APPENDIX D. PURPOSE AND NEED MEMORANDUM

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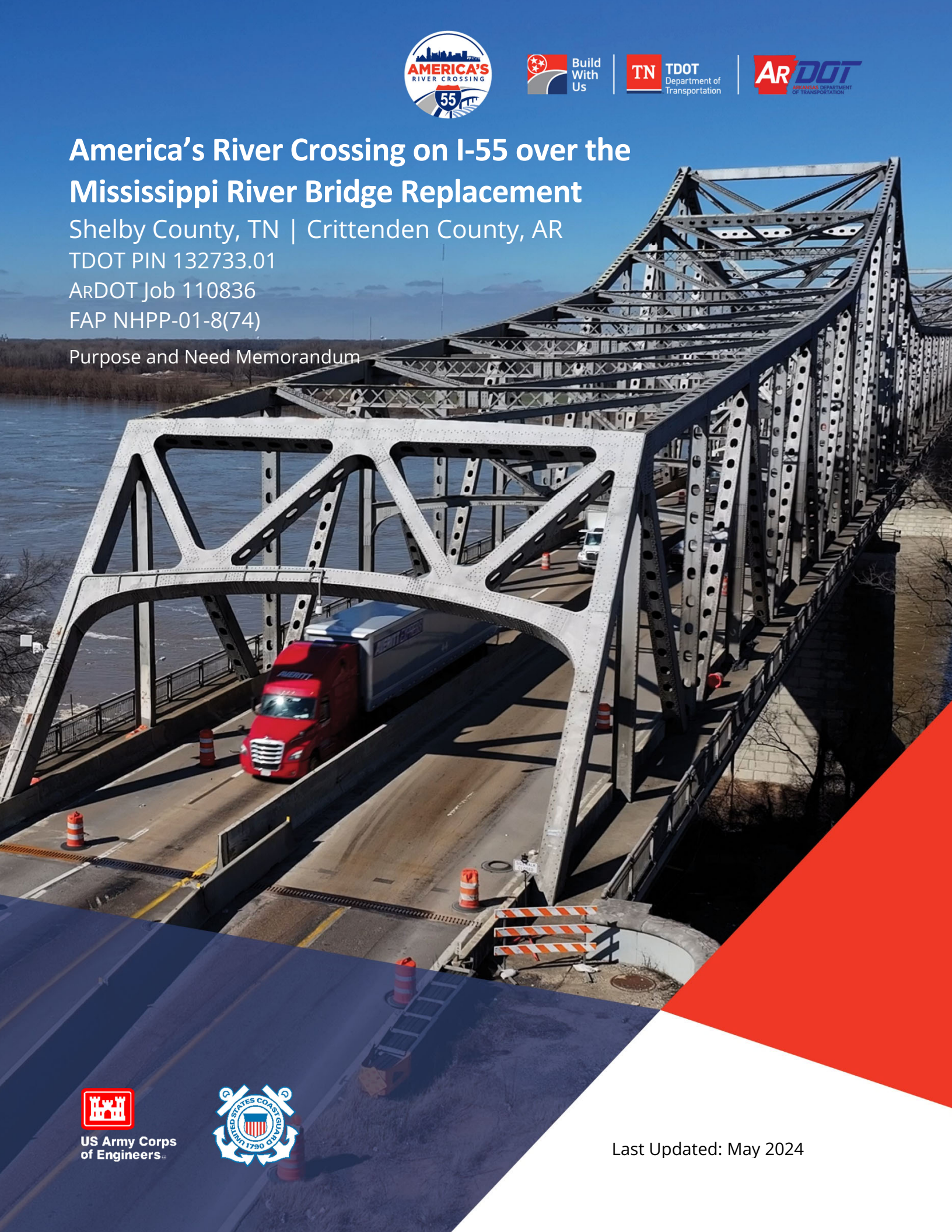

America's River Crossing on I-55 over the Mississippi River Bridge Replacement

Shelby County, TN | Crittenden County, AR

TDOT PIN 132733.01

ARDOT Job 110836

FAP NHPP-01-8(74)

Purpose and Need Memorandum

US Army Corps of Engineers

Last Updated: May 2024

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APPENDIX

1. INTRODUCTION

This document presents the purpose and need for the America's River Crossing Bridge Replacement Project ("Project") on the Interstate 55 Bridge (I-55 Bridge). The purpose and need is essential in explaining to the public and decision makers why a proposed project is necessary and worthwhile. The purpose and need also establishes the basis for identifying and screening reasonable alternatives, drives in-depth analysis, and ultimately results in selecting a preferred alternative. The purpose element defines the project's fundamental reason(s) in terms of the desired transportation outcome(s) that the project intends to address. The need element of the statement provides the relevant data substantiating that the transportation problem(s) that the proposed project intends to address exist.

Detailed data and analysis from previous studies documented in the *Project History/Past Studies Memorandum*, as well as an assessment of existing conditions documented in the *Baseline Conditions Memorandum*, were utilized in defining the problems and potential solutions to address future needs within the study area. These key issues are summarized in this document.

1.1. Background

The I-55 bridge, which is also known as the Memphis-Arkansas Bridge, is nearly 75 years old and opened to traffic in December 1949. The I-55 bridge is one of only two Mississippi River roadway crossings in the Memphis area, the other being the I-40 bridge, which opened to traffic in 1973 and is located approximately two miles north of the I-55 bridge. The next closest vehicular crossings- of the Mississippi River are located approximately 71 miles north (I-155 bridge between Missouri and Dyer County, Tennessee) and approximately 54 miles south (US 49 bridge between Helena, Arkansas, and Mississippi).

The I-55 bridge serves as a major freight corridor for the Mid-South (Memphis) Region[1]. In terms of total tonnage, truck freight represented 42 percent of the total tons in the Mid-South (Memphis) Region in 2019 and is forecasted to increase to 48 percent in 2050.[2]

[1] The Mid-South Region of the United States is usually thought to be anchored by the Memphis metropolitan area and includes portions of Tennessee, Mississippi, Arkansas, Missouri, and Kentucky.
[2] Mid-South Freight Flows and Industry Analysis, WSP, February 2023.

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2. PROJECT NEEDS

Data from the May 2023 *Targeted Approach for Crossing the Mississippi River, Interstate 55 (US 64) (SR 61) (Targeted Approach) Preliminary Purpose and Need* was reviewed and utilized when applicable.

The *Targeted Approach* report identified preliminary needs, proposed alternative corridors, and created a framework for the development of evaluation criteria for screening the alternatives. Preliminary needs identified included high cost of bridge maintenance, structural deficiencies, susceptibility to seismic demands, and route resilience. Secondary needs such as increased capacity, improving traffic operations and freight movement were also identified.

The *Target Approach* report identified preliminary purposes for the project based on the aforementioned needs. These included financially feasible alternatives that account for on-going operation and maintenance costs, construction costs, and anticipated funding available, improving structural deficiencies and meeting current TDOT design standards. The secondary purpose identified include capacity relief, improve traffic operational efficiencies for both the I-40 and I-55 bridges over the Mississippi River and enhance local and regional freight movement, including traffic generated by the airport, rail yards, and riverports.

The following Project Needs were informed by data presented in the *Targeted Approach.* The Projed needs were refined based on supplementary and current data documented in the *Baseline Conditions Memorandum* and explained in detail in the following sections.

2.1. Safety

2.1.1. Geometric Deficiencies

Geometric design deficiencies on the existing bridge create hazardous safety issues for motorists, as described below. Designed in 1944 and opened to traffic in 1949, the existing I-55 bridge was constructed before the inception of the Interstate System and therefore not built to current interstate standards.[3] The existing bridge roadway, with 11-foot wide lanes and no shoulders, is narrower than the approach roadway widths on both the Tennessee and Arkansas sides and does not meet current design criteria for interstates with median barriers. Current design criteria for interstates require 12-foot lanes with a 10-foot outside shoulder and an 8-foot minimum inside shoulder, and separated by a median barrier

[3] *Although officially designated as an interstate route in 1957, the I-55 Bridge was not designed to interstate standards.*

compliant with the Manual for Assessing Safety Hardware (MASH) guidelines. As outlined in **Appendix A**, the original raised median was replaced with a safer bolted concrete median barrier in 1971[4]. This bolted concrete barrier was later replaced with a cast-in-place barrier in 1996[5], which is shown in **Appendix B**. Because the existing bridge is a through truss, it cannot be widened to improve deck geometry. The narrowing of the bridge roadway from the approach roadway creates a potentially hazardous situation for drivers on both the Tennessee and Arkansas sides of the river. Geometric deficiencies of the existing I-55 bridge are shown in **Figure 2-1**.

Figure 2-1. Photo Illustrating I-55 Bridge Geometric Deficiencies

Source: Project Team, Photo Taken 1/31/24.

Crash rates are calculated along roadway segments as a per million vehicle miles traveled (MVMT) and then compared to average statewide crash rate based on similar facility types. The I-55 bridge crash rates were compared to other urban interstates in Tennessee with four or more lanes. The existing I-55 bridge experienced significantly higher crash rates than the TDOT average statewide crash rate for urban interstates using the most recent 5-years (January 1, 2018 through December 31, 2022) of crash data. Compared to the statewide average critical crash rate of 2.294 crashes per MVMT, the bridge crash rate of 3.327 crashes per MVMT is 45 percent higher.

[4] *Layout of Memphis Bridge Median Barrier, TDOT 1971*
[5] *Bridge Repair Plans, TDOT, 1996*

A large proportion of the crashes involve a commercial vehicle (46 percent), which further illustrates the need to improve the typical section and geometrics of the bridge and its approaches. Among the 458 total crashes within the project area, approximately 44 percent were rear-end crashes, 19 percent were angle crashes, and 22 percent were sideswipe crashes, which can most likely be attributed to congestion, capacity, and roadway design. Moreover, this observation combined with the number of commercial vehicle-related crashes, can be attributed to the narrow lanes and inadequate shoulders for existing and future traffic volume on the bridge.

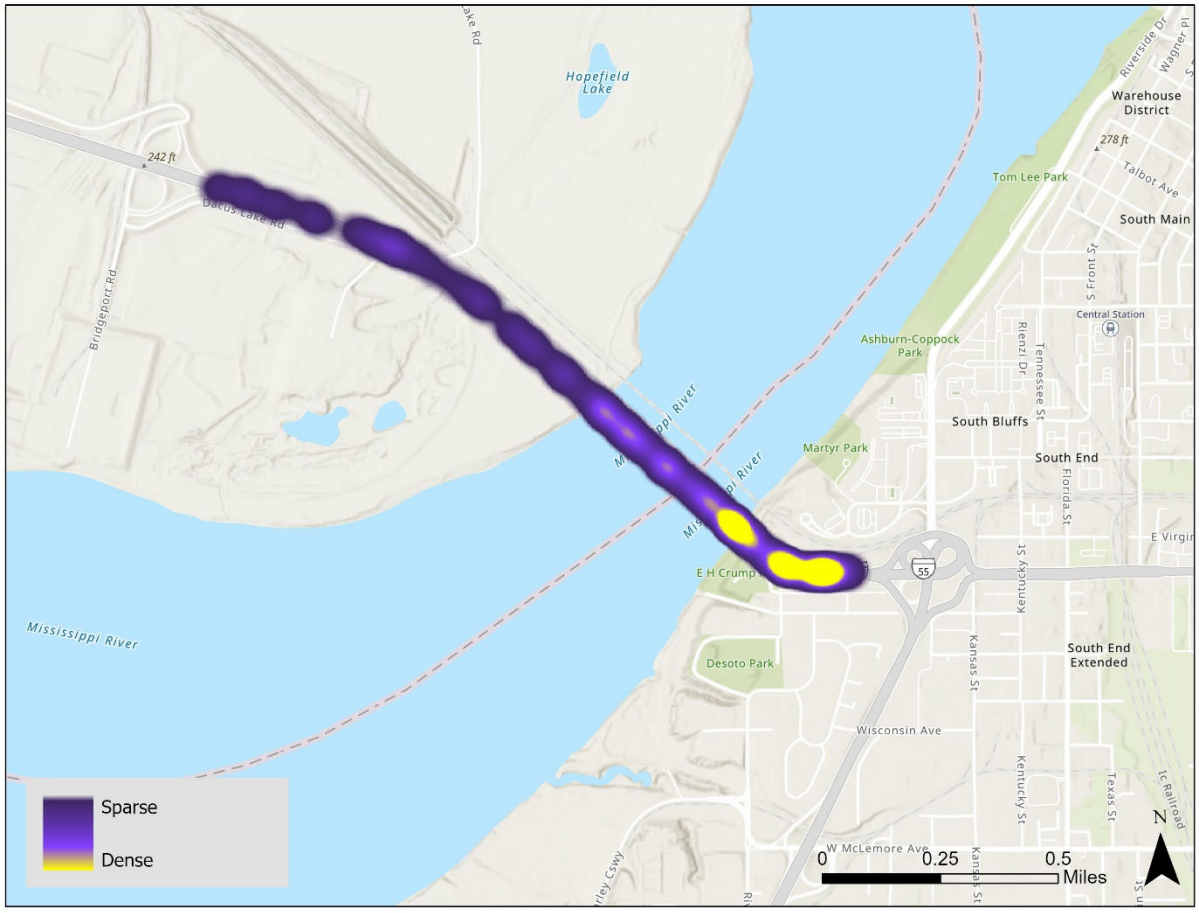
Crash data[6] was also analyzed to determine spatial distribution of crashes within the project area. Crashes were mainly concentrated on the Tennessee side of the project limits, where I-55 connects to local streets at the Alston Avenue/Metal Museum Drive interchange. The concentration of crashes in this area is consistent with the approach roadway narrowing from four lanes to two lanes in each direction on the bridge.

The E.H. Crump Interchange Reconstruciton Project, east of the existing bridge and currently under construction, improves this condition by eliminating the Alston Avenue/Metal Museum Drive interchange. However, upon completion of that project, a roadway narrowing condition will remain except it will be from three lanes to two lanes in each direction on the bridge.

Figure 2-2 examines concentrations of high-crash density along the bridge corridor.

[6] Because the project area falls in both states of Arkansas and Tennessee, the data was collected from ACAT and E-TRIMS respectively for crashes within each state between 2018-2022. Statewide average crash rate (average of the rates for 2019-2021 and 2021-2023) was used since 2018-2022 is the latest average crash data from both TDOT and ARDOT. Crashes from 2023 are available from TDOT, but 2022 is the latest available data from ARDOT. Statewide average crash rates for 2018-2022 from ARDOT were also reviewed but not utilized because a majority of the crashes are in Tennessee.

Figure 2-2. I-55 Bridge Crash Concentrations, 2018-2022



Source: ACAT and ETRIMS, ARDOT and TDOT respectively, Accessed March 2024

2.1.2. Bridge Appraisal Ratings

Bridge inspections for all public bridges in Arkansas, including the I-55 Bridge, are performed every two years by ARDOT. The latest inspection was conducted in August 2023 and published in March 2024 and is included in the *Baseline Conditions Memorandum*. National Bridge Inventory (NBI) appraisal ratings provide an assessment of potential bridge vulnerabilities. The ratings are the lowest values obtained from component ratings and those determined from regular inspections. A guide to understand the appraisal ratings is provided in **Figure 2-3**.

Figure 2-3. National Bridge Inventory Appraisal Rating Classification

Rating	Description
9	Superior to present desirable criteria
8	Equal to present desirable criteria
7	Better than present minimum criteria
6	Equal to present minimum criteria
5	Somewhat better than minimum adequacy to tolerate being left in place as is
4	Meets minimum tolerable limits to be left in place as is
3	Basically intolerable requiring high priority of corrective action
2	Basically intolerable requiring high priority of replacement
1	This value of rating code not used
0	Bridge closed

Source: National Bridge Inventory, USDOT/FHWA, 2022

The appraisal of the I-55 bridge shows that the deck geometry is rated 2, indicating an intolerable condition. This is because of the existing bridge geometric conditions described in **Section 2.1.1**. In addition, given the bridge was constructed in 1949, it was not designed to any modern seismic code, thus creating a potentially hazardous condition for motorists in the case of an earthquake. This is further discussed in **Section 2.3** in relation to route resiliency.

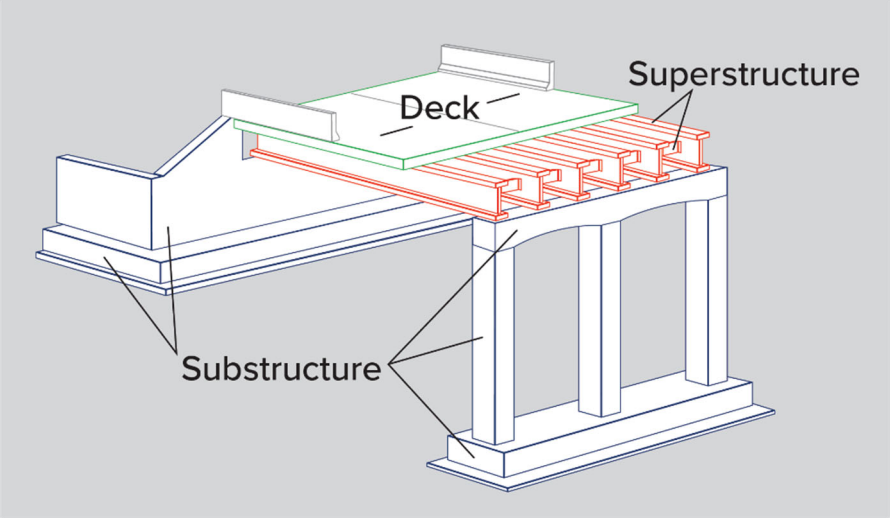
2.1.3. Bridge Condition Ratings

In addition to the appraisal ratings (**Section 2.1.2**), the NBI Tennessee Inventory and Appraisal Report, based on the bridge inspection of I-55 by ARDOT (conducted in August 2023), also evaluates bridge condition ratings. The primary bridge components and the bridge waterway configurations are inspected and assessed as part of the condition

rating. These ratings assist with determining maintenance needs of the bridge or if a bridge needs to be replaced.

Condition ratings describe the existing field conditions of the bridge components which include the bridge deck, superstructure, and substructure, all shown in **Figure 2-4**. The Deck is the concrete roadway surface on which vehicles ride on. The superstructure is defined as the major elements such as beams and trusses that span a waterway or roadway below. Substructure is defined as those elements such as piers and abutments that support the superstructure.

Figure 2-4. Bridge Components



Source: Project Team, 2024

A condition rating considers the type, location, and severity of the defects and the degree to which the defects affect strength and performance of the bridge. A guide to understanding the rating values is provided below in **Figure 2-5**[7].

[7] *Bridge rating values as referenced from the Specifications for the National Bridge Inventory, publication by USDOT/FHWA, 2022.*

Figure 2-5. Bridge Condition Rating Classification

Rating	Description
9	Excellent
8	Very good
7	Good
6	Satisfactory
5	Fair
4	Poor
3	Serious
2	Critical
1	Imminent Failure
0	Failed

Source: Specifications for the National Bridge Inventory, USDOT/FHWA, 2022

As shown in **Table 2-1**, the Superstructure of the I-55 Bridge is rated 5 (Fair Condition). However, due to its age (nearly 75 years old), active corrosion on the main Superstructure elements, failing paint, and observed steel section loss as of the March 2023 bridge inspection, it is likely that the Superstructure condition rating will fall to a rating of 4 (Poor Condition) in the future without rehabilitation, indicating widespread major defects. The existing I-55 bridge superstructure is shown in **Figure 2-6**.

Table 2-1. Condition Ratings of the I-55 Bridge

BRIDGE COMPONENT	CONDITION RATING
Deck	6
Superstructure	5
Substructure	5
Stream Channel and Protection	5

Source: ARDOT Special Inspection Report dated 08/15/2023 for Asset #02271 (NSTM)

Figure 2-6. I-55 Bridge Superstructure

Source: Project Team, Photo Taken 1/31/24.

2.2. Maintain State of Good Repair

The existing I-55 bridge does not meet current design standards (**Section 2.1**), has had increased and ongoing maintenance costs (**Section 2.2.1**), and hinders the resiliency of the regional tri-state network (**Section 2.3**), all of which are needed to contribute to maintaining a state of good repair (SOGR). The existing I-55 bridge is not consistent with the objectives of both TDOT and ARDOT's Transportation Asset Management Plans (TAMPs) because it is a structurally deficient and poorly rated (NBI) bridge that cannot be maintained in a SOGR.

2.2.1. High Cost of Maintaining the Existing I-55 Bridge

Operating and Maintenance (O&M) costs were assessed for the existing I-55 bridge as part of a March 2023 Benefit-Cost Analysis[8] (**Appendix C**). Maintenance of the existing I-55 bridge is shared by both TDOT and ARDOT. For bridge structures, O&M costs of $50,000 per year (2021 dollars) is assumed for a proposed new bridge. However, the O&M cost of maintaining the existing I-55 bridge structure would be approximately $1M per year (2021 dollars). In addition, the current bridge coating was originally applied

[8] *Targeted Approach for Crossing the Mississippi River Interstate 55 (US 64) (SR 61), Benefit-Cost Analysist Technical Memorandum, March 2023*

during the construction of the bridge in the late 1940s. Accordingly, bridge painting costs must account for the removal of lead-based paint, which requires a specialized containment system and regulated disposal. The repainting cost of the existing I-55 bridge structure per 30-years would be approximately $50M (2021 dollars).

Both TDOT and ARDOT have defined performance targets in their most recent TAMPs to ensure consistent and cost-effective maintenance of all agency assets. For SOGR, both states have set targets for bridges in good and poor condition.

2.3. Ability to Withstand a Strong Earthquake to Provide Route Resiliency

The I-55 bridge is located within 100 miles of the New Madrid Seismic Zone (NMSZ). In December 1811 the area experienced the most powerful earthquake to hit the contiguous United States east of the Rocky Mountains in recorded history, registering 7.2 – 8.2 on the Richter scale. At least three large aftershocks with magnitudes that ranged from 6.0 to 7.0 occurred in early 1812. In addition, hundreds of small seismic events still occur annually in the NMSZ. The existing I-55 bridge was not constructed to withstand a strong earthquake, which is defined by The U.S. Geological Survey as a magnitude of 6.3 on the Richter Magnitude Scale. An earthquake could not only damage the bridge, but also lead to a disruption of normal traffic operations and an emergency evacuation route. Highway bridges with long spans such as cable-stayed, suspension, and arch bridges are considered flexible and therefore categorized as special or complex bridges. The American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 9th Edition, 2020 (AASHTO LRFD) Section 4.5 and 4.6 requires special mathematical models to design these types of structures. AASHTO LRFD Section 3.10 also requires that all bridges be designed to withstand the prevailing earthquake with a 7 percent probability in 75 years, which equates to a 1000-year seismic return period. The existing bridge has not been designed for this requirement and furthermore has been classified as a non-candidate for seismic retrofitting due to high cost, estimated between $250 - $500 million[9].

[9] *Targeted Approach for Crossing the Mississippi River Interstate 55 (US 64) (SR61), Appendix G, Section 5.1.3, May 2023*

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3. PURPOSE OF THE PROJECT

The purpose of the proposed project is as follows:

3.1. Improve Safety

Replacing the I-55 bridge would improve geometric and structural deficiencies of the existing bridge. A new bridge would meet current interstate design standards, such as establishing acceptable shoulder and lane widths, reducing crash potential.

3.2. Maintain a State of Good Repair

Returning the I-55 bridge to a SOGR upon project completion would modernize the infrastructure asset to meet current design standards, substantially reducing ongoing maintenance costs for the replaced asset and the need for major rehabilitation work over the next decade.

3.3. Provide a Reliant Route

Replacing the I-55 bridge would strengthen the resiliency of the regional tri-state network, a need reinforced by the fact that Memphis is located in the NMSZ, which is still one of the most seismically active regions in the United States with hundreds of small events occurring annually. The operational continuity of the I-55 bridge is of utmost importance, as it facilitates the transportation of rail and truck freight, as well as passenger vehicles.

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4. SECONDARY GOALS

4.1. Enhance Multimodal Connectivity, Including Non-Motorized Access

One of the goals of the project is to strengthen the multimodal network that connects neighborhoods in and near the corridor. The Big River Crossing is a pedestrian bridge running parallel to the I-55 bridge spanning the Mississippi, shown in **Figure 4-1**. Nearly a mile in length, the Big River Crossing is the longest public pedestrian and cyclist bridge across the Mississippi, creating a connection from Memphis to West Memphis.

Multimodal connectivity is lacking in the vicinity of the existing I-55 bridge. The Project Team will explore the feasibility of expanding the existing shared use path, connecting non-motorized travelers in the project area to jobs, parks, and recreation and improving connections to the Big River Crossing. Additionally, better connectivity at existing trailheads (**Figure 4-2**) along the Big River Crossing would be addressed.

Figure 4-1. Big River Crossing Pedestrian Bridge

Source: Project Team, Photo Taken 1/31/24

.

Figure 4-2. Big River Crossing Trailhead in West Memphis

Source: Project Team, Photo Taken 3/11/24

4.2. Improve Freight Movement

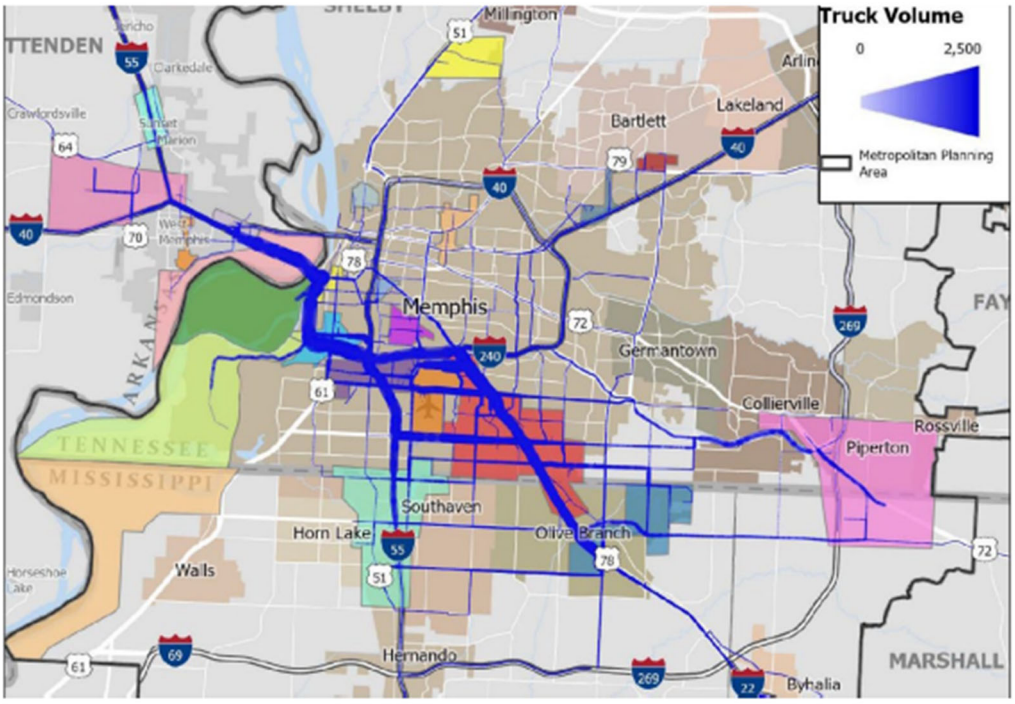
In terms of total tonnage, truck freight represented 42 percent of the total tons in the Mid-South (Memphis) Region in 2019 and is forecasted to increase to 48 percent in 2050. I-55 serves as a major freight corridor for the Mid-South region. Existing traffic on the I-55 bridge was approximately 30 percent trucks. **Figure 4-3** shows freight movement along the I-55 bridge.

Figure 4-3. Freight Movement Along the I-55 Bridge

Source: Project Team, Photo Taken 1/31/24.

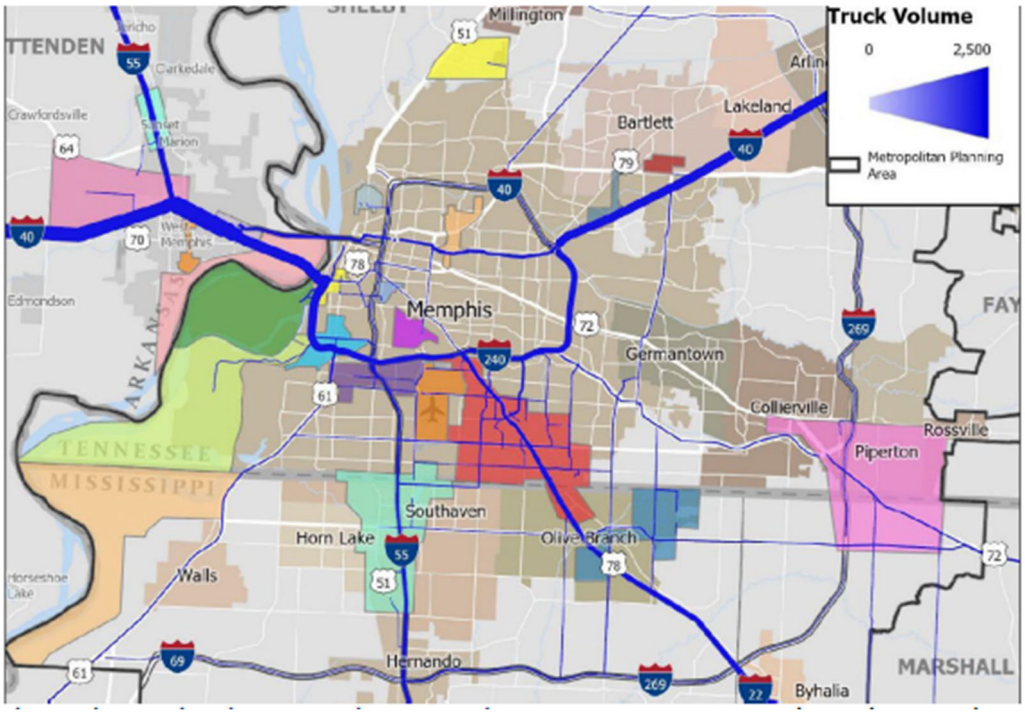
The Mid-South Freight Flows & Industry Analysis study defined 24 freight clusters that include truck terminals, warehouses, wholesale establishments, rail intermodal terminals, ports, and the Memphis International Airport in the Mid-South region. Many of these freight clusters are located in South Memphis. In 2021, these freight clusters generated over 70,000 truck trips, which is about 30% of all trips in the region. The study shows that a significant share of the trips between freight clusters (**Figure 4-4**) and from the freight clusters to regions outside the Mid-South (**Figure 4-5**) use the existing I-55 bridge, with I-55 being one of the primary roads used to access freight clusters and other freight facilities in the region.

Figure 4-4. Daily Truck Volumes of Trips Between Freight Clusters



Source: Mid-South Freight Flows and Industry Analysis (2023)

Figure 4-5. Daily Truck Volumes of Trips from Freight Clusters to Regions Outside the Mid-South



Source: Mid-South Freight Flows and Industry Analysis (2023)

4.3. Promote Innovative and Timely Delivery

TDOT intends to utilize an alternative delivery method to expedite the project and begin construction in 2026 if awarded a Large Bridge Investment Program (BIP) grant. Alternative delivery encourages contractors to streamline their work to finish projects early while also encouraging the identification and incorporation of innovative solutions to address issues such as travel delays and access to businesses. TDOT's alternative delivery program has resulted in measurable benefits, with an estimated $22 million in cost savings and approximately 70% faster delivery compared to traditional delivery.[10]

The America's River Crossing Project is planning to consider several innovative technologies during the design and construction phases. These innovative technologies include, but are not limited to the following:

- **Seismic Innovations** that can reduce the seismic demand on the bridge foundations by 25% or more, resulting in a savings of 10% in the bridge foundation cost. Based on the preliminary data, this could result in a savings of over $11 million.
- **Wind Performance** would be improved by using open traffic rails and a taller-than-normal median barrier that could save up to $3 million.
- **Material Innovations** such as modern steel reinforcement is readily available and would be incorporated into foundation and tower elements of the bridge and potentially save several million dollars. Other material innovations include the use of high-performance concretes and steels.
- **Security Innovations** could be included to detect a variety of incidents from crashes to intruders. The bridge would be connected by wireless, wired, fiber optic or a combination of camera systems both above and below deck.
- **Safety Innovations** that would be considered include an air draft monitor that detects and reports, in real time, the distance between low steel and the water surface to provide mariners with real-time under-clearance to eliminate vessel allisions with the bridge superstructure, towers fitted with ladders and platforms for maintenance and inspection, changeable message signs, weather monitoring for fog zone detection or potential icing, image stabilizing cameras for better visual reference, and roadside units for future connected vehicle applications.
- **Energy-Saving Enhancements** such as safety lighting at ramps to navigation and aerial obstruction lighting could be incorporated using high-intensity LED lamps. This change alone can save more than 2.4 million kWh in electricity over the life of the bridge.

[10] *Alternative Delivery Methods, The Right Tools for the Right Projects, TDOT*

Other construction and maintenance innovations that would also be incorporated include, but are not limited to:

- Miniature Drilled Shaft Inspection Device (Mini-SID) to evaluate the cleanliness of the bottom of the drilled shaft;
- Cross-hole Sonic Logging (CSL) to determine the integrity of the completed shaft within the reinforcing steel cage;
- Thermal Integrity Profile (TIP) testing to evaluate concrete placement quality both inside and outside the reinforcing steel cage; and a
- Structural Health Monitoring (SHM) system to detect seismic events at a predetermined level of shaking and cameras that would detect and report vessel allisions. These cameras may eliminate the need for inspections in half of the events, thereby saving an estimated inspection cost of $100,000 or more for each event. This results in a savings of over $1 million over the life of the bridge in 2024 dollars.

4.4. Improve the Economic Vitality of the Region

The Memphis-Arkansas Bridge is a vital crossing over the Mississippi River in Memphis and West Memphis, serving as a crucial link for residents, workers, and the transportation of goods between Tennessee, Arkansas, and Mississippi. The Memphis region contains the Memphis International Airport, which is the largest cargo airport in the world in terms of tonnage as of 2022. Memphis is one of only five cities in the U.S. that is served by five or more Class 1 railroads[11], which allows businesses in the region to ship by rail to any area of North America. Because the city sits on the Mississippi River, the Port of Memphis and Port of West Memphis are also vital assets to the region and a great example of multimodal activity. With these connections through Memphis, a truck leaving the city can reach roughly 35% of the population of the United States overnight, and 68% in two days. By reducing congestion and improving travel times, the proposed Project could potentially expand businesses' access to customers, suppliers, and workers, thereby increasing their productivity, sales, and ability to create new jobs. The proposed Project would also eliminate logistics costs valued at $174,413 per day resulting from lost trips due to a bridge closure. This avoided cost will unlock additional revenue and job creation among regional shippers and carriers. The proposed Project would enhance mobility to meet the current and future demands of growth and employment, ultimately

[11] A Class I railroad is considered one of the largest in the network and has an operating revenue of $490 million or more, which is adjusted for inflation each year. Class I railroads account for roughly 67 percent of freight rail mileage and 94 percent of revenue. The railroads are often used for long-haul shipments with as few stops as possible. An Introduction to Class I Freight Railroads, March 2023.

contributing to the economic prosperity of Memphis, West Memphis, and the broader tri-state area.

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DATE REVISED	DATE PLOTTED	DATE REVISED	DATE PLOTTED	FED. ROAD NO.	STATE	FED. AID PROJ.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
12-22-71	12-22-71 561			6	ARK.	EHS T55-1(23)0			
				JOB NO.		11814		3	12
				① 2271		LAYOUT		17568	

NOTE:
All joints have 2" openings except as noted. For Piers A1-A25

Median Barrier Joint Location

℄ Joint

Sta. 208+73.54

Construction Identification Sign (Right side Sta 208+74)

East End Transition Section

Beginning of Job

80'-0"

1 at 35'-0" = 245'-0"
RC Deck Girder Spans

1 at 58'-11⅜" = 235'-9½"
RC Deck Girder Spans

28'-10½" (Typ.)

38'-0" (Typ.)

7 at 87'-0" = 609'-0"
Deck Girder Spans

℄ Joint (Typ.)

87'-0"
Deck Girder Span

173'-7"
Deck Truss Span

173'-9"
Deck Truss Span

Sta. 220+08.00

Sta. 224+08.15

Total Length of Bridge = 5221'-6"

434'-7⅞"

Sta. 229+43.00

435'-1⅛"

Sta. 233+78.15

433'-1⅛"

Sta. 238+11.28

Match Line

Pier No. A25 A24 A23 A22 A21 A20 A19 A18 A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1 I II III IV V VI

Existing Ground Line

PLAN-A

182'-8"

438'-4⅝"

182'-8"

438'-4⅝"

179'-7⅛"

451'-1⅝"

179'-7⅛"

359'-3⅝"

279'-11¼"

200'-0"

Match Line

1'-9"
Metal Exp. Device A offset 1⅝" from Panel Point

℄ Joint (Typ.)

1'-9"
Metal Exp. Device A offset 1⅝" from Panel Point

Transition Type 2 to Crossover Ramp (Typ.)

1'-9"
Metal Exp. Device A offset 1⅝" from Panel Point

1'-9"
Metal Exp. Device A offset 1⅝" from Panel Point

1'-5"
Metal Exp. Device B offset 13⅝" from ℄ Bearing

℄ Bearing

Construction Identification Sign Left Side Sta 264+55

Sta 264+65

Exit or Jog

Existing Median Divider Rail

Standard (Tenn.) Median Divider Rail

Protective Median Divider Rail

East End Transition Unit

Stringer Expansion 1" open Jt. (Typ.)

Median Crossover Ramp

Approx.

Type 2 Barrier

Type 1 Barrier

Type 3 Barrier

28'-6" Transition Type 2 to Type 1

State Line Sta. 248+08.47

ARKANSAS

TENNESSEE

Sta. 231+81.64

Sta. 244+04.80

Sta. 250+25.36

Sta. 258+45.18

Sta. 262+35.06

621'-0²⁵/₃₂"

621'-0²⁵/₃₂"

Total Length of Bridge = 5221'-6"

790'-5"

359'-3⅝"

Memphis Anchor Span

℄ Pier (Typ. Piers I-III)

Memphis Abutment

Existing Ground Line

Pier No. IV III II I

PLAN-B

ELEVATION-A

ELEVATION-B

NOTE:
The dimensions shown are the best available information from existing plans. The contractor shall make check measurements of the existing bridge and approaches and make the adjustments necessary to fit the median barrier and crossover ramps to the conditions at the time of construction.

Revised 12-28-71. Added Constr. ID. Signs

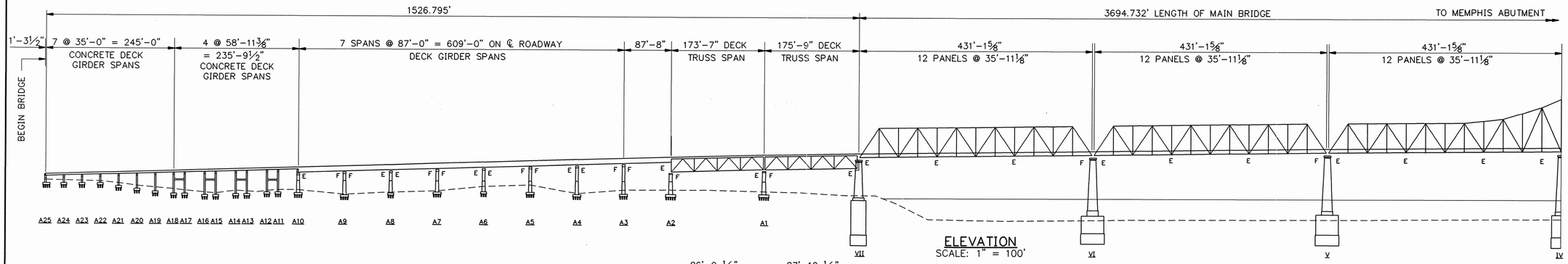
LAYOUT OF
MEMPHIS BRIDGE MEDIAN BARRIER
CRITTENDEN, ARK. SHELBY, TENN.
ROUTE 55 SEC.
ARKANSAS STATE HIGHWAY COMMISSION
LITTLE ROCK, ARK.

DRAWN BY: J.P.S. DATE: 9-17-71
TRACED BY: DATE:
CHECKED BY: F.H. DATE: 2-24-71
SCALE: 1"=100'-0"

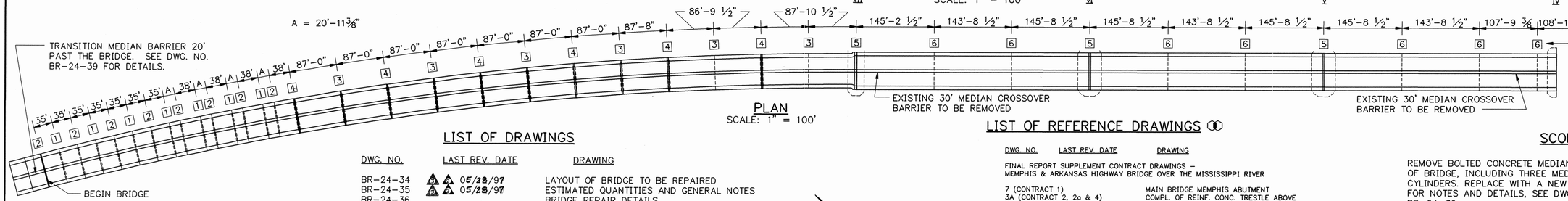
BRIDGE ENGINEER

BRIDGE NO. 2271 DRAWING NO. 17568

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS



ELEVATION
SCALE: 1" = 100'



PLAN
SCALE: 1" = 100'

SPAN LENGTH AS SHOWN ON DWG. NOS. BR-24-37 AND BR-24-38. ACTUAL LENGTHS TO BE FIELD VERIFIED.

JOINT TYPE, SEE DWG. NOS. BR-24-40, BR-24-41 AND BR-24-42.

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION
1	05/24/96	NDT	ADDED REVISION DATE
2	06/12/96	NDT	ADDED REVISION DATE
3	5-28-97	M.L.	Revised Revision Dates

LIST OF SPECIAL PROVISIONS

NO.	LAST REV. DATE	REGARDING
105A	**	APPROVAL OF SHOP DRAWINGS
604CR		REPAIR OF BRIDGE DECK CRACKS
604S	5-1-95	STRIP SEAL EXPANSION JOINTS

** DENOTES CURRENT REVISION DATE AS PER CONTRACT DOCUMENTS

LIST OF DRAWINGS

DWG. NO.	LAST REV. DATE	DRAWING
BR-24-34	2 2 05/28/97	LAYOUT OF BRIDGE TO BE REPAIRED
BR-24-35	3 2 05/28/97	ESTIMATED QUANTITIES AND GENERAL NOTES
BR-24-36		BRIDGE REPAIR DETAILS
BR-24-37		BRIDGE REPAIR DETAILS
BR-24-38		BRIDGE REPAIR DETAILS
BR-24-39	2 06/12/96	BRIDGE REPAIR DETAILS
BR-24-40	1 05/24/96	BRIDGE REPAIR DETAILS
BR-24-41	1 05/24/96	BRIDGE REPAIR DETAILS
BR-24-42	1 05/24/96	BRIDGE REPAIR DETAILS
BR-24-43		BRIDGE REPAIR DETAILS
BR-24-44		BRIDGE REPAIR DETAILS

LIST OF REFERENCE DRAWINGS

DWG. NO.	LAST REV. DATE	DRAWING
FINAL REPORT SUPPLEMENT CONTRACT DRAWINGS – MEMPHIS & ARKANSAS HIGHWAY BRIDGE OVER THE MISSISSIPPI RIVER		
7 (CONTRACT 1)		MAIN BRIDGE MEMPHIS ABUTMENT
3A (CONTRACT 2, 2a & 4)		COMPL. OF REINF. CONC. TRESTLE ABOVE GR. LINE
4 (CONTRACT 2, 2a & 4)		CONCRETE TRESTLE – TYPICAL SECTIONS & DETAILS
2 (CONTRACT 4)		ARKANSAS APPROACH STRESS SHEET
4 (CONTRACT 4)		DECK TRUSS & EXPANSION DAM DETAILS
5 (CONTRACT 4)		DETAILS OF GIRDER SPANS
6 (CONTRACT 4)		DRAINAGE, HANDRAIL & MISC. DETAILS
ARKANSAS STATE HIGHWAY COMMISSION BRIDGE REPAIR PLANS – 1971		
17569		DETAILS OF PRECAST UNITS AND DETAILS OF EXISTING MEDIAN
17571		DETAILS OF MEDIAN CROSSOVER RAMP

ALL REFERENCE DRAWINGS TO BE PRINTED WITH THE PLANS

SCOPE OF WORK

REMOVE BOLTED CONCRETE MEDIAN BARRIER FROM BEGINNING OF BRIDGE TO END OF BRIDGE, INCLUDING THREE MEDIAN CROSSOVER BARRIERS AND SIX HYDRAULIC CYLINDERS. REPLACE WITH A NEW CAST-IN-PLACE CONCRETE MEDIAN BARRIER. FOR NOTES AND DETAILS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

REMOVE EXISTING CANTILEVER SLAB ON EACH SIDE OF CENTERLINE OF BRIDGE AND REPLACE WITH NEW 6'-4" WIDE CONCRETE SLAB IN CONCRETE DECK GIRDER SPANS AND 5'-0" WIDE CONCRETE SLAB ELSEWHERE. FOR NOTES AND DETAILS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

CLEAN AND SPOT PAINT AREAS OF STRUCTURAL STEEL IDENTIFIED BY THE ENGINEER. FOR NOTES, SEE DWG. NOS. BR-24-35, BR-24-43 AND BR-24-44.

REPLACE SELECTED EXISTING RIVETED TOP DIAGONAL WIND BRACE GUSSET PLATES WITH NEW GUSSET PLATES AND BOLTS IN DECK GIRDER AND DECK TRUSS SPANS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44.

AT SELECTED ENDS OF STEEL STRINGERS IN THE DECK GIRDER PORTION OF THE BRIDGE, CUT OUT THE BOTTOM FLANGE AND A PORTION OF THE LOWER WEB AND INSTALL A REPLACEMENT PIECE USING FULL PENETRATION WELDS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44.

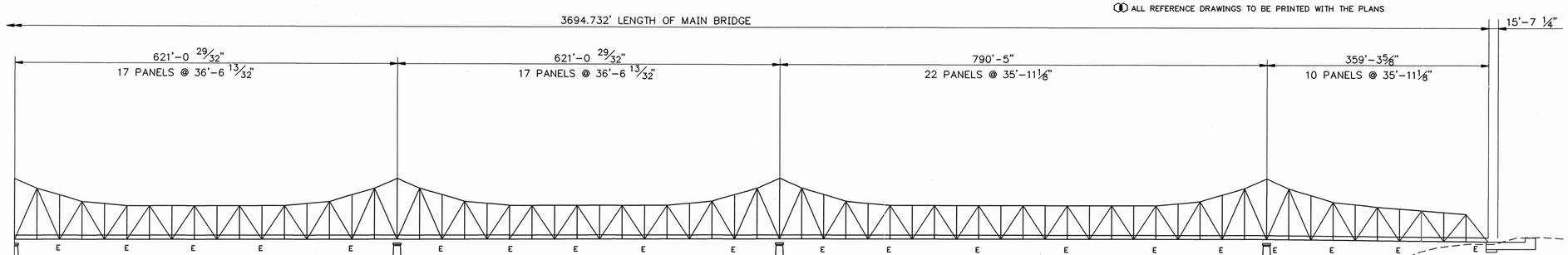
REPLACE PORTIONS OF SELECTED EXISTING RIVETED TOP PLATES ON FLOOR BEAMS WITH NEW PLATES AND BOLTS IN DECK GIRDER AND DECK TRUSS SPANS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44.

INSTALL EXPANSION JOINT SEGMENTS AT LOCATIONS THROUGHOUT THE BRIDGE. CONNECT EXISTING JOINTS THROUGH THE NEW MEDIAN. FOR LOCATIONS, SEE PLAN THIS DWG. FOR NOTES AND DETAILS, SEE DWG. NOS. BR-24-40, BR-24-41 AND BR-24-42.

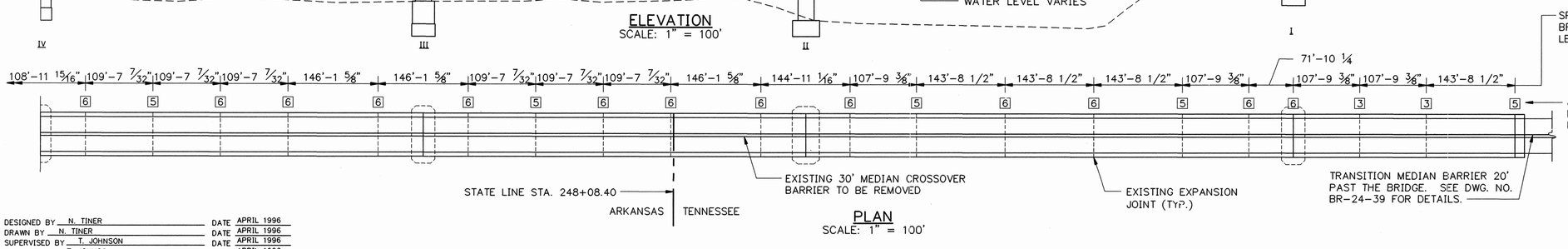
PROVIDE SPALL REPAIR TO DIAPHRAGMS, BENTS AND BEAMS IN CONCRETE DECK GIRDER SPANS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-43.

PROVIDE ADDITIONAL ACCESS RESTRICTION AT FLOOR BEAM I BETWEEN PIER I AND MEMPHIS ABUTMENT. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-43.

SEAL THE COLD JOINT AT THE EDGES OF THE NEW MEDIAN STRIP WITH A HIGH MOLECULAR WEIGHT METHACRYLATE FOR THE ENTIRE LENGTH OF THE BRIDGE. FOR LOCATIONS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39. FOR NOTES, SEE DWG. NO. BR-24-35.



ELEVATION
SCALE: 1" = 100'



PLAN
SCALE: 1" = 100'

SPAN LENGTH AS SHOWN ON DWG. NOS. BR-24-37 AND BR-24-38. ACTUAL LENGTHS TO BE FIELD VERIFIED.

JOINT TYPE, SEE DWG. NOS. BR-24-40, BR-24-41 AND BR-24-42.

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

TERRY L. JOHNSON REGISTERED ENGINEERING AGRICULTURE No. 23121 STATE OF TENNESSEE
Terry Johnson 6/12/96

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

LAYOUT OF BRIDGE TO BE REPAIRED

INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

1996

B-1

BR-24-34

NDT/NDT 155-4 93/943 6/12/96 2 1=1 5:15 p.m.

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS

BRIDGE REPAIR QUANTITIES

	ITEM	DESCRIPTION	UNIT	QUANTITY
(1)	602-10.27	STRUCTURAL STEEL FLOOR BEAM REPAIRS	EACH	8
(2)	602-10.32	STRUCTURAL STEEL (REPAIRS)	LB.	1198
(3)	602-10.39	STRUCTURAL STEEL BRIDGE REPAIR	EACH	3
(4)	603-02.20	SPOT PAINTING OF EXISTING STEEL STRUCTURES	S.F.	12,494
(5)	604-10.07	CONCRETE REMOVAL	L.S.	1
(6)	604-10.12	CONCRETE SLAB REPAIRS	C.Y.	587
(7)	604-10.18	REINFORCING STEEL (REPAIRS)	LB.	130,201
(8)	604-10.20	HYDRODEMOLITON	S.Y.	1914
A2 (19)	604-10.21	CONTAINMENT AND DISPOSAL OF WASTE	L.S.	1
(9)	604-10.34	MISCELLANEOUS STRUCTURAL STEEL REPAIRS	LB.	14,931
(10)	604-10.44	EXPANSION JOINT REPAIRS	L.F.	3300
(11)	604-10.54	CONCRETE REPAIRS	S.F.	76
(12)	604-10.92	MEDIAN BARRIER REPAIRS	L.F.	5278
(13)	617-02	BRIDGE DECK CRACK SEALING	L.F.	10,476
(14)	617-05	SEALANT (HMWM)	GAL.	53
	712-01	TRAFFIC CONTROL	L.S.	1
(15)	712-02.02	INTERCONNECTED PORTABLE BARRIER RAIL	L.F.	10,860
	712-04.01	FLEXIBLE DRUMS (CHANNELIZING)	EACH	50
	712-05.01	WARNING LIGHTS (TYPE A)	EACH	15
	712-05.03	WARNING LIGHTS (TYPE C)	EACH	23
	712-06.10	NEW SIGNS (CONSTRUCTION)	S.F.	432
(16)	712-06.01	VERTICAL PANELS	S.F.	504
	712-06.15	NEW SIGNS (CONSTRUCTION)(BEE ALERT)	EACH	2
(17)	712-06.16	NEW SIGNS (CONSTRUCTION)(REDUCED SPEED WARNING)	EACH	2
	712-08.03	ARROW BOARD (TYPE C)	EACH	2
	712-09.01	REMOVABLE PAVEMENT MARKING LINE	L.F.	3000
	713-16.01	CHANGEABLE MESSAGE SIGN UNIT	EACH	3
(18)	716-02.01	PLASTIC PAVEMENT MARKING (4" LINE)	L.M.	2.00
	717-01	MOBILIZATION	L.S.	1
A3 (20)	*714-01*	*ROADWAY AND STRUCTURAL LIGHTING*	*L.S.*	*1*

(1) INCLUDES ALL COSTS FOR REMOVAL AND REPLACEMENT OF PART OF FLOOR BEAM TOP COVER PLATES, INCLUDING A325 BOLTS, STRUCTURAL STEEL, WELDING, CLEANING AND PAINTING, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44. THE ENGINEER MAY INCREASE, DECREASE OR ELIMINATE THE QUANTITY FOR THIS ITEM.

(2) INCLUDES ALL COSTS FOR REMOVAL AND REPLACEMENT OF W18X50 BEAM ENDS INCLUDING A325 BOLTS, STRUCTURAL STEEL, WELDING, CLEANING AND PAINTING, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44. THE ENGINEER MAY INCREASE, DECREASE OR ELIMINATE THE QUANTITY FOR THIS ITEM.

(3) INCLUDES ALL COSTS FOR REMOVAL AND REPLACEMENT OF GUSSET PLATES OVER FLOOR BEAMS, INCLUDING A325 BOLTS, STRUCTURAL STEEL, WELDING, CLEANING AND PAINTING, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-44. THE ENGINEER MAY INCREASE, DECREASE OR ELIMINATE THE QUANTITY FOR THIS ITEM.

(4) INCLUDES ALL COSTS TO SPOT CLEAN AND PAINT AREAS OF RUSTED STRUCTURAL STEEL IDENTIFIED BY THE ENGINEER. THE QUANTITY MAY BE INCREASED, DECREASED OR ELIMINATED BY THE ENGINEER. FOR NOTES AND LOCATIONS, SEE DWG. NO. BR-24-43, AND THE PAINTING NOTES ON THIS DRAWING.

(5) INCLUDES COST OF ALL LABOR AND MATERIALS TO REMOVE THE CONCRETE MEDIAN BARRIER, INCLUDING SALVAGING "GLAREFOIL" LIGHT ATTENUATORS AND MOUNTING HARDWARE. ALSO INCLUDED IS REMOVAL OF TWO MOVABLE STEEL MEDIAN BARRIER SECTIONS AND HYDRAULIC CYLINDERS. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-36.

(6) INCLUDES ALL LABOR AND MATERIALS FOR FORMING AND PLACING CLASS "D" CONCRETE FOR THE REPLACEMENT SLAB IN THE MEDIAN AREA. FOR NOTES AND DETAILS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

(7) INCLUDES COST OF ALL REINFORCING STEEL REQUIRED TO COMPLETE REPAIRS AS SHOWN ON THESE PLANS. FOR BAR LISTS, SEE DWG. NOS. BR-24-38, BR-24-39 AND BR-24-42.

(8) INCLUDES ALL COSTS FOR REMOVAL BY HYDRODEMOLTION OF EXISTING CONCRETE SLAB AS SHOWN ON DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39. ALSO INCLUDED COST OF HAND CHIPPING OR OTHER MEANS NECESSARY TO COMPLETELY REMOVE ALL CONCRETE FROM STRUCTURAL STEEL AND REINFORCEMENT NOT REMOVED BY HYDRODEMOLITION.

(9) INCLUDES ALL COSTS FOR FURNISHING AND INSTALLING STEEL BARS, INCLUDING CUTTING STEEL GRID AND WELDING TO STEEL GRID. FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-42.

(10) INCLUDES ALL COSTS FOR INSTALLING EXPANSION JOINT SEGMENTS UNDER MEDIAN BARRIER TO MATCH EXISTING ADJACENT JOINTS. ([1] FIXED-FIXED, 7 EACH, 457 L.F.; [2] PREFORMED SEAL, 8 EACH, 522 L.F.; [3] FOAM JOINT SEALER, 8 EACH, 528 L.F.; [4] STRIP SEAL JOINTS, 6 EACH, 388 L.F.; [5] FINGER JOINTS, 8 EACH, 15 L.F.; [6] 1" CLOSED CELL FOAM JOINTS, 20 EACH, 1,390 L.F.) FOR NOTES, DETAILS AND AND LOCATIONS, SEE DWG. NOS. BR-24-40, BR-24-41 AND BR-24-42.

(11) INCLUDES ALL COSTS TO PERFORM SPALL REPAIRS ON EXISTING BENTS, BEAMS AND DIAPHRAGMS. THIS ITEM MAY BE INCREASED OR DECREASED BY THE ENGINEER. FOR REPAIR NOTES, DETAILS AND LOCATIONS, SEE DWG. NO. BR-24-43.

(12) INCLUDES ALL COSTS FOR INSTALLING THE CONCRETE MEDIAN BARRIER ALONG THE ENTIRE LENGTH OF THE BRIDGE. FOR NOTES AND DETAILS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

(13) INCLUDES ALL COSTS FOR INSTALLING THE BRIDGE DECK CRACK SEALER (HMWM) INCLUDING CRACK PREPARATION, CLEANING, LABOR, SAND AND ALL MISCELLANEOUS MATERIALS REQUIRED TO SEAL THE NEW COLD JOINTS ALONG THE ENTIRE LENGTH OF THE BRIDGE ACCORDING TO THE STANDARD SPECIFICATIONS AND THE MANUFACTURER'S SPECIFICATIONS. THIS ITEM DOES NOT INCLUDE THE COST OF FURNISHING THE BRIDGE DECK CRACK SEALER (HMWM). FOR NOTES AND LOCATIONS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

(14) INCLUDES ALL COSTS FOR FURNISHING THE SEALER MATERIAL (HMWM) FOR SEALING CRACKS. THE SEALER (HMWM) SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. FOR NOTES AND LOCATIONS, SEE DWG. NOS. BR-24-36, BR-24-37, BR-24-38 AND BR-24-39.

HMWM = HIGH MOLECULAR WEIGHT METHACRYLATE.

GENERAL NOTES

SPECIFICATIONS: STANDARD ROAD AND BRIDGE SPECIFICATIONS OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION. (MARCH 1, 1995 EDITION).

DESIGN SPECIFICATIONS: AASHTO 1992 EDITION WITH ADDENDA.

STRUCTURAL STEEL: SHALL CONFORM TO AASHTO M270 GRADE 36 (ASTM A709 GRADE 36) UNLESS OTHERWISE NOTED.

REINFORCING STEEL: SEE THE STANDARD SPECIFICATIONS.

SHOP DRAWINGS: SHALL BE SUBMITTED ACCORDING TO SPECIAL PROVISION NO. 105A, EXCEPT SHOP DRAWINGS SHALL BE SUBMITTED TO THE HEADQUARTERS BRIDGE INSPECTION AND REPAIR OFFICE IN LIEU OF THE DIVISION OF STRUCTURES.

BOLTS: SHALL BE HIGH TENSILE STRENGTH BOLTS (ASTM-A325), UNLESS OTHERWISE NOTED. SIZE TO BE AS NOTED ON PLANS. SEE AASHTO SPECIFICATIONS, ARTICLE 11 5.6, DIVISION II. EXISTING CONTACT SURFACES SHALL BE CLEANED TO SSPC-10 SPECIFICATIONS PRIOR TO ATTACHMENT OF NEW MEMBERS.

BRIDGE DECK CONCRETE: SHALL BE CLASS "D" CONCRETE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

BRIDGE DECK SURFACE FINISH: TO BE IN ACCORDANCE WITH METHOD (C) IN SUBSECTION 604.23 OF THE STANDARD SPECIFICATIONS.

CONCRETE CURING: ALL CONCRETE IN REPAIR AREAS SHALL BE CURED ACCORDING TO THE STANDARD SPECIFICATIONS.

WELDING: ANSI/AASHTO/AWS D1.5-88 BRIDGE WELDING CODE AND THE STANDARD SPECIFICATIONS.

SPECIAL NOTE: TO IMPROVE THE FLOWABILITY OF THE CONCRETE, THE CONTRACTOR MAY USE ADMIXTURES (SUPERPLASTICIZERS) IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. CONCRETE ADMIXTURES (SUPERPLASTICIZERS) USED SHALL BE APPROVED BY THE TENNESSEE DEPARTMENT OF TRANSPORTATION MATERIALS AND TEST DIVISION PRIOR TO USE. COARSE AGGREGATE FOR THE CONCRETE USED IN THE REPAIR AREAS SHALL BE SIZE 67 STONE.

DEMOLITION: THE CONTRACTOR SHALL TAKE SPECIAL CARE TO PROTECT ANY PARTS OF THE STRUCTURE THAT ARE NOT TO BE REMOVED SPECIFICALLY. THE CONTRACTOR IS NOT ALLOWED TO USE A HYDRAULIC RAM (COMMONLY CALLED A HOE RAM) OR SIMILAR HEAVY EQUIPMENT FOR CONCRETE REMOVAL. ALL DEVICES PROPOSED FOR CONCRETE DEMOLITION SHALL BE APPROVED BY THE ENGINEER.

SURFACE PREPARATION AND SPOT PAINTING OF EXISTING STEEL

CLEANING OF STEEL SHALL BE DONE IN ACCORDANCE WITH SECTION 603.13 – REPAINTING OF EXISTING STEEL STRUCTURE, TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.

CLEANING OF STEEL MAY BE DONE WITH A VACUUM-SHROUDED DEVICE CAPABLE OF CONTAINING ALL WASTE MATERIAL ELIMINATING THE TOTAL CONTAINMENT REQUIREMENT.

PAINTING SHALL BE IN ACCORDANCE WITH SECTION 603.06, SCHEDULE OF PAINTING, SYSTEM B, OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.

PAINTING NEW STEEL

CLEANING OF STEEL TO BE SHOP PAINTED SHALL BE IN ACCORDANCE WITH SECTON 603.06 – SCHEDULE OF PAINTING, SYSTEM A – INORGANIC ZINC, OF THE TDOT STD. SPEC.

PAINTING SHALL BE IN ACCORDANCE WITH SECTION 603.06 – SCHEDULE OF PAINTING, SYSTEM A – INORGANIC ZINC, OF THE TDOT STD. SPEC.

A1 COST OF SHOP PAINTING THE PREPARED AND PAINTED SURFACES AS NOTED ON DWG. NO. BR-24-44 SHALL BE INCLUDED IN THE PRICES BID FOR ITEM NO. 604-10.32, STRUCTURAL STEEL REPAIRS, LB.; ITEM NO. 604-10.27, STRUCTURAL STEEL FLOOR BEAM REPAIRS, EACH; AND ITEM NO. 04-10.39, STRUCTURAL STEEL BRIDGE REPAIR, EACH.

A1 COST OF SHOP PAINTING THE PREPARED AND PAINTED SURFACES AS NOTED ON DWG. NOS. BR-24-40, BR-24-41 AND BR-24-42 SHALL BE INCLUDED IN THE PRICES BID FOR ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F.

(15) INCLUDES ALL COSTS FOR FURNISHING INTERCONNECTED PORTABLE BARRIER RAIL, INCLUDING STEEL PLATES TO COVER GAPS IN CONCRETE RAIL AT ALL JOINT REPAIR LOCATIONS EXCEPT FINGER JOINTS (49 JOINT LOCATIONS, 98 STEEL PLATES). RAIL IS MEASURED BY THE LINEAR FOOT WITHOUT REGARD TO JOINT GAPS WHERE THE STEEL PLATES ARE USED. FOR NOTES AND DETAILS, SEE DWG. BR-24-36.

(16) INCLUDES ALL COSTS FOR FURNISHING AND INSTALLING VERTICAL PANELS ON THE INTERCONNECTED PORTABLE BARRIER RAIL. INCLUDES 252 S.F. OF VP-1L VERTICAL PANELS AND 252 S.F. OF VP-1R VERTICAL PANELS. FOR NOTES AND DETAILS, SEE STD. DWG. NO. T-PBR-2. FOR LOCATIONS, SEE SHEET NOS. 3 AND 4, TRAFFIC CONTROL PLAN.

(17) ITEM TO BE USED ONLY WHEN THE CONTRACTOR ESTABLISHES A REDUCED SPEED LIMIT WITHIN THE FROJECT CONSTRUCTION WORK ZONE LIMITS. ITEM INCLUDES SIGN FACE, SUPPORTS AND TWO (2) TYPE "B" FLASHERS PER THE STANDARD SPECIFICATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TURNING ONT HE TYPE "B" FLASHERS WHEN WORKERS ARE IN THE CONSTRUCTION ZONE AND TURNING THEM OFF WHEN WORKERS ARE NO LONGER IN THE CONSTRUCTION WORK ZONE.

(18) ALL PERMANENT PAVEMENT MARKING SHALL BE THERMOPLASTIC.

A2 (19) INCLUDES ALL COSTS TO PLACE THE HYDRODEMOLITION CONTAINMENT SYSTEM. SEE HYDRODEMOLITION CONTAINMENT NOTE THIS SHEET.

A3 (20) *INCLUDES ALL COST TO MODIFY THE BRIDGE LIGHTING AS PER SHEETS NO. 5 AND NO. 6.*

CONST. WORK ZONE TRAFFIC CONTROL

ADVANCED WARNING SIGNS SHALL NOT BE DISPLAYED MORE THAN FORTY-EIGHT (48) HOURS BEFORE PHYSICAL CONSTRUCTION BEGINS. SIGNS MAY BE ERECTED UP TO ONE WEEK BEFORE NEEDED, IF THE SIGN FACE IS FULLY COVERED.

IF THE CONTRACTOR MOVES OFF THE PROJECT, HE SHALL COVER OR REMOVE ALL UNNEEDED SIGNS AS DIRECTED BY THE ENGINEER. COSTS OF REMOVAL, COVERING, AND REINSTALLING SIGNS SHALL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT ALL COSTS SHALL BE INCLUDED IN THE ORIGINAL UNIT PRICE BID FOR ITEM NO. 712-01, TRAFFIC CONTROL, LUMP SUM.

A LONG TERM BUT SPORADIC USE WARNING SIGN, SUCH AS FLAGGER SIGNS MAY REMAIN IN PLACE WHEN NOT REQUIRED PROVIDED THE SIGN FACE IS FULLY COVERED.

TRAFFIC CONTROL DEVICES SHALL NOT BE DISPLAYED OR ERECTED UNLESS RELATED CONDITIONS ARE PRESENT NECESSITATING WARNING.

USE OF BARRICADES, PORTABLE BARRIER RAILS, VERTICAL PANELS, AND DRUMS SHALL BE LIMITED TO THE IMMEDIATE AREAS OF CONSTRUCTION WHERE A HAZARD IS PRESENT. THESE DEVICES SHALL NOT BE STORED ALONG THE ROADWAY WITHIN THIRTY (30) FEET OF THE EDGE OF THE TRAVELED WAY BEFORE OR AFTER USE UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES. THESE DEVICES SHALL BE REMOVED FROM THE CONSTRUCTION WORK ZONE WHEN THE ENGINEER DETERMINES THEY ARE NO LONGER NEEDED. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS THIRTY (30) FEET SETBACK, THE ENGINEER SHALL APPROVE ALTERNATE LOCATIONS.

THE CONTRACTOR WILL NOT BE PERMITTED TO PARK ANY VEHICLES OR CONSTRUCTION EQUIPMENT DURING PERIODS OF INACTIVITY, WITHIN THIRTY (30) FEET OF THE EDGE OF PAVEMENT WHEN THE LANE IS OPEN TO TRAFFIC, UNLESS PROTECTED BY GUARDRAIL, BRIDGE RAIL, AND/OR BARRIERS INSTALLED FOR OTHER PURPOSES. PRIVATELY OWNED VEHICLES SHALL NOT BE ALLOWED TO BE PARKED WITHIN THIRTY (30) FEET OF AN OPEN TRAFFIC LANE AT ANY TIME UNLESS PROTECTED AS DESCRIBED ABOVE. WHERE THERE IS INSUFFICIENT RIGHT-OF-WAY TO PROVIDE FOR THIS THIRTY (30) FEET SETBACK, THE ENGINEER SHALL APPROVE ALTERNATE LOCATIONS

GUARDRAIL: CONTRACTOR SHALL NOT REMOVE ANY SECTIONS OF EXISTING GUARDRAIL TO REWORK SHOULDERS OR FLATTEN SLOPES UNTIL THE ENGINEER CONCURS IN THE NECESSITY OF REMOVAL DUE TO CONSTRUCTION REQUIREMENTS AND THE APPROPRIATE WARNING DEVICES ARE INSTALLED. THE PROPOSED GUARDRAIL, INCLUDING ANY ANCHOR SYSTEM, SHALL BE INSTALLED QUICKLY TO MINIMIZE TRAFFIC EXPOSURE TO ANY HAZARD. NO PAYMENT WILL BE MADE FOR A SECTION OF PROPOSED GUARDRAIL, INCLUDING ANCHORS, UNTIL IT IS COMPLETELY IN PLACE.

IF ANY APPROACH END OF A SECTION OF GUARDRAIL OR BRIDGE RAIL MUST TEMPORARILY BE LEFT INCOMPLETE AND EXPOSED TO TRAFFIC, THE CONTRACTOR SHALL USE TWO (2) TEMPORARY BARRICADES OR DRUMS WITH TYPE A LIGHTS AND ROUNDED END ELEMENTS AS MINIMUM MEASURES TO PROTECT TRAFFIC FROM THE HAZARD OF AN EXPOSED END. ALL COST OF FURNISHING AND INSTALLING A TEMPORARY ROUNDED END ELEMENT SHALL BE INCLUDED IN THE COST OF THE PROPOSED GUARDRAIL.

IF THERMOPLASTIC IS USED ON THE FINAL SURFACE, THE CONTRACTOR SHALL HAVE THE OPTION OF USING REFLECTORIZED PAINT INSTALLED TO PERMANENT STANDARDS AT THE END OF EACH DAY'S WORK AND THEN INSTALLING THE PERMANENT MARKING AFTER THE PAVING OPERATION IS COMPLETED SHORT, UNMARKED SECTIONS WILL NOT BE ALLOWED. THE TEMPORARY MARKINGS FOR THE FINAL SURFACE WILL NOT BE MEASURED OR PAID FOR DIRECTLY, BUT THE COSTS ARE TO BE INCLUDED IN THE PRICE BID FOR THE PERMANENT MARKINGS. THESE MARKINGS WILL BE MEASURED AND PAID FOR UNDER ITEM NO. 716-02.01, PLASTIC PAVEMENT MARKING (LINE), L.M.

UTILITY NOTES

THE LOCATION OF UTILITIES SHALL BE FIELD LOCATED BY THE CONTRACTOR AND BY CONTACTING THE UTILITY COMPANIES INVOLVED.

UNLESS OTHERWISE NOTED, ALL UTILITY ADJUSTMENTS WILL BE PERFORMED BY THE UTILITY OR ITS REPRESENTATIVE. THE CONTRACTOR AND UTILITY OWNERS WILL BE REQUIRED TO CO-OPERATE WITH EACH OTHER IN ORDER TO EXPEDITE THE WORK REQUIRED BY THIS CONTRACT.

THE CONTRACTOR WILL PROVIDE ALL NECESSARY PROTECTIVE MEASURES TO SAFEGUARD EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION OF THIS PROJECT. IN THE EVENT THAT SPECIAL EQUIPMENT IS REQUIRED TO WORK OVER AND AROUND THE UTILITIES, THE CONTRACTOR WILL BE REQUIRED TO FURNISH SUCH EQUIPMENT. THE COST OF PROTECTING UTILITIES FROM DAMAGE AND FURNISHING SPECIAL EQUIPMENT WILL BE INCLUDED IN THE PRICE BID FOR OTHER ITEMS OF CONSTRUCTION.

THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR CONTACTING ALL AFFECTED UTILITIES PRIOR TO SUBMITTING HIS BID. IN ORDER TO DETERMINE THE EXTENT TO WHICH UTILITY RELOCATIONS AND/OR ADJUSTMENTS WILL HAVE UPON THE SCHEDULE OF THE WORK FOR THE PROJECT. SOME UTILITY FACILITIES MAY NEED TO BE ADJUSTED CONCURRENTLY WITH THE CONTRACTOR'S OPERATIONS, WHILE SOME WORK MAY BE REQUIRED "AROUND" UTILITY FACILITIES THAT WILL REMAIN IN PLACE. IT IS UNDERSTOOD AND AGREED THAT THE CONTRACTOR WILL RECEIVE NO ADDITIONAL COMPENSATION FOR ANY DELAYS OR INCONVENIENCE CAUSED BY THE UTILITY ADJUSTMENTS.

THE CONTRACTOR SHALL NOTIFY EACH INDIVIDUAL OWNER OF HIS PLAN OF OPERATION IN THE AREA OF UTILITIES. PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL CONTACT OWNERS AND REQUEST THEM TO PROPERLY RELOCATE THEIR RESPECTIVE UTILITY ON THE GROUND. THIS NOTIFICATION SHALL BE GIVEN AT LEAST THREE (3) BUSINESS DAYS PRIOR TO COMMENCEMENT OF OPERATIONS AROUND THE UTILITY.

A2 HYDRODEMOLITION CONTAINMENT

THE CONTRACTOR SHALL PLACE A PLATFORM AND/OR SCREENING UNDER ALL AREAS, EXCEPT IN THE CONCRETE DECK GIRDER SPANS (A25-A10), THAT RECEIVE HYDRODEMOLITION TO CATCH ALL MATERIALS LARGER THAN ONE HALF (1/2) INCH IN DIAMETER. THE WATER GENERATED BY HYDRODEMOLITION AND ALL MATERIALS ONE HALF (1/2) INCH DIAMETER AND SMALLER SHALL BE RELEASED INTO THE ENVIRONMENT. ALL MATERIALS RETAINED (LARGER THAN ONE HALF (1/2) INCH DIAMETER) SHALL BE COLLECTED AND DISPOSED OFF-SITE.

AREAS TO RECEIVE HYDRODEMOLITION IN THE CONCRETE DECK GIRDER SPANS (A25-A10) SHALL NOT REQUIRE CONTAINMENT. ALL MATERIALS AND WATER SHALL BE ALLOWED TO BE RELEASED TO THE GROUND BELOW. A FILTRATION WALL MADE UP OF CONCRETE WASTE MATERIAL SHALL BE CONSTRUCTED TO FILTER WATER FLOWING TO THE RIVER OR TO SURROUNDING LAND AREAS.

THE CONTAINMENT SYSTEM DOES NOT HAVE TO BE PLACED FOR THE FULL LENGTH OF BRIDGE AT ONE TIME BUT BE PLACED UNDERNEATH SECTIONS ON THE BRIDGE BEING DEMOLISHED AT THAT TIME.

A SKETCH SHOWING THE GENERAL CONCEPT OF PLACEMENT FOR THE CONTAINMENT SYSTEM IS SHOWN ON DWG. NO. BR-24-39. THE DESIGN OF THE SYSTEM IS THE RESPONSIBILITY OF THE CONTRACTOR.

THE PROPOSED CONTAINMENT SYSTEM SHALL BE SUBMITTED FOR REVIEW TO THE OFFICE OF BRIDGE INSPECTION AND REPAIR PRIOR TO INSTALLATION.

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	2

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION
A1	05/24/96	NDT	REVISED PAINT NOTE
A2	06/12/96	NDT	ADD HYDRODEMOLITION NOTE AND ITEM NO. 604-10.21.
3	5-28-97	M.L.	*Added Item No. 714-01 And Footnote.*

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

ESTIMATED QUANTITIES AND GENERAL NOTES
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

1996

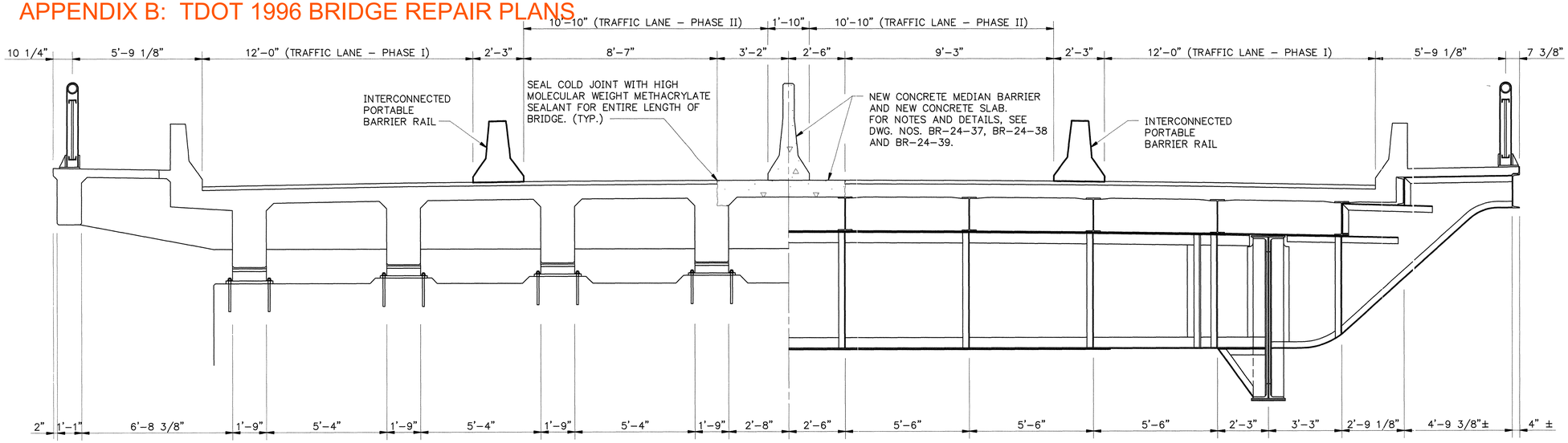
TERRY L. JOHNSON REGISTERED ENGINEER AGRICULTURAL No. 23131 STATE OF TENNESSEE
6/12/96

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

NDT/NDT 155-2 9.1943 6/12/96 2 1=1 4 46 p m

B-2
BR-24-35

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS



TYPICAL HALF SECTION

(SHOWING PHASE I OF TRAFFIC CONTROL)
(TYP. FROM ABUTMENT A25 TO BENT A10)
SCALE: 3/8" = 1'-0"

TYPICAL HALF SECTION

(SHOWING PHASE I OF TRAFFIC CONTROL)
(TYP. FROM BENT A10 TO BENT A2, FROM BENT A2 TO PIER VII SIMILAR)
SCALE: 3/8" = 1'-0"

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION

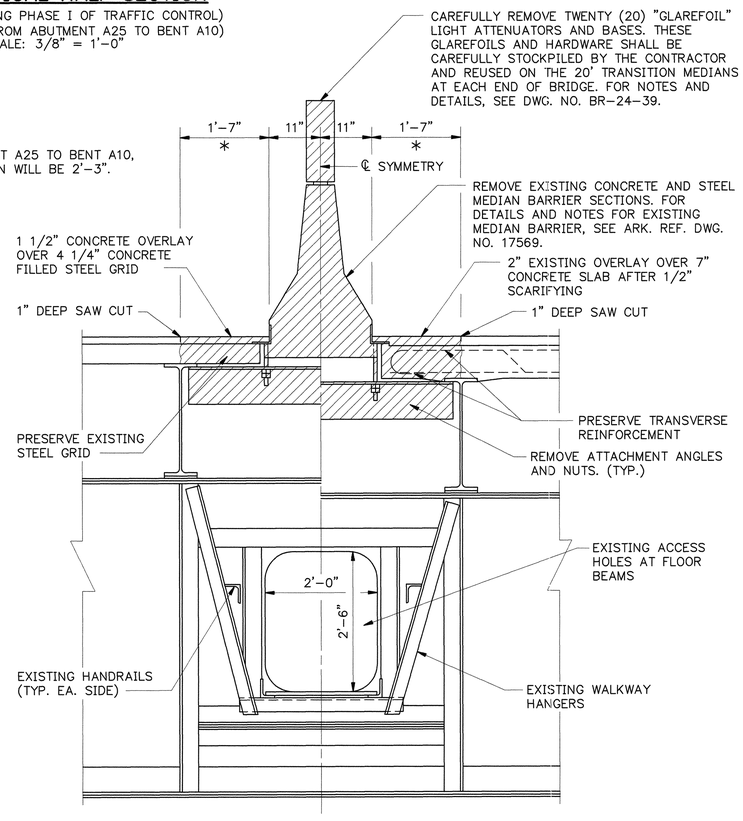
NOTES:

CONTRACTOR SHALL INSTALL A 3/8" THICK STEEL CONNECTOR PLATE TO THE PORTABLE CONCRETE BARRIERS IN AREAS WHERE THE JOINT IS TO BE REPLACED. (49 JOINTS, 98 LOCATIONS)

A 3/8" STEEL BARRIER CONNECTOR PLATE SHALL BE ATTACHED TO THE ENDS OF THE INTERCONNECTED PORTABLE BARRIER RAIL ON THE TRAFFIC LANE SIDE FOR PHASE I. DURING PHASE II, THE PLATE LOCATION SHALL BE REVERSED. 1" ø HOLES MAY BE REUSED FOR PHASE II CONSTRUCTION WITH NEW HOLES FOR BOTTOM MASONRY ANCHORS.

COST OF 3/8" THICK STEEL BARRIER CONNECTOR PLATES, ALL BOLTS WITH HEX NUTS AND WASHERS, MASONRY ANCHORS, DRILLING, LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY FOR THE INSTALLATION OF 98 STEEL BARRIER CONNECTOR PLATES AND REINSTALLATION FOR PHASE II SHALL BE INCLUDED IN ITEM NO. 712-02.02, INTERCONNECTED PORTABLE BARRIER RAIL.

1" ø HOLES FOR THE MASONRY ANCHOR AND 1" ø HOLES FOR 7/8" ø BOLTS SHALL BE DRILLED WITH A HIGH SPEED DRILL. THE DRILL BIT SHALL BE CAPABLE OF DRILLING THROUGH EXISTING REINFORCING BARS AND CONCRETE. (TYP.)



NOTE:

CROSS HATCHED ITEMS TO BE REMOVED EXCEPT FOR EXISTING TRANSVERSE REINFORCING STEEL AND STEEL GRID, WHICH ARE TO BE PRESERVED.

DEMOLITION DETAILS

NOTES:

ALL COSTS ASSOCIATED WITH REMOVAL OF THE EXISTING MEDIAN BARRIER, EXISTING ATTACHMENT ANGLES, MEDIAN CROSSOVER BARRIERS, HYDRAULIC CYLINDERS AND "GLAREFOIL" AS SHOWN IN THE DEMOLITION DETAILS SHALL BE INCLUDED IN ITEM NO. 604-10.07, CONCRETE REMOVAL, L.S.

REMOVAL OF EXISTING CONCRETE SLAB AS SHOWN IN THE DEMOLITION DETAILS SHALL BE INCLUDED IN ITEM NO. 604-10.20, HYDRODEMOLITION, S.Y.

ALL COSTS ASSOCIATED WITH NEW CONCRETE SLAB INCLUDING CLASS "D" CONCRETE, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 604-10.12, CONCRETE SLAB REPAIRS, C.Y.

COST OF CLASS "A" CONCRETE, EPOXY COATED REINFORCING STEEL, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY TO BUILD THE NEW CONCRETE MEDIAN BARRIER SHALL BE INCLUDED IN ITEM NO. 604-10.92, MEDIAN BARRIER REPAIRS, L.F.

COST OF ALL EPOXY COATED REINFORCING STEEL IN THE NEW CONCRETE SLAB SHALL BE INCLUDED IN ITEM NO. 604-10.18, REINFORCING STEEL (REPAIRS), LB.

COST OF SEALING COLD JOINTS WITH A HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) TO BE INCLUDED IN ITEM NOS. 617-02, BRIDGE DECK CRACK SEALING, L.F. AND 617-05, SEALANT (HMWM), GAL.

ALL COSTS ASSOCIATED WITH THE INTERCONNECTED PORTABLE BARRIER RAIL SHALL BE INCLUDED IN ITEM NO. 712-02.02, INTERCONNECTED PORTABLE BARRIER RAIL, L.F.

FOR MORE DETAILS OF TRAFFIC CONTROL, SEE SHEET NO. 3 AND 4.

PARTIAL SECTION OF MAIN TRUSS

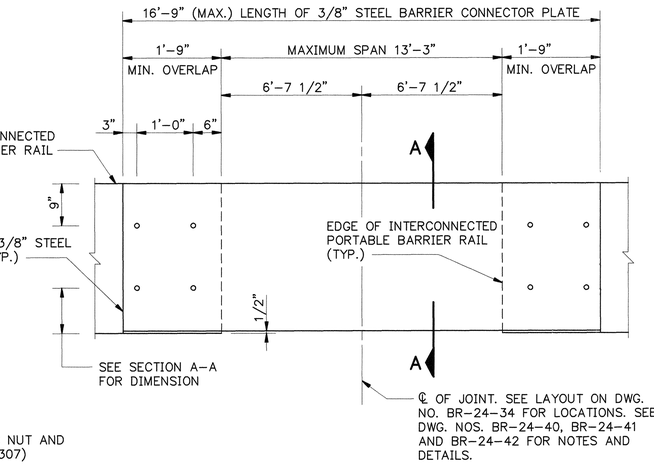
(TYP. FROM PIER VII TO PIER I)
SCALE: 3/4" = 1'-0"

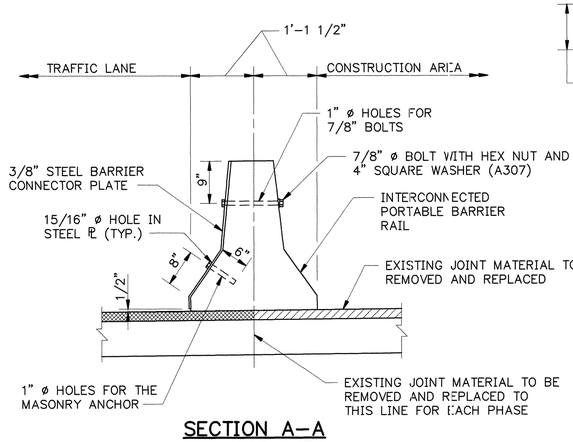
PARTIAL SECTION OF MAIN TRUSS

(TYP. FROM PIER I TO MEMPHIS ABUTMENT)
SCALE: 3/4" = 1'-0"

SPECIAL NOTE TO CONTRACTOR:

IN LIEU OF THE STEEL BARRIER CONNECTOR PLATE AS SHOWN IN THE DETAILS, THE CONTRACTOR HAS THE OPTION OF SUBMITTING TO THE ENGINEER AN ALTERNATE METHOD OF PLACING THE CONCRETE PORTABLE BARRIERS WHEN WORKING AROUND THE JOINT REPLACEMENT AREAS. IF ALTERNATIVE IS CHOSEN, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT THE TRAFFIC FROM THE AREAS OF JOINT REPLACEMENT. IF ALTERNATIVE METHOD IS CHOSEN, THERE SHALL BE NO ADDITIONAL COMPENSATION.





SECTION A-A

SCALE: 3/4" = 1'-0"

ELEVATON OF STEEL BARRIER CONNECTOR PLATE

SCALE: 3/4" = 1'-0"

STEEL BARRIER CONNECTOR PLATE DETAILS

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TERRY L. JOHNSON
REGISTERED ENGINEER
AGRICULTURE
No. 23121
STATE OF TENNESSEE
5/3/96

BRIDGE REPAIR DETAILS
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY
1996

B-3

BR-24-36

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

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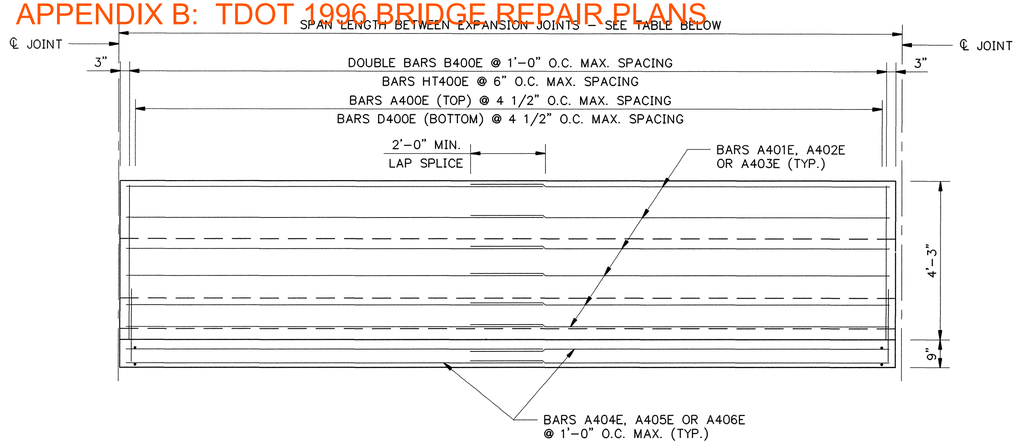
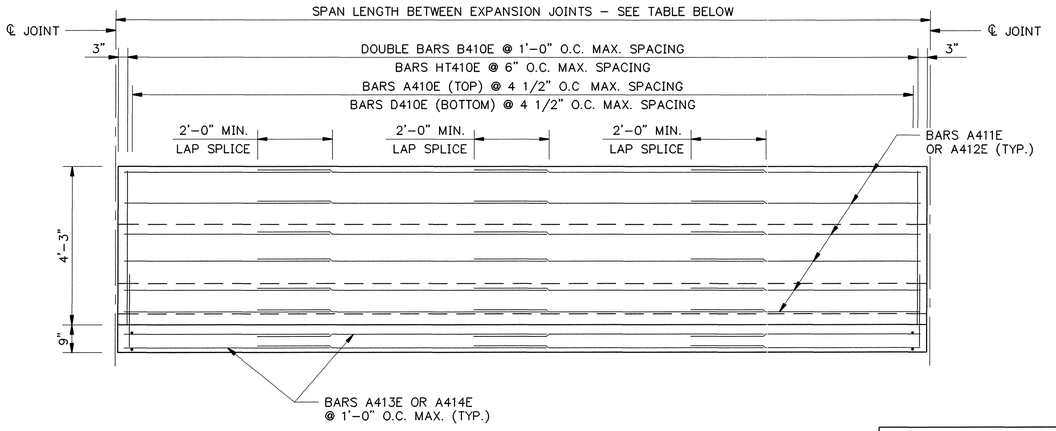


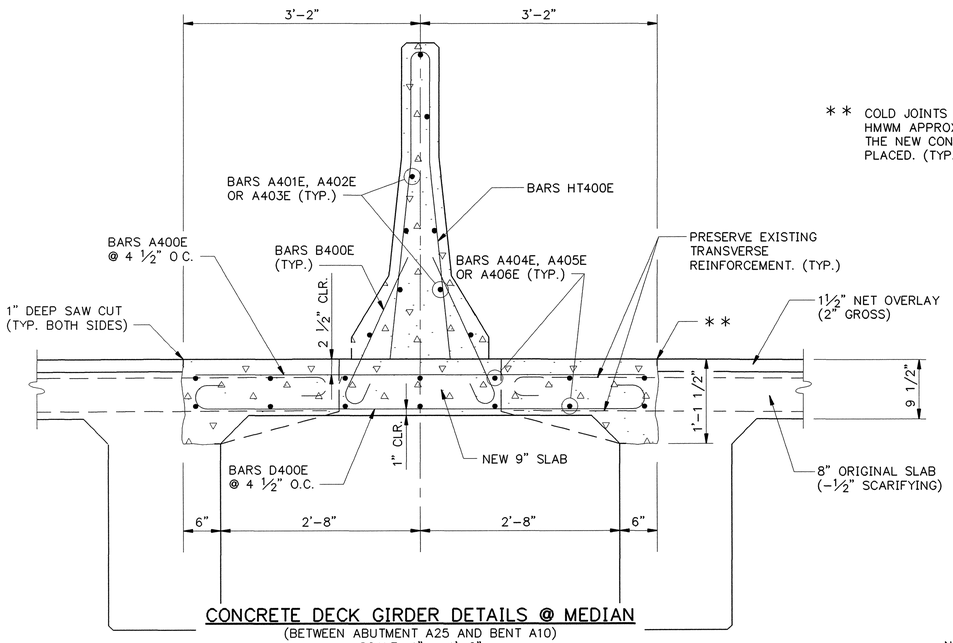
ELEVATION OF CONCRETE DECK GIRDER @ MEDIAN

N.T.S.



ELEVATION OF DECK GIRDER & DECK TRUSS @ MEDIAN

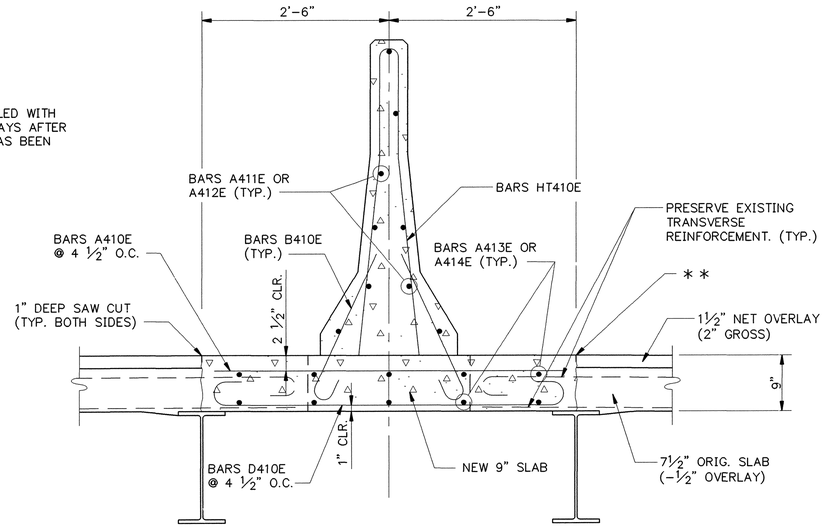
N.T.S.



CONCRETE DECK GIRDER DETAILS @ MEDIAN

(BETWEEN ABUTMENT A25 AND BENT A10)
SCALE: 1" = 1'–0"

** COLD JOINTS SHALL BE SEALED WITH HMWM APPROXIMATELY 10 DAYS AFTER THE NEW CONCRETE SLAB HAS BEEN PLACED. (TYP. BOTH SIDES)



DECK GIRDER & DECK TRUSS DETAILS @ MEDIAN

(DECK GIRDER BETWEEN BENT A10 AND BENT A2, DECK TRUSS BETWEEN BENT A2 AND PIER VII)
SCALE: 1" = 1'–0"

SPAN LOCATIONS BETWEEN EXPANSION JOINTS	NO. OF SPANS	LENGTH OF SPAN BETWEEN EXPANSION JOINTS	NO. OF B400E BARS	NO. OF HT400E BARS	NO. OF A400E BARS	NO. OF D400E BARS
CONCRETE DECK GIRDER	7	35'–0"	72	72	93	93
CONCRETE DECK GIRDER	4	20'–11 3/8"	44	44	56	56
CONCRETE DECK GIRDER	4	38'–0"	78	78	101	101
SPAN LOCATIONS BETWEEN EXPANSION JOINTS	NO. OF SPANS	LENGTH OF SPAN BETWEEN EXPANSION JOINTS	NO. OF B410E BARS	NO. OF HT410E BARS	NO. OF A410E BARS	NO. OF D410E BARS
DECK GIRDER	7	87'–0"	176	176	232	232
DECK GIRDER	1	87'–8"	178	178	234	234
DECK TRUSS	2	86'–9 ½"	176	176	232	232
DECK TRUSS	2	87'–10 ½"	178	178	234	234

TABLE SHOWING SPAN LOCATIONS, NO. OF SPANS AND SPAN LENGTHS BETWEEN EXPANSION JOINTS AND NO. OF BARS REQUIRED PER SPAN.

NOTES:

ALL COSTS ASSOCIATED WITH NEW CONCRETE SLAB INCLUDING CLASS "D" CONCRETE, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 604–10.12, CONCRETE SLAB REPAIRS, C.Y.

COST OF CLASS "A" CONCRETE, EPOXY COATED REINFORCING STEEL, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY TO BUILD THE NEW CONCRETE MEDIAN BARRIER SHALL BE INCLUDED IN ITEM NO. 604–10.92, MEDIAN BARRIER REPAIRS, L.F.

COST OF ALL EPOXY COATED REINFORCING STEEL IN THE NEW CONCRETE SLAB SHALL BE INCLUDED IN ITEM NO. 604–10.18, REINFORCING STEEL (REPAIRS), LB.

COST OF SEALING COLD JOINTS WITH A HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) TO BE INCLUDED IN ITEM NOS. 617–02, BRIDGE DECK CRACK SEALING, L.F. AND 617–05, SEALANT (HMWM), GAL.

FOR DEMOLITION DETAILS, SEE DWG. NO. BR–24–36.

FOR EXPANSION AND FIXED JOINT DETAILS, SEE DWG. NO. BR–24–40, BR–24–41 AND BR–24–42.

FOR MEDIAN BARRIER DETAILS, SEE DWG. NO. BR–24–39 AND STD. DWG. NOS. STD–1–4.

FOR LOCATIONS OF SPANS, SEE DWG. NO. BR–24–34.

PROJECT NO.	YEAR	SHEET NO.
79005–4144–04	1996	

REVISIONS

NO	DATE	BY	BRIEF DESCRIPTION

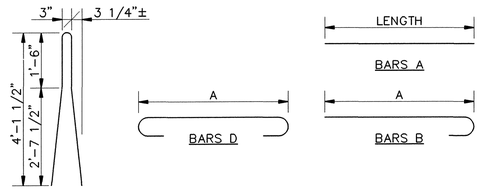
BILL OF STEEL

BAR	LOCATION	SIZE	NO. REQ'D.	A	LENGTH
CONCRETE DECK GIRDER					
A400E	SLAB	4	1279		6'–0"
* A401E	35'–0" MED. BAR.	4	126		18'–3"
* A402E	20'–11 3/8" MED. B.	4	72		11'–3"
* A403E	38'–0" MED. BAR.	4	72		19'–9"
A404E	35'–0" SLAB	4	196		18'–3"
A405E	20'–11 3/8" SLAB	4	112		11'–3"
A406E	38'–0" SLAB	4	112		19'–9"
B400E	MEDIAN BARRIER	4	992	2'–1"	2'–7"
D400E	SLAB	4	1279	6'–0"	7'–0"
* HT400E	MEDIAN BARRIER	4	992		8'–6"
DECK GIRDER & DECK TRUSS					
A410E	SLAB	4	2790		4'–8"
* A411E	87'–0" MED. BAR.	4	252		23'–2"
* A412E	87'–8" MED. BAR.	4	36		23'–5"
* A411E	86'–9½" MED. BAR.	4	72		23'–2"
* A412E	87'–10½" MED. BAR.	4	72		23'–5"
A413E	87'–0" SLAB	4	280		23'–2"
A414E	87'–8" SLAB	4	40		23'–5"
A413E	86'–9½" SLAB	4	80		23'–2"
A414E	87'–10½" SLAB	4	80		23'–5"
B410E	MEDIAN BARRIER	4	2118	2'–1"	2'–7"
D410E	SLAB	4	2790	4'–8"	5'–8"
* HT410E	MEDIAN BARRIER	4	2118		8'–6"

ALL BAR DIMENSIONS GIVEN ARE OUT TO OUT.

ALL DIMENSIONS SHALL BE FIELD VERIFIED BY CONTRACTOR PRIOR TO FABRICATION.

* BARS TO BE INCLUDED IN COST OF MEDIAN BARRIER.



DESIGNED BY N TINER DATE APRIL 1996
DRAWN BY N TINER DATE APRIL 1996
SUPERVISED BY T JOHNSON DATE APRIL 1996
CHECKED BY T JOHNSON DATE APRIL 1996

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TERRY L. JOHNSON REGISTERED ENGINEER AGRICULTURE No. 23112 STATE OF TENNESSEE 4/25/96

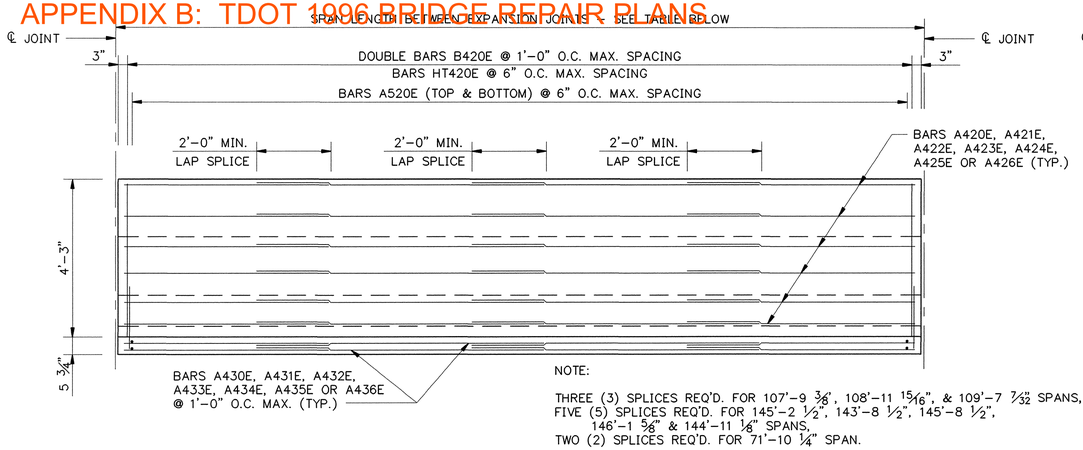
BRIDGE REPAIR DETAILS

INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79–I55–12.00
SHELBY COUNTY

1996

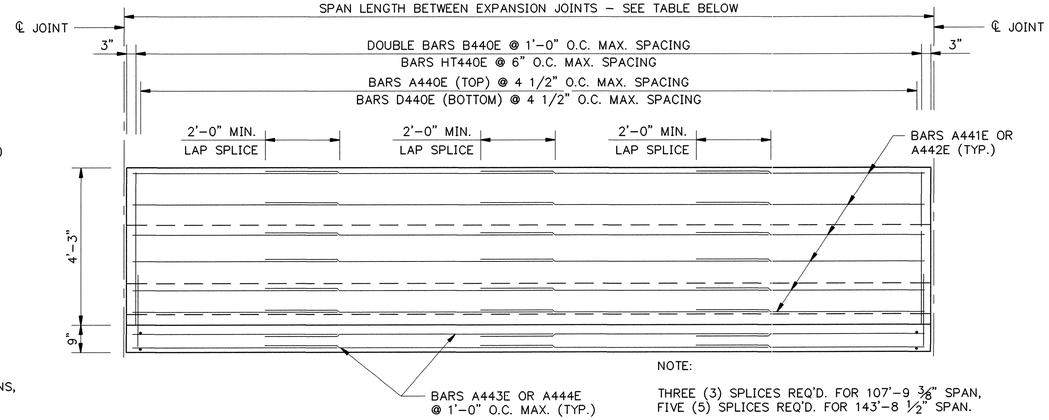
B-4

BR–24–37



NOTE:

THREE (3) SPLICES REQ'D. FOR 107'–9 3/8", 108'–11 15/16", & 109'–7 7/32" SPANS,
FIVE (5) SPLICES REQ'D. FOR 145'–2 1/2", 143'–8 1/2", 145'–8 1/2",
146'–1 5/8" & 144'–11 1/16" SPANS,
TWO (2) SPLICES REQ'D. FOR 71'–10 1/4" SPAN.



NOTE:

THREE (3) SPLICES REQ'D. FOR 107'–9 3/8" SPAN,
FIVE (5) SPLICES REQ'D. FOR 143'–8 1/2" SPAN.

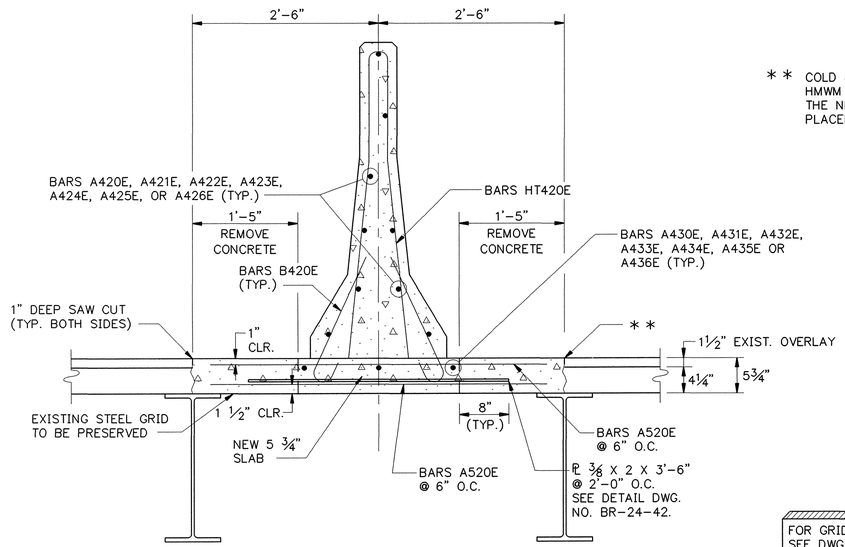
PROJECT NO.	YEAR	SHEET NO.
79005–4144–04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION

ELEVATION OF MAIN TRUSS @ MEDIAN

N.T.S.



** COLD JOINTS SHALL BE SEALED WITH HMWM APPROXIMATELY 10 DAYS AFTER THE NEW CONCRETE SLAB HAS BEEN PLACED. (TYP. BOTH SIDES)

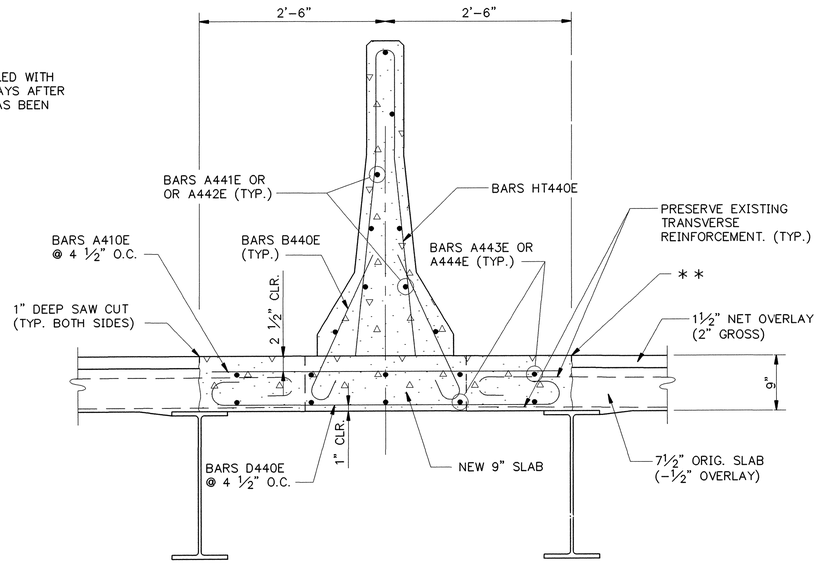
FOR GRID DETAILS, SEE DWG. NO. BR–24–42.

MAIN TRUSS DETAILS @ MEDIAN

(BETWEEN PIER VII AND PIER I)
SCALE: 1" = 1'–0"

ELEVATION OF MEMPHIS ANCHOR SPAN @ MEDIAN

N.T.S.



MEMPHIS ANCHOR SPAN DETAILS @ MEDIAN

(BETWEEN PIER I AND MEMPHIS ABUTMENT)
SCALE: 1" = 1'–0"

SPAN LOCATIONS BETWEEN EXPANSION JOINTS	NO. OF SPANS	LENGTH OF SPAN BETWEEN EXPANSION JOINTS	NO. OF B420E BARS	NO. OF HT420E BARS	NO. OF A520E BARS
MAIN TRUSS	1	145'–2 1/2"	292	292	582
MAIN TRUSS	6	143'–8 1/2"	290	290	576
MAIN TRUSS	4	145'–8 1/2"	294	294	584
MAIN TRUSS	3	107'–9 3/8"	218	218	432
MAIN TRUSS	1	108'–11 15/16"	220	220	436
MAIN TRUSS	6	109'–7 7/32"	222	222	440
MAIN TRUSS	3	146'–1 5/8"	294	294	586
MAIN TRUSS	1	144'–11 1/16"	292	292	580
MAIN TRUSS	1	71'–10 1/4"	146	146	288

SPAN LOCATIONS BETWEEN EXPANSION JOINTS	NO. OF SPANS	LENGTH OF SPAN BETWEEN EXPANSION JOINTS	NO. OF B440E BARS	NO. OF HT440E BARS	NO. OF A440E BARS	NO. OF D440E BARS
MEMPHIS ANCHOR	2	107'–9 3/8"	218	218	288	288
MEMPHIS ANCHOR	1	143'–8 1/2"	290	290	383	383

TABLE SHOWING SPAN LOCATIONS, NO. OF SPANS AND SPAN LENGTHS BETWEEN EXPANSION JOINTS AND NO. OF BARS REQUIRED PER SPAN.

NOTES:

ALL COSTS ASSOCIATED WITH NEW CONCRETE SLAB INCLUDING CLASS "D" CONCRETE, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 604–10.12, CONCRETE SLAB REPAIRS, C.Y.

COST OF CLASS "A" CONCRETE, EPOXY COATED REINFORCING STEEL, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY TO BUILD THE NEW CONCRETE MEDIAN BARRIER SHALL BE INCLUDED IN ITEM NO. 604–10.92, MEDIAN BARRIER REPAIRS, L.F.

COST OF ALL EPOXY COATED REINFORCING STEEL IN THE NEW CONCRETE SLAB SHALL BE INCLUDED IN ITEM NO. 604–10.18, REINFORCING STEEL (REPAIRS), LB.

COST OF INSTALLING NEW ℄ 3/8 X 2 X 3'–6", INCLUDING STRUCTURAL STEEL, WELDING, LABOR AND MISCELLANEOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 602–10.34, MISCELLANEOUS STRUCTURAL STEEL REPAIRS, LB.

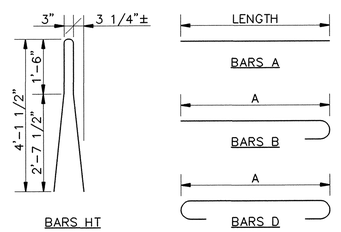
COST OF SEALING COLD JOINTS WITH A HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) TO BE INCLUDED IN ITEM NOS. 617–02, BRIDGE DECK CRACK SEALING, L.F. AND 617–05, SEALANT (HMWM), GAL.

FOR DEMOLITION DETAILS, SEE DWG. NO. BR–24–36.

FOR EXPANSION JOINT DETAILS, SEE DWG. NOS. BR–24–40, BR–24–41 AND BR–24–42.

FOR MEDIAN BARRIER DETAILS, SEE DWG. NO. BR–24–39 AND STD. DWG. NO. STD–1–4.

FOR LOCATIONS OF SPANS, SEE DWG. NO. BR–24–34.



BILL OF STEEL

BAR	LOCATION	SIZE	NO. REQ'D.	A	LENGTH
MAIN TRUSS					
A520E	SLAB	5	13,372		4'–8"
* A420E	145'–2 1/2" MED. BAR.	4	54		25'–10"
* A421E	143'–8 1/2" MED. BAR.	4	324		25'–7"
* A422E	145'–8 1/2" MED. BAR.	4	216		26'–0"
* A423E	107'–9 3/8" MED. BAR.	4	108		28'–4"
* A424E	108'–11 15/16" MED. B.	4	36		28'–8"
* A425E	109'–7 7/32" MED. BAR.	4	216		28'–10"
* A422E	146'–1 5/8" MED. BAR.	4	162		26'–0"
* A420E	144'–11 1/16" MED. B.	4	54		25'–10"
* A426E	71'–10 1/4" MED. BAR.	4	27		25'–2"
A430E	145'–2 1/2" SLAB	4	18		25'–10"
A431E	143'–8 1/2" SLAB	4	108		25'–7"
A432E	145'–8 1/2" SLAB	4	72		26'–0"
A433E	107'–9 3/8" SLAB	4	36		28'–4"
A434E	108'–11 15/16" SLAB	4	12		28'–8"
A435E	109'–7 7/32" SLAB	4	72		28'–10"
A432E	146'–1 5/8" SLAB	4	54		26'–0"
A430E	144'–11 1/16" SLAB	4	18		25'–10"
A436E	71'–10 1/4" SLAB	4	9		25'–2"
B420E	MEDIAN BARRIER	4	6734	1'–9"	2'–3"
* HT420E	MEDIAN BARRIER	4	6734		8'–6"
MEMPHIS ANCHOR SPAN					
A440E	SLAB	4	959		4'–8"
* A441E	107'–9 3/8" MED. BAR.	4	72		28'–4"
* A442E	143'–8 1/2" MED. BAR.	4	54		25'–7"
A443E	107'–9 3/8" SLAB	4	80		28'–4"
A444E	143'–8 1/2" SLAB	4	60		25'–7"
B440E	MEDIAN BARRIER	4	726	2'–1"	2'–7"
D440E	SLAB	4	959	4'–8"	5'–8"
* HT440E	MEDIAN BARRIER	4	726		8'–6"

ALL BAR DIMENSIONS GIVEN ARE OUT TO OUT.

ALL DIMENSIONS SHALL BE FIELD VERIFIED BY CONTRACTOR PRIOR TO FABRICATION.

* BARS TO BE INCLUDED IN COST OF MEDIAN BARRIER.

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TERRY L. JOHNSON REGISTERED ENGINEER AGRICULTURE NUMBER 23172 STATE OF TENNESSEE
4/25/96

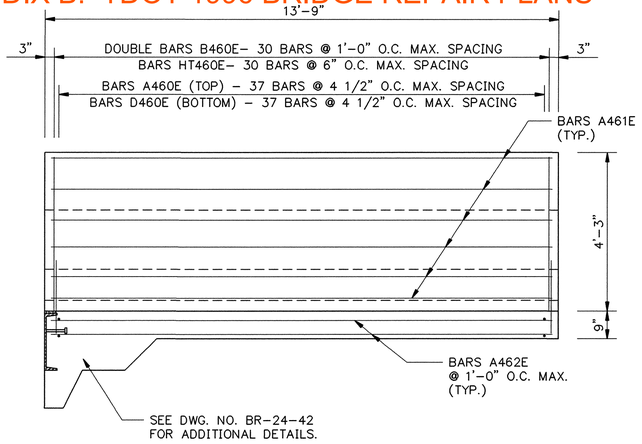
BRIDGE REPAIR DETAILS
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79–I55–12.00
SHELBY COUNTY

1996

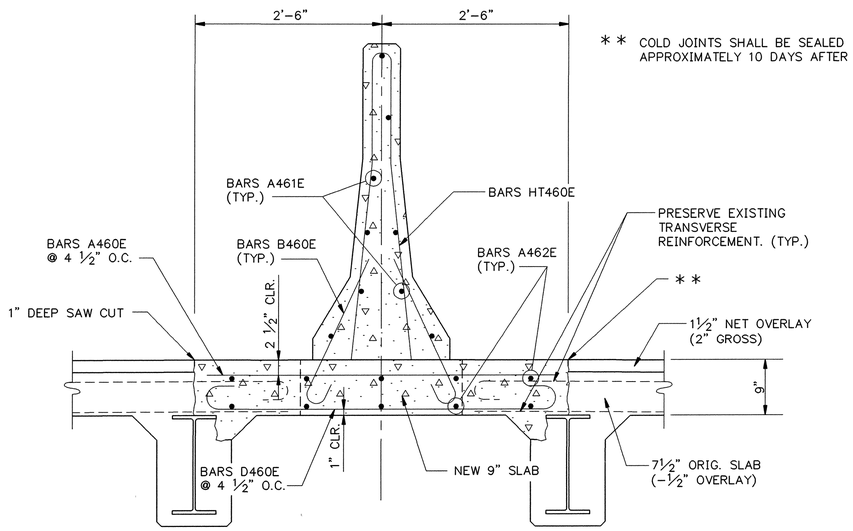
B-5

BR–24–38

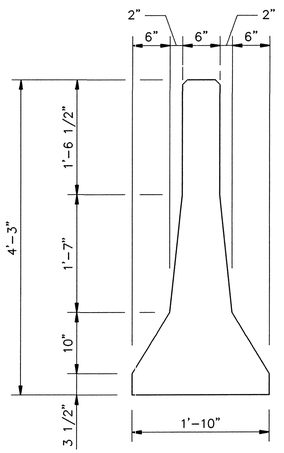
APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS



ELEVATION OF EAST APPROACH SPAN
N.T.S.



EAST APPROACH SPAN DETAILS
SCALE: 1" = 1'-0"

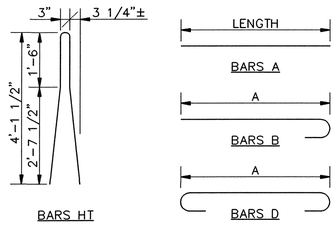


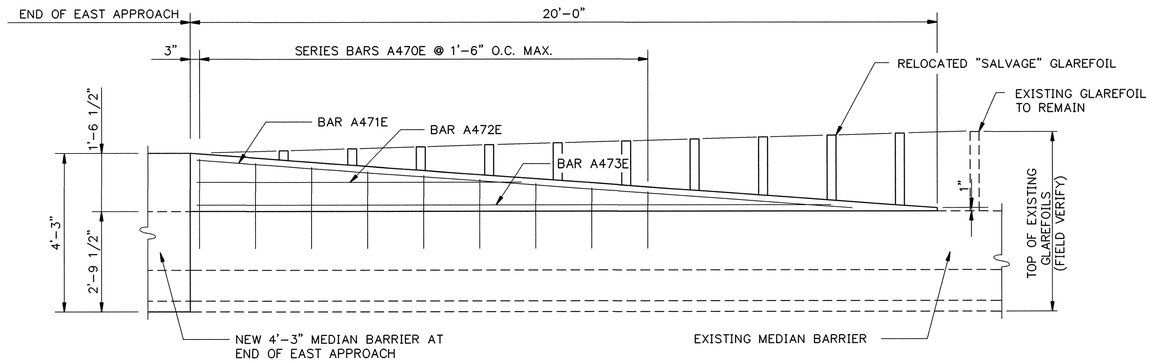
MEDIAN BARRIER DIMENSIONS
SCALE: 1" = 1'-0"

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

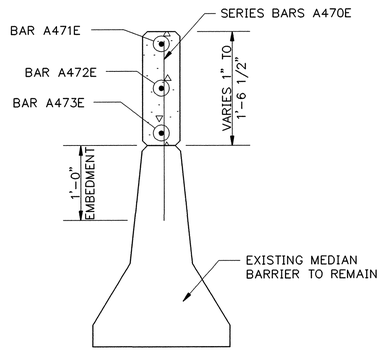
REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION
1	06/12/96	NDT	ADDED HYDRODEMOLITION DETAIL





ELEVATION OF 20' TRANSITION MEDIAN
(EAST END OF BRIDGE SHOWN, WEST END SIMILAR)
N.T.S.

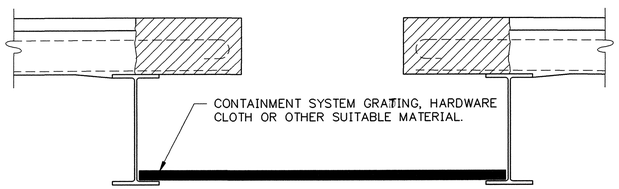


20' TRANSITION MEDIAN
SCALE: 1" = 1'-0"

BILL OF STEEL

BAR	LOCATION	SIZE	NO. REQ'D.	A	LENGTH
EAST APPROACH					
A460E	SLAB	4	37		4'-8"
* A461E	13'-9" MED. BAR.	4	9		13'-5"
A462E	13'-9" SLAB	4	10		13'-5"
B460E	MEDIAN BARRIER	4	30	2'-1"	2'-7"
D460E	SLAB	4	37	4'-8"	5'-8"
* HT460E	MEDIAN BARRIER	4	30		8'-6"
20' TRANSITION MEDIAN BARRIER					
SERIES * A470E	TRANSITION BARRIER	4	2	**	17'-7 1/2"
* A471E	TRANSITION BARRIER	4	2		17'-7"
* A472E	TRANSITION BARRIER	4	2		8'-8"
* A473E	TRANSITION BARRIER	4	2		17'-0"

ALL BAR DIMENSIONS GIVEN ARE OUT TO OUT.
ALL DIMENSIONS SHALL BE FIELD VERIFIED BY CONTRACTOR PRIOR TO FABRICATION.
* BARS TO BE INCLUDED IN COST OF MEDIAN BARRIER.
** LENGTH VARIES FROM 2'-5" TO 1'-6" IN INCREMENTS OF 1 3/8" (9 REQUIRED)



⚠1 HYDRODEMOLITION DETAIL

NOTES:

FOR ADDITIONAL INFORMATION, SEE HYDRODEMOLITION NOTE ON DWG. NO. BR-24-35.

COST OF CONTAINMENT TO BE INCLUDED IN ITEM NO. 604-10.21, CONTAINMENT AND DISPOSAL OF WASTE, L.S.

DESIGNED BY N TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

NOTES:

ALL COSTS ASSOCIATED WITH NEW CONCRETE SLAB INCLUDING CLASS "D" CONCRETE, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 604-10.12, CONCRETE SLAB REPAIRS, C.Y.

COST OF CLASS "A" CONCRETE, EPOXY COATED REINFORCING STEEL, FORMING, DRILLING AND GROUTING LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY TO BUILD THE NEW CONCRETE MEDIAN BARRIER AND 20' TRANSITION MEDIAN SHALL BE INCLUDED IN ITEM NO. 604-10.92, MEDIAN BARRIER REPAIRS, L.F.

HOLES FOR GROUTED BARS SHALL BE DRILLED WITH A HIGH SPEED DRILL. THE DRILL BIT SHALL BE CAPABLE OF DRILLING THROUGH REINFORCING BARS AND CONCRETE. THE VERTICAL DRILLED HOLES SHALL BE 1/4" IN DIAMETER LARGER THAN THE BAR, CLEANED, PACKED WITH NON-SHRINK GROUT, AND THE BAR DRIVEN TO ITS SEAT. A LIST OF APPROVED GROUTS MAY BE OBTAINED FROM THE TENNESSEE DEPARTMENT OF TRANSPORTATION DIVISION OF MATERIAL TESTS.

COST OF ALL EPOXY COATED REINFORCING STEEL IN THE NEW CONCRETE SLAB SHALL BE INCLUDED IN ITEM NO. 604-10.18, REINFORCING STEEL (REPAIRS), LB.

COST OF SEALING COLD JOINTS WITH A HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) TO BE INCLUDED IN ITEM NOS. 617-02, BRIDGE DECK CRACK SEALING, L.F. AND 617-05, SEALANT (HMWM), GAL.

FOR DEMOLITION DETAILS, SEE DWG. NO. BR-24-36.

FOR EXPANSION JOINT DETAILS, SEE DWG. NO. BR-24-42.

FOR ADDITIONAL MEDIAN BARRIER DETAILS, SEE STD. DWG. NO. STD-1-4.

FOR LOCATIONS OF EAST APPROACH SPAN AND MEDIAN BARRIER TRANSITION, SEE DWG. NO. BR-24-34.

GLAREFOIL INSTALLATION NOTES:

THE GOAL IS TO TRANSITION FROM THE EXISTING GLAREFOIL SYSTEM TO THE NEW 4'-3" CONCRETE MEDIAN BARRIER ON THE BRIDGE. MODIFYING GLAREFOILS AND MOUNTING AT THE SAME SPACING AND ANGLES TO MATCH THE EXISTING GLAREFOILS AND SMOOTHLY TRANSITIONING TOP HEIGHTS OF THE GLAREFOILS SHALL BE USED TO ACCOMPLISH. THIS WORK SHALL BE DONE TO THE FULL SATISFACTION OF THE ENGINEER.

INSTALL GLAREFOILS SALVAGED FROM THE MEDIAN BARRIER DEMOLITION ON THE 20' CONCRETE TRANSITIONS.

CUT LOWER END OF EACH PLASTIC GLAREFOIL SUCH THAT THE TOP ELEVATION OF ALL GLAREFOILS SMOOTHLY TRANSITIONS FROM THE TOP OF THE LAST EXISTING GLAREFOIL TO REMAIN AND THE TOP OF THE 4'-3" MEDIAN BARRIER.

USE GROUT OR OTHER PERMANENT MEANS ACCEPTABLE TO THE ENGINEER TO PROVIDE LEVEL BEARING UNDER THE GLAREFOIL MOUNTING BASES.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BRIDGE REPAIR DETAILS
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

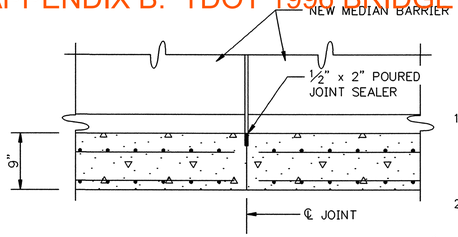
1996

B-6

BR-24-39

NDT/NDT I55-8 93943 6/12/96 2 1=1 5:13 p.m.

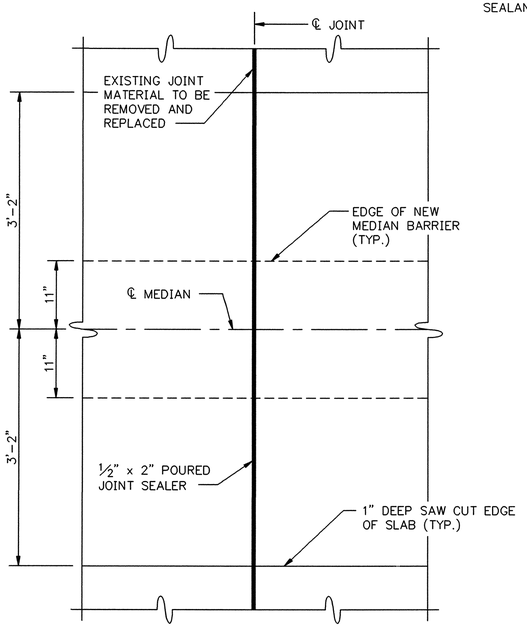
APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS



ELEVATION
SCALE: 1" = 1'-0"

NOTES:

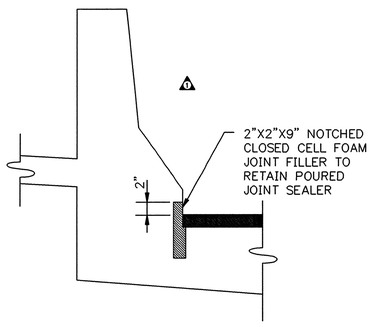
1. COST OF INSTALLING EXPANSION JOINT TO BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F. THE LENGTH OF PAY ITEM IS MEASURED ALONG ℄ JOINT FOR THE ENTIRE WIDTH OF THE BRIDGE. SEE DETAILS FOR LIMITS OF ACTUAL JOINT PLACEMENT.
2. REINFORCEMENT FOR NEW MEDIAN SLAB STRIP NOT SHOWN. SEE DWG. NO. BR-24-37 FOR DETAILS.
3. (Δ0) THE BRIDGE JOINT IS TO BE SEALED WITH A NEW JOINT SEALER. NEW JOINT SEALER SHALL BE A SELF-LEVELING, COLD-APPLIED, RAPID-CURE, TWO PART, ULTRA-LOW-MODULUS, 100 PERCENT SILICONE RUBBER SEALANT, DOW CORNING 902 RCS JOINT SEALANT OR APPROVED EQUAL.



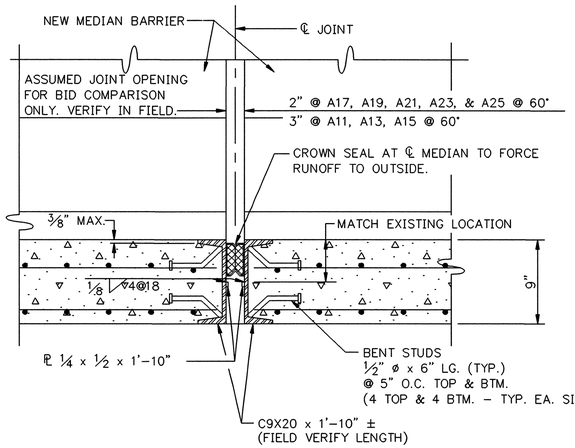
PLAN
SCALE: 1" = 1'-0"

FIXED-FIXED JOINT
(SEE DWG. NO. BR-24-34 FOR LOCATIONS)

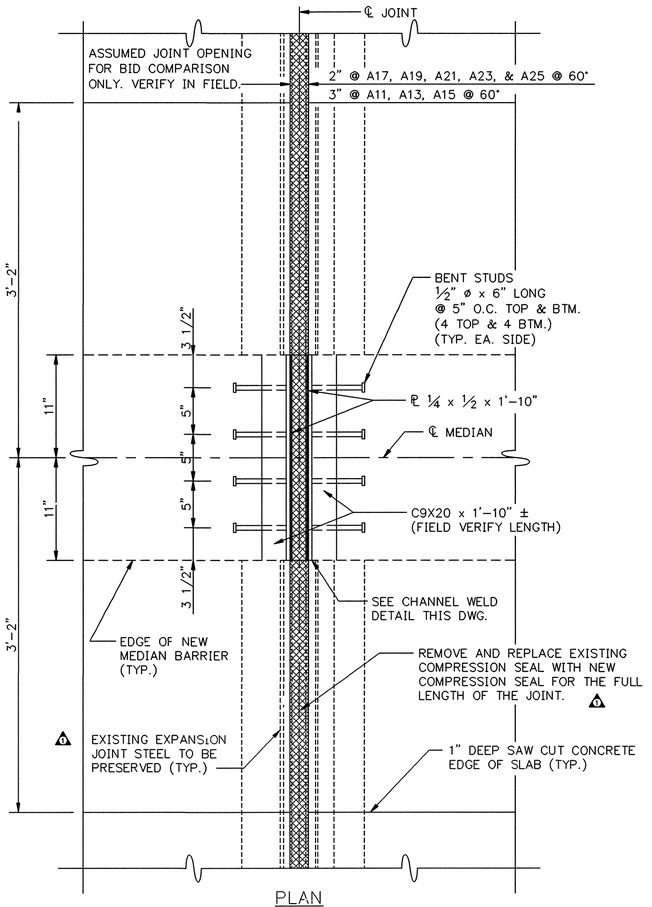
1



END JOINT DETAIL
(TYPICAL EACH EDGE OF ROADWAY)
SCALE: 1" = 1'-0"



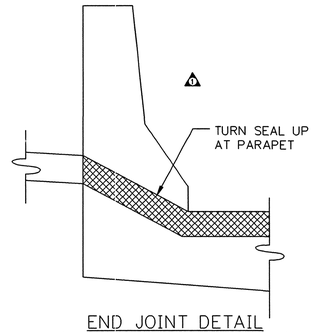
ELEVATION
SCALE: 1 ½" = 1'-0"



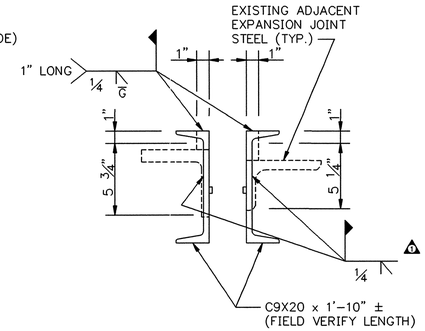
PLAN
SCALE: 1 ½" = 1'-0"

PREFORMED SEAL JOINT DETAILS
(SEE DWG. NO. BR-24-34 FOR LOCATIONS)

2



END JOINT DETAIL
(TYPICAL EACH EDGE OF ROADWAY)
SCALE: 1" = 1'-0"



CHANNEL WELD DETAIL
N.T.S.

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION
Δ1	05/24/96	NDT	ADDED NOTES TO DRAWING AND MODIFIED END JOINT DETAIL

NOTES:

1. UNCOMPRESSED SEAL WIDTH FOR PREFORMED JOINT SEAL:
   3" FOR 1½" TO 2¼" OPENING
   4" FOR 2⅜" TO 3¼" OPENING
2. COST OF INSTALLING EXPANSION JOINT TO BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F. THE LENGTH OF PAY ITEM IS MEASURED ALONG ℄ JOINT FOR THE ENTIRE WIDTH OF THE BRIDGE. SEE DETAILS FOR ACTUAL JOINT PLACEMENT. ALSO INCLUDED IN THE PRICE ARE THE 1'-10" LENGTHS OF NEW EXTRUSION, BENT STUDS, WELDING AND ALL LABOR AND INCIDENTALS NEEDED TO INSTALL THE COMPLETE JOINT SEAL.
3. REINFORCEMENT FOR NEW MEDIAN SLAB STRIP NOT SHOWN. SEE DWG. NO. BR-24-37 FOR DETAILS.
4. (Δ0) NEW CHANNELS SHALL BE SHOP PAINTED, AND WELD AREAS AND SURROUNDING DISTURBED AREAS SHALL BE CLEANED AND SPOT PAINTED IN ACCORDANCE WITH NOTES ON DWG. NO. BR-24-35. COST OF PAINTING NEW CHANNELS SHALL BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F.

JOINT LEGEND

1	FIXED - FIXED JOINT (7 LOCATIONS) SEE NOTES AND DETAILS, THIS DWG.
2	PREFORMED SEAL JOINT (8 LOCATIONS) SEE NOTES AND DETAILS, THIS DWG.
3	CLOSED CELL FOAM JOINT (8 LOCATIONS) FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-41.
4	STRIP SEAL JOINT (6 LOCATIONS) FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-41.
5	FINGER JOINT (8 LOCATIONS) FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-42.
6	1" CLOSED CELL FOAM JOINT (20 LOCATIONS) FOR NOTES AND DETAILS, SEE DWG. NO. BR-24-41.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BRIDGE REPAIR DETAILS
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY
1996

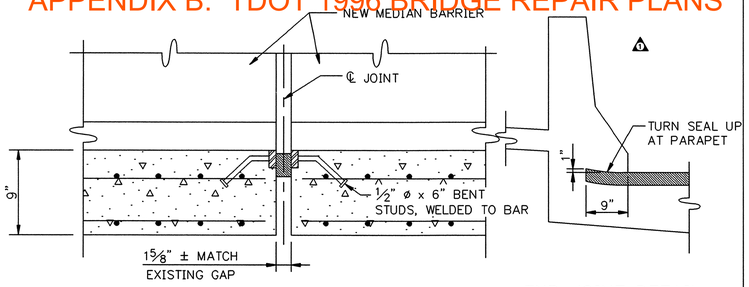
B-7

BR-24-40

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

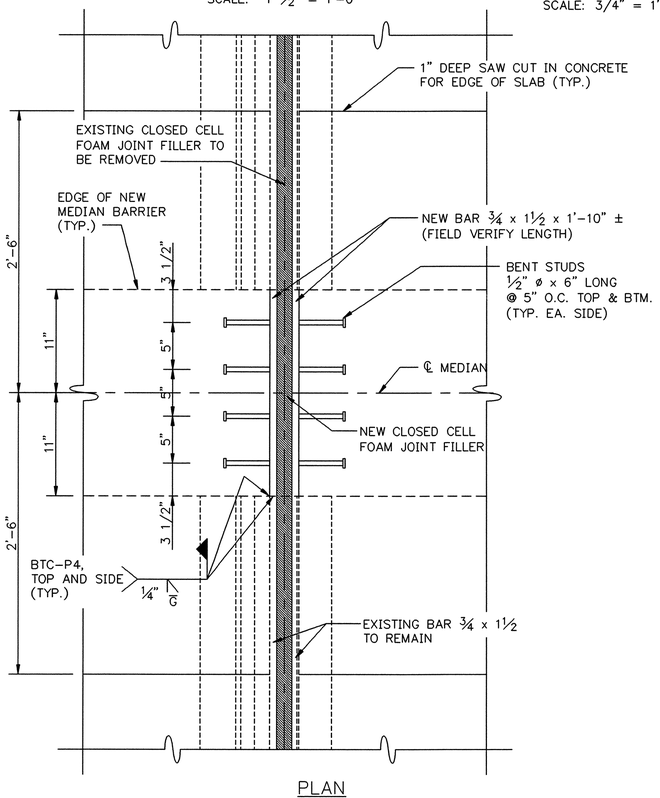
NDT/NDT I55-9 93I943 5/24/96 2 1=1 1:38 p.m.

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS



ELEVATION
SCALE: 1 ½" = 1'-0"

END JOINT DETAIL
(TYPICAL EACH EDGE OF ROADWAY)
SCALE: 3/4" = 1'-0"



PLAN
SCALE: 1 ½" = 1'-0"

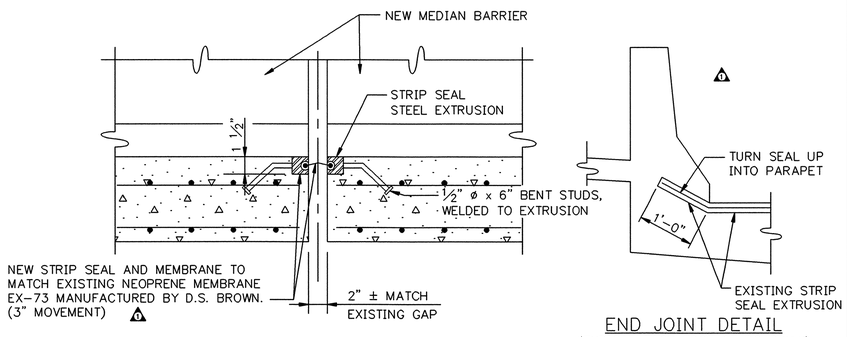
NOTE:

1. COST OF INSTALLING EXPANSION JOINT TO BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F. THE LENGTH OF PAY ITEM IS MEASURED ALONG ℄ JOINT FOR THE ENTIRE WIDTH OF THE BRIDGE. SEE DETAILS FOR LIMITS OF ACTUAL JOINT PLACEMENT. ALSO INCLUDED ARE 1'-10" STEEL BARS, STUDS, WELDING AND ALL LABOR AND INCIDENTALS NECESSARY TO COMPLETE THE JOINT INSTALLATION.
2. REINFORCEMENT FOR NEW MEDIAN SLAB STRIP NOT SHOWN. SEE DWG. NOS. BR-24-37 AND BR-24-38 FOR DETAILS.
3. JOINT FILLER SHALL BE INSTALLED IN ONE CONTINUOUS PIECE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS. MATERIAL SHALL CONTAIN UV INHIBITOR, AND BE SIMILAR AND EQUAL TO EVAZOTE 380 BY E-POXY CORPORATION.
4. SIDES OF JOINT OPENING SHALL BE SANDBLASTED IMMEDIATELY BEFORE INSTALLING THE EPOXY AND THE JOINT FILLER.
1. 5. NEW STEEL BARS SHALL BE SHOP PAINTED, AND WELD AREAS AND SURROUNDING DISTURBED AREAS SHALL BE CLEANED AND SPOT PAINTED IN ACCORDANCE WITH NOTES ON DWG. NO. BR-24-35. COST OF PAINTING NEW CHANNELS SHALL BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F.

CLOSED CELL FOAM JOINT DETAILS
(SEE DWG. NO. BR-24-34 FOR LOCATIONS)

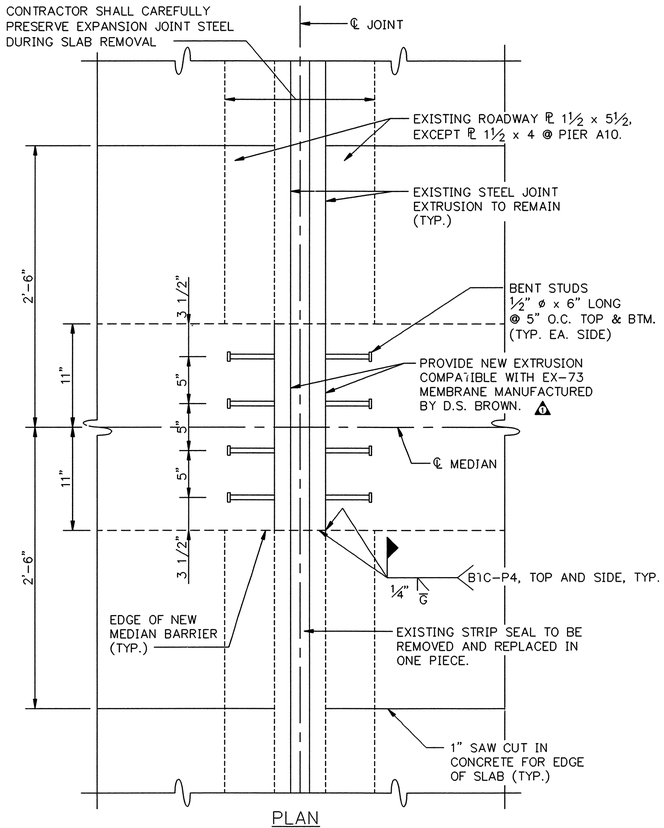
3

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996



ELEVATION
SCALE: 1 ½" = 1'-0"

END JOINT DETAIL
(TYPICAL EACH EDGE OF ROADWAY)
SCALE: 3/4" = 1'-0"



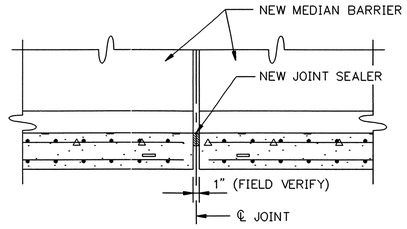
PLAN
SCALE: 1 ½" = 1'-0"

NOTE:

1. COST OF INSTALLING EXPANSION JOINT TO BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F. THE LENGTH OF PAY ITEM IS MEASURED ALONG ℄ JOINT FOR THE ENTIRE WIDTH OF THE BRIDGE. SEE DETAILS FOR LIMITS OF ACTUAL JOINT PLACEMENT. ALSO INCLUDED ARE 1'-10" STEEL BARS, STUDS, WELDING AND ALL LABOR AND INCIDENTALS NECESSARY TO COMPLETE THE JOINT INSTALLATION.
2. REINFORCEMENT FOR NEW MEDIAN SLAB STRIP NOT SHOWN. SEE DWG. NOS. BR-24-37 FOR DETAILS.
1. 3. NEW STEEL EXTRUSIONS SHALL BE SHOP PAINTED, AND WELD AREAS AND SURROUNDING DISTURBED AREAS SHALL BE CLEANED AND SPOT PAINTED IN ACCORDANCE WITH NOTES ON DWG. NO. BR-24-35. COST OF PAINTING NEW CHANNELS SHALL BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F.

STRIP SEAL JOINT DETAILS
(SEE DWG. NO. BR-24-34 FOR LOCATIONS)

4

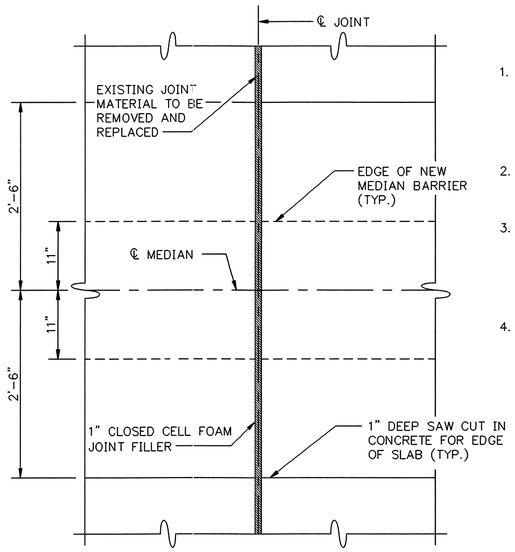


ELEVATION
SCALE: 1" = 1'-0"

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO	DATE	BY	BRIEF DESCRIPTION
1	05/24/96	NDT	ADDED MEMBRANE TYPE CALLOUT, ADDED NOTES AND MODIFIED END JOINT DETAIL



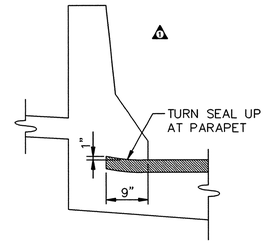
PLAN
SCALE: 1" = 1'-0"

NOTES:

1. COST OF INSTALLING EXPANSION JOINT TO BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F. THE LENGTH OF PAY ITEM IS MEASURED ALONG ℄ JOINT FOR THE ENTIRE WIDTH OF THE BRIDGE. SEE DETAILS FOR LIMITS OF ACTUAL JOINT PLACEMENT.
2. REINFORCEMENT FOR NEW MEDIAN SLAB STRIP NOT SHOWN. SEE DWG. NO. BR-24-38 FOR DETAILS.
3. JOINT FILLER SHALL BE SIZED AND INSTALLED IN ONE CONTINUOUS PIECE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS. MATERIAL SHALL CONTAIN UV INHIBITOR, AND BE SIMILAR AND EQUAL TO EVAZOTE 380 BY E-POXY CORPORATION.
4. SIDES OF JOINT OPENING SHALL BE SANDBLASTED IMMEDIATELY BEFORE INSTALLING THE EPOXY AND THE JOINT FILLER.

1" CLOSED CELL FOAM JOINT DETAIL
(SEE DWG. NO. BR-24-34 FOR LOCATIONS

6



END JOINT DETAIL
(TYPICAL EACH EDGE OF ROADWAY)
SCALE: 3/4" = 1'-0"

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

TERRY L JOHNSON REGISTERED ENGINEER AGRICULTURE COMMERCE No. 23727 STATE OF TENNESSEE
5/24/96

BRIDGE REPAIR DETAILS

INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

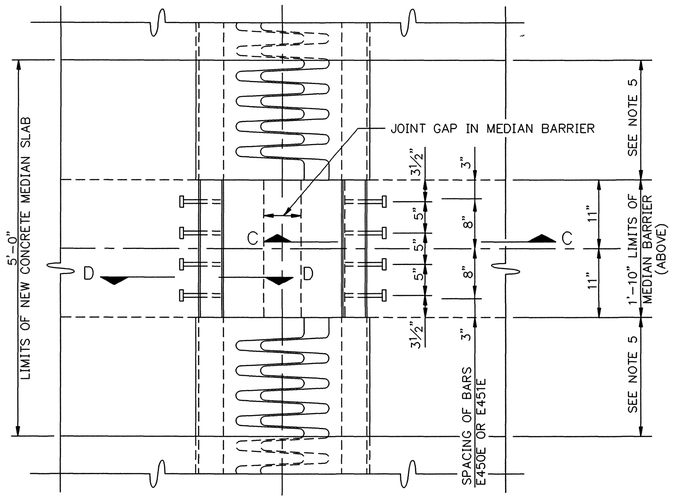
1996

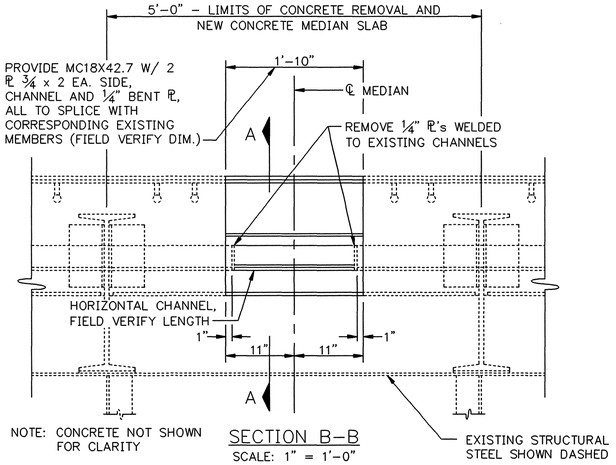
B-8

BR-24-41

NDT/NDT 155-10 931943 5/24/96 2 1=12 1:45 p.m

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS

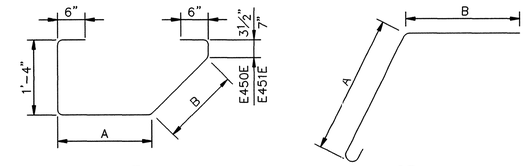




SECTION B–B
SCALE: 1" = 1'-0"

BILL OF STEEL – PER JOINT

BAR	NUMBER REQUIRED PER LOCATION				SIZE	A	B	LENGTH
	PIER VII	PIER V & VI	P.P.17,34 51,63	MEM. ABUT.				
A450E	12	12	12	13	4			4'-8"
E450E	3	6	6		4	1'-8"	1'-5 1/2"	5'-9"
E451E	3			6	4	1'-11"	1'-1"	5'-11"
GB550E				3	5	2'-5"	2'-0"	5'-0"



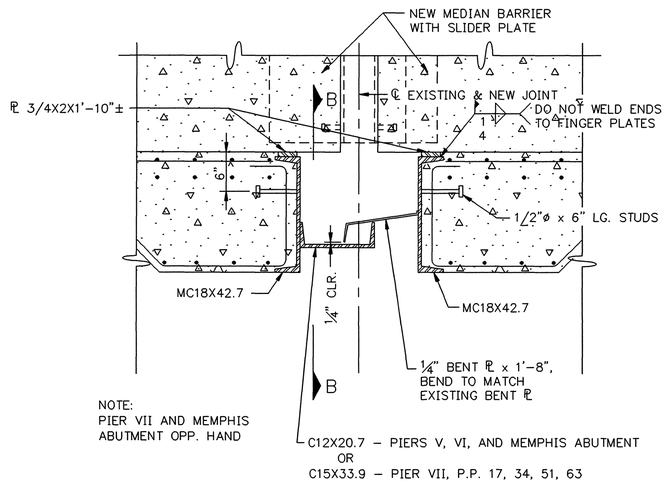
ALL BAR DIMENSIONS ARE OUT-TO-OUT

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

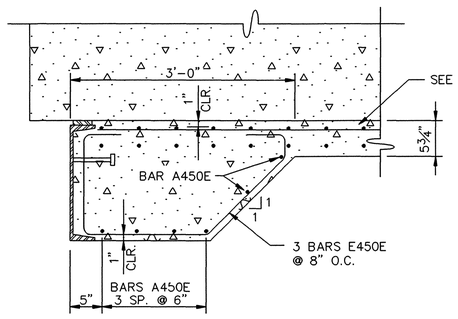
NO.	DATE	BY	BRIEF DESCRIPTION
1	05/24/96	NDT	ADDED PAINT NOTE

PLAN
SCALE: 1" = 1'-0"

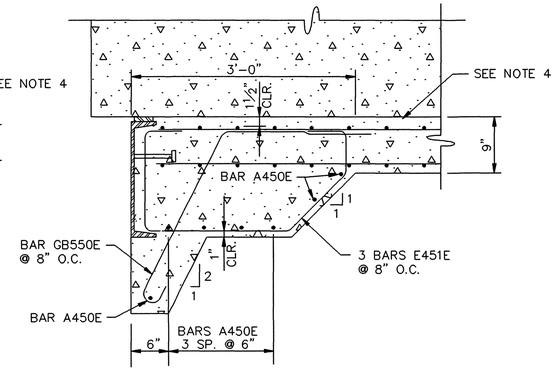


NOTE:
PIER VII AND MEMPHIS ABUTMENT OPP. HAND

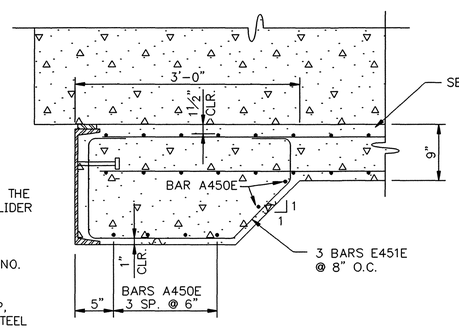
SECTION A–A
SCALE: 1" = 1'-0"



SECTION C–C
SCALE: 1" = 1'-0"



SECTION D–D
MEMPHIS ABUT. ABUT. SIDE OF JOINT
SCALE: 1" = 1'-0"



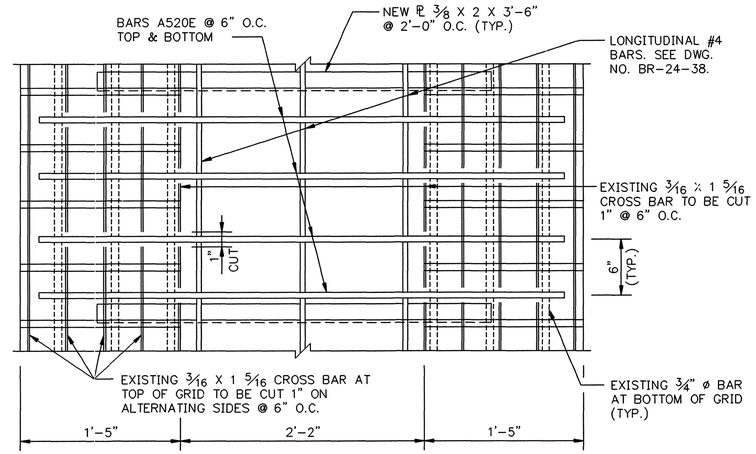
SECTION D–D
PIER VII DECK TRUSS SIDE OF JOINT
MEMPHIS ABUT. TRUSS SIDE OF JOINT
SCALE: 1" = 1'-0"

NOTES:

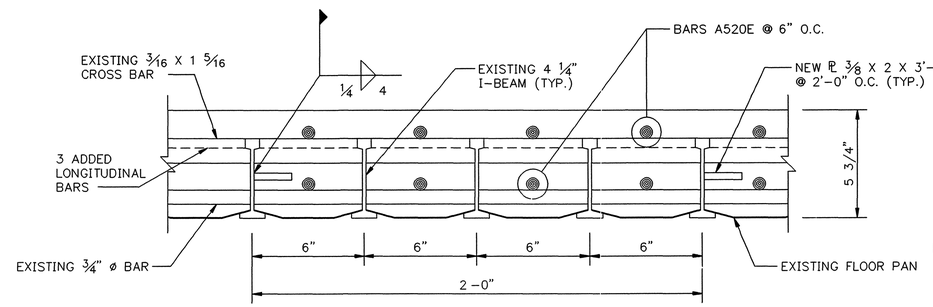
1. MEDIAN SLIDER PLATES ARE REQUIRED AT EACH OF THE FINGER JOINTS (TYPE 5), 8 LOCATIONS. DIMENSIONS AND GEOMETRY OF SLIDER PLATES SHALL CONFORM TO THAT OF THE MEDIAN BARRIER DETAILED ON DWG. NO. BR-24-39. FOR NOTES AND DETAILS OF THE SLIDER PLATE ASSEMBLIES, SEE DRAWING STD-1-4.
2. COST OF STRUCTURAL STEEL, FORMING, LABOR AND ALL MISCELLANEOUS MATERIALS NECESSARY TO COMPLETE THE SLIDER PLATE ASSEMBLIES TO BE INCLUDED IN THE ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.S.
3. FOR ADDITIONAL DETAILS OF REINFORCEMENT IN THE NEW CONCRETE MEDIAN SLAB STRIP, SEE DWG. NOS. BR-24-38 AND BR-24-39. COST OF ALL EPOXY COATED REINFORCING STEEL TO BE INCLUDED IN ITEM NO. 604-10.18, REINFORCING STEEL (REPAIRS), LB.
4. HAND CHIPPING MAY BE REQUIRED TO COMPLETELY CLEAN THE EXISTING STRUCTURAL STEEL AND REINFORCEMENT SURFACES IN THE AREA OF THE NEW MEDIAN SLAB. COST OF THIS WORK TO BE INCLUDED IN ITEM NO. 604-10.20, HYDRODEMOLITION, S.Y.
5. EXISTING REINFORCING STEFL IN CONCRETE REMOVED BY HYDRODEMOLITION SHALL BE PRESERVED.
6. NEW PLATES, CHANNELS AND SLIDER PLATES SHALL BE SHOP PAINTED, AND WELD AREAS AND SURROUNDING DISTURBED AREAS SHALL BE CLEANED AND SPOT PAINTED IN ACCORDANCE WITH NOTES ON DWG. NO. BR-24-35. COST OF PAINTING NEW CHANNELS SHALL BE INCLUDED IN ITEM NO. 604-10.44, EXPANSION JOINT REPAIRS, L.F.

FINGER JOINT DETAILS
(SEE DWG NO. BR-24-34 FOR LOCATIONS)

5



PLAN OF BAR DETAIL IN GRID
(BETWEEN PIER VII AND PIER I)
N.T.S.



BAR DETAIL IN GRID
(BETWEEN PIER VII AND PIER I)
SCALE: 3" = 1'-0"

GRID DETAILS

NOTES:

SEE DWG. NO. BR-24-38 FOR MAIN TRUSS SLAB DETAILS.

COST OF INSTALLING NEW ℙ ⅜ X 2 X 3'-6", INCLUDING STRUCTURAL STEEL, WELDING, LABOR AND MISCELLANFOUS MATERIALS SHALL BE INCLUDED IN ITEM NO. 604-10.34, MISCELLANEOUS STRUCTURAL STEEL REPAIRS, LB.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BRIDGE REPAIR DETAILS

INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

1996

B-9

BR-24-42

DESIGNED BY N TINER DATE APRIL 1996
DRAWN BY N TINER DATE APRIL 1996
SUPERVISED BY T JOHNSON DATE APRIL 1996
CHECKED BY T JOHNSON DATE APRIL 1996

NDT/NDT 155-11 931943 5/24/96 2 1=12 1:50 p.m.

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS

PAINTING

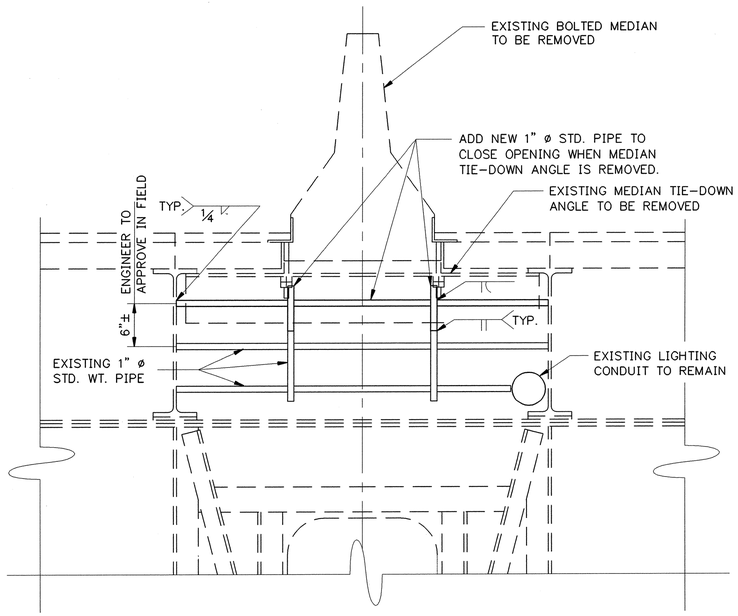
BENT/PIER	FLOOR BEAM	AREA (S.F.)
A10	A	92
	B	43
	C	45
	D	48
A9	E	6
A9	A	31
	B	23
	C	25
	D	17
A8	E	6
A8	A	12
	B	23
	C	40
	D	23
A7	E	6
A7	A	22
	B	23
	C	25
	D	17
A6	E	6
A6	A	27
	B	23
	C	25
	D	23
A5	E	6
A5	A	7
	B	23
	C	25
	D	23
A4	E	6
A4	A	35
	B	23
	C	25
	D	23
A3	E	6
A3	A	10
	B	23
	C	25
	D	23
A2	E	6
A2	A	24
	B	33
	C	26
	D	29
	E	70
	F	29
	G	90
	H	50
A1	I	6
A1	A	27
	B	35
	C	31
	D	30
	E	20
	F	43
	G	31
	H	23
VII	I	6
	TOTAL	1,523

PAINTING

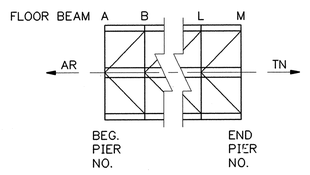
BENT/PIER	FLOOR BEAM	AREA (S.F.)
VII	A	28
	B	18
	C	14
	D	49
	E	93
	F	115
	G	13
	H	109
	I	158
	J	51
	K	92
	L	120
VI	M	127
VI	A	118
	B	43
	C	32
	D	137
	E	143
	F	128
	G	47
	H	66
	I	14
	J	23
	K	111
	L	38
V	M	138
V	A	105
	B	29
	C	40
	D	137
	E	92
	F	18
	G	107
	H	155
	I	50
	J	27
	K	26
	L	24
IV	M	8
IV	A	7
	B	131
	C	170
	D	171
	E	14
	F	171
	G	143
	H	132
	I	393
	J	149
	K	201
	L	182
	M	158
	N	173
	O	171
	P	402
	Q	158
III	R	22
	TOTAL	5,791

PAINTING

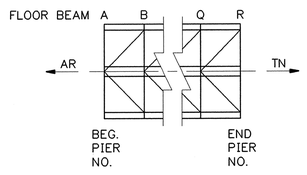
BENT/PIER	FLOOR BEAM	AREA (S.F.)
III	A	61
	B	26
	C	163
	D	103
	E	87
	F	159
	G	128
	H	43
	I	386
	J	176
	K	135
	L	425
	M	155
	N	163
	O	103
	P	268
	Q	21
II	R	22
II	A	–
	B	15
	C	145
	D	35
	E	33
	F	104
	G	47
	H	40
	I	78
	J	193
	K	30
	L	39
	M	31
	N	226
	O	43
	P	102
	Q	51
	R	163
	S	34
	T	171
	U	187
	V	148
I	W	56
I	A	14
	B	32
	C	30
	D	99
	E	35
	F	30
	G	41
	H	31
	I	67
	J	32
MEMPHIS AB.	K	174
	TOTAL	5,180



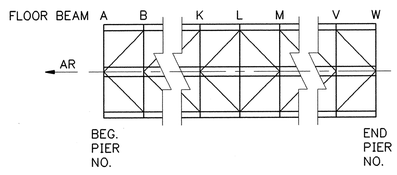
ACCESS RESTRICTION
(FLOOR BEAM I BETWEEEN PIER I AND MEMPHIS ABUTMENT)
SCALE: 1" = 1'-0"



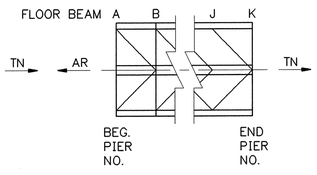
MAIN BRIDGE KEY PLAN
(BETWEEN PIERS V AND IV)



MAIN BRIDGE KEY PLAN
(BETWEEN PIERS IV AND II)



MAIN BRIDGE KEY PLAN
(BETWEEN PIERS II AND I)



MAIN BRIDGE KEY PLAN
(BETWEEN PIERS I AND MEMPHIS ABUT.)

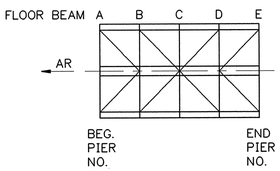
NOTES

FOR ADDITIONAL PAINT NOTES, SEE DWG. NO. BR-24-35.

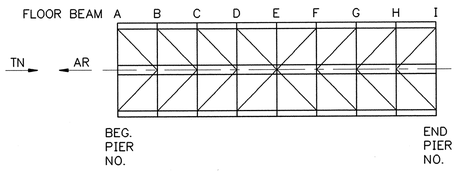
COST OF CLEANING AND SPOT PAINTING AREAS OF RUSTED STRUCTURAL STEEL SHALL BE INCLUDED IN ITEM NO. 603-02.20, SPOT PAINTING OF EXISTING STEEL STRUCTURES, S.F.

AREAS FOR SPOT PAINTING INCLUDE PARTS OF ALL STRUCTURAL STEEL MEMBERS, INCLUDING FLOOR BEAMS, WIND BRACING, WALKWAY, EXTERIOR GIRDERS, BEARINGS AND MISCELLANEOUS STEEL.

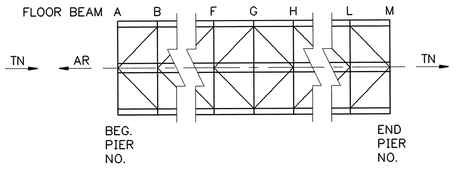
THE QUANTITY CAN BE INCREASED OR DECREASED. EXACT LOCATIONS TO BE LOCATED BY THE ENGINEER FOR THE BRIDGE REPAIR SECTION.



DECK GIRDER KEY PLAN
(BETWEEN BENTS A10 AND A2)



DECK TRUSS KEY PLAN
(BETWEEN BENT A2 AND PIER VII)



MAIN BRIDGE KEY PLAN
(BETWEEN PIERS VII AND V)

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

PAINTING

DIAPHRAGMS

BENT	AREA (S.F.)
A10	1.00
A11	2.00
A12	3.00
A13	3.00
A14	3.00
A15	2.00
A16	1.50
A17	3.00
A18	0.50
A19	2.50
A20	4.00
A21	3.00
A22	4.00
A23	3.50
A24	3.00
A25	3.00
TOTAL	42

BENTS

BENT	AREA (S.F.)
A11	1.00
A13	5.75
A14	2.50
A15	8.50
A18	1.00
A24	5.00
TOTAL	24

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION

BEAMS

SPAN	BEAM	AREA (S.F.)
A18	D	10.00
	TOTAL	10.00

NOTES

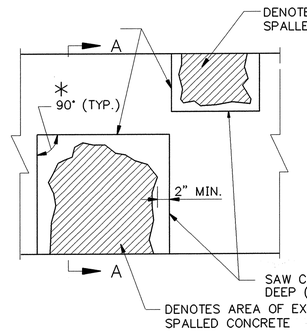
* SAW CUT EXISTING CONCRETE 1" DEEP SO AS TO OBTAIN A RECTANGULAR AREA. ALL EXISTING REINFORCEMENT SHALL BE CAREFULLY PRESERVED AND BLAST CLEANED.

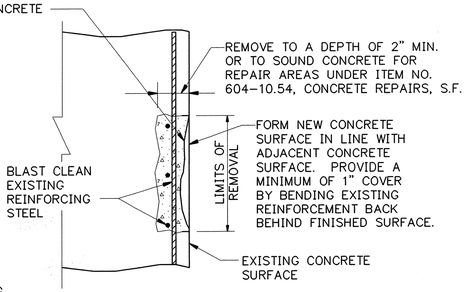
ENGINEER SHALL INSPECT ALL AREAS BEFORE PATCHING MATERIAL IS APPLIED TO ENSURE THAT ALL REBAR HAS BEEN PROPERLY BLAST CLEANED.

COST OF CUTTING, REMOVING SPALLED OR CRACKED CONCRETE, BLAST CLEANING, PATCHING MATERIAL, LABOR, AND ANY MISCELLANEOUS MATERIALS NECESSARY TO COMPLETE THE REPAIRS AS SHOWN SHALL BE INCLUDED IN ITEM 604-10.54, CONCRETE REPAIRS, S.F.

PATCHING MATERIAL SHALL BE POLYMER-MODIFIED, CEMENTITIOUS STRUCTURAL PATCHING MATERIAL FROM THE TENNESSEE DEPARTMENT OF TRANSPORTATION QUALIFIED PRODUCTS LIST 13, SEC. F.

SEE TABLES THIS SHEET FOR LOCATIONS OF SPALL REPAIRS. OTHER LOCATIONS MAY BE DESIGNATED BY ENGINEER.





SECTION A-A

SPALL REPAIR DETAILS

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

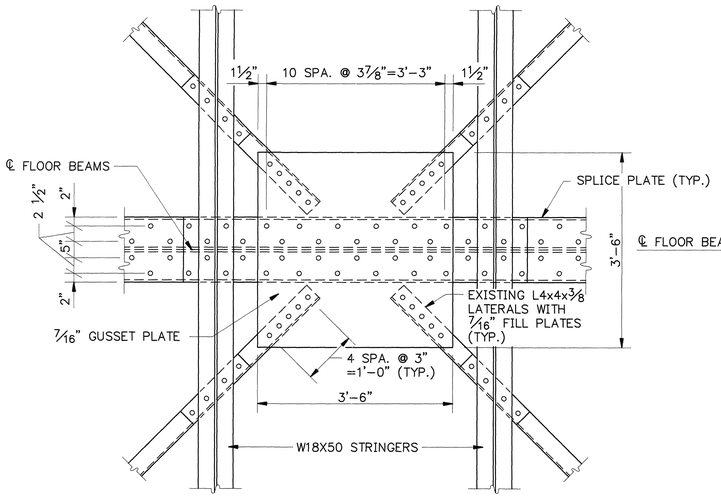
BRIDGE REPAIR DETAILS
INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY
1996

B-10

BR-24-43

APPENDIX B: TDOT 1996 BRIDGE REPAIR PLANS

NOTE: CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND HOLE SPACING BEFORE FABRICATION.



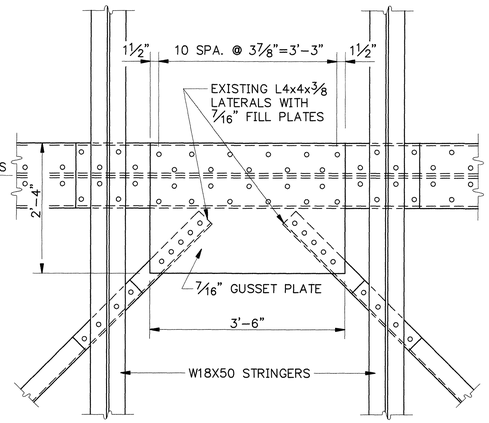
CENTER FLOOR BEAM

PROCEDURE

1. REMOVE EXISTING 7/16" GUSSET PLATE BY REMOVING RIVETS THROUGH LATERALS AND TOP OF FLOOR BEAM.
2. CLEAN AND PAINT ENDS OF LATERALS, 7/16" FILL PLATES, AND TOP OF FLOOR BEAM AND ANY OTHER DISTURBED SURFACES. COST TO BE INCLUDED IN ITEM NO. 603-02.20, SPOT PAINTING OF EXISTING STEEL STRUCTURES, S.F.
3. INSTALL NEW SHOP PAINTED 7/16" GUSSET PLATE USING 7/8" DIA. A325 BOLTS. MATCH EXISTING HOLE LOCATIONS.
4. GUSSET PLATE SHALL BE SHOP PAINTED AS PER 603.06, SCHEDULE OF PAINTING SYSTEM A OF TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
5. TOP COVER PLATES ARE ALSO TO BE REPLACED AT ALL GUSSET PLATE REPLACEMENT LOCATIONS. SEE SCHEDULE THIS DRAWING.

GUSSET PLATE REPLACEMENT AT CENTER FLOOR BEAM	
LOCATION	WEIGHT (LB.)
FLOOR BEAM E BETWEEN A2 & A1	219
FLOOR BEAM E BETWEEN A1 & VII	219
TOTAL	418

NOTE: LOCATIONS MAY INCREASE OR DECREASE.



QUARTER POINT FLOOR BEAM

NOTES:

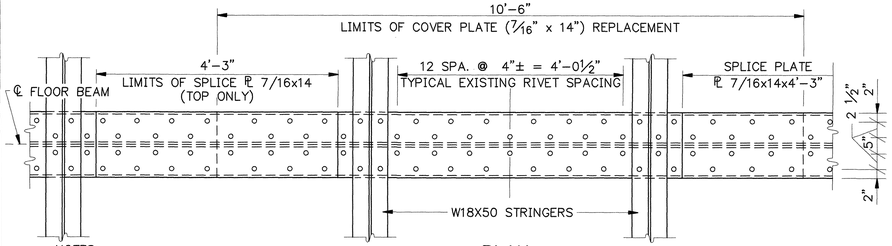
1. ONLY ONE GUSSET PLATE PER SPAN (BETWEEN PIERS) SHALL BE REMOVED AT ONE TIME. IT SHALL BE REINSTALLED BEFORE ANOTHER GUSSET PLATE IS REMOVED.
2. FOR ADDITIONAL DETAILS OF EXISTING STRUCTURE, SEE REF. DWG. NO. 5, CONTRACT 4.
3. COST OF REMOVAL AND REPLACEMENT OF THREE (3) GUSSET PLATES OVER FLOOR BEAMS, INCLUDING A325 BOLTS, STRUCTURAL STEEL, CLEANING AND PAINTING, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS TO BE INCLUDED IN ITEM NO. 602-10.39, STRUCTURAL STEEL BRIDGE (REPAIRS), EACH.
4. TOP COVER PLATE IS ALSO TO BE REPLACED AT THIS LOCATION. SEE SCHEDULE THIS DRAWING.

GUSSET PLATE REPLACEMENT AT QUARTER POINT FLOOR BEAM	
LOCATION	WEIGHT (LB.)
FLOOR BEAM H BETWEEN A1 & VII	146
TOTAL	146

NOTE: LOCATIONS MAY INCREASE OR DECREASE.

GUSSET PLATE REPLACEMENT

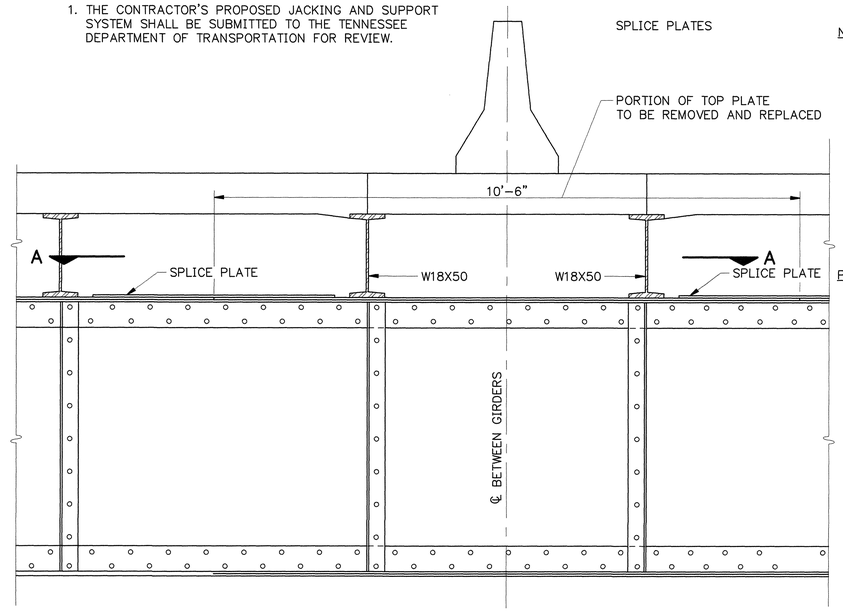
SCALE: ¾" = 1'-0"



NOTES:

1. THE CONTRACTOR'S PROPOSED JACKING AND SUPPORT SYSTEM SHALL BE SUBMITTED TO THE TENNESSEE DEPARTMENT OF TRANSPORTATION FOR REVIEW.

PLAN



ELEVATION

TOP COVER PLATE REPLACEMENT AT FLOOR BEAM

SCALE: ¾" = 1'-0"

PROJECT NO.	YEAR	SHEET NO.
79005-4144-04	1996	

REVISIONS

NO.	DATE	BY	BRIEF DESCRIPTION

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND HOLE SPACING. SHOP DRAWINGS SHALL BE SUBMITTED AND APPROVED BEFORE FABRICATION.
2. FOR ADDITIONAL STRUCTURAL DETAILS, SEE REF. DWG. NO. 5, CONTRACT NO. 4.
3. COST OF REMOVAL AND REPLACEMENT OF TOP COVER PLATES OVER FLOOR BEAMS, INCLUDING A325 BOLTS, SPLICE PLATES, CLEANING AND PAINTING, JACKING, SUPPORTS, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS OF EIGHT (8) FLOOR BEAMS TO BE INCLUDED IN ITEM NO. 602-10.27, STRUCTURAL STEEL FLOOR BEAM REPAIRS, EACH.

PROCEDURE

1. REMOVE RIVETS WITHIN LIMITS OF PLATE REMOVAL.
2. SAW CUT THROUGH EXISTING 7/16" TOP COVER PLATE AT EACH END.
3. JACK AND SUPPORT W18X50 STRINGERS FOR REMOVAL OF EXISTING PLATE.
4. CLEAN ANY CORROSION OF REMAINING SURFACES.
5. INSTALL NEW PL 7/16" x 14" COVER PLATES AND SPLICE PLATES, SHOP PAINTED WITH SYSTEM A, TENNESSEE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION SECTION 603.06.
6. INSTALL 7/8" DIA. A325 BOLTS AT EACH HOLE.
7. CLEAN AND PAINT WELD AREAS AND ALL OTHER DISTURBED SURFACES WITH PAINT SYSTEM B. SEE NOTE ON DWG. NO. BR-24-35.

TOP COVER PLATE REPLACEMENT & SPLICE PLATE AT FLOOR BEAM	
LOCATION	WEIGHT (LB.)
FLOOR BEAM A BETWEEN A8 & A7	396.5
FLOOR BEAM A BETWEEN A7 & A6	396.5
FLOOR BEAM A BETWEEN A5 & A4	396.5
FLOOR BEAM A BETWEEN A4 & A3	396.5
FLOOR BEAM A BETWEEN A3 & A2	396.5
* FLOOR BEAM E BETWEEN A2 & A1	396.5
* FLOOR BEAM E BETWEEN A1 & VII	396.5
* FLOOR BEAM H BETWEEN A1 & VII	396.5
TOTAL	3,172

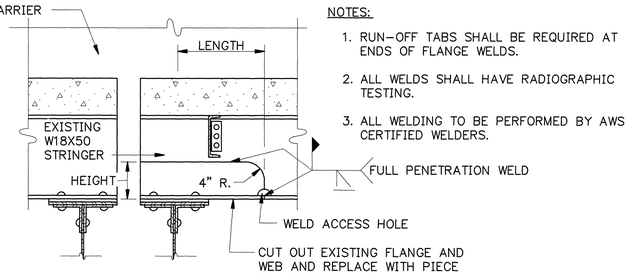
NOTE: LOCATIONS MAY INCREASE OR DECREASE.
* GUSSET PLATE REPLACEMENT ALSO.

W18X50 STRINGER END REPAIR				
BENT	STRINGER	LENGTH	HEIGHT	WEIGHT (LB.)
A9 (TN SIDE)	LEFT	3'-0"	5"	60
A8 (TN SIDE)	LEFT	4'-0"	6"	85
A8 (TN SIDE)	RIGHT	4"-0"	6"	85
A7 (TN SIDE)	LEFT	3'-0"	6"	64
A7 (TN SIDE)	RIGHT	3'-0"	6"	64
A6 (AR SIDE)	LEFT	4'-0"	8"	95
A6 (AR SIDE)	RIGHT	4'-0"	8"	95
A6 (TN SIDE)	LEFT	3'-0"	9"	75
A6 (TN SIDE)	RIGHT	2'-0"	9"	50
A5 (TN SIDE)	LEFT	5'-0"	5"	101
A5 (TN SIDE)	RIGHT	5'-0"	5"	101
A4 (TN SIDE)	LEFT	2'-6"	6"	53
A3 (TN SIDE)	LEFT	4'-0"	5"	81
** (AR SIDE)	RIGHT	4'-6"	10"	118
** (TN SIDE)	RIGHT	3'-0"	8"	71
			TOTAL	1,198

NOTE: LOCATIONS MAY INCREASE OR DECREASE.

PROCEDURE

1. REMOVE RIVETS AT BEARING.
2. SUPPORT W18X50 STRINGER.
3. REMOVE PORTION OF WEB AND LOWER FLANGE SHOWN IN TABLE OR AS DIRECTED BY THE ENGINEER.
4. CLEAN ANY CORROSION OFF REMAINING SURFACES.
5. INSTALL REPLACEMENT SECTION USING FULL PENETRATION WELDS.
6. INSTALL 7/8" DIA. A325 BOLTS TO REPLACE RIVETS.
7. NEW SECTION SHALL BE SHOP PAINTED, AND WELD AREAS AND SURROUNDING DISTURBED AREAS SHALL BE CLEANED AND SPOT PAINTED IN ACCORDANCE WITH NOTES ON DWG. NO. BR-24-35.



NOTES:

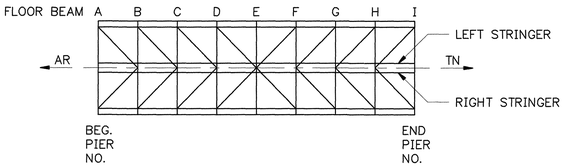
1. RUN-OFF TABS SHALL BE REQUIRED AT ENDS OF FLANGE WELDS.
2. ALL WELDS SHALL HAVE RADIOGRAPHIC TESTING.
3. ALL WELDING TO BE PERFORMED BY AWS CERTIFIED WELDERS.

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND HOLE SPACING. SHOP DRAWINGS SHALL BE SUBMITTED AND APPROVED BEFORE FABRICATION.
2. FOR ADDITIONAL STRUCTURAL DETAILS, SEE REF. DWG. NO. 4, CONTRACT NO. 4. EXACT CONFIGURATION MAY VARY.
3. COST OF REMOVAL AND REPLACEMENT OF W18X50 BEAM ENDS INCLUDING WELDING, STRUCTURAL STEEL, CLEANING AND PAINTING, JACKING, SUPPORTS, AND ALL LABOR AND MISCELLANEOUS MATERIAL NEEDED TO COMPLETE THE REPAIRS TO BE INCLUDED IN ITEM NO. 602-10.32, STRUCTURAL STEEL (REPAIRS), LB.

W18X50 BEAM END REPAIR

SCALE: ¾" = 1'-0"

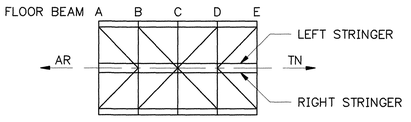


DECK TRUSS KEY PLAN

(BETWEEN BENT A2 AND PIER VII)

NOTE:

SEE DWG. NO. BR-24-34 FOR LOCATIONS OF BENTS AND PIERS



DECK GIRDER KEY PLAN

(BETWEEN BENTS A10 AND A2)

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BRIDGE REPAIR DETAILS

INTERSTATE 55
OVER MISSISSIPPI RIVER
BRIDGE NO. 79-I55-12.00
SHELBY COUNTY

1996

TERRY L. JOHNSON REGISTERED ENGINEER AGRICULTURE No. 23... STATE OF TENNESSEE 5/3/96

DESIGNED BY N. TINER DATE APRIL 1996
DRAWN BY N. TINER DATE APRIL 1996
SUPERVISED BY T. JOHNSON DATE APRIL 1996
CHECKED BY T. JOHNSON DATE APRIL 1996

** LOCATION OF THE REPAIR IS BETWEEN BENT A1 AND PIER VII AT FLOOR BEAM E.

B-11
BR-24-44

User/NDT 155-13 93943 5/2/96 2 1=1 10:36 a.m.

Targeted Approach for Crossing the Mississippi River Interstate 55 (US 64) (SR 61)

Benefit-Cost Analysis Technical Memorandum

March 2023

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1. INTRODUCTION

The Tennessee Department of Transportation (TDOT), in coordination with the Arkansas Department of Transportation (ARDOT), has requested that Kimley-Horn and Associates, Inc. (Consultant) assist in the preparation of a Targeted Approach for Crossing the Mississippi River study for Interstate 55 (I-55) / US Highway 64 (US-64) / State Route (SR 61), in Shelby County, Tennessee.

The purpose of this study is to update the environmental screening, conduct traffic analysis, and develop cost estimates for the four design options included in the Southern Gateway Study Cost Benefit Analysis (2014), as well as information contained in the Mississippi River Crossing Feasibility and Location Study (2006).

As part of this effort, Kimley-Horn conducted a Benefit-Cost Analysis (BCA) for the project. This BCA evaluates four build alternatives and a no-build alternative. The benefit-cost analysis was conducted in accordance with the US Department of Transportation (USDOT) "Benefit-Cost Analysis Guidance for Discretionary Grant Programs", January 2023.

Section 2 of this report documents the methodological framework used in the BCA. Section 3 provides an overview of the project, including the no-build and build discussions. Specific data elements and assumptions pertaining to the long-term benefit estimates are presented in Section 4. Project cost estimates are discussed in Section 5. Estimates of the project's Net Present Value (NPV), its Benefit-Cost ratio (BCR), and other project evaluation metrics are reported in Section 6. Section 7 provides the outcomes of the sensitivity analysis. Additional data tables are provided in Section 8, which includes annual estimates of benefits and costs.

2. METHODOLOGY

The Benefit-Cost Analysis (BCA) conducted for this project includes the monetized benefits and costs measured using USDOT guidance for the project study area, as well as the quantitative merits of the project. A BCA provides estimates of the anticipated benefits that are expected to accrue from a project over a specified period and compares them to the anticipated costs of the project. Costs include both the resources required to develop the project and the costs of maintaining the new or improved asset over time. Estimated benefits are based on the projected impacts of the project on both users and non-users of the facility, valued in monetary terms.

The BCA provides a useful benchmark to evaluate and compare potential transportation investments. The project specific methodology was developed using the BCA guidance from USDOT and is consistent with the discretionary grant program guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the build and no-build scenarios;
- Measuring benefits in dollar terms and expressing benefits and costs in a common unit of measurement;
- Using DOT guidance for the valuation of travel time savings, safety benefits and reductions in air emissions;
- Discounting future benefits and costs with the real discount rates recommended by the DOT; and
- Conducting a sensitivity analysis to assess the impacts of changes in key estimating assumptions.

2.1. Analysis Period

The BCA analysis was completed for a 42-year analysis period starting in 2023 and covering the 12-year final design and construction of the project as well as the recommended 30-year operating period of benefits following completion of the project. This analysis period was used to capture the benefits of the project while staying within USDOT guidance. The present value of all benefits and costs was calculated using 2021 dollars.

The analysis uses the following project schedule and construction duration assumptions. Environmental impact evaluation, preliminary engineering, and right-of-way phases will be completed between 2023 and 2029. Construction is scheduled to commence in 2030 and to be completed in 2034. The project will be open for use beginning in 2035. Any temporary net benefits or indirect costs caused by the construction of the project, including jobs created by the construction or travel time delays due to construction, were excluded from the analysis.

3. PROJECT OVERVIEW

Four design options included in the Southern Gateway Study Cost Benefit Analysis (2014) was analyzed in this project:

- Build Alternative 2 (I-40 West Memphis AR to Highway 61 Memphis TN)
- Build Alternative 4 (I-40 West Memphis AR to I-55/South Parkway Memphis TN)
- Build Alternative 5A or 5B (Replacement of the existing I-55 bridge)
- Build Alternative 6 (I-40 West Memphis AR to Highway 51 Memphis TN)

Details related to future year traffic forecasts and analysis are provided in the **Traffic Analysis Memorandum**, January 2023. A brief description of the four build alternatives is provided below. The preliminary alignment of each build alternative is shown in **Figure 1** from a regional perspective. **Figure 2** shows a more detailed view of the alignment and interchange locations of each build alternative.

3.1. Build Alternative 2

The western terminus is I-40, at a new interchange approximately two miles west of the I-40/College Boulevard Interchange in West Memphis, Arkansas. The alignment proceeds generally south for five miles before turning southeast to cross the Mississippi River, entering into Tennessee just south of the Frank C. Pidgeon industrial park. The corridor continues to the east, terminating at US-61 just north of the Tennessee-Mississippi state line.

3.2. Build Alternative 4

The western terminus is I-40, at a new interchange approximately two miles west of the I-40/College Boulevard Interchange in West Memphis, Arkansas. The alignment proceeds generally south for three miles before turning southeast to cross the Mississippi River, entering into Tennessee on President's Island and proceeding north of Harbor Avenue. Past the intersection of Harbor Avenue and Channel Avenue, the corridor crosses over Jack Carley Causeway and ties to the existing I-55 / East Parkway interchange.

3.3. Build Alternative 5A or 5B

For Alternative 5A or 5B, a new bridge will be constructed south of the existing I-55 bridge crossing the Mississippi River. The western terminus is the existing I-55 alignment, just east of Bridgeport Road in Arkansas. The alignment generally parallels the existing I-55 alignment and existing I-55 Mississippi River Bridge. Crossing into Tennessee, the alignment crosses through E.H. Crump Park and ties into existing I-55 just north of the French Fort neighborhood and west of the proposed Crump Interchange which is currently under construction.

3.4. Build Alternative 6

The western terminus is I-40, at a new interchange approximately one-mile east of the existing I-40/I-55 system interchange in West Memphis, Arkansas. The alignment proceeds generally north for two miles before turning to the northeast for five miles to cross the Mississippi River. After entering into Tennessee, the alignment continues in a northeasterly direction for 1.5 miles and then turns to the southeast, terminating at a new interchange with US-51.

Figure 1: Build Alternatives – Regional Perspective

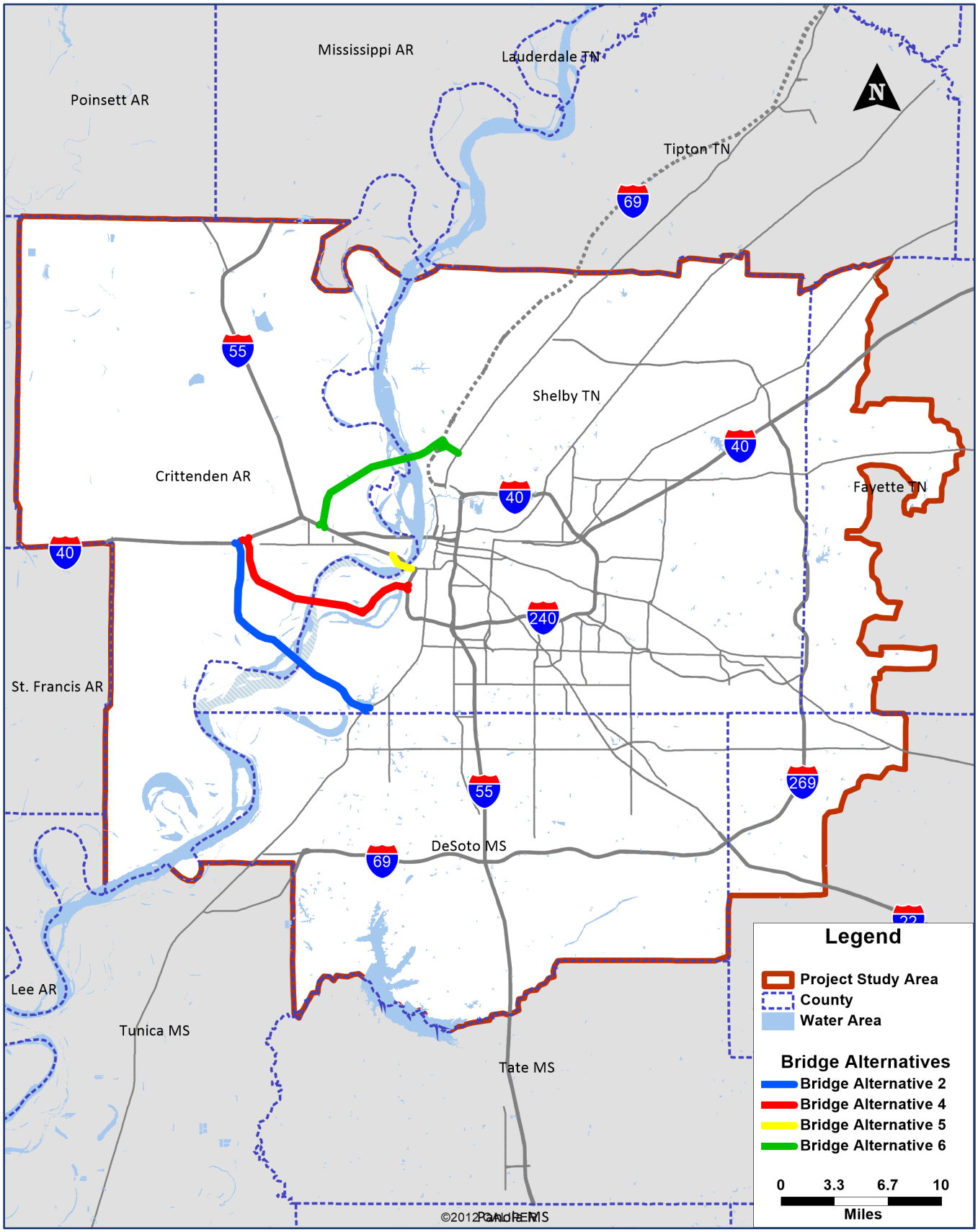
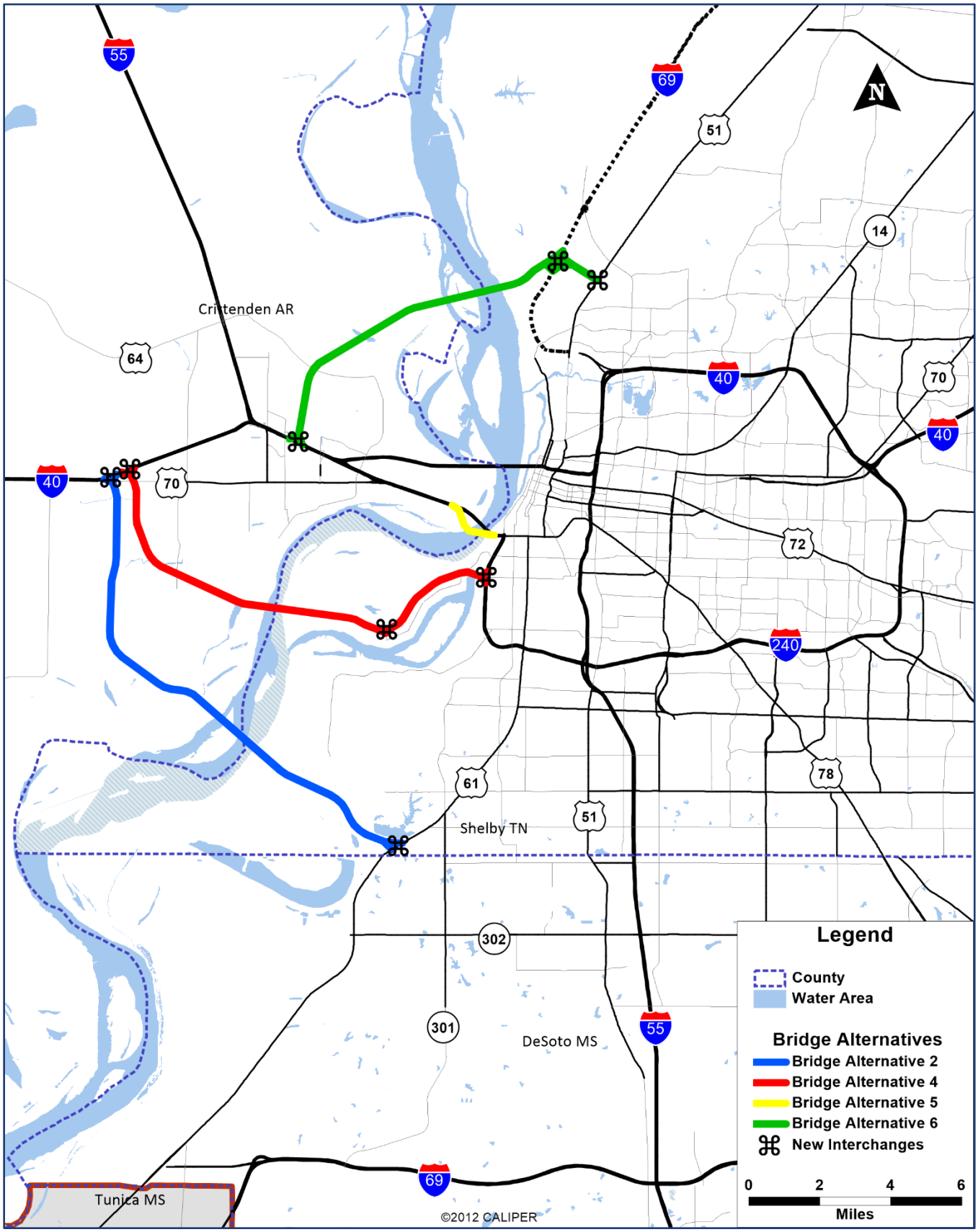


Figure 2: Build Alternatives – Alignment and Interchange Locations



4. BENEFITS MEASUREMENT

This section describes the assumptions used to quantify benefits.

4.1. General Assumptions

The BCA analysis was completed for a 42-year analysis period starting in 2023 and covering the 12-year NEPA, design, and construction of the project as well as the recommended 30-year operating period of benefits following completion of the project. The analysis uses the current project schedule and construction duration assumptions. This assumes construction will commence in 2030 and be completed in 2034, meaning that the project will be open for use beginning in 2035. Any temporary net benefits or indirect costs caused by the construction of the project, including jobs created by the construction or travel time delays due to construction, are assumed to be minimal and were excluded from the analysis.

The BCA analysis makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. The assumptions include:

- Input prices are expressed in 2021 Dollars, based on USDOT **"Benefit-Cost Analysis Guidance for Discretionary Grant Programs"**, January 2023;
- A 7 percent real discount rate is assumed throughout the period of analysis as required by USDOT discretionary grant programs applications; and
- Opening year travel time savings, crash reduction, and travel demand are inputs to the BCA and are assumed to be fully realized in the opening year 2035 (no ramp-up).

Project benefits are calculated in the areas of economic competitiveness, facility and vehicle amenity, environmental sustainability, and safety improvements by comparing the build scenarios to the no-build scenario.

4.2. Project Influence Area

A project influence area is defined to include the area within the regional highway network that potentially has significant impacts by the proposed project. For this BCA, the project influence area is the same as the project study area used in the traffic analysis, as shown in **Figure 1**. The project influence area includes the Memphis Area Metropolitan Planning Organization (MPO)'s planning area and Crittenden County, Arkansas. Project benefits are calculated by travel time savings, crash reduction, and air quality improvements for the project influence area by comparing the build scenarios to the no-build scenario.

4.3. Economic Competitiveness

The project will contribute to enhancing the economic competitiveness through improvements in the mobility of people and goods within and across the study area. In this analysis, three measures of mobility are presented: travel-time savings due to reduction of recurring congestion and non-recurring congestion, and out-of-pocket transportation cost savings.

Travel time savings for travelers are dependent on their value of time (VOT) and the reduction of time spent on traveling (travel time). Once the project is complete, some car and truck drivers will experience a reduction in travel time as a result of less congestion. VOT is then applied to each reduction in travel time to estimate the reduction in travel time costs. The assumptions used in the estimation of travel time savings due to recuring and non-recurring congestion are summarized in **Table 1**.

Table 1: Assumptions used in the Estimation of Travel Time Savings

Variable Name	Unit	Value	Source
Travel Time Cost – Personal Travel (All Purposes)	$ per Hour	$18.80	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
Travel Time Cost – Truck Drivers	Person/ Auto	$32.40	
Average Weekday Auto Occupancy	Person/ Auto	1.53	Memphis MPO 2014 Regional Household Travel Survey
Vehicle Hours Traveled (VHT)	Hours		Memphis MPO Travel Demand Model
Annualization Factor	Number of Weekdays	324	EPA MOVES Air Quality VMT Conversion Template
Real Annual Growth Rate of Value of Time	%	0%	Assumption

To measure travel time saving benefits due to non-recurring congestion caused by traffic incidents, weather, and work zones, delay estimates using year 2019 data from the Regional Integrated Transportation Information System (RITIS) were obtained. For the non-recurring congestion calculation, the following freeway segments that are shared by all four build alternatives were estimated and compared:

- I-40/I-55 shared route in Crittenden County from 7th Street to I-40/55 split
- I-40 from the I-40/55 split in Crittenden County to Riverside Drive in Shelby County
- I-55 from the I-40/55 split in Crittenden County to Crump Boulevard in Shelby County

Travel delays from the 2019 RITIS data and traffic counts were used to estimate total delays in VHT. The VHT was factored based on the 2019 base year estimates from the regional Travel Demand Model (TDM). Future year delays for no-build and build alternatives were estimated using VHT growth forecasts from the TDM. The additional assumptions used in the estimation of travel time savings due to non-recurring congestion are summarized in **Table 2**.

Table 2: Assumptions used in the Estimation of Travel Time Savings (Non-Recurring Congestion)

Variable Name	Unit	Value	Source
Truck % on I-40 / I-55 for Segments Analyzed	%	42%	Traffic counts by TDOT, ARDOT and Kimley-Horn
Ratio of Non-recurring Congestion to Total Congestion	%	39%	RITIS 2019 Data

Out-of-pocket costs are composed of four vehicle operating costs: fuel, oil, tires, maintenance and depreciation. Assumptions used in the estimation of vehicle operating costs are summarized in **Table 3**.

Table 3: Assumptions used in the Estimation of Vehicle Operating Costs

Variable Name	Unit	Value	Source
Light Duty Vehicles	$ per Mile	$0.46	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
Commercial Trucks	$ per Mile	$1.01	
Annualization Factor	Number of Weekdays	342.4	EPA MOVES Air Quality VMT Conversion Template
Vehicle Miles Traveled (VMT)	Miles	Varies by scenario	Memphis MPO Travel Demand Model

Table 4 presents the estimates of travel time savings afforded by the proposed project in the opening year (2035) and over the thirty-year project lifecycle (2035-2064) for the four build alternatives.

Table 4: Estimates of Economic Competitiveness Benefits, in 2021 Dollars

Benefits		In Project Opening Year (2035)		Over Project Lifecycle (2035- 2064)	
		In Constant $	Discounted at 7%	In Constant $	Discounted at 7%
Alternative 2	Recurring Congestion Reduction	$39,791,177	$15,431,704	$2,333,572,006	$336,434,313
	Non-Recurring Congestion Reduction	$19,967,875	$7,743,886	$1,068,537,755	$157,001,277
	Vehicle Operating Cost Savings	($17,136,296)	($6,645,751)	($567,307,986)	($94,381,601)
	Total	$42,622,756	$16,529,840	$2,834,801,775	$399,053,989
Alternative 4	Recurring Congestion Reduction	$20,656,990	$8,011,137	$1,650,637,069	$225,338,297
	Non-Recurring Congestion Reduction	$34,180,670	$13,255,853	$1,750,291,856	$259,657,108
	Vehicle Operating Cost Savings	($25,287,587)	($9,806,962)	($839,644,001)	($139,562,940)
	Total	**$29,550,073**	**$11,460,028**	**$2,561,284,924**	**$345,432,464**
Alternative 5A or 5B	Recurring Congestion Reduction	$7,945,453	$3,081,384	$1,531,595,351	$190,152,571
	Non-Recurring Congestion Reduction	$9,065,958	$3,515,935	$459,790,829	$68,356,954
	Vehicle Operating Cost Savings	($2,935,196)	($1,138,320)	$438,512,130	$45,651,718
	Total	**$14,076,214**	**$5,458,999**	**$2,429,898,311**	**$304,161,243**
Alternative 6	Recurring Congestion Reduction	($1,583,027)	($613,925)	$617,246,084	$68,559,148
	Non-Recurring Congestion Reduction	$8,427,694	$3,268,405	$506,192,996	$72,634,816
	Vehicle Operating Cost Savings	($17,982,038)	($6,973,744)	($651,873,622)	($105,567,507)
	Total	**($11,137,371)**	**($4,319,265)**	**$471,565,458**	**$35,626,457**

The first column of **Table 4** shows the estimated economic competitiveness benefits in 2035 (the project opening year) in constant dollars. The second column shows the estimated opening year benefits in dollars discounted at 7% per year to present value. Similarly, the third column of **Table 4** shows the cumulative benefits from 2035 to 2064 in constant dollars, and the fourth column shows the cumulative benefits discounted at 7% per year to present value.

4.4. Environmental Sustainability

The project could contribute to environmental sustainability in the project influence area through reduced demand on the roadway due to the change in capacity and reduced usage of motorized vehicles in particular – lower VMT will result in lowered emissions. In the BCA, the benefits from reduced emissions of nitrogen oxides (NO_X), sulfur Oxide (SO_X), fine particulate matter ($PM_{2.5}$), and CO_2 values were considered and monetized.

Reductions in emission volumes are derived based upon the reduction in VMT in the project influence area estimated from the Travel Demand Model. Emission rates for Shelby County were obtained from Motor Vehicle Emission Simulator (MOVES) – a tool provided by the U.S. Environmental Protection Agency (EPA). Per-unit emission costs were applied to the emission reduction volumes due to the reduction in VMT caused by the project. The assumptions used in the estimation of environmental sustainability benefits are summarized in **Table 5**.

Table 5: Assumptions used in the Estimation of Emissions Reduction Benefits

Variable Name	Unit	Value	Source
NOx Damage Costs (2033 to 2062)	$ per Metric Ton	18,900	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
SOx Damage Costs (2033 to 2062)	$ per Metric Ton	51,300	
PM 2.5 Damage Costs (2033 to 2062)	$ per Metric Ton	907,600	
CO2 Damage Costs (2035)	$ per Metric Ton	70	
CO2 Damage Costs (2064)	$ per Metric Ton	102	
NOx Emission Rate (Auto)	Kilograms per Million VMT	0.084	EPA Motor Vehicle Emission Simulator (MOVES) model run
SOx Emission Rate (Auto)	Kilograms per Million VMT	0.003	
PM 2.5 Emission Rate (Auto)	Kilograms per Million VMT	0.004	
CO2 Emission Rate (Auto)	Kilograms per Million VMT	392.007	
NOx Emission Rate (Single-unit Truck)	Kilograms per Million VMT	1.443	
SOx Emission Rate (Single-unit Truck)	Kilograms per Million VMT	0.004	
PM 2.5 Emission Rate (Single-unit Truck)	Kilograms per Million VMT	0.017	
CO2 Emission Rate (Single-unit Truck)	Kilograms per Million VMT	1086.720	
NOx Emission Rate (Combination-unit Truck)	Kilograms per Million VMT	3.659	
SOx Emission Rate (Combination-unit Truck)	Kilograms per Million VMT	0.006	
PM 2.5 Emission Rate (Combination-unit Truck)	Kilograms per Million VMT	0.047	
CO2 Emission Rate (Combination-unit Truck)	Kilograms per Million VMT	1686.436	

Table 6 presents the estimates of emission reductions in the opening year (2035) and over the thirty-year project lifecycle (2035-2064) for the four build alternatives.

Table 6: Estimates of Emission Reduction Benefits, in 2021 Dollars

Benefits		In Project Opening Year (2035)		Over Project Lifecycle (2035- 2064)	
		In Constant $	Discounted at 7%	In Constant $	Discounted at 7%
Alternative 2	Emissions Reduction	($1,670,006)	($647,657)	($62,690,048)	($10,052,252)
Alternative 4	Emissions Reduction	($2,543,477)	($986,404)	($98,216,681)	($15,625,842)
Alternative 5A or 5B	Emissions Reduction	($249,188)	($96,639)	$62,233,506	$6,761,291
Alternative 6	Emissions Reduction	($1,689,386)	($655,173)	($67,447,051)	($10,633,910)

4.5. Safety

The project may contribute to promoting US DOT's safety long-term outcome by reducing the VMT through a change in capacity on the roadway and specific roadway safety improvements to be implemented as part of the project.

The approach to estimating the value of safety impacts relies on actual crash data for all existing roadways in the project influence area from the TDOT Tennessee Integrated Traffic Analysis Network (TITAN), Mississippi Department of Transportation Safety Analysis Management System (SAMS), and ARDOT Crash Analysis Tool (ACAT). Tennessee statewide average crash rates in 2019 were used for all proposed new roadways in the project. The reduction in crashes were then monetized using estimates of the economic cost of crashes taken from USDOT's Guidance.

The assumptions used in the estimation of safety benefits are summarized in the **Table 7**.

Table 7: Assumptions used in the Estimation of Safety Benefits

Variable Name	Unit	Value	Source
Vehicle Miles Traveled (VMT)	Hours	Varies by scenario	Memphis MPO Travel Demand Model
Cost per Fatality	$	$13,046,800	US DOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2023
Cost per Injury Crash	$	$307,800	
Cost per Property Damage Only (PDO) – Per Vehicle	$	$4,800	
Average # of Cars per PDO Crash	# of vehicles	1.91	TDOT TITAN Database
Fatal Crash Rate (Rural Freeway Section)	Per 100 million VMT	0.006	TDOT 2019 Statewide Averages
Injury Crash Rate (Rural Freeway Section)	Per 100 million VMT	0.132	
PDO Crash Rate (Rural Freeway Section)	Per 100 million VMT	0.478	
Fatal Crash Rate (Urban Freeway Section)	Per 100 million VMT	0.005	
Injury Crash Rate (Urban Freeway Section)	Per 100 million VMT	0.266	
PDO Crash Rate (Urban Freeway Section)	Per 100 million VMT	0.951	

Crash reduction is the primary monetized benefit in the analysis. **Table 8** presents estimates of safety benefits in the opening year (2035) and over the thirty-year project lifecycle (2035-2064) for the four build alternatives.

Table 8: Estimates of Safety Benefits, in 2021 Dollars

Benefits		In Project Opening Year (2035)		Over Project Lifecycle (2035- 2064)	
		In Constant $	Discounted at 7%	In Constant $	Discounted at 7%
Alternative 2	Safety	$17,253,654	$6,691,265	$1,326,830,989	$182,228,587
Alternative 4	Safety	$15,504,304	$6,012,837	$1,318,258,334	$178,287,606
Alternative 5A or 5B	Safety	($631,108)	($244,754)	$270,913,238	$30,198,517
Alternative 6	Safety	($4,858,098)	($1,884,054)	($275,375,746)	($39,975,485)

5. ESTIMATED COSTS

This section describes the estimated capital costs, operating and maintenance costs, and the residual value at the end of the 30-year project lifecycle for the four build alternatives.

5.1. Capital Costs

Cost estimates for each of the build alternatives are summarized in **Table 9**. The cost estimates were developed in 2022 dollars. An annual discount rate of 7% was used to convert the cost estimates to 2021 dollars.

Table 9: Planning Level Cost Estimates

Item	Alternative 2	Alternative 4	Alternative 5A	Alternative 5B	Alternative 6
Preliminary Engineering	$1,635,000,000	$1,578,000,000	$530,000,000	$752,000,000	$1,415,000,000
Right-of-Way	$45,900,000	$44,300,000	$15,300,000	$21,700,000	$39,900,000
Utilities	$46,400,000	$41,200,000	$4,860,000	$5,290,000	$34,900,000
Construction Engineering & Inspection	$11,600,000	$17,400,000	$1,230,000	$1,310,000	$9,090,000
Construction	$139,000,000	$134,000,000	$46,200,000	$65,800,000	$121,000,000
Total Cost (2022 $)	$1,392,100,000	$1,341,100,000	$462,410,000	$657,900,000	$1,210,110,000
Total Cost (2021 $)	**$1,635,000,000**	**$1,578,000,000**	**$530,000,000**	**$752,000,000**	**$1,415,000,000**

Right-of-way and preliminary engineering phases were assumed to begin in 2023 with completion in 2029. The construction phase is assumed to begin in 2030 and complete in 2034. The project will be open for use beginning in 2035.

5.2. Operating and Maintenance Costs

Routine roadway operating and Maintenance (O&M) cost was estimated based on "Estimating Cost Per Lane Mile for Routine Highway Operations and Maintenance", January 2011 by University of Wisconsin and Wisconsin Department of Transportation. Average operating and maintenance cost is $2,035 per lane mile. Zero routine roadway O&M cost is assumed for Alternative 5A and 5B (the I-55 bridge replacement alternative).

For bridge structures, O&M cost of $50,000 per year is assumed for the proposed new bridge for all build alternatives. For Alternative 2, 4, and 6, the existing I-55 bridge will be maintained with a 1.04 million cost per year. In addition, the existing I-55 bridge requires repainting every 30 years with a 50 million repainting cost assumed in 2054. For Alternative 5, the existing I-55 bridge will be removed with a one-time 11 million demolition cost assumed in 2036. In addition,

O&M cost estimates for each of the build alternatives are summarized in **Table 10**.

Table 10: Operating and Maintenance Cost Estimates

Item	Alternative 2	Alternative 4	Alternative 5A	Alternative 5B	Alternative 6
Miles	14.66	13.01	1.53	1.67	11.01
Lane Miles	87.96	78.06	9.18	10.02	66.06
Roadway O&M Cost ($2021)	$178,994	$158,848	$0	$0	$134,429
New Bridge Structure O&M Cost ($2021)	$43,672	$43,672	$43,672	$43,672	$43,672
Existing I-55 Bridge Structure O&M Cost ($2021)	$909,832	$909,832	$0	$0	$909,832
Total O&M Cost per Year ($2021)	**$1,132,498**	**$1,112,352**	**$62,353**	**$64,062**	**$1,087,933**
One-time Old I-55 Bridge Structure Demolition Cost ($2021)	$0	$0	$9,526,254	$9,526,254	$0
Existing I-55 Bridge Structure Repainting Cost per 30-years ($2021)	$43,710,783	$43,710,783	$0	$0	$43,710,783

5.3. Residual Value

Bridges and structures have service lives beyond the 30-year analysis period, so the residual capital value was calculated for each of the Build alternatives. This residual value is applied as a benefit in the BCA. A 70-year design life was assumed for bridge and structures item. All other construction cost and soft cost were assumed as no residual value. The residual value was assumed as a benefit at the end of the analysis period in year 2062. **Table 11** shows the estimates in residual values.

Table 11: Residual Value

Item	Alternative 2	Alternative 4	Alternative 5A	Alternative 5B	Alternative 6
Cost items assumed no residual value (2022 $)	$742,000,000	$754,700,000	$171,120,000	$234,120,000	$663,400,000
Cost items assumed 70 year service life (2022 $)	$893,000,000	$823,300,000	$358,880,000	$517,880,000	$751,600,000
Residual ratio at end of analysis (linear depreciation)	57.1%	57.1%	57.1%	57.1%	57.1%
Residual Value at end of analysis (2022 $)	$510,285,714	$470,457,143	$205,074,286	$295,931,429	$429,485,714
Residual Value at end of analysis (7% discounted to 2021 $)	$476,902,537	$439,679,573	$191,658,211	$276,571,429	$401,388,518

Table 12 presents estimates of project costs and residual value.

Table 12: Estimates of Costs and Residual Value, in 2021 Dollars

Benefits		In Project Opening Year (2035)		Over Project Lifecycle (2035- 2064)	
		In Constant $	Discounted at 7%	In Constant $	Discounted at 7%
Alternative 2	Total Cost	$1,529,169,881	$750,184,914	$1,605,723,114	$760,703,813
	Residual Value (2062)			$476,902,537	$25,997,237
Alternative 4	Total Cost	$1,475,878,707	$723,220,625	$1,551,847,706	$733,635,785
	Residual Value (2062)			$439,679,573	$23,968,113
Alternative 5A	Total Cost	$504,897,029	$240,969,454	$506,163,515	$244,888,780
	Residual Value (2062)			$191,658,211	$10,447,803
Alternative 5B	Total Cost	$712,373,664	$341,538,315	$713,640,150	$345,457,641
	Residual Value (2062)			$276,571,429	$15,076,651
Alternative 6	Total Cost	$1,323,517,839	$648,092,332	$1,355,067,892	$653,694,436
	Residual Value (2062)			$401,388,518	$21,880,765

6. SUMMARY OF FINDINGS AND BCA OUTCOMES

Table 13 summarizes the BCA findings. Annual costs and benefits were computed over the lifecycle of the project (30 years). Construction is expected to be completed by 2034. Benefits accrue during the operation of the proposed project, beginning in 2035.

Table 13: Overall Results of the Benefit-Cost Analysis, in 2021 Dollars

Build Alternative		Total Benefits	Total Costs	Net Present Value	Internal Rate of Return	Benefit / Cost Ratio
Alternative 2	Cumulative Total	$4,575,845,253	$1,533,407,213	-	-	-
	Discounted at 7%	$597,227,561	$760,703,813	($163,476,252)	**6%**	**0.79**
Alternative 4	Cumulative Total	$4,221,006,149	$1,479,531,805	-	-	-
	Discounted at 7%	$532,062,341	$733,635,785	($201,573,444)	**5%**	**0.73**
Alternative 5A	Cumulative Total	$2,954,703,266	$495,327,103	-	-	-
	Discounted at 7%	$351,568,854	$244,888,780	$106,680,074	**9%**	**1.44**
Alternative 5B	Cumulative Total	$3,039,616,484	$702,803,738	-	-	-
	Discounted at 7%	$356,197,701	$345,457,641	$10,740,061	**7%**	**1.03**
Alternative 6	Cumulative Total	$530,131,178	$1,326,462,774	-	-	-
	Discounted at 7%	$6,897,827	$653,694,436	($646,796,609)	**-3%**	**0.01**

Considering all monetized benefits and costs, bridge replacement alternative 5A has the highest benefit cost ratio of 1.44. The estimated internal rate of return of Build Alternative 5A is nine percent. With a seven percent real discount rate, the $3 billion investment would result in $107 million in Net Present Value. Build Alternative 5A and 5B are bridge replacement alternatives that do not provide an alternative bridge crossing the Mississippi River in the region.

Among build Alternatives 2, 4, and 6 that provide a third bridge crossing the river, Alternative 2 has the highest benefit cost ratio of 0.79. Alternative 4 is the second highest with a 0.73 benefit cost ratio. Alternative 6 has a negative internal rate of return. **Table 14** summarizes the benefit estimates for each build alternative.

Table 14: Benefit Estimates by Long-Term Outcome (Discounted at 7%)

Long-Term Outcomes	Benefit or Impact Categories	Alternative 2	Alternative 4	Alternative 5A	Alternative 5B	Alternative 6
Safety	Accident reduction	$182,228,587	$178,287,606	$30,198,517	$30,198,517	($39,975,485)
Economic Competitiveness	Travel time savings (Recurring Congestion)	$336,434,313	$225,338,297	$190,152,571	$190,152,571	$68,559,148
	Travel time savings (Non-recurring Congestion)	$157,001,277	$259,657,108	$68,356,954	$68,356,954	$72,634,816
	Vehicle operating cost savings	($94,381,601)	($139,562,940)	$45,651,718	$45,651,718	($105,567,507)
Environmental Sustainability	Emissions reductions	($10,052,252)	($15,625,842)	$6,761,291	$6,761,291	($10,633,910)
Residual Value		$25,997,237	$23,968,113	$10,447,803	$15,076,651	$21,880,765

7. BCA SENSITIVITY ANALYSIS

The BCA outcomes presented in the previous sections rely on assumptions and long-term projections; both of which are subject to uncertainty. The primary purpose of the sensitivity analysis is to help identify the variables and model parameters whose variations have the greatest impact on the BCA outcomes: the "critical variables." The sensitivity analysis can also be used to:

- Evaluate the impact of changes in individual critical variables – how much the final results would vary with reasonable departures from the "preferred" or most likely value for the variable; and
- Assess the robustness of the BCA and evaluate whether the conclusions reached under the "preferred" set of input values are significantly altered by reasonable departures from those values.

The outcomes of the quantitative analysis for the project build alternatives using a seven percent discount rate are summarized in the table below. **Table 15** provides the percentage changes in project NPV associated with variations in variables or parameters (listed in row), as indicated in the column headers.

Table 15: Summary of Quantitative Assessment of Sensitivity

Alternatives		Value of Time		Value of Statistical Life		Capital Cost Estimate	
		- 25%	+ 25%	- 25%	+ 25%	- 25%	+ 25%
Alt 2	New NPV	($286,835,149)	($40,117,354)	($209,033,398)	($117,919,105)	$24,069,977	($351,022,480)
	NPV +/- %	-75%	75%	-28%	28%	115%	-115%
	New B/C	0.62	0.95	0.73	0.84	1.04	0.63
Alt 4	New NPV	($322,822,295)	($80,324,593)	($246,145,345)	($157,001,542)	($20,768,288)	($382,378,600)
	NPV +/- %	-60%	60%	-22%	22%	90%	-90%
	New B/C	0.56	0.89	0.66	0.79	0.96	0.58
Alt 5A	New NPV	$42,052,693	$171,307,455	$99,130,445	$114,229,703	$166,922,437	$46,437,710
	NPV +/- %	-61%	61%	-7%	7%	56%	-56%
	New B/C	1.17	1.7	1.4	1.47	1.9	1.15
Alt 5B	New NPV	($53,887,321)	$75,367,442	$3,190,431	$18,289,690	$96,124,639	**($74,644,518)**
	NPV +/- %	-602%	602%	-70%	70%	795%	-795%
	New B/C	0.84	1.22	1.01	1.05	1.37	0.83
Alt 6	New NPV	($682,095,100)	($611,498,118)	($636,802,737)	($656,790,480)	($484,773,526)	($808,819,692)
	NPV +/- %	-5%	5%	2%	-2%	25%	-25%
	New B/C	-0.04	0.06	0.03	0	0.01	0.01

The above sensitivity results show that the rankings of build alternatives are economically robust even with fairly significant variances to the model assumptions.

8. AGGREGATE ANNUAL BENEFITS AND COSTS

Table 16 through **20** show all benefits associated with the three long-term outcome criteria (Economic Completeness, Environmental Sustainability, and Safety) in annual form for each project alternative respectively.

Table 16: Annual Summary of Benefits and Cost with Net Benefits – Build Alternative 2

Alternative 2													
Project Year	Calendar Year	Project Benefits ($ 2021)							Project Costs ($ 2021)			Net Project Costs and Benefits	Discounted Benefits @ 7%
		Travel Time Savings	Vehicle Operating Savings	Non-Recurring Congestion	Safety Benefits	Air Quality Benefits	Residual Value	Total Benefits	Construction Costs	Operating & Maitenance Cost	Total Cost		
1	2023	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($10,763,471)
2	2024	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($10,059,318)
3	2025	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($9,401,232)
4	2026	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($8,786,198)
5	2027	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($8,211,400)
6	2028	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($7,674,206)
7	2029	$0	$0	$0	$0	$0	$0	$0	$12,323,097	$0	$12,323,097	($12,323,097)	($7,172,155)
8	2030	$0	$0	$0	$0	$0	$0	$0	$288,355,140	$0	$288,355,140	($288,355,140)	($156,846,091)
9	2031	$0	$0	$0	$0	$0	$0	$0	$288,355,140	$0	$288,355,140	($288,355,140)	($146,585,131)
10	2032	$0	$0	$0	$0	$0	$0	$0	$288,355,140	$0	$288,355,140	($288,355,140)	($136,995,450)
11	2033	$0	$0	$0	$0	$0	$0	$0	$288,355,140	$0	$288,355,140	($288,355,140)	($128,033,131)
12	2034	$0	$0	$0	$0	$0	$0	$0	$288,355,140	$0	$288,355,140	($288,355,140)	($119,657,132)
13	2035	$39,791,177	($17,136,296)	$19,967,875	$17,253,654	($1,670,006)	$0	$58,206,404	$0	$1,132,498	$1,132,498	$57,073,906	$22,134,245
14	2036	$42,411,491	($17,258,638)	$21,047,189	$19,113,933	($1,698,949)	$0	$63,615,026	$0	$1,132,498	$1,132,498	$62,482,528	$22,646,544
15	2037	$45,031,805	($17,380,981)	$22,126,502	$20,974,212	($1,727,891)	$0	$69,023,648	$0	$1,132,498	$1,132,498	$67,891,150	$22,997,081
16	2038	$47,652,120	($17,503,324)	$23,205,816	$22,834,491	($1,756,833)	$0	$74,432,270	$0	$1,132,498	$1,132,498	$73,299,772	$23,204,831
17	2039	$50,272,434	($17,625,667)	$24,285,130	$24,694,770	($1,785,775)	$0	$79,840,892	$0	$1,132,498	$1,132,498	$78,708,394	$23,286,974
18	2040	$52,892,748	($17,748,010)	$25,364,444	$26,555,049	($1,814,717)	$0	$85,249,514	$0	$1,132,498	$1,132,498	$84,117,016	$23,259,056
19	2041	$55,513,062	($17,870,352)	$26,443,758	$28,415,328	($1,843,660)	$0	$90,658,137	$0	$1,132,498	$1,132,498	$89,525,638	$23,135,126
20	2042	$58,133,377	($17,992,695)	$27,523,072	$30,275,607	($1,872,602)	$0	$96,066,759	$0	$1,132,498	$1,132,498	$94,934,260	$22,927,866
21	2043	$60,753,691	($18,115,038)	$28,602,385	$32,135,886	($1,901,544)	$0	$101,475,381	$0	$1,132,498	$1,132,498	$100,342,882	$22,648,710
22	2044	$63,374,005	($18,237,381)	$29,681,699	$33,996,165	($1,930,486)	$0	$106,884,003	$0	$1,132,498	$1,132,498	$105,751,504	$22,307,950
23	2045	$65,994,319	($18,359,724)	$30,761,013	$35,856,444	($1,959,428)	$0	$112,292,625	$0	$1,132,498	$1,132,498	$111,160,126	$21,914,843
24	2046	$68,614,634	($18,482,066)	$31,840,327	$37,716,723	($1,988,371)	$0	$117,701,247	$0	$1,132,498	$1,132,498	$116,568,748	$21,477,696
25	2047	$71,234,948	($18,604,409)	$32,919,641	$39,577,002	($2,017,313)	$0	$123,109,869	$0	$1,132,498	$1,132,498	$121,977,370	$21,003,953
26	2048	$73,855,262	($18,726,752)	$33,998,954	$41,437,281	($2,046,255)	$0	$128,518,491	$0	$1,132,498	$1,132,498	$127,385,993	$20,500,275
27	2049	$76,475,576	($18,849,095)	$35,078,268	$43,297,560	($2,075,197)	$0	$133,927,113	$0	$1,132,498	$1,132,498	$132,794,615	$19,972,604
28	2050	$79,095,891	($18,971,438)	$36,157,582	$45,157,839	($2,104,139)	$0	$139,335,735	$0	$1,132,498	$1,132,498	$138,203,237	$19,426,236
29	2051	$81,716,205	($19,093,780)	$37,236,896	$47,018,118	($2,133,082)	$0	$144,744,357	$0	$1,132,498	$1,132,498	$143,611,859	$18,865,876
30	2052	$84,336,519	($19,216,123)	$38,316,210	$48,878,397	($2,162,024)	$0	$150,152,979	$0	$1,132,498	$1,132,498	$149,020,481	$18,295,692
31	2053	$86,956,833	($19,338,466)	$39,395,524	$50,738,676	($2,190,966)	$0	$155,561,601	$0	$1,132,498	$1,132,498	$154,429,103	$17,719,369
32	2054	$89,577,148	($19,460,809)	$40,474,837	$52,598,955	($2,219,908)	$0	$160,970,223	$0	$44,843,281	$44,843,281	$116,126,942	$12,452,838
33	2055	$92,197,462	($19,583,152)	$41,554,151	$54,459,234	($2,248,850)	$0	$166,378,845	$0	$1,132,498	$1,132,498	$165,246,347	$16,560,881
34	2056	$94,817,776	($19,705,494)	$42,633,465	$56,319,513	($2,277,793)	$0	$171,787,467	$0	$1,132,498	$1,132,498	$170,654,969	$15,984,046
35	2057	$97,438,090	($19,827,837)	$43,712,779	$58,179,792	($2,306,735)	$0	$177,196,089	$0	$1,132,498	$1,132,498	$176,063,591	$15,411,807
36	2058	$100,058,405	($19,950,180)	$44,792,093	$60,040,071	($2,335,677)	$0	$182,604,711	$0	$1,132,498	$1,132,498	$181,472,213	$14,846,031
37	2059	$102,678,719	($20,072,523)	$45,871,406	$61,900,350	($2,364,619)	$0	$188,013,333	$0	$1,132,498	$1,132,498	$186,880,835	$14,288,322
38	2060	$105,299,033	($20,194,866)	$46,950,720	$63,760,629	($2,393,561)	$0	$193,421,955	$0	$1,132,498	$1,132,498	$192,289,457	$13,740,045
39	2061	$107,919,347	($20,317,208)	$48,030,034	$65,620,908	($2,422,504)	$0	$198,830,577	$0	$1,132,498	$1,132,498	$197,698,079	$13,202,353
40	2062	$110,539,662	($20,439,551)	$49,109,348	$67,481,187	($2,451,446)	$0	$204,239,199	$0	$1,132,498	$1,132,498	$203,106,701	$12,676,208
41	2063	$113,159,976	($20,561,894)	$50,188,662	$69,341,466	($2,480,388)	$0	$209,647,821	$0	$1,132,498	$1,132,498	$208,515,323	$12,162,401
42	2064	$115,780,290	($20,684,237)	$51,267,975	$71,201,745	($2,509,330)	$476,902,537	$691,958,980	$0	$1,132,498	$1,132,498	$690,826,482	$37,658,805
Cumulative Total		$2,333,572,006	($567,307,986)	$1,068,537,755	$1,326,830,989	($62,690,048)	$476,902,537	$4,575,845,253	$1,528,037,383	$77,685,731	$1,605,723,114	$2,970,122,139	($163,476,252)
Present Value		$336,434,313	($94,381,601)	$157,001,277	$182,228,587	($10,052,252)	$25,997,237	$597,227,561	$750,184,914	$10,518,898	$760,703,813	($163,476,252)	

Table 17: Annual Summary of Benefits and Cost with Net Benefits – Build Alternative 4

Alternative 4													
Project Year	Calendar Year	Project Benefits ($ 2021)							Project Costs ($ 2021)			Net Project Costs and Benefits	Discounted Benefits @ 7%
		Travel Time Savings	Vehicle Operating Savings	Non-Recurring Congestion	Safety Benefits	Air Quality Benefits	Residual Value	Total Benefits	Construction Costs	Operating & Maitenance Cost	Total Cost		
1	2023	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($9,970,495)
2	2024	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($9,318,220)
3	2025	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($8,708,617)
4	2026	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($8,138,894)
5	2027	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($7,606,443)
6	2028	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($7,108,825)
7	2029	$0	$0	$0	$0	$0	$0	$0	$11,415,220	$0	$11,415,220	($11,415,220)	($6,643,762)
8	2030	$0	$0	$0	$0	$0	$0	$0	$278,971,963	$0	$278,971,963	($278,971,963)	($151,742,264)
9	2031	$0	$0	$0	$0	$0	$0	$0	$278,971,963	$0	$278,971,963	($278,971,963)	($141,815,200)
10	2032	$0	$0	$0	$0	$0	$0	$0	$278,971,963	$0	$278,971,963	($278,971,963)	($132,537,570)
11	2033	$0	$0	$0	$0	$0	$0	$0	$278,971,963	$0	$278,971,963	($278,971,963)	($123,866,888)
12	2034	$0	$0	$0	$0	$0	$0	$0	$278,971,963	$0	$278,971,963	($278,971,963)	($115,763,446)
13	2035	$20,656,990	($25,287,587)	$34,180,670	$15,504,304	($2,543,477)	$0	$42,510,900	$0	$1,112,352	$1,112,352	$41,398,548	$16,055,071
14	2036	$23,026,938	($25,473,831)	$35,847,042	$17,465,521	($2,593,850)	$0	$48,271,819	$0	$1,112,352	$1,112,352	$47,159,466	$17,092,761
15	2037	$25,396,886	($25,660,076)	$37,513,413	$19,426,738	($2,644,224)	$0	$54,032,737	$0	$1,112,352	$1,112,352	$52,920,385	$17,925,965
16	2038	$27,766,834	($25,846,321)	$39,179,785	$21,387,954	($2,694,597)	$0	$59,793,656	$0	$1,112,352	$1,112,352	$58,681,304	$18,576,998
17	2039	$30,136,782	($26,032,565)	$40,846,157	$23,349,171	($2,744,970)	$0	$65,554,574	$0	$1,112,352	$1,112,352	$64,442,222	$19,066,128
18	2040	$32,506,730	($26,218,810)	$42,512,529	$25,310,387	($2,795,343)	$0	$71,315,493	$0	$1,112,352	$1,112,352	$70,203,141	$19,411,753
19	2041	$34,876,678	($26,405,054)	$44,178,901	$27,271,604	($2,845,717)	$0	$77,076,411	$0	$1,112,352	$1,112,352	$75,964,059	$19,630,556
20	2042	$37,246,626	($26,591,299)	$45,845,273	$29,232,820	($2,896,090)	$0	$82,837,330	$0	$1,112,352	$1,112,352	$81,724,978	$19,737,652
21	2043	$39,616,574	($26,777,543)	$47,511,645	$31,194,037	($2,946,463)	$0	$88,598,249	$0	$1,112,352	$1,112,352	$87,485,896	$19,746,719
22	2044	$41,986,522	($26,963,788)	$49,178,017	$33,155,253	($2,996,836)	$0	$94,359,167	$0	$1,112,352	$1,112,352	$93,246,815	$19,670,125
23	2045	$44,356,470	($27,150,033)	$50,844,388	$35,116,470	($3,047,210)	$0	$100,120,086	$0	$1,112,352	$1,112,352	$99,007,733	$19,519,040
24	2046	$46,726,418	($27,336,277)	$52,510,760	$37,077,687	($3,097,583)	$0	$105,881,004	$0	$1,112,352	$1,112,352	$104,768,652	$19,303,538
25	2047	$49,096,366	($27,522,522)	$54,177,132	$39,038,903	($3,147,956)	$0	$111,641,923	$0	$1,112,352	$1,112,352	$110,529,571	$19,032,694
26	2048	$51,466,314	($27,708,766)	$55,843,504	$41,000,120	($3,198,329)	$0	$117,402,841	$0	$1,112,352	$1,112,352	$116,290,489	$18,714,671
27	2049	$53,836,262	($27,895,011)	$57,509,876	$42,961,336	($3,248,703)	$0	$123,163,760	$0	$1,112,352	$1,112,352	$122,051,408	$18,356,802
28	2050	$56,206,210	($28,081,256)	$59,176,248	$44,922,553	($3,299,076)	$0	$128,924,679	$0	$1,112,352	$1,112,352	$127,812,326	$17,965,660
29	2051	$58,576,158	($28,267,500)	$60,842,620	$46,883,769	($3,349,449)	$0	$134,685,597	$0	$1,112,352	$1,112,352	$133,573,245	$17,547,132
30	2052	$60,946,106	($28,453,745)	$62,508,992	$48,844,986	($3,399,823)	$0	$140,446,516	$0	$1,112,352	$1,112,352	$139,334,163	$17,106,474
31	2053	$63,316,054	($28,639,989)	$64,175,363	$50,806,202	($3,450,196)	$0	$146,207,434	$0	$1,112,352	$1,112,352	$145,095,082	$16,648,373
32	2054	$65,686,002	($28,826,234)	$65,841,735	$52,767,419	($3,500,569)	$0	$151,968,353	$0	$44,823,135	$44,823,135	$107,145,218	$11,489,685
33	2055	$68,055,950	($29,012,479)	$67,508,107	$54,728,635	($3,550,942)	$0	$157,729,271	$0	$1,112,352	$1,112,352	$156,616,919	$15,696,045
34	2056	$70,425,898	($29,198,723)	$69,174,479	$56,689,852	($3,601,316)	$0	$163,490,190	$0	$1,112,352	$1,112,352	$162,377,838	$15,208,785
35	2057	$72,795,846	($29,384,968)	$70,840,851	$58,651,069	($3,651,689)	$0	$169,251,108	$0	$1,112,352	$1,112,352	$168,138,756	$14,718,103
36	2058	$75,165,794	($29,571,212)	$72,507,223	$60,612,285	($3,702,062)	$0	$175,012,027	$0	$1,112,352	$1,112,352	$173,899,675	$14,226,530
37	2059	$77,535,742	($29,757,457)	$74,173,595	$62,573,502	($3,752,435)	$0	$180,772,946	$0	$1,112,352	$1,112,352	$179,660,593	$13,736,285
38	2060	$79,905,690	($29,943,702)	$75,839,967	$64,534,718	($3,802,809)	$0	$186,533,864	$0	$1,112,352	$1,112,352	$185,421,512	$13,249,296
39	2061	$82,275,638	($30,129,946)	$77,506,338	$66,495,935	($3,853,182)	$0	$192,294,783	$0	$1,112,352	$1,112,352	$191,182,430	$12,767,236
40	2062	$84,645,586	($30,316,191)	$79,172,710	$68,457,151	($3,903,555)	$0	$198,055,701	$0	$1,112,352	$1,112,352	$196,943,349	$12,291,544
41	2063	$87,015,534	($30,502,435)	$80,839,082	$70,418,368	($3,953,928)	$0	$203,816,620	$0	$1,112,352	$1,112,352	$202,704,268	$11,823,450
42	2064	$89,385,482	($30,688,680)	$82,505,454	$72,379,584	($4,004,302)	$439,679,573	$649,257,111	$0	$1,112,352	$1,112,352	$648,144,759	$35,332,110
Cumulative Total		$1,650,637,069	($839,644,001)	$1,750,291,856	$1,318,258,334	($98,216,681)	$439,679,573	$4,221,006,149	$1,474,766,355	$77,081,351	$1,551,847,706	$2,669,158,444	($201,573,444)
Present Value		$225,338,297	($139,562,940)	$259,657,108	$178,287,606	($15,625,842)	$23,968,113	$532,062,341	$723,220,625	$10,415,160	$733,635,785	($201,573,444)	

Table 18: Annual Summary of Benefits and Cost with Net Benefits – Build Alternative 5A

Alternative 5A													
Project Year	Calendar Year	Project Benefits ($ 2021)							Project Costs ($ 2021)			Net Project Costs and Benefits	Discounted Benefits @ 7%
		Travel Time Savings	Vehicle Operating Savings	Non-Recurring Congestion	Safety Benefits	Air Quality Benefits	Residual Value	Total Benefits	Construction Costs	Operating & Maitenance Cost	Total Cost		
1	2023	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($2,350,938)
2	2024	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($2,197,138)
3	2025	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($2,053,400)
4	2026	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($1,919,066)
5	2027	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($1,793,519)
6	2028	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($1,676,186)
7	2029	$0	$0	$0	$0	$0	$0	$0	$2,691,589	$0	$2,691,589	($2,691,589)	($1,566,529)
8	2030	$0	$0	$0	$0	$0	$0	$0	$95,297,196	$0	$95,297,196	($95,297,196)	($51,835,361)
9	2031	$0	$0	$0	$0	$0	$0	$0	$95,297,196	$0	$95,297,196	($95,297,196)	($48,444,262)
10	2032	$0	$0	$0	$0	$0	$0	$0	$95,297,196	$0	$95,297,196	($95,297,196)	($45,275,011)
11	2033	$0	$0	$0	$0	$0	$0	$0	$95,297,196	$0	$95,297,196	($95,297,196)	($42,313,095)
12	2034	$0	$0	$0	$0	$0	$0	$0	$95,297,196	$0	$95,297,196	($95,297,196)	($39,544,948)
13	2035	$7,945,453	($2,935,196)	$9,065,958	($631,108)	($249,188)	$0	$13,195,919	$9,526,254	$43,672	$9,569,926	$3,625,993	$1,406,223
14	2036	$10,918,399	($1,724,695)	$9,497,710	$35,206	($88,937)	$0	$18,637,683	$0	$43,672	$43,672	$18,594,011	$6,739,325
15	2037	$13,891,346	($514,194)	$9,929,462	$701,520	$71,314	$0	$24,079,448	$0	$43,672	$43,672	$24,035,776	$8,141,749
16	2038	$16,864,292	$696,307	$10,361,214	$1,367,833	$231,565	$0	$29,521,212	$0	$43,672	$43,672	$29,477,540	$9,331,834
17	2039	$19,837,239	$1,906,808	$10,792,966	$2,034,147	$391,816	$0	$34,962,976	$0	$43,672	$43,672	$34,919,304	$10,331,362
18	2040	$22,810,186	$3,117,310	$11,224,718	$2,700,461	$552,067	$0	$40,404,741	$0	$43,672	$43,672	$40,361,069	$11,160,172
19	2041	$25,783,132	$4,327,811	$11,656,470	$3,366,775	$712,318	$0	$45,846,505	$0	$43,672	$43,672	$45,802,833	$11,836,322
20	2042	$28,756,079	$5,538,312	$12,088,221	$4,033,088	$872,569	$0	$51,288,269	$0	$43,672	$43,672	$51,244,597	$12,376,241
21	2043	$31,729,025	$6,748,813	$12,519,973	$4,699,402	$1,032,819	$0	$56,730,034	$0	$43,672	$43,672	$56,686,362	$12,794,858
22	2044	$34,701,972	$7,959,314	$12,951,725	$5,365,716	$1,193,070	$0	$62,171,798	$0	$43,672	$43,672	$62,128,126	$13,105,735
23	2045	$37,674,919	$9,169,816	$13,383,477	$6,032,030	$1,353,321	$0	$67,613,562	$0	$43,672	$43,672	$67,569,890	$13,321,175
24	2046	$40,647,865	$10,380,317	$13,815,229	$6,698,343	$1,513,572	$0	$73,055,327	$0	$43,672	$43,672	$73,011,655	$13,452,337
25	2047	$43,620,812	$11,590,818	$14,246,981	$7,364,657	$1,673,823	$0	$78,497,091	$0	$43,672	$43,672	$78,453,419	$13,509,325
26	2048	$46,593,758	$12,801,319	$14,678,733	$8,030,971	$1,834,074	$0	$83,938,855	$0	$43,672	$43,672	$83,895,183	$13,501,283
27	2049	$49,566,705	$14,011,820	$15,110,485	$8,697,284	$1,994,325	$0	$89,380,620	$0	$43,672	$43,672	$89,336,948	$13,436,475
28	2050	$52,539,652	$15,222,322	$15,542,237	$9,363,598	$2,154,576	$0	$94,822,384	$0	$43,672	$43,672	$94,778,712	$13,322,363
29	2051	$55,512,598	$16,432,823	$15,973,989	$10,029,912	$2,314,827	$0	$100,264,148	$0	$43,672	$43,672	$100,220,476	$13,165,675
30	2052	$58,485,545	$17,643,324	$16,405,741	$10,696,226	$2,475,077	$0	$105,705,913	$0	$43,672	$43,672	$105,662,241	$12,972,471
31	2053	$61,458,491	$18,853,825	$16,837,493	$11,362,539	$2,635,328	$0	$111,147,677	$0	$43,672	$43,672	$111,104,005	$12,748,199
32	2054	$64,431,438	$20,064,326	$17,269,245	$12,028,853	$2,795,579	$0	$116,589,441	$0	$43,672	$43,672	$116,545,769	$12,497,750
33	2055	$67,404,385	$21,274,828	$17,700,997	$12,695,167	$2,955,830	$0	$122,031,206	$0	$43,672	$43,672	$121,987,534	$12,225,511
34	2056	$70,377,331	$22,485,329	$18,132,749	$13,361,480	$3,116,081	$0	$127,472,970	$0	$43,672	$43,672	$127,429,298	$11,935,403
35	2057	$73,350,278	$23,695,830	$18,564,500	$14,027,794	$3,276,332	$0	$132,914,734	$0	$43,672	$43,672	$132,871,062	$11,630,929
36	2058	$76,323,225	$24,906,331	$18,996,252	$14,694,108	$3,436,583	$0	$138,356,499	$0	$43,672	$43,672	$138,312,827	$11,315,212
37	2059	$79,296,171	$26,116,832	$19,428,004	$15,360,422	$3,596,834	$0	$143,798,263	$0	$43,672	$43,672	$143,754,591	$10,991,024
38	2060	$82,269,118	$27,327,334	$19,859,756	$16,026,735	$3,757,084	$0	$149,240,027	$0	$43,672	$43,672	$149,196,356	$10,660,827
39	2061	$85,242,064	$28,537,835	$20,291,508	$16,693,049	$3,917,335	$0	$154,681,792	$0	$43,672	$43,672	$154,638,120	$10,326,793
40	2062	$88,215,011	$29,748,336	$20,723,260	$17,359,363	$4,077,586	$0	$160,123,556	$0	$43,672	$43,672	$160,079,884	$9,990,837
41	2063	$91,187,958	$30,958,837	$21,155,012	$18,025,676	$4,237,837	$0	$165,565,320	$0	$43,672	$43,672	$165,521,649	$9,654,641
42	2064	$94,160,904	$32,169,338	$21,586,764	$18,691,990	$4,398,088	$191,658,211	$362,665,296	$0	$43,672	$43,672	$362,621,624	$19,767,478
Cumulative Total		$1,531,595,351	$438,512,130	$459,790,829	$270,913,238	$62,233,506	$191,658,211	$2,954,703,266	$504,853,357	$1,310,158	$506,163,515	$2,448,539,752	$106,680,074
Present Value		$190,152,571	$45,651,718	$68,356,954	$30,198,517	$6,761,291	$10,447,803	$351,568,854	$244,663,900	$224,880	$244,888,780	$106,680,074	

Table 19: Annual Summary of Benefits and Cost with Net Benefits – Build Alternative 5B

Alternative 5B													
Project Year	Calendar Year	Project Benefits ($ 2021)							Project Costs ($ 2021)			Net Project Costs and Benefits	Discounted Benefits @ 7%
		Travel Time Savings	Vehicle Operating Savings	Non-Recurring Congestion	Safety Benefits	Air Quality Benefits	Residual Value	Total Benefits	Construction Costs	Operating & Maitenance Cost	Total Cost		
1	2023	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($3,147,411)
2	2024	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,941,506)
3	2025	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,749,071)
4	2026	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,569,225)
5	2027	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,401,145)
6	2028	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,244,061)
7	2029	$0	$0	$0	$0	$0	$0	$0	$3,603,471	$0	$3,603,471	($3,603,471)	($2,097,253)
8	2030	$0	$0	$0	$0	$0	$0	$0	$135,515,888	$0	$135,515,888	($135,515,888)	($73,711,664)
9	2031	$0	$0	$0	$0	$0	$0	$0	$135,515,888	$0	$135,515,888	($135,515,888)	($68,889,406)
10	2032	$0	$0	$0	$0	$0	$0	$0	$135,515,888	$0	$135,515,888	($135,515,888)	($64,382,622)
11	2033	$0	$0	$0	$0	$0	$0	$0	$135,515,888	$0	$135,515,888	($135,515,888)	($60,170,675)
12	2034	$0	$0	$0	$0	$0	$0	$0	$135,515,888	$0	$135,515,888	($135,515,888)	($56,234,276)
13	2035	$7,945,453	($2,935,196)	$9,065,958	($631,108)	($249,188)	$0	$13,195,919	$9,526,254	$43,672	$9,569,926	$3,625,993	$1,406,223
14	2036	$10,918,399	($1,724,695)	$9,497,710	$35,206	($88,937)	$0	$18,637,683	$0	$43,672	$43,672	$18,594,011	$6,739,325
15	2037	$13,891,346	($514,194)	$9,929,462	$701,520	$71,314	$0	$24,079,448	$0	$43,672	$43,672	$24,035,776	$8,141,749
16	2038	$16,864,292	$696,307	$10,361,214	$1,367,833	$231,565	$0	$29,521,212	$0	$43,672	$43,672	$29,477,540	$9,331,834
17	2039	$19,837,239	$1,906,808	$10,792,966	$2,034,147	$391,816	$0	$34,962,976	$0	$43,672	$43,672	$34,919,304	$10,331,362
18	2040	$22,810,186	$3,117,310	$11,224,718	$2,700,461	$552,067	$0	$40,404,741	$0	$43,672	$43,672	$40,361,069	$11,160,172
19	2041	$25,783,132	$4,327,811	$11,656,470	$3,366,775	$712,318	$0	$45,846,505	$0	$43,672	$43,672	$45,802,833	$11,836,322
20	2042	$28,756,079	$5,538,312	$12,088,221	$4,033,088	$872,569	$0	$51,288,269	$0	$43,672	$43,672	$51,244,597	$12,376,241
21	2043	$31,729,025	$6,748,813	$12,519,973	$4,699,402	$1,032,819	$0	$56,730,034	$0	$43,672	$43,672	$56,686,362	$12,794,858
22	2044	$34,701,972	$7,959,314	$12,951,725	$5,365,716	$1,193,070	$0	$62,171,798	$0	$43,672	$43,672	$62,128,126	$13,105,735
23	2045	$37,674,919	$9,169,816	$13,383,477	$6,032,030	$1,353,321	$0	$67,613,562	$0	$43,672	$43,672	$67,569,890	$13,321,175
24	2046	$40,647,865	$10,380,317	$13,815,229	$6,698,343	$1,513,572	$0	$73,055,327	$0	$43,672	$43,672	$73,011,655	$13,452,337
25	2047	$43,620,812	$11,590,818	$14,246,981	$7,364,657	$1,673,823	$0	$78,497,091	$0	$43,672	$43,672	$78,453,419	$13,509,325
26	2048	$46,593,758	$12,801,319	$14,678,733	$8,030,971	$1,834,074	$0	$83,938,855	$0	$43,672	$43,672	$83,895,183	$13,501,283
27	2049	$49,566,705	$14,011,820	$15,110,485	$8,697,284	$1,994,325	$0	$89,380,620	$0	$43,672	$43,672	$89,336,948	$13,436,475
28	2050	$52,539,652	$15,222,322	$15,542,237	$9,363,598	$2,154,576	$0	$94,822,384	$0	$43,672	$43,672	$94,778,712	$13,322,363
29	2051	$55,512,598	$16,432,823	$15,973,989	$10,029,912	$2,314,827	$0	$100,264,148	$0	$43,672	$43,672	$100,220,476	$13,165,675
30	2052	$58,485,545	$17,643,324	$16,405,741	$10,696,226	$2,475,077	$0	$105,705,913	$0	$43,672	$43,672	$105,662,241	$12,972,471
31	2053	$61,458,491	$18,853,825	$16,837,493	$11,362,539	$2,635,328	$0	$111,147,677	$0	$43,672	$43,672	$111,104,005	$12,748,199
32	2054	$64,431,438	$20,064,326	$17,269,245	$12,028,853	$2,795,579	$0	$116,589,441	$0	$43,672	$43,672	$116,545,769	$12,497,750
33	2055	$67,404,385	$21,274,828	$17,700,997	$12,695,167	$2,955,830	$0	$122,031,206	$0	$43,672	$43,672	$121,987,534	$12,225,511
34	2056	$70,377,331	$22,485,329	$18,132,749	$13,361,480	$3,116,081	$0	$127,472,970	$0	$43,672	$43,672	$127,429,298	$11,935,403
35	2057	$73,350,278	$23,695,830	$18,564,500	$14,027,794	$3,276,332	$0	$132,914,734	$0	$43,672	$43,672	$132,871,062	$11,630,929
36	2058	$76,323,225	$24,906,331	$18,996,252	$14,694,108	$3,436,583	$0	$138,356,499	$0	$43,672	$43,672	$138,312,827	$11,315,212
37	2059	$79,296,171	$26,116,832	$19,428,004	$15,360,422	$3,596,834	$0	$143,798,263	$0	$43,672	$43,672	$143,754,591	$10,991,024
38	2060	$82,269,118	$27,327,334	$19,859,756	$16,026,735	$3,757,084	$0	$149,240,027	$0	$43,672	$43,672	$149,196,356	$10,660,827
39	2061	$85,242,064	$28,537,835	$20,291,508	$16,693,049	$3,917,335	$0	$154,681,792	$0	$43,672	$43,672	$154,638,120	$10,326,793
40	2062	$88,215,011	$29,748,336	$20,723,260	$17,359,363	$4,077,586	$0	$160,123,556	$0	$43,672	$43,672	$160,079,884	$9,990,837
41	2063	$91,187,958	$30,958,837	$21,155,012	$18,025,676	$4,237,837	$0	$165,565,320	$0	$43,672	$43,672	$165,521,649	$9,654,641
42	2064	$94,160,904	$32,169,338	$21,586,764	$18,691,990	$4,398,088	$276,571,429	$447,578,513	$0	$43,672	$43,672	$447,534,841	$24,396,325
Cumulative Total		$1,531,595,351	$438,512,130	$459,790,829	$270,913,238	$62,233,506	$276,571,429	$3,039,616,484	$712,329,992	$1,310,158	$713,640,150	$2,325,976,334	$10,740,061
Present Value		$190,152,571	$45,651,718	$68,356,954	$30,198,517	$6,761,291	$15,076,651	$356,197,701	$345,232,760	$224,880	$345,457,641	$10,740,061	

Table 20: Annual Summary of Benefits and Cost with Net Benefits – Build Alternative 6

Alternative 6													
Project Year	Calendar Year	Project Benefits ($ 2021)							Project Costs ($ 2021)			Net Project Costs and Benefits	Discounted Benefits @ 7%
		Travel Time Savings	Vehicle Operating Savings	Non-Recurring Congestion	Safety Benefits	Air Quality Benefits	Residual Value	Total Benefits	Construction Costs	Operating & Maitenance Cost	Total Cost		
1	2023	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($8,722,726)
2	2024	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($8,152,080)
3	2025	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($7,618,767)
4	2026	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($7,120,343)
5	2027	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($6,654,526)
6	2028	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($6,219,183)
7	2029	$0	$0	$0	$0	$0	$0	$0	$9,986,649	$0	$9,986,649	($9,986,649)	($5,812,321)
8	2030	$0	$0	$0	$0	$0	$0	$0	$250,504,673	$0	$250,504,673	($250,504,673)	($136,257,944)
9	2031	$0	$0	$0	$0	$0	$0	$0	$250,504,673	$0	$250,504,673	($250,504,673)	($127,343,873)
10	2032	$0	$0	$0	$0	$0	$0	$0	$250,504,673	$0	$250,504,673	($250,504,673)	($119,012,966)
11	2033	$0	$0	$0	$0	$0	$0	$0	$250,504,673	$0	$250,504,673	($250,504,673)	($111,227,071)
12	2034	$0	$0	$0	$0	$0	$0	$0	$250,504,673	$0	$250,504,673	($250,504,673)	($103,950,533)
13	2035	($1,583,027)	($17,982,038)	$8,427,694	($4,858,098)	($1,689,386)	$0	($17,684,856)	$0	$1,087,933	$1,087,933	($18,772,788)	($7,280,411)
14	2036	($54,896)	($18,240,458)	$9,010,136	($5,156,105)	($1,727,927)	$0	($16,169,250)	$0	$1,087,933	$1,087,933	($17,257,183)	($6,254,797)
15	2037	$1,473,234	($18,498,877)	$9,592,578	($5,454,111)	($1,766,469)	$0	($14,653,645)	$0	$1,087,933	$1,087,933	($15,741,578)	($5,332,217)
16	2038	$3,001,365	($18,757,297)	$10,175,019	($5,752,117)	($1,805,010)	$0	($13,138,040)	$0	$1,087,933	$1,087,933	($14,225,972)	($4,503,579)
17	2039	$4,529,496	($19,015,716)	$10,757,461	($6,050,124)	($1,843,551)	$0	($11,622,434)	$0	$1,087,933	$1,087,933	($12,710,367)	($3,760,539)
18	2040	$6,057,627	($19,274,136)	$11,339,903	($6,348,130)	($1,882,093)	$0	($10,106,829)	$0	$1,087,933	$1,087,933	($11,194,762)	($3,095,445)
19	2041	$7,585,758	($19,532,555)	$11,922,345	($6,646,137)	($1,920,634)	$0	($8,591,223)	$0	$1,087,933	$1,087,933	($9,679,156)	($2,501,278)
20	2042	$9,113,888	($19,790,975)	$12,504,787	($6,944,143)	($1,959,175)	$0	($7,075,618)	$0	$1,087,933	$1,087,933	($8,163,551)	($1,971,604)
21	2043	$10,642,019	($20,049,394)	$13,087,228	($7,242,150)	($1,997,717)	$0	($5,560,013)	$0	$1,087,933	$1,087,933	($6,647,946)	($1,500,529)
22	2044	$12,170,150	($20,307,814)	$13,669,670	($7,540,156)	($2,036,258)	$0	($4,044,407)	$0	$1,087,933	$1,087,933	($5,132,340)	($1,082,651)
23	2045	$13,698,281	($20,566,233)	$14,252,112	($7,838,163)	($2,074,799)	$0	($2,528,802)	$0	$1,087,933	$1,087,933	($3,616,735)	($713,027)
24	2046	$15,226,412	($20,824,653)	$14,834,554	($8,136,169)	($2,113,340)	$0	($1,013,197)	$0	$1,087,933	$1,087,933	($2,101,130)	($387,131)
25	2047	$16,754,542	($21,083,072)	$15,416,995	($8,434,175)	($2,151,882)	$0	$502,409	$0	$1,087,933	$1,087,933	($585,524)	($100,825)
26	2048	$18,282,673	($21,341,492)	$15,999,437	($8,732,182)	($2,190,423)	$0	$2,018,014	$0	$1,087,933	$1,087,933	$930,081	$149,678
27	2049	$19,810,804	($21,599,911)	$16,581,879	($9,030,188)	($2,228,964)	$0	$3,533,619	$0	$1,087,933	$1,087,933	$2,445,686	$367,837
28	2050	$21,338,935	($21,858,330)	$17,164,321	($9,328,195)	($2,267,506)	$0	$5,049,225	$0	$1,087,933	$1,087,933	$3,961,292	$556,810
29	2051	$22,867,066	($22,116,750)	$17,746,763	($9,626,201)	($2,306,047)	$0	$6,564,830	$0	$1,087,933	$1,087,933	$5,476,897	$719,484
30	2052	$24,395,196	($22,375,169)	$18,329,204	($9,924,208)	($2,344,588)	$0	$8,080,435	$0	$1,087,933	$1,087,933	$6,992,503	$858,491
31	2053	$25,923,327	($22,633,589)	$18,911,646	($10,222,214)	($2,383,130)	$0	$9,596,041	$0	$1,087,933	$1,087,933	$8,508,108	$976,230
32	2054	$27,451,458	($22,892,008)	$19,494,088	($10,520,221)	($2,421,671)	$0	$54,822,429	$0	$1,087,933	$1,087,933	$53,734,496	$1,074,890
33	2055	$28,979,589	($23,150,428)	$20,076,530	($10,818,227)	($2,460,212)	$0	$12,627,251	$0	$1,087,933	$1,087,933	$11,539,319	$1,156,463
34	2056	$30,507,720	($23,408,847)	$20,658,971	($11,116,233)	($2,498,754)	$0	$14,142,857	$0	$1,087,933	$1,087,933	$13,054,924	$1,222,763
35	2057	$32,035,850	($23,667,267)	$21,241,413	($11,414,240)	($2,537,295)	$0	$15,658,462	$0	$1,087,933	$1,087,933	$14,570,529	$1,275,438
36	2058	$33,563,981	($23,925,686)	$21,823,855	($11,712,246)	($2,575,836)	$0	$17,174,067	$0	$1,087,933	$1,087,933	$16,086,135	$1,315,988
37	2059	$35,092,112	($24,184,106)	$22,406,297	($12,010,253)	($2,614,377)	$0	$18,689,673	$0	$1,087,933	$1,087,933	$17,601,740	$1,345,774
38	2060	$36,620,243	($24,442,525)	$22,988,738	($12,308,259)	($2,652,919)	$0	$20,205,278	$0	$1,087,933	$1,087,933	$19,117,345	$1,366,030
39	2061	$38,148,374	($24,700,945)	$23,571,180	($12,606,266)	($2,691,460)	$0	$21,720,884	$0	$1,087,933	$1,087,933	$20,632,951	$1,377,876
40	2062	$39,676,505	($24,959,364)	$24,153,622	($12,904,272)	($2,730,001)	$0	$23,236,489	$0	$1,087,933	$1,087,933	$22,148,556	$1,382,326
41	2063	$41,204,635	($25,217,784)	$24,736,064	($13,202,279)	($2,768,543)	$0	$24,752,094	$0	$1,087,933	$1,087,933	$23,664,161	$1,380,297
42	2064	$42,732,766	($25,476,203)	$25,318,506	($13,500,285)	($2,807,084)	$401,388,518	$427,656,218	$0	$1,087,933	$1,087,933	$426,568,285	$23,253,382
Cumulative Total		$617,246,084	($651,873,622)	$506,192,996	($275,375,746)	($67,447,051)	$401,388,518	$573,841,961	$1,322,429,907	$32,637,985	$1,355,067,892	($781,225,931)	($646,796,609)
Present Value		$68,559,148	($105,567,507)	$72,634,816	($39,975,485)	($10,633,910)	$21,880,765	$6,897,827	$648,092,332	$5,602,104	$653,694,436	($646,796,609)	