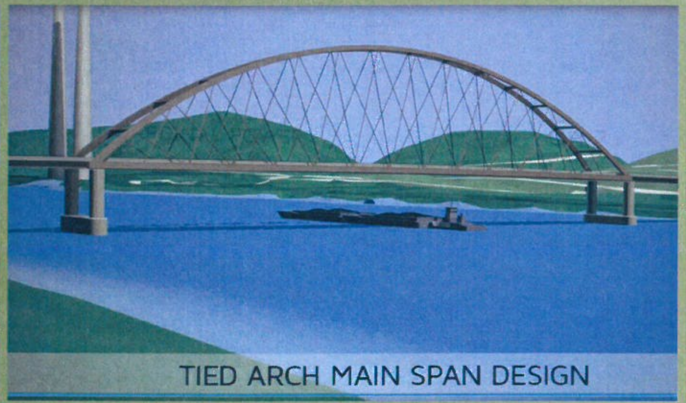
CABLE STAYED MAIN SPAN DESIGN



CABLE STAYED MAIN SPAN DESIGN


CABLE STAYED MAIN SPAN DESIGN


TIED ARCH MAIN SPAN DESIGN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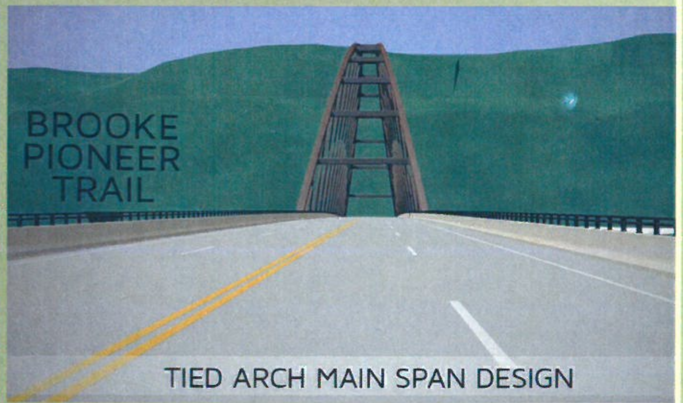

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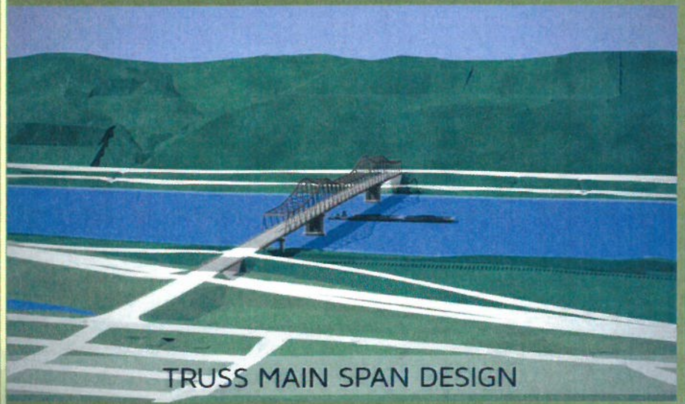
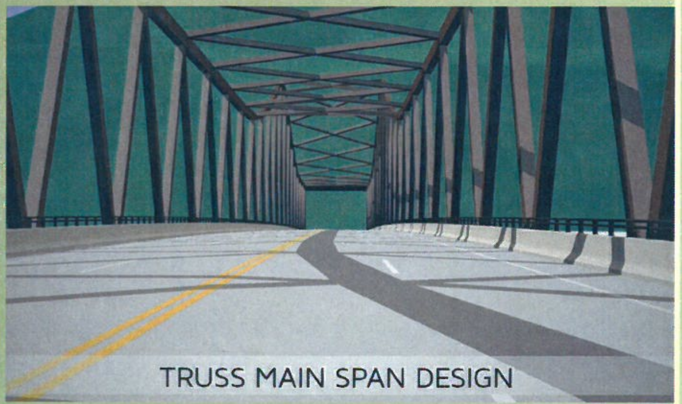

TRUSS MAIN SPAN DESIGN

TRUSS MAIN SPAN DESIGN


TRUSS MAIN SPAN DESIGN

Proposed Ohio River Bridge

Bridge Deck Width Study

Brooke County, West Virginia
Jefferson County, Ohio

State Project No.: S205-2/23-0.00 00
Federal Project No.: HPP-0223(003)D
PID No.: 79353

~~May 2014~~

HDR

Proposed Ohio River Bridge

Wellsburg Bridge Over the Ohio River
Brooke County, West Virginia
Jefferson County, Ohio
State Project Number: S205-2/23-0.00 00
Federal Project Number: HPP-0223(003)D
PID Number: 79353

Deck Width Study Report

Prepared By:

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Prepared For:

West Virginia Department of Transportation
and
Ohio Department of Transportation

May, 2014

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INTRODUCTION AND BACKGROUND

Purpose and Scope

HDR Engineering, Inc. (HDR) has conducted these studies and prepared this report with the primary objective of determining the relative cost of various deck width options for the Proposed Ohio River Bridge, generally referred to as the Wellsburg Bridge.

This study is based on the Alternative Crossing 8B alignment and configuration as shown in Appendix A (Sheets A-1 through A-3). Alternative 8B is the Preferred Alternative, as described in the most recent environmental documents (see the Finding of No Significant Impact and Section 4(f) de minimis Determination dated December 2013), and Final Design Report (submitted in May, 2013) for this project.

The cost estimates developed for this study encompass only the mainline bridges, where the deck width is in question. This includes County Route 2/23 from an abutment located in the vicinity of WV Route 2, across the Pioneer Trail, the Ohio River and several railroads in OH, to an abutment located between the railroads and OH Route 7. They also include the simple span bridge over OH Route 7. It should be noted that the cost of the following construction work is not included in the cost estimates as it would be relatively constant for any of the deck width options:

- Earthwork (including the hillside cut adjacent to WV2 which will have a relatively high cost)
- Other Roadway Work (Pavement, Drainage, Etc.)
- Approach Slabs
- Off Bridge Lighting and Electrical
- Walls on Hillside Above WV2
- Structural Work associated with ultimate configuration of Alternative 8B (i.e. modification or replacement of OH Route 7 Bridges and associated walls).
- Other non-bridge construction work not specifically listed

These cost estimates have been prepared based on numerous assumptions that are discussed later in this report. Engineering judgment, historical data and preliminary criteria and design tools were utilized to establish the assumed structural configurations and member sizes included in the estimates. No detailed numerical structural analyses were performed for this study.

Viable Structure Types and Span Arrangements

At this early stage in the project, the type of main span structure that will be advanced through final design has not been determined. Based on previous project studies and bridges of similar length that have been constructed recently, there are several structure types that are most viable for this crossing. It should be noted that the lengths provided are approximate and will be refined during preliminary design, as appropriate and acceptable substructure locations are determined. For all alternative main river bridge alternatives, a simple span bridge over Ohio Route 7 (approximately 150' long) will also be required. The viable main structure types include:

<u>Simple Span Tied Arch</u> - This structure would have an 845' main span over the Ohio River navigation channel with pier locations as identified in the Seamen's Church Institute simulations and as directed by the USCG. Girder approach units, consisting of multiple spans, would be required on both the WV (430' total length) and OH (618' total length) sides of the main span.

<u>3-Span Continuous Truss</u> - This structure would have an 845' main span over the Ohio River navigation channel with pier locations as identified in the Seamen's Church Institute simulations and as directed by the USCG. Side spans of the truss would be approximately 430' long. On the WV side, the truss side span would extend to the WV abutment, therefore no approach unit would be required. On the OH side, an approach unit of approximately 190' total length, comprised of either a simple span or multiple spans, would be required.

<u>3-Span Continuous Cable-Stayed</u> - This structure would have an 845' main span (minimum) over the Ohio River navigation channel with tower locations as identified in the Seamen's Church Institute simulations and as directed by the USCG. It is possible that in order to properly balance the spans for the cable-stayed bridge, the main span length may be somewhat longer than the 845' minimum. End spans of the cable-stayed bridge would be approximately 430' long. On the WV side, the end span would extend to the WV abutment, therefore no approach unit would be

required. On the OH side, an approach unit of 190' (or less if the main span is extended) total length would be required, and would be comprised of either a simple span or multiple spans.

Minimum Number of Lanes

As part of this study, in order to determine the minimum number of lanes required to meet traffic demands, HDR prepared revised traffic analyses using ODOT provided Certified Traffic data dated April 2, 2014. These data included the redevelopment site, known as the Beech Bottom Industrial Park, located south of the proposed bridge. Turn lane analyses for opening day (2017) and design year (2037) for Alternative 8B both with and without ramps were prepared. The findings are summarized below and shown graphically in Appendix A on Sheet A-4. Recommended turn lane lengths:

- CR 2/23 EB left-turn to WV 2 NB: 300' minimum storage plus 180' taper
- CR 2/23 WB right-turn to OH SR 7 NB: 300' minimum storage plus 180' taper
- CR 2/23 EB left-turn to OH SR 7 NB: 375' minimum storage plus 180' taper (note, this storage occurs between the proposed OH SR 7 ramps and storage/taper may not be achieved due to ramp termini locations)
- CR 2/23 WB right-turn to 3rd Street NB: 220' plus 180' storage (note, this storage occurs between 3rd Street and the proposed OH SR 7 SB ramps and storage/taper may not be achieved due to ramp termini location)

Based on the analyses, a portion of the taper for the CR 2/23 EB left-turn to WV 2 NB will occur on the main span of the bridge.

Also shown on Sheet A-4 are the approximate limits of both a Simple Span River Bridge unit (Tied Arch) and a 3-Span Continuous River Bridge unit (Truss or Cable-Stayed). As can be seen, a significant portion of the 3-Span Continuous River Bridge unit is within the limits of the alignment which require a minimum of three lanes. Given that varying the width of river bridges along their length can create undesirable complexities at little to no construction cost savings, the decision has been made (with concurrence from the WVDOH) that three lanes will be provided for the entire limit of any possible River Bridge units (controlled by the 3-Span Continuous River Bridge types). This will result in no specific bridge type (such as the Simple Span Tied Arch) having an economic advantage in the Span Arrangement and TS&L Studies that will be performed later in the project. It should also be noted that the remaining portion of the Ohio approach to the possible River Bridge units and the bridge over Ohio Route 7 also require a minimum of three lanes.

Using this approach, three lanes will be provided on all of the mainline bridges. Different shoulder widths along with possible options for pedestrian/shared use facilities will also be investigated. For each option studied, the proposed width will be held constant along the entire length of the alignment. Based on the results of the traffic studies, it appears that four lane structures should not be necessary to accommodate the traffic volumes currently projected. It should be noted, however, that some of the three lane options that will be studied could accommodate four lanes at some time in the future by utilizing the shoulders.

Deck Width Options Evaluated

Based on the considerations discussed in the previous section, along with input from the WVDOH, the options for the deck width listed below were considered in this study. While there are other possible combinations of number of lanes, shoulder width and pedestrian/shared use facility configuration, it is believed that the options studied include practical lower and upper bound values for the width, and will yield relative cost information that can be utilized to determine the appropriate configuration to advance to preliminary design.

For these studies, it is assumed that all lanes are 12' wide, traffic barriers are TL-4 and are assumed to be 1'-3" wide, and pedestrian rail (outside of shared use path or sidewalk) is assumed to be 1'-0" wide. Based on the proposed design speed (40 mph) and likelihood that actual speeds may exceed this limit, any proposed sidewalk or shared use path will be separated from traffic by a TL-4 barrier for safety. A complete table of Roadway Design Criteria is provided in Appendix C. It is assumed that there are 3 different alternates for pedestrian accommodation, including:

A. No pedestrian accommodation (no sidewalk, widened shoulder or shared-use path).

B. A separated shared use path with 1' pedestrian rail on one side of the bridge, outside of the lanes, shoulders and traffic barriers. This shared use path is to be a minimum of 8' wide and preferred 10’ wide. For this study an 8’ wide path has been assumed to determine the overall required deck width.

C. A 5’ wide separated sidewalk with 1’ pedestrian rail on one side of the bridge outside of the lanes, shoulders and traffic barriers. Bicycle traffic will use shoulders.

- Option 1 – 3 lanes with 2’ shoulders:
  - Option 1A – No Pedestrian Facilities - 42’-6” Out-to-Out of Deck
  - Option 1B – Shared-Use Path – 51’-6” Out-to-Out of Deck
  - Option 1C – Sidewalk and One 8’ Shoulder – 54’-6” Out-to-Out of Deck
- Option 2 – 3 lanes with 4’ shoulders:
  - Option 2A – No Pedestrian Facilities - 46’-6” Out-to-Out of Deck
  - Option 2B – Shared-Use Path – 55’-6” Out-to-Out of Deck
  - Option 2C – Sidewalk and One 8’ Shoulder – 56’-6” Out-to-Out of Deck
- Option 3 – 3 lanes with 6’ shoulders:
  - Option 3A – No Pedestrian Facilities - 50’-6” Out-to-Out of Deck
  - Option 3B – Shared-Use Path – 59’-6” Out-to-Out of Deck
  - Option 3C – Sidewalk– 56’-6” Out-to-Out of Deck
- Option 4 – 3 lanes with 8’ shoulders:
  - Option 4A – No Pedestrian Facilities - 54’-6” Out-to-Out of Deck
  - Option 4B – Shared-Use Path – 63’-6” Out-to-Out of Deck
  - Option 4C – Sidewalk – 60’-6” Out-to-Out of Deck

It should be noted that the options listed below could either initially or at some time in the future accommodate an additional (fourth) lane without structural modifications, by striping as follows. These options would maintain a minimum of 11’ wide lanes and 2’ wide shoulders:

- Option 2C, 3A, 3B and 3C – Four 11’ Lanes with 2’ Shoulders
- Option 4A, 4B and 4C – Four 11’ Lanes with 4’ Shoulders or Four 12’ Lanes with 2’ Shoulders

However, such use would be at the discretion of the Department and might necessitate the need for a design exception.

Typical Sections for each of the twelve options are provided in Appendix A on Sheets A-7 through A-14 for the Approach Units and on Sheets A-15 through A-22 for the Main River Bridge.

As indicated by the WVDOH, the ability to maintain a minimum of two lanes of traffic on the bridges during future redecking operations would be important. If it is assumed that for the temporary condition, 11' lanes and no shoulders would be permitted, options with a curb-to-curb width of at least 48’-0” could be redecked while maintaining 2 lanes of traffic (assuming the use of mechanical couplers and temporary concrete barrier less than 2’ wide). It should be noted that additional work could be required during the redecking, such as providing a temporary stringer under the partially demolished/partially constructed deck overhangs. The options which meet this criteria are Options 2C, 3A, 3B, 3C, 4A, 4B, and 4C.

The ability to maintain a minimum of two lanes of traffic on the bridges during future redecking will avoid lengthy traffic detours and delays. This may result in cost savings from eliminating the need for maintenance and protection of traffic along detour routes and road user cost associated with traffic delays. Additional savings may also be realized by eliminating the need for accelerated construction that may be desired with options that do not allow for two lane traffic during redecking.

Maintaining traffic during bridge inspection is also a consideration. A bridge inspection crane requires a minimum lane width of 12’. A telescopic boom lift (manlift) with the capacity to reach the highest points of the bridge superstructure above the bridge deck requires an approximate lane width of 15’. Options with a curb-to-curb width of at least 48’-0” could accommodate three 11’ lanes (with no shoulders) and bridge inspection vehicles.

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ASSUMPTIONS AND DESCRIPTION OF BRIDGES

Structure Type Estimated and Distribution of Cost Based On State Line Location

For this study, the Simple Span Tied Arch was selected as the main river bridge structure type for which cost estimates have been generated. The tied arch was selected for a number of reasons. First, this type is the most straightforward type to estimate, with a fairly well-defined configuration (less variability in design choices that could be assumed). Also, there is a relatively large amount of historical data and rules of thumb available to develop preliminary sizes for primary structural members. Finally, for purposes of capturing the split of bridge cost between WV and OH, this simple span bridge type is less complicated. It is believed, however, that the results obtained for the tied arch, specifically the relative cost of the various deck widths studied, are representative of those that would be obtained for the other structure types.

As requested by the WVDOH and ODOT, the estimated costs determined for each deck width option have been allocated to the two agencies based on the location of the State Line, as identified on the current USGS mapping. This location is shown in Appendix A on Sheet A-5 and occurs at approximately Station 26+35 on the Alternative 8B alignment. With the State Line located at this station, approximately 75% of the simple span tied arch is located within West Virginia and 25% within Ohio. Therefore, for the cost estimates, the following split has been used:

WV Cost:

- WV Approach Spans
- 75% of Simple Span Tied Arch

OH Cost:

- OH Approach Spans
- OH Route 7 Overpass Bridge
- 25% of Simple Span Tied Arch

For all of the deck width options investigated, the percentage of the overall mainline bridge cost remained relatively constant as shown below:

% of Total Mainline Bridge Cost:

- WV – 65%
- OH – 35%

The estimated cost for each option supporting these percentages is provided in the section, Estimated Construction Cost, which can be found later in this report. While OH has only been assigned 25% of the main span cost, the fact that the OH approach is longer (and includes the OH Route 7 Overpass Bridge) results in the OH percentage of the total mainline bridge cost being greater than 25%.

It should be noted that based on the cost estimates prepared for the Final Design Report, besides the mainline bridge cost, the largest elements of work on the project include the hillside excavation and wall along WV Route 2 (fully within WV and estimated at ~$21 million), and the other bridge and wall work required in OH for the ultimate 8B configuration (fully within OH and estimated at ~$19 million).

Main Unit Description

The simple span tied arch river bridge is assumed to 845’ long which, when the width of river piers and slight skew of the navigation channel are taken into account, will provide the required 800’ clear navigation clearance. The span is assumed to have vertical arches, although inclined arches in a basket-handle configuration is also viable. A diamond-shaped top lateral bracing system and a K-type bottom lateral bracing system is utilized. The tied arch has a networked system of hangers between the arch rib and tie girder, as this type of system has been shown to be more efficient than vertical hangers. For this study, it is assumed that the hangers intersect the tie girder at increments of 32’-6”, and a floorbeam is present at each intersection point. A conventional reinforced concrete deck is supported by steel rolled beam stringers which are supported on top of the floorbeams. Preliminary details of the Main River Bridge superstructure are provided in Appendix A on Sheets A-23 through A-25.

The two main river piers (Piers 3 and 4) are shown in Appendix A on Sheet A-30 and are assumed to have two large circular columns that begin 3 feet above the 100 year flood elevation of the river and which support one arch each. Below the circular columns, a single large solid shaft is utilized to resist potential barge impact forces. The solid shaft extends down to a footing on top of a tremie seal founded on bedrock. Dimensions for the substructure elements were selected based on geometry and past experience. Approximate elevations for the top of rock and mudline have been assumed for this study. It has also been assumed that the cofferdams in the river that would facilitate construction would extend from the top of rock to an elevation 3 feet above the normal pool elevation.

West Virginia Approach Description

For the 430' long WV Approach Unit, a two-span (215'-215') steel plate girder structure has been assumed. For each of the twelve deck width options, a reasonable girder spacing has been utilized. The girder spacing was selected to meet the requirements of the WVDOH for use of the standard 8" Class H deck with reinforcement based on the empirical design methodology with standard overhang reinforcement.

The pier supporting this unit (Pier 5) is shown in Appendix A on Sheet A-29. The upper portion of this pier is assumed to be of a hammerhead configuration. However, since this pier is still within the flood plain, it is assumed that a larger solid shaft section will be required below a point three feet above the 100 year flood elevation to resist potential barge impact forces. The solid shaft extends down to a footing on top of a tremie seal founded on bedrock. Dimensions for the substructure elements were selected based on geometry and past experience. Approximate elevations for the top of rock and mudline have been assumed for this study. It has also been assumed that the cofferdams in the river that would facilitate construction would extend from the top of rock to an elevation 3 feet above the normal pool elevation. The WV Abutment is assumed to be a full-height abutment with flared wingwalls founded on steel H-piles as shown in Appendix A on Sheets A-26 and A-27.

Ohio Approach Description

For the 618' long OH Approach Unit, a three-span (190'-238'-190') steel plate girder structure has been assumed. For each of the twelve deck width options, a girder spacing similar to that used on the WV approach for the same deck width option has been utilized. Since ODOT does not utilize the empirical deck design method, the deck thickness for the different options varies and is based on the ODOT Bridge Manual Section 302.2.1.

There are two piers supporting this unit. Pier 2 is shown in Appendix A on Sheet A-29. The upper portion of this pier is assumed to be of a hammerhead configuration. However, since this pier is still within the flood plain, it is assumed that a larger solid shaft section will be required below a point three feet above the 100 year flood elevation to resist potential barge impact forces. The solid shaft extends down to a footing on top of a tremie seal founded on bedrock. Dimensions for the substructure elements were selected based on geometry and past experience. Approximate elevations for the top of rock and mudline have been assumed for this study. It has also been assumed that the cofferdams in the river that would facilitate construction would extend from the top of rock to an elevation 3 feet above the normal pool elevation. The other pier (Pier 1) is outside of the floodplain and is assumed to be a hammerhead type pier with the footing founded on steel H-piles, as shown in Appendix A on Sheet A-28. The OH Abutment is assumed to be a full-height abutment with flared wingwalls founded on steel H-piles as shown in Appendix A on Sheets A-26 and A-27.

Ohio Route 7 Overpass Bridge Description

For the 150' long simple span OH Route 7 Overpass Bridge, a steel plate girder structure has been assumed. For each of the twelve deck width options, a girder spacing similar to that used on the WV and OH approaches for the same deck width option has been utilized. Since ODOT does not utilize the empirical deck design method, the deck thickness for the different options varies and is based on the ODOT Bridge Manual Section 302.2.1.

There are no piers for this unit. Both abutments are assumed to be full-height with flared wingwalls founded on steel H-piles as shown in Appendix A on Sheets A-26 and A-27.

MISCELLANEOUS STRUCTURES INFORMATION

Superstructure Joints

It is anticipated that expansion joints of the type and movement capacity indicated will be provided at the following locations. To size the joints, an assumed thermal variation of 150 degrees per the WV Bridge Design Manual was assumed. Bearing fixities assumed to compute the associated expansion lengths are identified in Appendix A on Sheet A-6:

- OH Route 7 – Both Abutments – Integral with 3" Strip Seal at ends of approach slabs
- OH Approach Abutment - Semi-Integral with 6" Modular Dam at end of approach slab
- Pier 3 – Juncture of OH plate-girder approach and tied arch – 3" Strip Seal
- Pier 4 - Juncture of WV plate-girder approach and tied arch – 13" Modular Dam
- WV Approach Abutment – Semi-Integral with 3" Strip Seal at end of approach slab

Bearings

It is anticipated that laminated elastomeric pads will be used for all of the bearings for the WV and OH approach units. It is anticipated that large capacity disc-type bearings will be used for all four bearings for the tied arch.

Deck Drainage

It is anticipated that scuppers and downspouts will be required for all of the options. While the narrow deck options may have a somewhat lower demand, for all of the options a constant lump sum amount ($150,000) has been included in each option.

Roadway and Navigation Lighting and Electrical

It is anticipated that roadway lightling, a navigation lighting system and electrical work will be required for all of the options. A constant lump sum amount ($250,000) has been included in each option for these items.

Bridge Materials

Structural Steel - All steel plate-girder approach units to utilize AASHTO M270 Gr. 50W. The tied arch is to utilize a combination of AASHTO M270 Gr. 50W (approximately 75% of the total) and Gr. HPS 70W steel (approximately 25% of the total utilized in highly stressed regions). It is anticipated that unpainted weathering steel will be used for all approach units and for the majority of the floor system of the tied arch. It is assumed that the arch floorsystem near the limits of the deck along with any structural steel above the level of the deck will be painted.

Reinforced Concrete - It has been assumed that normal strength reinforced concrete will be used, as follows:

- Deck and Barriers - f'c = 4000 psi
- Piers and Abutments - f'c = 3000 psi
- Tremie – f'c = 2000 psi

ESTIMATED CONSTRUCTION COSTS

For each deck width option, a detailed estimate of quantities and corresponding cost estimate for the mainline bridges has been prepared. The supporting calculations including the breakdown of items, quantities and unit costs are not included in this report, but are available if requested. For these cost estimates, unit costs based on recent bid data and historical data adjusted for inflation have been utilized.

A summary of the total mainline bridge costs is provided in the table to the right. For more in-depth information, such as WV and OH calculated shares, cost per square foot of bridge deck and breakdown of substructure/superstructure cost, see Appendix B, Sheets B-1 through B-4. Note that a 10% contingency has been included in each. As previously described, for all of the deck width options investigated, the percentage of the overall mainline bridge cost remained relatively constant as shown below:

<u>% of Total Mainline Bridge Cost:</u>

- WV – 65%
- OH – 35%

Also indicated in the table are the options which provide pedestrian accommodation (sidewalk or shared use), bicycle accommodation (shared use or shoulder), options which will not need a design exception, options which could be restriped for 4 lanes of traffic as previously discussed, and options which could be re-decked while maintaining 2 lanes of traffic.

Option 2C and 3C are the narrowest and lowest cost options that meet all of the desirable criteria listed in the table. Therefore, they have been used as the baseline for the Normalized Cost column in the table.

Tabulation of Estimated Mainline Bridge Cost *

Option No.	Option Description	Out-to-Out Deck	Total Bridge Cost	Pedestrian Accommodation	Bicycle Accommodation	No Design Exception Required	4 Future Lanes Possible	Redeckable Maintaining 2 Lanes	Normalized Cost
1A	3 Lanes; 2' Shoulders; No Ped. Facilities	42'-6"	$58.4						0.84
1B	3 Lanes; 2' Shoulders; Shared-Use	51'-6"	$65.2	X	X				0.94
1C	3 Lanes; 2' & 8' Shoulders; Sidewalk	54'-6"	$67.4	X	X				0.97
2A	3 Lanes; 4' Shoulders; No Ped. Facilities	46'-6"	$60.9			X			0.87
2B	3 Lanes; 4' Shoulders; Shared-Use	55'-6"	$68.1	X	X	X			0.98
2C	3 Lanes; 4' & 8' Shoulders; Sidewalk	56'-6"	$69.7	X	X	X	X	X	1.00
3A	3 Lanes; 6' Shoulders; No Ped. Facilities	50'-6"	$64.1		X	X	X	X	0.92
3B	3 Lanes; 6' Shoulders; Shared-Use	59'-6"	$71.4	X	X	X	X	X	1.02
3C	3 Lanes; 6' Shoulders; Sidewalk	56'-6"	$69.7	X	X	X	X	X	1.00
4A	3 Lanes; 8' Shoulders; No Ped. Facilities	54'-6"	$67.9		X	X	X	X	0.97
4B	3 Lanes; 8' Shoulders; Shared-Use	63'-6"	$75.1	X	X	X	X	X	1.08
4C	3 Lanes; 8' Shoulders; Sidewalk	60'-6"	$73.1	X	X	X	X	X	1.05

* Cost in Millions for Main Span, WV Approach, OH Approach and OH 7 Overpass Bridge

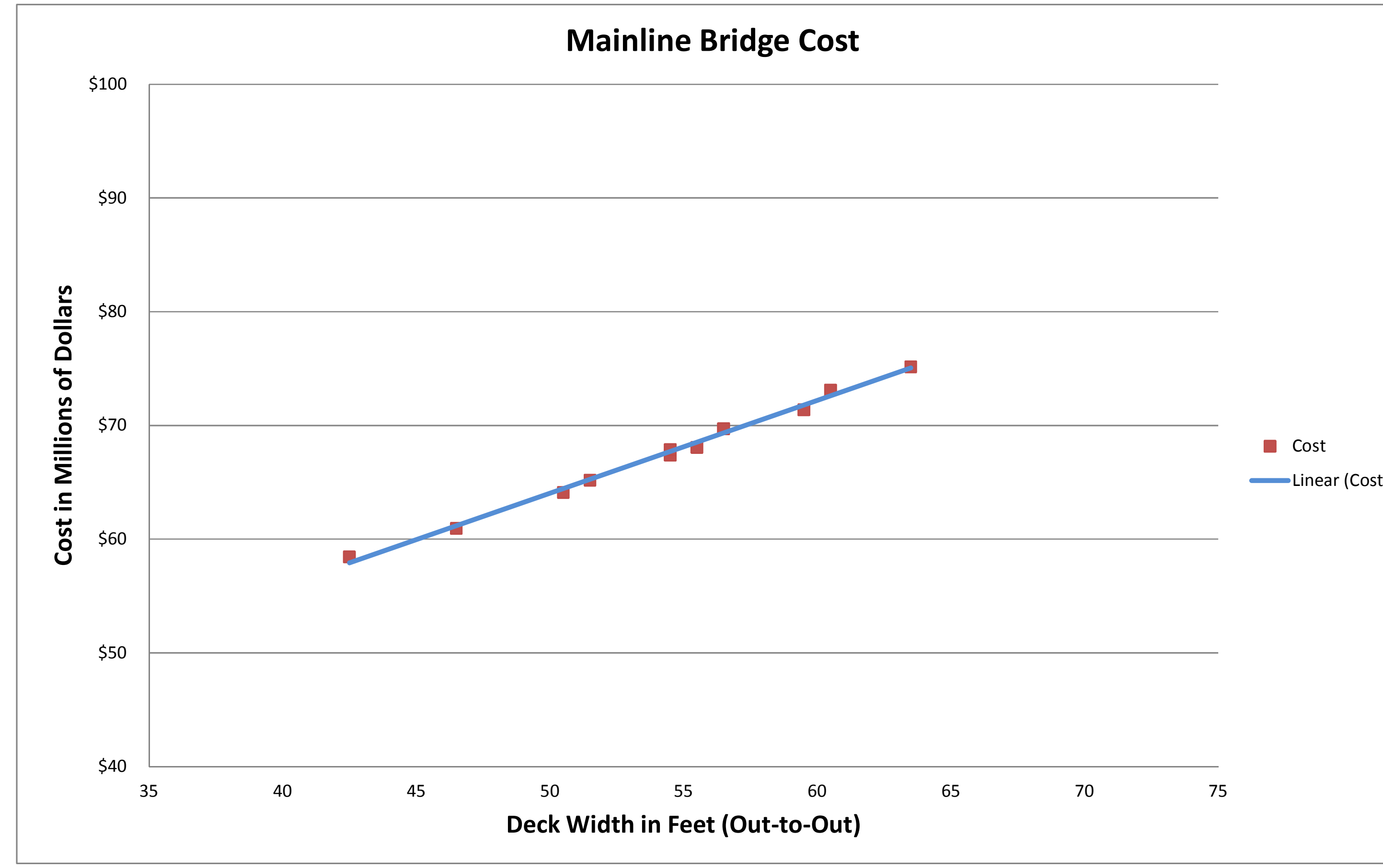
CONCLUSIONS

Based on the cost estimates developed, it appears that the relationship between deck width and anticipated mainline bridge cost is linear in this range of deck widths. The chart on this page is a plot of the deck width and cost for the 12 options studied along with a linear trendline. This chart can be used to estimate the cost of deck widths not included in this study. It should be noted that the slope of the trendline is not such that a percentage increase in overall deck width results in the same percentage increase in cost. For example, Option 4B is approximately 50% wider than Option 1A, but the cost is only 29% higher. This is due to the fact that there are fixed costs associated with all of the options. Two such items include:

- The same size river pier solid shaft section will be required to resist potential barge impact forces regardless of the deck width.
- For any deck width, the arch hanger configuration and total length remains the same. While the diameter of the hangers may change somewhat, this is a material savings which is relatively small on an item where the majority of the cost is associated with the end connections, fabrication and installation.

No recommendations are being made as part of this study report on which option should be advanced to preliminary design, as such decisions are dependent on available funding. However, the following generalizations can be made:

- For a given lane/shoulder configuration, adding the 8’ shared-use path increases the cost by approximately $6.8 to $7.3 million.
- For a given lane/shoulder configuration, adding a 5’ sidewalk and increasing one of the shoulders to 8’ increases the cost from $9 million for Option 1 down to $5.2 million for Option 4.
- There are 5 options which meet all of the desirable criteria shown in the table on Page 7 – Options 2C, 3B, 3C, 4B and 4C. Of these five options, Option 3B is considered the preferred option. It is only slightly (2%) higher in cost than the two lowest of the five (Option 2C and 3C). However, it provides an 8’ wide separated shared use path which is preferable to the 5’ wide separated sidewalk because it provides a safer condition for bicycles which can use the path as opposed to the shoulder. In addition, should Option 2C or 3C ever be striped for 4 lanes, there would be no bicycle accommodation possible.

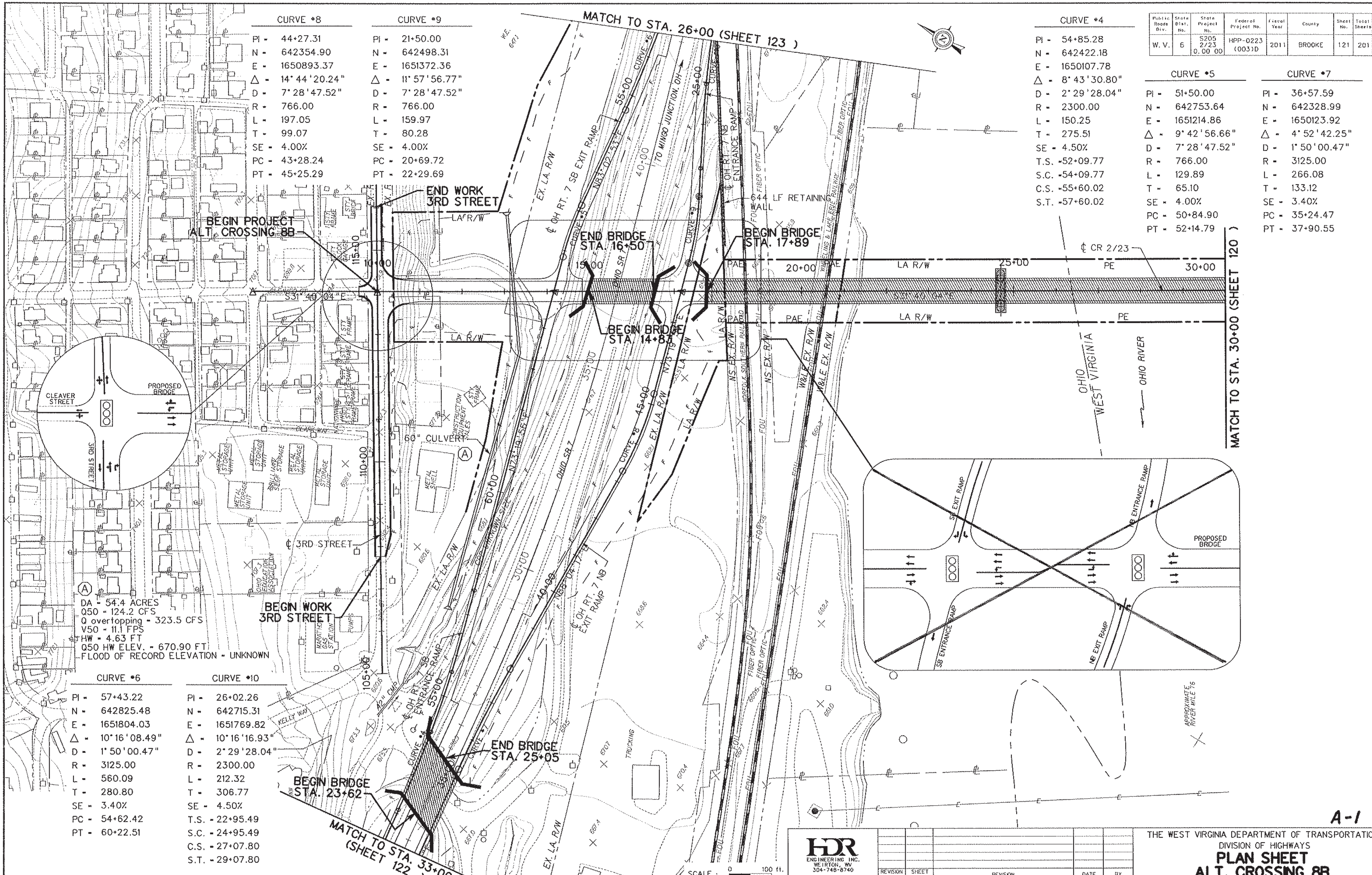


STRUCTURAL PLAN DESCRIPTION

The structural plans for the options are included in Appendix A. The following list describes the material covered on each plan sheet:

Sheets	Description
A-1 to A-3	Roadway Plan and Profile for Alternative 8B
A-4	Minimum Number of Lanes
A-5	Assumed Funding Split
A-6	Assumed Fixities, Joints and Bearings
A-7 to A-14	Approach Typical Sections
A-15 to A-22	Main River Bridge Typical Sections
A-23 to A-25	Main River Bridge Superstructure
A-26 to A-27	Abutments and Wingwalls
A-28 to A-30	Piers

APPENDIX A - DRAWINGS



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N -	642354.90
E -	1650893.37
Δ -	14° 44' 20.24"
D -	7° 28' 47.52"
R -	766.00
L -	197.05
T -	99.07
SE -	4.00%
PC -	43+28.24
PT -	45+25.29

CURVE #9	
PI -	21+50.00
N -	642498.31
E -	1651372.36
Δ -	11° 57' 56.77"
D -	7° 28' 47.52"
R -	766.00
L -	159.97
T -	80.28
SE -	4.00%
PC -	20+69.72
PT -	22+29.69

CURVE #4	
PI -	54+85.28
N -	642422.18
E -	1650107.78
Δ -	8° 43' 30.80"
D -	2° 29' 28.04"
R -	2300.00
L -	150.25
T -	275.51
SE -	4.50%
T.S. -	52+09.77
S.C. -	54+09.77
C.S. -	55+60.02
S.T. -	57+60.02

CURVE #5	
PI -	51+50.00
N -	642753.64
E -	1651214.86
Δ -	9° 42' 56.66"
D -	7° 28' 47.52"
R -	766.00
L -	129.89
T -	65.10
SE -	4.00%
PC -	50+84.90
PT -	52+14.79

CURVE #7	
PI -	36+57.59
N -	642328.99
E -	1650123.92
Δ -	4° 52' 42.25"
D -	1° 50' 00.47"
R -	3125.00
L -	266.08
T -	133.12
SE -	3.40%
PC -	35+24.47
PT -	37+90.55

CURVE #6	
PI -	57+43.22
N -	642825.48
E -	1651804.03
Δ -	10° 16' 08.49"
D -	1° 50' 00.47"
R -	3125.00
L -	560.09
T -	280.80
SE -	3.40%
PC -	54+62.42
PT -	60+22.51

CURVE #10	
PI -	26+02.26
N -	642715.31
E -	1651769.82
Δ -	10° 16' 16.93"
D -	2° 29' 28.04"
R -	2300.00
L -	212.32
T -	306.77
SE -	4.50%
T.S. -	22+95.49
S.C. -	24+95.49
C.S. -	27+07.80
S.T. -	29+07.80

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205 2/23 0.00 00	HPP-0223 (003)D	2011	BROOKE	121	201

A-1

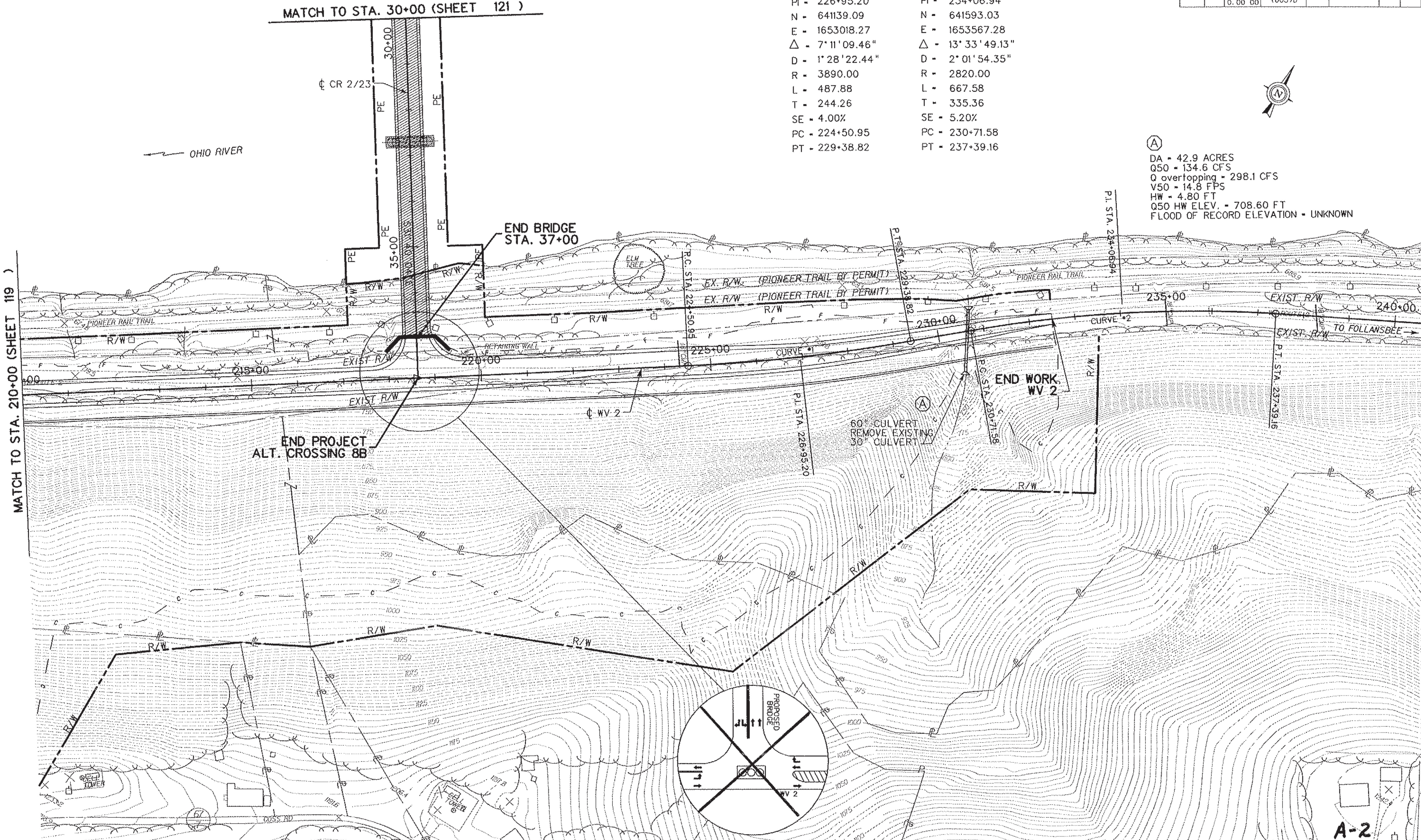
HDR ENGINEERING INC. WEIRTON, WV 304-748-8740

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PLAN SHEET
ALT. CROSSING 8B

CHECK PRINT | No. 1 JULY 07, 2011 | CORRECTIONS CHECKED BY:
DRAWING ORIGINATOR: | CHANGES MADE BY:
CHECKED BY: | CHANGES VERIFIED BY:

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205 2/23 0.00 00	HPP-0223 (003)D	2011	BROOKE	120	201



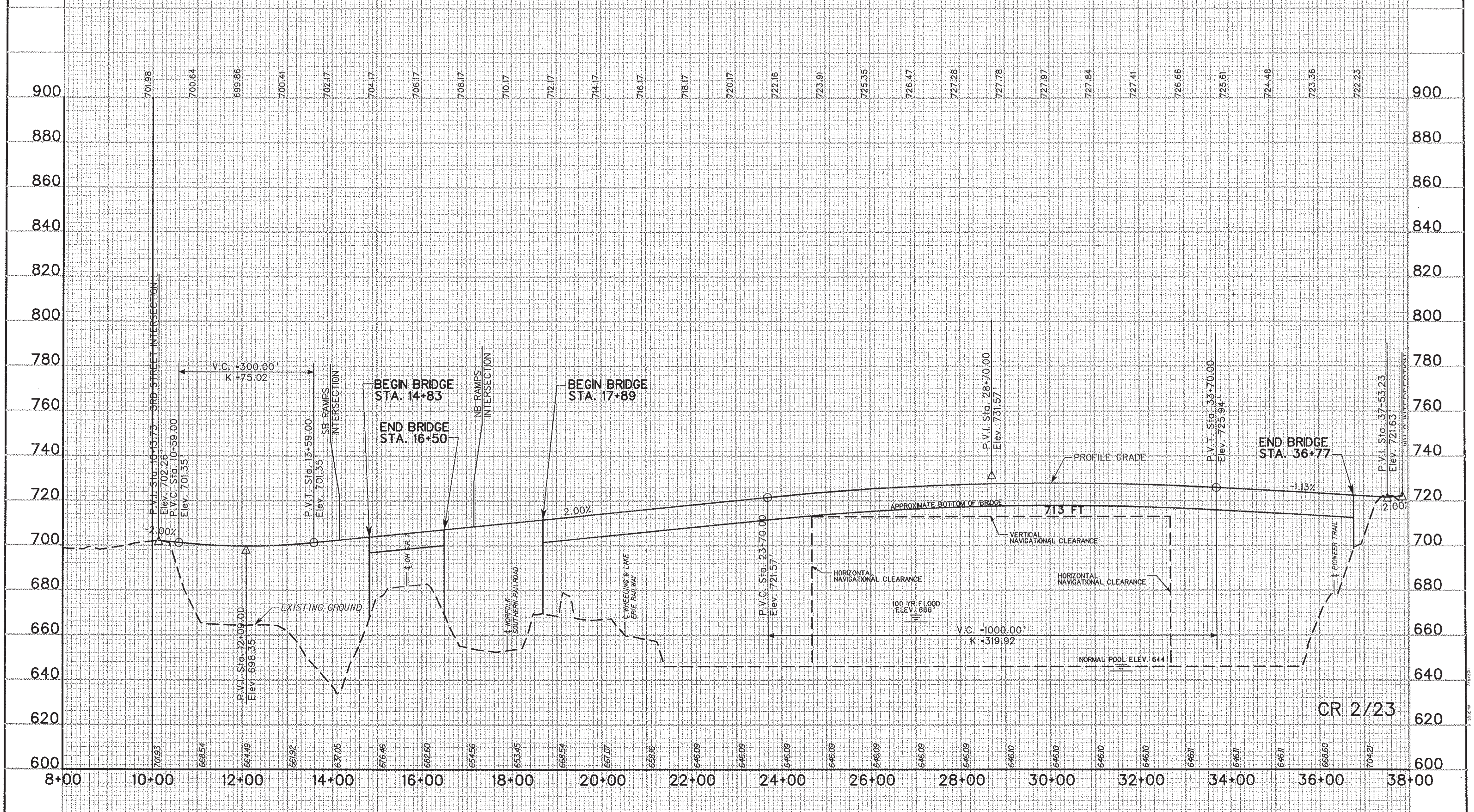
HDR ENGINEERING INC. WEIRTON, WV 304-748-8740

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PLAN SHEET
ALT. CROSSING 8B

HDR CHECK PRINT No. 1 July 07, 2011 CORRECTIONS CHECKED BY:
DRAWING ORIGINATOR: CHANGES MADE BY:
CHECKED BY: CHANGES VERIFIED BY:

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205 2/23 0.00 00	HPP-0223 (003)D	2011	BROOKE	126	201



SCALES 20 ft. 0 100 ft. 0

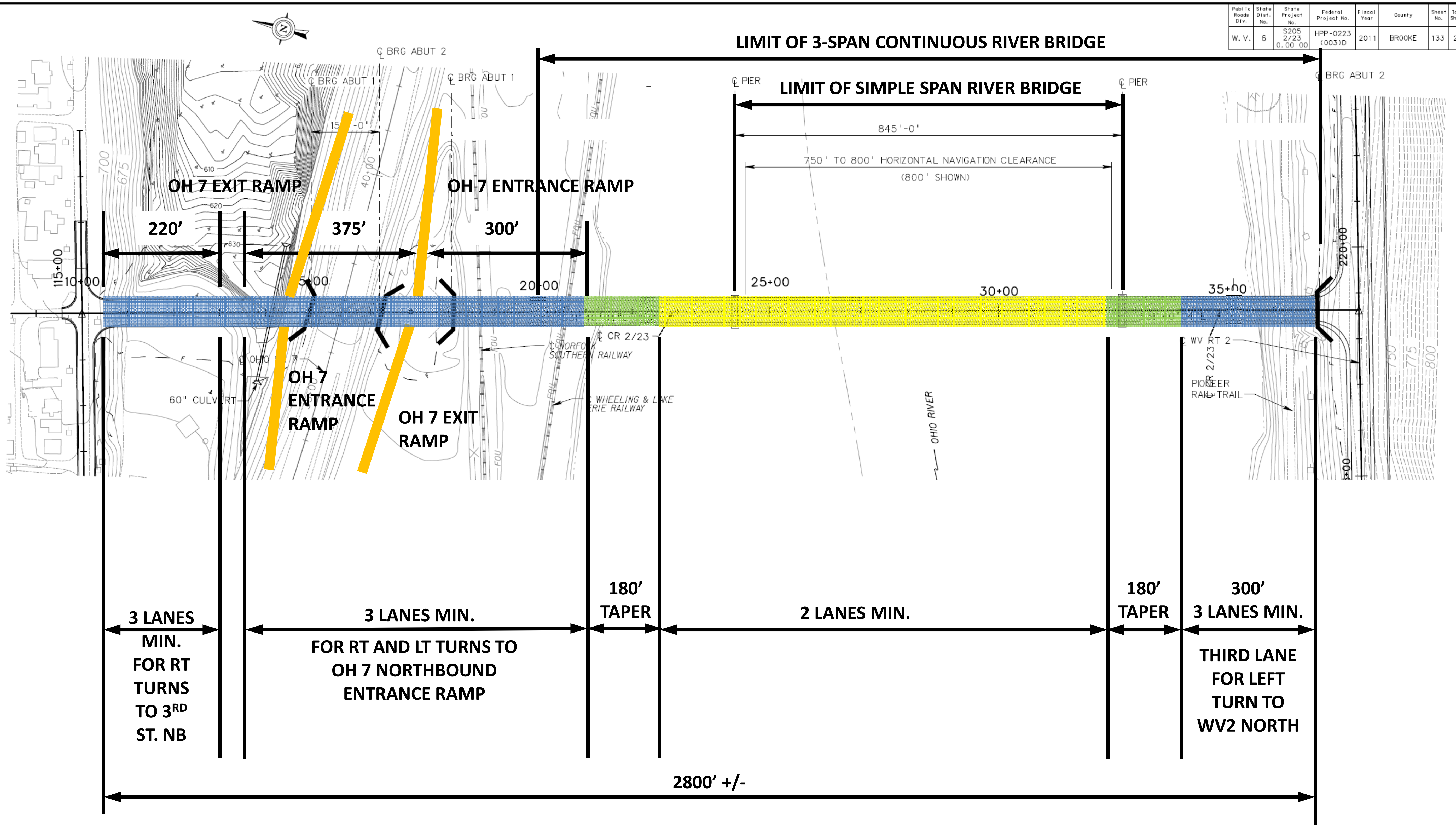
HDR ENGINEERING INC. WEIRTON, WV 304-748-8740

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

PROFILE ALT 8 & 8B

A-3



MINIMUM NUMBER OF LANES

A-4

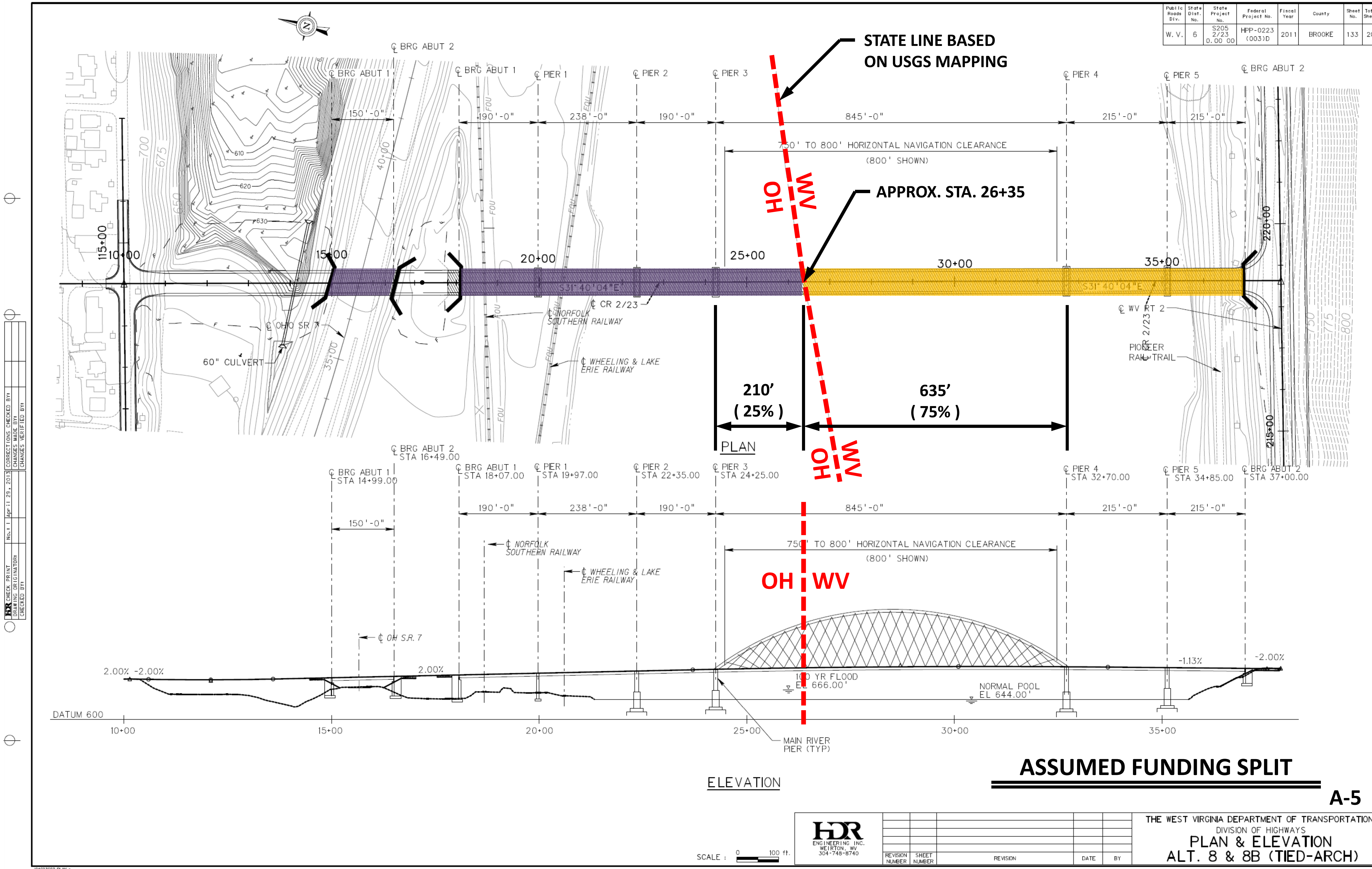
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205 2/23 0.00 00	HPP-0223 (003)D	2011	BROOKE	133	201

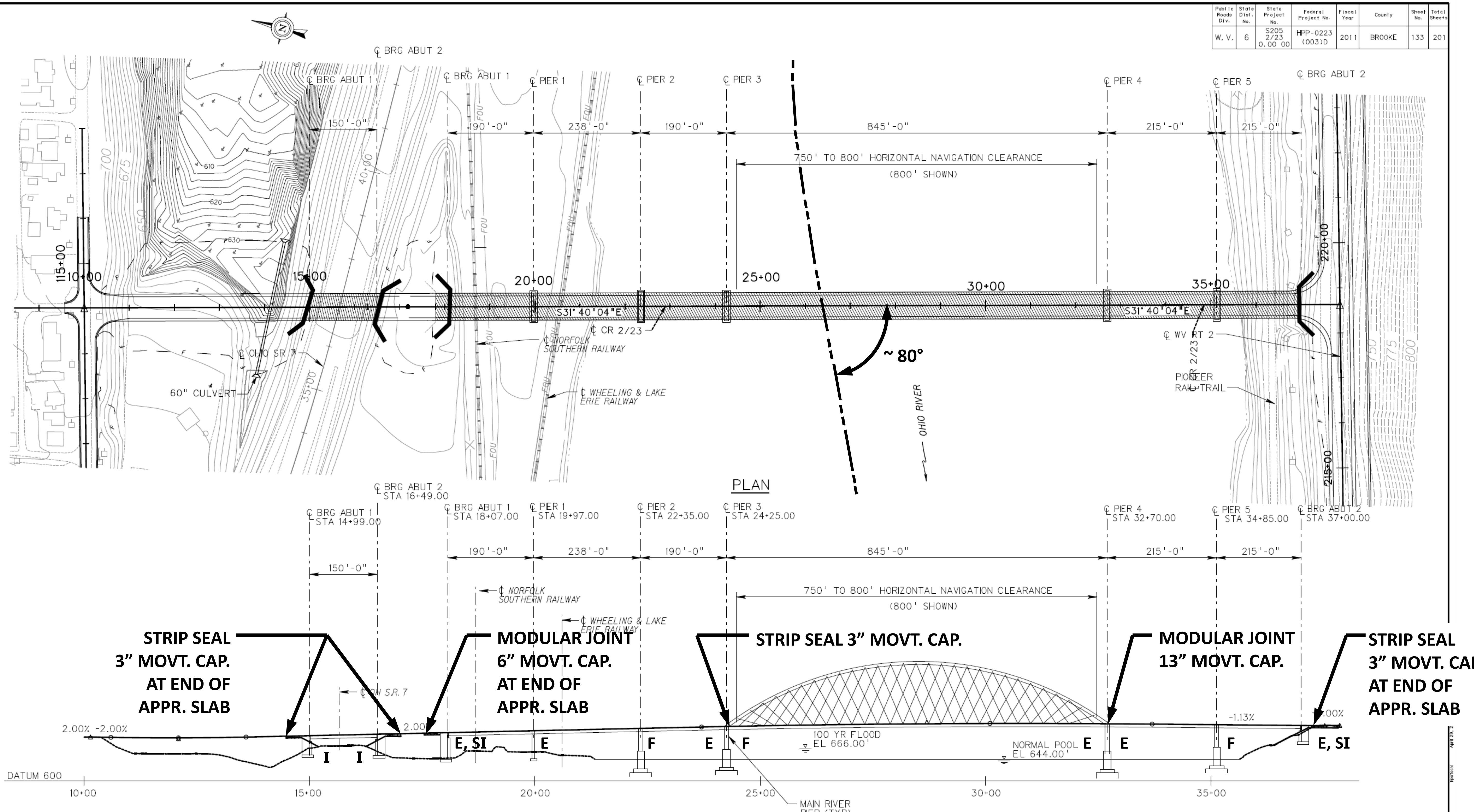
HDR ENGINEERING INC. WEIRTON, WV 304-748-8740

SCALE : 0 100 ft.

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PLAN & ELEVATION
ALT. 8 & 8B (TIED-ARCH)


STATE LINE BASED ON USGS MAPPING
APPROX. STA. 26+35
OH
WV
210’ (25%)
635’ (75%)
PLAN
ELEVATION
℄ BRG ABUT 2 STA 16+49.00
℄ BRG ABUT 1 STA 14+99.00
℄ BRG ABUT 1 STA 18+07.00
℄ PIER 1 STA 19+97.00
℄ PIER 2 STA 22+35.00
℄ PIER 3 STA 24+25.00
℄ PIER 4 STA 32+70.00
℄ PIER 5 STA 34+85.00
℄ BRG ABUT 2 STA 37+00.00
150'-0"
190'-0"
238'-0"
190'-0"
845'-0"
215'-0"
215'-0"
750' TO 800' HORIZONTAL NAVIGATION CLEARANCE
(800' SHOWN)
℄ NORFOLK SOUTHERN RAILWAY
℄ WHEELING & LAKE ERIE RAILWAY
℄ OHIO SR 7
℄ CR 2/23
℄ WV RT 2
PIONEER RAIL TRAIL
60" CULVERT
S31°40'04"E
100 YR FLOOD EL 666.00'
NORMAL POOL EL 644.00'
MAIN RIVER PIER (TYP)
DATUM 600
2.00% -2.00%
2.00%
-1.13%
-2.00%
10+00
15+00
20+00
25+00
30+00
35+00
ASSUMED FUNDING SPLIT
A-5
W. V.
6
S205 2/23 0.00 00
HPP-0223 (003)D
2011
BROOKE
133
HDR ENGINEERING INC. WEIRTON, WV 304-748-8740
THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PLAN & ELEVATION
ALT. 8 & 8B (TIED-ARCH)
SCALE : 0 100 ft.



ASSUMED FIXITIES, JOINTS & BEARINGS

A-6

NOTE: ALL BEARINGS TO BE REINFORCED ELASTOMERIC EXCEPT ARCH BEARINGS TO BE DISC TYPE.

NOTE: ASSUMED ΔT = 150° PER WVBDM (-30° TO 120°)

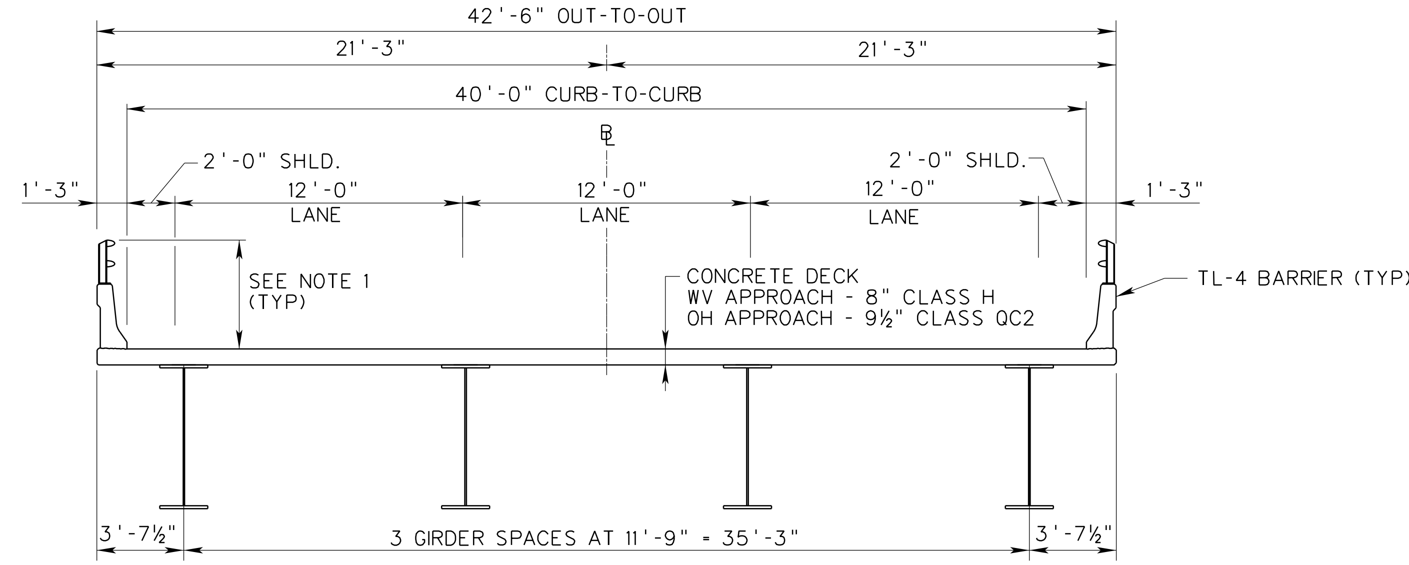
SCALE : 0 100 ft.

HDR ENGINEERING INC. WEIRTON, WV 304-748-8740

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PLAN & ELEVATION
ALT. 8 & 8B (TIED-ARCH)

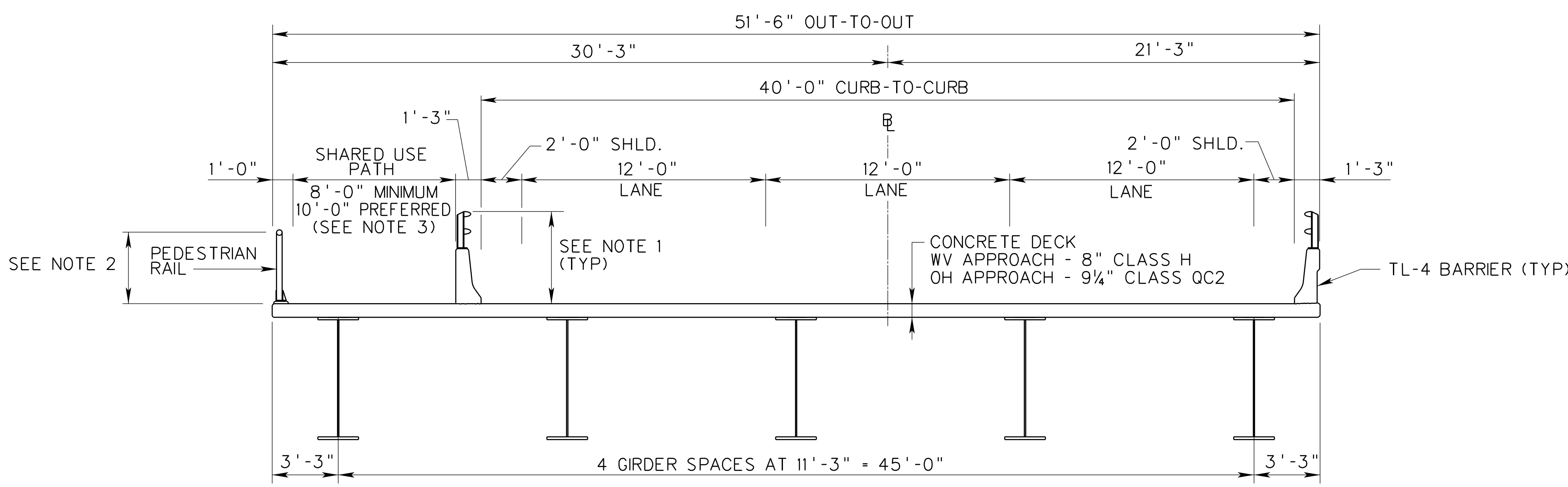
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 1A - 3 LANES; 2' SHOULDERS

4' 2' 0 4'

SCALE: ¼" = 1'-0"



OPTION 1B - 3 LANES; 2' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

APPROACHES

A-7

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

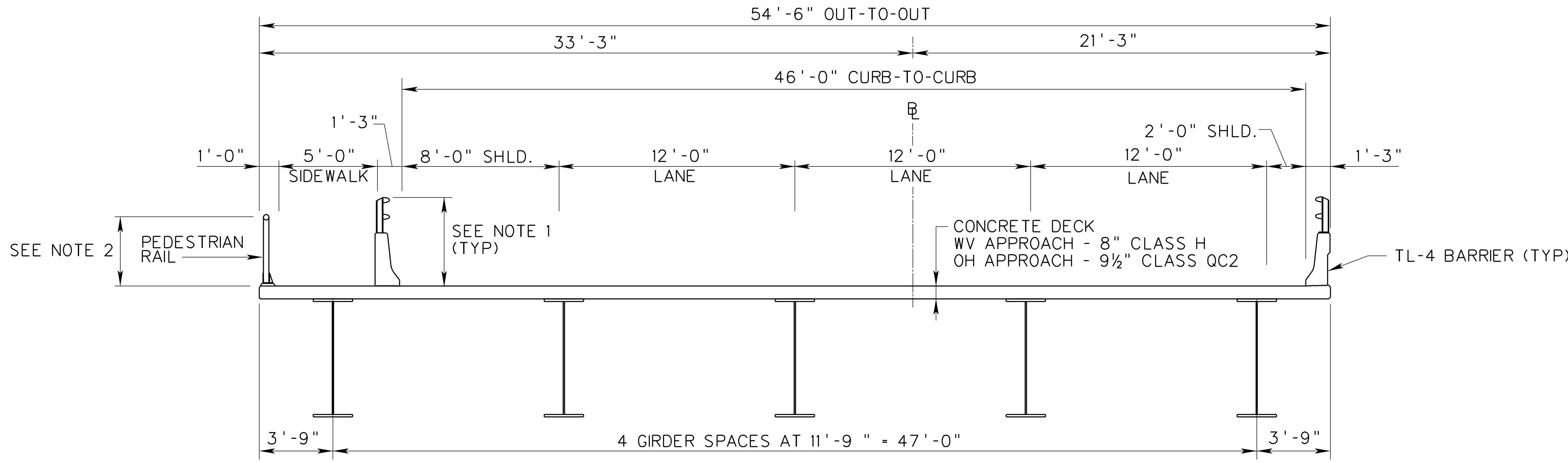
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 1C - 3 LANES; 2' & 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

APPROACHES

A-8

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

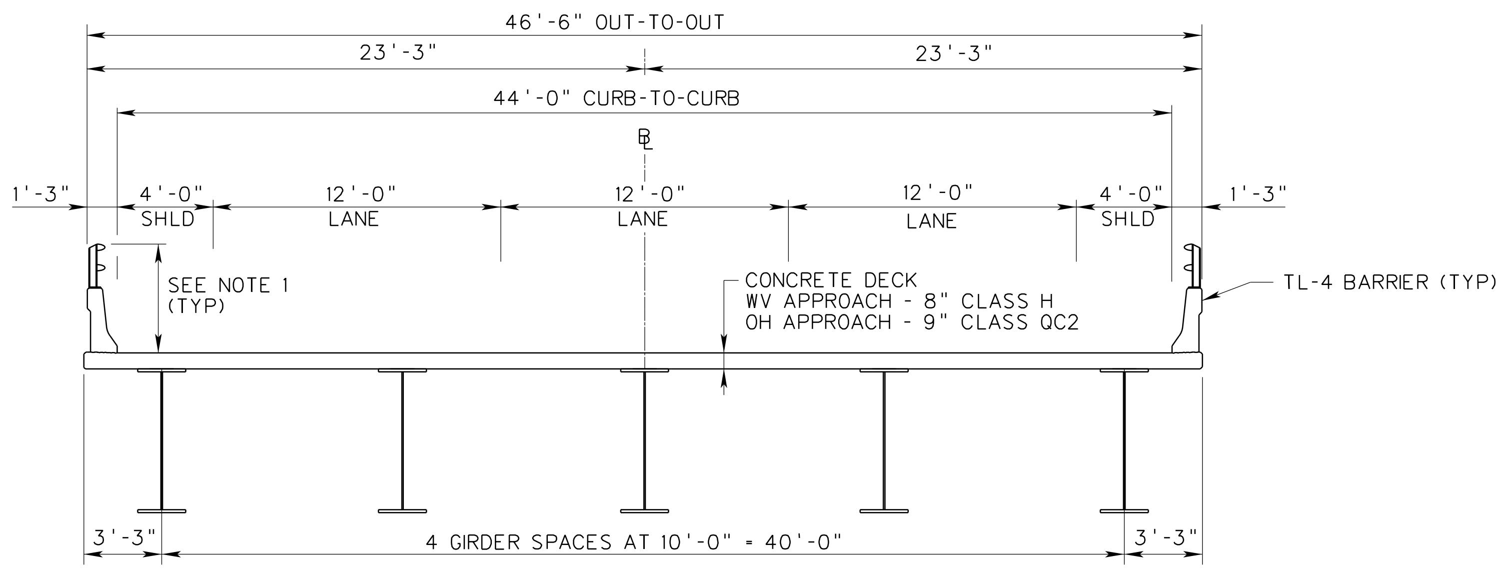
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE 6

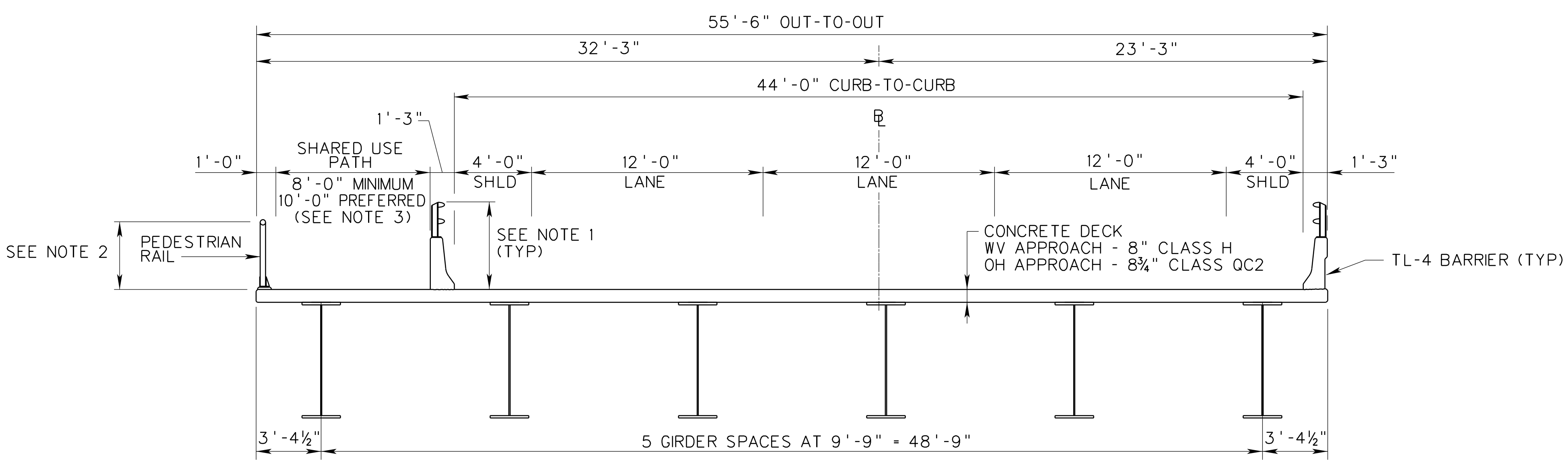
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 2A - 3 LANES; 4' SHOULDERS

4' 2' 0 4'

SCALE: ¼" = 1'-0"



OPTION 2B - 3 LANES; 4' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

APPROACHES

A-9

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

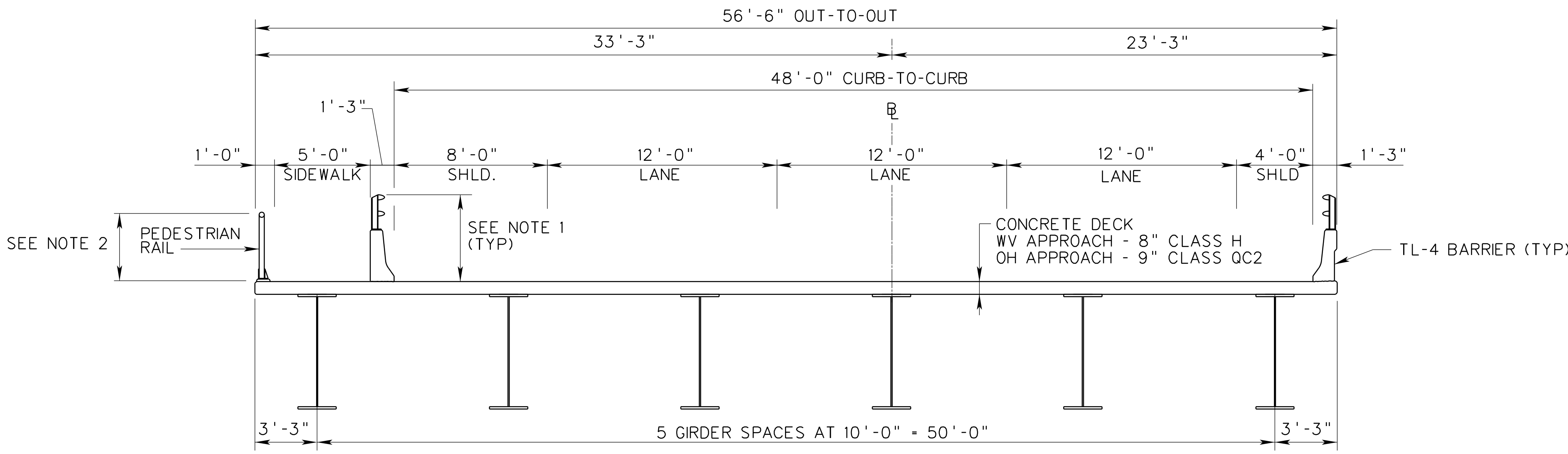
DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET
OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 2C - 3 LANES; 4' & 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

APPROACHES

A-10

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

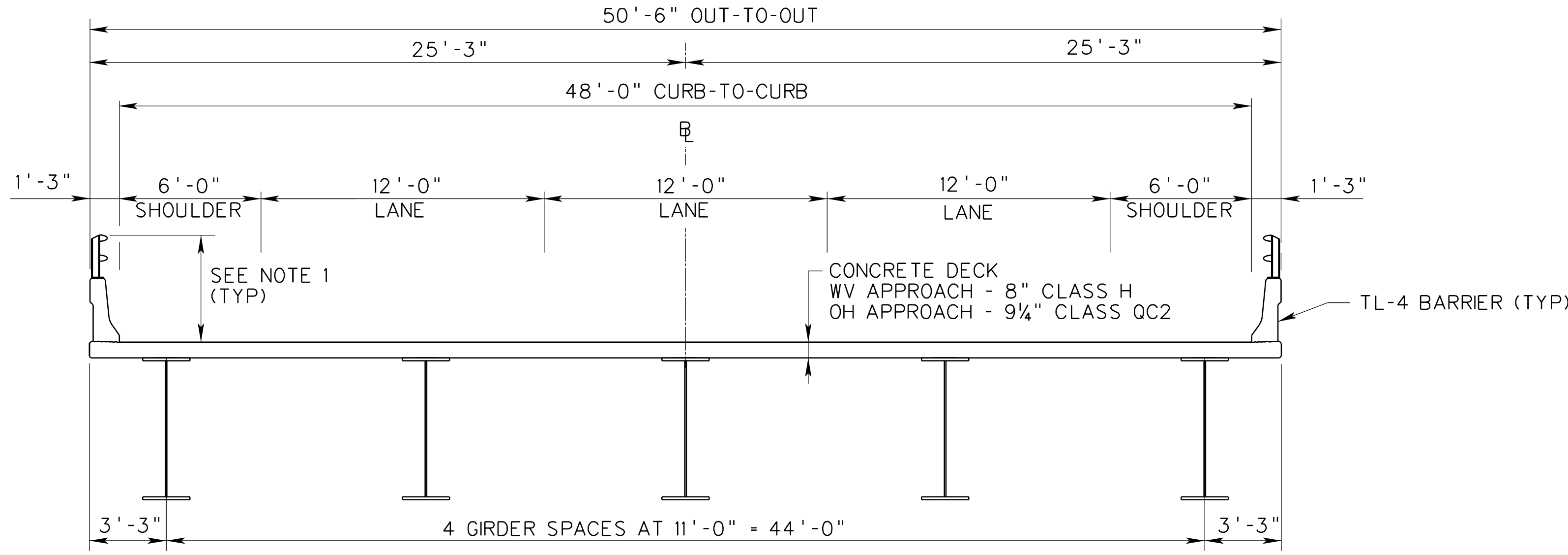
DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET
OF
BRIDGE NO.

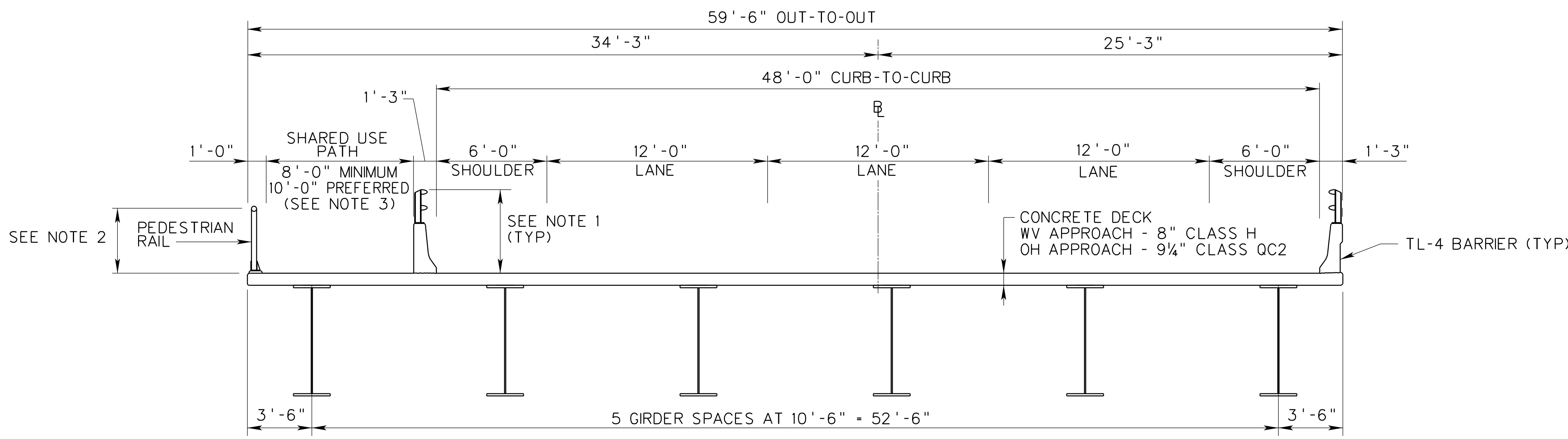
J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 3A - 3 LANES; 6' SHOULDERS

4' 2' 0 4'
SCALE: ¼" = 1'-0"



OPTION 3B - 3 LANES; 6' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'
SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

APPROACHES

A-11

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

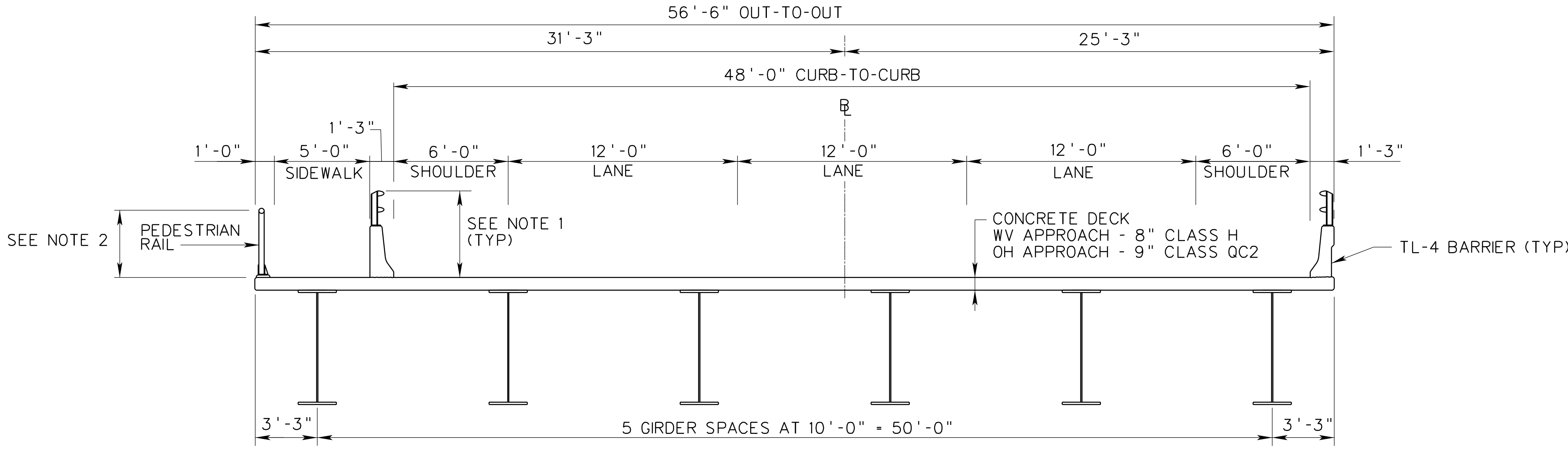
DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 3C - 3 LANES; 6' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

APPROACHES

A-12

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

HDR

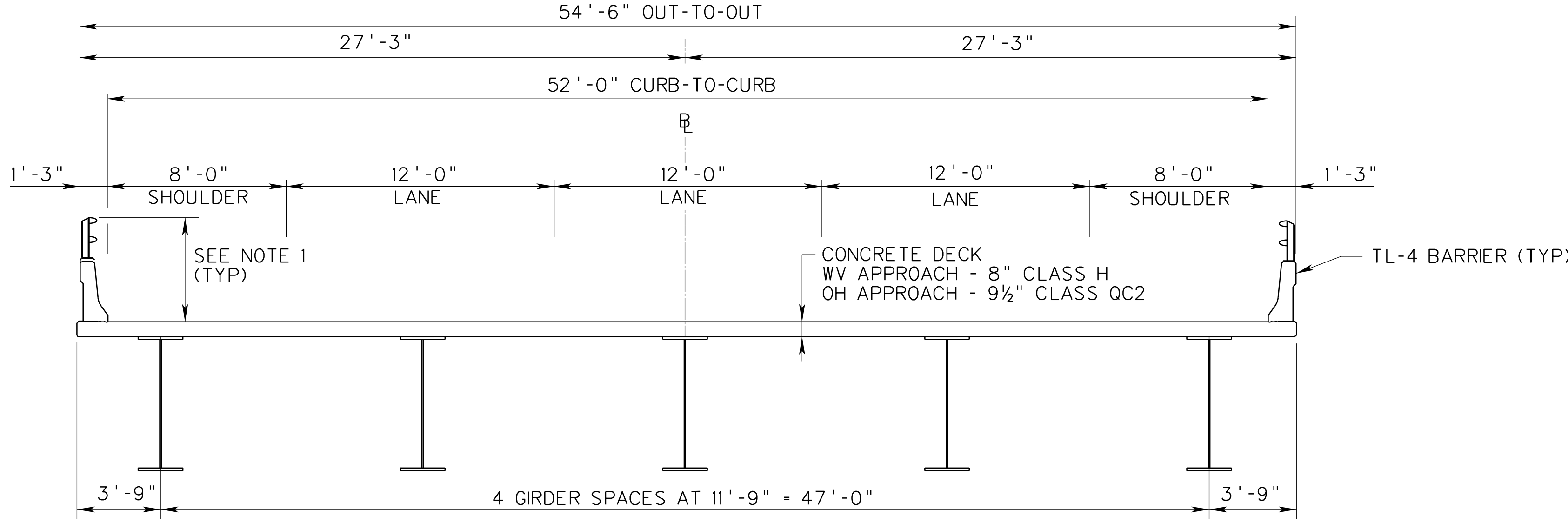
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE 6

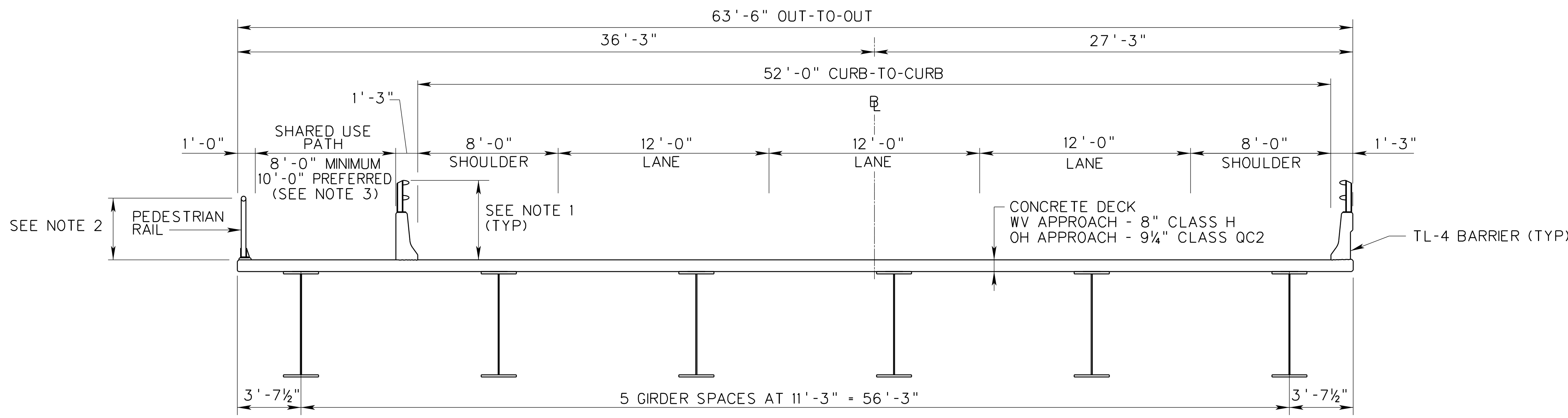
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 4A - 3 LANES; 8' SHOULDERS

4' 2' 0 4'

SCALE: ¼" = 1'-0"



OPTION 4B - 3 LANES; 8' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

APPROACHES

A-13

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

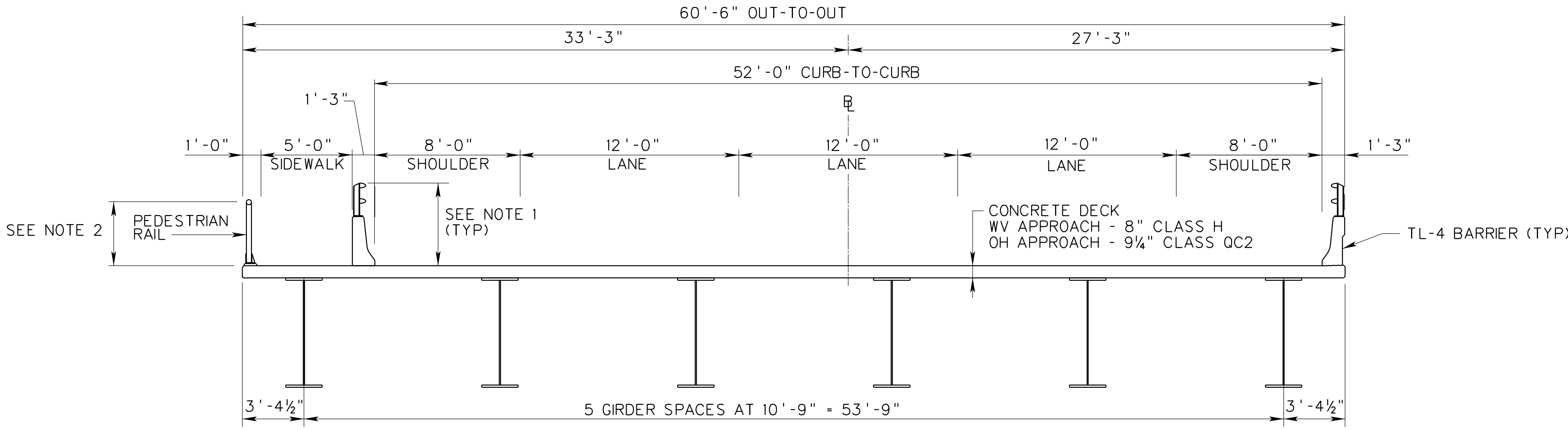
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 4C - 3 LANES; 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

APPROACHES

A-14

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

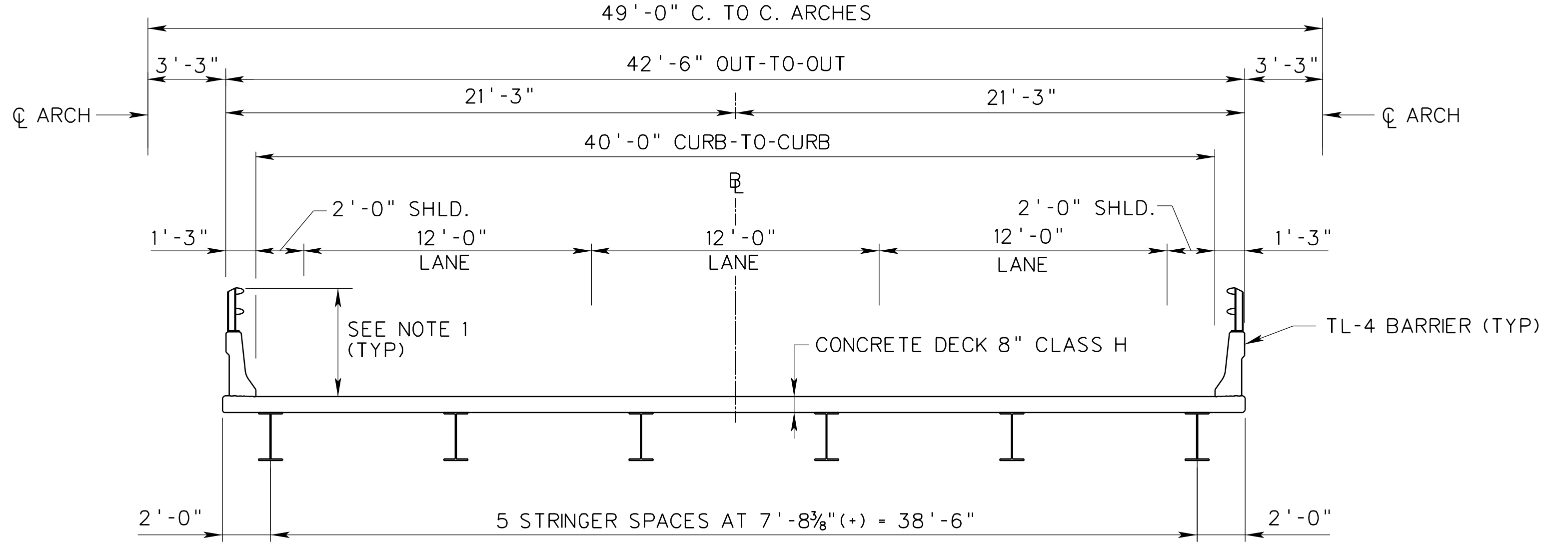
DESIGNED | DATE
DRAWN
CHECKED
CHECKED

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE 6

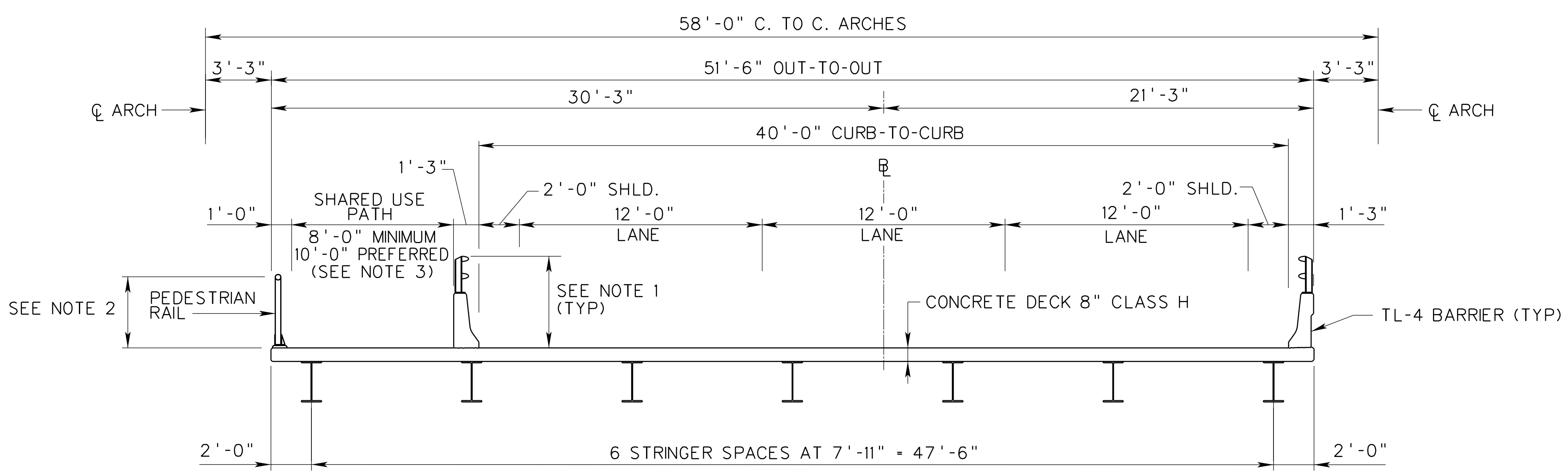
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 1A - 3 LANES; 2' SHOULDERS

4' 2' 0 4'

SCALE: ¼" = 1'-0"



OPTION 1B - 3 LANES; 2' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

MAIN RIVER BRIDGE

A-15

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

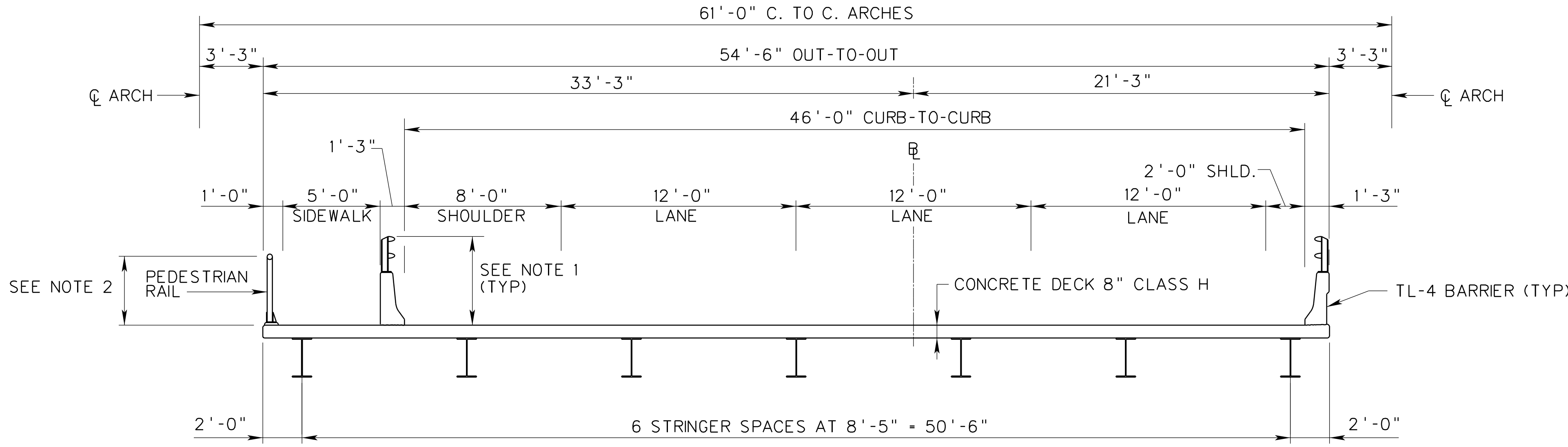
DESIGNED	DATE
DRAWN	
CHECKED	
CHECKED	

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 1C – 3 LANES; 2' & 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

MAIN RIVER BRIDGE

A-16

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

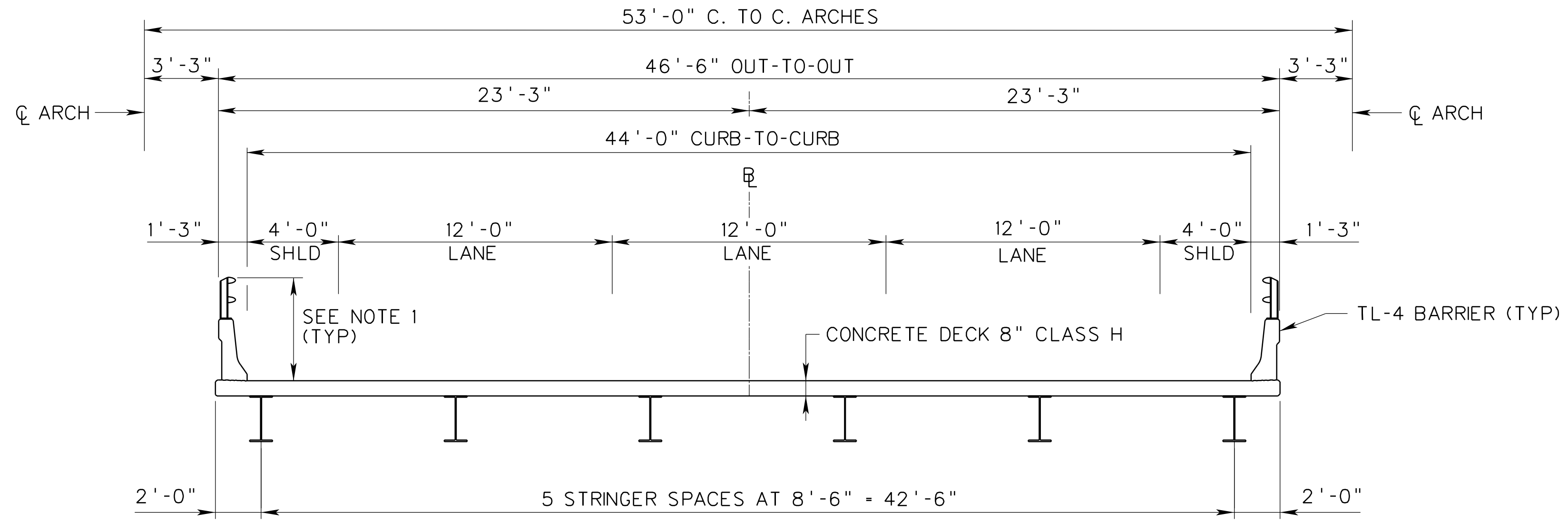
DESIGNED | DATE
DRAWN
CHECKED
CHECKED

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF
BRIDGE NO.

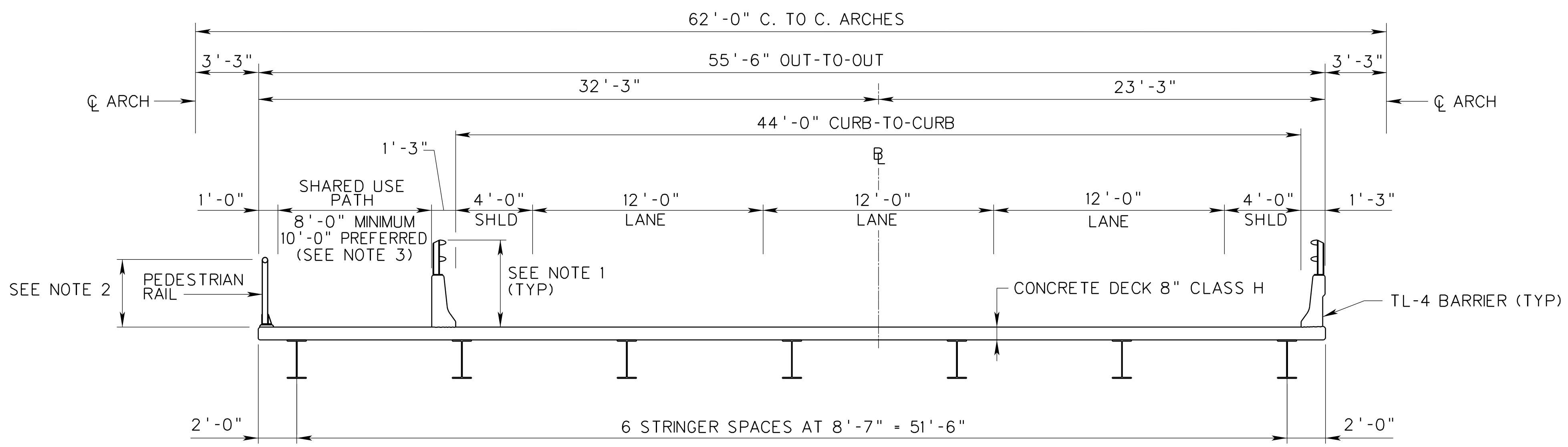
J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 2A - 3 LANES; 4' SHOULDERS

4' 2' 0 4'
SCALE: ¼" = 1'-0"



OPTION 2B - 3 LANES; 4' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'
SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

MAIN RIVER BRIDGE

A-17

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
CHECKED	
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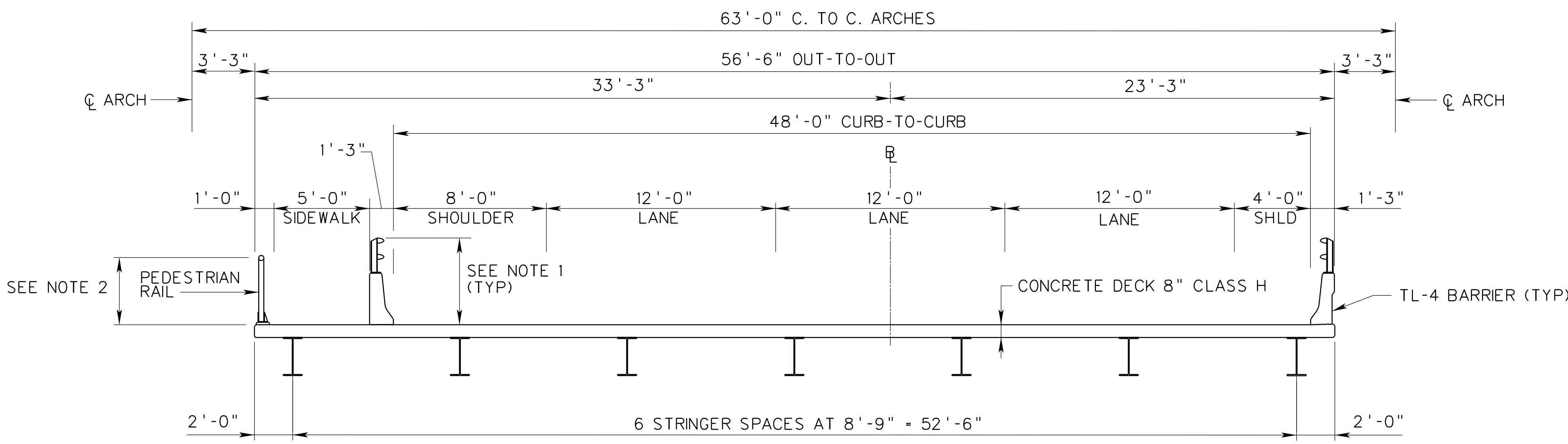
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 2C - 3 LANES; 4' & 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

MAIN RIVER BRIDGE

A-18

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
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CHECKED	

HDR ENGINEERING, INC.
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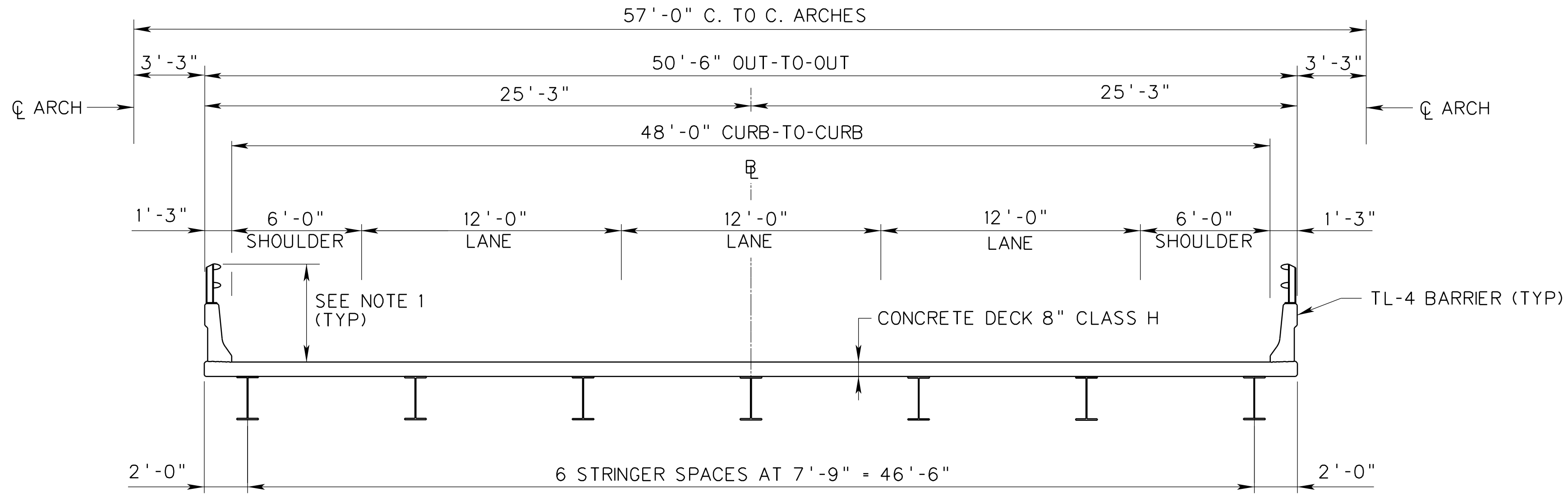
SHEET OF

BRIDGE NO.

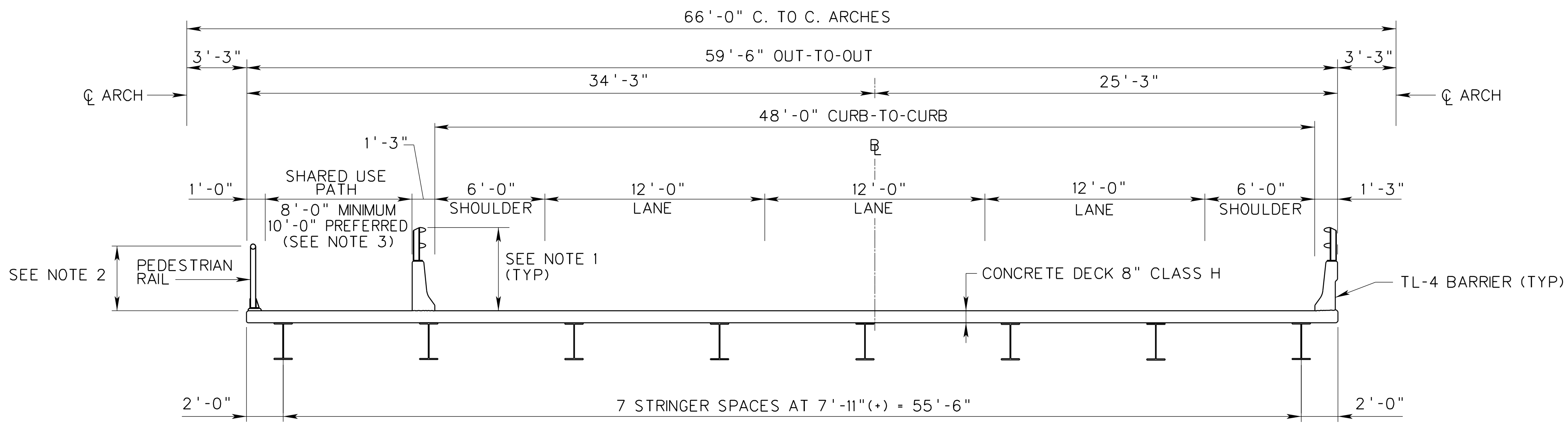
J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 3A - 3 LANES; 6' SHOULDERS

4' 2' 0 4'
SCALE: ¼" = 1'-0"



OPTION 3B - 3 LANES; 6' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'
SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

MAIN RIVER BRIDGE

A-19

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
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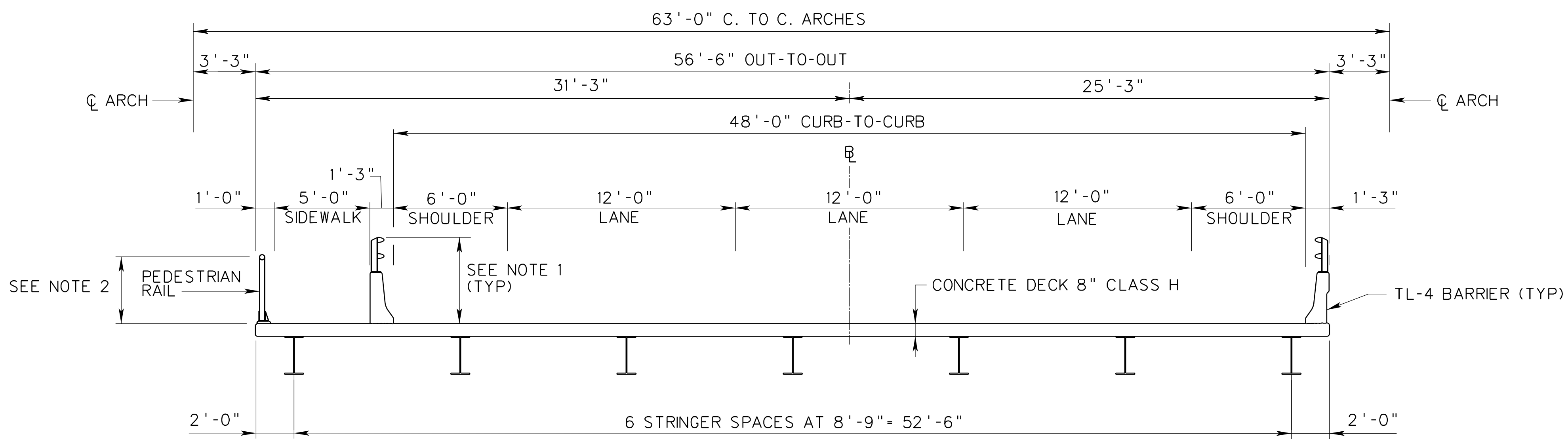
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 3C - 3 LANES; 6' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

MAIN RIVER BRIDGE

A-20

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
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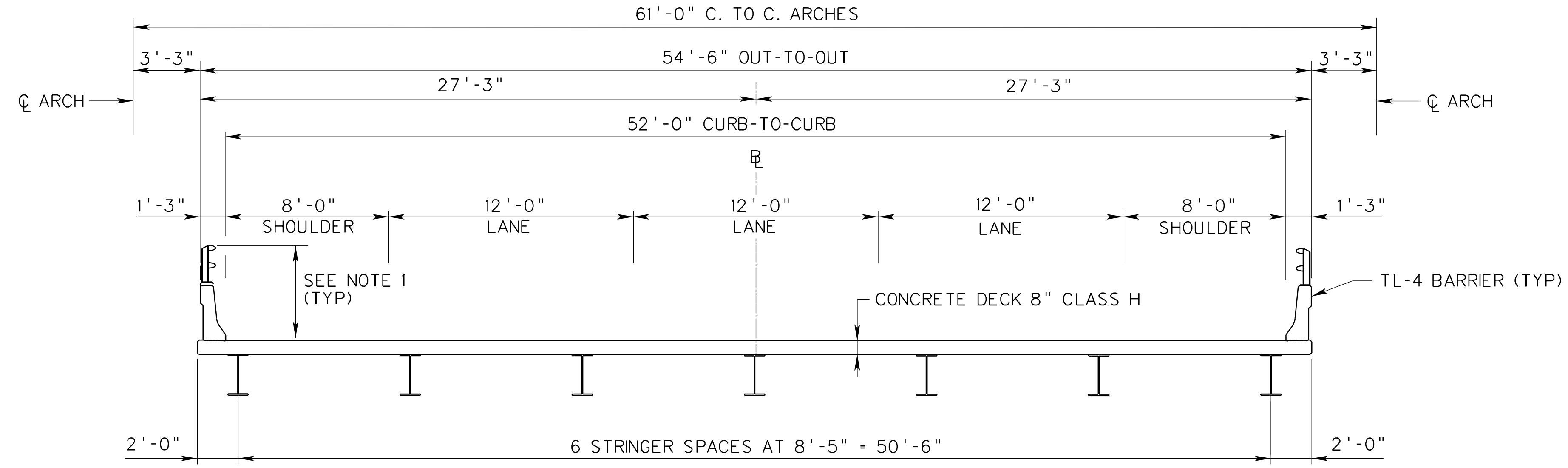
SHEET
OF
BRIDGE NO.

J04C22C03 - BRIDGE b

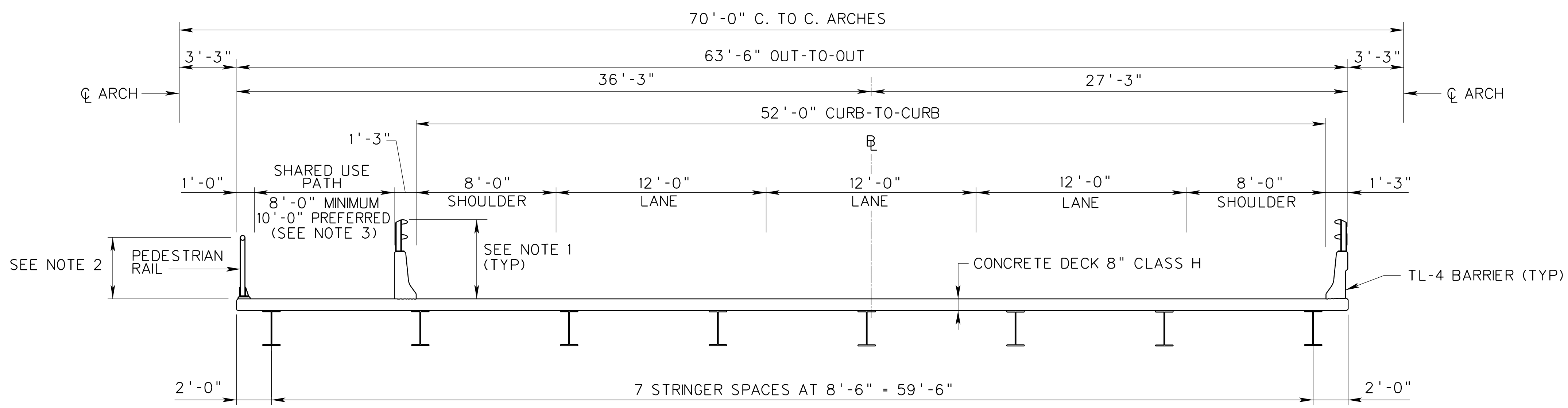
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 4A - 3 LANES; 8' SHOULDERS

4' 2' 0 4'

SCALE: ¼" = 1'-0"



OPTION 4B - 3 LANES; 8' SHOULDERS; SHARED-USE PATH

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".
3. OTHER SECTION DIMENSIONS BASED ON 8'-0" SHARED USE PATH WIDTH.

MAIN RIVER BRIDGE

A-21

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED	DATE
DRAWN	
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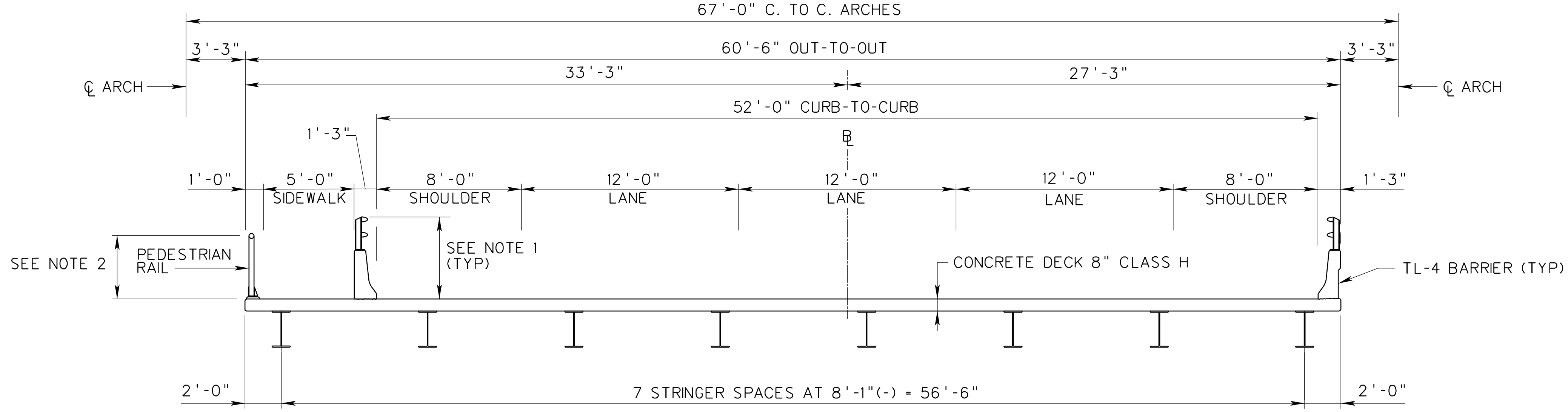
WEIRTON, W.VA. 304-748-8700

SHEET OF

BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W. V.	6	S205-2/23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



OPTION 4C - 3 LANES; 8' SHOULDERS; SIDEWALK

4' 2' 0 4'

SCALE: ¼" = 1'-0"

NOTES:

1. TL-4 BARRIER MAY BE BARRIER ALONE OR COMBINATION OF BARRIER AND RAILING (AS SHOWN). IN EITHER CASE, TOTAL HEIGHT OF TL-4 BARRIER SHALL BE A MINIMUM OF 48".
2. PEDESTRIAN RAIL HEIGHT SHALL BE A MINIMUM OF 48".

MAIN RIVER BRIDGE

A-22

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

TYPICAL SECTION OPTIONS

DESIGNED | DATE
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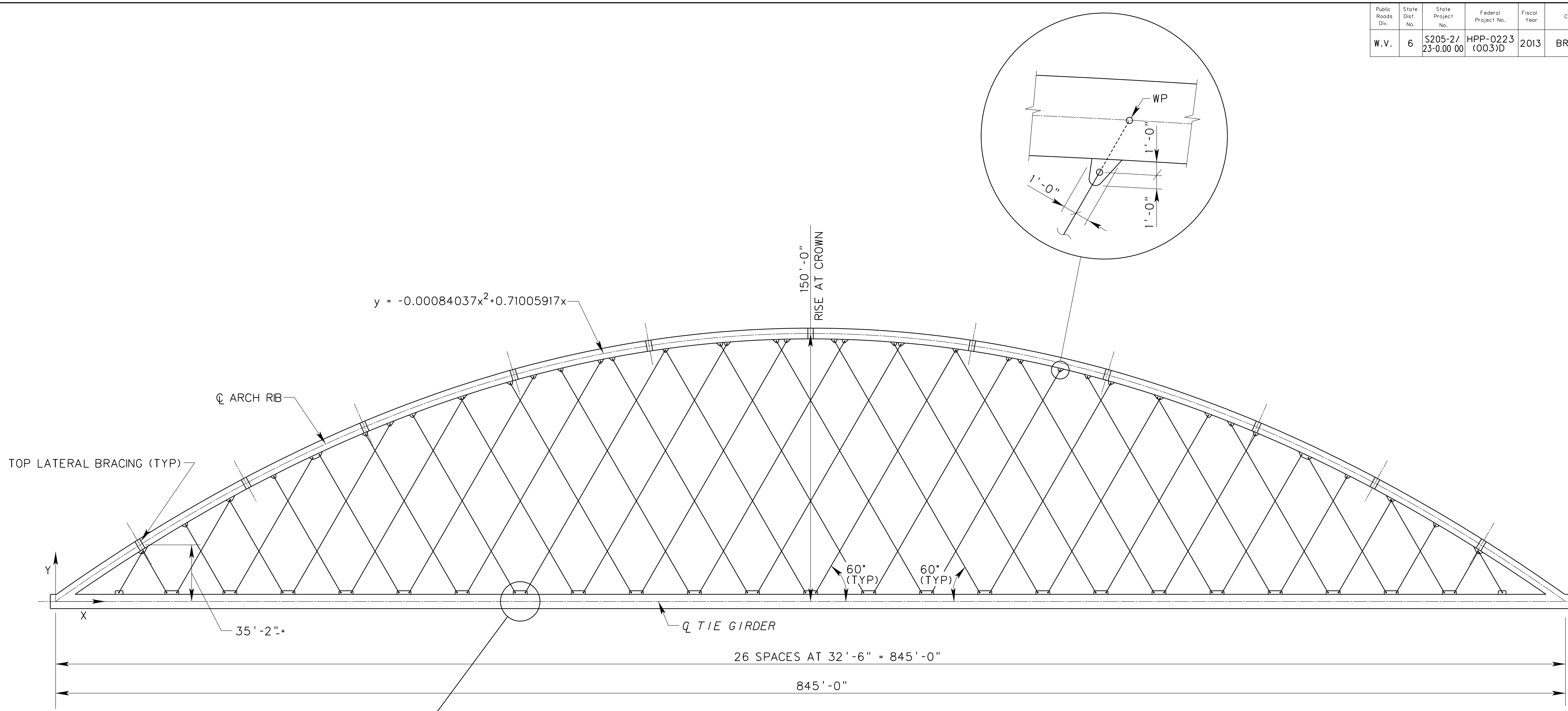
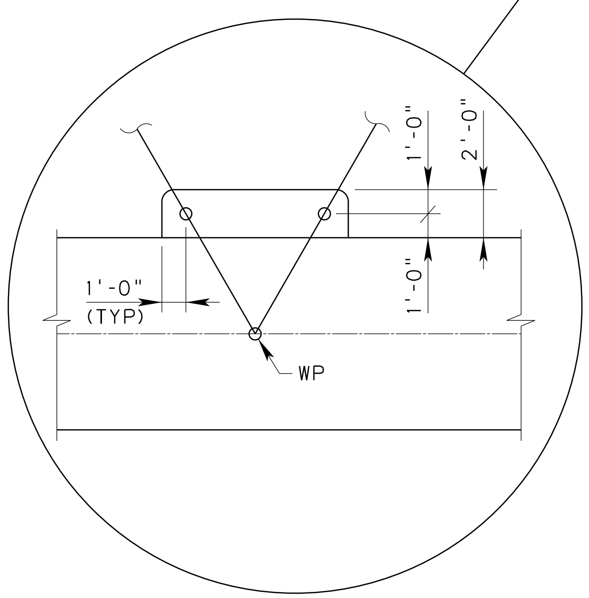
SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



ELEVATION



MAIN RIVER BRIDGE

A-23

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
WELLSBURG BRIDGE

ARCH ELEVATION

DESIGNED	DATE 2 / 13
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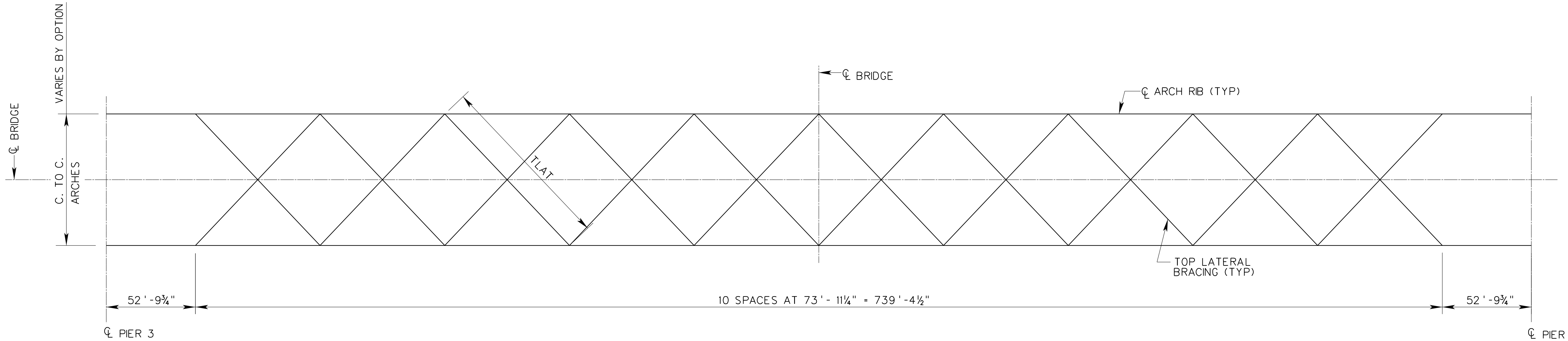
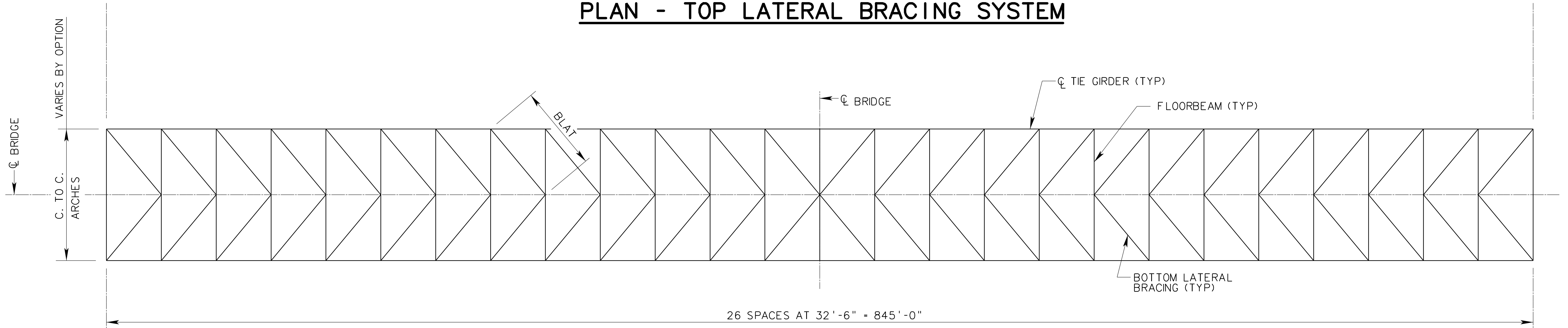
SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



PLAN - TOP LATERAL BRACING SYSTEM



PLAN - BOTTOM LATERAL BRACING SYSTEM

MAIN RIVER BRIDGE A-24

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

ARCH BRACING PLANS

	DATE
DESIGNED	2 / 13
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CHECKED	

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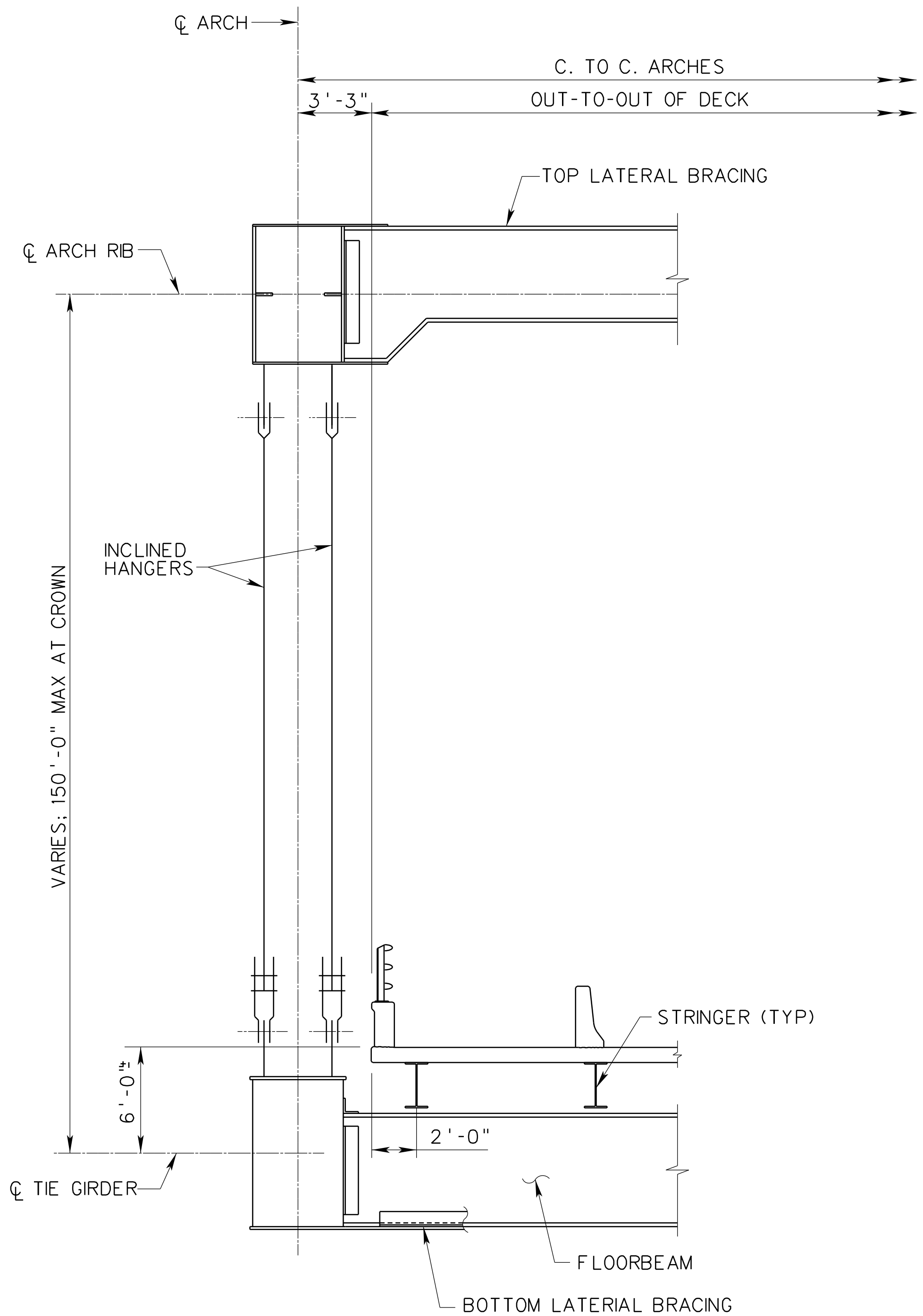
SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



TYPICAL SECTION - MAIN SPAN

MAIN RIVER BRIDGE A-25

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
WELLSBURG BRIDGE

	DATE
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CHECKED	

TYPICAL ARCH SECTION

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
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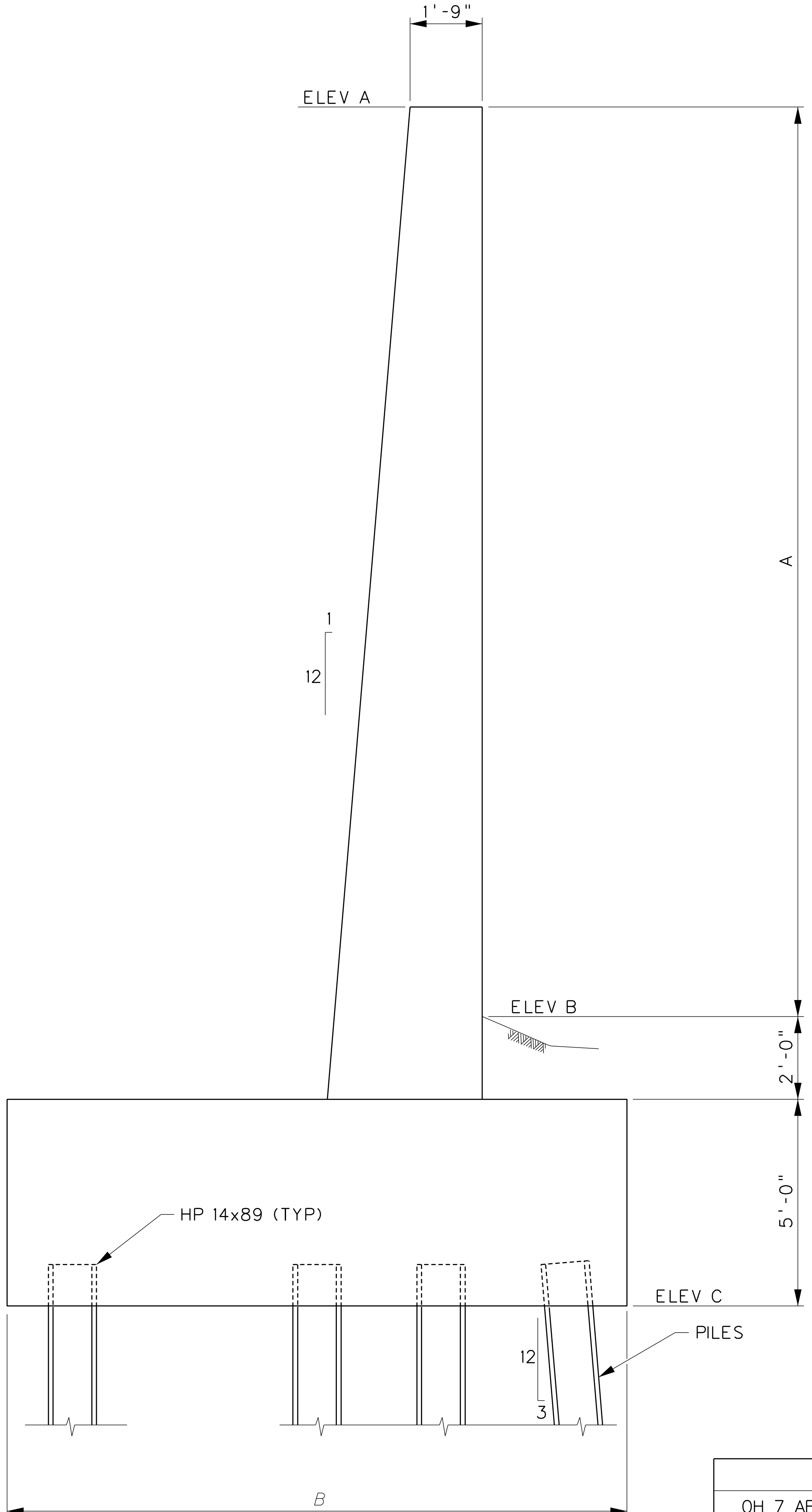
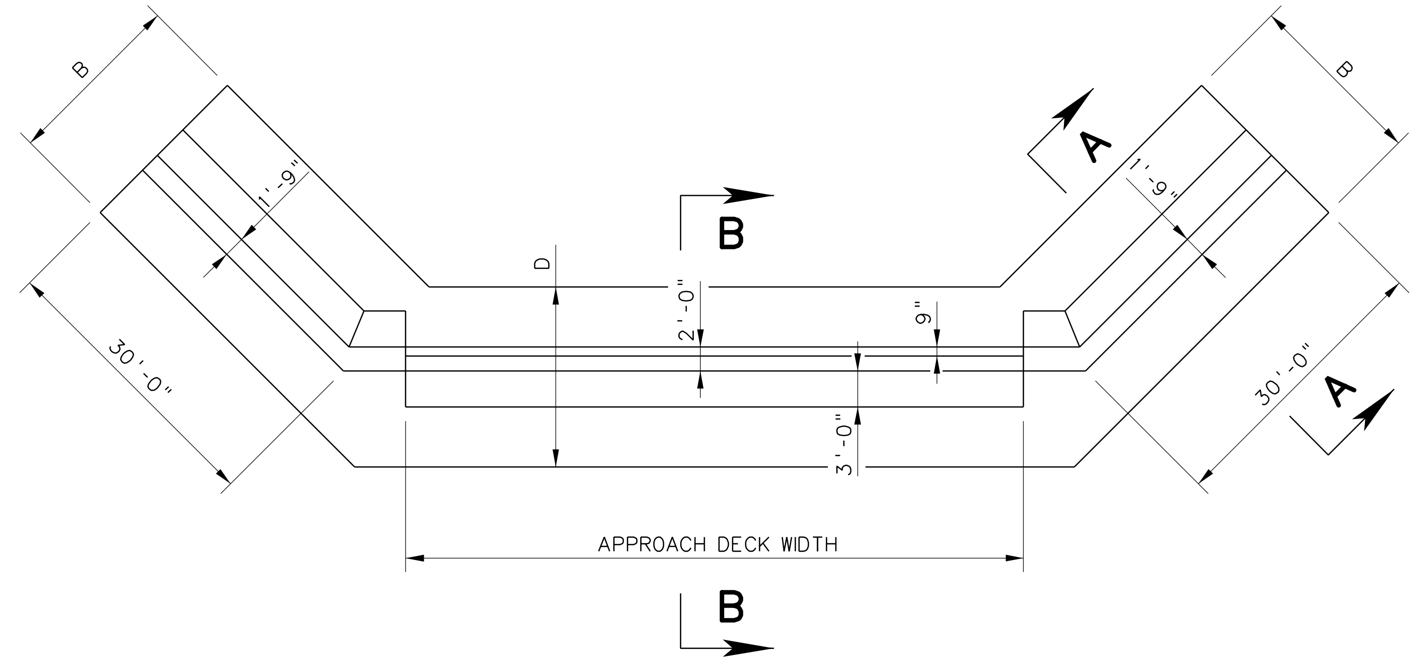
SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



SECTION A - WINGWALLS



PLAN

	A	B	PILES	ELEV A	ELEV B	ELEV C	ELEV D
OH 7 ABUT 1	35'	25'	SPACED @ 5'	704	669	662	698
OH 7 ABUT 2	37'	25'	SPACED @ 5'	707	670	663	701
ABUT 1	40'	25'	SPACED @ 5'	712	670	663	706
ABUT 2	22'	15'	SPACED @ 5'	722	700	693	716

SUBSTRUCTURE

A-26

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

DESIGNED JWP	DATE 8 / 13
DRAWN MM	8 / 13
CHECKED	
CHECKED	

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

WINGWALLS

HDR ENGINEERING, INC.
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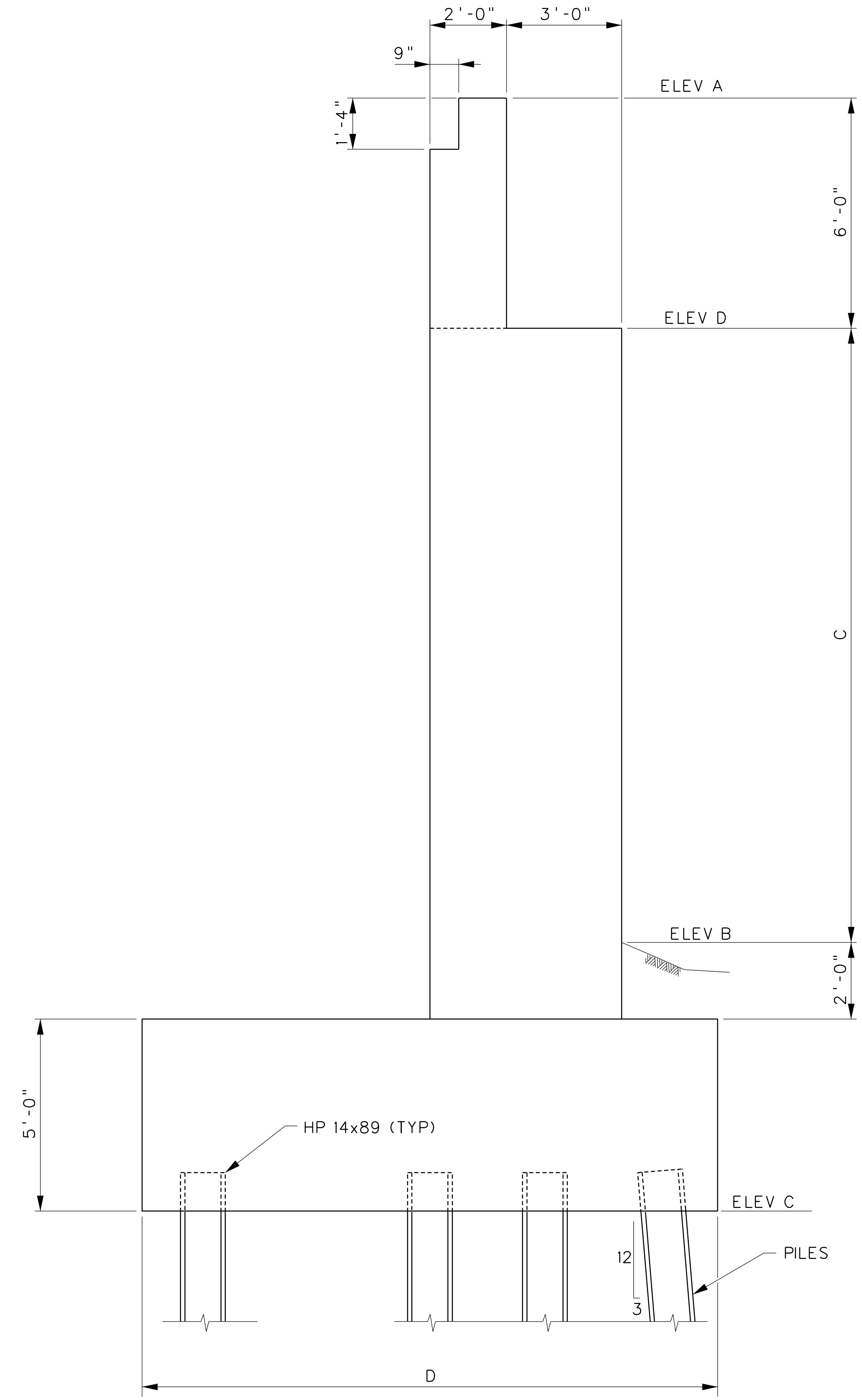
SHEET OF
BRIDGE NO.

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



SECTION B - ABUTMENTS

	C	D	PILES
OH 7 ABUT1	29'	25'	SPACED @ 5'
OH 7 ABUT 2	31'	25'	SPACED @ 5'
ABUT 1	36'	25'	SPACED @ 4'
ABUT 2	16'	15'	SPACED @ 4'

SUBSTRUCTURE

A-27

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
WELLSBURG BRIDGE

ABUTMENTS

	DATE
DESIGNED JWP	8 / 13
DRAWN MM	8 / 13
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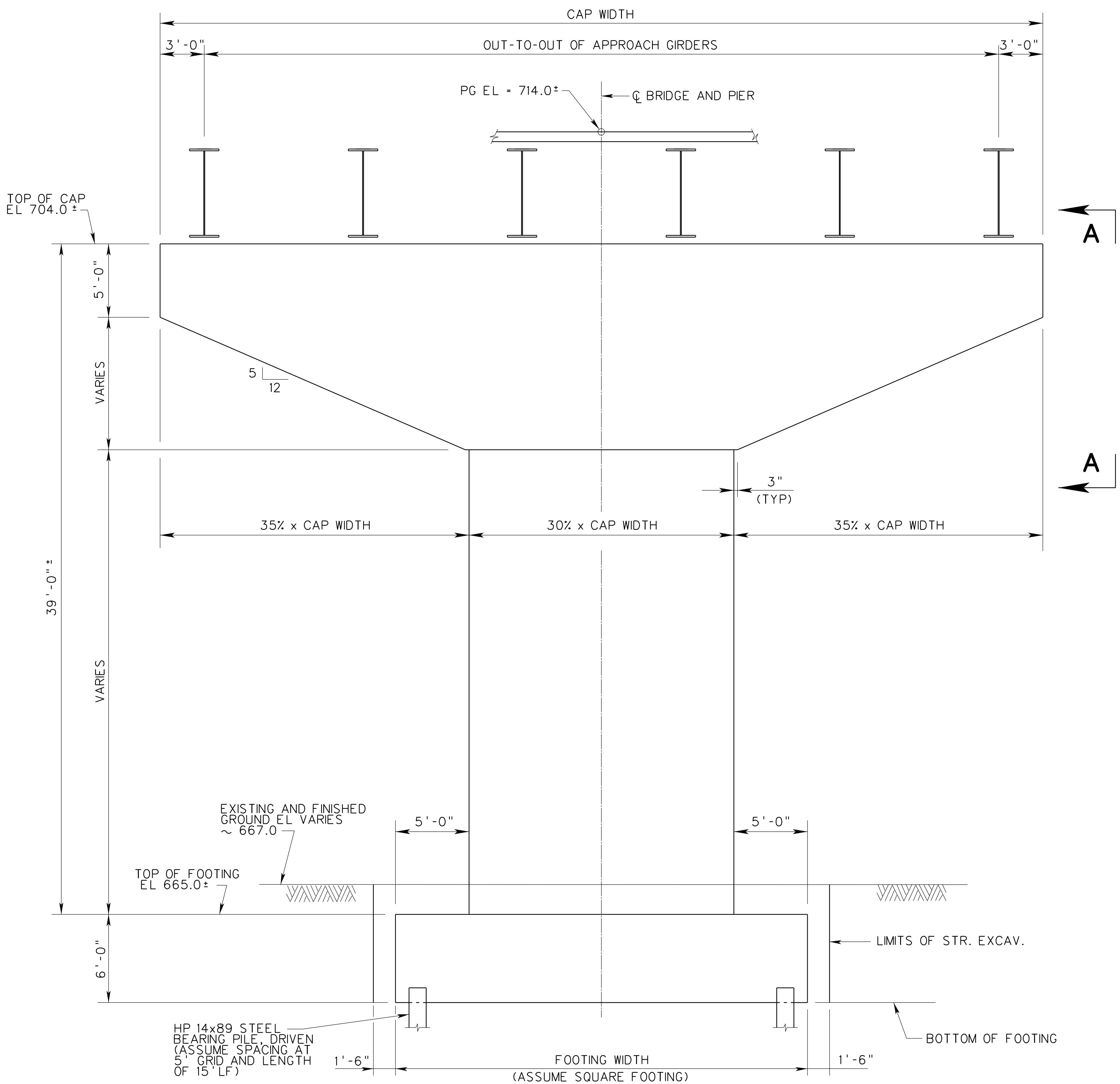
CHECKED	

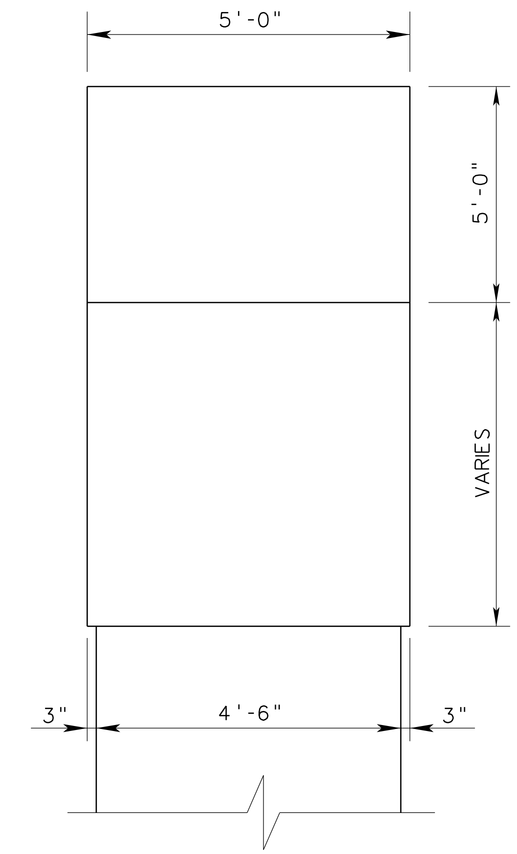
HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET OF
BRIDGE NO.

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



PIER 1



VIEW A-A

SUBSTRUCTURE
A-28

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
WELLSBURG BRIDGE

PIER 1

	DATE
DESIGNED	2 / 13
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HDR ENGINEERING, INC.
CONSULTING ENGINEERS
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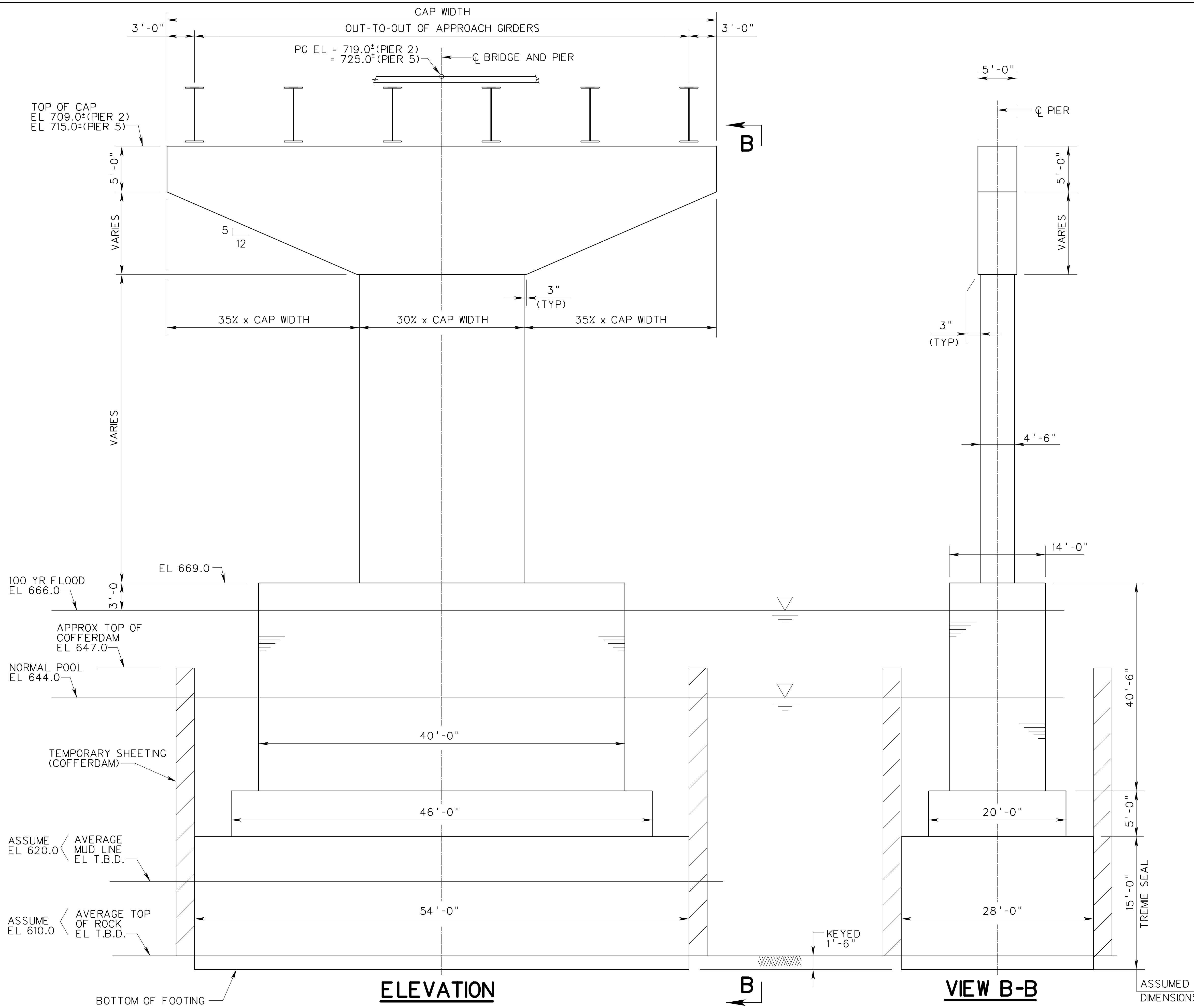
SHEET OF
BRIDGE NO.

J04C22C03 - BRIDGE b

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



SUBSTRUCTURE

A-29

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

	DATE
DESIGNED	2 / 13
DRAWN	2 / 13
CHECKED	
CHECKED	

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

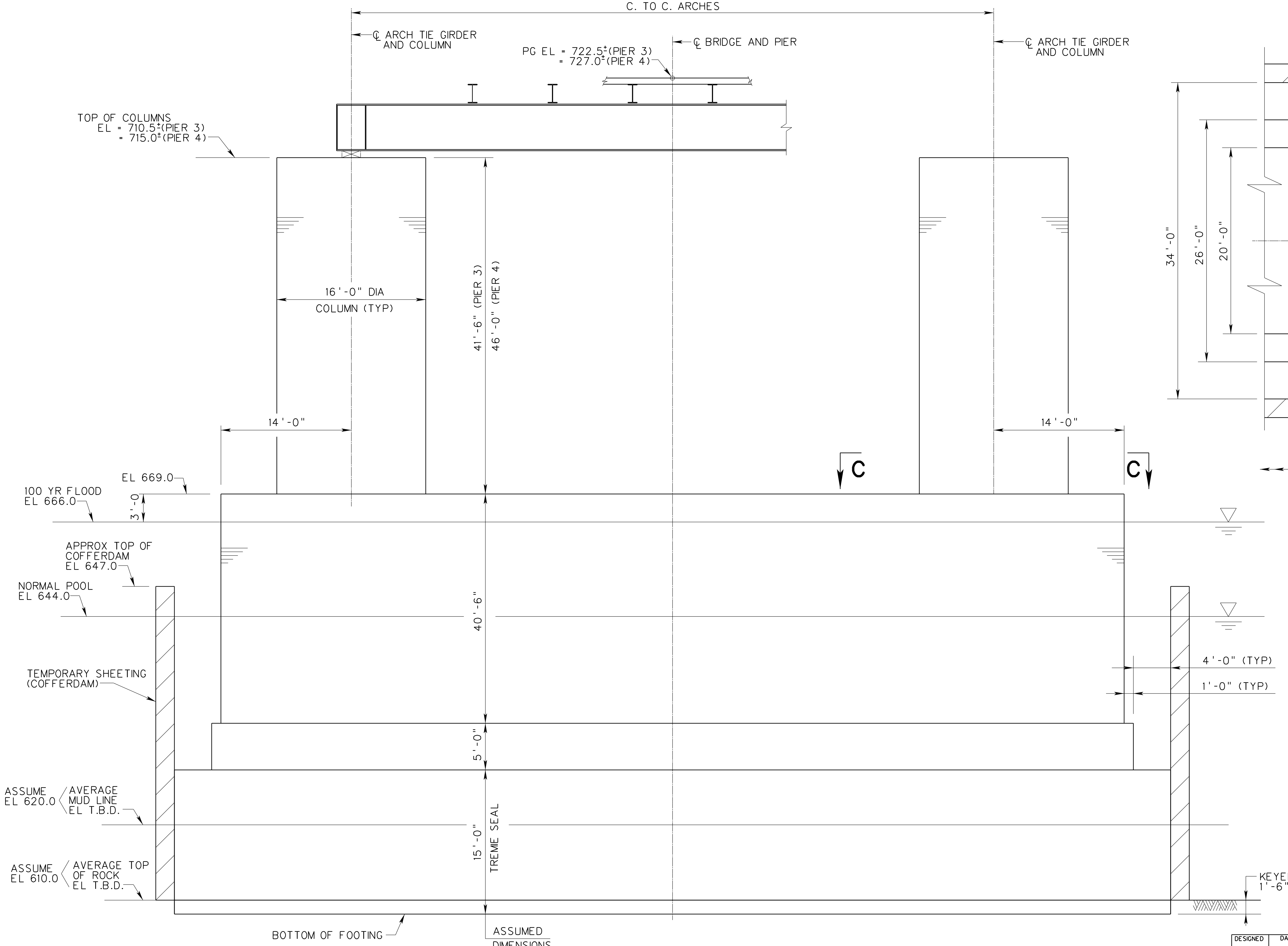
PIERS 2 AND 5

HDR ENGINEERING, INC.
CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

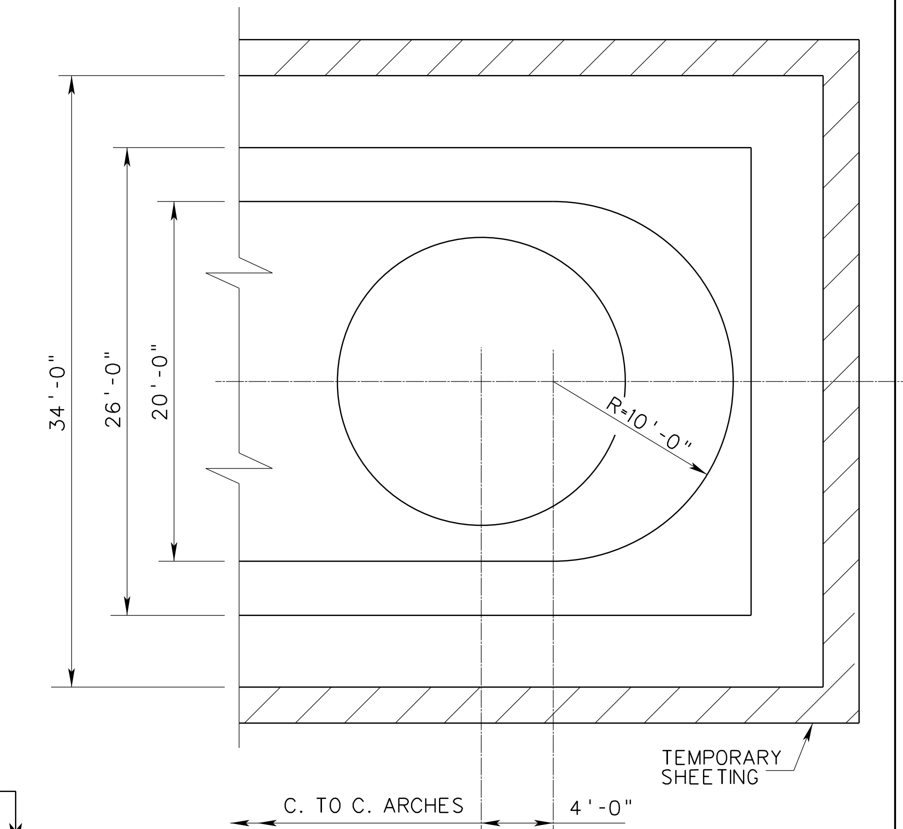
SHEET
OF
BRIDGE NO.

J04C22C03 - BRIDGE 6

Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	Fiscal Year	County	Sheet No.	Total Sheets
W.V.	6	S205-2/ 23-0.00 00	HPP-0223 (003)D	2013	BROOKE		



ELEVATION



SECTION C-C

SUBSTRUCTURE

A-30

REVISION NUMBER	SHEET NUMBER	REVISION	DATE	BY

	DATE
DESIGNED	2 / 13
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THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

WELLSBURG BRIDGE

PIERS 3 AND 4

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CONSULTING ENGINEERS
WEIRTON, W.VA. 304-748-8700

SHEET
OF
BRIDGE NO.

APPENDIX B – SUMMARY OF COST ESTIMATES

OPTION 1A	**TOTAL SUBSTRUCTURE COST**	$13,793,557			
	TOTAL SUPERSTRUCTURE COST	$39,336,314			
	10% CONTINGENCY	$5,312,987			
	BRIDGE TOTAL COST	$58,442,857			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	42.50 FT			
	BRIDGE AREA	86,828 SF			
	COST PER SF	$673			
	WVDOH BRIDGE COST	$37,983,687	65%		
	ODOT BRIDGE COST	$20,459,170	35%		
	BRIDGE TOTAL COST	$58,442,857		**Normalized Cost**	0.84
OPTION 1B	**TOTAL SUBSTRUCTURE COST**	$14,835,452			
	TOTAL SUPERSTRUCTURE COST	$44,428,603			
	10% CONTINGENCY	$5,926,405			
	BRIDGE TOTAL COST	$65,190,460			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	51.50 FT			
	BRIDGE AREA	105,215 SF			
	COST PER SF	$620			
	WVDOH BRIDGE COST	$42,218,705	65%		
	ODOT BRIDGE COST	$22,971,755	35%		
	BRIDGE TOTAL COST	$65,190,460		**Normalized Cost**	0.94
OPTION 1C	**TOTAL SUBSTRUCTURE COST**	$15,162,164			
	TOTAL SUPERSTRUCTURE COST	$46,091,630			
	10% CONTINGENCY	$6,125,379			
	BRIDGE TOTAL COST	$67,379,173			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	54.50 FT			
	BRIDGE AREA	111,344 SF			
	COST PER SF	$605			
	WVDOH BRIDGE COST	$43,545,915	65%		
	ODOT BRIDGE COST	$23,833,258	35%		
	BRIDGE TOTAL COST	$67,379,173		**Normalized Cost**	0.97

OPTION 2A	TOTAL SUBSTRUCTURE COST	$14,257,908			
	TOTAL SUPERSTRUCTURE COST	$41,142,813			
	10% CONTINGENCY	$5,540,072			
	BRIDGE TOTAL COST	$60,940,794			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	46.50 FT			
	BRIDGE AREA	95,000 SF			
	COST PER SF	$641			
	WVDOH BRIDGE COST	$39,521,393	65%		
	ODOT BRIDGE COST	$21,419,401	35%		
	BRIDGE TOTAL COST	$60,940,794		Normalized Cost	0.87
OPTION 2B	TOTAL SUBSTRUCTURE COST	$15,318,096			
	TOTAL SUPERSTRUCTURE COST	$46,560,271			
	10% CONTINGENCY	$6,187,837			
	BRIDGE TOTAL COST	$68,066,203			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	55.50 FT			
	BRIDGE AREA	113,387 SF			
	COST PER SF	$600			
	WVDOH BRIDGE COST	$43,947,603	65%		
	ODOT BRIDGE COST	$24,118,600	35%		
	BRIDGE TOTAL COST	$68,066,203		Normalized Cost	0.98
OPTION 2C	TOTAL SUBSTRUCTURE COST	$15,421,260			
	TOTAL SUPERSTRUCTURE COST	$47,948,806			
	10% CONTINGENCY	$6,337,007			
	BRIDGE TOTAL COST	$69,707,072			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	56.50 FT			
	BRIDGE AREA	115,430 SF			
	COST PER SF	$604			
	WVDOH BRIDGE COST	$45,163,244	65%		
	ODOT BRIDGE COST	$24,543,828	35%		
	BRIDGE TOTAL COST	$69,707,072		Normalized Cost	1.00

OPTION 3A	TOTAL SUBSTRUCTURE COST	$14,707,287			
	TOTAL SUPERSTRUCTURE COST	$43,564,076			
	10% CONTINGENCY	$5,827,136			
	BRIDGE TOTAL COST	$64,098,499			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	50.50 FT			
	BRIDGE AREA	103,172 SF			
	COST PER SF	$621			
	WVDOH BRIDGE COST	$41,541,729	65%		
	ODOT BRIDGE COST	$22,556,771	35%		
	BRIDGE TOTAL COST	$64,098,499		Normalized Cost	0.92
OPTION 3B	TOTAL SUBSTRUCTURE COST	$15,795,232			
	TOTAL SUPERSTRUCTURE COST	$49,088,021			
	10% CONTINGENCY	$6,488,325			
	BRIDGE TOTAL COST	$71,371,578			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	59.50 FT			
	BRIDGE AREA	121,559 SF			
	COST PER SF	$587			
	WVDOH BRIDGE COST	$46,116,744	65%		
	ODOT BRIDGE COST	$25,254,835	35%		
	BRIDGE TOTAL COST	$71,371,578		Normalized Cost	1.02
OPTION 3C	TOTAL SUBSTRUCTURE COST	$15,421,260			
	TOTAL SUPERSTRUCTURE COST	$47,948,806			
	10% CONTINGENCY	$6,337,007			
	BRIDGE TOTAL COST	$69,707,072			
	BRIDGE LENGTH	2,043 FT			
	BRIDGE WIDTH	56.50 FT			
	BRIDGE AREA	115,430 SF			
	COST PER SF	$604			
	WVDOH BRIDGE COST	$45,163,244	65%		
	ODOT BRIDGE COST	$24,543,828	35%		
	BRIDGE TOTAL COST	$69,707,072		Normalized Cost	1.00

OPTION 4A	TOTAL SUBSTRUCTURE COST	$15,162,164		
	TOTAL SUPERSTRUCTURE COST	$46,551,417		
	10% CONTINGENCY	$6,171,358		
	BRIDGE TOTAL COST	$67,884,939		
	BRIDGE LENGTH	2,043 FT		
	BRIDGE WIDTH	54.50 FT		
	BRIDGE AREA	111,344 SF		
	COST PER SF	$610		
	WVDOH BRIDGE COST	$44,081,426	65%	
	ODOT BRIDGE COST	$23,803,513	35%	
	BRIDGE TOTAL COST	$67,884,939	Normalized Cost	0.97

OPTION 4B	TOTAL SUBSTRUCTURE COST	$16,239,289		
	TOTAL SUPERSTRUCTURE COST	$52,072,735		
	10% CONTINGENCY	$6,831,202		
	BRIDGE TOTAL COST	$75,143,226		
	BRIDGE LENGTH	2,043 FT		
	BRIDGE WIDTH	63.50 FT		
	BRIDGE AREA	129,731 SF		
	COST PER SF	$579		
	WVDOH BRIDGE COST	$48,625,082	65%	
	ODOT BRIDGE COST	$26,518,144	35%	
	BRIDGE TOTAL COST	$75,143,226	Normalized Cost	1.08

OPTION 4C	TOTAL SUBSTRUCTURE COST	$15,905,997		
	TOTAL SUPERSTRUCTURE COST	$50,551,624		
	10% CONTINGENCY	$6,645,762		
	BRIDGE TOTAL COST	$73,103,383		
	BRIDGE LENGTH	2,043 FT		
	BRIDGE WIDTH	60.50 FT		
	BRIDGE AREA	123,602 SF		
	COST PER SF	$591		
	WVDOH BRIDGE COST	$47,336,595	65%	
	ODOT BRIDGE COST	$25,766,788	35%	
	BRIDGE TOTAL COST	$73,103,383	Normalized Cost	1.05

APPENDIX C – ROADWAY DESIGN CRITERIA

Project:	Wellsburg Bridge	Computed	CWM	Date: 5/11/09
Subject:	Design Criteria	Checked:	SAB	Date: 6/25/09
Task:		Page:		of:
Job #:	83938	No.:		

References: WVDOH Design Directives 601
2004 AASHTO " A Policy on Geometric Design of Highways and Streets"
2001 AASHTO "Geometric Design of Very Low-Volume Local Roads"
ODOT Location and Design Manual - Volume One Roadway Design

WV - Route 2
Alternatives 2/2B and 8/8B

Road Classification:	Arterial
Terrain:	Mountainous
DHV (2030):	1,030 vph
ADT (2030):	10,300 vpd
Design Speed:	60 mph (posted 55 mph)
Min. Radius:	1,200' for 8.00% (2004 AASHTO, Pg 147)
Superelevation:	emax=8.0%
Lane Width:	12' (DD 601, Pg 8)
Shoulder Width:	10' min (8' Paved)
Max. Grade:	6.0% (DD 601, Pg 7)
SSD:	570' (Kcrest=151; Ksag=136) (2004 AASHTO, Pg 272, 277)
Clear Width of Bridge:	same as roadway clear width (bridges < 200'); 4' min shoulder Lt & Rt (bridges > 200') (DD 601, Pg 8)
Horizontal Clearance:	32' for 6:1 or flatter (Roadside Design Guide Pg 3-6)
Min Vertical Clearance:	16' 6" Min. (DD 601, Pg 8)

Project:	Wellsburg Bridge	Computed	CWM	Date: 5/11/09
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Job #:	83938	No.:		

References: WVDOH Design Directives 601
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ODOT Location and Design Manual - Volume One Roadway Design

OH - Route 7
Alternatives 2/2B and 8/8B

Road Classification:	Divided Arterial
Terrain:	Hilly
DHV (2030):	1,500 vph
ADT (2030):	15,000 vpd
Design Speed:	60 mph (posted 55 mph) (Fig. 104-1E)
Min. Radius:	$D_c = 4^o45'$; R = 1206' (Fig 202-2E)
Superelevation:	emax=8.0% (Fig. 202-7E)
Lane Width:	12' (Fig. 301-2E)
Shoulder Width:	8' Paved - Graded varies 8'-12' (Fig. 301-3E)
Max. Grade:	6% (Fig. 203-1E)
SSD:	570' (Fig 201-1E)
Clear Width of Bridge:	NA
Horizontal Clearance:	30' for 6:1 or flatter (Fig. 600-1E)
Min Vertical Clearance:	16' 6" Minimum - 17'0" Preferred (Fig. 302-1E)

Project:	Wellsburg Bridge	Computed	CWM	Date: 5/11/09
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References: WVDOH Design Directives 601
2004 AASHTO " A Policy on Geometric Design of Highways and Streets"
2001 AASHTO "Geometric Design of Very Low-Volume Local Roads"
ODOT Location and Design Manual - Volume One Roadway Design

CR 2/23 (Bridge)
Alternatives 2/2B and 8/8B

Road Classification:	Arterial
Terrain:	Mountainous
DHV (2030):	1,000 vph
ADT (2030):	10,000 vpd
Design Speed:	40 mph (DD 601, Pg 10)
Min. Radius:	444' for 8.00% (2004 AASHTO, Pg 147)
Superelevation:	emax=8.0%
Lane Width:	12' (DD 601, Pg 10)
Shoulder Width:	8' Graded (6' Paved) (DD 601, Pg 10)
Max. Grade:	10.0% (DD 601, Pg 7)
SSD:	305' (Kcrest=44; Ksag=64) (2004 AASHTO, Pg 272, 277))
Clear Width of Bridge:	4' Minimum; use 6' shoulders (DD 601 Pg 10)
Horizontal Clearance:	16' for 6:1 or flatter (Roadside Design Guide Pg 3-6)
Min Vertical Clearance:	16' 6" Min. (DD 601, Pg 8)

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Project:	Wellsburg Bridge	Computed	CWM	Date: 5/11/09
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References: WVDOH Design Directives 601
2004 AASHTO " A Policy on Geometric Design of Highways and Streets"
2001 AASHTO "Geometric Design of Very Low-Volume Local Roads"
ODOT Location and Design Manual - Volume One Roadway Design

OH - 3rd Street
Alternatives 2/2B and 8/8B

Road:	**3rd Street**	**NB Connector**	**SB Connector**	**Access 2**
Road Classification:	Collector			
Terrain:	Hilly			
DHV (2030):	960 vph	560 vph	645 vph	485 vph
ADT (2030):	9,600 vpd	5,600 vpd	6,450 vpd	4,850 vpd
Design Speed:	30 mph (Fig 104-2E)			
Min. Radius:	D_c = 26°45'; R = 214' (Fig 202-2E)			
Superelevation:	emax=8.0% (Fig 202-7E)			
Lane Width:	12' (Fig 301-2E)			
Shoulder Width:	4' Paved - Graded varies 8'-10' (Fig. 301-3E)			
Max. Grade:	12% (Fig. 203-1E)			
SSD:	200' (Fig 201-1E)			
Clear Width of Bridge:	NA			
Horizontal Clearance:	15' for 6:1 or flatter (Fig. 600-1E)			
Min Vertical Clearance:	14' 6" Min., 15' 0" Pref. (Fig. 302-1E)			

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Project:	Wellsburg Bridge	Computed	CWM	Date: 5/11/09
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Job #:	83938	No.:		

References: WVDOH Design Directives 601
2004 AASHTO " A Policy on Geometric Design of Highways and Streets"
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ODOT Location and Design Manual - Volume One Roadway Design

OH - Entrance and Exit Ramps
Alternative 2B and 8B

Road:	**Entrance**	**Exit**		
Road Classification:	Ramp			
Terrain:	Hilly			
DHV (2030):	370 vph	190 vph		
ADT (2030):	3,700 vpd	1,900 vpd		
Design Speed:	Varies 30 mph @ CR 2/23 to 50 mph @ SR 7 gore (Fig. 503-1E)			
Min. Radius:	See Fig. 503-2cE (Entrance Terminal); See 503-3cE (Exit Terminal)			
Superelevation:	emax=8.0% - Varies with Design Speed			
Lane Width:	16' (Fig. 303-1E)			
Shoulder Width:	Paved (3' Left; 6' Right) - Graded varies (6'-9' Left; 8'-11' Right) (Fig.			
Max. Grade:	Varies with Design Speed see Table 503-1 Pg 5-8			
SSD:	Varies with Design Speed see Fig. 201-1E			
Clear Width of Bridge:	NA			
Horizontal Clearance:	Varies with Design Speed see Fig. 600-1E			

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