**ALABAMA**
**DEPARTMENT OF TRANSPORTATION**
SOUTHWEST REGION
**OFFICE OF REGION ENGINEER**
1701 I-65 WEST SERVICE ROAD NORTH
**MOBILE, ALABAMA 36618-1109**
TELEPHONE: (251) 470-8200
FAX: (251) 473-3624

***Kay Ivey***
***GOVERNOR***

***John R. Cooper***
***TRANSPORTATION DIRECTOR***

October 20, 2022

To: Registered Proposers

**RE: NHDB-I010()**
**I-10 Mobile River Bridge and Bayway**
**Mobile and Baldwin Counties**

**Wallace Tunnel Design Exception Request**

**East Tunnel Interchange Ramp B – Conceptual Design Exception Request**

**West High Level Approach Alignment – Conceptual Design Exception Request**

**I-10 Bayway Reduced Inside Shoulder – Memorandum**

Attached are final and conceptual design exception requests that FHWA provided concurrence to for the Mobile River Bridge and Bayway Project. This concurrence was provided during the P3 Procurement and based on the design requirements at that time.

The design exceptions may need to be reevaluated based on updated requirements or design changes. Please see latest draft of the Technical Provisions and Technical Provision Attachments for Project requirements.

ELP/ADW/sad

Attachment
Cc: File w/a

Design Exception File

U.S. Department of Transportation
Federal Highway Administration

Alabama Division

9500 Wynlakes Place
Montgomery, AL 36117
334-274-6350
334-274-6352
Alabama.FHWA@dot.gov

February 26, 2019

In Reply Refer To:
HDA-AL

Mr. John R. Cooper
Director
Alabama Department of Transportation
1409 Coliseum Blvd.
Montgomery, AL 36110


Subject: Project No. DPI-0030(005)
I-10 Mobile River Bridge and Bayway
Design Exceptions Request

Dear Mr. Cooper:

We have reviewed the letter from Mr. Steven Walker to Mr. Don Arkle dated December 12, 2018 regarding Design Exceptions and the decision to use a four foot inside shoulder on the Bayway Bridge.

The Final design exception for the Wallace Tunnel roadway elements is approved as the project will retain the Wallace Tunnel and portals existing elements.

We agree with the Conceptual design exception for Stopping Sight Distance for the West High Level Approach to the Mobile River Bridge Main Span. We also agree with the Conceptual design exception for Vertical and Horizontal Stopping Sight Distance on the East Tunnel Interchange (Ramp B). FHWA encourages the successful concession team to provide designs that eliminate the need for these design exceptions. If the final designs in these or other areas require a design exception, the concession team must seek approval from FHWA.

We have also reviewed the documentation of the decision to use a four foot inside shoulder on the Bayway. FHWA concurs with this decision.

If you have any further questions or comments, please contact Mr. Jeff Shelley at 334-274-6362.

Sincerely,

Mark D. Bartlett

Mark D. Bartlett, P. E.
Division Administrator

By email

cc: FHWA File

Attachment

# INTERDEPARTMENTAL MEMORANDUM

**ALABAMA DEPARTMENT OF TRANSPORTATION**
1409 Coliseum Boulevard, Montgomery, Alabama 36110

December 12, 2018

**TO:** Mr. Don T. Arkle, P.E.
Chief Engineer

**FROM:** Steven E. Walker, P.E. S. E. Walker
State Design Engineer

**RE:** Project No. DPI-0030(005)
I-10 Mobile River Bridge and Bayway
Mobile and Baldwin Counties

Attached is a design exception request for the project elements in the reference documents that do not meet AASHTO criteria. The Wallace Tunnel design exception is a Final design exception as the project will retain the Wallace Tunnel and portals existing elements. The West High Level Approach and East Tunnel Ramp B are Conceptual design exceptions as the successful concession team will provide designs that may eliminate the need for a design exception. If a design exception in these or other areas are proposed by the concession team, they will be responsible for obtaining the design exception approval.

Also included is the documentation of the decision to use a 4' inside shoulder on the Bayway Bridge.

Approval of these design exceptions is recommended. Please advise if any additional information is needed.

cc: Mr. Vince Calametti, PE
File

ALABAMA
DEPARTMENT OF TRANSPORTATION
SOUTHWEST REGION
OFFICE OF REGION ENGINEER
1701 I-65 WEST SERVICE ROAD NORTH
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TELEPHONE: (251) 470-8200
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*Kay Ivey*
*GOVERNOR*

*John R. Cooper*
*TRANSPORTATION DIRECTOR*

December 6, 2018

Mr. Don T. Arkle, P.E.
Chief Engineer
Alabama Department of Transportation
1409 Coliseum Boulevard
Montgomery, AL 36110

RE: **DPI-0030(005)**
**I-10 Mobile River Bridge and Bayway**
**Mobile and Baldwin Counties**

**MRB – Wallace Tunnel Design Exception Request**

**East Tunnel Interchange Ramp B – Conceptual Design Exception Request**

**West High Level Approach Alignment – Conceptual Design Exception Request**

**I-10 Bayway Reduced Inside Shoulder – Memorandum**

Mr. Arkle,

Attached you will find, for your review and approval, the below identified documents:

1. Wallace Tunnel Design Exception Request: a request for design exception and design variance for Project elements that are constrained by the existing Wallace Tunnel. This request shall be identified as Final, for implementation and/or consideration in final design.
2. East Tunnel Interchange Ramp B – Conceptual Design Exception Request: a request for design exception for vertical and horizontal Stopping Sight Distance (SSD) on the East Tunnel Ramp B. This request is based on the Project's Reference Design and will be considered as conceptual approval, for consideration in the final design. If implemented in Final Design, a formal request for Design Exception will be presented.
3. West High Level Approach Alignment – Conceptual Design Exception Request: a request for design exception for horizontal SSD on the I-10 eastbound alignment within the West High Level Approach. This request is based on the

Project's Reference Design and will be considered as conceptual approval, for consideration in the final design. If implemented in Final Design, a formal request for Design Exception will be presented.

4. I-10 Bayway Reduced Inside Shoulder: a memorandum documenting the change to 4-ft inside shoulder width for the entirety of the Bayway structure.

Please advise if you have any questions or need additional information.

Regards,

Vincent E. Calametti, P.E.
Region Engineer

VEC/MJE/SAD

Attachment
Cc: Steve Walker, P.E. Design Bureau Chief w/a
File w/a

Submitted by: _____ 12-10-18
Mr. Vincent E. Calametti, P.E. Date
SW Region Engineer

Recommended by: Steven E. Walker 12/13/18
Mr. Steven E Walker, P.E. Date
State Design Engineer

Approved: _____ 12-17-18
Mr. Don T. Arkle, P.E. Date
Chief Engineer

Approved: Mark D. Bartlett 2/26/2019
Mr. Mark D. Bartlett, P.E. Date
Federal Highway Administration

**November 27, 2018**

**RE: Technical Memorandum**
**East Tunnel Interchange Ramp B Stopping Sight Distance (SSD)**

**To: Andrew Wood / Project Manager, MRB Project, ALDOT**

**From: Katie Parker / East Design Lead, Mott MacDonald**

**REF: I-10 Mobile River Bridge and Bayway Project**

## BACKGROUND

The purpose of this memorandum is to document a design exception request for Vertical and Horizontal Stopping Sight Distance for the I-10 Mobile River Bridge and Bayway project currently under development. The location of the design exception request is for the East Tunnel Interchange Ramp B (Ramp B). An exception is required to the design criteria for vertical stopping sight (SSD) distance on Ramp B as it approaches the tie to WB I-10 Business (PVI Station 554+97.10) and the horizontal SSD on Ramp B for the curve at PI Station 559+76.72

Ramp B is a connection from WB US 90/98 to WB I-10 Business approximately 1300 ft. from the entrance to the Wallace Tunnel and approximately 550 ft. from the existing abutment (to be retained) and end of the tunnel counterweight. Ramp B has a very similar horizontal alignment to the existing WB entrance ramp (existing Ramp D). The vertical profile of the proposed I-10 Bayway and I-10 Business in this area will be raised to accommodate the effects of Storm Surge based upon the Storm Surge Analysis performed for this project. Therefore, the vertical profile for Ramp B has also been revised. Ramp B passes under both the EB and WB I-10 Business bridges, while crossing over existing US-90/US-98, all of which constrains the vertical and horizontal alignments.

The existing and proposed design speed for Ramp B is 40 mph which requires a K value of 44 for a crest vertical curve. Due to the identified constraints in the vertical alignment, the proposed K value for the crest curve at Station 554+97.10 is K=32. This K value exceeds a 35 mph design speed curve, but does not meet the required 40 mph design speed. A review of the historical design plans for the existing WB entrance ramp (Ramp D) show that the existing crest curve at this location has a K value of 42, which is also below the 40 mph design speed.

The horizontal SSD for a 40 mph design speed is 305 ft. The horizontal geometry is constrained by the location of the exit gore on US-90/US-98, the tie to the westbound tunnel and the number of bridges the alignment must go under and avoid. Due to these constraints in the horizontal SSD achieved is 180 ft, which corresponds to a design speed between 25 mph and 30 mph. The historical plans for this ramp (Ramp D) provide the same approximate SSD/design speed.

## DESIGN EXCEPTION

A design exception is requested for Vertical Stopping Sight Distance (SSD) for Ramp B, PVI Station 554+97.10.

**Table 1: Vertical Stopping Sight Distance Requirement for the Selected Alternative***

| Scenario | SSD(ft.) | Rate of Vertical Curvature (K) |
|---|---|---|

| | | |
|---|---|---|
| 35 MPH | 250 | 29 |
| Ramp B | 272 | 32** |
| Existing (Ramp D) | 303 | 42 |
| 40 MPH | 305 | 44 |

* Design Basis __ (*AASHTO 2011 Green Book* Table 3-34)
** Stopping Sight Distance design exception requested

A design exception is requested for Horizontal Stopping Sight Distance (SSD) for Ramp B, PI Station 559+76.72.

**Table 2: Horizontal Stopping Sight Distance Requirement for the Selected Alternative***

| Scenario | SSD(ft.) |
|---|---|
| 25 MPH | 155 |
| Ramp B | 180** |
| Existing (Ramp D) | 180 |
| 40 MPH | 305 |

* Design Basis __ (*AASHTO 2011 Green Book* Table 3-1)
** Stopping Sight Distance design exception requested

**ANALYSIS**

The l alignment of Ramp B of the East Tunnel interchange is constrained both horizontally and vertically by the interaction it has with both the I-10 mainline bridge and the bridges for EB and WB I-10 Business. The horizontal alignment is constrained by the requirement of having Ramp B weave between the piles associated with the elevated bridge alignments. The vertical alignment is constrained by the change in the I-10 Business profile as previously discussed and is also impacted by the inability to alter the grade of I-10 Business going into the Wallace tunnel.

Ramp B has a 40 mph design speed. This design speed requires SSD of 305 ft. (K=44) (*AASHTO 2011 Green Book*, Table 3-34). The proposed PVI at Station 554+97.10 provides a SSD of 272 ft. (K=32). The proposed SSD does not meet the minimum SSD for 40 mph and only provides SSD for 35 mph, see Table 1. The proposed PI at Station 559+76.72 provides a SSD of 180 ft., which does not meet the minimum SSD for 40 mph and only provides SSD for 25 mph, see Table 2

To meet the minimum vertical SSD for 40 mph. the Ramp B PVI would require a curve length of 276 ft. (200 ft. provided). The location of this PVI does not allow for the curve to be extended toward the tunnel. I-10 Business going into the tunnel is already in a vertical curve Ramp B ties into I-10 Business in this vertical curve. Any attempt to lengthen the vertical curve at PVI 554+97.10 creates a steeper grade and therefore increases the needed vertical curve length and would move the gore closer to the Wallace Tunnel. Alternatively, we investigated moving the PVI further from the tunnel entrance. This would require steepening the grade on the exit tangent and therefore require a longer vertical curve, due to the constraint of passing under WB I-10 Business.

To achieve the required horizontal SSD for 40 mph, the entire horizontal alignment would need to be revised. The curve at PI Station 559+76.72 would need a radius far exceeding what can be provided in this constrained location or the inside shoulder would need to be substantially wider to achieve the SSD.

In the preparation of this design exception, we analyzed the crash data for the existing ramp. From 2013 to present, there were a total of five (5) crashes on this ramp. Four (4) crashes occurred at the ramp/I-10 merge gore area and one (1) crash occurred at the ramp/US 98 diverge gore. The crashes were determined to be caused by rear ending at the yield signs (following to close), failure to yield to merging vehicles and one incident where a truck braked to allow a vehicle to merge then skidded and struck the barrier. None of the accidents were in the area of, or appear to be influenced by the sight distance on the existing vertical curve.

Other alternatives to achieve the required SSD were examined during the development of the project. These alternatives required a completely new horizontal alignment that created additional impacts both environmentally and to the geometry of the entire interchange.

Additionally, in this area existing I-10 and proposed I-10 Business will have an advisory speed limit of 40 mph for vehicles traveling WB into the tunnel; therefore, providing a Ramp with a design speed of 35 mph as the ramp approaches the gore is in line with standard design practices. The location of the horizontal curve where we are requesting a Design Exception is a sufficient distance from the ramp gore to allow traffic to increase speed as needed to merge into traffic.

**RECOMMENDATION**

Mott MacDonald recommend the Ramp B alignment continue with the proposed alignment under a design exception for the stopping sight distance criteria. The exception is to accept 35 mph design speed criteria for vertical SSD in lieu of the 40 mph requirement for this one vertical curve (PVI Station 554+97.10) and a 25 mph design speed for horizontal SSD in lieu of the 40mph requirement for the horizontal curve at PI Station 559+76.72

**CONCLUSION**

The selected alternative presents a balance of horizontal and vertical alignments that best fit with the entire interchange. Other alternatives considered to improve SSD are not favored because of site conditions. Your concurrence is requested.

Attachments

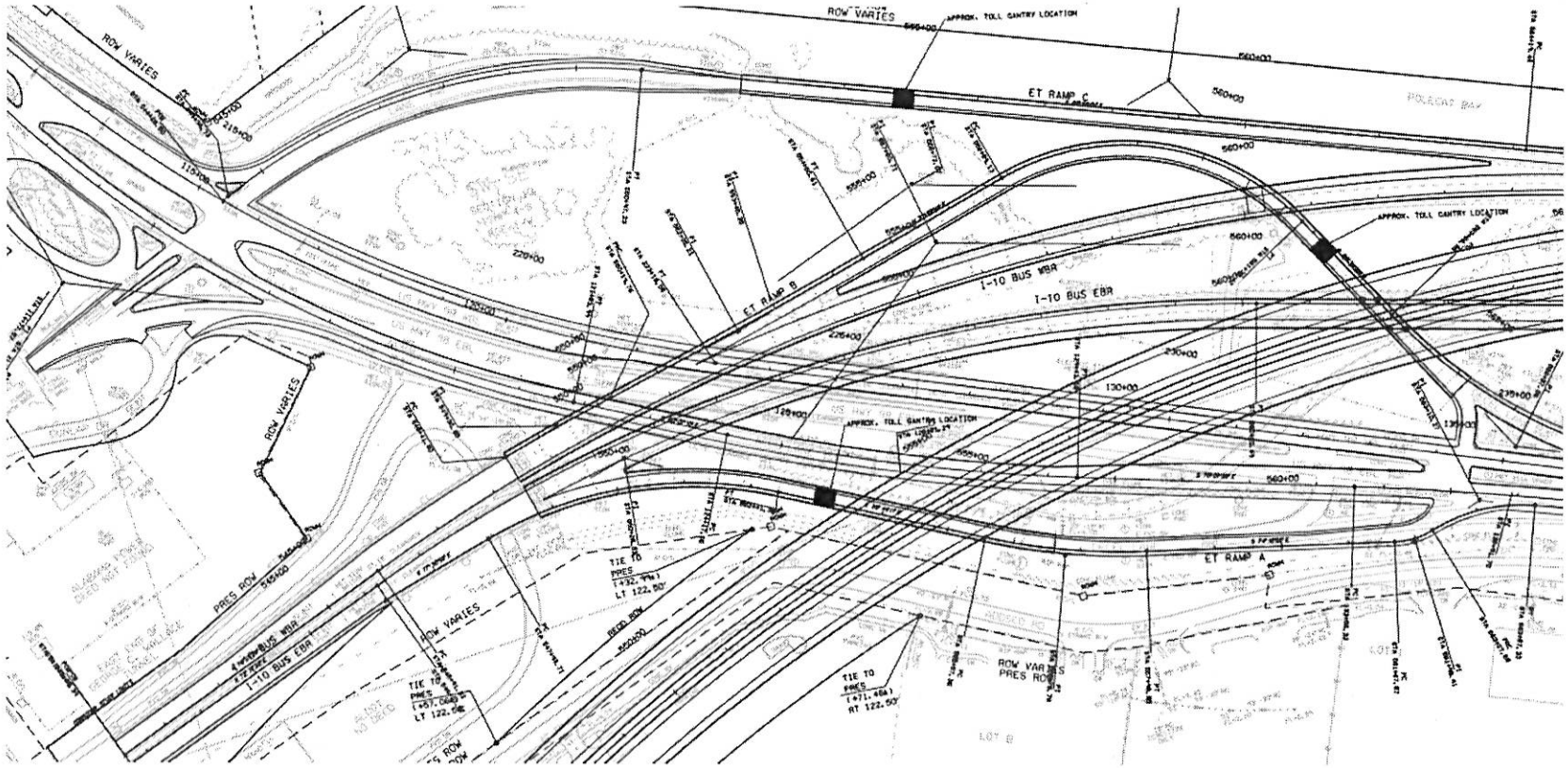


**Figure 1: East Tunnel Interchange Ramp B Plan View**

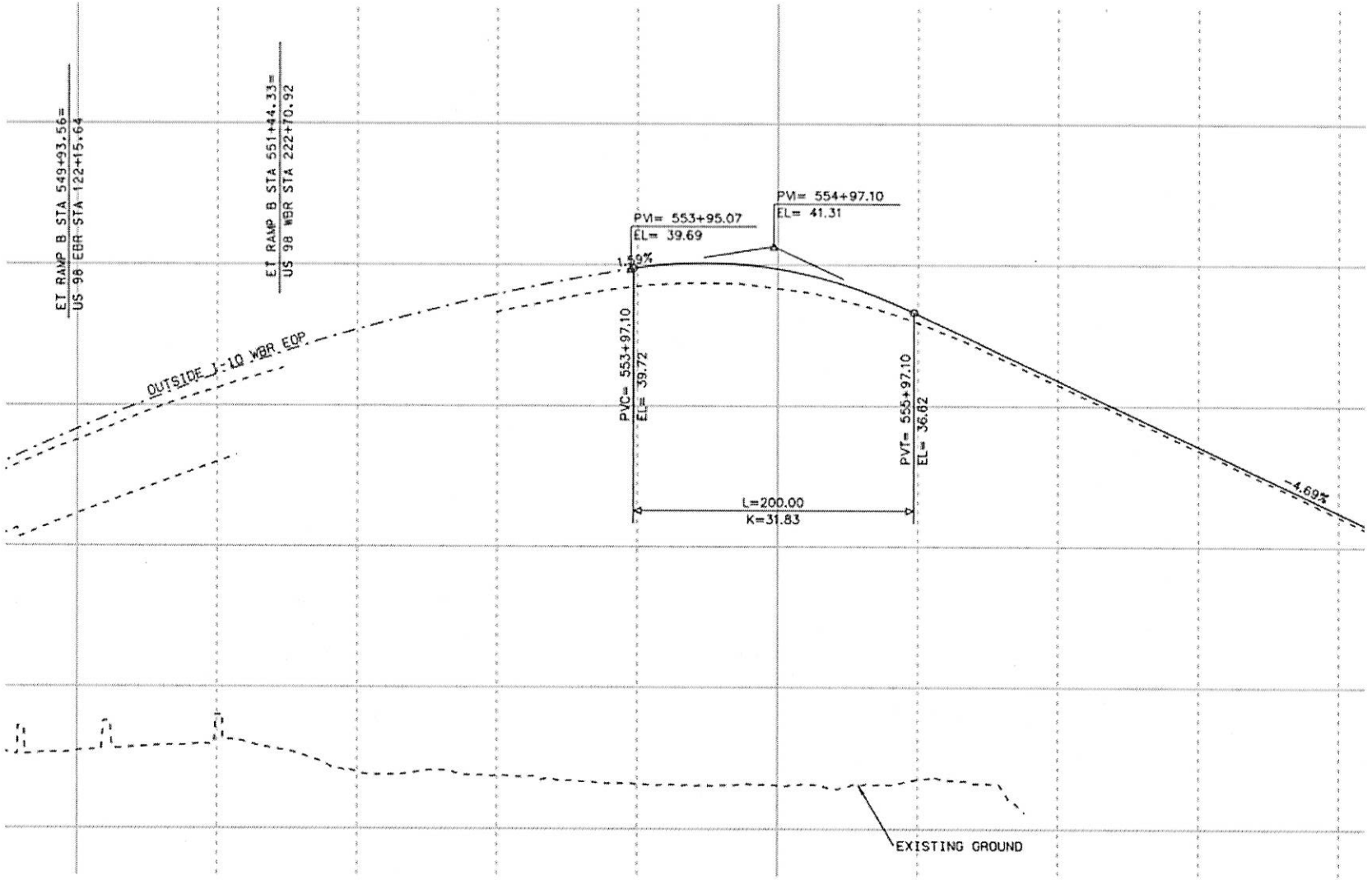


**Figure 2: East Tunnel Interchange Ramp B Profile View**

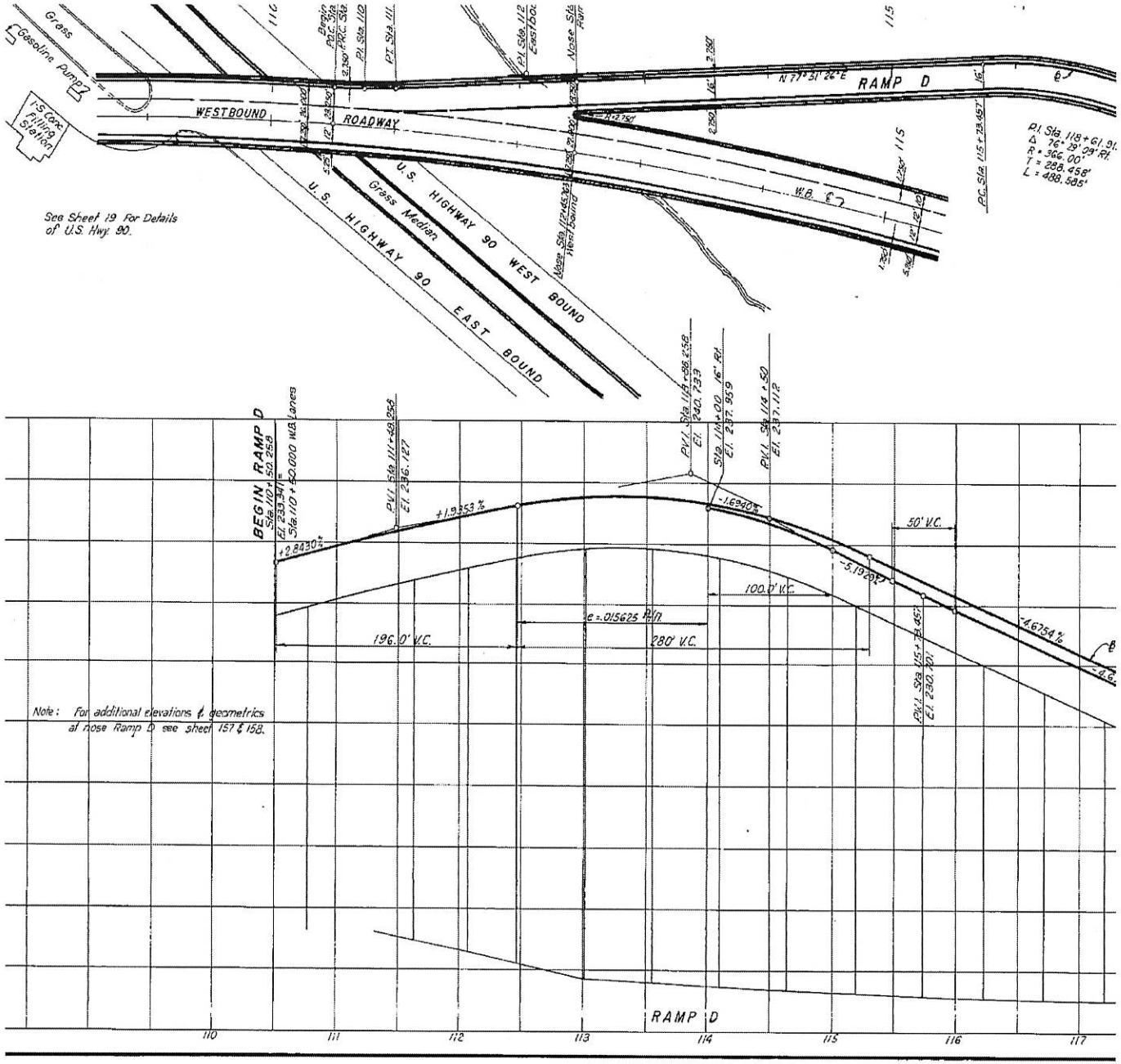


**Figure 3: Existing East Tunnel Interchange Ramp D Plan/Profile View**

**November 27, 2018**

**RE:** **Design Exception Request**
**Design constraints at the existing Wallace Tunnel**

**To:** **Andrew Wood, PE**
**ALDOT Project Manager**

**From:** **Katie Parker, PE / East Design Lead, Mott MacDonald**
**Tom Harjung, PE / West Design Lead, Thompson Engineering**

**REF:** **I-10 Mobile River Bridge and Bayway Project (Project)**

## BACKGROUND

The purpose of this memorandum is to document a Design Exception request for Project roadway features that are restricted by the existing conditions at the Wallace Tunnel. The Project proposes to realign Interstate 10 (I-10) in Mobile County across the Mobile River via new alignment as a cable-stayed bridge. Existing I-10 through the Wallace Tunnel will be re-configured as I-10 Business (I-10 BUS). This will include new alignment for I-10 BUS as it approaches the Wallace Tunnel, including re-development of the interchanges at each portal. Interchanges are defined as Canal / Water St Interchange (at the west portal) and East Tunnel Interchange (at the east portal.) The Wallace Tunnel tubes and constraining elements, such as tunnel counterweights, retaining walls, and tunnel portals, are not to be impacted by the proposed Project and therefore restrict planned improvements to I-10 BUS.

This Design Exception request is for the proposed I-10 BUS as it enters/exits the Wallace Tunnel as well as any proposed ramps that tie to I-10 BUS and the Wallace Tunnel, whose geometry is controlled by the constraints of the existing Wallace Tunnel. This request is based on the preliminary plans produced for the Project, described in the Environmental Impact Statement (EIS) and identified in Concession Documents as Reference Plans.

The Design Speed for I-10 BUS is set at 55 mph. All existing regulatory and advisory signs related to the Wallace Tunnel will remain in place or be enhanced. The existing conditions at Wallace Tunnel constrain not only I-10 BUS but also any ramps that connect to the Wallace Tunnel portals.

Existing conditions of current I-10 alignment through and at the approaches to Wallace Tunnel:

**Longitudinal Grade:**

1) 5.25% at the West approach to Wallace Tunnel, *Figure 1*
2) 5.05% at the East approach to Wallace Tunnel, *Figure 2*

**Shoulder Width:**

1) 1' inside / outside shoulders with curb*, *Figure 3*

*The existing typical section of the EB and WB lanes of I-10 at the Wallace Tunnel is a curb section with two 12-ft lanes and 1-ft shoulders to the face of curb, for a total width of 26-ft curb face to curb face.

**Crash Data:**

In the preparation of the Design Exception request, the available crash data was analyzed. Crash data, including number of accidents, within the Wallace Tunnel and portals from June 2015 through June 2018 was provided by ALDOT. The accidents were categorized as three main types: rear end, side swipe, and

single vehicle. Most of the rear end accidents were caused by following too close or misjudging stopping distance. The causes for side swipe accidents were attributed to driving too fast, swerved to avoid object, or distracted driving. The causes for single vehicle accidents were driving too fast, swerving to avoid object, or distracted driving. The following table summarizes the accidents:

| Scenario | Rear End (# crashes) | | Side Swipe (# crashes) | | Single Vehicle (# crashes) | | Injury (# crashes) | |
|---|---|---|---|---|---|---|---|---|
| | WB | EB | WB | EB | WB | EB | WB | EB |
| Crash Data June 2015 - June 2018 | 44 | 58 | 4 | 10 | 11 | 8 | 9 | 9 |

The majority cause of accidents appears to be driver behavior.

## DESIGN CONSIDERATIONS

**Maximum longitudinal grade:**

From AASHTO "A policy on Geometric Design of Highways and Streets" (Green Book) Table 8-1, the maximum grade for Level Terrain at 55 mph Design Speed is 4%.

From U.S Department of Transportation Federal Highway Administration Publication FHWA-NHI-10-034, "Technical Manual for Design and Construction of Road Tunnels – Civil Elements" Section 2.2.1 states:

*Road tunnel grades should be evaluated on the basis of driver comfort while striving to reach a point of economic balance between construction costs and operating and maintenance expenses. Maximum effective grades in main roadway tunnels preferably should not exceed 4%; although grades up to 6% have been used where necessary. Long or steep uphill grades may result in a need for climbing lanes for heavy vehicles. However, for economic and ventilation reasons, climbing lanes should be avoided within tunnels; the addition of a climbing lane part-way through a tunnel may also complicate construction considerably, particularly in a bored tunnel.*

| Scenario | Green Book | FHWA-NHI-10-034 |
|---|---|---|
| 55 MPH | 4% | 4% preferred / 6% max |

**Superelevation rates:**

From Green Book Section 3.3.3, page 3-30: "The maximum rates of superelevation on highways are controlled by four factors: climate conditions (i.e., frequency and amount of snow and ice); terrain conditions (i.e., flat, rolling, or mountainous); type of area (i.e., rural or urban); and frequency of very slow-moving vehicles whose operation may be affected by high superelevation rates. Consideration of these factors jointly leads to the conclusion that no single maximum superelevation rate is universally applicable. However, using only one maximum superelevation rate within a region of similar climate and land use is desirable, as such a practice promotes a design consistency."

For this Project, ALDOT has specified a maximum superelevation rate of 8% (for $e_{max}$ of 8%).

**Minimum horizontal curve radius:**

From Green Book Table 3-10b for a 55 mph design speed, the minimum radius for a horizontal curve is 960' (for $e_{max}$ of 8%).

From FHWA-NHI-10-034, Section 2.2.2 states:

*Horizontal and vertical curves shall satisfy Green Book's geometrical requirements. The horizontal alignment for a road tunnel should be as short as practical and maintain as much of the tunnel length on tangent as possible, which will limit the numbers of curves, minimize the length and improve operating efficiency. However, slight curves may be required to accommodate ventilation/access shafts location, portal locations, construction staging areas, and other ancillary facilities as discussed in Chapter 1 – Planning. A slight horizontal curve at the exit of the tunnel may be required to allow drivers to adjust gradually to the brightness outside the tunnel. When horizontal curves are needed, the minimum acceptable horizontal radii should consider traffic speed, sight distances, and the super-elevation provided. In general, for planning purpose, the curve radii should be as large as possible and no less than 850 to 1000-ft radius. A tighter curve may be considered at the detailed design stage based on the selected tunneling method.*

| Scenario | Green Book | FHWA-NHI-10-034 |
|---|---|---|
| $e_{max}$ of 8% | 960' | 850' to 1000' |

**Stopping sight distances (SSD):**

From Green Book Table 3-1, the stopping sight distance for 55 mph on level terrain is 495'. Further, table 3-2 provides recommended stopping sight distances for grades.

From FHWA-NHI-10-034, Section 2.2.3 states:

*Sight and braking distance requirements cannot be relaxed in tunnels. On horizontal and vertical curves, it may be necessary to widen the tunnel locally to meet these requirements by providing a "sight shelf". When designing a tunnel with extreme curvature, sight distance should be carefully examined, otherwise it may result in limited stopping sight distance.*

| Scenario | Green Book | FHWA-NHI-10-034 |
|---|---|---|
| 4 lane divided Interstate Highway (55 MPH DS) | 495' | *No relaxed requirements* |

**Shoulder Width:**

From Green Book Section 8.2.4; page 8-3:

*On four-lane freeways the median or left shoulder is normally 4- to 8-ft wide. The paved width of the right shoulder should be at least 10-ft and 12-ft should be considered.*

From FHWA-NHI-10-034, Section 2.4.2 states:

*Although the Green Book states that it is preferable to carry the full left- and right-shoulder widths of the approach freeway through the tunnel, it also recognizes that the cost of providing full shoulder widths may be prohibitive. Reduction of shoulder width in road tunnels is usual. In certain situations, narrow shoulders are provided on one or both sides. Sometimes shoulders are eliminated completely and replaced by barriers. Based on a study conducted by World Road Association (PIARC) and published a report entitled "Cross Section Geometry in Unidirectional Road Tunnels" 2001; shoulder widths vary from country to country and they range from 0 to 2.75 m (9 ft). They are generally in the range of 1 m (3.3 ft).*

*It is suggested for unidirectional road tunnels that the right shoulder be at 4 ft (1-2 m) and left shoulder at least 2 ft (0.6 m).*

| Scenario | Green Book | | FHWA-NH1-034 | |
|---|---|---|---|---|
| | Inside Shoulder (ft) | Outside Shoulder (ft) | Inside Shoulder (ft) | Outside Shoulder (ft) |
| 4 lane divided Interstate Highway (55 MPH DS) | 4 to 8 | 10 to 12 | 0 to 2 | 0 to 4 |

**DESIGN EXCEPTION**

This Design Exception Request will consider the following Project roadway elements:

- maximum longitudinal grades
- minimum horizontal curve radius
- stopping sight distances (SSD)
- superelevation rates
- shoulder widths

This Design Exception is also requesting approval of any necessary Design Variances for roadway elements that are restricted within the limitations identified here due to the existing Wallace Tunnel constraints. Design Variances may include roadway elements that are compliant with AASHTO or FHWA requirements but are not compliant with the more restrictive Technical Provisions developed for the Project.

**RECOMMENDATION**

The project team recommends that required Design Exceptions, and any Design Variances associated with the same, be approved for those roadway elements that are constrained by the existing Wallace Tunnel from meeting required design criteria. Final design will strive to meet the design criteria to the maximum extent possible while meeting or improving existing conditions.

A table of requested Design Exceptions and Design Variances, based on the Project's Reference Plan, is included as *Figures 4* and *5*.

**CONCLUSION**

The costs associated with changing the grades and shoulder widths on the Wallace Tunnel are prohibitive and implementing these changes would require complete replacement of the Tunnel. With the Project, I-10 mainlines will be realigned over the Mobile River via a new cable stayed bridge and the Wallace Tunnel will become I-10 Business. The added capacity with the new I-10 bridge, which will be supplemental to the Wallace Tunnel, will allow the tunnel to act as a commuter or local route and should allow the tunnels to provide continued acceptable service for many years.

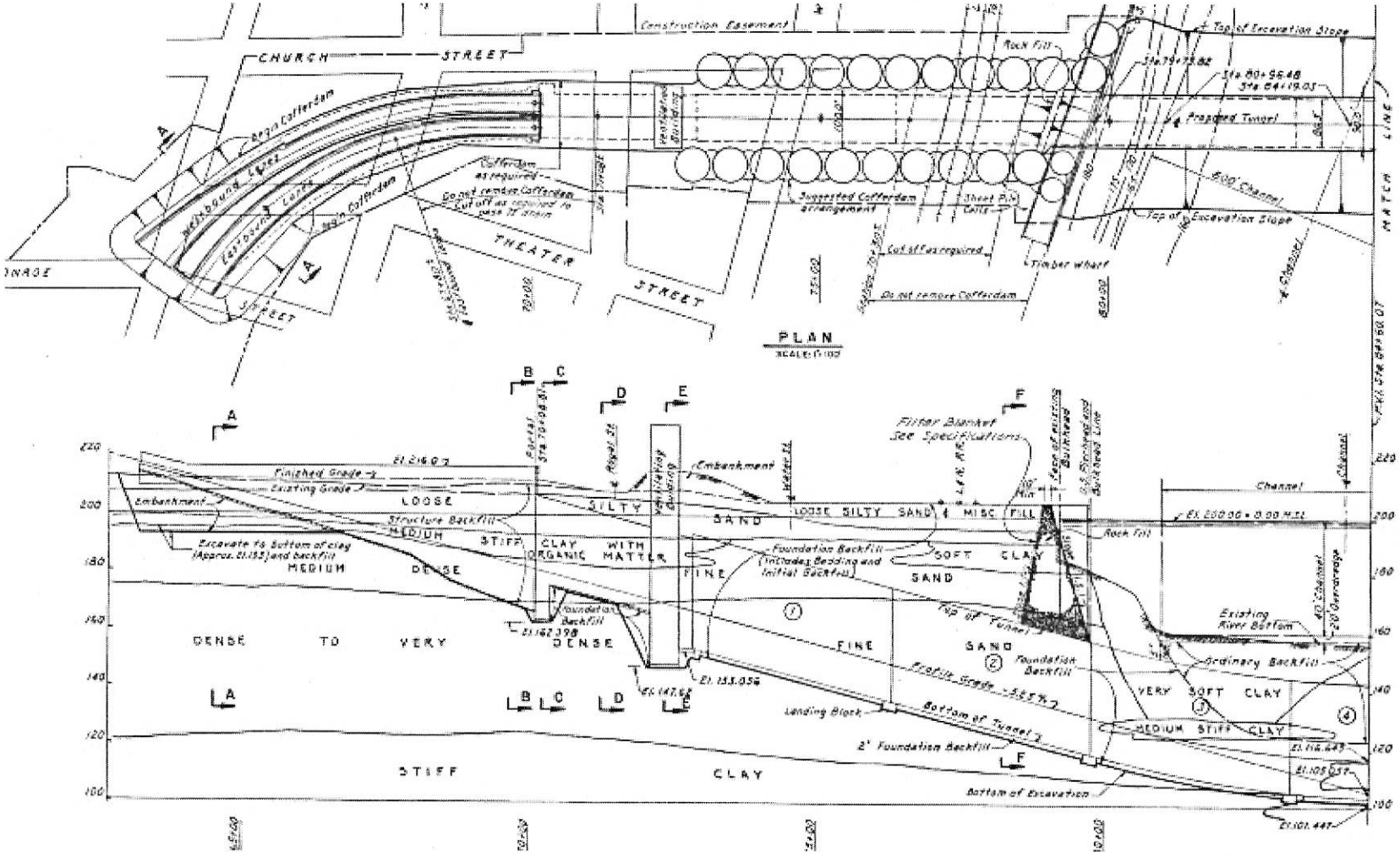


**Figure 1: West approach of Wallace Tunnel – from original design plans**

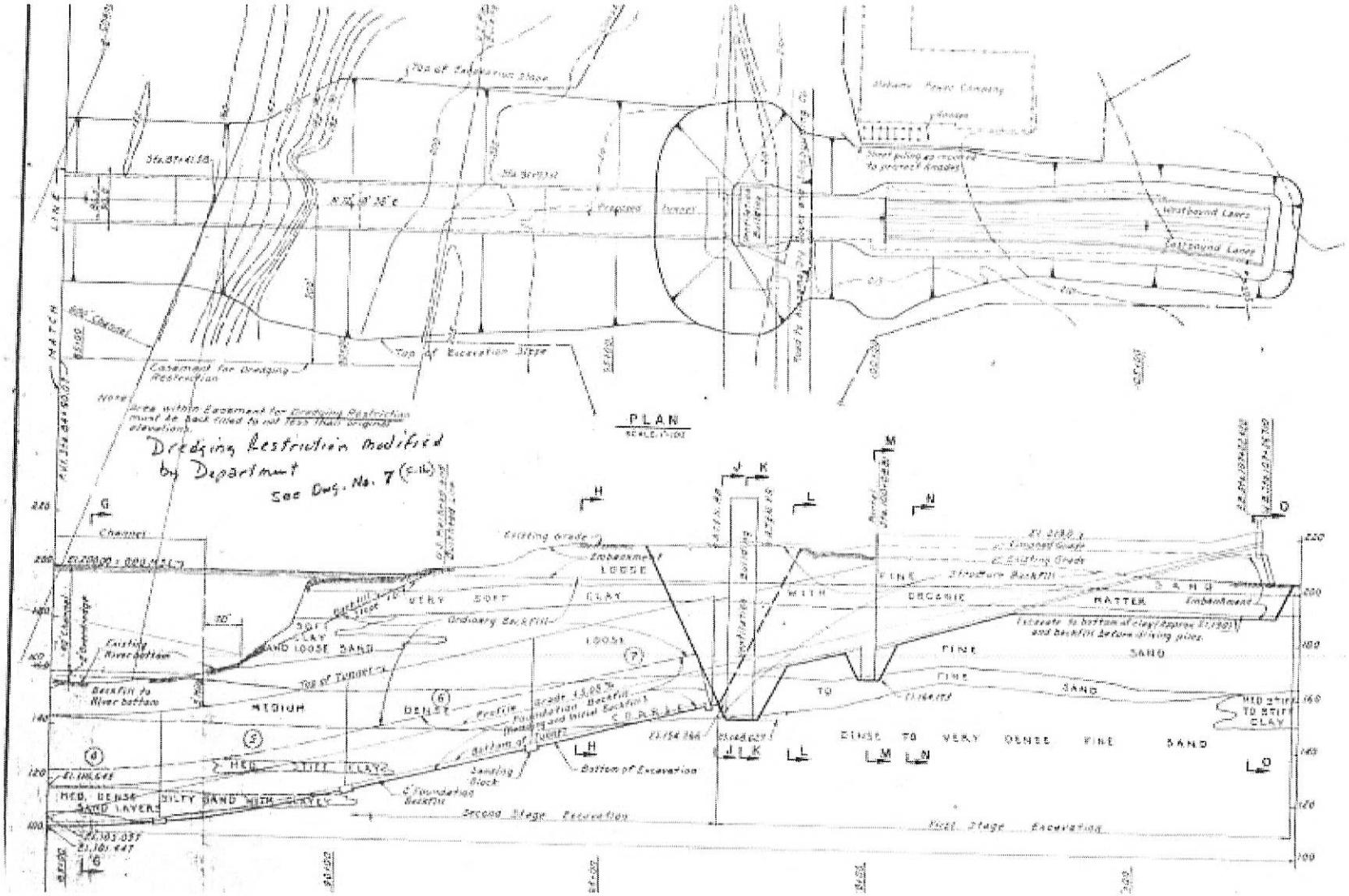


**Figure 2: East approach of Wallace Tunnel – from original design plans**

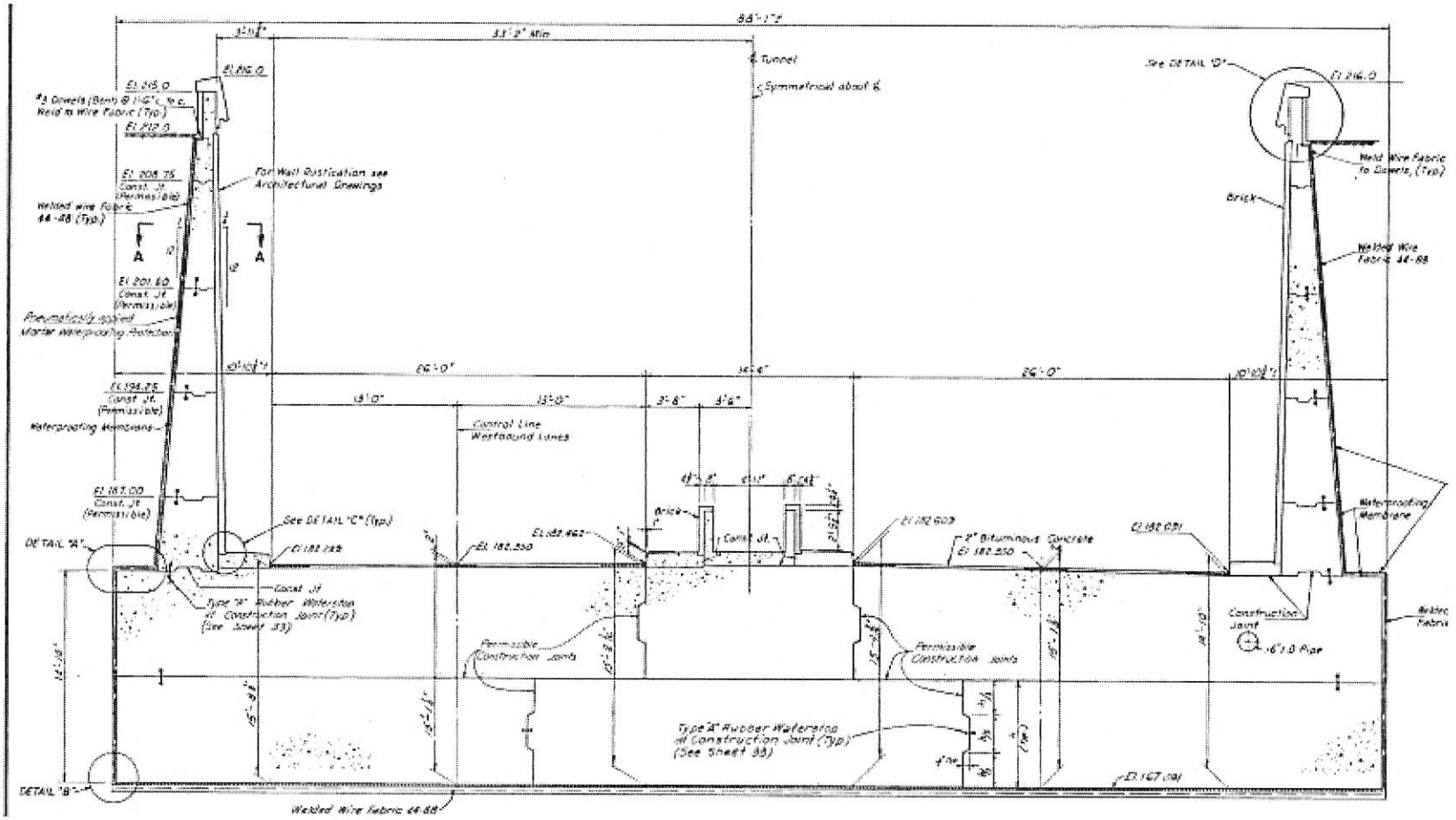


**Figure 3: Wallace Tunnel Typical Section – from original design plans**

**Figure 4: Design Exception Request**

| Project Reference Plan Alignment | Location (STA to STA) | Roadway Element | Design Criteria Value | Design Exception Value / Project Reference Plan Condition | Justification |
|---|---|---|---|---|---|
| I-10 BUS | 158+93 to 162+45.88 | Minimum Curve Radius | 960' | 640' | Maximum allowable within Wallace Tunnel constraints. |
| I-10 BUS | 158+93 to 162+45.89 | SSD | 495' | 258.41' | Maximum allowable within Wallace Tunnel constraints. |
| I-10 BUS | 150+47.10 to 163+43.41 | Outside Shoulder Width | 12' | Taper from 12' to 1' | Allows taper from Design Criteria value (12') to exisiting conditions (1') |
| I-10 BUS | 158+93.10 to 163+43.41 | Shoulder Width | 12' Outside / 4' to 8' Inside | 1' Outside / 1' Inside | Match existing. |
| I-10 BUS (Eastbound) | 152+20 to 159+85 | Maximum Longitudinal Grade | -4% | -6.31% | Minimum allowable due to Project development within Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | 159+85 to 163+28.74 | Maximum Longitudinal Grade | -4% | -4.93% | Minimum allowable due to Project development within Wallace Tunnel constraints. |
| I-10 BUS (Westbound) | 150+40 to 163+28.74 | Maximum Longitudinal Grade | -4% | 4.93% | Minimum allowable due to Project development within Wallace Tunnel constraints. |
| I-10 BUS | 158+93 to 163+43.41 | Superelevation Rate | | *existing condition* | Match existing. |
| I-10 BUS (Eastbound) | 541+69.39 to 553+96.17 | Maximum Longitudinal Grade | 4% | 5.10% | Minimum allowable due to Project development within Wallace Tunnel constraints. |
| I-10 BUS (Westbound) | 541+24.48 to 552+62.55 | Maximum Longitudinal Grade | 4% | 4.97% | Minimum allowable due to Project development within Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | 541+64.48 to 548+79.94 | Shoulder Width | 12' Outside / 4' to 8' Inside | 1' | Match existing. |
| I-10 BUS (Westbound) | 541+25.52 to 548+43.29 | Shoulder Width | 12' Outside / 4' to 8' Inside | 1' | Match existing. |

**Figure 5: Design Variance Request**

| Project Reference Plan Alignment | Location (STA to STA) | Roadway Element | Design Criteria Value* | Design Variance Value / Project Reference Plan Condition | Justification |
|---|---|---|---|---|---|
| I-10 BUS | 158+93 to 162+45 | Radius relation in compound circular curves | 1 : 1.5 | 1 : 2.31 | Minimum allowable within existing Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | 159-20 to 159+85 | Maximum Longitudinal Grade | -3% | -6.31% | Minimum allowable within existing Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | 158+85.00 to 160+85.00 | Minimum Vertical Curve Length | 600' | 200' | Maximum allowable within Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | 159+85 to 163+43.41 | Maximum Longitudinal Grade | -3% | -4.93% | Minimum allowable within existing Wallace Tunnel constraints. |
| I-10 BUS (Westbound) | 150+40 to 163+28.74 | Maximum Longitudinal Grade | 3% | 4.93% | Minimum allowable within existing Wallace Tunnel constraints. |
| Canal/Water St Ramp D | 1205+00 to 1211+69 | Acceleration lane length | 1000' | 300' | Maximum allowable within Wallace Tunnel constraints. |
| I-10 BUS | 158+93 to 162+44 | Superelevation Transition Length | 202.5' | *existing conditions* | Match existing. |
| Canal/Water St Ramp D | 1300+35 to 1302+15 | K crest value | 114 | 63.91 | Maximum allowable within Wallace Tunnel constraints. |
| Canal/Water St Ramp D | 1306+75 to 1302+15 | K sag value | 64 | 28.84 | Maximum allowable within Wallace Tunnel constraints. |
| Canal/Water St Ramp C | 1206+65 to 1211+65 | K crest value | 114 | 65.6 | Maximum allowable within Wallace Tunnel constraints. |
| I-10 BUS (Eastbound) | Sta 541+69.39 to Sta 553+96.17 | Maximum Longitudinal Grade | 3% | 5.10% | Minimum allowable within existing Wallace Tunnel constraints. |
| I-10 BUS (Westbound) | Sta 541+24.48 to Sta 552+62.55 | Maximum Longitudinal Grade | 3% | 4.97% | Minimum allowable within existing Wallace Tunnel constraints. |
| East Tunnel Interchange Ramp A | Sta 543+10 to Sta 547+60 | Minimum Deceleration Lane Length | 800' | 277' | Maximum allowable within Wallace Tunnel constraints. |
| East Tunnel Interchange Ramp B | Sta 546+00 to Sta 551+20 | Minimum Acceleration Lane Length | 1000' | 520' | Maximum allowable within Wallace Tunnel constraints. |

* Includes criteria defined for the Project, within Technical Provision.

**November 30, 2018**

**RE:** **Bayway Shoulder Design Criteria**

**To:** **Andrew Wood, PE**
**ALDOT Project Manager**

**From:** **Katie Parker, PE / East Design Lead, Mott MacDonald**

**REF:** **I-10 Mobile River Bridge and Bayway Project (Project)**

## BACKGROUND

The purpose of this memorandum is to document the change in Project design criteria for the I-10 Bayway inside shoulder width. The I-10 Bayway is an approximately 7.5-mile concrete bridge structure that spans the Mobile Bay, beginning at the East Tunnel Interchange and ends at the Eastern Shore Interchange where it ties to at-grade I-10, Project Sta 570+00 to 582+40.

The I-10 Bayway will consist of 4-lanes of travel in each direction, set at a 70 mph design/posted speed. Travel lanes will be set at 12-ft width. Prior design criteria for the Bayway structures included full 12-ft inside and outside shoulders. This memo is documenting the change to 4-ft inside shoulder width for the entirety of the Bayway. The outside shoulder width will remain 12-ft.

## DESIGN CONSIDERATIONS

From AASHTO "A Policy on Geometric Design of Highways and Streets" (Green Book) Section 4.4.2:

*Heavily traveled, high-speed highways and highways carrying large numbers of trucks should have usable shoulders at least 3.0 m [10 ft] wide and preferably 3.6 m [12 ft] wide...*

From AASHTO "A Policy on Design Standards – Interstate System" Page 7:

*Long bridges, defined as bridges having an overall length in excess of 200 ft (60 m), may have a lesser width and should be analyzed individually. On long bridges, a reduced shoulder width of 4 ft (1.2 m) may be used on both the left and right sides.*

## RECOMMENDATION

The project team recommends that the inside shoulder for the I-10 Bayway structure be set at 4-ft. The Project Bayway Typical Section is shown in Figure 1.

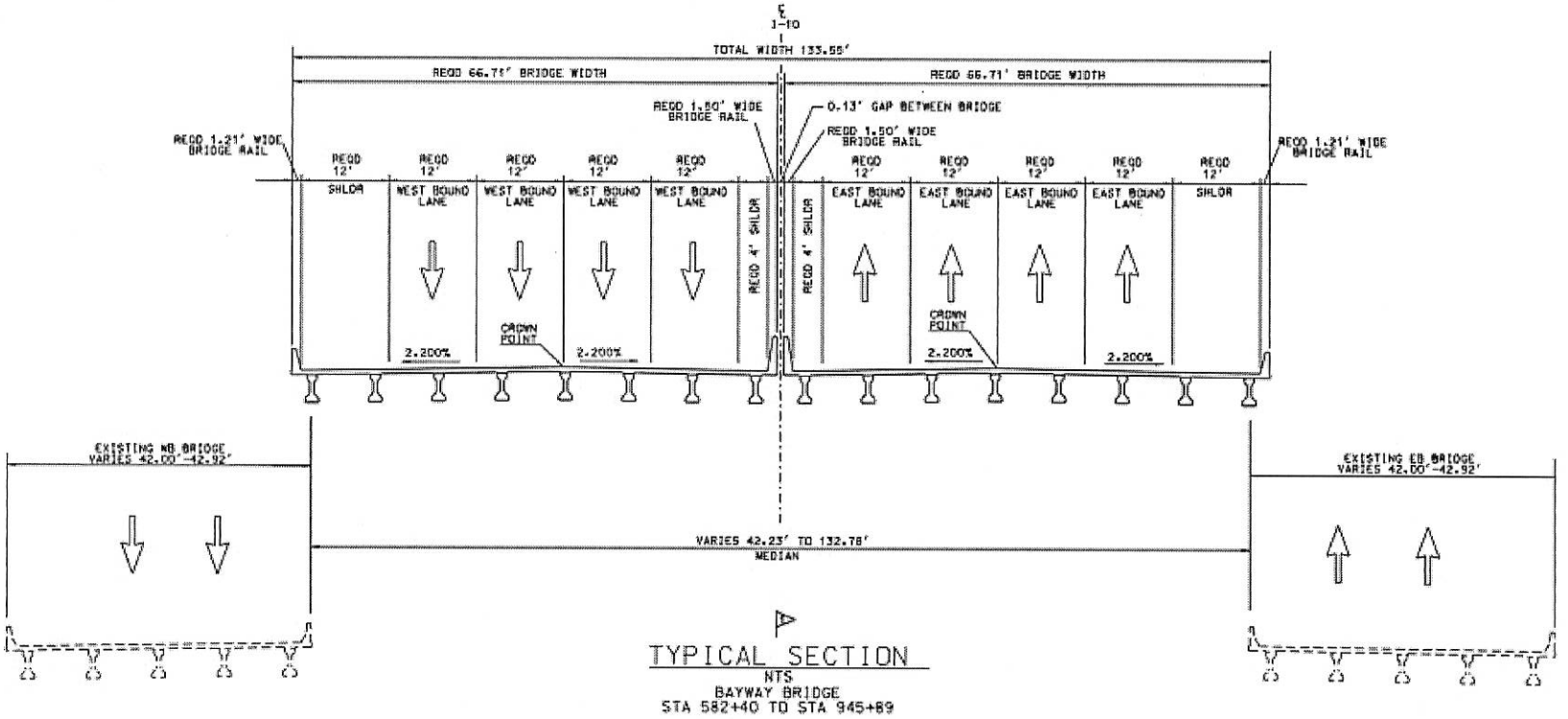


**Figure 1: Bayway Bridge Typical Section**

thompson
ENGINEERING

November 13, 2017

**RE:** **Technical Memorandum TM2017-0817**
**West High Level Approach Horizontal Stopping Sight Distance (HSSD)**

**To:** **Edwin Perry / Project Manager, MRB Project, ALDOT**

**From:** **Tom Harjung / West Design Lead, Thompson Engineering**

**REF:** **I-10 Mobile River Bridge and Bayway**
**Proj. # DPI-0030(005), DPI-1010()()**
**Contract ID#2074**

## BACKGROUND

The purpose of this memorandum is to document a design exception request for Stopping Sight Distance for the I-10 Mobile River Bridge and Bayway project currently under development. The location of the design exception request is for the West High Level Approach (HLA) to the Mobile River Bridge Main Span. An exception is required to the design criteria for horizontal stopping sight (HSS) distance within the high-rise curvature because of grade level alignment constraints to the B' Alignment on the west side of the Main Span Unit.

Proposed eastbound and westbound I-10 bridges will be free standing with 10 feet of space between the two bridges, three 12 ft. lanes and 12 ft. shoulders on each side. The eastbound bridge alignment is located on an upgrade section and has a centerline inside curve radius of 1891 ft. and the westbound bridge alignment is on a downgrade with centerline curve radius of 1976 ft. The eastbound and westbound I-10 is an interstate through movement across the bridge. The proposed design speed is 65 mph. HSS restrictions on the West High Level Approach (HLA) would limit our proposed design speed minimum to 55 mph in both directions.

## DESIGN EXCEPTION

A design exception is requested for Stopping Sight Distance (SSD) for the westbound bridge inside lane and eastbound outside lane of the I-10 West High Level Approach.

**Table 1: Stopping Sight Distance Requirement for the Selected Alternative***

| Scenario | Eastbound SSD, ft. | Eastbound SSD ft. | Westbound SSD ft. | Westbound SSD ft. |
|---|---|---|---|---|
| | Required | Available | Required | Available |
| 55 MPH | 465 | 522 | 526 | 534 |
| 60 MPH | 534 | 522** | 606 | 534** |
| 65 mph | 607 | 522** | 691 | 534** |

* Design Basis __ (*AASHTO 2011 Green Book* Section 3.3.12)

** Stopping Sight Distance design exception requested

## ANALYSIS

The design alignment of the preferred B' Alternate is constrained by the Mobile County Jail, the B' alignment of the mobile river crossing, and the Alabama Cruise Terminal. The curve characteristics as described above for both eastbound and westbound "inside" lanes were achieved in the West High Level Approach selected alternative.

I-10 has a design speed of 65 mph. This design speed on a 3.565% vertical grade requires a minimum SSD of 607 ft. upgrade and 691 ft. downgrade (*AASHTO 2011 Green Book*, Table 3-2). The eastbound upgrade I-10 bridge alignment through the elevated curved section provides a stopping sight distance of 522 ft. The westbound downgrade I-10 bridge alignment provides a stopping sight distance of 534 ft. The available SSDs in both directions do not meet the minimum SSDs for the design speed of 65 mph and only are adequate for a 55 mph design speed (see Table 1). Horizontal sight lines for the pertinent design speed are obstructed by a 36-inch barrier rail located along the 12 ft. shoulders, limiting the ability to achieve the desired sight distances (see Figure 1).

To meet the minimum SSD requirements for the 65mph design speed, the eastbound bridge alignment will require widening of the outside shoulder from 12ft. to 18.3ft. through the curved segment. The westbound bridge will require widening the left shoulder from 12 ft. to 24.1 ft. These shoulder widths exceed AASHTO's recommended limiting width of 12 ft. The concern of the shoulders being used as passing lanes and or likely as "observation deck" particularly on the eastbound bridge section becomes more evident with these wide shoulders. More so, right of way restrictions towards the Mobile County Jail and the narrow air space between the bridges leave little room for widening of the outside shoulder of the eastbound bridge and the inside shoulder of the westbound bridge, respectively.

Other alternatives were examined. An alternative to provide for the 65 mph SSD applied a flatter radius of 3310 ft. (minimum radius required to achieve 691 ft. SSD with 12ft inside shoulder) to the horizontal geometry of the westbound bridge. This large sweeping radius introduced bridge straddle bents, Environmental Justice neighborhood impacts and difficult traffic control during construction. A significant differential bridge cost in addition to the aforementioned impacts eliminated this option (see Table 2).

Another alternative considered provided 60 mph design speed SSDs and required additional 5.2 ft. shoulder widening to westbound bridge and 0.8 ft. to the eastbound outside shoulder in order to achieve the desired 65mph SSDs. This was however, eliminated due to additional straddle bent cost, difficult traffic control during construction and overall increased construction costs of the bridges.

**Table 2: Differential Alternative Costs**

| Design Scenario Based on SSD design speed criteria | Description | Approximate Differential Cost |
|---|---|---|
| Original 55MPH layout | Low SSD | Base |
| Modified 55 MPH layout (Selected alternative) | 55 mph SSD (design exception required) | $0 |
| 60 MPH layout | Acceptable SSD with flatter radius & additional westbound inside shoulder widening, significant cost impact, (design exception required) | $22M |
| 65 MPH layout | Acceptable SSD with flatter radius, ROW impact & significant cost impact (not included) | $20M |

**RECOMMENDATION**

The Thompson team recommends both the eastbound and the westbound bridges to continue with the proposed alignment under a design exception for the stopping sight distance criteria, allowing for an inside shoulder dimension of 12 ft. westbound and 12 ft. outside shoulder eastbound. The exception is to accept 55 mph design speed criteria for SSD in lieu of the 65 mph requirement in this 1600 ft. length horizontal curve on the west HLA coming off the Main Span.

**CONCLUSION**

The selected alternative presents a balance design of cost, environmental impact, right of way impact, maintenance of traffic during construction and meets the FHWA ten (10) controlling criteria for 65 mph design speed with the exception of the SSD for eastbound and westbound bridge alignments. Other alternatives considered in order to improve SSD are not favored because of site conditions. Your concurrence is requested.

Attachments

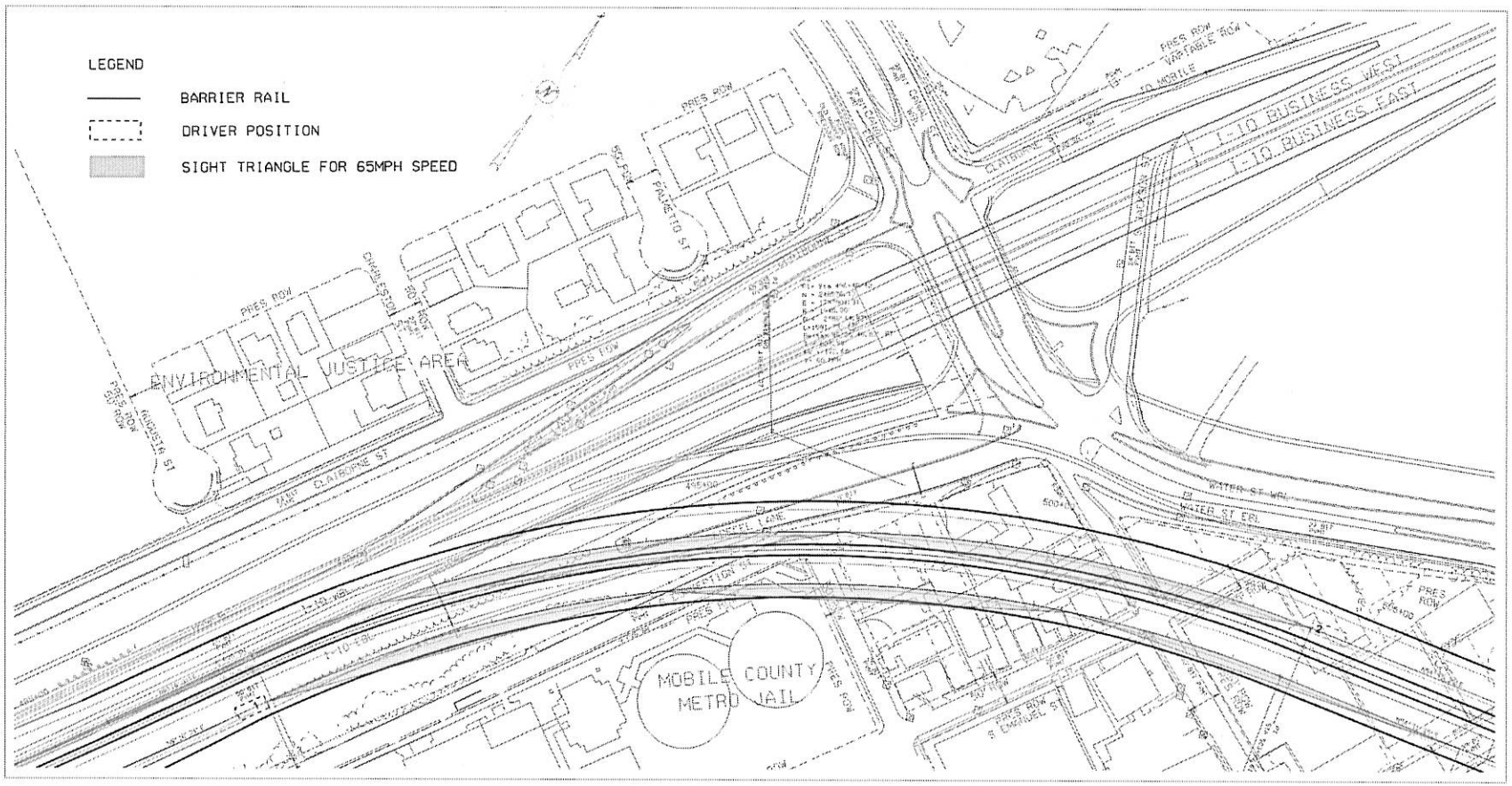


**Figure 1: Horizontal Sight Triangles for 65mph Design Speed Superimposed on Selected Alternative**