

Federal Highway Administration

**CityArchRiver 2015**

Access Justification Report for  
Concept Approval

04/05

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# 1 Executive Summary

This Access Justification Report (AJR) seeks approval from the Federal Highway Administration (FHWA) for Interstate highway ramp modifications proposed as part of the CityArchRiver 2015 (CAR 2015) project. CAR 2015 is a foundation-led project to reconnect downtown St. Louis, the Jefferson National Expansion Memorial (JNEM) grounds (home to the Gateway Arch) and the Mississippi River through improvements to St. Louis City streets and sidewalks, bridges, landscaping and highway ramp modifications.

The CAR 2015 project aims to create this connection, in part, with a park over the depressed section of Interstate 70 highway, between Market and Chestnut Streets in downtown St. Louis. This action initiates modifications to Memorial Drive and Interstate ramp access.



Figure 1.1: Rendering of CAR 2015 Park over the Depressed Section of I-70 Highway and across Memorial Drive, looking east (Image: MVVA, Inc.)

FHWA approval is requested for the following Interstate ramp, highway and local street modifications:

- Removal of the on-ramp from Memorial Drive northbound to I-70 westbound and replacement with an off-ramp from I-70 westbound to Washington Avenue;
- Removal of the off-ramp from I-70 eastbound to Memorial Drive southbound and replacement with an on-ramp from Washington Avenue to I-70 eastbound;
- Addition of auxiliary lanes within the depressed section of I-70 highway; and
- Addition of a ramp which connects the I-70 mainline ramp towards the New Mississippi River Bridge (NMRB) eastbound, with the ramp from I-70 westbound to North Tucker Boulevard, at the western end of the NMRB.

Other modifications to City streets that are associated with these modifications include:

- North 3<sup>rd</sup> Street extension to connect with an existing on-ramp to I-70 westbound near the western terminus of the Martin Luther King Jr. Bridge, and

- Memorial Drive closures.

As project sponsor, the Missouri Department of Transportation (MoDOT) has helped CAR 2015 to engage in an extensive public involvement process that resulted in coordination and engagement with the following agencies and organizations:

- St. Louis Streets Department;
- FHWA;
- East-West Gateway Council of Governments;
- Metro;
- Illinois Department of Transportation;
- Explore St. Louis, Convention and Visitors Center;
- Lumiere Casino;
- Mercantile Exchange; and
- Laclede's Landing.

This AJR is the culmination of 19 months of planning and collaboration with these and other stakeholder agencies and design team members.

The proposed Interstate highway modifications and other elements of the CAR 2015 transportation plan will improve the St. Louis transportation network that work at both local and regional scales to improve traffic movements, access to and from downtown St. Louis, pedestrian mobility and safety, and connections to and from a national treasure, the Jefferson National Expansion Memorial.

The analysis described in this report confirms that the proposed actions will:

- Support the goals of the CAR 2015 project;
- Maintain or improve highway operations in the vicinity of the project;
- Maintain or improve the operations of the St. Louis street network;
- Maintain or improve access and connectivity for local businesses, residents and workers;
- Maintain or improve safety for motorists and particularly for millions of pedestrians who visit the Arch;
- Work within the planned future layout and operations of the Poplar Street Bridge Ramp Modification Project and the NMRB Phase II plans; and
- Not negatively impact existing river crossings or highway operations east of the Mississippi River.

This AJR recommends approval of the proposed CAR 2015 ramp access modifications presented herein.

## 2 Introduction

This Access Justification Report (AJR) was generated by the Missouri Department of Transportation (MoDOT) for submission to the U.S. Department of Transportation, Federal Highway Administration (FHWA) and addresses freeway access modifications proposed for Interstate 70 (I-70) through downtown St. Louis, Missouri. The proposed access changes affect an approximately 1.6-mile segment of I-70, from I-55/I-64 at the west end of the Poplar Street Bridge (PSB) to the future Missouri North I-70 Interchange at the west end of the New Mississippi River Bridge (NMRB), currently under construction.

The proposed freeway modifications result from the CityArchRiver 2015 (CAR 2015) project which includes three access modifications to highway ramps and one modification to surface streets which enables access to an existing on-ramp. Specifically, the CAR 2015 project includes and this AJR seeks approval for:

- ‘Flipping’ ramps at Memorial Drive which currently serve traffic from the north of St. Louis, to serve traffic from the south of St. Louis onto Washington Avenue;
- Adding a new connection between NMRB ramps at N. Tucker Boulevard to replace the EB/SB off-ramp movement lost at Memorial; and
- Adding a new street network connection to create new access to an existing on-ramp at the Martin Luther King Jr. Bridge (MLK), which replaces the WB/NB on-ramp movement lost at Memorial.

All proposed modifications are designed to work in concert for improving access to, and from, downtown St. Louis for motorists, transit users, pedestrians, and cyclists. This AJR demonstrates that the impact of the proposed CAR 2015 improvements will:

- Improve Interstate highway network performance;
- Improve regional and local access to and from downtown St. Louis;
- Improve downtown city street signal progressions and network efficiency;
- All while improving pedestrian, cycling, transit access and activity in the vicinity of the CAR 2015 project.

## 2.1 CityArchRiver 2015 Project Description

This section of the AJR describes the CAR 2015 project. Detailed studies of the impacts of this project, as described in subsequent sections, are generally limited to the specific Interstate access changes being requested through this AJR.

### 2.1.1 Project History

The Gateway Arch, the iconic symbol of the westward expansion of the United States as a part of the Louisiana Purchase, was built in 1965 on the grounds of the JNEM in Downtown St. Louis, Missouri. The national historic landmark is a major tourist attraction, drawing more than 2.5 million visitors each year. Surrounded by major roadway infrastructure, the JNEM is currently isolated from downtown St. Louis, Laclede’s Landing and Chouteau’s Landing by highway, road, rail and bridge infrastructure, hindering visitor exploration of downtown, as seen in Figure 2.1. Additionally, the location of the Arch parking garage creates a condition where visitors arriving by auto come and go without exploring City neighborhoods that are otherwise a short walk from the Arch Grounds.

Recently, a number of programs have been established to address the JNEM Park’s access constraints with Downtown St. Louis. The JNEM General Management Plan (GMP) led to the resulting CAR 2015 Project furnishing a vision for the future park development and surrounding landscape. In early 2008, the National Park Service (NPS) took on the venture of updating the outdated 1962 JNEM GMP. The plan’s purpose being to offer a park development guide for the next 15-20 years to address the connectivity issues between the JNEM and the City of St. Louis.

A November 2009 Record of Decision for the Park’s GMP and Environmental Impact Statement (EIS) selected an alternative for the revitalization of the JNEM. The selected alternative called for a design competition to provide a pool of concepts and ideas to fill out the basis for the design of more specific projects.



Figure 2.1: Arch Grounds Site between Downtown St. Louis and the Mississippi River, Looking North (Image: MVVA, Inc.)

Inspired by the ten design goals set forth in The CAR 2015 Competition, U.S. Secretary of Transportation Ray LaHood has described the CAR 2015 initiative as a “legacy project.” The social, environmental, and economic goals of the project are intended to serve for generations to come as a model for other American cities struggling to become more liveable and more welcoming to visitors. The ten design goals are as follows:

1. Create an iconic place for the international icon, the Gateway Arch;
2. Catalyze increased vitality in the St. Louis region;
3. Honor the character defining elements of the National Historical Landmark;
4. Weave connections and transitions from the City and the Arch Grounds to the River;
5. Mitigate the impact of transportation systems;
6. Embrace the Mississippi River and the east bank in Illinois as an integral part of the National Park;
7. Reinvigorate the mission to tell the story of St. Louis as the gateway to national expansion;
8. Create attractors to promote extended visitation to the Arch, the City, and the River;
9. Develop a sustainable future; and
10. Enhance the visitor experience and create a welcoming and accessible environment.

### 2.1.2 CityArchRiver 2015 Proposed Design

The design team led by the landscape architecture firm Michael Van Valkenburgh Associates, Inc. (MVVA), won the CAR 2015 design competition and prepared a design which proposes

to achieve the competition goals, in part, through modifications to the local transportation network. The primary goal of MVVA’s CAR 2015 plan is to reconnect the Arch Grounds with the rest of downtown St. Louis from the south, west, north, and across the Mississippi river to East St. Louis.



Figure 2.2: Rendering of CAR 2015 Park over the Depressed Section of I-70 Highway and across Memorial Drive, Looking East (Image: MVVA)

The following initiatives intend to improve pedestrian and vehicular access and circulation:

- Improve the pedestrian environment and connectivity to the Grounds by closing strategic portions of Memorial Drive, Washington Avenue and through expanded streetscaping along Market, Chestnut, and Washington Streets.
- Continue to maintain an appropriate level of freeway access for the downtown area and acceptable traffic flow on the City’s street system through reconfigured roads and ramps.
- Use the areas of Laclede’s Landing and the Old Courthouse as gateways into the Arch Grounds, encouraging Arch users to travel through those areas and support local businesses during their visit to St. Louis and the Arch.
- Provide more convenient and clear access to existing parking options and offer better connections with surrounding neighborhoods. Specifically, redistribute parking from the Arch Grounds parking garage to existing parking resources throughout Laclede’s Landing and downtown St. Louis.
- Support visitors’ and commuters’ ability to ‘park once’ then access the Arch Grounds and tour St. Louis as a pedestrian and/or cyclist.

The transportation initiatives listed above are supported by an assembly of proposed highway, ramp and local street modifications as shown in Figure 2.3, and described in the following sections.

### 2.1.2.1 City Street Modifications

The CAR 2015 project includes a number of proposed surface street modifications, some of which do not directly affect the Interstate highway system. Appendix B details all of the proposed surface street changes. The most significant of these are also shown in Figure 2.3 and described in more detail below. (The numbers below correlate to the numbers in the Figure 2.3.)

2. **Washington Avenue Closure:** Washington Avenue east of Memorial Drive would be reclaimed for Park Land, extending the Arch Grounds to the edge of the Eads Bridge. The closure of Washington Avenue would remove the related signals at northbound and southbound Memorial Drive, simplifying the existing traffic control at the west end of the Eads Bridge and Washington Ave, enabling the proposed I-70 off-ramp, and improving the pedestrian link between the Arch Grounds and the Washington Street retail corridor.

**Note:** The NPS’s Preferred Alternative (as funding becomes available) involves full demolition of the garage per their Value Analysis (VA) Study conducted in August 2011 (identified as “Alternative 5” in the VA) but NPS has not approved this portion of the plan. However, the Washington Avenue closure is independent from the removal of the parking garage, given that vehicle access can be maintained to the garage via Laclede Landing Boulevard, 1<sup>st</sup> and 2<sup>nd</sup> Streets., which the NPS has not yet approved.

3. **Memorial Drive Closure:** Walnut to Washington on the northbound side, Chestnut to Market on the southbound side. This area would be reclaimed for Park Land, enabling the Park over the Highway and flipping of the Interstate ramps to Memorial Drive.

4. **Poplar Street:** The eastbound lanes on Poplar Street, at the southern border of the JNEM, become two-way. The two westbound lanes would be closed.

5. **Removal of Existing Bridges:** The existing road bridges over the Interstate at Walnut, Market, Chestnut, Pine Streets would be removed. The existing bridges are nearing the end of their design lives and are not needed in the proposed plan.

6. **New Walnut Street Bridge:** A new bridge would replace the existing Walnut Street Bridge which will become the new vehicle gateway into downtown St. Louis from the south. It would allow large trucks to enter downtown from the Interstate, which is currently not possible from Memorial Drive across the existing bridges.

7. **Modified Walnut Street:** The Walnut Street corridor, from Memorial Drive to North 8<sup>th</sup> Street, will be revised from a one-way eastbound street to a two-way street within the existing right-of-way. New westbound lanes will provide direct access to downtown from the reconstructed Walnut Street Bridge. See Figure 2.3 and Appendix B for further detail.

8. **Memorial Drive U-Turn:** As part of the Washington Ave ramps, a U-turn would be placed on existing pavement to connect the off-ramp with Memorial drive southbound.

9. **North 3<sup>rd</sup> Street Extension:** Two currently divided sections of North 3<sup>rd</sup> Street would be reconnected, thereby providing access from downtown to the existing Interstate on-ramp at the base of the MLK Bridge

10. **Off-Ramp to North Tucker Blvd:** Not shown in Figure 2.3, a new connection between off-ramps being built as part of the NMRB would provide new access to downtown from the north.

11. **Memorial Drive Reversal:** Memorial Drive between Walnut and Market and between Chestnut and Pine Streets would be reversed to enable bus circulation around Luther Ely Smith plaza.

12. **New Washington Ave Ramps:** The existing Interstate off-ramp from I-70 eastbound and the on-ramp to I-70 westbound via Memorial Drive would be closed and “flipped” to provide access to/from Washington Ave.

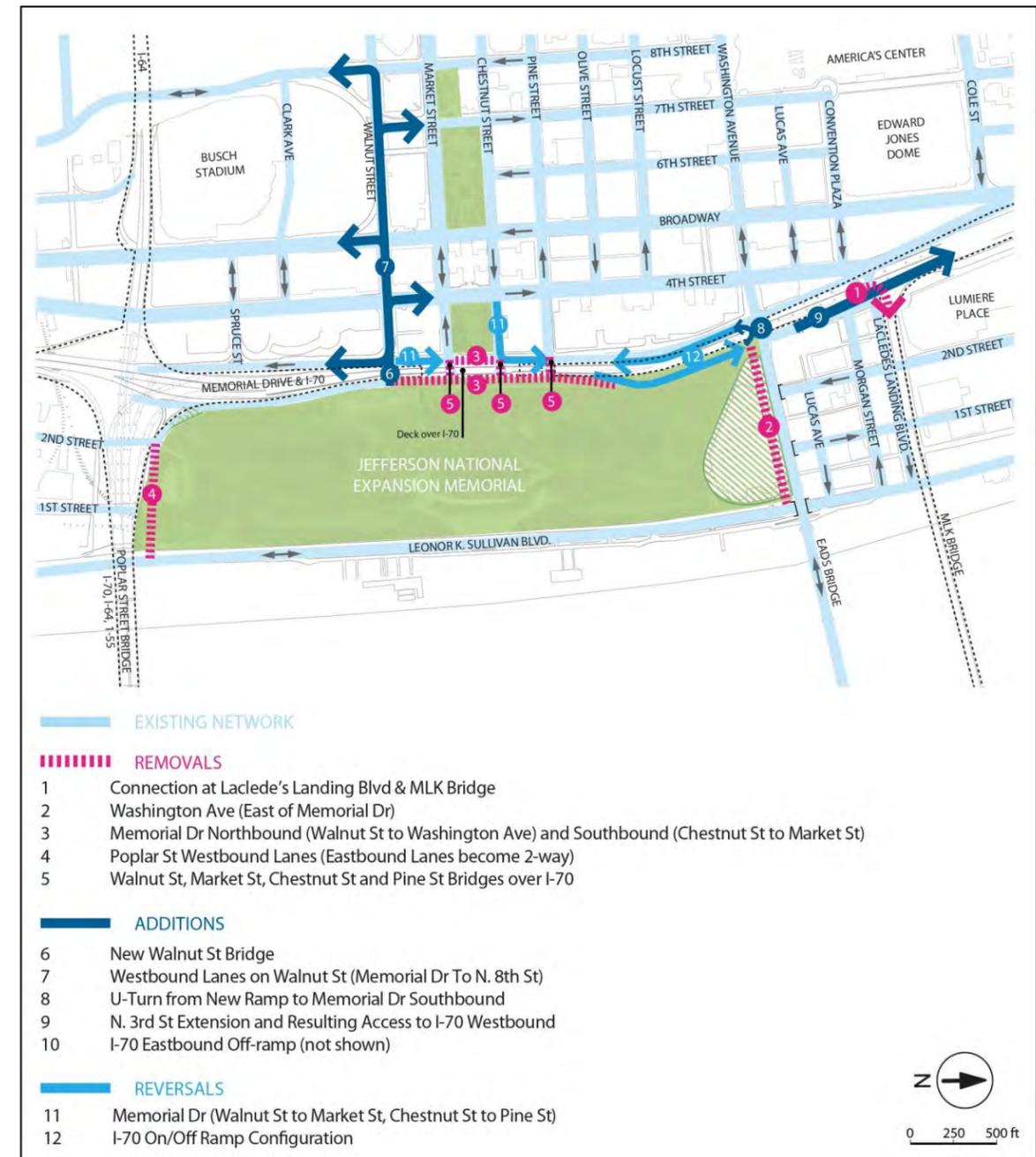


Figure 2.3: CAR 2015, Proposed Network Changes (Image: Arup)

### 2.1.3 Proposed CAR 2015 Interstate Access Modifications

The primary goal of the proposed CAR 2015 modifications is to improve access and connectivity rather than capacity. The proposed I-70 ramp changes are a response to closures and modifications to the arterial network to improve access and mobility.

These transportation initiatives include seven discreet components that impact I-70 access, as listed in Table 2.1 and described below.

Table 2.1: I-70 Access Modifications Related to the CAR 2015 Project.

Modification
Remove existing Memorial Drive northbound to I-70 westbound on-ramp (250B).
Construct new I-70 westbound to Memorial Drive northbound off-ramp.
Remove existing I-70 eastbound to Memorial Drive southbound off-ramp (250B).
Construct new Memorial Drive southbound to I-70 eastbound on-ramp.
Construct new U-turn connection from Memorial Drive northbound to Memorial Drive southbound, south of Washington Avenue.
Modify North 3 <sup>rd</sup> Street between the Eads Bridge and Laclede's Landing Blvd and extend North 3 <sup>rd</sup> Street across the west end of the MLK Bridge landing to connect with existing North 3 <sup>rd</sup> Street in the vicinity of the I-70 westbound on-ramp (250A). This connection replaces the I-70 westbound on-ramp that would be removed at Memorial Drive.
Construct off-ramp from the new (currently under construction) I-70 eastbound to NMRB eastbound ramp to the new Cass Avenue/North Tucker Boulevard intersection. This off-ramp replaces the I-70 eastbound off-ramp that would be removed at Memorial Drive.

The proposed Interstate access modifications and the requirement for this AJR stem from the impact of the proposed Park over the Highway which closes portions of Memorial Drive and bridges over the depressed section of Interstate highway (currently I-70). The proposed Park over the Highway connects two separated portions of the JNEM National Park – Luther Ely Smith Plaza and the Arch Grounds – creating a seamless connection for pedestrians, bicycles and the mobility impaired between the Arch grounds and the heart of downtown St. Louis. However, the Park over the Highway partially restricts vehicular access to the North end of downtown, currently accessed from the Interstate via Memorial Drive. Thus, modifications to Interstate access are proposed in several locations, including modifications to existing ramps, a street level connection to an existing ramp, and a proposed new link connecting two future highway ramps.

Given that the CAR 2015 project is focused more on improving access and connectivity than increasing capacity, Transportation Systems Management (TSM) strategies were not considered at this stage. By reconnecting the JNEM to the urban core of St. Louis and improving pedestrian flow and non-motorized travel within the City, TSM strategies may not be needed to manage future volumes at ramps and interchanges.



Figure 2.4: Existing Memorial Drive Layout, Downtown St. Louis

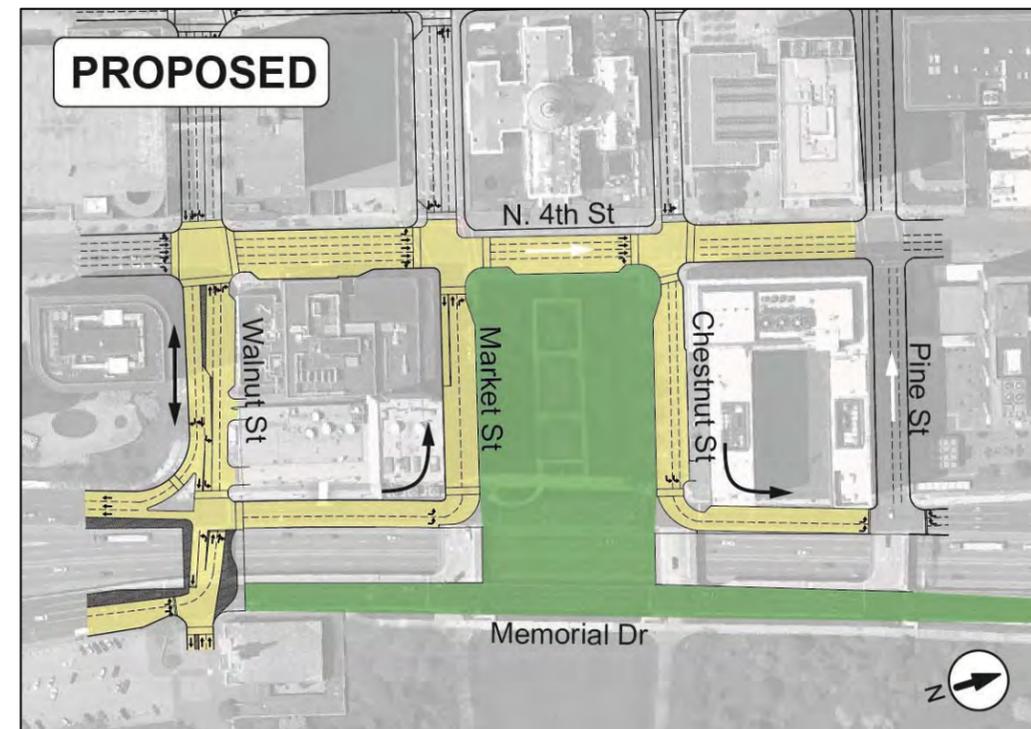


Figure 2.5: Proposed Memorial Drive Layout with Park over the Highway and Downtown Access via Walnut Street Bridge

### 2.1.3.1 Removal of Memorial Drive Ramps, Addition of Washington Avenue Ramps and U-turn

The I-70 access modifications proposed by the CAR 2015 project team center around a plan to “flip” the I-70 access ramps to and from Memorial Drive adjacent to the JNEM (Figure 2.7). A new parallel style off-ramp from I-70 westbound to Memorial Drive northbound is proposed where the current on-ramp from Memorial Drive northbound is situated. In accordance with MoDOT preference for pairing ramps, the I-70 eastbound off-ramp to Memorial Drive southbound would be converted to a parallel style on-ramp from Washington Avenue.

These changes to the ramp orientation are proposed as a response to community concerns about Interstate access from the south to the north end of downtown should Memorial Drive be closed. The proposed ramps would improve access to the northern area of the downtown central business district from the south, in accordance with a historic shift of peak hour traffic entering the downtown central business district. Thirty years ago, St. Louis’ major suburbs were located north and west on I-70. Currently, however, the overall proportion of users accessing downtown from the south is roughly 10 percent higher than that from the north, based on peak-hour ramp volumes. Therefore, the new ramps would provide a benefit at the local level while serving broader, regional traffic movements.

In addition, these ramp modifications accommodate the closure of Memorial Drive caused by the installation of the Park over the depressed section of Interstate highway. The closure of Memorial Drive would affect its northbound section between Walnut Street and Washington Avenue and its southbound section between Market and Chestnut Streets (Figure 2.5). Most of the land previously occupied by northbound Memorial Drive in this area would be restored as National Park land. The Park over the Highway would be landscaped to provide extended park space and ADA-compliant access to the new primary JNEM entrance that would face west, towards the existing Memorial Drive. This proposed connection is illustrated in Figure 2.5.

With these modifications, Walnut Street would serve as the main vehicle gateway to downtown from the south, accessed via the existing Memorial Drive exit. The new Washington Avenue ramp would serve as a secondary downtown exit. The next exit from the westbound highway lanes is at Madison Street, located more than 1.5 miles further north. The main vehicle gateway from the north would continue to be the exits at Broadway, accessed via the existing mainline highway and express lane off-ramp. North-south movements that once used Memorial Drive would now shift to North 4<sup>th</sup> Street and North Broadway within downtown St. Louis.

Utilizing existing pavement from the portion of Washington Avenue under I-70, a U-turn connection is proposed between northbound and southbound Memorial Drive, just south of the Eads Bridge (shown in Figure 2.7). This connection would provide direct access for travelers using the new I-70 Washington Avenue exit whose destinations are within the central business district (those who previously utilized Memorial Drive northbound to the Pine Street Bridge). Removing these vehicles from the intersections of Memorial Drive with Washington Avenue and the Eads Bridge would reduce the volume serviced by those signals as well as the potential for pedestrian conflicts.

Creating a full-access, split-diamond interchange at Washington Avenue, with an on-ramp from Washington Avenue to I-70 westbound/future I-44 eastbound (located north of the Eads Bridge, on the east side of the Interstate) and an off-ramp to Washington Avenue from I-70 eastbound/future I-44 westbound (located north of the Eads Bridge, on the west side of the Interstate) was considered but deemed inappropriate given spatial constraints and the density of existing buildings in the area where these ramps would be constructed. The proposed ramps can be constructed entirely within existing FHWA and MoDOT right-of-way. Ramps to the north would require takings and property acquisition. Plus, these movements to and from the Interstate are already provided for at the on-ramp from MLK westbound/N. 3<sup>rd</sup> Street to I-70 westbound/future I-44 eastbound and the off-ramp to MLK eastbound from I-70 eastbound/future I-44 westbound. In effect, these MLK ramps, in association with the new Washington Avenue ramps, will form a full-access, split-diamond interchange. (See Figure 2.13 and Figure 7.4.) This is an improvement over the existing interchanges which are currently partial interchanges. In this regard, the CAR 2015 network modifications will not reduce access and will, in fact, improve projected levels of service based on SYNCHRO and VISSIM traffic analyses. More detail on model results can be found in Section 7.

To further accommodate citybound trips from I-70 eastbound, the off-ramp at N. Tucker Boulevard (at the NMRB interchange north of downtown) is proposed. (See Section 2.1.3.3 for more information.) Existing counts and model results demonstrate that this ramp in particular will carry most trips traveling into downtown St. Louis. More information on future travel patterns can found in Section 5.5, Future Year Traffic Development: Network Modifications and Resulting Traffic Shifts.

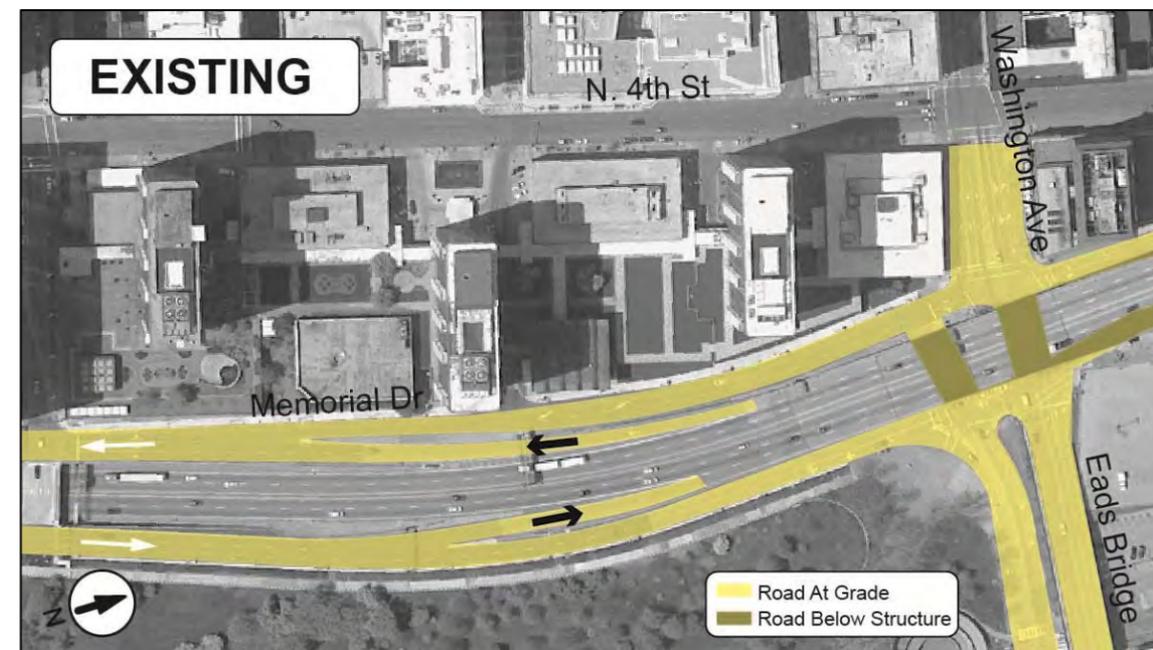


Figure 2.6: Existing Layout of Memorial Drive Ramps

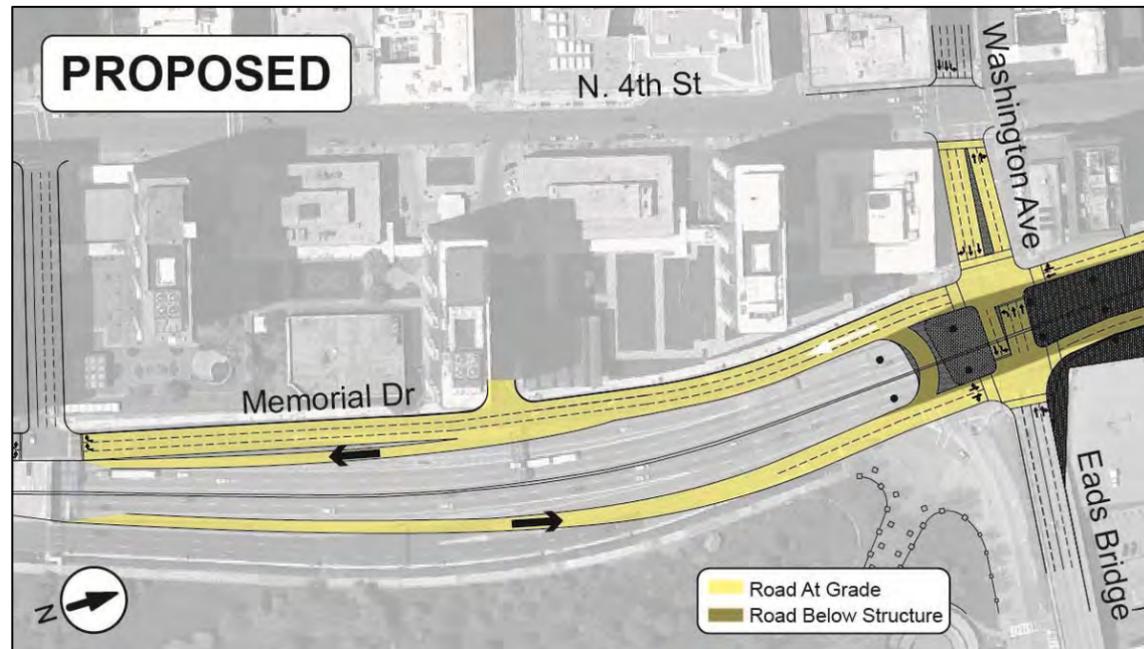


Figure 2.7: Proposed Layout of Washington Avenue Ramps and U-turn

### 2.1.3.2 North 3<sup>rd</sup> Street Extension

North 3<sup>rd</sup> Street is currently divided into two sections, decoupled in the vicinity of the MLK Bridge. The proposed modifications would create a continuous connection from the new I-70 westbound exit at Washington Street, to the existing section just north of the MLK Bridge landing. The revised alignment would:

- Begin at an improved intersection at the west end of the Eads Bridge where it meets the proposed off-ramp to Washington Ave;
- Run along the existing alignment underneath the elevated portion of the Interstate highway adjacent to Laclede’s Landing;
- Connect with Convention Plaza and Laclede’s Landing Blvd in an improved intersection at the base of the MLK Bridge;
- Provide a new, single lane, one way segment crossing over an existing traffic island to join with the existing section of North 3<sup>rd</sup> Street north of MLK Bridge and to the existing I-70 westbound on-ramp.

The extension provides a local connection from the northeast corner of the central business district to an existing on-ramp towards I-70 westbound and is intended to replace the access lost through the removal of the Memorial Drive on-ramp. At a local level, the extension allows better access and circulation into and out of Laclede’s Landing and reconnects disjointed portions of the existing network.



Figure 2.8: Existing Layout of North 3<sup>rd</sup> Street at Laclede’s Landing

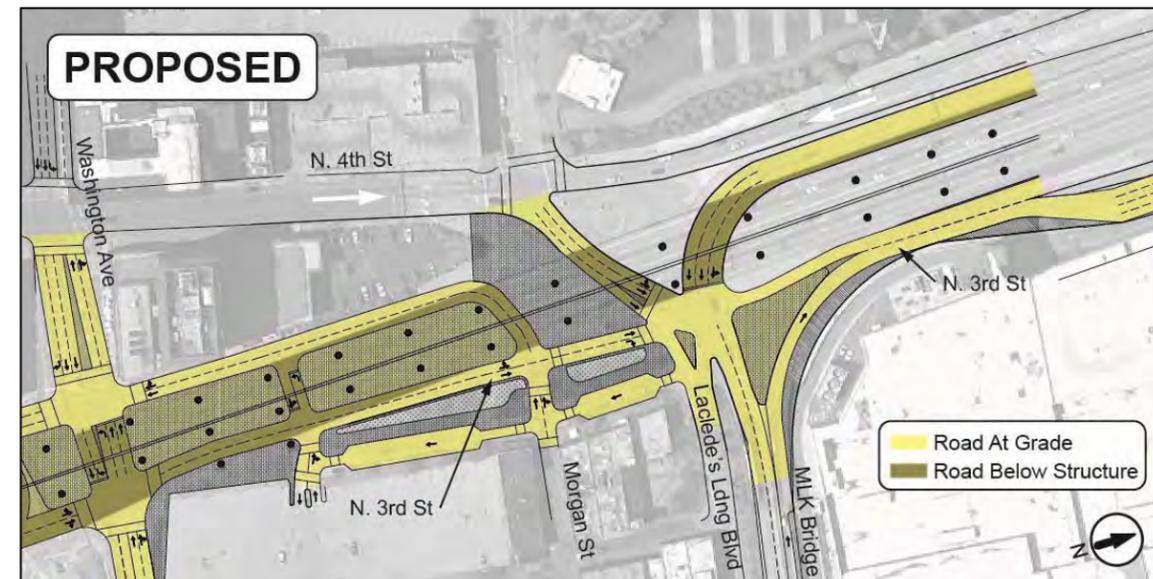


Figure 2.9: Proposed Layout of North 3<sup>rd</sup> Street and Extension to I-70 On-ramp

### 2.1.3.3 Off-Ramp Connection to North Tucker Boulevard

The proposed ramps at Washington Ave create new access and connectivity for motorists traveling to St. Louis from the south. The ramps, however, eliminate an existing on-ramp to I-70 westbound and an off-ramp from I-70 eastbound. The North 3<sup>rd</sup> Connection described in the previous section is proposed to replace the access to I-70 westbound that would be removed at Memorial Drive. The North Tucker Boulevard off-ramp is proposed to replace the access from I-70 eastbound that was removed by the NMRB project at 10<sup>th</sup> Street and the off-ramp proposed to be removed by the CAR 2015 project to Memorial Drive.

The proposed “Tucker” ramp is a ramp to ramp link that would connect the future I-70 eastbound ramp with the future I-70 westbound ramp to Cass Avenue (Figure 2.11). This new connection would be located in nearly the same location as the 10<sup>th</sup> Street off-ramp. Before its removal as part of the NMRB project, the 10<sup>th</sup> Street off-ramp was historically a primary access point to downtown St. Louis. Vehicles that utilized the 10<sup>th</sup> Street off-ramp would likely shift to the mainline highway and express lane exits at North Broadway.



Figure 2.10: Existing Street Layout in Vicinity of NMRB, Missouri North Interchange

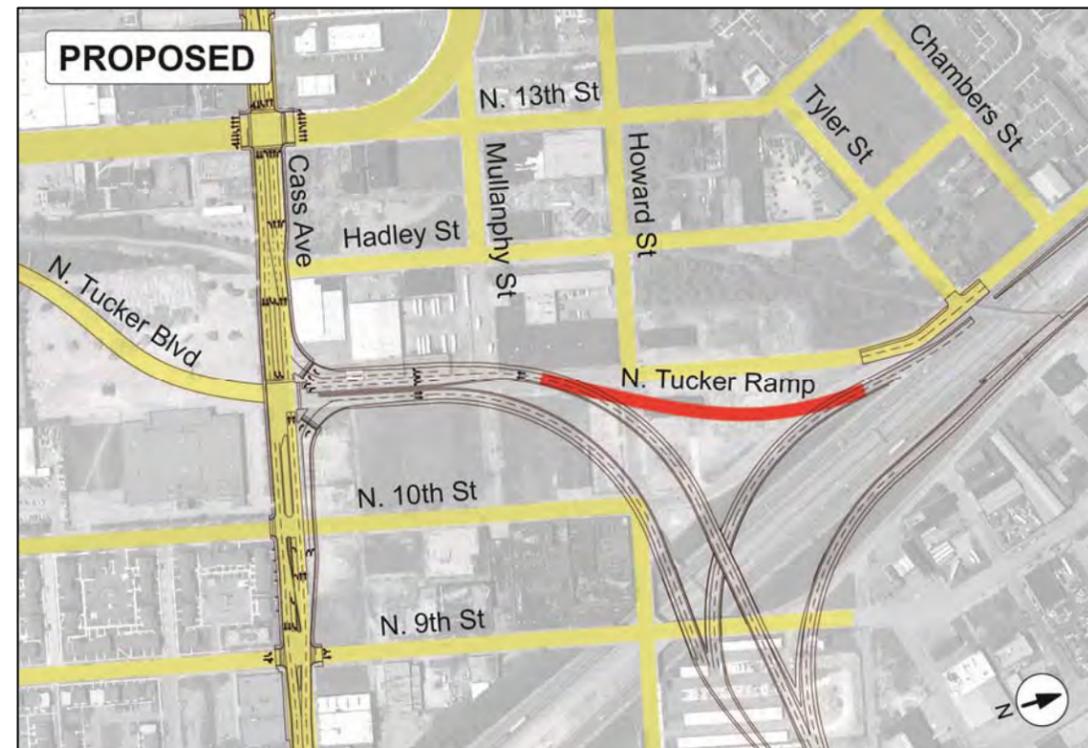


Figure 2.11: Proposed Layout of North Tucker Blvd off-ramp from I-70



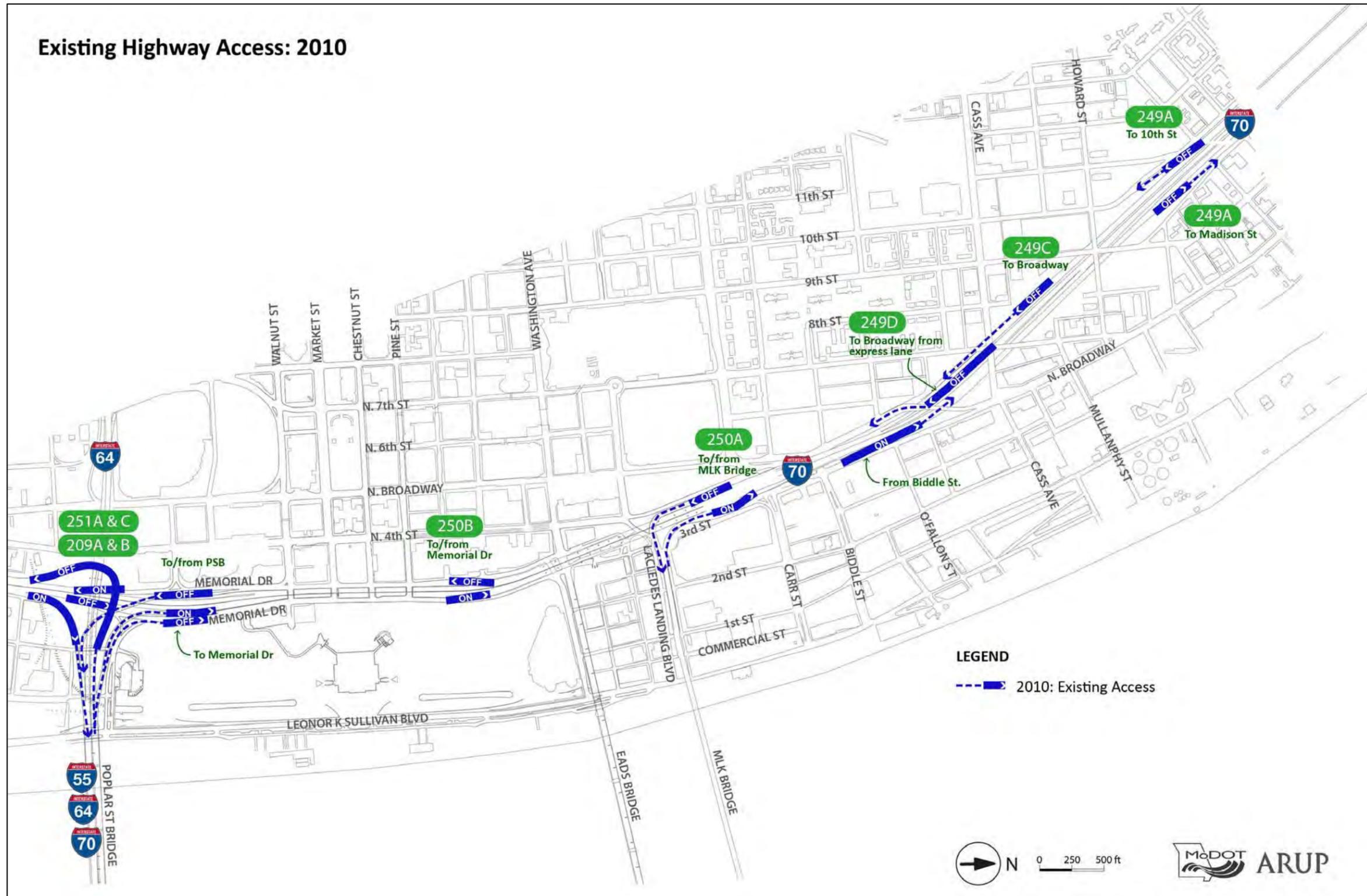


Figure 2.12: Existing Interstate Access and Ramp Configurations along the I-70 Corridor (Image: Arup)

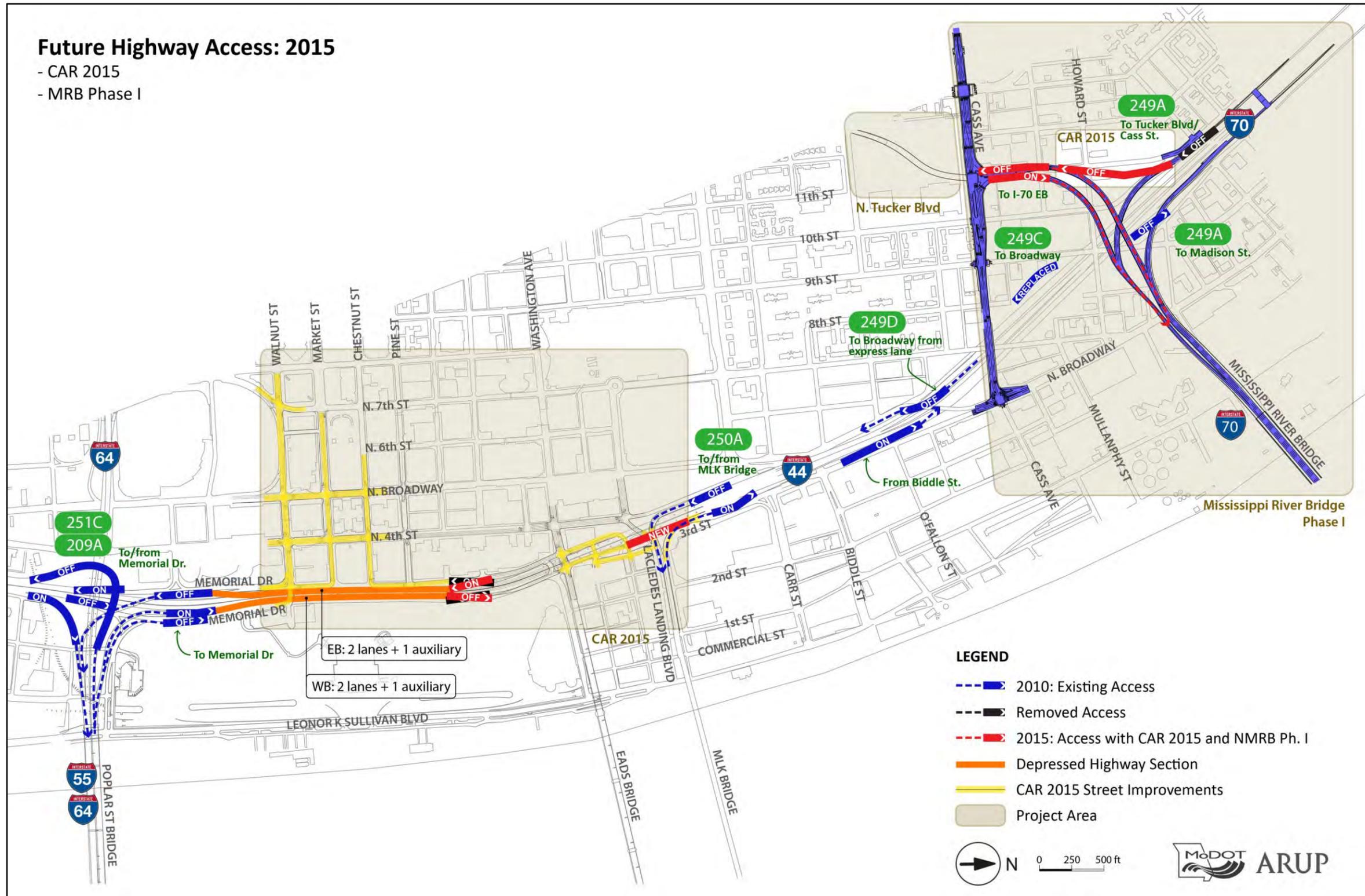


Figure 2.13: Proposed I-70 Corridor Access with CAR 2015 and NMRB Phase I Ramp Modifications (Image: Arup)

## 2.2 CAR 2015 Purpose and Need

The primary purpose of the CAR 2015 project is to improve vehicular access to downtown St. Louis from the south and provide unrestricted access for pedestrians to and from the JNEM grounds and downtown. The CAR 2015 design team's transportation initiatives build upon the JNEM GMP, which considered ways to improve pedestrian connections, enhance views, and encourage mobility between the Arch Grounds, adjacent city neighborhoods, and the river.

### CAR 2015 Project Goals

- Improve network connectivity and flow;
- Create connections through parking;
- Promote animated and diverse pedestrian experiences;
- Anchor the visitor experience of the Arch at the thresholds of the city;
- Strengthen the sense of scale that unites the Arch, the levee, and the river;
- Reconfigure the riverfront for new programming opportunities;
- Establish a development platform to accommodate visitors and future program development; and
- Explore an educational program to relate urban context to a reconstructed bottomlands landscape.

### CAR 2015 Project Needs

- Regional redistribution of population and travel demands has shifted in the decades since the JNEM was created, rendering the current configuration of the downtown ramps inadequate. The downtown ramps are currently configured to handle the majority of incoming traffic moving from the north to the south. Traffic numbers show that the movement of traffic in the area has now shifted to a significant south to north orientation. A reconfiguration of the ramps is needed to facilitate this change in traffic movement.
- Regional traffic destined for I-70 travels on Memorial Drive a local city street, rather than on the I-70 facility, thus mixing regional traffic with local traffic and pedestrians crossing Memorial Drive to the JNEM.
- Pedestrians and bicyclists wanting to access the JNEM or downtown are currently restricted by Memorial Drive. These travelers must cross 4 to 6 lanes of traffic on Memorial Drive to get from one destination to the other. Safe, unimpeded access is needed to and from the JNEM.
- Access constraints in Laclede's Landing make it difficult for visitors to travel to and from the area.
- Missed economic opportunities stem from infrastructure barriers that cause JNEM visitors to drive to the Arch Grounds, park on-site, visit the park and leave without exploring downtown St. Louis. This potentially prevents millions of additional visits to downtown annually.

- Changes that may result from adopting any or all of the features of the CAR 2015 plan, primarily the Park over the depressed section of I-70.

## 2.3 Consistency with FHWA Policy

The road network changes proposed by CAR 2015 described in this document require approval by FHWA. The FHWA policy on access to the Interstate system was developed to ensure that proposed modifications are properly reviewed to ensure that the highest level of service in terms of safety and mobility can be maintained.

Approval from the FHWA is a two-step process consisting of conceptual approval and final approval. Conceptual approval is requested by MoDOT via this AJR. After conceptual approval has been obtained, the final approval is automatic after the National Environmental Policy Act (NEPA) requirements have been fulfilled assuming no significant changes have been made to the original concept. This AJR addresses the changes to Interstate Freeway Access as part of the CAR 2015 project.

As directed by FHWA, the AJR should contain a clear description of the proposed access along with any background information that would explain and/or support the proposal. In addition, new or revised access points to the existing (or future) Interstate System should meet the requirements outlined in the following eight categories:

1. Existing Facilities
2. Transportation System Management
3. Safety and Operational Analysis
4. Access, Connections and Design
5. Consistency with Local Transportation Land Use Plans
6. Consistency with Comprehensive Interstate Network Study
7. Coordination with Transportation System Improvements
8. Consideration for NEPA Environmental Processes

The following table presents the applicable policy statement listed for each element and followed by the conclusions with regards to each proposed project concepts and designs.

Table 2.1: FHWA Policy Points and Responses

Policy Point 1: Existing Facilities	
<i>"The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands."</i>	
Questions	Section Reference
<i>Q1: Does the access request clearly describe the need and purpose of the proposal and identify project goals and objectives that are specific and measurable?</i>	Purpose and Need: See Section 2.2 Goals and Objectives: See Section 2.2
<i>Q2: Is the proposal in the best interest of the travelling public, or does it merely serve a narrow interest?</i>	See Section 2.1
<i>Q3: Is the proposal serving a regional transportation need, or is it merely compensating for deficiencies in the local network of arterials and collectors?</i>	See Section 2.1
<i>Q4: In lieu of granting new access, is there any reasonable alternative consisting of improvements to the existing roadway(s) or adjacent access points that could serve the need and purpose.</i>	See Section 4.7.2
<i>Q5: Has the evaluation of existing interchanges and the local road network taken into account all proposed improvements currently identified in the State and/or Regional Long Range Plan?</i>	See Section 4.6
<i>Q6: Will the proposed change in access result in needed upgrades or improvements to the cross road for a significant distance away from the interchange?</i>	See Section 2.1.2

Policy Point 2: Transportation System Management	
<i>"The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access."</i>	
Questions	Section Reference
<i>Q1: Was FHWA actively involved in preliminary studies and decisions? If not, then more detailed information may be required in support of proposed action.</i>	See Section 0
<i>Q2: Did the study area cover sufficient area to allow for an evaluation of all reasonable alternatives?</i>	See Section 5.2
<i>Q3: Was a No Build Alternative evaluated?</i>	See Section 6
<i>Q4: Considering the context of the proposal, is this the best location for the proposed new interchange?</i>	See Section 2.1.3
<i>Q5: Were different interchange configurations (Tight diamond, SPDI, Parclo) considered?</i>	See Section 2.1.3.1
<i>Q6: Were pedestrians and bicyclists considered in the alternative evaluation?</i>	See Sections 2.1.2 and 2.2
<i>Q7: Was there an evaluation of different intersection configurations (stop control, signal, roundabout, free right turns, etc.)</i>	See Section 7
<i>Q8: Have Transportation Systems Management (i.e. HOV, ITS, Ramp Metering, Transit, etc.) options been evaluated as an alternative to new or modification to an existing interchange?</i>	See Section 2.1.3
<i>Q9: Did the report discuss how TSM alternatives were evaluated and eliminated from consideration?</i>	N/A
<i>Q10: Does the proposal consider any future planned TSM strategies and is the design consistent with the ability to implement the future TSM strategies?</i>	See Section 2.1.3

Policy Point 3: Safety and Operational Analysis	
<p><i>"An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which included mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access. The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network. Requests for proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network. Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative."</i></p>	
Questions	Section Reference
Q1: Does the report demonstrate that a proper traffic operational analysis was conducted? The analysis should include the applicable basic freeway segments, freeway weaving segments, freeway ramp segments, ramp junctions, and crossroad intersections related to the proposed access point and at least the two adjacent interchanges.	See Section 5
Q2: Does the report include a safety analysis of the mainline, ramps and intersections of the proposed access point and the nearest adjacent interchange (provided they are near enough that it is reasonable to assume there may be impacts)?	See Section 7.5
Q3: Has the design traffic volume been validated?	See Sections 5.3 and 5.4
Q4: Has a conceptual signing plan been provided?	See Appendix I
Q5: Is guidance signing (i.e., way-finding or trail blazing signs) clear and simple?	See Appendix I
Q6: Do the results of the operational analysis result in a significant adverse impact to existing or future conditions?	See Section 7 and Appendix E
Q7: Will the proposed change in access result in needed upgrades or improvements to the cross road for a significant distance away from the interchange? If so, have impacts to the local network been disclosed and fully evaluated?	See Sections 2.1.2.1, 2.1.3 and 5.5
Q8: Are the cross roads or adjacent surface level roads and intersections affected by the proposed access point analyzed to the extent (length) where impacts caused or affecting the new proposed access point are disclosed to the appropriate managing jurisdiction?	See Sections 1 and 4.7

Policy Point 3: Safety and Operational Analysis	
<p><i>"An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which included mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access. The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network. Requests for proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network. Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative."</i></p>	
Questions	Section Reference
Q9: Are pedestrian and/or bicycle facilities included (as appropriate) and do these facilities provide for reasonable accommodation?	See Sections 2.1 and 2.2
Q10: Does the proposed access secure sufficient Limits of Access adjacent to the Interchange ramps?	See Appendix E and Appendix G
Q11: Does the proximity of the nearest crossroad intersections to the ramps contribute to safety or operational problems? Can they be mitigated?	See Sections 2.1.2.1 and 2.1.3.1
Q12: In addition to HCS, what analysis tools were employed and were they appropriate?	See Section 5.1
Q13: Has the proposal distinguished between nominal safety (i.e. adherence to design policies and standards) and substantive safety (actual and expected safety performance)?	See Section 7.5
Q14: Will any individual elements within the recommended alternative be degraded operationally as a result of this action? If yes, are reasons provided to accept them?	See Section 7
Q15: In evaluating whether the proposal has a "significant adverse impact" on safety, has the State Strategic Highway Safety Plan been used as a benchmark?	See Section 7.5
Q16: Are the proposed interchange design configurations able to satisfactorily accommodate the design year traffic volumes?	See Section 7 and Appendix E
Q17: If the project is to be built in stages, has the traffic operational and safety analyses considered the interim stages of the proposal?	N/A. The project is not expected to be constructed in stages.

Policy Point 4: Access Connections and Design	
<i>"The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards."</i>	
Questions	Section Reference
Q1: Does the proposed access connect to a public road?	See Sections 2.1.2.1 and 2.1.3
Q2: Are all traffic movements for full interchange access provided?	See Section 2.1.3 and Figure 2.13
Q3: If a partial interchange is proposed, is there sufficient justification for providing only a partial interchange?	See Section 2.1.3
Q4: If a partial interchange is proposed; was a full interchange evaluated as an alternative and is there sufficient justification to eliminate or discard it?	See Section 2.1.3
Q5: Is sufficient ROW available (or being acquired) to provide a full interchange at a future date (staged construction)?	N/A
Q6: Are you comfortable with how the missing movements will be accommodated on the surface streets and adjacent interchanges?	See Section 2.1.3
Q7: If not, is the proposed access for special purposes such as transit vehicles, HOV's, and/or a park and ride lot?	N/A
Q8: Does FHWA support the selection of design controls/criteria and desired operational goals?	See Section 0
Q9: Does the proposed access meet or exceed current design standards for the Interstate System?	See Appendices G, H, I and J
Q10: If not, have anticipated design exceptions been identified and reviewed (at least conceptually)?	See Appendices G, H, I and J
Q11: If expected design exceptions could have significant operational impacts on the Interstate and/or Crossroad system, are mitigation measures described?	See Section 7 for operational assessments.
Q12: If expected design exceptions could have significant safety impacts on the Interstate and/or Crossroad system, are mitigation measures described?	See Section 7 for operational assessments.
Q13: Will the length of access control along the crossroad provide for acceptable operations and safety? (100-300' is a minimum. Additional access control is strongly encouraged when needed for safety and operational enhancement)	

Policy Point 4: Access Connections and Design	
<i>"The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards."</i>	
Questions	Section Reference
Q14: Does FHWA support selection of opening and design years?	See Section 0
Q15: Have all design criteria (including but not limited to the following) been adequately addressed?	Washington Ave ramps: See Appendix E N. Tucker Blvd ramp: See Appendix F Depressed section: See Appendix G N. 3 <sup>rd</sup> St ramps: See Appendix H
a. Sight distance at ramp terminals (Don't overlook signal heads obscured by structures.)	
b. Sufficient storage on ramp to prevent queues from spilling on to the Interstate (based on current and/or future projected traffic demand)	
c. Vertical clearance	
d. Pedestrian access through the interchange	
e. Length of accel/decel lanes	
f. Length of tapers	
g. Spacing between ramps	
h. Lane continuity	
i. Lane balance	
j. Uniformity in interchange design and operational patterns (i.e. right-side ramps, exit design consistent w/adjacent interchanges)	
Q16: Has each movement of the proposal been "tested" for ease of operation?	See Sections 5 and 7

<b>Policy Point 5: Consistency with Local Transportation Land Use Plans</b>	
<i>"The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93."</i>	
Questions	Section Reference
<i>Q1: Does the AJR discuss or include (as appropriate) other project(s), studies or planned actions that may have an effect on the report analysis results?</i>	See Section 4.5
<i>Q2: Does the project conform to the local planning, MPO or other related plans?</i>	See Section 8.1
<i>Q3: Is the access request located within a Transportation Management Areas? (TMA's are metropolitan areas of 200,000 or more in population)</i>	Yes, 2010 Census data lists the population of the City of St. Louis's as 319,294.
<i>Q4: Is the access request located within a non-attainment area for air quality? (requests for access in a non-attainment or maintenance areas for air quality must be a part of a conforming transportation plan)</i>	Yes, the St. Louis region currently is designated as a non-attainment area for the eight-hour standard for ozone pollution levels. The new eight-hour designation came in April 2004, just months after the region was declared to be in attainment of the one-hour standard.
<i>Q5: Is the project included in the TIP/STIP and LRTP?</i>	See Section 8.1
<i>Q6: Is the access point covered as a part of an Interstate corridor study or plan? (especially important for areas where the potential exists for construction of future adjacent interchanges)</i>	No, the proposed modifications do not fall within any recent corridor studies or plans.
<i>Q7: If the project is to be built in stages, are follow-on stages included in the STIP? (may demonstrate a commitment on the part of the requestor)</i>	N/A
<i>Q8: If the project is to be built in stages, are the funding commitments consistent with state and local government transportation plans?</i>	N/A

<b>Policy Point 6: Consistency with Comprehensive Interstate Network Study</b>	
<i>"In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111)."</i>	
Questions	Section Reference
<i>Q1: Is it possible that new interchange(s) not addressed in the IJR could be added within an area of influence to the proposed access point? (If so, could the proposal preclude or otherwise be affected by any future access points?)</i>	N/A
<i>Q2: Does the IJR report include the traffic volumes generated by any future additional interchanges within a vicinity of influence that are proposed?</i>	See Sections 5.4 and 5.5
<i>Q3: Does the IJR report fail to include any other proposed Interstate access points within a vicinity of influence that are being proposed or are in the current long range construction program?</i>	No, the project investigated and included all proposed projects within the study area of influence.

<b>Policy Point 7: Coordination with Transportation System Improvements</b>	
<i>"When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d))."</i>	
Questions	Section Reference
<i>Q1: Does the access request adequately demonstrate that an appropriate effort of coordination has been made with appropriate proposed developments?</i>	See Section 5
<i>Q2: Are the proposed improvements compatible with the existing street network or are other improvements needed?</i>	See Sections 2.1.2, 5 and 7
<i>Q3: Are there any pre-condition contingencies required in regards to the timing of other improvements?</i>	N/A
<i>Q4: If pre-condition contingencies are required, are pertinent parties in agreement with these contingencies and is this documented?</i>	N/A
<i>Q5: If the proposed improvements are founded on the need for providing access to new development, are appropriate commitments in place to ensure that the development will likely occur as planned?</i>	N/A

<b>Policy Point 7: Coordination with Transportation System Improvements</b>	
<i>"When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d))."</i>	
<b>Questions</b>	<b>Section Reference</b>
<i>Q6: If project is privately funded, are appropriate measures in place to ensure improvements will be completed if the developer is unable to meet financial obligations?</i>	N/A
<i>Q7: If the purpose and need to accommodate new development/traffic demands that aren't fully known, is a worst case scenario used for future traffic?</i>	See Section 5.4
<i>Q8: Does the project require financial or infrastructure commitments from other agencies, organizations or private entities?</i>	See Section 8.1

<b>Policy Point 8: Consideration for NEPA Environmental Processes</b>	
<i>"The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111)."</i>	
<b>Questions</b>	<b>Section Reference</b>
<i>Q1: Are there any known social or environmental issues that could affect the proposal?</i>	See Section 4.7
<i>Q2: Is the project consistent with the current TIP/STIP and LRTP and/or proposed amendments to the plan?</i>	See Section 8.1
<i>Q3: Although NEPA is a separate action, is an environmental overview for the proposed improvements included?</i>	See Section 4.7
<i>Q4: Is it appropriate to emphasize to the project stakeholders that the access approval will be handled as a two-step process? (i.e. Step 1: Engineering and Operational Acceptability and Step 2: Environmental Approvals)</i>	See Section 4.7

### 3 FHWA Project Planning Involvement

The CAR 2015 transportation initiatives began to take shape in November, 2010. In an effort to solicit early feedback from FHWA on proposed network changes, the MoDOT and CAR 2015 teams reached out to FHWA as soon as initial alternatives were defined. FHWA feedback throughout this process has been instrumental in refining the project planning and sculpting this AJR.

In December, 2010, CAR 2015 submitted a memorandum as an initial project description document:

- JNEM Expansion – Transportation Plan Technical Memorandum

A meeting with FHWA representatives at MoDOT's District office on December 16<sup>th</sup>, 2010 gave the project team an opportunity to elaborate on the initial Technical Memorandum as well as answer any questions. This meeting initiated regular dialogue between FHWA, MoDOT, and the CAR 2015 Design Team in an effort to streamline the federal review process. This exchange of information was formalized as the PSB-JNEM Core Team Meetings, facilitated by MoDOT every two weeks. These meetings began as an extension of the regular project meetings held by the NMRB project staff (including MoDOT and FHWA) in March, 2011 and are anticipated to continue throughout implementation of the CAR 2015 and PSB projects. FHWA representatives are in attendance at these meetings, where all aspects of both projects are discussed. In addition, the implications of other projects and potential projects in the region are discussed, including for example, IL Route 3 and the Tri-Level Interchange in East St. Louis.

The Design Team went beyond the regularly scheduled Core Team meetings in their efforts to coordinate with FHWA. In May, 2011, the team met with FHWA to exhibit and discuss the Traffic Analysis Models. The Design Team followed this meeting with documentation aimed at detailing the methodology and results of the traffic analysis (laying the groundwork for AJR documentation):

- Pre-AJR Briefing Memo 1: Project Overview – June, 2011
- Pre-AJR Briefing Memo 2: Traffic Modeling Approach and Assumptions – July, 2011

Subsequent to these Memos, MoDOT and the Design Team met with FHWA representatives on September 21<sup>st</sup> at the NMRB project office to present the two projects and to solicit feedback regarding information that should be included in the AJR for projects of this scale and complexity. These comments led to the development of the FHWA Technical Memorandum:

- Pre-AJR Briefing Memo 3: FHWA Technical Memorandum – October, 2011

In addition to the Technical Memorandum produced by the CAR 2015 design team, MoDOT issued a similarly styled memo to FHWA for review:

- PSB Interchange J6I2377B Pre-AJR Design Memo – October, 2011

The five memoranda listed above are attached to this AJR as Appendices. It should be noted that all of these documents represent a snapshot in time and are not necessarily representative of the current design plans. FHWA's comments and recommendations to the memoranda have been incorporated into this AJR.

In mid-November, FHWA responded to the two October Memos with a set of comments for consideration by MoDOT and the CAR 2015 design team. The Core Team subsequently hosted a telephone call with FHWA on November 22<sup>nd</sup>, 2011 to review and discuss FHWA's comments prior to the release of the Initial Draft AJR. The outcome of this process, including FHWA's comments and subsequent discussion with the Design Team, are summarized as follows:

- FHWA supports the selection of CAR 2015's opening year of 2015 and the design year, established as 20 years beyond the opening year (2035) per MoDOT project design requirements.
- FHWA confirmed operational and modeling scenarios to be studied;
- FHWA confirmed that the peak hour is appropriate for the modeling period;
- FHWA confirmed the modeled area is appropriate:
  - a. equivalent full interchange on I-64 at the west extents (including westbound off and on, eastbound off and on) across the PSB to the beginning of the Tri-Level bridge in Illinois at the east extents,
  - b. I-70/44/55 at 10<sup>th</sup> Street off-ramp at the north extents to one service interchange south of the I-44/55 interchange at the south extents,
  - c. I-70 NMRB from Missouri North interchange to NMRB crossing, and
  - d. MLK from I-44 to MLK crossing.

In terms of design controls, criteria and operational goals, MoDOT follows the "Green Book" (FHWA Policy for Highways and Streets) for facility design criteria and operations. Likewise, FHWA recognizes and accepts MoDOT's Practical Design Implementation Manual for design and operation of highway facilities.

It should be noted that FHWA initially recommended that the CAR 2015 and PSB projects be incorporated into a combined AJR due to their proximity and similar project timelines. Subsequently, when the PSB project was put on hold, FHWA came to the decision to split out the CAR 2015 project in a stand-alone AJR.

## 4 Existing Conditions

### 4.1 Metropolitan St. Louis Interstate System

St. Louis is home to many large national transportation routes that serve local, regional, and national traffic demands. The Interstate highways that traverse downtown St. Louis are:

- **Interstate 44 (I-44)** begins in Wichita Falls, Texas, and runs about 634 miles (including about 290 miles in Missouri) in a generally northeasterly direction to a junction with I-55, southeast of the PSB. Upon completion of the NMRB and related connector roadway and interchange projects, the Interstate freeway segment between the I-44/I-55 junction and the Missouri North I-70 Interchange, currently designated as I-70, would be re-designated as I-44.
- **Interstate 55 (I-55)** begins in LaPlace, Louisiana, and runs about 964 miles (including about 210 miles in Missouri) in a generally northerly direction to Chicago, Illinois. From Memphis, Tennessee, to St. Louis, I-55 roughly parallels the Mississippi River. I-55 crosses the Mississippi River on the PSB.
- **Interstate 64 (I-64)** begins in Wentzville, Missouri, about 40 miles west of St. Louis, and runs about 954 miles in a generally easterly direction to Chesapeake, Virginia. I-64 crosses the Mississippi River on the PSB.
- **Interstate 70 (I-70)** begins in Cove Fort, Utah, and runs about 2,153 miles (including about 252 miles in Missouri) in a generally easterly direction to Baltimore, Maryland. I-70 currently crosses the Mississippi River on the PSB. Upon completion of the NMRB and related connector roadway and interchange projects, the new Interstate freeway segment from the Missouri North I-70 Interchange across the NMRB to the Tri-Level Interchange in Illinois would be designated as I-70. The Interstate freeway segment between the west end of the PSB and the Tri-Level Interchange would cease to be designated as I-70, but would remain as I-55 and I-64. The Interstate freeway segment between the I-44/I-55 junction and the Missouri North I-70 Interchange, currently designated as I-70, would be re-designated as I-44.
- **Interstate 255 (I-255)** begins in Mehlville, Missouri, about 3.8 miles west of the Mississippi River, and runs about 30.8 miles in a generally northeasterly direction to Pontoon Beach, Illinois. I-255 composes the eastern third of the belt system around metropolitan St. Louis. I-255 crosses the Mississippi River on the Jefferson Barracks Bridge.
- **Interstate 270 (I-270)** begins in Mehlville, Missouri, about 3.8 miles west of the Mississippi River, and runs about 50.6 miles in a generally northerly and then easterly direction to Troy, Illinois. I-270 composes the western two-thirds of the belt system around metropolitan St. Louis. I-270 crosses the Mississippi River on the Chain of the Rocks Bridge.

The metropolitan St. Louis Interstate system is displayed in Figure 4.1.

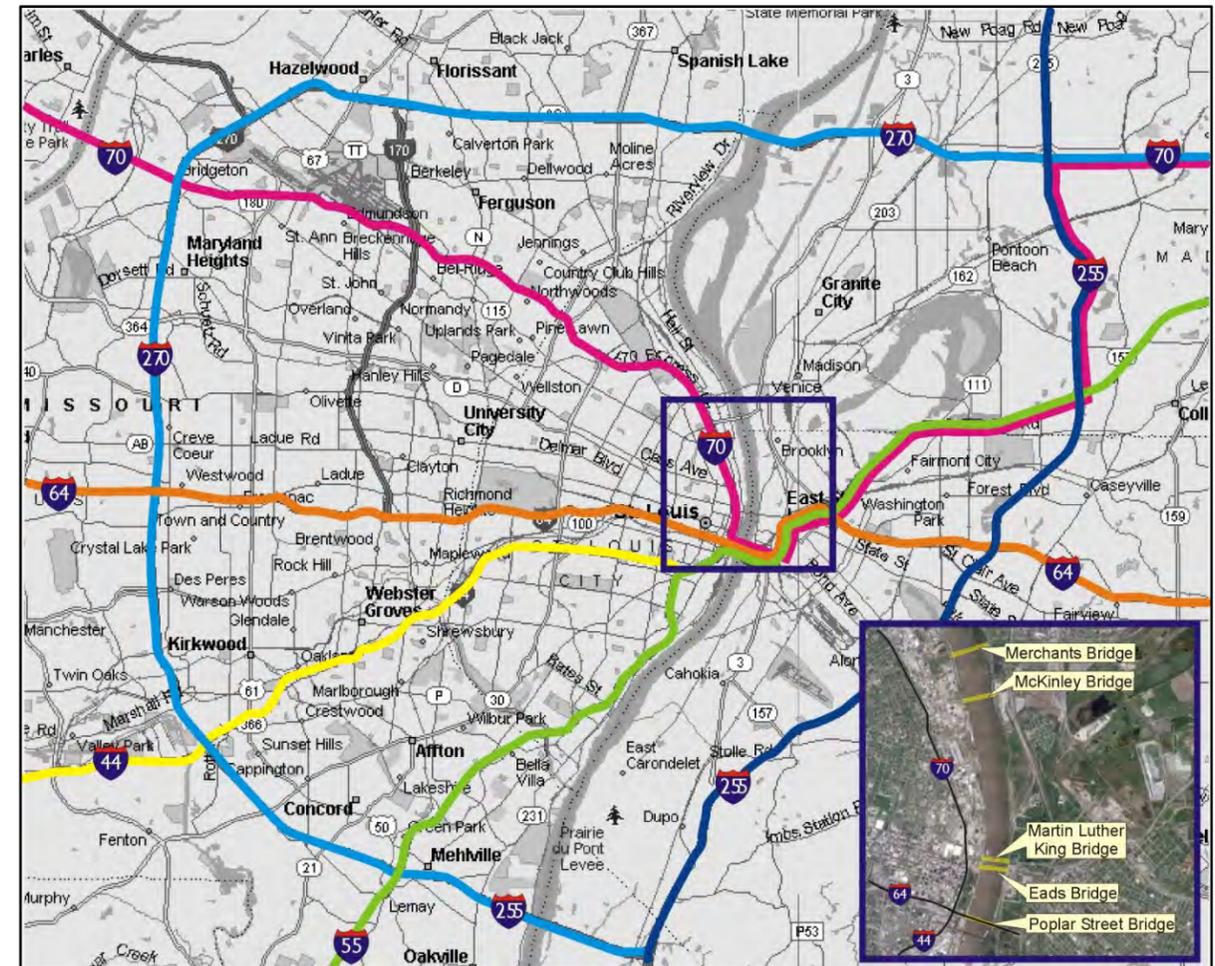


Figure 4.1: Metropolitan St. Louis Existing Interstate System (Image: CBB)

### 4.2 Metropolitan St. Louis Bridge System

Also displayed in Figure 4.1 are the vehicular crossings of the Mississippi River available to metropolitan St. Louis motorists. These include:

- **Eads Bridge.** Completed in 1874, the Eads Bridge was the first major bridge to use steel and was, at the time, the longest supported-deck arch bridge. Today, the Eads Bridge is the oldest bridge crossing of the Mississippi River, and is owned and operated by the City of St. Louis. It has undergone several periods of rehabilitation and serves as an iconic structure within the downtown landscape. The Eads Bridge accommodates four lanes of traffic and a pedestrian/bicycle path on its upper deck and MetroLink rail on the lower deck; however the upper deck is occasionally closed to vehicles for special events. The Eads Bridge connects Washington Avenue in St. Louis, between the JNEM and Laclede's Landing, with Broadway Avenue in East St. Louis, Illinois.

- **Poplar Street Bridge (PSB)**, located about 4,100 feet south of the Eads Bridge, carries eight lanes of traffic and about 100,000 vehicles per day. The PSB is designated as I-55, I-64, I-70, and U.S. Highways 40 and 66 across its entire length.
- **MacArthur Bridge** is located about one mile south of the Eads Bridge and carries rail traffic only.
- **Jefferson Barracks Bridge (J.B. Bridge)**, located about 11 miles south of the Eads Bridge, is a pair of bridges carrying three lanes of traffic each. The J.B. Bridge is designated as I-255 and US-50. Pedestrians and bicyclists are accommodated by twelve-foot shoulders on the bridge, but bicycle access is very limited on the Illinois side.
- **Martin Luther King Bridge**, located about 740 feet north of the Eads Bridge, provides an alternate, direct connection between I-70 in downtown St. Louis and I-55/I-64/I-70 in East St. Louis. A five-foot pedestrian walkway is located on the south side of the bridge.
- **McKinley Bridge**, located 2.5 miles north of the Eads Bridge, was originally built in 1910 as a railroad bridge. One lane in each direction for automobile traffic was added in the 1930s. A major refurbishment in 2004 resulted in its current configuration with two automobile travel lanes on the inside, an exclusive service lane on the north side of the bridge, and an exclusive pedestrian sidewalk/bike path on the south side of the bridge. McKinley Bridge connects northern downtown St. Louis with Venice, Illinois.
- **Merchants Bridge** is located about three miles north of the Eads Bridge and carries rail traffic only.
- **New Chain of Rocks Bridge**, located about nine miles north of the Eads Bridge, is a pair of bridges carrying two lanes of traffic each. The New Chain of Rocks Bridge is designated as I-270. The original Chain of Rocks Bridge, located about 1,700 feet south of the New Chain of Rocks Bridge, is a narrow bridge with a 22° bend that currently carries pedestrians and bicyclists only.
- **Clark Bridge**, located about 17 miles north of the Eads Bridge, connects Missouri with Alton, Illinois. Clark Bridge carries four lanes of traffic and is designated as links U.S. Highway 67.

### 4.3 Metro Transit

Metro Transit is the Regional Transit Authority (RTA). It provides public transportation for The City of St. Louis and St. Louis County in Missouri and St. Clair County in Illinois. Metro Transit is a bi-state agency that transports nearly 150,000 passengers daily. The system can accommodate 25,000 additional passengers during peak hours and up to 100,000 additional boardings daily. Metro Transit operates:

- **MetroBus:** 75 MetroBus routes, servicing four counties in Missouri and Illinois, including the City of St. Louis. These include 43 local/regional and 6 commuter/express routes in Missouri and 13 local and 4 commuter/express routes in St. Clair County, Illinois.

- **MetroLink:** the region's light-rail system consists of two lines (Red Line and Blue Line) connecting Lambert-St. Louis International Airport and Shrewsbury, MO with Scott Air Force Base near Shiloh, Illinois through Downtown St. Louis as shown in Figure 4.2. The system features 37 stations, carries an average of 61,573 people each weekday, and uses a shared fare system with MetroBus.
- **Metro Call-A-Ride:** (Curb-to-Curb van service for A.D.A. eligible riders) in Missouri

Madison County Transit is a Metro Transit partner providing additional bus service to downtown St. Louis from nearby Madison County, Illinois.



Figure 4.2: St. Louis MetroLink System (Image: UrbanRail.net)

### 4.4 Bicycle/Pedestrian Connections

The centerpiece of the Missouri-Illinois Bicycle/Pedestrian system is the Old Route 66/Chain of Rocks Bridge across the Mississippi River which runs parallel to the new Chain of Rocks Bridge and I-270. This bridge is the only true bicycle/pedestrian crossing for cross-country touring cyclists for several hundred miles connecting the St. Louis Riverfront Trail in Missouri and the Madison County Transit Confluence Trail in Illinois. From North Riverfront Park at the west approach to this crossing, the ten-mile St. Louis Riverfront Trail follows the Mississippi River's west bank south to the Gateway Arch in Downtown St. Louis, passing through several of St. Louis' oldest neighborhoods. The Eads Bridge from Downtown St. Louis to East St. Louis also has bike lanes, and is often closed to accommodate bicycle and pedestrian events. The newly-renovated McKinley Bridge offers bike lanes as well, connecting to the St. Louis Riverfront Trail on its west end and to green space at the base of the bridge's east end in Venice, Illinois.

Several bicycle advocacy groups are active in St. Louis including Great Rivers Greenway and Bike St. Louis, among others. Consulting with MoDOT and several other agencies and local

governments, these two groups developed the Gateway Bike Plan, a 20 year bicycle master plan for the St. Louis area. The Gateway Bike Plan includes a number of various bicycle facilities including on-street bicycle lanes, dedicated bicycle lanes, shared lanes and off-road bicycle trails. Within the area of the CAR 2015 project, bicycle facilities are planned for Leonor K. Sullivan, North 4<sup>th</sup> Street, North Broadway, Market Street, Chestnut Street, and Washington Avenue. These facilities are being considered within the local street network of the CAR 2015 plans but do not affect the proposed Interstate highway modifications of either project.

## 4.5 Related Projects

### 4.5.1 The New Mississippi River Bridge

The NMRB is the first bridge connecting downtown St. Louis and southwestern Illinois to be built in more than 40 years. When it opens in 2014, the NMRB will create a new crossing between Illinois and Missouri, providing better connections to and through St. Louis. The project includes a new landmark bridge structure and the realignment and reconstruction of I-70 and numerous local roads on both sides of the state line. The project aims to provide enhanced transportation system reliability, linkages, and community access and to reduce traffic congestion and incident potential on the existing St. Louis area Mississippi River crossings as shown in Figure 4.1. When complete, the NMRB would be designated as I-70, as shown in Figure 4.4, relocating that east-west movement from the PSB and reducing overall traffic volumes in the downtown area. The segment of existing I-70 between the PSB and the future NMRB Missouri interchange would be re-designated as I-44.

The NMRB project initially received a Record of Decision (ROD), Final Environmental Impact Statement (FEIS) Approval, and Design Approval in 2001. In that document, the Preferred Alternative included the following components:

- Relocated I-70 in Illinois, north of its current location (Illinois I-70 roadways) including an Interchange with Relocated IL Route 3;
- A new, eight-lane, I-70 Mississippi River Bridge;
- An interchange in Missouri with existing I-70 (aka the Missouri North I-70 Interchange);
- An improved Tri-Level Interchange (I-55/64/70) in East St. Louis;
- A connection between existing Tri-Level Interchange and the relocated I-70; and
- Improvements to ramps at the west side of the existing I-55/64/70 Poplar Street Bridge (aka the Missouri South Interchange).

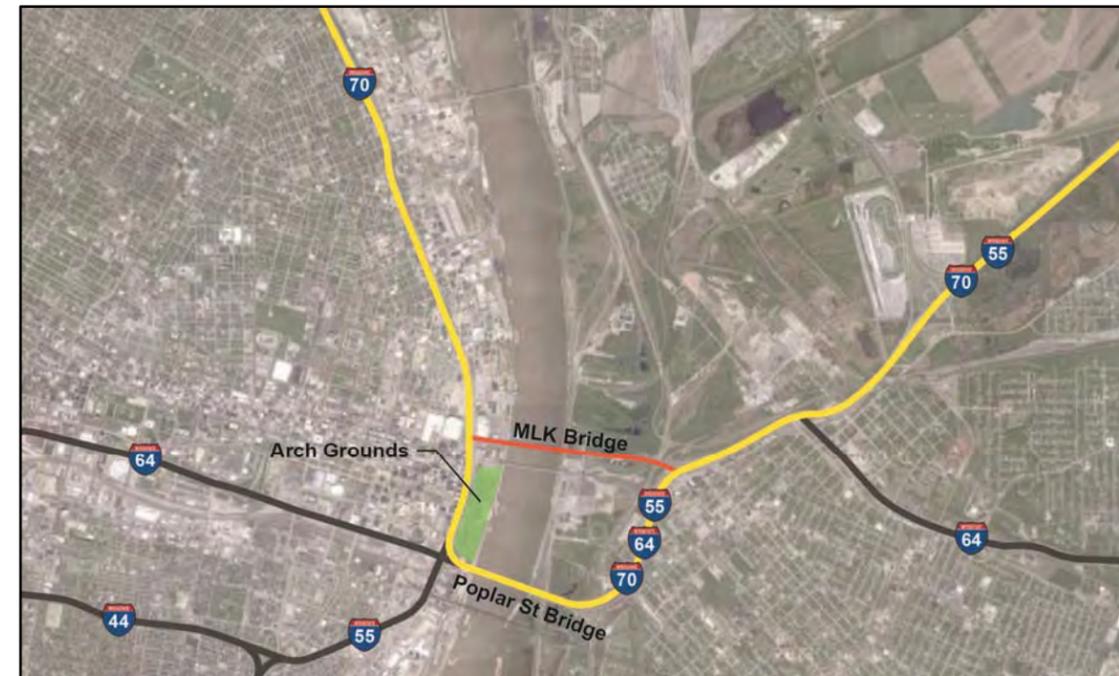


Figure 4.3: Existing Interstate I-70 Alignment through Downtown St. Louis (Image: Arup)

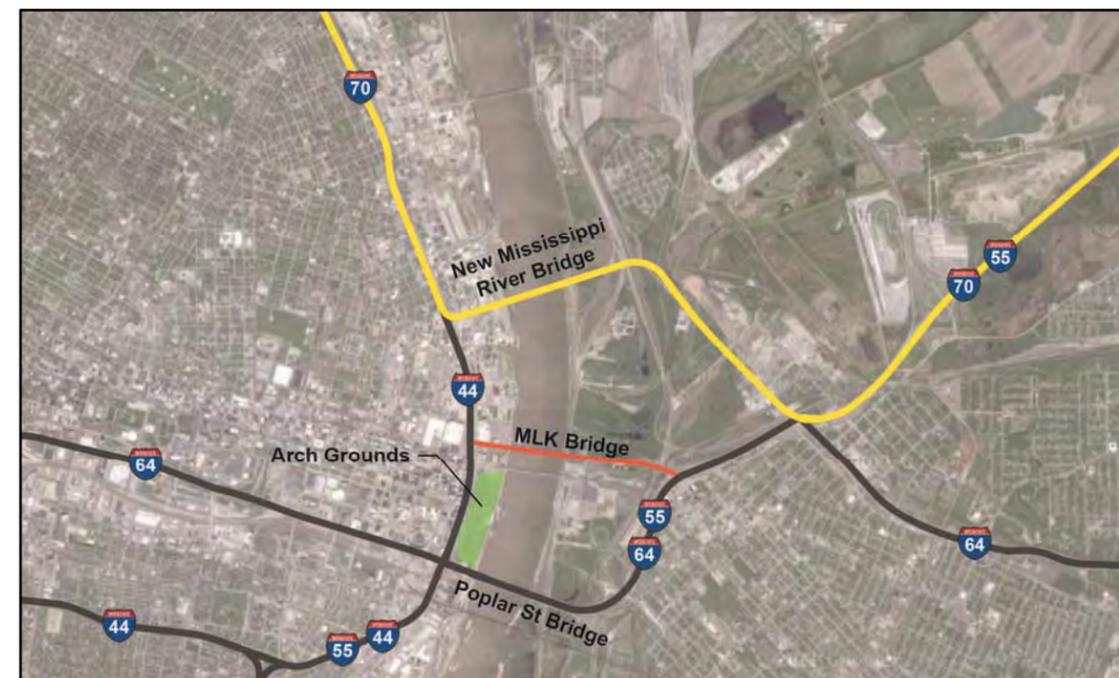


Figure 4.4: Future Interstate I-70 Alignment North of Downtown St. Louis (Image: Arup)

In 2004, it was determined that funding for the entire project could not be secured to satisfy the financial plan requirements for a major project. In May 2005, Illinois and Missouri proposed the following revisions to reduce the cost of the project:

- Relocated I-70 in Illinois, north of its current location but avoiding the Cahokia Canal Relocation;
- A new, eight-lane, I-70 Mississippi River Bridge with the main span reduced in length from 2,000 feet to 1,500 feet;
- Reduced scale of the interchange in Missouri with existing I-70 (Missouri North I-70 Interchange);
- Elimination of the reconstruction of the Tri-Level Interchange (I-55/64/70) in East St. Louis;
- Elimination of the connection between existing I-55/64/70 (Tri-Level Interchange) and the relocated I-70; and
- Elimination of the proposed improvements to ramps at the west side of the existing I-55/64/70 Poplar Street Bridge (Missouri South Interchange).

In January 2007, the Federal Highway Administration issued a Major Project Guidance which amended Title 23 United States Code Subchapter 106 and made several significant changes to the requirements for Major Projects. One of the changes allows the scope of work described in the ROD to be divided into multiple projects that would independently conform to Major Project requirements. The multiple projects would be operationally independent phases of work which can be built and function as a viable transportation facility even if the rest of the work described in the ROD is never built.

Based on the Title 23 amendment, the Illinois Department of Transportation (IDOT) submitted an October 2008 Memorandum that re-evaluated the 2001 FEIS. The Memorandum describes an operationally independent initial phase of the New Mississippi River Bridge Project that allows the states to satisfy the Major Projects requirements while providing components essential to meeting the main elements of the project’s purpose and need. The proposed improvements are referred to as the New Mississippi River Bridge crossing which includes:

- A new two-way, four-lane I-70 Mississippi River Bridge and approaches in Illinois and Missouri;
- A four-lane roadway (Relocated I-70), primarily following the original I-64 connector alignment, connecting the new bridge to both Interstate 55/70 (north & east) toward Collinsville and I-64 at the existing I-55/64/70 interchange in East St. Louis;
- Various ramp improvements and local street improvements at the I-55/64/70 Tri-Level Interchange in East St. Louis;
- A new interchange (Missouri North I-70 interchange) connecting the new bridge to I-70 (west) toward Lambert Airport in Missouri; and
- A new local street connection from the new bridge to Cass Avenue in St. Louis.

It is anticipated that a future project (referred to as NMRB Phase II) would include the following key components carried over from the original plans (Figure 4.5):

- A companion four-lane Mississippi River Bridge

- A relocated I-70 alignment from the east end of the NMRB to east of the I-55/I-64/I-70 “Tri-Level” interchange
- Connections to and from I-44 south of the NMRB Missouri touchdown
- Additional local street connections at the Missouri North I-70 Interchange near Cass Avenue

At this time, however, additional projects are not approved or funded and there is no timeline for construction.



Figure 4.5: Missouri North Interchange Showing Possible NMRB Phase II in Pink (Image: MoDOT)

### 4.5.2 Proposed Poplar Street Bridge Ramp Modifications

The PSB currently provides the only Interstate crossing of the Mississippi River into and out of the City of St. Louis. Currently carrying I-55, I-64, and I-70, as well as U.S. Highways 40 and 66 across its entire length, the PSB has a total of eight travel lanes (four in each direction) and no shoulders. The combination of all Downtown St. Louis Interstate connections onto a single bridge contributes to severe peak-period congestion.

Most of the congestion on the bridge, both commuter and non-commuter traffic, is caused by the I-55 ramps to and from the PSB. The traffic demand has greatly oversaturated the capacity of these single-lane ramps. Increasing these ramps to two lanes is the only viable option for improving operations of the bridge.

There are currently four ramp connections at the west end of the PSB:

- “Ramp A” from PSB westbound that splits to connect to Memorial Drive northbound and to the depressed section of I-70 westbound, north of the PSB;
- One-lane ramp from westbound PSB to I-55 to the south;
- Two ramps from eastbound I-70 and Memorial Drive southbound that merge to become a one-lane connection (“Ramp B”) to the eastbound PSB; and
- One-lane ramp from I-55 in the south to PSB eastbound.

The existing geometry is shown in Figure 2.12.

I-70 is currently undergoing a major realignment to divert the mainline highway to the north of downtown St. Louis. The first phase of the new Mississippi River Bridge roughly two miles north of the PSB (discussed in this document under Related Projects), is currently under construction and scheduled to open in year 2014. This project initially received a ROD, FEIS Approval and Design Approval in 2001. The preferred NMRB alternative included alterations to the PSB ramps at the west side of the existing I-55/64/70 Poplar Street Bridge (aka the Missouri South Interchange) among other Downtown St. Louis Interstate access improvements. In 2004, it was determined that funding for the entire project could not be secured to satisfy the Financial Plan requirements for a Major Project. In May 2005, Illinois and Missouri initiated numerous efforts among them including the elimination of the PSB ramp modifications to reduce the cost of the project.

When complete, the NMRB will be redesignated as I-70 and will add new river-crossing capacity for Interstate movements. The new bridge is expected to reduce the traffic on the existing PSB, especially the regional I-70 movements that currently pass through downtown St. Louis. In response to these shifts, MoDOT is again proposing to reconstruct the ramps at the west end of the PSB to alleviate the congestion on the bridge while working in conjunction with the roadway network changes proposed by the CAR 2015 project.

Throughout this AJR, this configuration of the PSB ramps will be referred to as “PSB Preferred Build” and includes:

- Replace Ramp A from PSB westbound to connect with Memorial Drive northbound and the depressed section of I-70 westbound, north of the PSB;
- Replace the one-lane ramp from PSB westbound to I-55 to the south with a dual-lane ramp;
- Remove Ramp B from Memorial Drive southbound and I-70 eastbound to PSB eastbound; and
- Replace the one-lane ramp from I-55 in the south to PSB eastbound with a dual-lane ramp.

The proposed geometry is shown in Figure 2.13.

Within the context of demonstrating that the CAR 2015 project can perform within several possible futures for the PSB ramps and lane configuration for the depressed highway section, the existing condition and four scenarios were considered for the depressed section of I-70 as described in Table 4.1 and shown in Figure 4.6:

Table 4.1: Depressed Highway Lane Configuration Possibilities

Project Alternative and Analysis Scenario	PSB Ramp and Depressed Highway Lane Configuration
Existing Configuration	Eastbound – two travel lanes Westbound – two travel lanes
3A and 10A, PSB Preferred Build 6A and 9A	Eastbound – two travel lanes Westbound – two travel lanes + one auxiliary lane connecting PSB Ramp A to the proposed Washington Ave exit
3B and 10B	Eastbound – two travel lanes + one auxiliary lane connecting the proposed Washington Ave on-ramp to PSB Ramp B Westbound – two travel lanes
3C and 10C	Eastbound – two travel lanes + one auxiliary lane connecting the proposed Washington Ave on-ramp to PSB Ramp B Westbound – two travel lanes + one auxiliary lane connecting PSB Ramp A to the proposed Washington Ave exit

These scenarios are described in detail in Section 6, Alternatives.

In terms of the CAR 2015 project, these scenarios comprise every possible future scenario for the PSB ramp modification project and potential lane configuration within the depressed highway section. All of these scenarios have been studied in detail and results are described in subsequent sections of this AJR

MoDOT is pursuing the PSB Ramp Modifications under separate AJR and Environmental Documentation processes. The PSB Ramp Modification Project will assume lane reconfiguration activities when the final alignment and configuration of the PSB project is determined.

### Interstate Highway, Ramp and Depressed Section Configuration

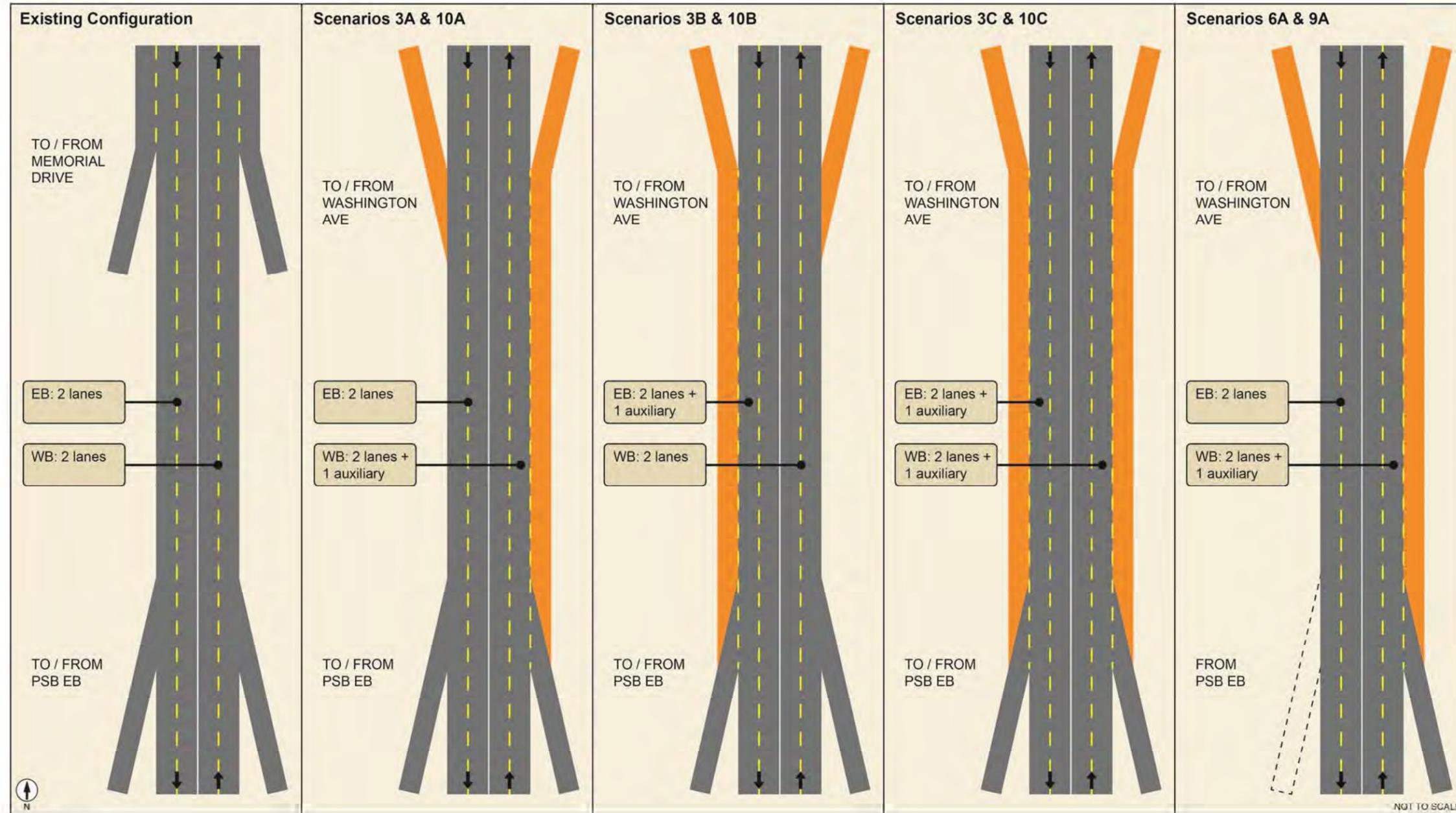


Figure 4.6: Potential Interstate Highway, Ramp and Depressed Section Configurations (Image: Arup)

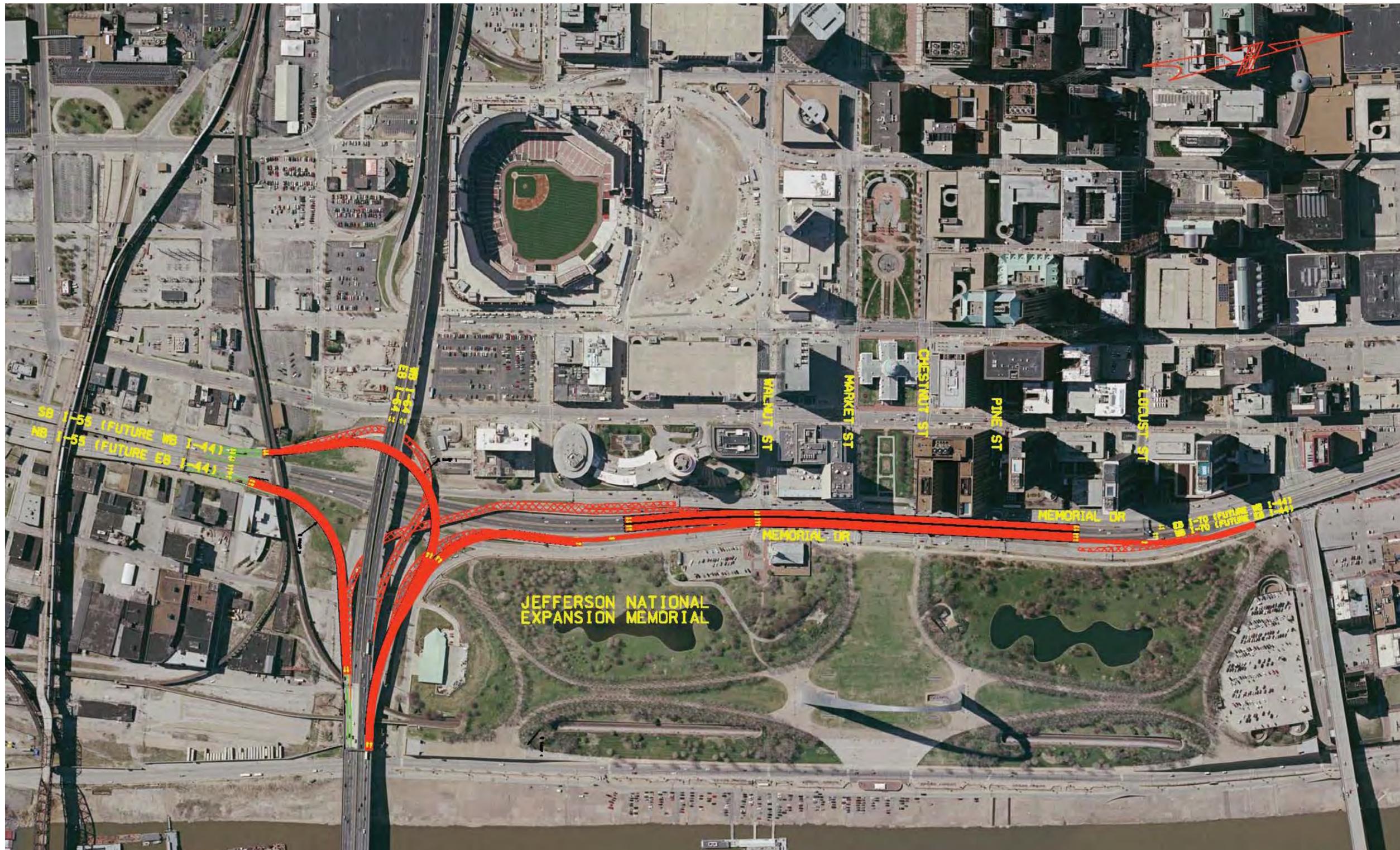


Figure 4.7: PSB Ramp Modification Project in the Preferred Scenario (6A and 9A) with Five Lane Depressed Highway Section Configuration (Image: MoDOT)

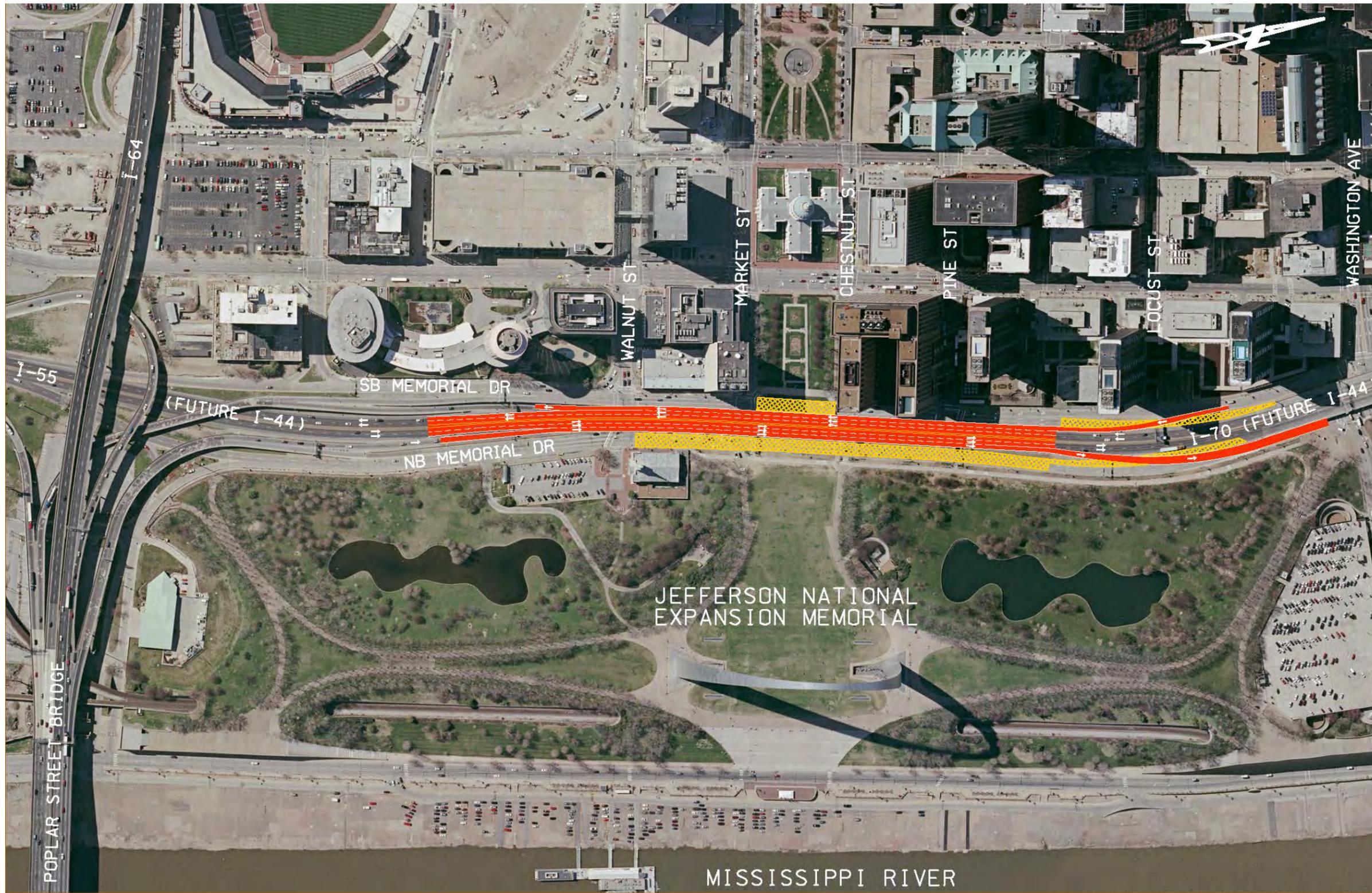


Figure 4.8: Potential Six-lane Depressed Highway Section Configuration (Scenarios 3C and 10C) (Image: MoDOT)

## 4.6 Related Transportation Studies

Evaluation of the CAR 2015 project has considered and included relevant programmed projects in the future network from the following state and regional Long Range Plans:

- MoDOT's Long Range Plan
- East-West Gateway's Regional Plan
- The City of St. Louis's Long Range Plan

This section describes other recent transportation studies in the project area that precede the CAR 2015 project.

### 4.6.1 2009 Memorial Drive Closure Traffic Study

In 2009, EDAA/AECOM in collaboration with AECOM Transportation performed a Traffic Impact Study as part of the General Management Plan/EIS for the JNEM in Downtown St. Louis. The purpose of the study was to determine the traffic impacts of closing a portion of Memorial Drive, adjacent to the JNEM, to vehicular traffic. The study identified the traffic impacts on adjacent streets, intersections, and ramps in the vicinity of the Memorial in Downtown St. Louis.

The following three scenarios were tested on Memorial Drive as a part of this study:

- Scenario A: One-block closure of northbound and southbound Memorial Drive between Market Street and Chestnut Streets;
- Scenario B: Two-block Closure of northbound and southbound Memorial Drive between Walnut and Chestnut Streets; and
- Scenario C: Three block closure of northbound and southbound Memorial Drive between Walnut and Pine Streets.

The results presented in the studio were:

- Scenario A: all intersections near the Arch Grounds operated at LOS D or better. The 4<sup>th</sup> Street and Walnut Street intersection showed a LOS E due to increased traffic through the intersection. A LOS D at the Broadway Avenue and Walnut Street intersection was due to a major increase in the southbound left turn volumes.
- Scenario B: LOS E during the AM peak period at the 4<sup>th</sup> Street and Walnut Street intersection due to increased traffic through this intersection. LOS D at the Broadway Avenue and Walnut Street intersection was due to a major increase in the southbound left turn volumes as under Scenario A.
- Scenario C: the SYNCHRO model displayed congested conditions with LOS E during the AM peak periods at the 4<sup>th</sup> Street and Walnut Street and 4<sup>th</sup> Street and Pine Street intersections. For the 4<sup>th</sup> Street and Walnut Street intersection, LOS E was projected due to increased traffic through the intersection in both directions while at the 4<sup>th</sup> Street and

Pine Street intersection a LOS E was anticipated due to increased traffic volumes on the westbound approach.

The findings of the Memorial Drive Closure Traffic Study were not supported by MoDOT.

### 4.6.2 2009 Martin Luther King Bridge Alternatives Analysis

Crawford, Bunte, Brammeier (CBB) performed an alternative analysis in 2009 summarizing alternative lane configurations on the MLK Bridge. The MLK Bridge connects Interstates 55/70/64 and Martin Luther King Drive in East St. Louis, Illinois, with Interstate 70 and the downtown street network in St. Louis, Missouri. 2009 IDOT internet ADT maps showed that the bridge carried about 37,500 vehicles per day.

The purpose of the MLK Bridge Alternatives Analysis was to evaluate alternative lane configurations that would improve safety along the bridge. MLK Bridge traffic flows are influenced by both the systematic interaction of the downtown bridge system and the MLK Bridge's geometrics. The MLK Bridge had four narrow travel lanes (approximately 10 feet in width) and no median barrier separating opposing traffic. It was common for motorists to avoid side-by-side travel with other vehicles, presumably because of discomfort with the narrow lane configuration. Likewise, the sharp right-turn movement at the Missouri end of the bridge required westbound vehicles to slow to 30 mph or less, resulting in minor traffic backups and/or "moving queues" under heavy volumes.

This configuration coupled with vehicles routinely traveling in excess of the 45 miles per hour (mph) speed limit were contributing factors to safety issues, specifically head-on collisions. Reducing the potential for these crashes was IDOT's primary focus in developing various alternative lane configurations on the MLK Bridge. However, the narrow width of the bridge (~40 feet) eliminated the feasibility of installing a median barrier and also maintaining four travel lanes. Therefore, all the alternatives evaluated were designed to carry a maximum of three travel lanes on the bridge.

Analysis results indicated that alternative lane configurations with one westbound lane impacted the merge area on the approach from Interstates 55/70/64 in Illinois and causing potential queue spillbacks on to the freeways in the am peak hour. Alternative lane configurations with one eastbound lane impacted signalized intersections on the Missouri side, creating the potential for queue spillbacks in Downtown St. Louis and I-70. Reversible lane configurations that provide two westbound lanes in the morning peak period and two eastbound lanes in the evening peak period operate similar to existing conditions. However, this configuration would create an unwelcome effect of having barriers on both sides on all travel lanes on the bridge. A reversible three-lane bridge operating westbound in the morning peak and eastbound in the evening peak was additionally investigated. Preliminary analysis indicated that this concept was feasible and could improve traffic operations on the Mississippi River Bridges.

The MLK Bridge is currently configured with one westbound and two eastbound travel lanes separated by a concrete jersey barrier median.

### 4.6.3 The Danforth Foundation Arch Study

In 2005, the Danforth Foundation, established by Former U.S. Sen. John C. Danforth, began studying ways to make the Arch riverfront livelier and better connected to Downtown St. Louis. It spent \$2 million on that work, leading two years later to the Foundation's suggestion, with support from the Mayor of the City of St. Louis, that local interests purchase a portion of the 91-acre Jefferson National Expansion Memorial for development purposes.

The goal of this concept was to entice visitors to remain in the area after visiting the popular Gateway Arch. The Danforth Foundation was prepared to spend \$50 million and help raise an additional \$100 million to invest in a new museum, cafes, an amphitheater and other attractions. The study estimated it would cost \$90 million to solve a longstanding local frustration: how to get people safely across Memorial Drive and peacefully over the noise of Interstate 70's depressed lanes.

The Danforth Foundation and the NPS never came to agreement on the land transfer. In November 2008, the Danforth Foundation withdrew from further discussions. The Foundation's efforts were the catalyst for the design competition held in December 2008.

Following Danforth's withdrawal from the Arch project, The CAR 2015 Foundation, a nonprofit organization, was established to oversee the redesign. MVVA of New York released their specific design proposal in 2009 following their victory in the international design competition.

The Danforth Foundation announced a \$1 million grant to the CAR 2015 Foundation in early 2011 in an effort to push the redesign of the Arch grounds and improve its connections to Downtown St. Louis, the Mississippi River, and the Illinois riverfront.

## 4.7 Environmental Review and Documentation

The operational analyses within this document are being used to provide input into four separate but linked environmental documents:

- MoDOT Environmental Assessment (EA) for the Washington Ave Ramps;
- MoDOT re-evaluation of the NMRB EIS for the proposed off-ramp at N. Tucker Blvd;
- MoDOT re-evaluation of the NMRB EIS for PSB Ramp Modifications; and
- The National Parks Department update of the GMP EIS.

Agencies such as MoDOT, IDOT and FHWA have participated in Core Team meetings every two weeks for more than a year to coordinate CAR 2015, PSB and NMRB related issues. Separate approvals of an environmental document and AJR have been discussed among the Core Team.

### 4.7.1 Environmental Impact

The content that follows was taken from the EA prepared by MoDOT which evaluates the environmental impacts of the preferred CAR 2015 alternative, the subject of this AJR. The EA's preliminary analysis concluded that the preferred alternative should have "minimal

environmental and socioeconomic impacts," and did not determine any fatal flaws. More detailed information on each of the following sections can be found in the EA document.

#### Land Use

This project involves no new right of way; therefore there will be no impacts to the existing land use or zoning.

#### Prime and Unique Farmland

The project in its entirety falls within the city limits of St. Louis. Therefore, it meets the Farmland Protection Policy Act (FPPA) definition of "land committed to other uses," and farmland impact will not be further evaluated for this project.

#### Employment Impacts

Employment impacts are measured by jobs lost and jobs generated by the proposed project. Under the proposed action, no employers in the project area are displaced.

Positive economic effects may be realized during the construction period due to the expenditure of public funds within the project area. This includes direct income for construction workers which may be expended for goods and services within the area. Indirect economic benefits are expected due to multiplier effects of capital investments whereby local materials and suppliers may benefit from providing goods to the construction contractor for the project.

#### Pedestrian and Bicycle Mobility

Currently pedestrians and cyclists are at risk trying to access the JNEM grounds from downtown and vice versa. In order to get back and forth, they must cross four to six lanes of traffic on Memorial Drive, mixing everyday traffic with pedestrians and cyclists.

With the construction of the Park over I-70 and the closure of Memorial Drive in this area, pedestrians and cyclists will have an unimpeded access from the downtown area to the JNEM grounds, making the area safer for both pedestrians and motorists.

#### Environmental Justice

The project corridor was evaluated to identify the presence of low income or minority populations and the potential impacts to them in accordance with Executive Order 12898. While both low income and minority populations were identified in the general area surrounding the proposed project, no disproportionately high and adverse human health or environmental effects to these groups will occur from the proposed action.

#### Community Cohesion

Due to the lack of new right of way, the proposed action does not disrupt current land use patterns or community components, cause a considerable change in communities, or result in community segmentation.

#### Community Facilities

The proposed action will result in no impacts to any public parks, recreational facilities, schools, private recreational areas or churches. While people that regularly work or visit the

area may need to learn new directions of travel; with the exception of temporary impacts during construction, the overall patterns should remain very similar and the proposed action should benefit access and reduce congestion. Police and fire protection should benefit from the proposed action due to improved access and reduced congestion that will improve response time of emergency vehicles.

### **Noise**

This project will not cause a change in vertical alignment or halve the distance between receptors and traffic noise sources and very likely will provide greater attenuation from I-70, which is the primary source of highway noise in the project area. This project qualifies as a Type III project and is exempt from noise analysis.

### **Threatened and Endangered Species**

The proposed improvements in the project area were reviewed by MoDOT's Threatened and Endangered Species specialist for any areas of concern regarding threatened and endangered species. Based on this review and the nature of the project, there does not appear to be any areas of concern for federal- or state-listed species of concern.

### **Wild and Scenic Rivers**

There are no designated wild, scenic or recreational rivers in the project area.

### **Air Quality**

EWGCOG has determined that the CAR 2015 project is not regionally significant for the purpose of regional emissions analysis by interagency consultation. Therefore, no air quality analysis will be required.

### **Floodplains**

There is no regulatory floodway or one percent floodplain within the project limits. Therefore, a floodplain development permit will not be required for the construction of this project.

### **Federal Emergency Management Agency (FEMA) Buyout Properties**

There are no FEMA buyout properties located within the project limits.

### **Water Quality**

This project will utilize all applicable Best Management Practices (BMPs) to ensure protection to all waterways in the project vicinity.

### **Wetlands and Waters of the U.S.**

National Wetland Inventory maps, United States Geological Survey (USGS) topographical maps, and a field survey to determine if unmapped wetlands are present were used to assess potential impacts for the proposed highway improvements. After these measures to assess impacts to Waters of the U.S. were conducted, it has been determined that this project will not have any impact to wetlands, streams, ponds, or special aquatic sites. Therefore, this project will not require a Section 404 or Section 401 permit.

### **Historic Sites**

There are ten properties listed on the National Register of Historic Places (NRHP) immediately adjacent to the project area; five are individually listed, and two are historic districts.

The project will have no direct effects on any of the individually listed properties or districts. Indirect effects could include increased traffic in the vicinity of the property, which could increase atmospheric pollution. None of these properties require a bucolic setting to convey their significance. They were constructed in an urbanized area, and have been part of an urban area for most, if not all, of their existence. The introduction of a changed traffic pattern will not significantly change the setting of these properties, and it is the recommendation of MoDOT that the project will have no adverse effect on the characteristics that make the properties eligible for listing on the National Register.

The Gateway Arch will not be affected by the CAR 2015 project. The western border of the JNEM National Historic Landmark (NHL) abuts I-70 except between Market and Chestnut Streets where the NHL boundary crosses the Interstate to encompass the Old Courthouse. This crossing is the only part of the NHL that would be directly affected by MoDOT's project. This section of the JNEM NHL currently consists of two overpasses over the depressed lanes of I-70. The project would cover the depressed section of I-70 within the park boundary with a land bridge which the NPS would then landscape in keeping with the rest of the park. The depressed section of I-70 within the NHL is not a contributing element of the JNEM NHL, and covering the Interstate will not have an adverse effect on the historically-designed landscape. The landscaping on the cover that will be done after construction will be included in the evaluation of the CAR 2015 project which is being evaluated by the NPS.

### **Bridges**

The four bridges to be removed at Pine, Chestnut, Market, and Walnut are all 79-foot concrete box girder spans built in 1963. All are considered to be non-significant and do not fulfill NRHP eligibility criteria. Care will be given, however, in avoiding impacts to the approach to the Eads Bridge, another National Historic Landmark located adjacent to the project.

### **Archaeology**

The removal of Memorial Drive and related improvements along the western boundary of the JNEM has the potential to impact significant archaeological resources. According to the NPS General Management Plan (2009), there is a low to moderate potential of archaeological deposits in the area of the project. However, if the project encroaches onto park property the potential becomes greater. Depending on the location of existing utilities, archaeological testing may be required after pavement has been removed. The improvements to 3<sup>rd</sup> Street at the Martin Luther King, Jr. Bridge may require archaeological testing, again depending on utility locations. The new exit ramp at N. Tucker Boulevard has already been surveyed for archaeological resources under the current NMRB project and will not require additional testing.

### Public Lands & Potential Section 4(f)/6(f) Properties

The JNEM is directly adjacent to the project. Current plans indicate that there will be no encroachment onto this property. Therefore, there will be no Section 4(f) eligible issues with the proposed project.

The subject site was purchased prior to the establishment of the Land and Water Conservation Funds. Therefore, 6(f) is not an issue.

### Hazardous Waste

There were numerous potential hazardous waste sites found within a 2,000 foot buffer area but no sites were found within the project limits. There is always a potential to encounter sites that are unknown. If any of these unknown sites are found during project construction, they will be handled in accordance with federal and state laws and regulations.

### Construction Impacts

During construction of the preferred alternative there will be some short-term impacts to the public due to noise, dust, and pollutants discharged by construction equipment as well as impacts to motorized and non-motorized traffic and to businesses in the area. Although it would be virtually impossible to completely avoid the kinds of short-term impacts typically associated with the construction phase of a highway project, generally these are among the most readily mitigated impacts.

Pollution control measures outlined in the Missouri Standard Specifications for Highway Construction will be used to minimize impacts associated with the construction of the Preferred Alternative. These measures pertain to air, noise, and water pollution as well as traffic control (e.g., detours) and safety measures. Best management practices will be employed to minimize or mitigate potential impacts.

The EA contains more detail on specific construction impacts.

## 4.7.2 Alternatives Considered

The following sections describe the various alternatives that have been reviewed and studied by the CAR 2015 Design Team, the NPS as part of their Value Analysis process, and by MoDOT within the Environmental Assessment.

### 4.7.2.1 CAR 2015 Studies

As part of the CAR 2015 planning process, three alternative highway access configurations were proposed. All were ultimately discarded for the reasons given below.

- An off-ramp from the depressed section of I-70 eastbound to Spruce Street was intended to replace the Memorial Drive off-ramp. This was discarded because it a) does not physically fit unless PSB Ramp B is removed, b) would create an unusual and complex intersection at Memorial and Spruce, and c) does not serve the eastbound interstate exiting movements where they are desired, which is to the north of downtown in the vicinity of the NMRB.

- The existing ramp from I-70 eastbound (Exit 250A) to the MLK Bridge was intended to be expanded to include a street segment exiting towards Convention Plaza. This would have replaced the Memorial Drive off-ramp. This was discarded because it would create an unusual intersection at Convention Plaza and North 4<sup>th</sup> Street and would introduce a new movement to an already saturated intersection.
- An expanded Biddle Street on-ramp to I-70 westbound was proposed but discarded because Memorial Drive entry movements are served through the North 3<sup>rd</sup> Street extension and no additional capacity is required.

### 4.7.2.2 NPS Value Analysis Study

The National Park Service (NPS) studied various options for maintaining the existing Arch Garage on Washington Avenue in a Value Analysis (VA) Study prepared in August 2011. Nine alternatives were evaluated, and all proposed removing access between the west end of Washington Avenue and the Arch Garage. Vehicular access to the Arch Garage would be provided via Laclede's Landing Boulevard, 1<sup>st</sup> and 2<sup>nd</sup> Streets.

**Alternative 1**, which proposed maintaining the existing parking garage was identified as the preferred alternative if sufficient funding for garage removal is not available (Figure 4.9). Access to the Arch Garage in NPS VA Alternative 1 would be through 1<sup>st</sup> and 2<sup>nd</sup> Streets and Laclede Landing Boulevard. A subset of this alternative is being considered which would create a lane connecting the proposed I-44 off-ramp, generally along the Washington Ave alignment, exiting towards the Arch Garage. This link would be one-way eastbound.

**Alternative 5**, which proposed removing the garage and building a new ranger station and North Gateway entry and welcome center, was identified as the preferred alternative if funding is available (Figure 4.10). Pick-up and drop-off access to the north end of the JNEM would be available via 1<sup>st</sup> and 2<sup>nd</sup> Streets in Laclede's Landing.

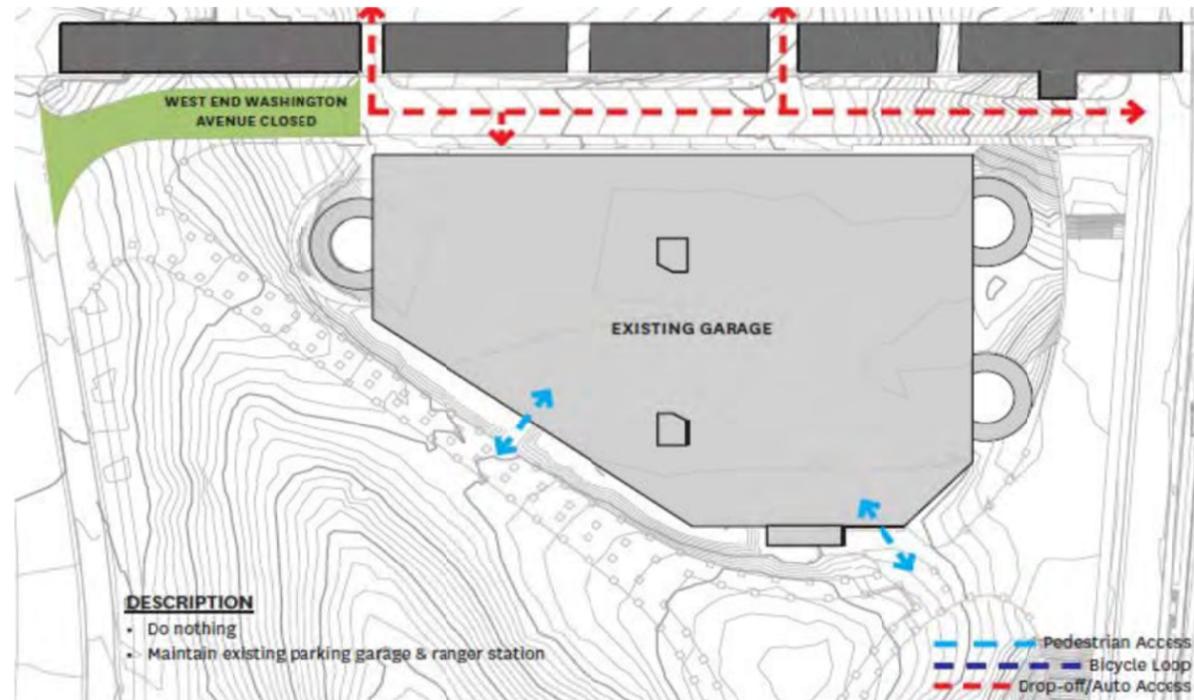


Figure 4.9: NPS, North Gateway, Alternative 1 from August 2011 VA Study

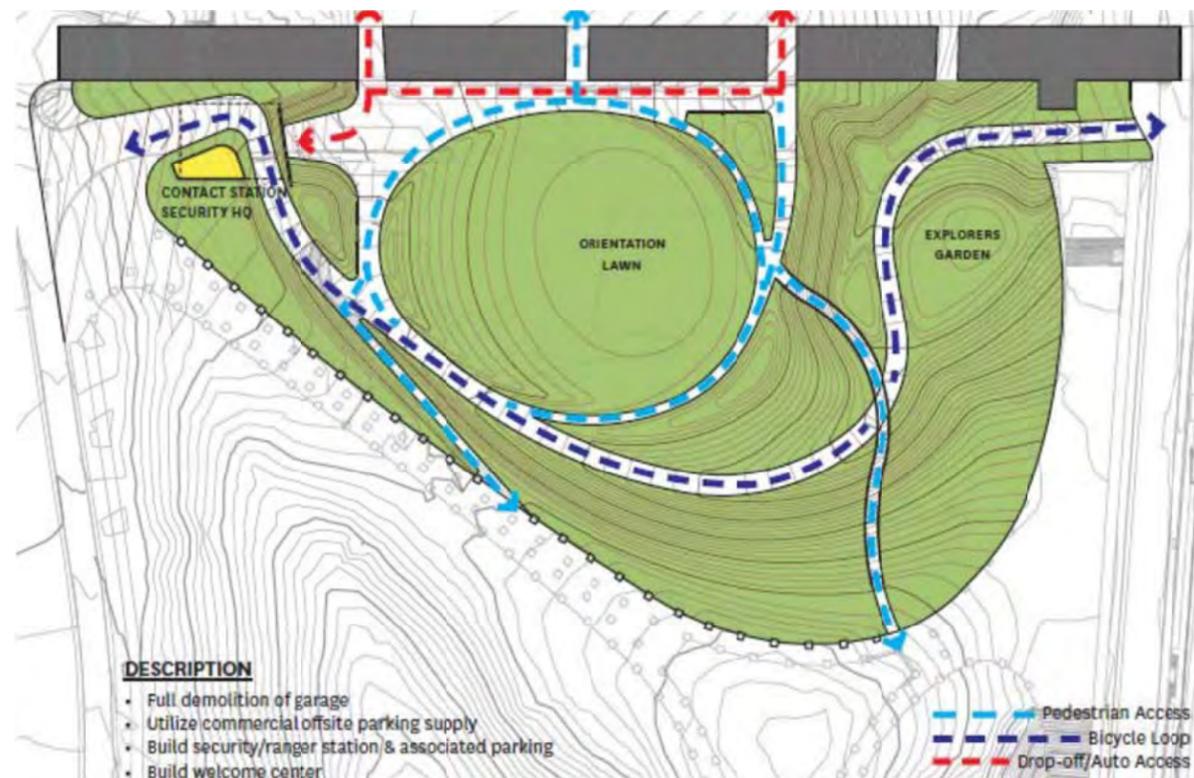


Figure 4.10: NPS, North Gateway, Alternative 5 from August 2011 VA Study

### 4.7.2.3 CAR 2015 Environmental Assessment

Alternatives considered in MoDOT’s Environmental Assessment (EA) considered a No-Build alternative as well as three Build scenarios. The **No-Build Alternative** would make no improvements to I-70 in the project area other than normal highway maintenance. Normal maintenance includes pothole patching, pavement replacement, striping, and overlays. No new major construction would be included with this alternative. It was decided that this alternative would be carried forward and used as a comparison to other alternatives and to justify the improvements needed to existing I-70.

**Alternative 1** consists of the closure of Memorial Drive northbound between Walnut Street and Washington Avenue and southbound between Chestnut Street and Market Street, the construction of a park spanning the depressed section of I-70 between Market Street and Chestnut Street and the “flipping” of the I-70 ramps at Washington Avenue. Also included in this alternative is the connection of two sections of Third Street by “punching” through the existing concrete island barrier at the MLK Bridge and a new ramp connection to downtown from eastbound I-70 at Tucker Boulevard near the new Mississippi River Bridge. This alternative also calls for the removal of the bridges at Walnut, Market, Chestnut, and Pine Streets. A new bridge will be constructed at Walnut Street to provide access to and from downtown St. Louis.

The closure of portions of Memorial Drive will result in northbound traffic from the Poplar Street Bridge shifting to adjacent city streets. Therefore, the on-ramp to I-70 from Memorial Drive will no longer be needed. This will create the need for a new connection to the Arch Grounds and downtown, resulting in the “flipping” of the ramps at Washington Avenue. The present on-ramp to westbound I-70 from Memorial Drive will become an off-ramp from westbound I-70 to the remaining section of Memorial Drive at Washington Avenue. The ramp that now allows traffic to exit off of eastbound I-70 on to southbound Memorial Drive will be converted so that traffic will be able to access eastbound I-70 from southbound Memorial Drive.

Alternative 1 would satisfy the EA’s purpose and need. It would also provide better southern access from I-70 into downtown and the JNEM area, as well as provide unrestricted JNEM access for pedestrians and cyclists. Consequently, Alternative 1 was deemed the preferred option and was retained for detailed analysis in the EA.

**Alternative 2** includes the construction of two pedestrian bridges extending from Luther Ely Square over to the JNEM grounds. This alternative was evaluated in several capacities, with the overall challenge to raise the new bridges over Memorial Drive to achieve a 17’-6” clearance. No changes to existing state and city roadways are associated with this alternative.

In trying to achieve clearance above Memorial Drive, grades that meet the American with Disabilities Act (ADA) were difficult to achieve. Pedestrian bridges built with switchbacks would meet ADA standards but obstruct the viewshed of the JNEM from the Old Courthouse and Luther Ely Square. In addition, bridge access points were limited to confined locations. This option does not change the access for vehicular traffic or remove the conflict of pedestrians crossing Memorial Drive.

Alternative 2 would not satisfy the EA’s purpose and need. It would not provide better access from I-70 from the south into downtown and the JNEM area and would not provide

unrestricted JNEM access for pedestrians and cyclists. Consequently, Alternative 2 was not retained for detailed analysis in the EA.

**Alternative 3** creates a park over the interstate for one block leaving the Market and Chestnut roadways in place. The bridges at Market and Chestnut will be removed and replaced with a new bicycle/pedestrian bridge constructed between these two roadway bridges. Southbound Memorial Drive would pass under the new park, cutting off the ability to turn onto Market or Chestnut Streets. Northbound Memorial Drive will use the new Market and Chestnut bridges to travel around what is now Luther Ely Smith Square and continue on northbound Memorial Drive. Alternative 3 allows pedestrian and cyclists to freely cross over the Interstate via the new park connection.

In this Alternative, the traffic patterns are greatly affected. Traffic enters northbound Memorial Drive from two access points: Westbound Poplar Street Bridge from Illinois and Northbound Interstate 55. The combination of these two traffic movements far exceeds the capacity, causing traffic to back up and posing a serious safety condition for motorists. Consequently, Alternative 3 was not retained for detailed analysis in the EA.

#### 4.7.3 Public Involvement

For over a year, representatives from agencies including FHWA, MoDOT and IDOT have participated with the CAR 2015 Design Team and other planners and engineers in “Core Team” meetings to coordinate CAR 2015, PSB and NMRB issues and discuss separate environmental approvals going forward.

In addition, MoDOT held a public meeting on April 10, 2012 at St. Louis City Hall to provide the public with information about the CAR 2015 project and obtain comments from interested parties. This meeting was advertised in a press release prior to the meeting date. Representatives from MoDOT, CAR 2015, and the NPS were on hand to answer any questions about the project and to encourage meeting attendees to record comments for further consideration. A total of 111 people attended the meeting.

A virtual public meeting was held for those who were unable to attend the City Hall meeting. All materials that were displayed at the public meeting were posted on the web page, and an opportunity to comment was made available. A total of 786 people logged on to the virtual public meeting to view the displays and post comments.

Between the City Hall meeting and the virtual public meeting, approximately 90 comments were received on the CAR 2015 the project. Many expressed support for the proposed project.

## 5 Technical Analysis and Modeling Methodology

### 5.1 Software Tools

In light of the significant functional modifications proposed by the CAR 2015 project, a combination of analysis tools are necessary to adequately investigate and determine how modifications to the transportation system would impact the existing network, and to describe whether proposed changes would meet project objectives. In addition to serving the project needs, traffic models are required by MoDOT to support the AJR given the complexity of the transportation network being affected.

The definition of each type of analytical tool, as well as the platform selected for CAR 2015, is described as follows.

**Microscopic Simulation Models:** Microscopic models evaluate the network as a system rather than as connected parts. The platform used for this project is VISSIM, version 5.30, developed by PTV. These stochastic models simulate the movement of individual vehicles based on car-following and lane-changing theories. They reflect the traffic conditions expected to occur within a network given certain volumetric and physical characteristics.

For this AJR, a set of VISSIM models was built to investigate freeway movements, ramps and arterials which incorporate both the PSB Ramp Modification and CAR 2015 projects.

**Traffic Signal Optimization Tools:** This project uses SYNCHRO version 7, developed by Trafficware. This tool is primarily designed to develop and evaluate signal phasing and timing plans.

For this AJR, a set of SYNCHRO models was constructed to investigate signal timings, intersection and link level of service for impacts stemming from localized street modifications and the impact of highway related traffic shifts to the St. Louis signalized network from the CAR 2015 and PSB Ramp Modification projects.

**Analytical/Deterministic Tools (HCM-Based):** Highway Capacity Software (HCS+), version 5.21, developed by McTrans implements the procedures of the Highway Capacity Manual 2000 (HCM), published by the Transportation Research Board, to determine estimates of capacity and system performance for isolated and small-scale facilities.

For this AJR, HCS was used to analyze operations on North 3<sup>rd</sup> at the confluence of the MLK Bridge, the proposed extension of North 3<sup>rd</sup> Street and the existing on-ramp to I-70 westbound.

#### 5.1.1 Tool Integration

This project used a “turnkey model” approach to integrate the various tools and analysis methodologies. Turnkey modeling combines the independent modeling needs required by large-scale operational analysis into an integrated modeling system. This process allows analysis of the demand and supply components in relation to each other, as opposed to separate analyses. Turnkey models can better represent capacity improvements and impacts

on demand and how those improvements affect operations. Such iterative analysis is difficult to do with traditional modeling techniques. Within these models, the functional scope included modeling a range of facility types, including:

- **Arterials:** signalized streets that primarily serve through traffic and secondarily provide access to abutting properties;
- **Intersections:** single crossing points between two or more roadway facilities;
- **Basic Freeway Segments:** multilane, divided highways with a minimum of two lanes for the exclusive use of traffic in each direction and full access control without traffic interruptions;
- **Auxiliary Lanes:** additional weaving lanes on freeways to connect on and off-ramps; and
- **Freeway Ramps:** short segments of roadway connecting two roadway facilities.

## 5.2 Area of Influence

The base data and existing geometries were used in concert with the selected analysis tools to develop a base set of models as described below. Microsimulation models generally have three primary components. The *physical network* is a graphical representation of the study area transportation facilities and consists of elements that do not change throughout the day. The *traffic control* element consists primarily of traffic signal timing plans, which are largely available from the agencies owning the study traffic signals. Finally, *traffic volumes* are typically derived from field counts and/or traffic forecasts at the onset of most projects. In this project all the three components were developed and integrated using both the VISSIM and SYNCHRO software platforms.

The **SYNCHRO** models focus on the City’s arterial network including:

- Tucker Boulevard to the west
- Cass Avenue to the north
- Leonor K Sullivan Boulevard to the east
- Spruce Street to the south.

To comply with FHWA policy<sup>1</sup>, the **VISSIM** models include:

- I-55 between the I-55/I-44 interchange and the PSB interchange (I-55/I-64/I-70);
- I-70 between the Poplar Street Bridge Interchange and 11<sup>th</sup> Street Ramps. 2015 and 2035 VISSIM models also include the Missouri New Mississippi River Bridge Interchange;
- I-64 from the S. 9<sup>th</sup> Street off-ramp at the west, across the Mississippi River to where the Tri-Level Interchange begins;

<sup>1</sup> Comprehensive Interstate Network Study: In areas where the potential exists for future multiple interchange additions or modifications, all requests for new or revised access are supported by a comprehensive Interstate network study with recommendations that address all proposed desired access (related or otherwise required transportation system improvements) within the context of a long-term plan.

- Memorial Drive, 4th Street and Broadway within the above extents of I-70 (including intersections with Spruce Street, Clark Avenue, Walnut Street, Market Street, Chestnut Street, Pine Street, Olive Street, Locust Street, St. Charles Street, Washington Avenue, Lucas Avenue and Convention Plaza, Cole Street and Biddle Street)

In general, the limits of the VISSIM models extend at least one service interchange beyond the CAR 2015 project boundary. The study area extends one system interchange north and south of the projects to capture the NMRB and the full operations of the I-55/I-44 interchange.

Figure 5.1 shows the general coverage of both the VISSIM and SYNCHRO models and the area of influence for traffic forecasts.

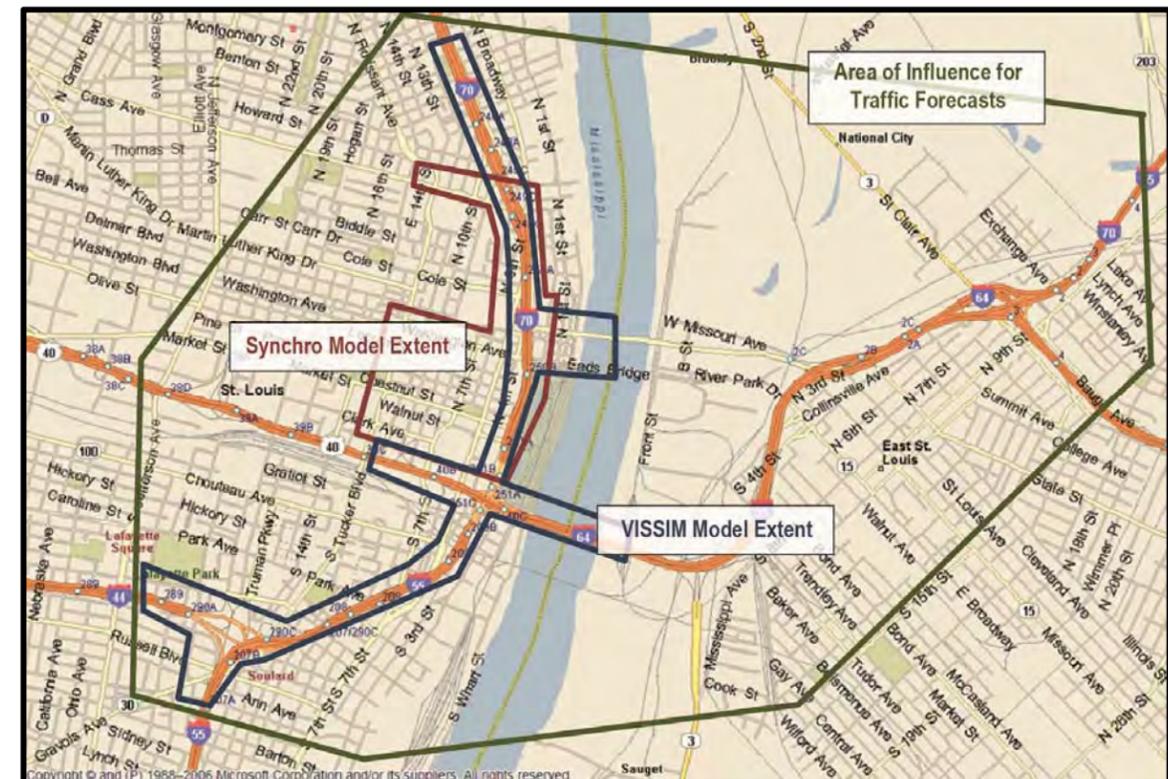


Figure 5.1: General Extents of VISSIM and SYNCHRO Models (Image: CBB)

## 5.3 Model Inputs

Travel demand forecasting and traffic microsimulation models require a comprehensive set of traffic data and a detailed inventory of the physical and operational attributes to describe and replicate the existing system. This section describes the procedures undertaken to collect, format, and present the data and physical attributes used to generate the models for the projects.

### 5.3.1 Traffic Volumes

**Freeway Mainline Volumes within the Study Network:** MoDOT provided through-volume vehicle counts for the mainline freeways. These counts were typically 48-hour counts collected between May 2009, and January 2011, and were provided in hourly increments. These counts were all collected outside of MoDOT’s freeway closures pertaining to the I-64 project, meaning that construction activities and detours did not influence those traffic counts. Traffic.com data was also utilized to validate and/or adjust MoDOT’s counts. Count data from previous projects within the study area was also referenced to evaluate the count volumes.

**Freeway Ramp Volumes for All Interchanges within the Study Network:** MoDOT provided vehicle counts collected between May 2009 and January 2011. These were typically 24- or 48-hour counts and results were given in hourly increments. Again, count data from previous CBB projects within the study area was additionally referenced to evaluate the count volumes.

**Arterial Intersection Volumes:** Count data from the National Park Service’s *Memorial Drive Closure Traffic Study* (AECOM, September 2009) was utilized. CBB collected additional counts outside and within that study area for comparison with and expansion of those volumes. Manual turning movement counts (TMCs) were collected for the AM and PM peak hours (7:30 – 8:30 am and 4:30-5:30 pm, respectively), at 26 locations in November 2010, 3 locations in January 2011 and 6 locations in April 2011. The 2011 counts were performed to collect data at locations closed or impacted by construction during November, 2010.

**Review and Reconciliation:** Careful examination of all traffic volumes was performed to assure the adequacy and consistency of data for use in modeling. Upstream counts were compared to downstream counts to detect any unexplained variations in the data. Where discrepancies were found, the counts were reconciled by normalizing or averaging counts from different time periods, or by assigning midblock sources and sinks where a particular land use warrants a large influx or egress of traffic volumes (e.g. parking garages in the St. Louis CBD). Engineering judgment was used based on local knowledge and field observations.

Traffic data (i.e., arterial and intersection volumes) were compiled taking into account average traffic conditions, free of incidents or poor weather, during multiple time periods. Where counts were needed at locations in close proximity, the counts were performed during the same day in an effort to capture related deficiencies. The final “balanced” peak period traffic volumes are shown in Appendix C.

### 5.3.2 Queue Pattern Observations (Length and Duration)

Observations of vehicle queues were made at several key points within the study corridor in order to support validation during model development. Observations were performed at arterial intersections, mainline freeway segments, and freeway ramps during formal data collection as well as during field visits throughout the project.

As with other field observations, care was taken to compile information during what were deemed as average conditions. However, the complete range of queue lengths was noted in order to capture operational variations. This helped to define “average” queuing patterns as

well as determine typical ranges of queuing fluctuations. These queuing patterns were used to validate VISSIM models and to study the effect of external capacity constraints.

### 5.3.3 Geometric Conditions and Signal Operations

The modeling team consulted high-resolution aerial photography and supplemented that information with site visits and consultations with MoDOT and the City of St. Louis to compile the geometric characteristics of the facilities. Signal operations were initially acquired from the City of St. Louis traffic controller system then verified by field observations of signal function as well as intersection geometry.

## 5.4 2015 and 2035 Traffic Forecasts

Traffic forecasts from 2010 to 2015 consider an increase in background traffic as well as additional traffic generated by local developments. Forecasts from 2015 to 2035 consider an overall background growth of 4%. These assumptions are described in more detail in the following sections.

### 5.4.1 Development Growth

Traffic forecasts from 2010 to 2015 assume 50% occupancy for the Mercantile, Laurel and Ball Park Village developments (except the Laurel Hotel which is assumed at 100% occupancy in 2015).

Table 5.2: Development Projects Anticipated within Project Analysis Timeframe

Development	Element	2015 Build-out	2035 Build-out
Mercantile Exchange	Retail	175,000 s.f.	350,000 s.f.
	Office	262,500 s.f.	525,000 s.f.
Laurel Development	Hi-Rise Apartments	60 units	120 units
	Hi-Rise Condominiums	88 units	175 units
	Hotel	216 rooms	216 rooms
Ball Park Village	Office	112,500 s.f.	225,000 s.f.
	Retail	50,000 s.f.	100,000 s.f.
Bottle District	Office	-	45,000 s.f.
	Apartments	-	235 units
	Restaurant	-	175,000 s.f.
	Hotel	-	150 rooms
Lumière Casino Phase II	Condominiums	-	375 units

	Retail	-	220,810 s.f.
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Institute of Traffic Engineers (ITE) Trip Generation Manual, 8th Edition, rates were utilized to forecast the anticipated traffic resulting from these developments. However, the overall plan for the St. Louis CBD is to create a more balanced environment that is pedestrian, bicycle, and transit friendly. In other words, the CBD is planned to become a more dynamic and active place with more round-the-clock activity where people work, live, visit and stay. These developments are based on the philosophy that they would allow residents and visitors to travel to and from the developments by means other than vehicles and would not generate the AM inbound and PM outbound vehicle trips typical of CBD commercial and office space.

Reductions from ITE trip generation rates to reflect the proposed character and style of the new developments were taken as follows in Table 5.3:

Table 5.3: Project-specific Reduction for ITE Trip Generation Rates

2015 Development	Reduction from ITE Rates (%)			
	Retail	Office	Condo/Apt.	Hotel
Mercantile Exchange	60	20	30	20
Laurel Development	60	20	30	20
Ball Park Village Phase I	60	20	-	-

After reductions, origin/destination assumptions were made for the forecasted trips. Then, the resulting traffic volumes were manually layered on top of the background growth to project area turning movement volumes in the SYNCHRO models and the path volumes in the VISSIM models.

### 5.4.2 Background Traffic Growth

The traffic growth in the St. Louis CBD has been generally flat or declining for the last several decades. In fact, the standard practice locally has been to use a 0.0% growth rate for downtown projects; this assumption has been supported by both MoDOT and East West Gateway Council of Governments on recent projects.

For reference, Table 5.4 describes the population of St. Louis City, St. Louis County and the State of Missouri at ten-year intervals. While population is only one of many variables that affects traffic volumes, the negative trend in downtown population and relatively flat growth in St. Louis County over the last several decades is evident.

Table 5.4: St. Louis and Missouri Population History

Year	St. Louis City	10-year Growth	St. Louis County	10-year Growth	Missouri State	10-year Growth
1950	856,796	5.0%	406,349	48.2%	3,954,653	4.5%

Year	St. Louis City	10-year Growth	St. Louis County	10-year Growth	Missouri State	10-year Growth
1960	750,026	-12.5%	703,532	73.1%	4,319,813	9.2%
1970	622,236	-17.0%	951,353	35.2%	4,676,501	8.3%
1980	453,085	-27.2%	973,896	2.4%	4,916,686	5.1%
1990	396,685	-12.4%	993,529	2.0%	5,117,073	4.1%
2000	348,189	-12.2%	1,016,301	2.3%	5,596,684	9.3%
2010	319,294	-8.3%	998,954	-1.7%	5,988,927	7.0%

The annual growth rate was assumed to be 0.2% per annum for the period from 2015 to 2035, in an effort to maintain some level of conservative background growth. This growth rate was determined in consultation with MoDOT.

For the 2035 model the team, in consultation with MoDOT and EWGCOG’s local travel demand model, determined that the 0.2% per annum growth rate remained reasonable for the period from 2015 to 2035. At this time, it was also determined that EWGCOG’s travel demand model incorporates proposed development into the land use projections that form a basis for its future traffic projections. Therefore, a flat 4% growth rate was added to each 2015 model in order to create the 2035 model scenarios, and no additional traffic growth due to specific developments was layered in. The traffic volumes resulting from the traffic forecasting process, and utilized for analyses, are displayed in Appendix C.

## 5.5 Future Year Traffic Development: Network Modifications and Resulting Traffic Shifts

This section describes the assumptions behind the future year traffic movements.

### 5.5.1 The NMRB and Interstate 70

#### Access and Movements

The NMRB is scheduled to open in 2015. The new facility will include four traffic lanes, two eastbound and two westbound, with direct ramp connections to and from downtown St. Louis as well as to and from I-70 to the west (from I-70 eastbound and to I-70). It is projected that a future phase would create a companion, four-lane bridge and connections to/from I-44. However, there is no funding or construction timeline for a Phase II at this time.

I-70 will be rerouted from its existing alignment across the PSB and through the depressed section in downtown St. Louis to the new alignment north of downtown, as shown in Figure 4.4. The section of Interstate formerly designated as I-70 in downtown St. Louis will be reassigned to I-44. The new I-70 alignment will remove a significant amount of Interstate traffic from the depressed section of the highway adjacent to the Arch Grounds. The new

alignment will also provide a new entry point on Cass Ave into the North end of downtown St. Louis. Interstates 64 and 55 will remain in their existing alignments.

## Modeling Assumptions

The new bridge and Interstate alignment will reduce traffic across the existing Mississippi River crossings (PSB and MLK Bridges) for those people making regional trips between Missouri and Illinois on I-70. Some commuter trips that cross the PSB and MLK bridges into downtown will also shift to the new alignment, though a small portion is still assumed to use the existing connections. All of the forecasting performed as part of the CAR2015 project reflects the assumptions put forth in the “Missouri River Crossing AJR”, October 2003, produced by MoDOT.

These shifts were taken into account for modeling based on the Mississippi River Crossing AJR and conversations with MoDOT:

- Poplar Street Bridge: 10% vehicle reduction, both directions;
- MLK Bridge: 50% vehicle reduction, both directions;
- Eads Bridge: 0% reduction (Eads is assumed to serve local trips and connections only)

These shifts generally assume the major traffic movements between I-70 west of St. Louis or the north end of the St. Louis CBD and I-70 or I-64 in IL will relocate their river crossing from the crowded PSB to the more direct NMRB. In addition, there will be non-Interstate traffic shifts that connect to the PSB from IL Route 3 and East St. Louis. All of these movements will obtain a direct connection to the NMRB, via the expanded “Tri Level Interchange” (I-64/70/55) east of the MLK bridge connection. However, all traffic with an origin/destination in the south study area is expected to utilize the PSB.

### 5.5.2 From the North and from the West to Downtown St. Louis

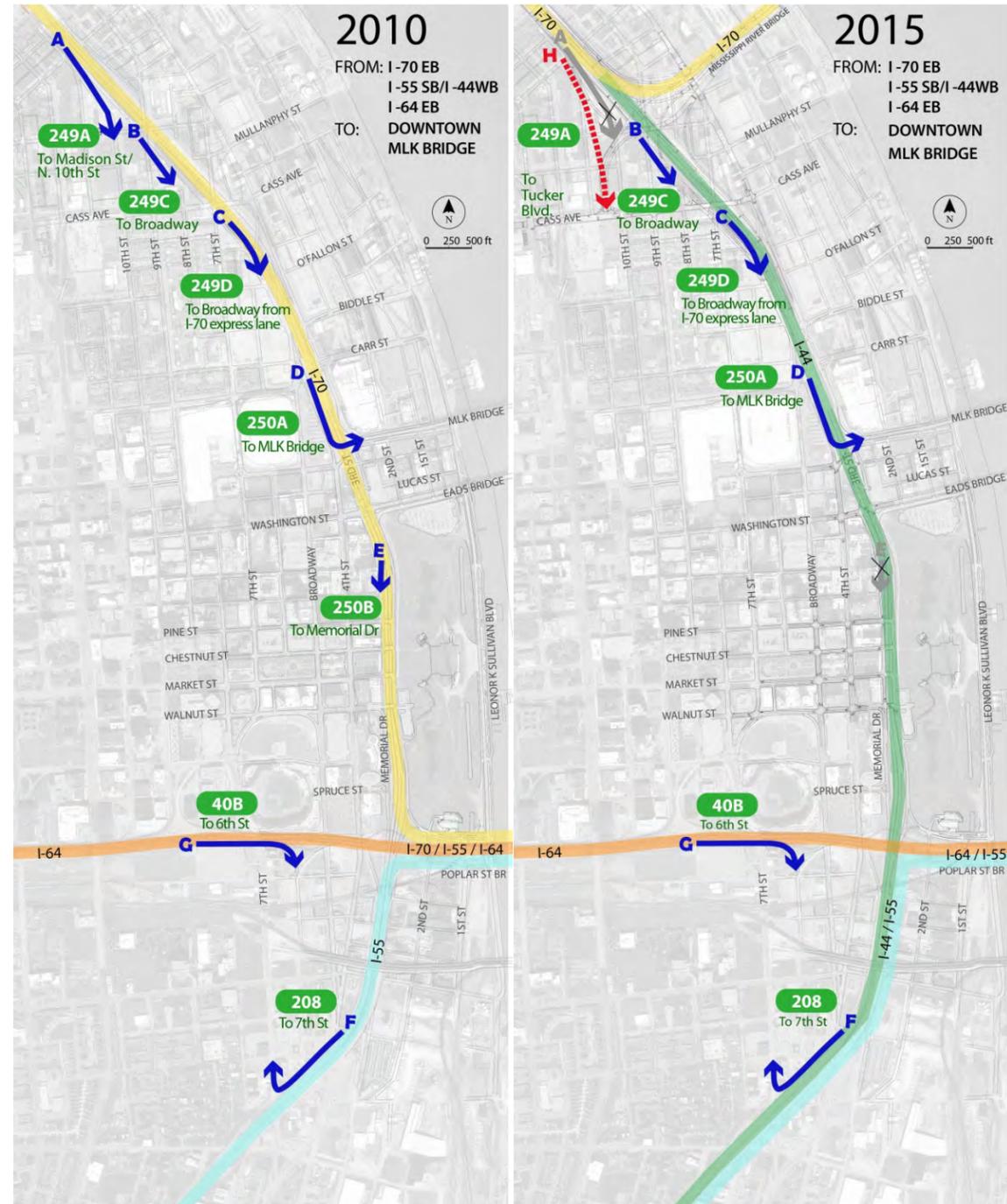


Figure 5.2A and Figure 5.2B: Southbound and Eastbound Interstate access to Downtown St. Louis, 2010 and 2015 (Images: Arup)

### Access and Movement

As shown in Figure 5.2A, existing movements coming from North and Northwest of St. Louis, eastbound on I-70, currently have access into downtown via the following four exits:

- Movement A: Exit 249A to North 10<sup>th</sup> Street
- Movement B: Exit 249C to Broadway
- Movement C: Exit 249D I-70 express lane exit to Broadway
- Movement E: Exit 250B to Memorial Drive

Movement A was closed and removed in October, 2011, as part of the NMRB Project. The CAR 2015 project proposes to remove the Memorial Drive exit (Movement E) and construct an entrance ramp in its place.

CAR 2015 proposes to construct a new exit to the St. Louis CBD from the future I-70 to NMRB eastbound ramp. This new exit ramp would connect to N. Tucker Boulevard at Cass Avenue (Movement H), providing a new, direct connection to the western portion of the St. Louis CBD. N. Tucker Boulevard is an eight-lane roadway that currently operates well under capacity.

### Modeling Assumptions

The 2015 movement shifts are shown in Figure 5.2B. For traffic modeling and analysis purposes, it was assumed that 100% of the existing volume utilizing the 10<sup>th</sup> Street exit (Movement A) would shift to the proposed N. Tucker Ramp (Movement H). The vehicles currently exiting to downtown via Memorial Drive (Movement E) would shift to exit via Movement B (50% of existing) and Movement C (50% of existing).

### 5.5.3 From the South and from the East to Downtown St. Louis

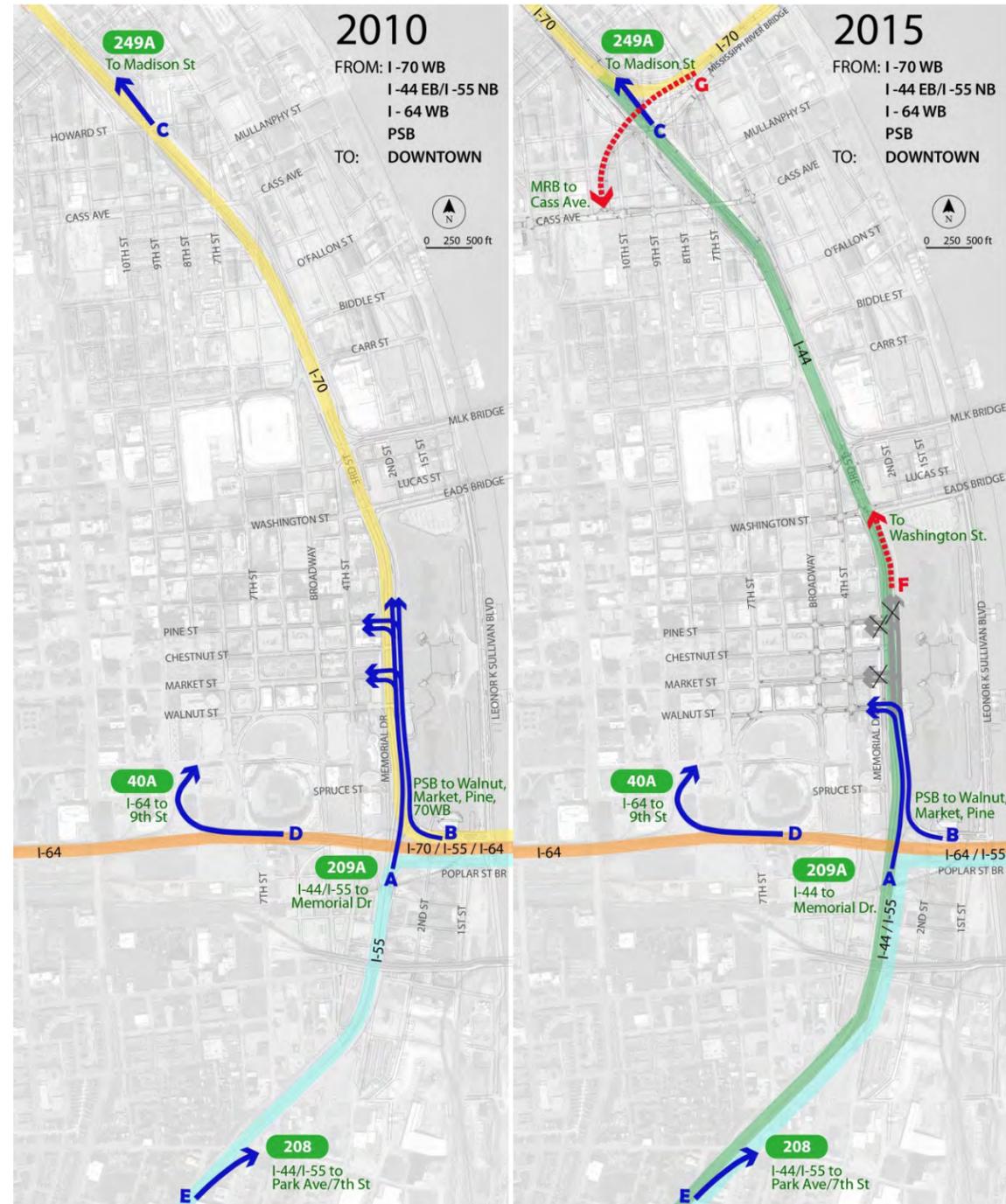


Figure 5.3A and Figure 5.3B: Northbound and Westbound Interstate access to Downtown St. Louis, 2010 and 2015 (Images: Arup)

### Access and Movement

Existing movements into St. Louis from the south (I-70 westbound, I-44 eastbound, and I-55 northbound) access downtown via five main exits, as shown in Figure 5.3A:

- Movement A: Exit 209A from I-55 to Memorial Drive northbound\*
- Movement B: PSB westbound to Memorial Drive northbound\* (and I-70 westbound)
- Movement C: Exit 249A to North 10<sup>th</sup> Street
- Movement D: Exit 40A to 9<sup>th</sup> Street
- Movement E: Exit 208 to Park Avenue / 7<sup>th</sup> Street

\* Memorial Drive provides access to downtown via Market and Pine Streets and also to the northern business district via Washington Avenue.

The CAR 2015 project proposes to remove Memorial Drive northbound between Walnut and Washington Streets and replace access to the north end of downtown with a new exit ramp to Memorial Drive northbound at Washington Street (Movement F), as shown in Figure 5.3B. Vehicles can continue to access downtown via Movements A and B as Walnut Street would be converted to a two-way street between Memorial Drive and 8<sup>th</sup> Street, creating a new gateway entrance to the downtown CBD. Travelers destined for the north end of the CBD and Laclede’s Landing would be able to use Movement F from the depressed section of the Interstate.

### Modeling Assumptions

Within the future traffic models, it is assumed that movements currently using Memorial Drive to access downtown would shift in the 2015 network as follows:

- 40% of vehicles currently using Movement A would shift to Movement F to access the north end of the CBD. This assumption is based on existing left turn movements from Memorial Drive with some adjustment for expected new developments at the north end of downtown
- 15% of vehicles that currently utilize the Pine Street access from Memorial Drive northbound would take Movement F and the proposed U-turn connection to approach Pine from Memorial Drive southbound
- 100% of vehicles that use Market Street to enter downtown would now use Walnut Street, based on left turn movement counts on Memorial Drive northbound
- 75% of vehicles that use Movement B would continue that access via Walnut Street. The other 25% would utilize the connection provided by Movement G
- 100% of vehicles currently using Movement C and Movement E would continue to utilize those exits

### 5.5.4 From Downtown to the North and to the West

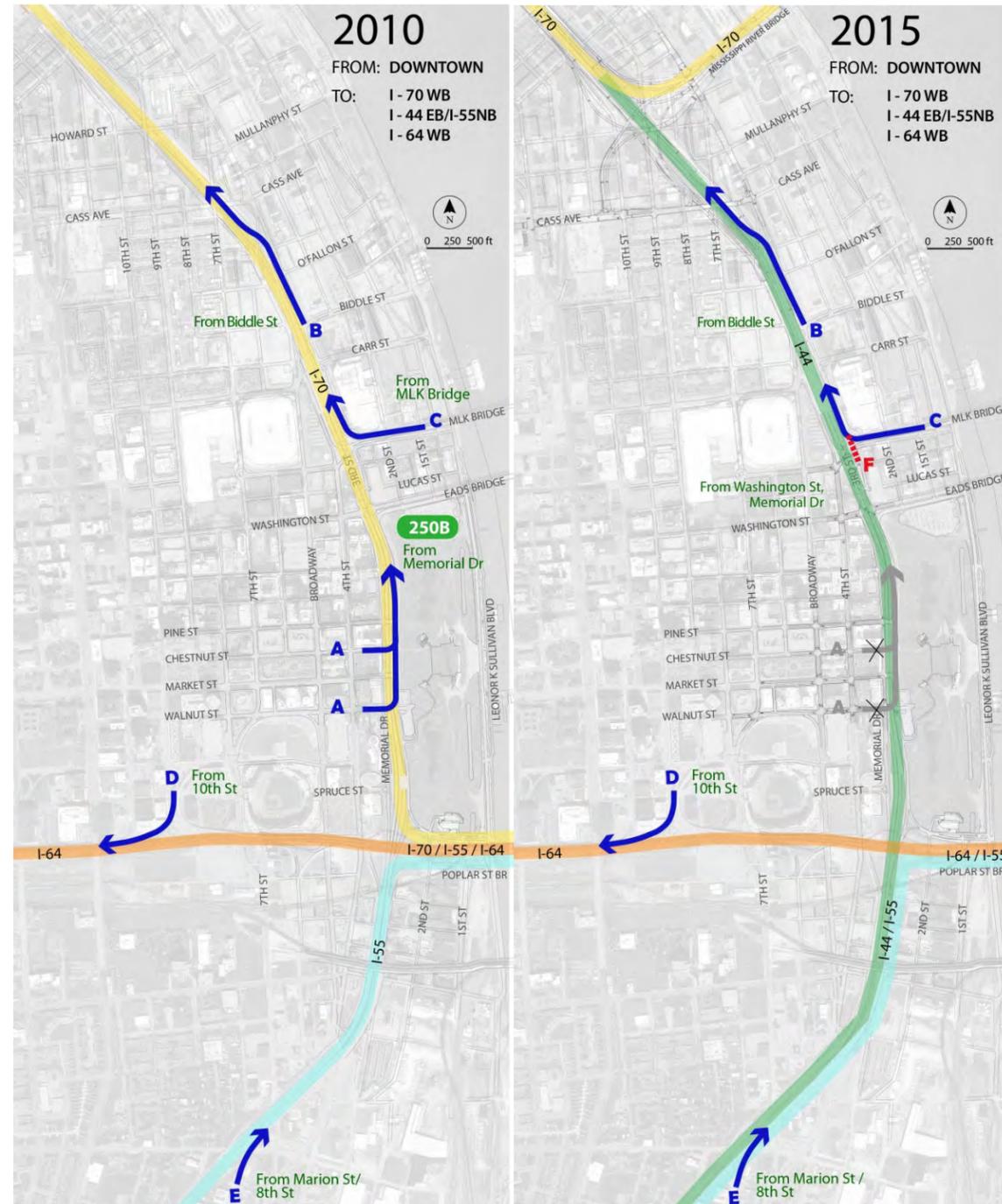


Figure 5.4A and Figure 5.4B: Downtown Interstate access to the north and west, 2010 and 2015 (Images: Arup)

### Access and Movement

Existing movements departing downtown St. Louis destined for the North and Northwest can currently access the Interstate at four points, as shown in Figure 5.4A:

- Movement A: Memorial Drive northbound onto I-70 westbound
- Movement B: Biddle Street on-ramp to I-70 westbound
- Movement D: 10<sup>th</sup> Street on-ramp to I-64 westbound
- Movement E: Marion Street / 8<sup>th</sup> Street on-ramp to I-70 westbound

As shown in Figure 5.4B, the CAR 2015 project proposes to remove the entrance from Memorial Drive (Movement A) and replace it with an exit ramp. In order to replace the Interstate access from downtown, the project proposes to modify North 3<sup>rd</sup> Street to create a new City street connection across the west end of the MLK Bridge (Movement F). This link creates new access from the CBD to the existing MLK/North 3<sup>rd</sup> on-ramp to westbound I-70. The extension would enable access from the northeast corner of downtown, Washington Street and Convention Plaza to I-70 westbound.

### Modeling Assumptions

For traffic modeling and analysis purposes, it is assumed that the new North 3<sup>rd</sup> extension (Movement F) would serve 55% of the existing Memorial Drive entrance traffic volume, with the remaining 45% utilizing the existing Biddle Street on-ramp (Movement B).

The expectation is that F would be a more attractive option for the relocated movements than B. However, the new intersection of 3<sup>rd</sup> Street, Convention Plaza and the MLK Bridge ramp is not expected to accommodate all of the demand. Therefore, this projected split was achieved by an iterative process that balanced the impacts of the relocated traffic on that intersection and its neighbors (e.g. the intersections of 4<sup>th</sup> Street with Convention, 4<sup>th</sup> Street with Biddle/Carr, 3<sup>rd</sup> with Carr Street, and 3<sup>rd</sup> with Biddle). The balancing effort also took into consideration the weaving effect to Movement C and the existing capacity constraints for Movement B (the signalized intersection, and merging movement with I-70).

### 5.5.5 From Downtown to the South and East

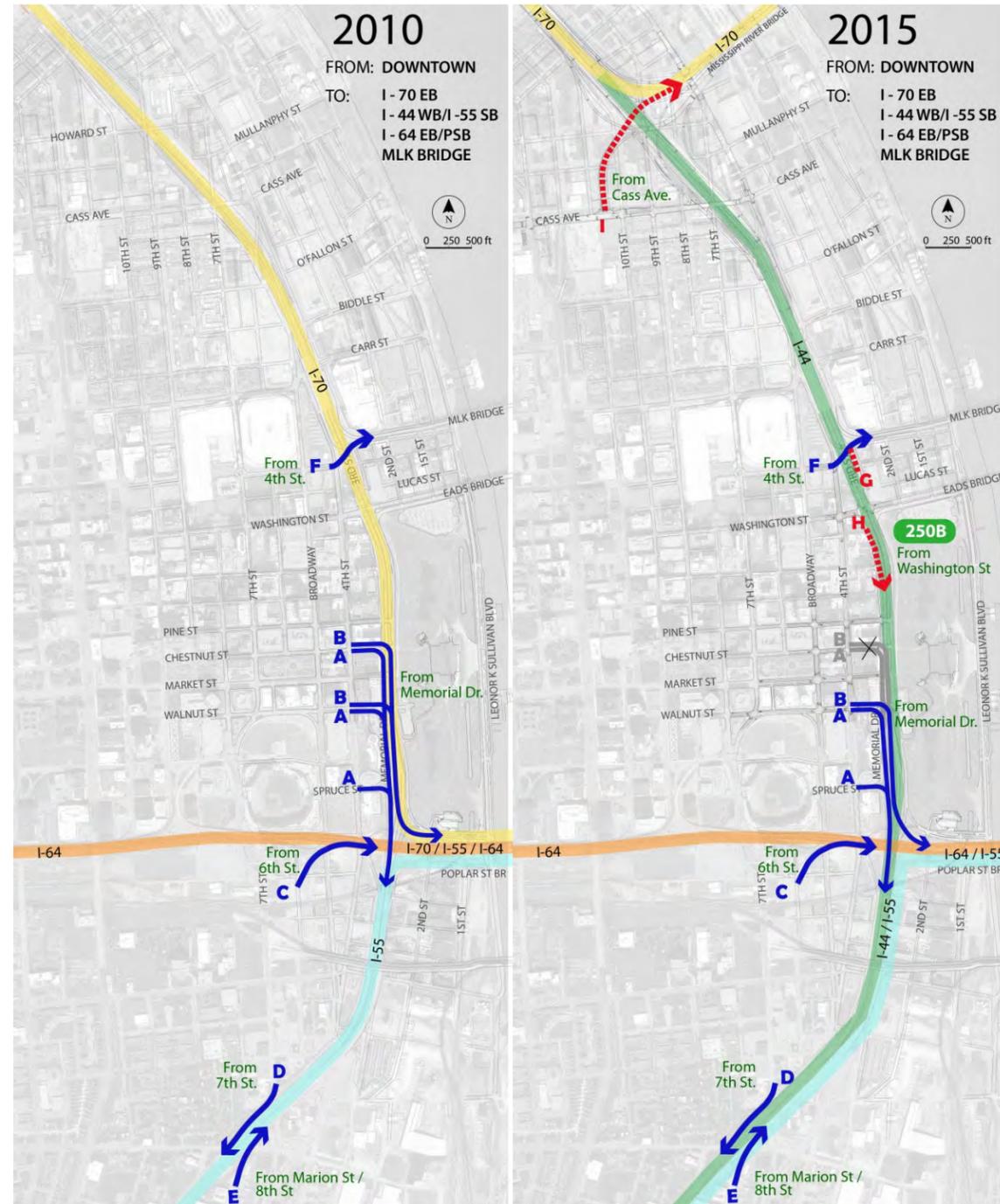


Figure 5.5A and Figure 5.5B: Downtown Interstate Access to the south and east, 2010 and 2015 (for PSB Preferred Build) (Images: Arup)

### Access and Movement

Existing movements leaving downtown headed to the south or eastbound to Illinois currently have several access options, as shown in Figure 5.5A:

- Movement A: From Memorial Drive southbound to I-44/55
- Movement B: From Memorial Drive southbound east across the PSB
- Movement C: From 6<sup>th</sup> Street to I-64 eastbound across the PSB
- Movement D: From 7<sup>th</sup> Street to the south via I-55
- Movement E: From Marion Street / 8<sup>th</sup> Street to I-55 linking to the PSB

As shown in Figure 5.5B, the NMRB project will provide a new connection from Cass Avenue to I-70 eastbound via the new bridge (Movement I). Utilizing that new capacity, the proposed PSB Preferred Build Project would remove the ramp that links Memorial Drive southbound to PSB eastbound (Movement B) in order to facilitate the widening of the ramps between the PSB and I-55.

Access from downtown to I-55 via southbound Memorial would be maintained, though the connection to Chestnut Street is proposed to be closed due to the Park over the Highway between Chestnut and Market. However, the CAR 2015 project proposes to create a new on-ramp into the depressed section from Washington Street via southbound Memorial (Movement H).

### Modeling Assumptions

Within the future traffic models, it is assumed that:

- 25% of the traffic utilizing Movement A would shift to Movement H, based on the assumed volumes originating from parking garages along Olive and Washington and destined south to I-44/55. The remainder will continue to use A.
- Upon opening of the NMRB, the existing traffic from the southbound portion of the depressed highway section (I-70 eastbound) to the PSB eastbound is expected to shift to Movement I via the new Tucker Boulevard connection;
- Upon completion of the NMRB and proposed PSB Preferred Build project, 100% of the volume from Movement B to the PSB would shift to I-55 via the Marion ramp (Movement E). Movements C and E currently operate at or near capacity due to capacity constraints on the PSB approach ramps. However, MoDOT’s PSB ramp modification project would help to alleviate the approach ramps as bottlenecks, thereby allowing Movement E to become an attractive alternative for eastbound PSB access.
- To be conservative, Movement F was not projected to take additional traffic volumes due to the capacity constraints of the City’s signal system at the Convention Plaza/North 3<sup>rd</sup> intersection, although there is excess capacity on the MLK Bridge facility

## 5.6 Base Year Model Development

### 5.6.1 SYNCHRO Model Development

Year 2010 AM and PM Peak Hour SYNCHRO models were created for the study area, as exhibited in Figure 5.6.

The project team utilized a base SYNCHRO model that was updated multiple times for the City of St. Louis recent CMAQ timing optimization projects. Current turning movement traffic counts, intersection geometries and turn bay lengths, and traffic signal plans were all inputs for the models. The SYNCHRO models were used to analyze arterial operations and were also constructed in such a way as to facilitate exportation of the SYNCHRO traffic signal timing plans directly into the VISSIM models to streamline the modeling process.

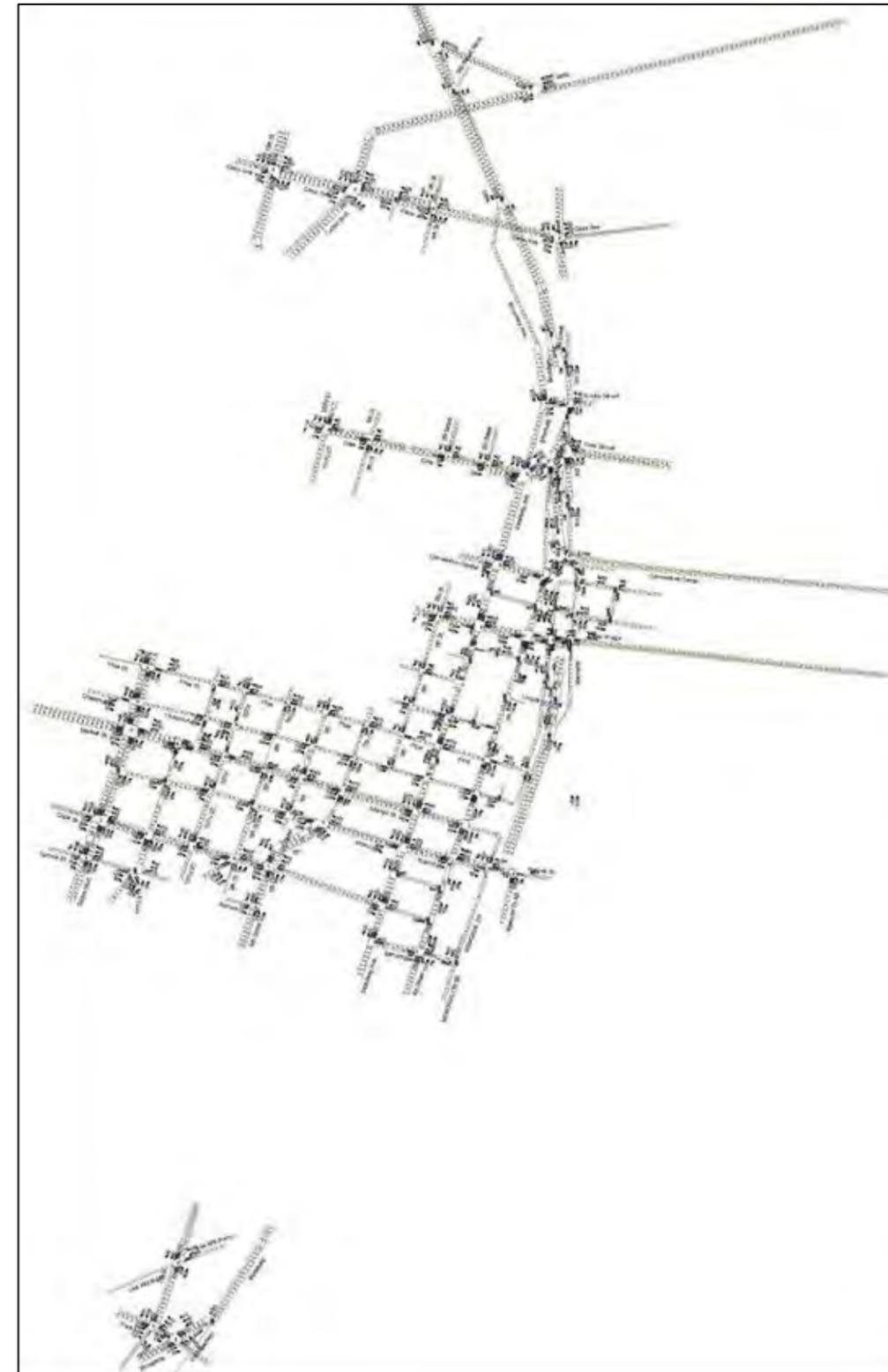


Figure 5.6: SYNCHRO Model Extents (Image: CBB)

Zones were set up along specific corridors to coordinate and optimize the signal timing of closely spaced signals within each corridor. These zones reflect the parameter used within the City of St. Louis' signal timing system and were set up within the following three areas:

1. Central Business District (24 intersections);
2. Washington Avenue (two intersections); and
3. Convention Plaza, Cole Street, and Biddle Street (eight intersections).

Additionally there are several signal pairs within this area, which are spaced so closely that they operate as one. These were counted separately for the number of signals in zones. The locations of these groups are:

- Park Avenue with Broadway Avenue and 7<sup>th</sup> Street;
- Convention Plaza with 4<sup>th</sup> Street and 3<sup>rd</sup> Street;
- Cole Street with Broadway Avenue and 4<sup>th</sup> Street; and
- Biddle Street with Broadway Avenue and 3<sup>rd</sup> Street.

### 5.6.2 VISSIM Model Development

**Physical Network:** The physical geometric network was developed in VISSIM based on aerial photography, as-built plans, and field observations. Some elements, such as reduced speed areas and desired speed decision points were coded based on a range of observed speeds in the study area. Our model used VISSIM's default vehicle classes, which is desirable to provide efficiencies in the merging or reprocessing of this model in future efforts.

**Traffic Control:** Traffic signal timing plans were imported from SYNCHRO into VISSIM, creating a true representation of the City of St. Louis downtown signal system. Another result of this import is that VISSIM incorporates the intersection node numbers defined in SYNCHRO. Allowing continuing symmetry between the two models as signal operations are fine-tuned in the SYNCHRO scenario models.

**Traffic Volumes:** Traffic can be input in VISSIM using two basic types of routing procedures: 1) origin to destination (O-D) paths, or 2) intersection turning movement volumes. Even though these two methodologies produce the same traffic volumes, it is recommended to use the O-D path procedure to more accurately reflect traffic patterns throughout the study area. Moreover, this method is usually more efficient to use in larger models. The O-D matrix required for this method should be calculated based on intersection turning movement counts. For this project a matrix was manually created using the balanced turning movement volumes from the SYNCHRO models.

The VISSIM models were developed for one-hour peak periods for both the AM and PM conditions. The extent of the peak periods was developed by studying the traffic volume variations during the day (as described in the section on traffic volumes), and are considered suitable for the St. Louis metropolitan area because they capture conditions during the most congested periods of travel over the entire study network. Traffic in the study area does not experience peak hour spreading and multi-directional peak movements occur simultaneously in both peak hours. The VISSIM model extents are exhibited in Figure 5.7.



Figure 5.7: VISSIM Model Extents (Image: Arup)

### 5.6.3 Calibration

Calibration is the adjustment of model parameters to improve the model's ability to reproduce local driver behavior and traffic performance characteristics. Extensive efforts were made to

calibrate model parameters so that the link performance in the models matched field conditions (e.g., traffic volumes, queuing characteristics, lane choice behavior, and travel speeds). In addition, after calibrating models within the consultant team, both the SYNCHRO and VISSIM models were evaluated side-by-side with MoDOT and City of St. Louis traffic specialists. These experts were able to further define any areas that needed special attention to more closely reflect existing field conditions. For example, MoDOT requested the modelers to fine tune volume inputs to the eastbound PSB links to more closely reflect travel speeds of 30-40 mph in the AM peak. After these reviews, both MoDOT and City of St. Louis traffic staff agreed that the existing peak hour SYNCHRO and VISSIM models were an accurate representation of year 2011 field conditions.

### SYNCHRO

The SYNCHRO model was calibrated previously for use on the City of St. Louis’ CMAQ timing projects. These models have been calibrated numerous times in the past and were updated with both the current signal timings and current turning-movement count data. A thorough review showed that projected queuing and operations very closely reflected existing field conditions.

### VISSIM

As part of the validation process, the project team coordinated with MoDOT to describe locations within the network where the model required user-generated treatments to reflect unique field conditions that the basic VISSIM driving patterns were unable to replicate. These modifications were applied on both eastbound and westbound I-70 near the Broadway overpass where MoDOT traffic staff agreed that current conditions are a reflection of the horizontal curvature of the road, combined with roadside and overhead barriers. Drivers have a tendency to slow down and space out in reaction to the perceived constriction. Therefore a unique VISSIM driver behavior was utilized to reduce the saturation flow rate of the freeway section to 1800 vphpl. As with SYNCHRO, the congestion and queuing patterns observed in the field were compared to the VISSIM simulations. This comparison shows a strong correlation between the model results and field conditions and suggests a good calibration of the model parameters.

### Comparison of SYNCHRO and VISSIM Results

As a final measure SYNCHRO and VISSIM results were compared to highlight any discrepancies between the modeling platforms. The various software platforms all calculate measures differently, so their results will differ compared to one-another. However, a comparison of their results can “flag” errors in the analysis if the differences cannot be resolved through an understanding of modeling assumptions or methods. A check of these measures concluded that all analysis platforms provided generally reasonable and consistent results. It should be noted that SYNCHRO is a deterministic model and results can be obtained directly from the software user interface. However, VISSIM is a stochastic model; therefore numerous model runs need to be performed and the output averaged to find the projected measures of effectiveness. The VISSIM results for each model are an average of ten model runs.

## 5.7 Model Outputs and Performance Metrics

### 5.7.1 SYNCHRO Models – Signals and City Streets

SYNCHRO uses procedures largely based on the methods outlined in the HCM to calculate delay and level of service estimates. As defined by the HCM, the Level of Service (LOS) for intersections is based on vehicle delay, as shown in Table 5.5. Furthermore, given the modelled conditions, a determination was made regarding which critical movement(s) was expected to generate the longest queue.

Table 5.5: Intersection Level of Service Criteria (HCM)

Level of Service	Delay per Vehicle (seconds/vehicle)
A	< 10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

### 5.7.2 VISSIM Models – Freeway Operations and Network Simulation

Freeway operations analyses for the base year (2010) conditions were performed with VISSIM using HCM methodologies. AM and PM peak periods were analyzed for basic freeway segments, weaving areas, and merge/diverge segments.

**Basic Freeway Segments:** Basic freeway segments were evaluated with the VISSIM software, utilizing the methodologies outlined in the HCM. The HCM defines basic freeway segments as sections of freeway that are outside of the influence area of ramps or weaving areas of the freeway. The primary measure for LOS is freeway density. Speed, freedom to maneuver and proximity to other vehicles are major indicators of service quality to drivers. Density is the parameter used to define LOS for the freeway and ramp sections in the HCM. The ranges of density used to define levels of service are shown in Table 5.6.

Table 5.6: Basic Freeway Segment Level of Service Criteria (HCM)

Level of Service	Delay per Vehicle (seconds/vehicle)
A	< 10
B	> 10 – 20

Level of Service	Delay per Vehicle (seconds/vehicle)
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

**Freeway Weaving:** The HCM defines a weaving segment as, “the crossing of two or more traffic streams travelling in the same general direction along a significant length of highway without the aid of traffic control devices. Weaving segments are formed when a merge area is closely followed by a diverge area, or when an on-ramp is closely followed by an off-ramp, and the two are joined by an auxiliary lane.”<sup>2</sup> The manual goes on to say that its methodologies apply only to weaving segments with a distance that is less than or equal to 2500 feet. LOS for weaving segments is also based on density, as shown in Table 5.7.

Table 5.7: Freeway Weaving Segment Level of Service Criteria (HCM)

Level of Service	Freeway Density (passenger cars/mile/lane)
A	0 – 10
B	> 10 – 20
C	> 20 – 28
D	> 28 – 35
E	> 35 – 43
F	> 43

**Merge and Diverge (Ramps):** The HCM 2000 defines ramp merge and diverge areas as ramp-freeway junction typically designed to permit high-speed merging or diverging with minimum disruption to the adjacent freeway traffic. Some of the ramp junctions in the study area are considered major merges or diverges. HCM methodologies have not yet been developed to properly analyze these situations; therefore, these areas must be analyzed by microsimulation.<sup>3</sup> For example the I-44/I-55 merge at the south end of the project area would be a major merge. As with freeway facilities, merge and diverge LOS are based on density, as shown in Table 5.8.

Table 5.8: Freeway Ramp Merge/Diverge Level of Service Criteria (HCM)

Level of Service	Freeway Density (passenger cars/mile/lane)
A	0 – 10
B	> 10 – 20
C	> 20 – 28
D	> 28 – 35
E	> 35
F	Demand > Capacity

<sup>2</sup> Highway Capacity Manual 2000, Chapter 13 – Freeway Concepts Basic Freeway Segments, page 13

<sup>3</sup> Highway Capacity Manual 2000, Chapter 25 – Ramps and Ramp Junctions, page 10

## 6 Alternatives

MoDOT ultimately directed that eleven VISSIM scenarios be tested for inclusion in the AJR. These Scenarios are described below in Table 6.1 and exhibited graphically in Figure 6.1 - Figure 6.11. Two models were constructed and analyzed for each Scenario: an AM and a PM peak-hour model.

Note that all scenarios except Scenario 1 include completed NMRB Phase I.

Table 6.1: VISSIM Model Scenarios and Descriptions

Model Scenario	Assessment Year	Description	Purpose
1	2010	Existing Conditions	Used to benchmark existing (2010) traffic conditions
2	2015	PSB No Build CAR 2015 No Build	Demonstrates the baseline network performance in future year 2015 No Build condition
3A	2015	PSB No Build CAR 2015 Build	Demonstrate the impacts of the CAR 2015 network with depressed highway configuration of 2 EB lanes, 3 WB lanes
3B	2015	PSB No Build CAR 2015 Build	Demonstrates the impacts of the CAR 2015 network with depressed highway configuration of 3 EB lanes, 2 WB lanes
3C	2015	PSB No Build CAR 2015 Build	Demonstrates the impacts of the CAR 2015 network with depressed highway configuration of 3 EB lanes, 3 WB lanes
6A*	2015	PSB Preferred Build including Ramp A CAR 2015 Build	Demonstrates impacts of the preferred 2015 Build options: - CAR 2015 project - PSB Preferred Build project including a ramp from PSB westbound to depressed section of I-44 eastbound
7	2035	PSB No Build CAR 2015 No Build	Demonstrates the baseline network performance in future year (2035) No Build condition
9A*	2035	PSB Preferred Build including Ramp A	Demonstrates impacts of the preferred 2035 Build options:

Model Scenario	Assessment Year	Description	Purpose
		CAR 2015 Build (Scenario 6A network geometry)	- CAR 2015 project - PSB Preferred Build project including a ramp from PSB westbound to depressed section of I-44 eastbound
10A	2035	PSB No Build CAR 2015 Build	Demonstrates the impacts of the CAR 2015 network with depressed highway configuration of 2 EB lanes, 3 WB lanes
10B	2035	PSB No Build CAR 2015 Build	Demonstrates the impacts of the CAR 2015 network with depressed highway configuration of 3 EB lanes, 2 WB lanes
10C	2035	PSB No Build CAR 2015 Build	Demonstrates the impacts of the CAR 2015 network with depressed highway configuration of 3 EB lanes, 3 WB lanes

\* Preferred Alternative for PSB Ramp network Geometry

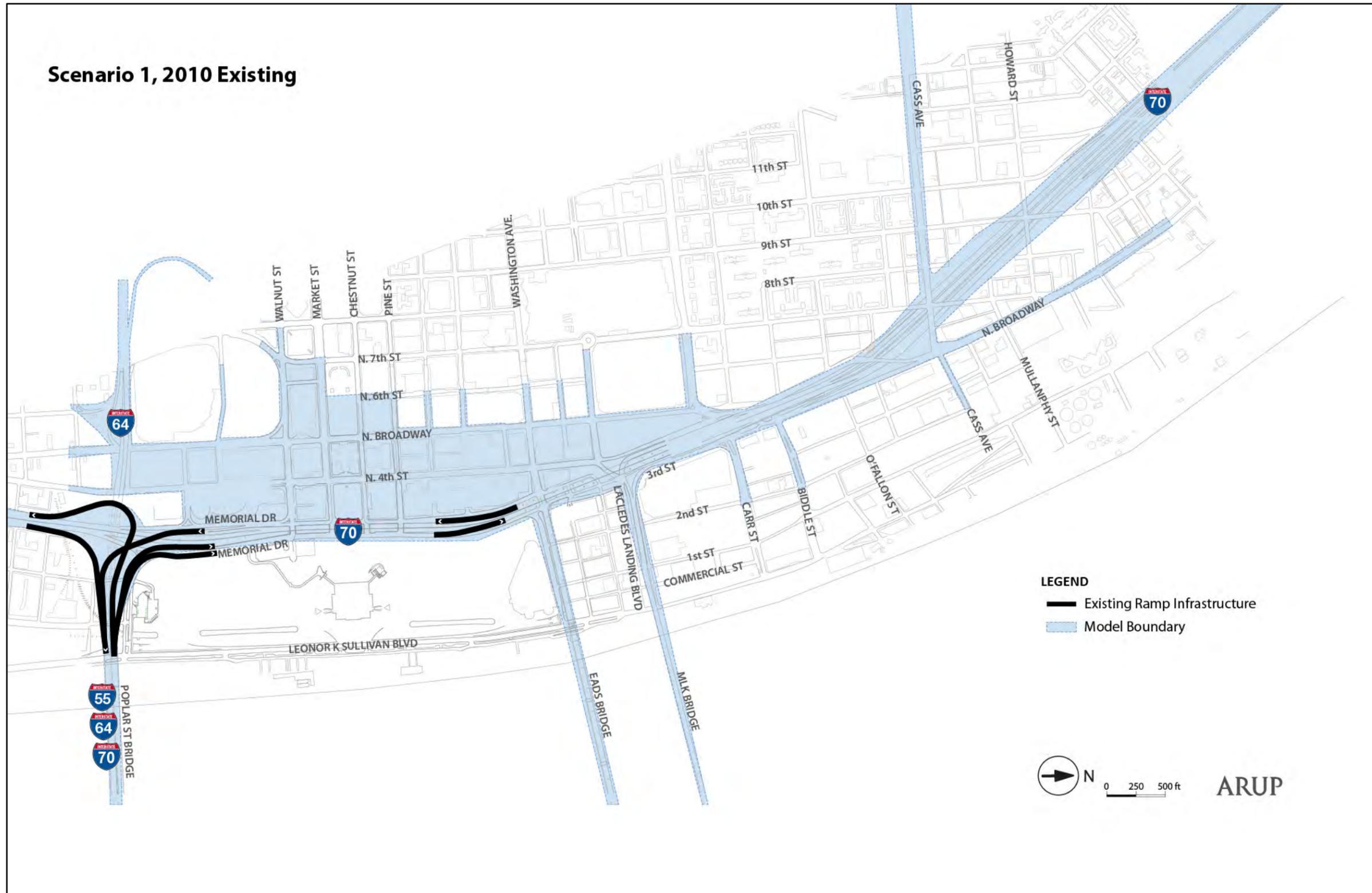


Figure 6.1: Scenario 1 – Year 2010, Existing Network (Image: Arup)

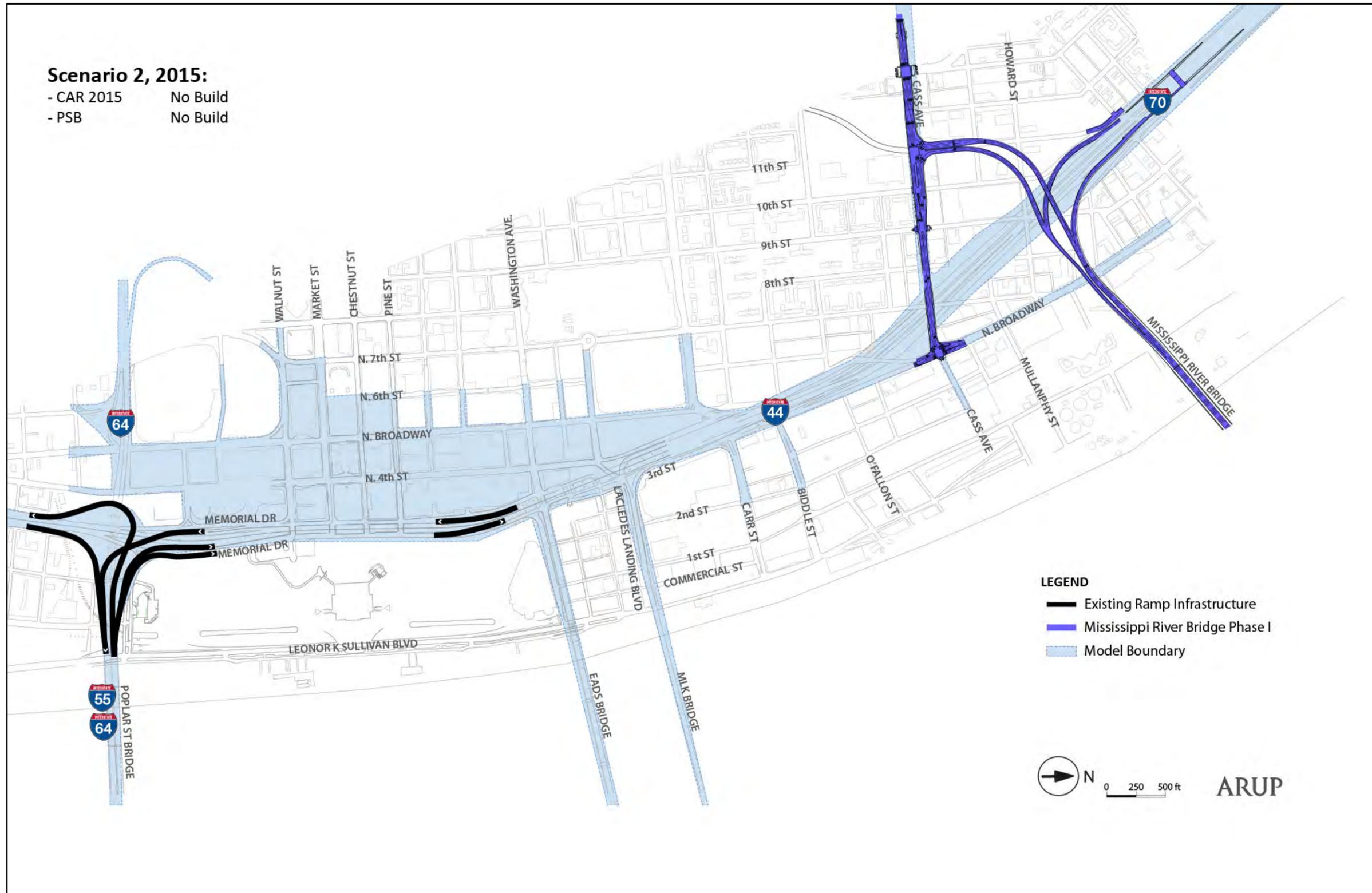


Figure 6.2: Scenario 2 – Year 2015, No Build Network (includes NMRB) (Image: Arup)

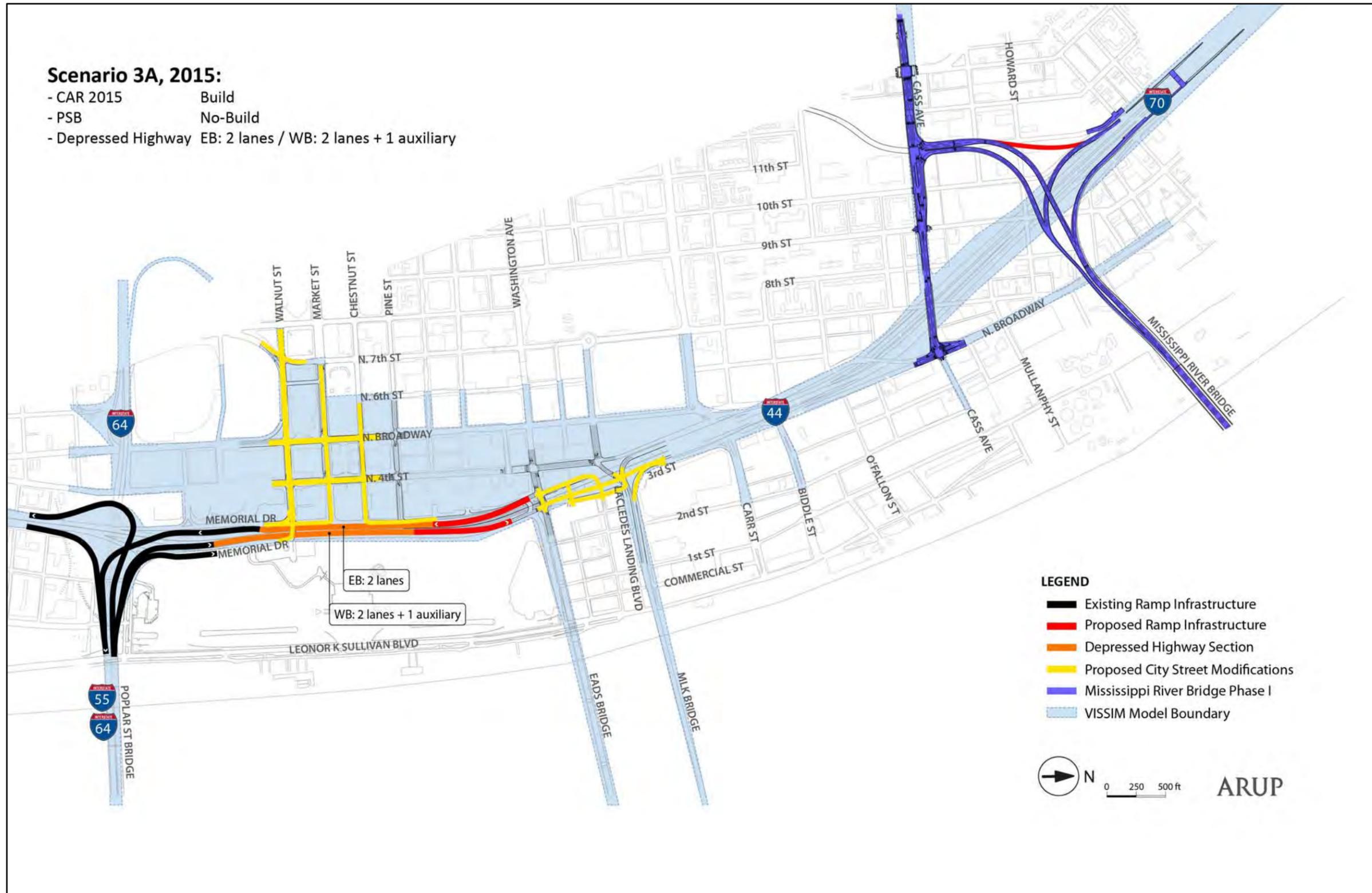


Figure 6.3: Scenario 3A – Year 2015, CAR 2015 Build with 2 EB and 3 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

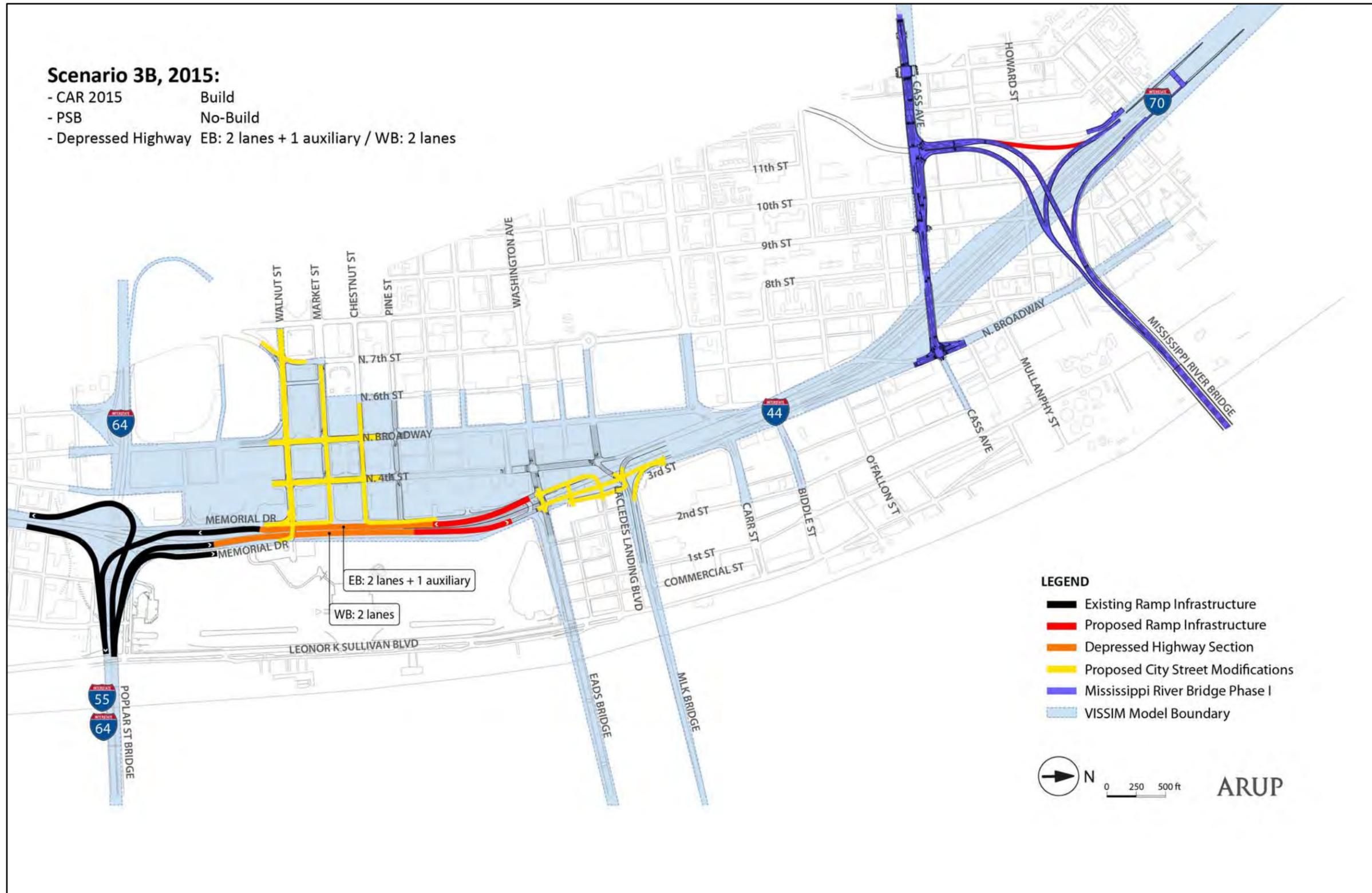


Figure 6.4: Scenario 3B – Year 2015, CAR 2015 Build with 3 EB and 2 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

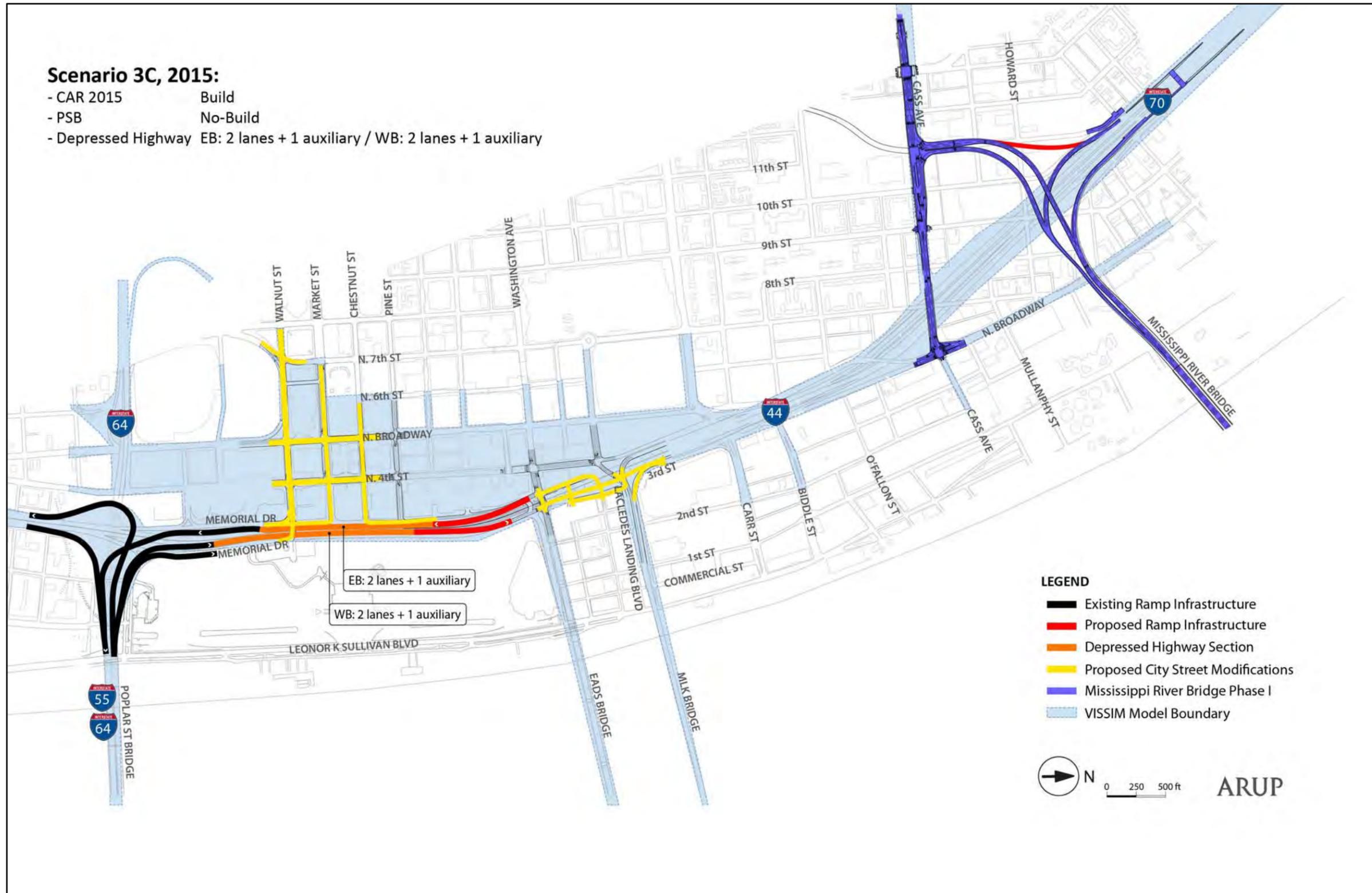


Figure 6.5: Scenario 3C – Year 2015, CAR 2015 Build with 3 EB and 3 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

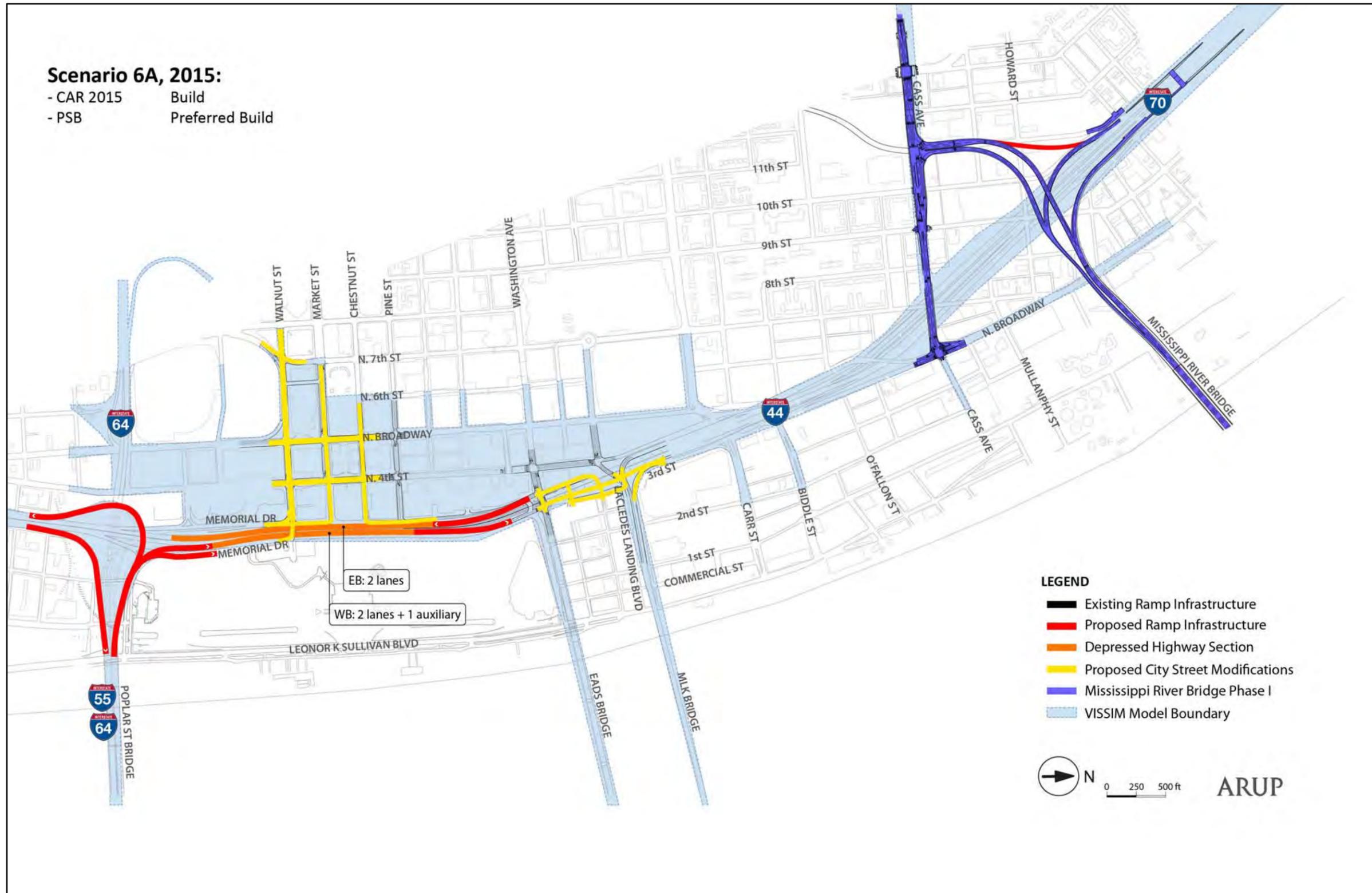


Figure 6.6: Scenario 6A – Year 2015, CAR 2015 Build, PSB Preferred Build with I-44 Eastbound Ramp (Image: Arup)



Figure 6.7: Scenario 7 – Year 2035, No Build Network (includes NMRB) (Image: Arup)

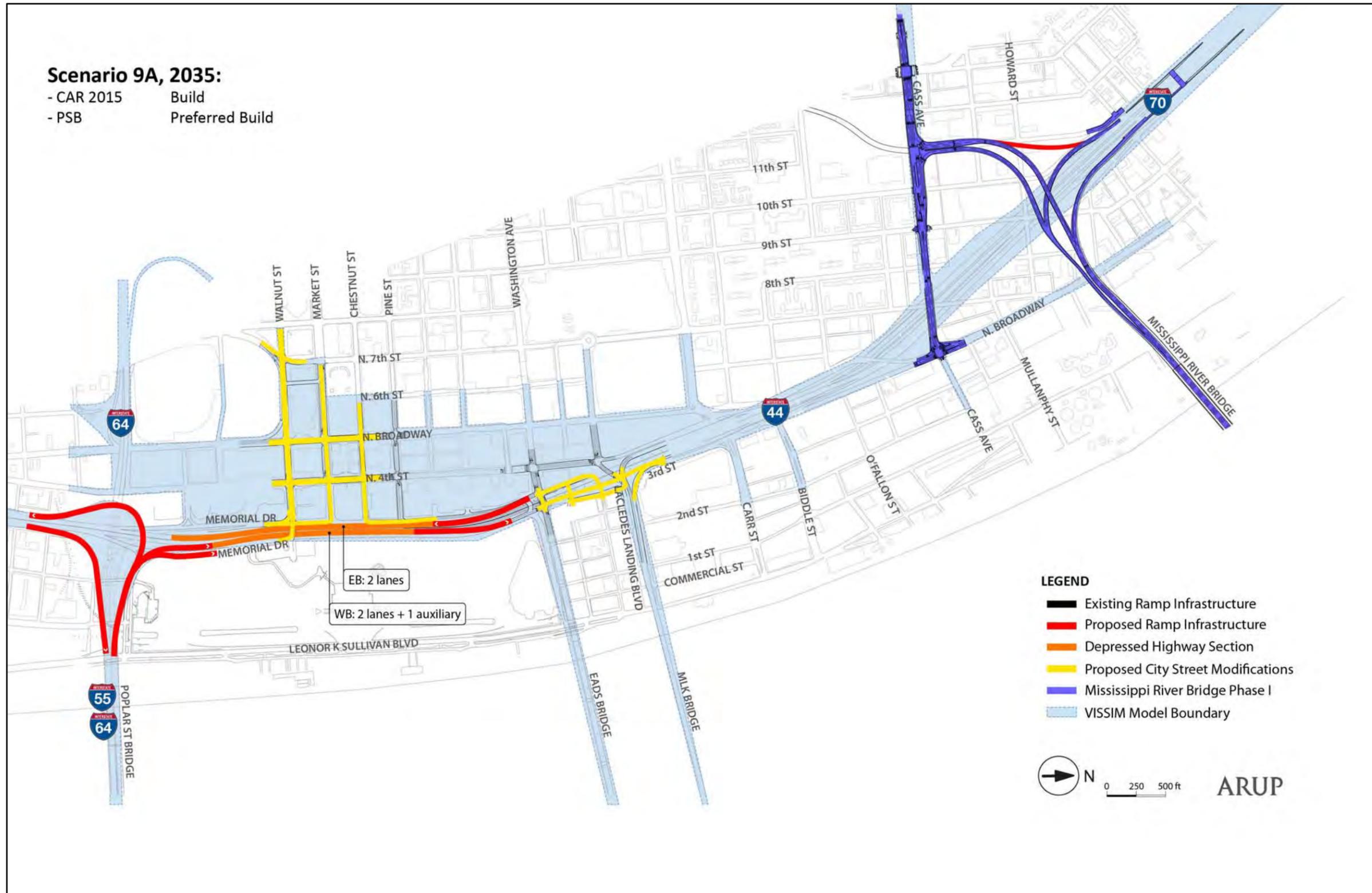


Figure 6.8: Scenario 9A – Year 2035, CAR 2015 Build, PSB Preferred Build with I-44 Eastbound Ramp (Image: Arup)

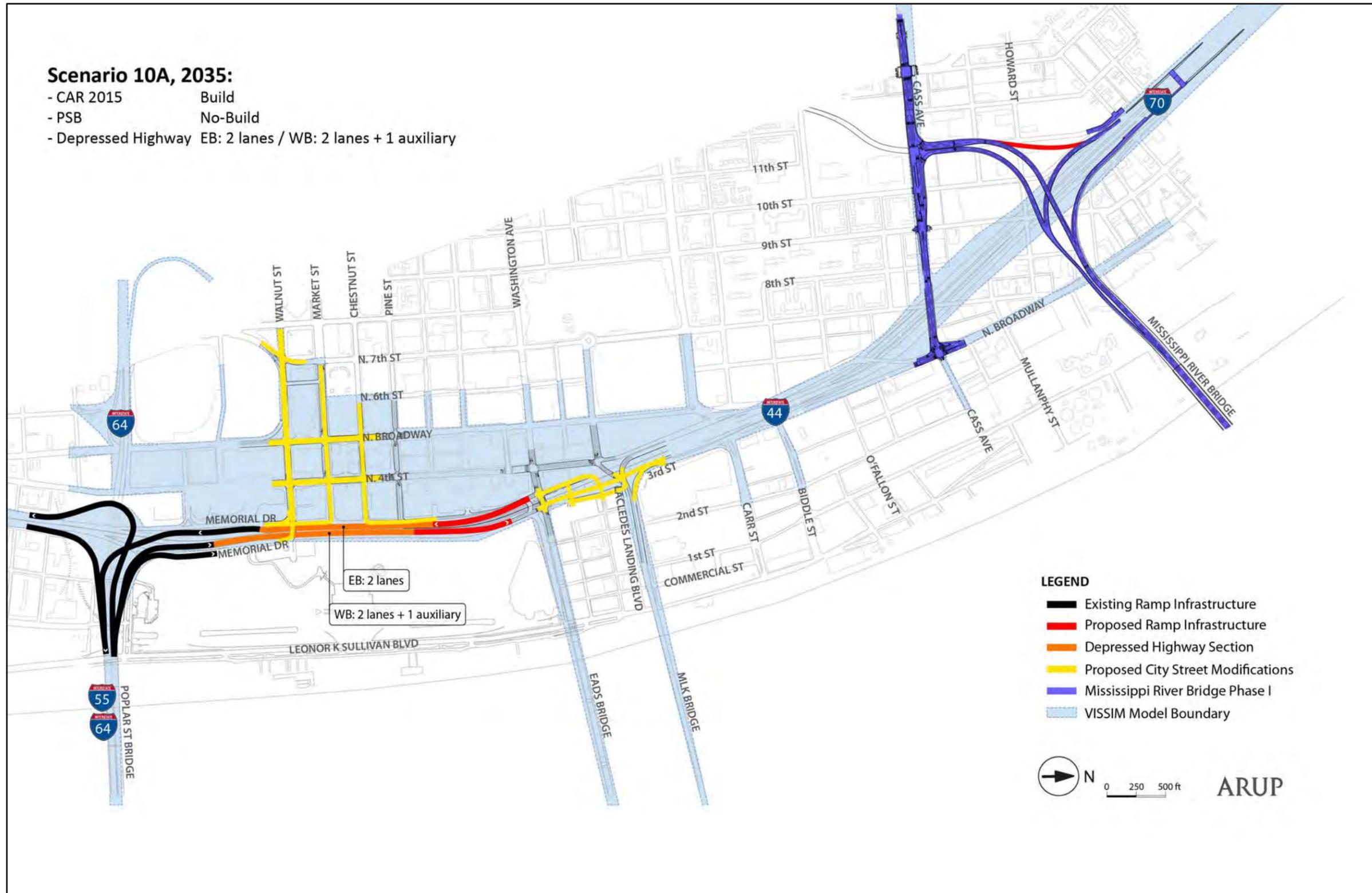


Figure 6.9: Scenario 10A – Year 2035, CAR 2015 Build with 2 EB and 3 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

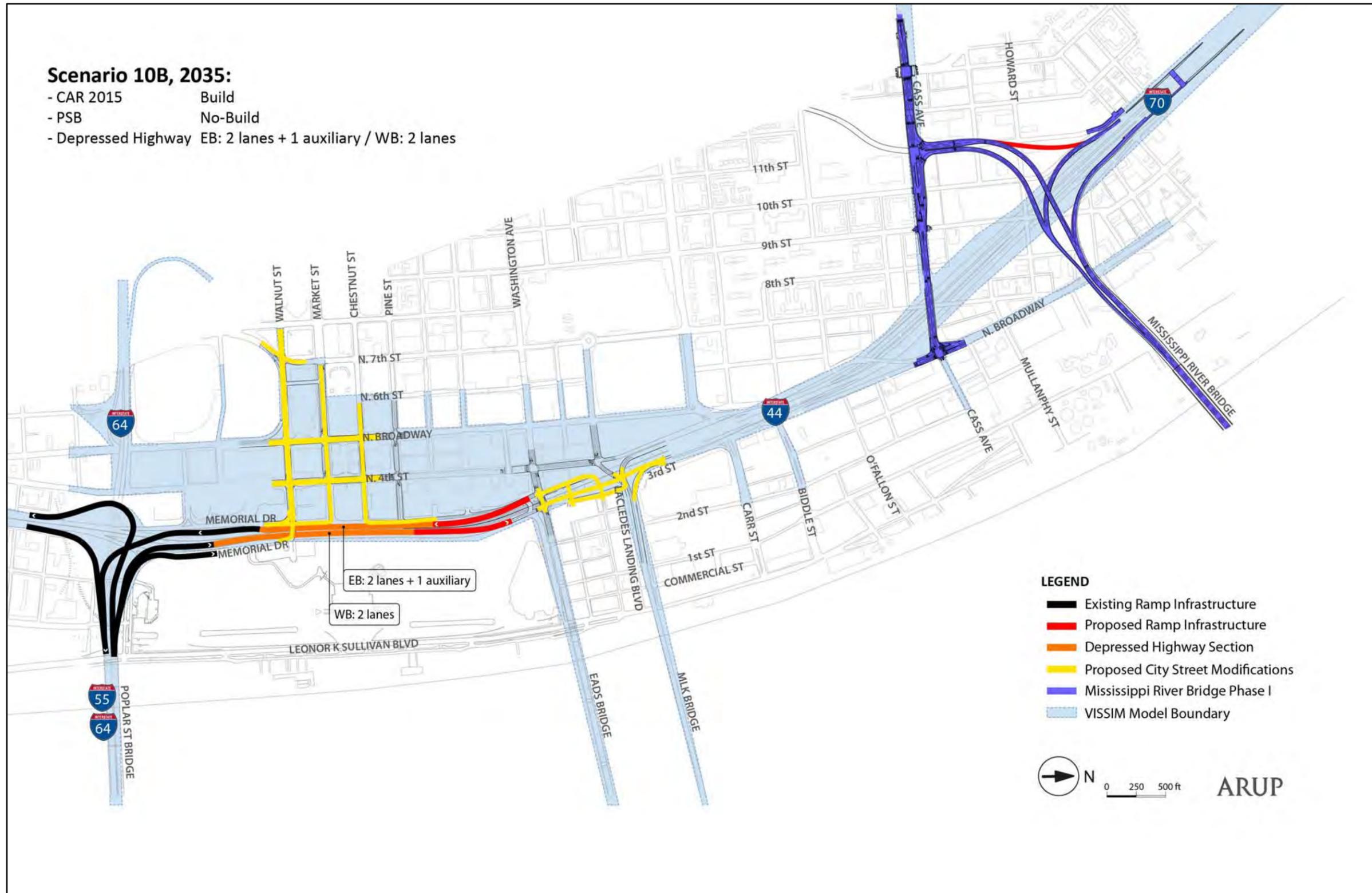


Figure 6.10: Scenario 10B – Year 2035, CAR 2015 Build with 3 EB and 2 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

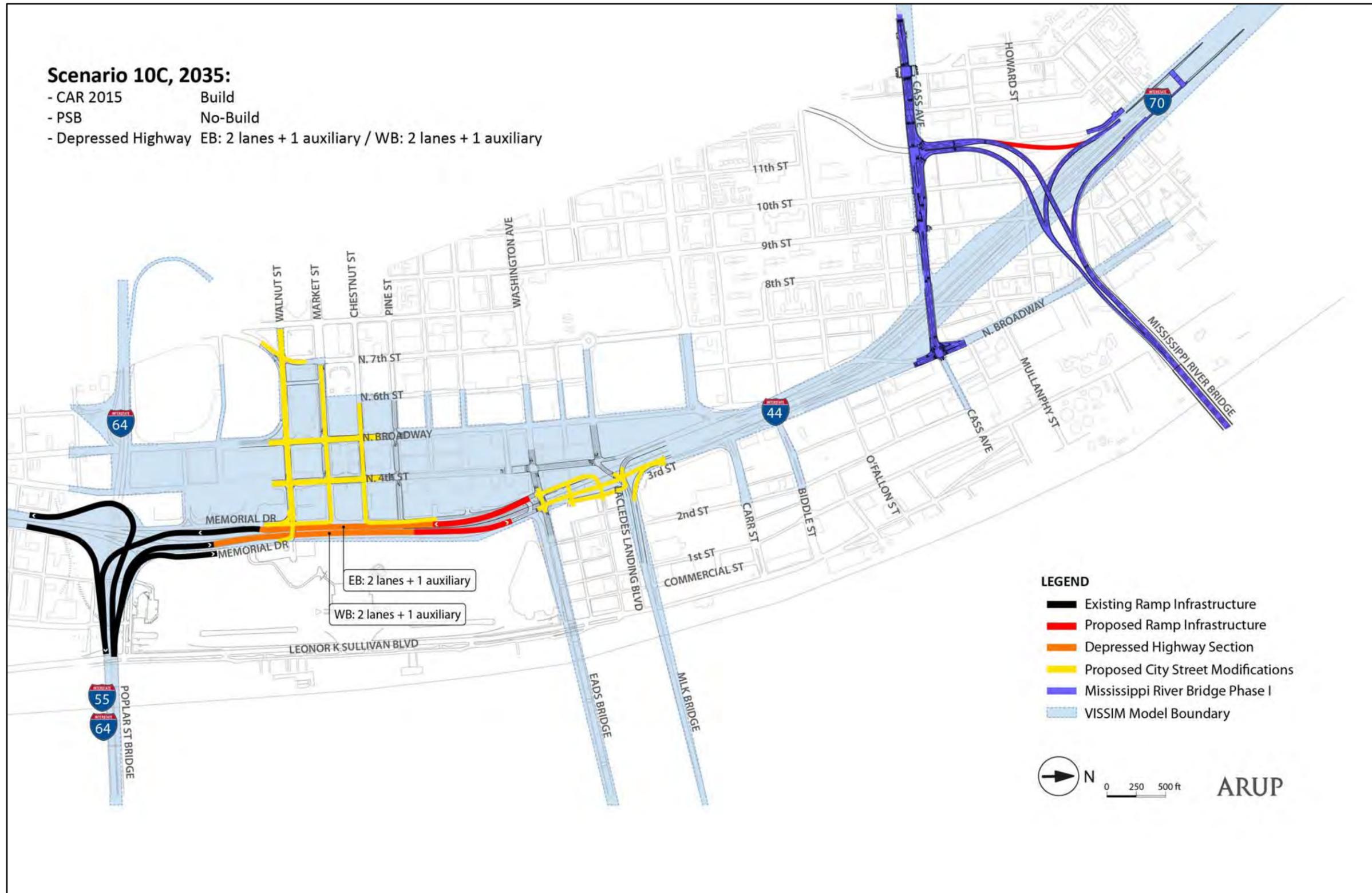


Figure 6.11: Scenario 10C – Year 2035, CAR 2015 Build with 3 EB and 3 WB Depressed Highway Lane Configuration, PSB No Build (Image: Arup)

## 7 Alternatives Analysis (Model Results and Outputs)

As presented in Section 6, the existing network and proposed network modifications were evaluated with dual traffic analysis tools. VISSIM microsimulation software was used to assess the performance of the freeway network and any impacts to MoDOT's system. SYNCHRO software was utilized to analyze the local arterial network and associated traffic signal operations – facilities that are typically owned and operated by the City of St. Louis. Within both software platforms, models were constructed for the peak periods of a typical weekday; determined through traffic data collection to be 7:30 – 8:30 am and 4:30 – 5:30 pm.

A number of measures of effectiveness (MOEs) can be quantified for analysis. Level of Service (LOS) was selected as a MOE for comparison across all alternatives. The LOS for the freeway system is based on the density per lane of a freeway segment (discussed in Section 5.7.2). The freeway system was divided into operational segments: basic freeway (mainline), weaving, and merging or diverging (ramp). The LOS results for the freeway segments for all Scenarios are reported in Figure 7.1 through Table 7.4. Appendix E presents a series of figures graphically representing the freeway LOS by Scenario.

The LOS for arterials is based on average driver delay induced by the intersection control (presented in Section 6.3.1). The arterial LOS results for all Scenarios are presented in Table 7.5 through Table 7.6.

Table 7.1: VISSIM Analysis Results (Freeway Segments), AM Peak Hour, Year 2015 Scenarios

Line	FREEWAY SEGMENT			SCENARIO 1 - EXISTING				SCENARIO 2 - 2015 NO BUILD				SCENARIO 3A - CAR2015 BUILD ONLY				SCENARIO 3B - CAR2015 BUILD ONLY				SCENARIO 6A - CAR 2015 & PSB BUILD w/RAMP			
				AM PEAK HOUR				AM PEAK HOUR				AM PEAK HOUR				AM PEAK HOUR				AM PEAK HOUR			
				Route	Direction	Location	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type
1	I-55	NB	South of I-44 WB	Freeway	4	D	33.6	Freeway	4	E	35.6	Freeway	4	D	34.7	Freeway	4	D	34.7	Freeway	4	E	35.0
2	I-55	NB	South of I-44 WB	Diverge	4	E	35.9	Diverge	4	E	37.1	Diverge	4	E	37.4	Diverge	4	E	37.4	Diverge	4	E	37.4
3	I-55	NB	to I-44 WB and Truman Pkwy	Diverge	3	B	19.4	Diverge	3	B	19.9	Diverge	3	B	19.7	Diverge	3	B	19.7	Diverge	3	B	19.7
4	I-44	WB	Ramp from I-55 NB to I-44	Freeway	1	D	34.3	Freeway	1	D	34.7	Freeway	1	D	34.3	Freeway	1	D	34.3	Freeway	1	D	34.3
5	Truman	NB	At I-44	Freeway	2	B	12.6	Freeway	2	B	12.7	Freeway	2	B	12.9	Freeway	2	B	12.9	Freeway	2	B	12.9
6	I-55	NB	South of I-44 EB Merge	Freeway	2	C	24.7	Freeway	2	C	25.7	Freeway	2	C	25.7	Freeway	2	C	25.7	Freeway	2	C	25.7
7	I-44	EB	West of Gravois on ramp	Freeway	2	C	24.1	Freeway	2	C	24.3	Freeway	2	C	24.4	Freeway	2	C	24.4	Freeway	2	C	24.4
8	I-44	EB	Gravois on ramp	Merge	3	B	18.3	Merge	3	B	18.4	Merge	3	B	18.5	Merge	3	B	18.5	Merge	3	B	18.5
9	I-44-I-55	EB	Merge to 7th St. off ramp	Weave	5	C	23.6	Weave	5	C	24.6	Weave	5	C	23.6	Weave	5	C	23.6	Weave	5	C	23.8
10	I-44-I-55	EB	Between 7th St. and Marion St. ramps	Freeway	4	C	24.8	Freeway	4	D	26.0	Freeway	4	C	24.8	Freeway	4	C	24.8	Freeway	4	C	24.8
11	I-44-I-55	EB	Marion St. on ramp	Merge	5	C	20.7	Merge	5	C	21.1	Merge	5	C	20.8	Merge	5	C	20.8	Merge	5	C	20.9
12	I-44-I-55	EB	Between Marion St. ramp and PSB EB ramp	Freeway	4	C	25.5	Freeway	4	C	26.0	Freeway	4	C	26.0	Freeway	4	C	25.9	Freeway	4	D	26.5
13	I-44-I-55	EB	PSB EB off ramp	Diverge	4	D	30.2	Diverge	4	D	34.0	Diverge	4	C	27.6	Diverge	4	C	27.5	Diverge	4	C	27.4
14	I-44-I-55	NB	I-70 and NB Memorial Drive Diverge	Diverge	3	E	37.6	Diverge	3	D	34.1	Diverge	3	D	31.1	Diverge	3	D	31.1	Diverge	3	D	32.3
15	I-70	NB	South of on ramp from PSB	Freeway	2	F	57.0	Freeway	2	D	26.4	Freeway	2	D	32.2	Freeway	2	D	33.8	Freeway	2	D	32.3
16	I-70	WB	PSB on ramp	Merge	3	E	43.5	Merge	3	B	17.3	Add Lane	3	C	22.5	Merge	3	C	25.0	Add Lane	3	C	22.6
17	I-70	WB	Between PSB and Memorial Drive/Washington Ave ramp	Freeway	2	D	31.8	Freeway	2	C	24.5				Freeway	2	E	40.8					
18	I-70	WB	Memorial Drive on ramp	Add Lane	3	C	21.8	Add Lane	3	C	18.4												
19	I-70	WB	Between NB Memorial Drive and Washington Avenue off ramp																				
20	I-70	WB	Washington Avenue off ramp								Weave	3	C	23.0	Diverge	2	E	39.7	Weave	3	C	23.2	
21	I-70	WB	Between Memorial Drive/Washington Ave and MLK on ramps	Freeway	3	C	20.8	Freeway	3	B	17.8	Freeway	2	D	27.5	Freeway	2	D	27.2	Freeway	2	D	27.6
22	I-70	WB	MLK on ramp	Merge	4	E	35.8	Merge	3	B	13.9	Add Lane	3	C	22.8	Add Lane	3	C	21.7	Add Lane	3	C	23.6
23	I-70	WB	Between MLK and Biddle on ramps	Freeway	3	D	34.7	Freeway	3	C	18.7	Freeway	3	C	20.1	Freeway	3	C	19.7	Freeway	3	C	21.3
24	I-70	WB	Reversible off ramp (left exit)																				
25	I-70	WB	Between reversible off ramp and Biddle on ramp																				
26	I-70	WB	Biddle on ramp	Merge	4	C	27.4	Merge	4	B	16.9	Merge	4	B	16.7	Merge	4	B	16.3	Merge	4	B	17.6
27	I-70	WB	Between Biddle on ramp and 10th St. off ramp	Freeway	3	D	33.1	Freeway	3	C	24.4	Freeway	3	C	20.6	Freeway	3	C	20.4	Freeway	3	C	22.0
28	I-70	WB	10th St. off ramp	Diverge	3	E	36.8	Drop Lane	3	D	31.2	Drop Lane	3	C	21.1	Drop Lane	3	C	20.9	Drop Lane	3	C	22.6
29	I-70	WB	Between 10th St. off and MRB on ramps					Freeway	2	E	38.9	Freeway	2	D	27.7	Freeway	2	D	27.5	Freeway	2	D	29.7
30	I-70	WB	MRB on Ramp					Merge	4	C	26.1	Merge	4	C	20.7	Merge	4	C	20.7	Merge	4	C	21.7
31	I-70	WB	Between MRB on Ramp and 10th on ramp					Freeway	3	D	34.6	Freeway	3	D	27.5	Freeway	3	D	27.5	Freeway	3	D	28.9
32	I-70	WB	Between 10th St. ramps	Freeway	3	D	32.7																
33	I-70	WB	10th St. on ramp	Add Lane	4	C	23.1	Add Lane	4	C	24.9	Weave	4	C	21.2	Weave	4	C	21.1	Weave	4	C	22.3
34	I-70	EB	West of 11th St. on ramp	Freeway	3	C	18.2	Freeway	3	B	17.6	Freeway	3	C	19.7	Freeway	3	C	19.7	Freeway	3	C	19.7
35	I-70	EB	11th St. on ramp	Merge	4	B	17.1	Add Lane	4	B	13.2	Add Lane	4	B	14.5	Add Lane	4	B	14.5	Add Lane	4	B	14.5
36	I-70	EB	Between 11th St. on ramp and MRB off ramp					Weave	4	B	13.4	Weave	4	B	15.5	Weave	4	B	15.5	Weave	4	B	15.5
37	I-70	EB	MRB off Ramp					Diverge	4	B	13.5	Diverge	4	B	15.6	Diverge	4	B	15.6	Diverge	4	B	15.6
38	I-70	EB	Between 11th St. on ramp and 10th St. off ramp	Freeway	3	C	19.4																
39	I-70	EB	10th St. off ramp	Diverge	4	B	18.8																
40	I-70	EB	Between MRB off ramp and Broadway off ramp					Freeway	3	B	15.1	Freeway	3	A	10.7	Freeway	3	A	10.7	Freeway	3	A	10.7
41	I-70	EB	Between 10th St. and Broadway off ramps	Diverge	3	B	13.3																
42	I-70	EB	Broadway off ramp					Diverge	3	B	15.4	Diverge	3	B	10.9	Diverge	3	B	10.9	Diverge	3	B	10.9
43	I-70	EB	Between Broadway off and reversibles	Freeway	2	B	16.9	Freeway	2	B	14.2	Freeway	2	A	10.1	Freeway	2	A	10.1	Freeway	2	A	10.1
44	I-70	EB	East of reversibles - includes MLK diverge	Freeway	3	B	14.8																
45	I-70	EB	East of reversibles - includes MLK diverge					Weave	3	B	14.3	Weave	3	B	12.2	Weave	3	B	12.2	Weave	3	B	12.1
46	I-70	EB	East of MLK off ramp					Freeway	3	B	13.9	Freeway	3	B	11.7	Freeway	3	B	11.7	Freeway	3	B	11.6
47	I-70	EB	West of SB Memorial on ramp to lane drop									Merge	3	B	11.8	Merge	3	B	11.8	Merge	3	B	11.8
48	I-70	EB	West of SB Memorial on ramp past lane drop									Freeway	2	B	17.2	Freeway	2	B	17.5	Freeway	2	B	17.1
49	I-70	EB	SB Memorial off ramp	Diverge	3	B	14.6	Diverge	3	B	13.9												
50	I-70	EB	SB Memorial on ramp									Merge	3	B	12.2	Add Lane	3	B	12.1	Merge	3	B	12.1
51	I-70	EB	Depressed Section	Freeway	2	B	17.7	Freeway	2	B	16.2	Freeway	2	C	18.1	Weave	3	B	12.0	Freeway	2	B	17.9
52	I-70	EB	PSB off ramp	Diverge	3	A	8.2	Diverge	2	B	14.1	Diverge	2	B	17.2	Diverge	3	B	11.7				
53	I-70	SB	TO I-55 and I-44 SB	Freeway	2	B	16.0	Freeway	2	B	16.2	Freeway	2	B	17.8	Freeway	2	B	17.9	Freeway	2	B	17.8
54	I-55	SB	Memorial Drive SB on ramp	Add Lane	3	B	11.3	Add Lane	3	B	11.4	Add Lane	3	B	12.4	Add Lane	3	B	12.4	Merge	3	B	12.7
55	I-55	SB	PSB on ramp	Add Lane	4	B	17.8	Add Lane	4	B	17.3	Add Lane	4	B	17.0	Add Lane	4	B	17.0	Add Lanes	4	C	18.8
56	I-55	SB	7th St. off ramp	Diverge	4	C	22.6	Diverge	4	C	25.2	Diverge	4	B	17.0	Diverge	4	B	17.5	Diverge	4	C	21.6
57	I-55	SB	Between 7th St. ramps	Freeway	4	B	12.1	Freeway	4	B	12.3	Freeway	4	B	11.6	Freeway	4	B	11.6	Freeway	4	B	12.9
58	I-55	SB	7th St. on ramp to 44 and 55 Diverge	Weave	5	A	9.7	Weave	5	A	9.9	Weave	5	A	9.5	Weave	5	A	9.5	Weave	5	B	10.4
59	I-55	SB	South of Diverge	Freeway	2	A	10.2	Freeway	2	A	10.8	Freeway	2	A	10.0	Freeway	2	A	10.0	Freeway	2	A	10.9
60	I-44	WB	Gravois off Ramp	Diverge	3	A	9.9	Diverge	3	A	9.7	Diverge	3	A	9.6	Diverge	3	A	9.6	Diverge	3	A	10.5
61	I-44	WB	Between Gravois off and I-55 NB on ramps	Freeway	2	A	7.7	Freeway	2	A	7.6	Freeway	2	A	7.5	Freeway	2	A	7.5	Freeway	2	A	8.2
62	I-44	WB	I-55 NB on ramp	Add Lane	3	B	15.3	Add Lane	3	B	15.4	Add Lane	3	B	15.3	Add Lane	3	B	15.3	Add Lane	3	B	15.8
63	I-44	WB	Truman Pkwy on ramp to Jefferson off Ramp	Weave	5	B	11.6	Weave	5	B	11.6	Weave	5	B	11.6	Weave	5	B	11.6	Weave	5	B	11.9
64																							

Table 7.2: VISSIM Analysis Results (Freeway Segments), AM Peak Hour, Year 2035 Scenarios

Line	FREEWAY SEGMENT			SCENARIO 7 - 2035 NO BUILD				SCENARIO 10A - 2035 CAR 2015 BUILD ONLY				SCENARIO 10B - 2035 CAR 2015 BUILD ONLY				SCENARIO 9A - 2035 CAR 2015 & PSB BUILD w/RAMP			
				AM PEAK HOUR				AM PEAK HOUR				AM PEAK HOUR				AM PEAK HOUR			
	Route	Direction	Location	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane
1	I-55	NB	South of I-44 WB	Freeway	4	F	46.8	Freeway	4	F	47.2	Freeway	4	F	47.2	Freeway	4	F	47.0
2	I-55	NB	South of I-44 WB	Diverge	4	E	42.1	Diverge	4	E	42.5	Diverge	4	E	42.5	Diverge	4	E	42.4
3	I-55	NB	to I-44 WB and Truman Pkwy	Diverge	3	C	20.0	Diverge	3	C	20.1	Diverge	3	C	20.1	Diverge	3	C	21.9
4	I-44	WB	Ramp from I-55 NB to I-44	Freeway	1	D	34.9	Freeway	1	D	34.6	Freeway	1	D	34.6	Freeway	1	D	34.6
5	Truman	NB	At I-44	Freeway	2	B	13.1	Freeway	2	B	13.2	Freeway	2	B	13.2	Freeway	2	B	13.2
6	I-55	NB	South of I-44 EB Merge	Freeway	2	D	28.8	Freeway	2	D	26.9	Freeway	2	D	27.7	Freeway	2	D	28.6
7	I-44	EB	west of Gravois on ramp	Freeway	2	E	40.8	Freeway	2	C	25.4	Freeway	2	D	27.5	Freeway	2	D	26.9
8	I-44	EB	Gravois on ramp	Merge	3	D	34.7	Merge	3	B	19.9	Merge	3	C	21.2	Merge	3	C	22.1
9	I-44/I-55	EB	Merge to 7th St. off ramp	Weave	5	D	34.0	Weave	5	C	26.1	Weave	5	C	26.4	Weave	5	C	27.4
10	I-44/I-55	EB	Between 7th St. and Marion St. ramps	Freeway	4	D	28.2	Freeway	4	D	26.3	Freeway	4	D	26.1	Freeway	4	D	26.4
11	I-44/I-55	EB	Marion St. on ramp	Merge	5	C	22.3	Merge	5	C	22.0	Merge	5	C	21.9	Merge	5	C	22.0
12	I-44/I-55	EB	Between Marion St. ramp and PSB EB ramp	Freeway	4	D	28.9	Freeway	4	D	27.3	Freeway	4	D	26.9	Freeway	4	D	27.8
13	I-44/I-55	EB	PSB EB off ramp	Diverge	4	E	41.9	Diverge	4	D	29.4	Diverge	4	D	28.4	Diverge	4	D	29.6
14	I-44/I-55	NB	I-70 and NB Memorial Drive Diverge	Diverge	3	E	36.4	Diverge	3	E	35.9	Diverge	3	D	33.8	Diverge	3	E	38.0
15	I-70	NB	South of on ramp from PSB	Freeway	2	D	27.3	Freeway	2	D	34.0	Freeway	2	E	36.4	Freeway	2	D	33.9
16	I-70	WB	PSB on ramp	Merge	3	B	17.9	Add Lane	3	C	23.4	Merge	3	C	27.9	Add Lane	3	C	23.4
17	I-70	WB	Between PSB and Memorial Drive/Washington Ave ramp	Freeway	2	C	25.6				Freeway	2	E	43.9					
18	I-70	WB	Memorial Drive on ramp	Add Lane	3	C	19.0												
19	I-70	WB	Between NB Memorial Drive and Washington Avenue off ramp																
20	I-70	WB	Washington Avenue off ramp					Weave	3	C	23.9	Diverge	2	E	41.0	Weave	3	C	23.9
21	I-70	WB	Between Memorial Drive/Washington Ave and MLK on ramps	Freeway	3	C	18.3	Freeway	2	D	28.7	Freeway	2	D	28.2	Freeway	2	D	28.5
22	I-70	WB	MLK on ramp	Add Lane	4	B	14.3	Add Lane	3	C	24.6	Add Lane	3	C	23.1	Add Lane	3	C	24.9
23	I-70	WB	Between MLK and Biddle on ramps	Freeway	3	C	19.2	Freeway	3	C	21.0	Freeway	3	C	20.6	Freeway	3	C	22.3
24	I-70	WB	Reversible off ramp (left exit)																
25	I-70	WB	Between reversible off ramp and Biddle on ramp																
26	I-70	WB	Biddle on ramp	Merge	4	B	17.6	Merge	4	B	17.3	Merge	4	B	17.3	Merge	4	B	18.5
27	I-70	WB	Between Biddle on ramp and 10th St. off ramp	Freeway	3	C	25.7	Freeway	3	C	21.4	Freeway	3	C	21.2	Freeway	3	C	22.9
28	I-70	WB	10th St. off ramp	Drop Lane	3	D	33.6	Drop Lane	3	C	21.7	Drop Lane	3	C	21.6	Drop Lane	3	C	23.3
29	I-70	WB	Between 10th St. off and MRB on ramps	Freeway	2	E	41.0	Freeway	2	D	28.8	Freeway	2	D	28.7	Freeway	2	D	30.8
30	I-70	WB	MRB on Ramp	Merge	4	C	27.4	Merge	4	C	21.8	Merge	4	C	21.6	Merge	4	C	22.7
31	I-70	WB	Between MRB on Ramp and 10th on ramp	Freeway	3	E	36.4	Freeway	3	D	28.6	Freeway	3	D	28.6	Freeway	3	D	30.1
32	I-70	WB	Between 10th St. ramps																
33	I-70	WB	10th St. on ramp	Weave	4	C	26.2	Weave	4	C	21.9	Weave	4	C	21.9	Weave	4	C	23.1
34	I-70	EB	West of 11th St. on ramp	Freeway	3	C	18.3	Freeway	3	C	20.5	Freeway	3	C	20.5	Freeway	3	C	20.5
35	I-70	EB	11th St. on ramp	Add Lane	4	B	13.8	Add Lane	4	B	15.0	Add Lane	4	B	15.0	Add Lane	4	B	15.0
36	I-70	EB	Between 11th St. on ramp and MRB off ramp	Weave	4	B	14.0	Weave	4	B	16.1	Weave	4	B	16.1	Weave	4	B	16.1
37	I-70	EB	MRB off Ramp	Diverge	4	B	14.7	Diverge	4	B	16.3	Diverge	4	B	16.3	Diverge	4	B	16.2
38	I-70	EB	Between 11th St. on ramp and 10th St. off ramp																
39	I-70	EB	10th St. off ramp																
40	I-70	EB	Between MRB off ramp and Broadway off ramp	Freeway	3	B	15.8	Freeway	3	B	11.2	Freeway	3	B	11.2	Freeway	3	B	11.1
41	I-70	EB	Between 10th St. and Broadway off ramps																
42	I-70	EB	Broadway off ramp	Diverge	3	B	16.3	Diverge	3	B	11.4	Diverge	3	B	11.4	Diverge	3	B	11.4
43	I-70	EB	Between Broadway off and reversibles	Freeway	2	B	14.8	Freeway	2	A	10.5	Freeway	2	A	10.5	Freeway	2	A	10.5
44	I-70	EB	East of reversibles - includes MLK diverge																
45	I-70	EB	East of reversibles - includes MLK diverge	Weave	3	B	14.8	Weave	3	B	12.6	Weave	3	B	12.6	Weave	3	B	12.6
46	I-70	EB	East of MLK off ramp	Freeway	3	B	14.5	Freeway	3	B	12.2	Freeway	3	B	12.2	Freeway	3	B	12.1
47	I-70	EB	West of SB Memorial on ramp to lane drop					Merge	3	B	12.4	Merge	3	B	12.4	Merge	3	B	12.3
48	I-70	EB	West of SB Memorial on ramp past lane drop					Freeway	2	B	18.0	Freeway	2	C	18.2	Freeway	2	B	17.9
49	I-70	EB	SB Memorial off ramp	Diverge	3	B	14.6												
50	I-70	EB	SB Memorial on ramp					Merge	3	B	12.7	Add Lane	3	B	12.6	Merge	3	B	12.7
51	I-70	EB	Depressed Section	Freeway	2	B	16.9	Freeway	2	C	18.8	Weave	3	B	12.4	Freeway	2	C	18.7
52	I-70	EB	PSB off ramp	Diverge	2	B	14.7	Diverge	2	B	18.0	Diverge	3	B	12.2				
53	I-70	SB	TO I-55 and I-44 SB	Freeway	2	B	16.9	Freeway	2	C	18.6	Freeway	2	C	18.7	Freeway	2	C	18.5
54	I-55	SB	Memorial Drive SB on ramp	Add Lane	3	B	12.0	Add Lane	3	B	12.9	Add Lane	3	B	12.9	Merge	3	B	13.2
55	I-55	SB	PSB on ramp	Add Lane	4	C	20.8	Add Lane	4	B	17.4	Add Lane	4	B	17.5	Add Lanes	4	C	19.7
56	I-55	SB	7th St. off ramp	Diverge	4	D	32.3	Diverge	4	B	18.7	Diverge	4	B	19.3	Diverge	4	C	23.0
57	I-55	SB	Between 7th St. ramps	Freeway	4	B	12.9	Freeway	4	B	12.0	Freeway	4	B	12.0	Freeway	4	B	13.4
58	I-55	SB	7th St. on ramp to 44 and 55 Diverge	Weave	5	B	10.2	Weave	5	A	9.8	Weave	5	A	9.8	Weave	5	B	10.9
59	I-55	SB	South of Diverge	Freeway	2	B	11.2	Freeway	2	A	10.3	Freeway	2	A	10.3	Freeway	2	B	11.4
60	I-44	WB	Gravois off Ramp	Diverge	3	B	10.1	Diverge	3	A	9.9	Diverge	3	A	9.9	Diverge	3	B	10.9
61	I-44	WB	Between Gravois off and I-55 NB on ramps	Freeway	2	A	7.8	Freeway	2	A	7.8	Freeway	2	A	7.8	Freeway	2	A	8.6
62	I-44	WB	I-55 NB on ramp	Add Lane	3	B	15.6	Add Lane	3	B	15.6	Add Lane	3	B	15.6	Add Lane	3	B	16.1
63	I-44	WB	Truman Pkwy on ramp to Jefferson off Ramp	Weave	5	B	11.8	Weave	5	B	11.9	Weave	5	B	11.8	Weave	5	B	12.2
64	I-44	WB	Between Jefferson Ramps	Freeway	4	A	10.8	Freeway	4	A	10.7	Freeway	4	A	10.7	Freeway	4	B	11.0
65	PSB	WB	Between Merge and I-55 off ramp	Weave	4	F	52.9	Weave	4	D	30.9	Weave	4	D	30.9	Weave	4	D	33.5
66	I-64	WB	West of off ramps	Freeway	2	D	29.6	Freeway	2	D	33.2	Freeway	2	D	33.2	Freeway	2	D	33.5
67	I-64	WB	Stadium off ramp	Diverge	3	B	17.8	Diverge	3	C	20.7	Diverge	3	C	20.7	Diverge	3	C	20.9
68	I-64	WB	Between Stadium and Broadway Ramps	Freeway	2	C	23.8	Freeway	2	D	27.2	Freeway	2	D	27.2	Freeway	2	D	27.6
69	I-64	WB	Broadway on Ramp	Add Lane	3	B	16.8	Add Lane	3	C	19.4	Add Lane	3	C	19.5	Add Lane	3	C	19.7
70	I-64	EB	2 to 5 mile from Broadway off ramp	Freeway	3	C	20.0	Freeway	3	C	20.0	Freeway	3	C	20.0	Freeway	3	C	20.0
71	I-64	EB	Broadway off Ramp	Diverge	3	C	20.8	Diverge	3	C	20.4	Diverge	3	C	20.4	Diverge	3	C	20.4
72	I-64	EB	Between Broadway and Gratiot ramps	Freeway	2	D	32.6	Freeway	2	D	32.3	Freeway	2	D	32.3	Freeway	2	D	32.4
73	I-64	EB	Gratiot on Ramp	Merge	3	C	20.0	Merge	3	C	21.3	Merge	3	C	21.3	Merge	3	C	21.3
74	I-64	EB	Between Gratiot and PSB	Freeway	2	D	31.7	Freeway	2	D									

Table 7.3: VISSIM Analysis Results (Freeway Segments), PM Peak Hour, Year 2015 Scenarios

Line	FREEWAY SEGMENT			SCENARIO 1 - EXISTING				SCENARIO 2 - 2015 NO BUILD				SCENARIO 3A - 2015 CAR 2015 BUILD ONLY				SCENARIO 3B - 2015 CAR 2015 BUILD ONLY				SCENARIO 6A - CAR 2015 & PSB BUILD w/RAMP							
				PM PEAK HOUR				PM PEAK HOUR				PM PEAK HOUR				PM PEAK HOUR				PM PEAK HOUR							
	Route	Direction	Location	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane
1	I-55	NB	South of I-44 WB	Freeway	4	B	13.3	Freeway	4	B	13.6	Freeway	4	B	13.5	Freeway	4	B	13.5	Freeway	4	B	13.7	Freeway	4	B	13.7
2	I-55	NB	South of I-44 WB	Diverge	4	B	13.7	Diverge	4	B	14.7	Diverge	4	B	15.0	Diverge	4	B	14.9	Diverge	4	B	15.8	Diverge	4	B	15.8
3	I-55	NB	to I-44 WB and Truman Pkwy	Diverge	3	B	13.3	Diverge	3	B	16.3	Diverge	3	B	18.7	Diverge	3	B	18.4	Diverge	3	C	20.2	Diverge	3	C	20.2
4	I-44	WB	Ramp from I-55 NB to I-44	Freeway	1	D	33.4	Freeway	1	D	35.0	Freeway	1	D	35.9	Freeway	1	D	35.8	Freeway	1	D	36.2	Freeway	1	D	36.2
5	Truman	NB	At I-44	Freeway	2	A	2.7	Freeway	2	A	2.8	Freeway	2	A	2.8	Freeway	2	A	2.8	Freeway	2	A	2.8	Freeway	2	A	2.8
6	I-55	NB	South of I-44 EB Merge	Freeway	2	B	11.5	Freeway	2	B	11.4	Freeway	2	B	11.6	Freeway	2	B	11.6	Freeway	2	B	11.6	Freeway	2	B	11.6
7	I-44	EB	west of Gravois on ramp	Freeway	2	B	15.3	Freeway	2	B	15.7	Freeway	2	B	15.7	Freeway	2	B	15.7	Freeway	2	B	15.7	Freeway	2	B	15.7
8	I-44	EB	Gravois on ramp	Merge	3	B	15.9	Merge	3	B	15.7	Merge	3	B	16.1	Merge	3	B	16.1	Merge	3	B	16.1	Merge	3	B	16.1
9	I-44/I-55	EB	Merge to 7th St. off ramp	Weave	5	B	15.5	Weave	5	B	15.4	Weave	5	B	16.0	Weave	5	B	16.0	Weave	5	B	16.0	Weave	5	B	16.0
10	I-44/I-55	EB	Between 7th St. and Marion St. ramps	Freeway	4	C	18.8	Freeway	4	C	18.4	Freeway	4	C	19.7	Freeway	4	C	19.7	Freeway	4	C	19.6	Freeway	4	C	19.6
11	I-44/I-55	EB	Marion St. on ramp	Merge	5	C	21.4	Merge	5	B	19.3	Merge	5	C	22.0	Merge	5	C	21.3	Merge	5	C	26.4	Merge	5	C	26.4
12	I-44/I-55	EB	Between Marion St. ramp and PSB EB ramp	Freeway	4	E	38.6	Freeway	4	D	29.6	Freeway	4	D	33.2	Freeway	4	D	31.0	Freeway	4	D	30.4	Freeway	4	D	30.4
13	I-44/I-55	EB	PSB EB off ramp	Diverge	4	F	65.3	Diverge	4	F	47.2	Diverge	4	E	45.8	Diverge	4	E	43.1	Diverge	4	D	32.5	Diverge	4	D	32.5
14	I-44/I-55	NB	I-70 and NB Memorial Drive Diverge	Diverge	3	C	21.9	Diverge	3	C	22.3	Diverge	3	C	24.5	Diverge	3	C	24.2	Diverge	3	C	23.1	Diverge	3	C	23.1
15	I-70	NB	South of on ramp from PSB	Freeway	2	D	29.4	Freeway	2	D	29.0	Freeway	2	D	32.6	Freeway	2	D	33.4	Freeway	2	D	30.4	Freeway	2	D	30.4
16	I-70	WB	PSB on ramp	Merge	3	E	43.3	Merge	3	C	25.0	Add Lane	3	B	17.9	Merge	3	C	26.2	Add Lane	3	B	17.5	Merge	3	B	17.5
17	I-70	WB	Between PSB and Memorial Drive/Washington Ave ramp	Freeway	2	D	34.8	Freeway	2	E	37.1				Freeway	2	E	39.5									
18	I-70	WB	Memorial Drive on ramp	Add Lane	3	D	30.4	Add Lane	3	D	29.4																
19	I-70	WB	Between NB Memorial Drive and Washington Avenue off ramp																								
20	I-70	WB	Washington Avenue off ramp								Weave	3	B	17.3	Diverge	2	E	40.2	Weave	3	B	17.0					
21	I-70	WB	Between Memorial Drive/Washington Ave and MLK on ramps	Freeway	3	D	28.4	Freeway	3	D	28.0	Freeway	2	C	23.5	Freeway	2	E	38.5	Freeway	2	C	22.7	Freeway	2	C	22.7
22	I-70	WB	MLK on ramp	Merge	4	C	27.7	Merge	3	C	26.5	Add Lane	3	B	18.7	Add Lane	3	C	22.8	Add Lane	3	B	18.8	Add Lane	3	B	18.8
23	I-70	WB	Between MLK and Biddle on ramps	Freeway	3	E	40.1	Freeway	3	E	37.6																
24	I-70	WB	Reversible off ramp (left exit)					Diverge	3	D	34.7	Diverge	3	B	17.9	Diverge	3	B	19.4	Diverge	3	B	18.5	Diverge	3	B	18.5
25	I-70	WB	Between reversible off ramp and Biddle on ramp					Freeway	3	C	21.4	Freeway	3	B	11.4	Freeway	3	B	11.9	Freeway	3	B	12.0	Freeway	3	B	12.0
26	I-70	WB	Biddle on ramp	Merge	4	E	51.1	Merge	4	D	29.4	Merge	4	B	15.1	Merge	4	B	15.3	Merge	4	B	15.4	Merge	4	B	15.4
27	I-70	WB	Between Biddle on ramp and 10th St. off ramp	Freeway	3	E	44.5	Freeway	3	D	34.0	Freeway	3	C	20.0	Freeway	3	C	20.4	Freeway	3	C	20.6	Freeway	3	C	20.6
28	I-70	WB	10th St. off ramp	Diverge	3	E	48.6	Drop Lane	3	E	42.7	Drop Lane	3	C	22.0	Drop Lane	3	C	22.5	Drop Lane	3	C	23.0	Drop Lane	3	C	23.0
29	I-70	WB	Between 10th St. off and MRB on ramps					Freeway	2	F	54.4	Freeway	2	D	26.6	Freeway	2	D	26.6	Freeway	2	D	27.9	Freeway	2	D	27.9
30	I-70	WB	MRB on Ramp					Merge	4	D	31.3	Merge	4	B	18.7	Merge	4	B	18.7	Merge	4	B	19.4	Merge	4	B	19.4
31	I-70	WB	Between MRB on Ramp and 10th on ramp					Freeway	3	E	42.3	Freeway	3	C	24.3	Freeway	3	C	24.2	Freeway	3	C	25.2	Freeway	3	C	25.2
32	I-70	WB	Between 10th St. ramps	Freeway	3	F	47.1																				
33	I-70	WB	10th St. on ramp	Add Lane	4	E	35.3	Add Lane	4	D	33.1	Weave	4	C	21.4	Weave	4	C	21.3	Weave	4	C	22.1	Weave	4	C	22.1
34	I-70	EB	West of 11th St. on ramp	Freeway	3	C	20.5	Freeway	3	D	30.6	Freeway	3	D	31.8	Freeway	3	D	31.8	Freeway	3	D	31.9	Freeway	3	D	31.9
35	I-70	EB	11th St. on ramp	Merge	4	C	22.1	Add Lane	4	C	23.4	Add Lane	4	C	24.4	Add Lane	4	C	24.4	Add Lane	4	C	24.4	Add Lane	4	C	24.4
36	I-70	EB	Between 11th St. on ramp and MRB off ramp					Weave	4	C	26.1	Weave	4	C	24.5	Weave	4	C	24.5	Weave	4	C	24.5	Weave	4	C	24.5
37	I-70	EB	MRB off Ramp					Diverge	4	D	30.3	Diverge	4	C	22.5	Diverge	4	C	22.5	Diverge	4	C	22.5	Diverge	4	C	22.5
38	I-70	EB	Between 11th St. on ramp and 10th St. off ramp	Freeway	3	C	24.2																				
39	I-70	EB	10th St. off ramp	Diverge	4	C	22.1																				
40	I-70	EB	Between MRB off ramp and Broadway off ramp					Freeway	3	C	20.9	Freeway	3	B	16.8	Freeway	3	B	16.8	Freeway	3	B	16.7	Freeway	3	B	16.7
41	I-70	EB	Between 10th St. and Broadway off ramps	Diverge	3	C	23.8																				
42	I-70	EB	Broadway off ramp					Diverge	3	C	20.9	Diverge	3	B	16.6	Diverge	3	B	16.6	Diverge	3	B	16.6	Diverge	3	B	16.6
43	I-70	EB	Between Broadway off and reversibles	Freeway	2	E	35.8	Freeway	2	C	23.5	Freeway	2	C	21.8	Freeway	2	C	21.8	Freeway	2	C	21.9	Freeway	2	C	21.9
44	I-70	EB	East of reversibles - includes MLK diverge	Freeway	3	B	17.6																				
45	I-70	EB	East of reversibles - includes MLK diverge					Weave	3	B	16.7	Weave	3	B	15.7	Weave	3	B	15.7	Weave	3	B	15.7	Weave	3	B	15.7
46	I-70	EB	East of MLK off ramp					Freeway	3	B	14.0	Freeway	3	B	13.1	Freeway	3	B	13.1	Freeway	3	B	10.8	Freeway	3	B	10.8
47	I-70	EB	West of SB Memorial on ramp to lane drop									Merge	3	B	14.1	Merge	3	B	14.1	Merge	3	B	11.1	Merge	3	B	11.1
48	I-70	EB	West of SB Memorial on ramp past lane drop									Freeway	2	C	19.9	Freeway	2	C	19.8	Freeway	2	B	16.0	Freeway	2	B	16.0
49	I-70	EB	SB Memorial off ramp	Diverge	3	B	17.6	Diverge	3	B	15.2																
50	I-70	EB	SB Memorial on ramp									Merge	3	B	17.5	Add Lane	3	B	16.3	Merge	3	B	14.5	Merge	3	B	14.5
51	I-70	EB	Depressed Section	Freeway	2	D	32.2	Freeway	2	C	20.3	Freeway	2	C	25.5	Weave	3	B	16.4	Freeway	2	C	21.1	Freeway	2	C	21.1
52	I-70	EB	PSB off ramp	Diverge	3	C	23.4	Diverge	2	B	17.5																
53	I-70	SB	TO I-55 and I-44 SB	Freeway	2	B	15.6	Freeway	2	B	16.2	Freeway	2	C	20.9	Freeway	2	C	20.8	Freeway	2	C	20.6	Freeway	2	C	20.6
54	I-55	SB	Memorial Drive SB on ramp	Add Lane	3	C	20.0	Add Lane	3	C	20.4	Add Lane	3	D	19.9	Add Lane	3	D	20.0	Merge	3	D	28.1	Merge	3	D	28.1
55	I-55	SB	PSB on ramp	Add Lane	4	C	24.5	Add Lane	4	C	25.3	Add Lane	4	C	24.0	Add Lane	4	C	24.2	Add Lane							

Table 7.4: VISSIM Analysis Results (Freeway Segments), PM Peak Hour, Year 2035 Scenarios

Line	FREEWAY SEGMENT			SCENARIO 7 - 2035 NO BUILD				SCENARIO 10A - 2035 CAR 2015 BUILD ONLY				SCENARIO 10B - 2035 CAR 2015 BUILD ONLY				SCENARIO 9A - 2035 CAR 2015 & PSB BUILD w/RAMP			
				PM PEAK HOUR				PM PEAK HOUR				PM PEAK HOUR				PM PEAK HOUR			
	Route	Direction	Location	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane	Type	Lanes	LOS	Density/Lane
1	I-55	NB	South of I-44 WB	Freeway	4	B	13.5	Freeway	4	B	14.2	Freeway	4	B	14.2	Freeway	4	B	14.6
2	I-55	NB	South of I-44 WB	Diverge	4	B	13.9	Diverge	4	B	15.5	Diverge	4	B	15.5	Diverge	4	B	17.4
3	I-55	NB	to I-44 WB and Truman Pkwy	Diverge	3	B	11.5	Diverge	3	B	18.5	Diverge	3	B	18.2	Diverge	3	C	24.6
4	I-44	WB	Ramp from I-55 NB to I-44	Freeway	1	E	37.9	Freeway	1	D	36.8	Freeway	1	D	36.8	Freeway	1	E	38.8
5	Truman	NB	At I-44	Freeway	2	A	3.0	Freeway	2	A	3.0	Freeway	2	A	3.0	Freeway	2	A	3.0
6	I-55	NB	South of I-44 EB Merge	Freeway	2	B	11.9	Freeway	2	B	12.1	Freeway	2	B	12.1	Freeway	2	B	12.1
7	I-44	EB	west of Gravois on ramp	Freeway	2	B	16.3	Freeway	2	B	16.3	Freeway	2	B	16.3	Freeway	2	B	16.3
8	I-44	EB	Gravois on ramp	Merge	3	B	16.4	Merge	3	B	16.5	Merge	3	B	16.8	Merge	3	B	16.8
9	I-44/55	EB	Merge to 7th St. off ramp	Weave	5	B	16.2	Weave	5	B	16.5	Weave	5	B	16.7	Weave	5	B	16.7
10	I-44/55	EB	Between 7th St. and Marion St. ramps	Freeway	4	C	19.4	Freeway	4	C	20.7	Freeway	4	C	21.1	Freeway	4	C	20.9
11	I-44/55	EB	Marion St. on ramp	Merge	5	C	20.5	Merge	5	C	24.8	Merge	5	C	25.8	Merge	5	D	29.9
12	I-44/55	EB	Between Marion St. ramp and PSB EB ramp	Freeway	4	D	34.3	Freeway	4	E	38.6	Freeway	4	E	39.8	Freeway	4	D	32.3
13	I-44/55	EB	PSB EB off ramp	Diverge	4	F	54.1	Diverge	4	E	53.7	Diverge	4	E	54.8	Diverge	4	D	34.6
14	I-44/55	NB	I-70 and NB Memorial Drive Diverge	Diverge	3	C	24.1	Diverge	3	C	26.0	Diverge	3	C	26.1	Diverge	3	C	24.9
15	I-70	NB	South of on ramp from PSB	Freeway	2	D	31.7	Freeway	2	D	34.4	Freeway	2	E	37.0	Freeway	2	D	33.0
16	I-70	WB	PSB on ramp	Merge	3	D	29.0	Add Lane	3	B	18.6	Merge	3	D	28.8	Add Lane	3	B	18.4
17	I-70	WB	Between PSB and Memorial Drive/Washington Ave ramp	Freeway	2	E	39.4					Freeway	2	E	44.1				
18	I-70	WB	Memorial Drive on ramp	Add Lane	3	D	30.8												
19	I-70	WB	Between NB Memorial Drive and Washington Avenue off ramp																
20	I-70	WB	Washington Avenue off ramp					Weave	3	C	18.2	Diverge	2	F	45.3	Weave	3	B	17.8
21	I-70	WB	Between Memorial Drive/Washington Ave and MLK on ramps	Freeway	3	D	29.4	Freeway	2	C	24.6	Freeway	2	E	41.8	Freeway	2	C	23.8
22	I-70	WB	MLK on ramp	Merge	4	C	27.4	Add Lane	3	B	19.5	Add Lane	3	C	23.8	Add Lane	3	B	19.6
23	I-70	WB	Between MLK and Biddle on ramps	Freeway	3	E	39.5												
24	I-70	WB	Reversible off ramp (left exit)	Diverge	3	E	37.1	Diverge	3	B	18.7	Diverge	3	C	20.6	Diverge	3	B	19.5
25	I-70	WB	Between reversible off ramp and Biddle on ramp	Freeway	3	C	23.1	Freeway	3	B	11.9	Freeway	3	B	12.5	Freeway	3	B	12.6
26	I-70	WB	Biddle on ramp	Merge	4	D	31.9	Merge	4	B	15.5	Merge	4	B	15.9	Merge	4	B	16.1
27	I-70	WB	Between Biddle on ramp and 10th St. off ramp	Freeway	3	E	35.7	Freeway	3	C	20.8	Freeway	3	C	21.7	Freeway	3	C	21.7
28	I-70	WB	10th St. off ramp	Drop Lane	3	F	45.9	Drop Lane	3	C	23.3	Drop Lane	3	C	24.7	Drop Lane	3	C	24.4
29	I-70	WB	Between 10th St. off and MRB on ramps	Freeway	2	F	57.2	Freeway	2	D	27.7	Freeway	2	D	27.8	Freeway	2	D	29.0
30	I-70	WB	MRB on Ramp	Merge	4	D	32.9	Merge	4	B	19.6	Merge	4	B	19.6	Merge	4	C	20.2
31	I-70	WB	Between MRB on Ramp and 10th on ramp	Freeway	3	E	44.8	Freeway	3	C	25.3	Freeway	3	C	25.3	Freeway	3	D	26.3
32	I-70	WB	Between 10th St. ramps																
33	I-70	WB	10th St. on ramp	Weave	4	D	34.9	Weave	4	C	22.3	Weave	4	C	22.3	Weave	4	C	23.0
34	I-70	EB	West of 11th St. on ramp	Freeway	3	D	30.6	Freeway	3	D	34.3	Freeway	3	D	34.3	Freeway	3	D	34.7
35	I-70	EB	11th St. on ramp	Add Lane	4	C	23.3	Add Lane	4	C	25.7	Add Lane	4	C	25.7	Add Lane	4	C	25.8
36	I-70	EB	Between 11th St. on ramp and MRB off ramp	Weave	4	C	26.2	Weave	4	C	25.9	Weave	4	C	25.9	Weave	4	C	25.8
37	I-70	EB	MRB off Ramp	Diverge	4	D	30.3	Diverge	4	C	23.8	Diverge	4	C	23.8	Diverge	4	C	23.8
38	I-70	EB	Between 11th St. on ramp and 10th St. off ramp																
39	I-70	EB	10th St. off ramp																
40	I-70	EB	Between MRB off ramp and Broadway off ramp	Freeway	3	C	21.0	Freeway	3	B	17.6	Freeway	3	B	17.6	Freeway	3	B	17.5
41	I-70	EB	Between 10th St. and Broadway off ramps																
42	I-70	EB	Broadway off ramp	Diverge	3	C	20.6	Diverge	3	B	17.3	Diverge	3	B	17.3	Diverge	3	B	17.3
43	I-70	EB	Between Broadway off and reversibles	Freeway	2	C	23.7	Freeway	2	C	22.7	Freeway	2	C	22.7	Freeway	2	C	22.9
44	I-70	EB	East of reversibles - Includes MLK diverge																
45	I-70	EB	East of reversibles - Includes MLK diverge	Weave	3	B	17.1	Weave	3	B	16.3	Weave	3	B	16.3	Weave	3	B	16.4
46	I-70	EB	East of MLK off ramp	Freeway	3	B	14.2	Freeway	3	B	13.6	Freeway	3	B	13.6	Freeway	3	B	11.2
47	I-70	EB	West of SB Memorial on ramp to lane drop					Merge	3	B	14.8	Merge	3	B	14.8	Merge	3	B	11.6
48	I-70	EB	West of SB Memorial on ramp past lane drop					Freeway	2	C	20.8	Freeway	2	C	20.7	Freeway	2	B	16.6
49	I-70	EB	SB Memorial off ramp	Diverge	3	B	15.6												
50	I-70	EB	SB Memorial on ramp					Merge	3	B	18.4	Add Lane	3	B	17.0	Merge	3	B	15.0
51	I-70	EB	Depressed Section	Freeway	2	C	20.4	Freeway	2	D	26.8	Weave	3	B	17.1	Freeway	2	C	21.9
52	I-70	EB	PSB off ramp	Diverge	2	B	17.6												
53	I-70	SB	I-55 and I-44 SB	Freeway	2	B	16.4	Freeway	2	D	26.8	Freeway	2	C	21.7	Freeway	2	C	22.2
54	I-55	SB	Memorial Drive SB on ramp	Add Lane	3	C	20.8	Add Lane	3	D	20.7	Add Lane	3	D	20.8	Merge	3	D	33.9
55	I-55	SB	PSB on ramp	Add Lane	4	D	26.3	Add Lane	4	C	25.2	Add Lane	4	C	25.4	Add Lanes	4	D	28.1
56	I-55	SB	7th St. off ramp	Diverge	4	D	28.3	Diverge	4	D	29.3	Diverge	4	D	29.1	Diverge	4	D	28.8
57	I-55	SB	Between 7th St. ramps	Freeway	4	C	21.1	Freeway	4	C	20.4	Freeway	4	C	20.4	Freeway	4	C	21.4
58	I-55	SB	7th St. on ramp to 44 and 55 Diverge	Weave	5	C	22.5	Weave	5	C	23.5	Weave	5	C	23.6	Weave	5	C	24.6
59	I-55	SB	South of Diverge	Freeway	2	D	26.1	Freeway	2	D	26.8	Freeway	2	D	27.1	Freeway	2	D	28.1
60	I-44	WB	Gravois off Ramp	Diverge	3	B	18.1	Diverge	3	B	18.4	Diverge	3	B	18.4	Diverge	3	B	19.0
61	I-44	WB	Between Gravois off and I-55 NB on ramps	Freeway	2	C	24.8	Freeway	2	C	25.1	Freeway	2	C	25.1	Freeway	2	D	26.1
62	I-44	WB	I-55 NB on ramp	Add Lane	3	D	26.4	Add Lane	3	D	26.4	Add Lane	3	D	26.4	Add Lane	3	D	27.1
63	I-44	WB	Truman Pkwy on ramp to Jefferson off Ramp	Weave	5	C	20.1	Weave	5	C	20.1	Weave	5	C	20.0	Weave	5	C	20.4
64	I-44	WB	Between Jefferson Ramps	Freeway	4	C	23.0	Freeway	4	C	22.4	Freeway	4	C	22.3	Freeway	4	C	22.8
65	PSB	WB	Between Merge and I-55 off ramp	Weave	4	C	26.3	Weave	4	C	24.5	Weave	4	C	24.5	Weave	4	C	21.0
66	I-64	WB	West of off ramps	Freeway	2	C	24.7	Freeway	2	C	23.2	Freeway	2	C	23.2	Freeway	2	C	23.2
67	I-64	WB	Stadium off ramp	Diverge	3	B	14.4	Diverge	3	B	14.4	Diverge	3	B	14.4	Diverge	3	B	14.4
68	I-64	WB	Between Stadium and Broadway Ramps	Freeway	2	C	21.2	Freeway	2	C	21.3	Freeway	2	C	21.3	Freeway	2	C	21.3
69	I-64	WB	Broadway on Ramp	Add Lane	3	C	22.9	Add Lane	3	C	22.3	Add Lane	3	C	22.3	Add Lane	3	C	22.3
70	I-64	EB	2 to 5 miles from Broadway off ramp	Freeway	3	D	27.6	Freeway	3	F	51.6	Freeway	3	F	52.6	Freeway	3	D	32.8
71	I-64	EB	Broadway off Ramp	Diverge	3	F	106.9	Diverge	3	F	116.6	Diverge	3	F	116.8	Diverge	3	F	99.5
72	I-64	EB	Between Broadway and Gratiot ramps	Freeway	2	F	90.8	Freeway	2	F	95.8	Freeway	2	F	96.1	Freeway	2	F	90.7
73	I-64	EB	Gratiot on Ramp	Merge	3	F	69.0	Merge	3	F	83.2	Merge	3	F	83.1	Merge	3	F	68.1
74	I-64	EB	Between Gratiot and PSB	Freeway	2	E	43.5	Freeway	2	F	71.3	Freeway	2	F	71.7	Freeway	2	F	61.9
75	PSB	EB	Between I-70 and I-55 on ramps and Diverge	Weave	4	D	32.2	Weave	4	F	43.1	Weave	4	F	43.1	Weave	4	A	3.3
76	Eads	WB	Bridge	Freeway	2	A	4.5	Freeway	2	A	5.3	Freeway	2	A	5.3	Freeway	2	A	5.3
77	Eads	EB	Bridge	Freeway	2	A	7.6	Freeway	1	C	25.6	Freeway	1	C	25.6	Freeway	1	C	26.0
78	MLK	WB	Bridge	Freeway	1	A	5.8	Freeway	1	A	6.3	Freeway	1	A	6.3	Freeway	1	A	6.3
79	MLK	EB	Bridge	Freeway	2	C	25.2	Freeway	2	C	24.3	Freeway	2	C	24.3	Freeway	2	D	29.8
80	MRB	WB	Bridge	Freeway	2	B	14.9	Freeway	2	B	15.0	Freeway	2	B	15.0	Freeway	2	B	15.0
81	MRB	WB	At ramps to I-70 and Tucker	Diverge	3	A	7.8	Diverge	3	B	11.0	Diverge	3	B	11.0	Diverge	3	B	11.0
82	MRB	EB	East of ramps from I-70 and Tucker	Merge	3	C	25.8	Merge	3	B	14.4	Merge	3	B	14.4	Merge	3	B	14.4
83	MRB	EB	Bridge	Freeway	2	D	28.4	Freeway	2	C	18.2	Freeway	2	C	18.1	Freeway	2	C	18.1

Table 7.5: SYNCHRO Analysis Results (Arterial Intersections), AM Peak Hour

Intersection	AM PEAK HOUR LOS (DELAY in sec.)						
	Existing	2015			2035		
	Scenario 1	Scenario 2	Scenario 3	Scenario 6A	Scenario 7	Scenario 10	Scenario 9A
Memorial Drive NB/Walnut St	B (16.1)	B (16.3)	A (8.2)	A (8.2)	B (18.3)	A (8.6)	A (8.6)
Memorial Drive NB/Market St	A (1.2)	A (1.5)			A (1.7)		
Memorial Drive NB/Chestnut St	B (16.9)	B (17.4)			B (16.3)		
Memorial Drive NB/Pine St	A (0.3)	A (0.6)			A (0.6)		
Memorial Drive NB/Washington Ave	B (10.3)	A (7.6)			A (7.7)		
Memorial Drive NB/Eads Bridge	E (43.8)	C (15.3)	D (40.5)	D (40.5)	C (16.7)	D (42.4)	D (42.4)
Memorial Drive SB/Spruce St	A (0.6)	A (1.5)	A (1.4)		A (1.5)	A (1.5)	
Memorial Drive SB/Walnut Ave	B (12.7)	B (14.1)	A (2.0)	A (2.1)	B (14.3)	A (2.2)	A (2.3)
Memorial Drive SB/Market St	F (143.5)	B (19.7)			C (21.1)		
Memorial Drive SB/Chestnut St	A (8.5)	A (8.4)			A (8.3)		
Memorial Drive SB/Pine St	C (20.2)	C (21.9)	A (0.2)	A (0.2)	C (22.0)	A (0.2)	A (0.2)
Memorial Drive SB/Washington Ave	A (8.5)	A (6.9)	A (9.1)	A (9.1)	A (6.9)	A (9.4)	A (9.3)
3 <sup>rd</sup> St/Convention Center	F (130.8)	A (5.9)	A (9.5)	A (8.2)	A (6.2)	A (9.7)	A (8.5)
3 <sup>rd</sup> St/Cole St	A (9.9)	B (13.6)	D (53.7)	D (53.7)	B (10.6)	D (53.4)	D (53.4)
3 <sup>rd</sup> St/Biddle St	B (11.2)	B (10.7)	B (13.0)	B (13.0)	B (10.7)	B (13.1)	B (13.1)
3 <sup>rd</sup> St/Cass Ave			A (6.5)	A (6.5)		A (6.6)	A (6.6)
4 <sup>th</sup> St/Spruce St	B (10.5)	B (10.6)	B (10.9)	B (10.9)	B (10.7)	B (11.0)	B (11.0)
4 <sup>th</sup> St/Walnut St	A (4.7)	A (4.8)	C (24.7)	C (24.4)	A (4.8)	C (27.6)	C (33.3)
4 <sup>th</sup> St/Market St	C (30.2)	D (37.8)	C (19.7)	C (21.4)	C (27.9)	C (21.7)	C (24.6)
4 <sup>th</sup> St/Chestnut St	A (7.0)	A (7.8)	A (10.7)	A (8.4)	A (7.8)	B (11.1)	A (8.7)
4 <sup>th</sup> St/Pine St	B (18.6)	C (26.9)	B (17.8)	B (17.8)	D (37.1)	B (18.6)	B (18.5)
4 <sup>th</sup> St/Olive St	A (5.3)	A (5.0)	A (1.5)	A (1.5)	A (5.5)	A (1.5)	A (1.5)
4 <sup>th</sup> St/Washington Ave	B (19.8)	B (18.7)	B (17.2)	B (17.2)	B (17.5)	B (19.4)	B (17.4)
4 <sup>th</sup> St/Convention Center	B (14.4)	B (17.1)	B (20.0)	B (15.1)	B (19.6)	B (17.3)	B (14.8)
4 <sup>th</sup> St/Cole St	E (75.5)	E (70.7)	D (42.9)	D (42.9)	E (73.1)	D (44.7)	D (44.7)
Broadway Ave/Spruce St	A (3.0)	A (3.0)	A (1.4)	A (1.4)	A (3.0)	A (1.4)	A (1.4)
Broadway Ave/Clark St	A (4.2)	A (4.2)	A (4.3)	A (3.6)	A (4.3)	A (4.4)	A (3.6)
Broadway Ave/Walnut St	B (15.2)	B (15.5)	C (21.7)	B (17.8)	C (22.4)	B (15.4)	B (18.6)
Broadway Ave/Market St	B (15.4)	B (19.5)	B (17.8)	B (17.0)	B (18.0)	C (22.0)	B (17.5)
Broadway Ave/Chestnut St	A (3.5)	A (3.7)	A (6.8)	A (2.7)	A (6.9)	A (3.0)	A (2.7)
Broadway Ave/Pine St	B (11.5)	C (28.9)	B (19.6)	B (19.6)	B (19.9)	C (31.4)	B (19.9)
Broadway Ave/Olive St	A (5.6)	A (6.2)	A (4.3)	A (4.1)	A (4.5)	A (5.9)	A (4.2)
Broadway Ave/Locust St	A (1.1)	A (1.3)	A (2.0)	A (1.6)	A (2.0)	A (1.4)	A (1.6)
Broadway Ave/St Charles St	A (7.3)	A (7.5)	A (5.3)	A (6.2)	A (5.5)	A (8.4)	A (6.3)
Broadway Ave/Washington Ave	B (16.1)	B (17.6)	C (20.6)	B (12.6)	C (21.3)	B (18.4)	B (13.0)
Broadway Ave/Convention Center	C (21.7)	B (19.0)	B (16.9)	B (16.9)	B (19.1)	B (17.2)	B (17.2)
Broadway Ave/Cole St	C (25.9)	E (77.8)	C (32.4)	C (32.4)	F (91.8)	C (33.8)	C (33.8)
Broadway Ave/Biddle St	A (4.3)	A (5.0)	A (4.5)	A (4.5)	A (5.2)	A (4.6)	A (4.6)

Table 7.6: SYNCHRO Analysis Results (Arterial Intersections), PM Peak Hour

Intersection	PM PEAK HOUR LOS (DELAY in sec.)						
	Existing	2015			2035		
	Scenario 1	Scenario 2	Scenario 3	Scenario 6A	Scenario 7	Scenario 10	Scenario 9A
Memorial Drive NB/Walnut St	A (9.2)	B (10.0)	A (6.6)	A (6.6)	B (10.2)	A (6.6)	A (6.6)
Memorial Drive NB/Market St	A (0.2)	A (0.6)			A (0.6)		
Memorial Drive NB/Chestnut St	B (15.0)	B (14.7)			C (24.4)		
Memorial Drive NB/Pine St	A (0.3)	A (0.4)			A (0.4)		
Memorial Drive NB/Washington Ave	A (8.9)	A (8.0)			A (8.1)		
Memorial Drive NB/Eads Bridge	B (13.9)	B (10.1)	B (17.1)	B (17.1)	B (10.5)	B (17.7)	B (17.7)
Memorial Drive SB/Spruce St	F (133.7)	F (89.6)	B (12.1)		F (106.2)	B (15.1)	
Memorial Drive SB/Walnut Ave	D (35.1)	C (30.2)	A (5.8)	A (5.8)	C (34.5)	A (6.0)	A (5.9)
Memorial Drive SB/Market St	C (24.0)	C (30.9)			C (32.7)		
Memorial Drive SB/Chestnut St	A (9.3)	B (11.1)			B (11.7)		
Memorial Drive SB/Pine St	B (17.8)	B (17.6)	A (0.0)	A (0.0)	B (18.3)	A (0.0)	A (0.0)
Memorial Drive SB/Washington Ave	B (11.1)	A (7.8)	B (17.7)	B (17.7)	A (7.9)	B (18.2)	B (18.2)
3 <sup>rd</sup> St/Convention Center	D (39.4)	C (20.8)	D (51.9)	D (51.9)	C (21.7)	E (58.3)	E (58.3)
3 <sup>rd</sup> St/Cole St	C (28.1)	C (31.2)	C (32.1)	C (32.1)	C (29.9)	C (32.1)	C (32.1)
3 <sup>rd</sup> St/Biddle St	C (25.5)	C (27.4)	A (8.5)	A (8.5)	C (27.7)	A (9.1)	A (9.1)
3 <sup>rd</sup> St/Cass Ave			A (9.0)	A (9.0)		A (9.4)	A (9.4)
4 <sup>th</sup> St/Spruce St	B (15.5)	B (15.8)	D (46.0)	C (29.1)	B (16.2)	D (51.6)	C (29.7)
4 <sup>th</sup> St/Walnut St	C (28.9)	C (27.4)	C (30.9)	C (29.7)	C (27.9)	C (31.7)	C (30.1)
4 <sup>th</sup> St/Market St	C (23.8)	C (33.9)	C (33.0)	C (32.2)	D (40.3)	C (33.4)	C (32.8)
4 <sup>th</sup> St/Chestnut St	B (18.7)	B (18.2)	B (19.0)	B (19.1)	B (18.5)	B (19.4)	B (19.5)
4 <sup>th</sup> St/Pine St	A (7.1)	A (7.7)	B (10.1)	B (10.1)	A (7.7)	B (10.1)	B (10.2)
4 <sup>th</sup> St/Olive St	A (2.4)	A (2.8)	C (27.9)	C (28.0)	A (3.1)	C (29.0)	C (29.1)
4 <sup>th</sup> St/Washington Ave	B (18.6)	B (19.9)	C (28.9)	C (28.9)	C (20.5)	C (30.1)	C (30.1)
4 <sup>th</sup> St/Convention Center	F (181.5)	C (20.6)	F (83.8)	F (83.8)	C (21.1)	F (94.0)	F (94.0)
4 <sup>th</sup> St/Cole St	D (48.6)	D (41.1)	D (53.4)	D (53.4)	D (44.7)	E (59.7)	E (59.7)
Broadway Ave/Spruce St	A (3.0)	A (3.3)	A (1.1)	A (1.1)	A (3.3)	A (1.1)	A (1.1)
Broadway Ave/Clark St	A (4.0)	A (4.0)	A (5.7)	A (5.5)	A (4.0)	A (5.8)	A (5.6)
Broadway Ave/Walnut St	B (11.3)	B (11.3)	D (39.7)	B (19.9)	B (11.7)	D (46.4)	C (20.5)
Broadway Ave/Market St	B (18.3)	B (19.0)	B (19.6)	B (19.3)	B (19.2)	C (20.3)	C (20.4)
Broadway Ave/Chestnut St	B (15.2)	B (13.4)	B (13.1)	B (14.3)	B (13.7)	B (13.6)	B (15.3)
Broadway Ave/Pine St	A (8.1)	A (8.3)	B (15.8)	B (15.7)	A (8.7)	B (16.1)	B (16.0)
Broadway Ave/Olive St	A (6.9)	A (7.0)	A (8.2)	A (6.8)	A (7.1)	A (8.7)	A (7.0)
Broadway Ave/Locust St	A (3.7)	A (4.0)	A (5.2)	A (5.2)	A (4.0)	A (5.2)	A (5.2)
Broadway Ave/St Charles St	A (3.1)	A (3.2)	A (2.4)	A (2.4)	A (3.2)	A (2.5)	A (2.5)
Broadway Ave/Washington Ave	B (12.9)	B (13.0)	B (19.7)	C (21.6)	B (13.2)	C (20.1)	C (22.6)
Broadway Ave/Convention Center	B (14.9)	B (15.6)	B (14.2)	B (14.2)	B (15.9)	B (14.3)	B (14.3)
Broadway Ave/Cole St	C (22.2)	C (20.9)	C (28.0)	C (28.0)	C (21.2)	C (28.4)	C (28.4)
Broadway Ave/Biddle St	C (21.6)	B (19.6)	A (6.7)	A (6.7)	B (19.6)	A (6.4)	A (6.4)

### 7.1 Existing 2010 Analysis (Scenario 1)

The investigation began with a review of the existing conditions. Table 7.7 and Table 7.8 exhibit the LOS determined by analysis. Generally, LOS A through D are considered acceptable LOS for peak periods in an urban environment. The existing analysis identified several areas with a LOS outside of this range. These locations are listed in Table 7.7 with a brief evaluation the probable cause for the LOS.

Table 7.7: Freeway Locations with LOS E or F, 2010 Existing (Scenario 1)

Peak Period	LOS	Location	Probable Cause
AM	E	diverge from I-55 NB to I-44 WB	ramp capacity constraints and geometry
AM	E	diverge to NB Memorial Drive from I-55 NB	horizontal and vertical geometry of the ramp and the downstream low-speed merge of the ramp from westbound PSB
AM	F	I-70 WB between the diverge to NB Memorial Drive and the merge from the PSB	upstream diverge and downstream merge are both LOS E; capacity constraints of the depressed section of I-70
AM PM	E	merge from PSB to I-70 WB	PSB ramp geometry (taper ramp) and low speed of merging traffic
AM	E	merge from MLK to I-70 WB	high volume of merging traffic
AM	E	diverge to 10 <sup>th</sup> Street off-ramp from I-70 WB	weaving movement
AM	E	weave between PSB merge and I-55/I-70 diverge	capacity issues and weaving movement
AM	F	WB MLK Bridge	WB lane is over capacity
PM	E	I-55 NB between Marion Street on-ramp and PSB off-ramp	one-lane PSB ramp is over capacity
PM	F	I-55 NB ramp to PSB	one-lane PSB ramp is over capacity
PM	E	I-70 WB between MLK and Biddle on-ramps	I-70 capacity constraints; I-70 is three-lane section
PM	E	merge from Biddle on-ramp to I-70 WB	I-70 capacity constraints; I-70 is three-lane section

Peak Period	LOS	Location	Probable Cause
PM	E	I-70 between Biddle on-ramp and 10 <sup>th</sup> Street off-ramp	I-70 capacity constraints; I-70 is three-lane section
PM	E	diverge to 10 <sup>th</sup> Street off-ramp from I-70 WB	I-70 capacity constraints; I-70 is three-lane section
PM	E	weave at I-70 WB on-ramp from 10 <sup>th</sup> Street	I-70 capacity constraints; I-70 is three-lane section
PM	E	I-70 EB between Broadway off-ramp and reversible add lane	I-70 geometry and capacity constraints; I-70 is two-lane section
PM	E	MLK Bridge EB	EB lanes are approaching capacity
PM	F	I-70 WB between 10 <sup>th</sup> Street ramps	I-70 capacity constraints; I-70 is three-lane section
PM	F	I-64 EB throughout model	capacity and weaving issues on the PSB

### 7.2 No Build 2015 and 2035 Analysis (Scenarios 2 and 7)

In order to provide an appropriate base line for comparison, the No Build Scenario tested the level of operations that could be expected during the forecast years without the proposed projects. The network includes all future changes to the network programmed for completion by 2015 and 2035. In this case, those changes are primarily the New Mississippi River Bridge and its related roadway improvements. Overall, the forecasted LOS for Scenario 2 is generally better than today’s operations, with fewer areas rated at a LOS E or F, as listed in Table 7.8.

Table 7.8: Freeway Locations with LOS E or F, 2015 No Build (Scenario 2)

Peak Period	LOS	Location	Probable Cause
AM	E	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
AM	E	I-44 NB between 10 <sup>th</sup> Street off-ramp and NMRB on-ramp	capacity constraints, I-44 will be a two lane section here to accommodate two full lanes from NMRB
AM	E	PSB WB weave section between IL 3 merge and I-55/I-44 off-ramps	PSB capacity constraints and weaving movements

Peak Period	LOS	Location	Probable Cause
PM	F	I-55 NB ramp to PSB	ramp is over capacity
PM	E	I-44 NB between PSB on-ramp and Memorial Drive	I-44 depressed section capacity constraints
PM	E	I-44 NB between MLK on-ramp and diverge to reversible lanes	weaving and capacity constraints; reversible lane is a left-side exit; I-44 is a three-lane section here
PM	E	diverge/drop lane to 10 <sup>th</sup> Street off-ramp from I-44 NB	downstream capacity constraints on I-44
PM	F	I-44 NB between 10 <sup>th</sup> Street off-ramp and NMRB on-ramp	I-44 capacity constraints; I-44 is two-lane section
PM	E	I-70 WB between NMRB on-ramp and 10 <sup>th</sup> Street on-ramp	I-70 capacity constraints
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from Gratiot on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	E	I-64 EB between Gratiot on-ramp and I-55 NB on-ramp	I-64 capacity constraints; I-64 is two-lane section

The Scenario 7 results indicate that traffic growth by 2035 would lead to decreased levels of service from 2015. However, the overall network operations appear to be comparable to the present day. The areas expected to operate at a LOS E or F in the Scenario 7 are presented in Table 7.9.

Table 7.9: Freeway Locations with LOS E or F, 2035 No Build (Scenario 7)

Peak Period	LOS	Location	Probable Cause
AM	F	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
AM	E	I-44 EB west of Gravois on-ramp	I-44 capacity constraints; I-44 is two-lane section

Peak Period	LOS	Location	Probable Cause
AM	E	diverge from I-55 NB to PSB ramp	ramp over capacity
AM	E	diverge from I-44 NB to NB Memorial Drive ramp	Downstream capacity constraints of I-44 depressed section and PSB entrance
AM	E	I-44 NB between 10 <sup>th</sup> Street off-ramp and NMRB on-ramp	capacity constraints, I-44 will be a two lane section here to accommodate two full lanes from NMRB
AM	E	I-70 WB between NMRB on-ramp and 10 <sup>th</sup> Street on-ramp	I-70 capacity constraints
AM	F	PSB WB weave section between IL 3 merge and I-55/I-44 off-ramps	PSB capacity constraints and weaving movements
PM	E	ramp from I-55 NB to I-44 WB	ramp is approaching capacity
PM	F	I-55 NB ramp to PSB	ramp is over capacity
PM	E	I-44 NB between PSB on-ramp and Memorial Drive	I-44 capacity constraints; two-lane section
PM	E	I-44 NB between MLK on-ramp and diverge to reversible lanes	weaving and capacity constraints; reversible lane is a left-side exit; I-44 is a three-lane section here
PM	E	diverge to the reversible lanes (left exit) from I-44 NB	weaving issues
PM	E	I-44 NB between Biddle Street on-ramp and 10 <sup>th</sup> Street off-ramp	downstream capacity constraints; I-44 will drop a lane at 10 <sup>th</sup> Street to become a two-lane section
PM	F	diverge/drop lane to 10 <sup>th</sup> Street off-ramp from I-44 NB	downstream capacity constraints on I-44
PM	F	I-44 NB between 10 <sup>th</sup> Street off-ramp and NMRB on-ramp	I-44 capacity constraints; I-44 is two-lane section
PM	E	I-70 WB between NMRB on-ramp and 10 <sup>th</sup> Street on-ramp	I-70 capacity constraints

Peak Period	LOS	Location	Probable Cause
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from Gratiot on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	E	I-64 EB between Gratiot on-ramp and I-55 NB on-ramp	I-64 capacity constraints; I-64 is two-lane section

### 7.3 PSB Build 2015 and 2035 Analysis (Scenarios 3 and 10)

The first build scenario incorporates only the changes to future road network proposed by the CAR 2015 project. This Scenario has three design alternatives based on the potential future design of the depressed section of I-44 only:

- 3A utilizes three lanes in the WB/NB direction and two lanes in the EB/SB direction of the depressed segment of I-44 (between the PSB ramp entrance and the Washington ramp exit)
- 3B reverses this design with three lanes in the EB/SB direction and 2 lanes in the WB/NB direction
- 3C incorporates three lanes in both the WB/NB and EB/SB directions of the depressed section of I-44. This Scenario was not modeled, rather the MOEs discussed elsewhere in this document are a combination of the results of the 3A and 3B model runs

As evidenced by Table 7.10 through Table 7.13, Table 7.10: Freeway Locations with LOS E or F, 2015 CAR 2015 Build (Scenario 3A) the network operations generally upgrade the previous Scenarios (2 and 7), adding further improvement over existing conditions (Scenario 1). Table 7.11 lists the remaining segments at LOS E or F in year 2015 Scenarios 3A and 3B, respectively. Table 7.12 and Table 7.13 list the same for year 2035 Scenarios 10A and 10B.

It should be noted that each of the areas shown also perform at the respective LOS E or F in the No Build Scenario for that forecast year: indicating there are no adverse impacts due to the CAR 2015 project, with two minor exceptions. The first is a change to LOS E in Scenarios 3B and 10B AM and PM for the depressed section of (future) I-44; the additional traffic and weaving in this segment due to the new Washington Ramp impacts the operations. However, Scenarios 3A and 10A report a better LOS, revealing that three lanes NB is a preferred alternative. The second exception is the addition of additional segments of LOS E and F for I-64 EB in Scenarios 3A, 3B, 10A, and 10B. These locations were very near the density threshold in the No Build scenario, and are just over the line in the CAR 2015 Build scenario.

Table 7.10: Freeway Locations with LOS E or F, 2015 CAR 2015 Build (Scenario 3A)

Peak Period	LOS	Location	Probable Cause
AM	E	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
PM	E	I-55 NB ramp to PSB	ramp is over capacity
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from I-55 on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	E	I-64 EB on the Poplar Street Bridge	Capacity and weaving issues on the PSB

Table 7.11: Freeway Locations with LOS E or F, 2015 CAR 2015 Build (Scenario 3B)

Peak Period	LOS	Location	Probable Cause
AM	E	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	Between PSB on-ramp and Washington Ave off-ramp	I-44 capacity constraints for two-lane depressed section
PM	E	I-55 NB ramp to PSB	ramp is over capacity
PM	E	I-44 NB between PSB on-ramp and MLK on-ramp/add lane	I-44 capacity constraints for two-lane depressed section
PM	E	I-55 NB ramp to PSB	ramp is over capacity
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from I-55 on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	E	I-64 EB on the Poplar Street Bridge	Capacity and weaving issues on the PSB

Table 7.12: Freeway Locations with LOS E or F, 2035 CAR 2015 Build (Scenario 10A)

Peak Period	LOS	Location	Probable Cause
AM	F	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
AM	E	diverge to NB Memorial Drive from I-55 NB	horizontal and vertical geometry of the ramp and the downstream low-speed merge of the ramp from westbound PSB
PM	E	I-55 NB/I-44 EB between Marion Street on-ramp and PSB off-ramp	one-lane PSB ramp is over capacity
PM	F	I-55 NB ramp to PSB	one-lane PSB ramp is over capacity
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from I-55 on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	F	I-64 EB on the Poplar Street Bridge	Capacity and weaving issues on the PSB

Table 7.13: Freeway Locations with LOS E or F, 2035 CAR 2015 Build (Scenario 10B)

Peak Period	LOS	Location	Probable Cause
AM	F	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
AM	E	I-70 WB between the diverge to NB Memorial Drive and the merge from the PSB	upstream diverge and downstream merge are both LOS E; capacity constraints of the depressed section of I-70
AM	E	Between PSB on-ramp and Washington Ave off-ramp	I-44 capacity constraints for two-lane depressed section
PM	E	I-55 NB/I-44 EB between Marion Street on-ramp and PSB off-ramp	one-lane PSB ramp is over capacity

Peak Period	LOS	Location	Probable Cause
PM	F	I-55 NB ramp to PSB	one-lane PSB ramp is over capacity
PM	E	I-44 NB south of PSB on-ramp	I-44 capacity constraints for two-lane depressed section, PSB ramp merging at slower speeds
PM	E	I-44 NB between PSB on-ramp and Washington exit	I-44 capacity constraints for two-lane depressed section
PM	F	I-44 NB at Washington exit diverge	I-44 capacity constraints for two-lane depressed section
PM	E	I-44 NB between Washington exit and MLK on-ramp	I-44 capacity constraints for two-lane section
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from I-55 on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	F	I-64 EB on the Poplar Street Bridge	Capacity and weaving issues on the PSB

### 7.4 CAR 2015 Build + PSB Preferred Build, 2015 and 2035 Analysis (Scenarios 6A and 9A)

The final full build scenario adds the proposed PSB Preferred Build project network changes to the previous (CAR 2015 Build) network. As evidenced by Table 7.14 and Table 7.15, these changes offers yet another level of improvements to the future network operations, especially evident in the PM peak period.

Table 7.14: Freeway Locations with LOS E or F, 2015 PSB Preferred Build + CAR 2015 Build (Scenario 6A)

Peak Period	LOS	Location	Probable Cause
AM	E	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	Diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from Gratiot on-ramp	over capacity

Peak Period	LOS	Location	Probable Cause
PM	F	I-64 EB between Gratiot on-ramp and I-55 NB on-ramp	I-64 capacity constraints; I-64 is two-lane section

The 2035 full-build network is projected to operate at nearly the same level of operations as the 2015 full-build network, as shown below in Table 22. Only one additional area is expected to be at an LOS outside the acceptable range for urban areas. However, the forecasted levels of service are still a significant improvement over the No Build scenarios, and a vast improvement over today’s general level of operations.

Table 7.15: Freeway Locations with LOS E or F, 2035 PSB Preferred Build + CAR 2015 Build (Scenario 9A)

Peak Period	LOS	Location	Probable Cause
AM	F	I-55 NB south of the diverge to I-44 WB	capacity constraint of the downstream ramp to I-44 WB causes congestion
AM	E	diverge to I-44 WB from I-55 NB	capacity constraints of ramp causes congestion
AM	E	diverge from I-44 NB to NB Memorial Drive ramp	Downstream capacity constraints of I-44 depressed section and PSB entrance
PM	E	ramp from I-55 NB to I-44 WB	ramp is approaching capacity
PM	F	I-64 EB from diverge to Broadway off-ramp to merge from Gratiot on-ramp	I-64 capacity constraints; I-64 is two-lane section
PM	F	I-64 EB between Gratiot on-ramp and I-55 NB on-ramp	I-64 capacity constraints; I-64 is two-lane section

## 7.5 Safety Analysis

Safety and security in travel is achieved by decreasing the risk of personal injury and property damage on and near transportation facilities.

Missouri’s Highway Safety Plan has a goal of reducing the number and severity of crashes occurring in Missouri. There is also a more specific goal – to reduce traffic fatalities to 850 or fewer by the year 2012 as identified in the state’s strategic highway safety plan, Missouri’s Blueprint to ARRIVE ALIVE. In line with the strategic plan, the proposed CAR 2015 improvements are expected to have a positive impact on safety in the project area. In fact, the

incidence of fatal and disabling injuries for the study area was investigated, and the results compared favorably to the average for the St. Louis City-County area.

This section discusses safety in two general physical areas:

- City Street Level at Memorial Drive and the park over the highway.
- Interstate 70 highway corridor

The safety review of these areas does not explicitly follow the traditional Highway Safety Manual approach because their layouts and locations do not comply with guideline examples.

### 7.5.1 Memorial Drive and The Park over the Highway

As described in the early sections of this AJR, a major component of the CAR 2015 project is a proposed new park over the highway between the Arch Grounds and Luther Ely Smith Plaza which would close Memorial Drive between Market and Chestnut Streets. The park will create a continuous pedestrian facility and landscaped park from Downtown St. Louis into the JNEM. Pedestrians who currently travel this path are required to cross (at least) six lanes of traffic between the JNEM and downtown. The existing facility exhibits numerous characteristics that prioritize vehicles, inhibit pedestrian movement and put pedestrians in potential conflict with vehicles:

- The north and south ends of Memorial Drive are connected to Interstate ramps and the facility’s main role is to provide direct and uninterrupted Interstate access. Vehicles are able to enter and exit the section at high speeds.
- The horizontal alignment is a straight section with no curves, wide setbacks to buildings, little landscaping, and no on-street parking. In other words, although the Memorial Drive facility is on the edge of a dense urban area, its design is such that there are few attributes to slow traffic between the highway ramps except for traffic signals at the cross streets.
- Four sets of traffic signals exist on Memorial Drive but timings are prioritized to serve the peak hour vehicle movements which serve to enable large volumes of vehicles to move through the section without stopping.

The impact of creating the park over the highway and associated closure of Memorial Drive between Market and Chestnut Streets is that the opportunity for any pedestrian-vehicle interaction is completely eliminated. There is no more direct solution to improving safety than to entirely segregate vehicle and pedestrian movements and remove the potential for crashes.

Within the Interstate highway in the depressed section, the project proposes facilities which should improve safety within the project area:

- Proposed new ramps are designed as full acceleration/deceleration lanes to/from the highway whereas the current layout incorporates tapered-styled ramps.
- Auxiliary lanes would be added which will enable vehicles longer travel distances and more time to navigate lane changes.

The two sections to follow include more detailed information and analysis of historic crashes in the project area.

### 7.5.2 I-70 Corridor Crash History

Crash data provided by MoDOT were reviewed to assess the potential impacts of the CAR 2015 project on traffic safety. Crash summaries were provided by MoDOT for I-70 during the years 2006 through 2010. The limits of the crash investigation through the I-70 corridor were St. Louis Avenue to the north and I-64 to the south.

The I-70 crash data is summarized in Table 7.16, Figure 7.1 and Figure 7.2 below. The majority of all crash types were classified as “Rear End” followed very closely by “Out of Control”, which represented the majority of the Fatal and Disabling Injury crashes. Together these two categories represent nearly 70 percent of all the collisions. The following relevant conditions were noted on the reports as well:

- “Congestion Present”: 28.2 percent
- Pavement = “Dry”: 62.8 percent
- Lighting Conditions = “Dark”: 41.9 percent

Table 7.16: I-70 Crash Data Summary (2006-2010)

Collision Class	Crash Severity				Total Crashes
	Fatal	Disabling Injury	Minor Injury	PDO	
Avoiding	0	0	5	4	9
Changing Lane	1	0	6	22	29
Fixed Object	0	0	8	11	19
Head On	0	0	1	0	1
Other	0	0	4	17	21
Out of Control	4	3	71	168	246
Parking or Parked Car	0	0	2	3	5
Passing	0	0	25	122	147
Pedestrian	1	1	1	0	3
Rear End	2	0	90	188	280
Right Angle	0	0	0	1	1
Right Turn	0	0	1	2	3
Sideswipe	1	0	0	3	4
U-Turn	0	0	0	1	1
<b>Total</b>	<b>9</b>	<b>4</b>	<b>214</b>	<b>542</b>	<b>769</b>

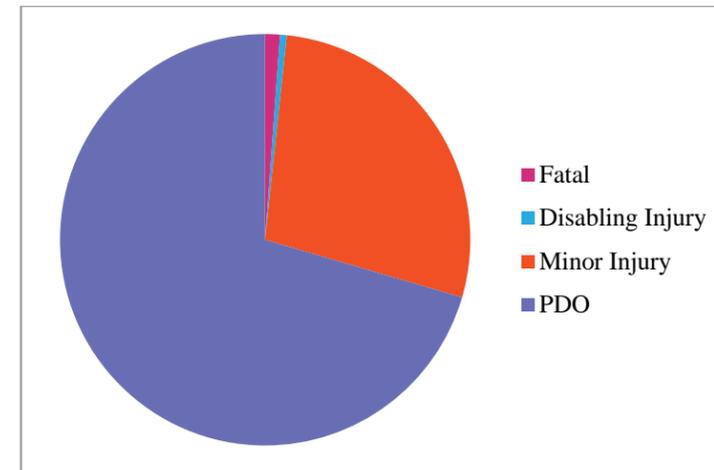


Figure 7.1: I-70 Crashes by Type (2006 – 2010)

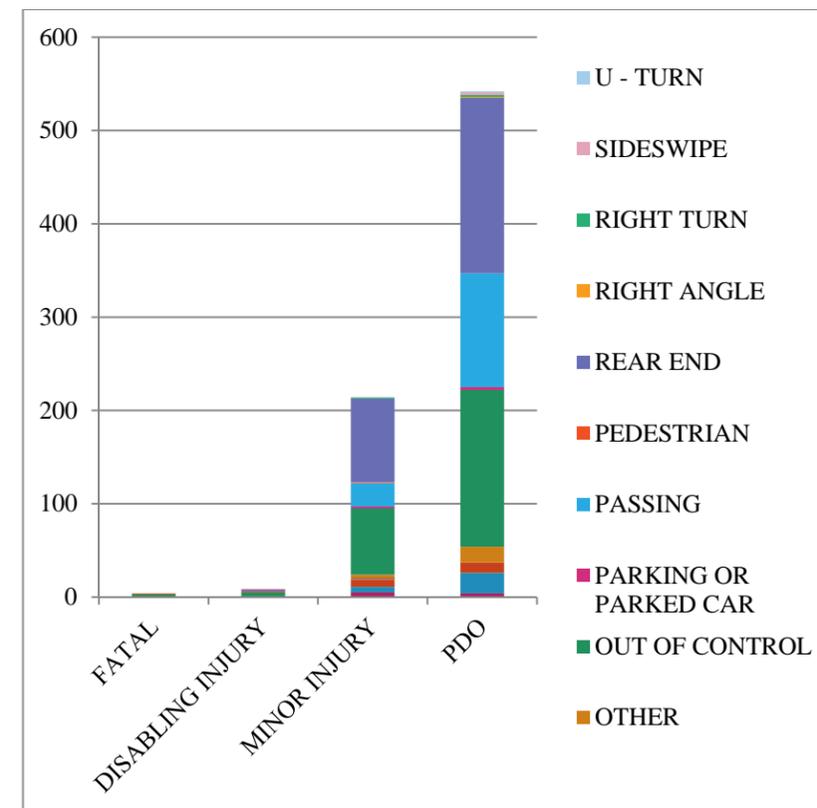


Figure 7.2: I-70 Crash Statistics (2006 – 2010)

Geometric features in the I-70 study area include closely spaced ramps, less than desirable horizontal and vertical alignments, and a constricted roadside with retaining walls and bridge abutments in the clear zone. These issues, along with heavy traffic volumes and recurring traffic congestion, create an environment where vehicular weaving takes place in constricted

conditions. These factors contribute to crash rates that are two to four times the Statewide Average, as shown below in Table 7.17.

Table 7.17: I-70 Crash Rates (2006 – 2010)

		Year (crashes per hundred million vehicle miles traveled)				
		2006	2007	2008	2009	2010
<b>I-70</b>	Eastbound	396	444	381	356	257
	Westbound	361	392	349	335	297
<b>Statewide Average For Interstates</b>		108	109	106	103	104

Missouri’s Highway Safety Plan has a goal of reducing the number and severity of crashes occurring in Missouri. There is also a more specific goal – to reduce traffic fatalities to 850 or fewer by the year 2012 as identified in the state’s strategic highway safety plan, Missouri’s Blueprint to ARRIVE ALIVE. In line with the strategic plan, the incidence of fatal and disabling injuries was investigated. Table Table 7.18 portrays a summary of their occurrence in the study area.

Table 7.18: I-70 Fatal and Disabling Injury Crash Summary (2006 – 2010)

Year	Fatal		Disabling Injury		Total Fatal/Disabling Injury		Total Crashes
	Number	Percent of Total Crashes	Number	Percent of Total Crashes	Number	Percent of Total Crashes	
2006	0	0.0%	2	1.2%	2	1.2%	163
2007	1	0.5%	0	0.0%	1	0.5%	188
2008	1	0.7%	4	2.7%	5	3.3%	150
2009	0	0.0%	2	1.4%	2	1.4%	139
2010	2	1.6%	1	0.8%	3	2.3%	129
<b>Total</b>	<b>4</b>	<b>0.5%</b>	<b>9</b>	<b>1.2%</b>	<b>13</b>	<b>1.7%</b>	<b>769</b>

As noted in the table, there were four fatal crashes in the study area, which is 0.5% of the total number of crashes. There were nine disabling injury crashes, which is 1.2% of the total number of crashes. Statistics from the Missouri Statewide Traffic Accident Records System (STARS) for St. Louis City and County were reviewed for year 2010 to establish a baseline for comparison to the study area data. The percentages for the City-County area, which includes all roadway systems for 2010, are 0.2% for fatal crashes and 2.0% for disabling crashes. The combined percentage for the project area is 1.7% compared to the 2.2% for the city-county area. Thus, while crash rates are high, crash severity compares favorably to the severe crash experience of the St. Louis area.

### 7.5.3 I-70 Corridor Crash Analysis

An effort was made to evaluate the potential safety impacts of the proposed changes to I-70 in the CAR 2015 project. The *Highway Safety Manual (1<sup>st</sup> Edition, 2010)* (HSM) provides guidance for quantifying effects on crash rates resulting from design decisions.

The HSM defines methodologies for estimating the expected number of crashes on a future facility. Crash frequency is defined as the number of crashes occurring on a particular facility in a one-year period. The crash history data for I-70 indicates a Crash Frequency of 153.8 crashes/year. The manual defines a number of Crash Modification Factors (CMFs) that represent the relative change to crash frequency resulting from a change in a specific condition. The CAR 2015 project proposes four changes to the conditions of I-70 in downtown St. Louis:

- Reversing the westbound I-70 entrance from NB Memorial to an exit to Washington Avenue;
- Reversing the eastbound I-70 exit to SB Memorial to an entrance from Washington Avenue;
- Adding two 11’ wide auxiliary lanes to the depressed section of I-70 by narrowing the four existing lanes from 12’ wide to 11’ wide;
- Creating a new segment of City Street to connect with an existing on-ramp to I-70 westbound, and
- Adding a ramp-to-ramp connection, allowing the future eastbound I-70 connection to the New MRB to also act as an exit to Tucker Boulevard and the downtown arterial network.

Of these four proposed changes to the network, only one has a CMF defined by the HSM; Table 13-5 of the HSM refers to the Potential Crash Effects of Adding Lanes by Narrowing Existing Lanes and Shoulders. However, this guidance refers to a base condition of four or five 12-foot lanes with traffic volume AADTs of 77,000 or more in one direction. I-70 in this study area has two lanes in each direction and ADTs of roughly 42,000 to 47,000 in each direction. The HSM guidance is not applicable to the proposed project modifications.

## 7.6 Modeling and Traffic Sensitivity Analyses

### 7.6.1 Introduction

During FHWA’s review of the pre-AJR briefing memos, FHWA noted that the CAR 2015 and PSB Ramp Modification projects might adversely impact existing river bridge crossings, City Streets and other highway infrastructure. This section represents a series of more detailed analyses that respond to the issues raised by FHWA.

### 7.6.2 Findings

Trip behaviors, anticipated to change in response to the roadway network modifications proposed through the CAR 2015, PSB, and NMRB projects, were studied in numerous combinations with a particular focus on trip origins and destinations. For example, trips to and from Illinois were analyzed in 2015 when the NMRB is scheduled to open. Once built, the new bridge and Interstate alignment are anticipated to divert traffic from existing river crossings. Furthermore, trips between downtown St. Louis and all cardinal directions were studied to predict changes in travel behaviors and the resulting traffic impacts to alternative

routes. The major changes in trip behaviors are summarized below and described in greater detail on the following pages.

The improvements proposed as part of the CAR 2015 and PSB projects would not negatively impact City Streets, existing river crossings or highway infrastructure. Regional travelers would still have route options for traveling between Missouri and Illinois.

### 7.6.3 Origins, Destinations, and Trip Change Behaviors

FHWA noted that the PSB and CAR 2015 projects might adversely impact Illinois traffic or increase traffic on the existing river bridge crossings. This section addresses this issue and demonstrates that origins and destinations and related shifts in travel patterns have been studied and evaluated, and there are no shifts which would create impacts in Illinois beyond the existing travel patterns and volumes.

#### 7.6.3.1 Impacts due to the NMRB

The NMRB and resulting realignment of I-70 will shift the greatest number of trips into and around St. Louis, many more than would shift as a result of the CAR 2015 or PSB projects. When complete, the NMRB will provide an additional crossing alternative that will free up capacity on the PSB and the MLK Bridge. It will ultimately reroute a considerable portion of regional east/west traffic from the existing crossings and the depressed section of I-70 to the new alignment, reducing overall highway traffic through downtown St. Louis. When NMRB Phase I is complete, regional east/west trips between Illinois and Missouri will shift north from the PSB and MLK Bridge. This shift will have the greatest impact on the Interstate infrastructure east of the Mississippi.

- MLK Bridge: 50% of east/west traffic (1,195 am, 1,600 pm) will shift to the MRB,
- PSB: 10% of east/west traffic (1,053 am, 1,078 pm) would shift to the MRB,
- Eads Bridge: No anticipated change in demand since the Eads serves mainly local trips

#### 7.6.3.2 From the North and West to Downtown

The primary change for trips on this route involves the CAR 2015 project which aims to modify the current off-ramp from I-70 eastbound to Memorial Drive southbound to an on-ramp from Washington Avenue to I-44 westbound. The vehicles currently using this exit would divert 50/50 (258 am, 30 pm) to the existing local and express Broadway exits, located to the north of downtown near Cass Avenue. The CAR 2015 project also proposes a new ramp at N. Tucker Blvd. which would serve as a replacement to the 10<sup>th</sup> Street off-ramp which is being removed as part of NMRB Phase I. Neither of these access changes will affect river crossings or travelers to/from Illinois.

#### 7.6.3.3 From the South and East to Downtown

When Memorial Drive closes between Walnut and Pine Streets as a result of the extension of the Arch Grounds over I-70, the following changes in trip behaviors are expected:

- 40% of vehicles (752 am, 186 pm) currently accessing downtown via Memorial Drive northbound would shift to the new off-ramp from the depressed section of the Interstate to Washington Avenue.
- 100% of vehicles (650 am, 205 pm) that currently use Market Street to enter downtown from Memorial would use Walnut Street which would remain open in the CAR 2015 build scenario
- 15% of vehicles (116 am, 17 pm) that currently use Pine Street to enter downtown from Memorial would shift to the new Washington Avenue off-ramp
- 25% of vehicles (205 am, 151 pm) that currently access downtown via the PSB westbound to Memorial would shift to the MRB westbound and enter downtown from the north

Frequent users of I-70 often divert to the MLK Bridge as a bypass to the PSB when travelling between Illinois and Missouri, especially when traffic is heavy on the PSB. This behavior is likely to decrease due to reduced traffic volume on the PSB and increased opportunities for crossing the Mississippi.

Vehicles currently using the PSB, Eads and MLK bridges will continue to have the same choices and opportunities to cross the Mississippi River.

#### 7.6.3.4 From Downtown to the North and West

An extension of North 3<sup>rd</sup> Street would connect Memorial Drive northbound by the northwest corner of the Arch Grounds to the existing segment of North 3<sup>rd</sup> by Lumière Place. This would provide an opportunity for vehicles to get from downtown to I-70 westbound. 45% of vehicles (101 am, 466 pm) currently using the existing Memorial Drive northbound on-ramp to I-70 would shift to this new North 3<sup>rd</sup> Street extension, while the remaining vehicles (124 am, 569 pm) would access the Interstate via the existing Biddle Street on-ramp.

#### 7.6.3.5 From Downtown to the South and East

With the removal of the ramp from I-70 eastbound/Memorial Drive southbound to the PSB eastbound, 100 percent of the vehicles originating from I-70 (10 am, 375 pm) would shift north to the MLK, while 100 percent of the vehicles originating from Memorial (135 am, 385 pm) would shift to the south, to the Marion Street on-ramp.

Overall, the proposed traffic shifts, street closures, and ramp modifications detailed herein would not have significant spillover effects onto other projects and would be absorbed by the existing and future street network.

### 7.6.4 Trans-River Trips and Impacts to Interstate Infrastructure in Illinois

#### 7.6.4.1 River Crossings

Build and no build scenarios for both the PSB and CAR 2015 projects were modeled with 2015 and 2035 demand year forecasts to test impacts to Mississippi River crossings, among

other areas. In Figure 7.1, Mississippi River Bridge crossing volumes are quantified based on three scenarios:

- Scenario 1: existing conditions and traffic demand
- Scenario 2: 2015 conditions with MRB Phase I complete
- Scenario 6A: 2015 conditions with MRB Phase I, PSB Preferred Build, and CAR 2015 projects complete

Note that the figure illustrates how the PSB’s capacity threshold is not met due to constraints at the Missouri South / PSB ramp interchange.

Crossing volumes on the PSB and MLK Bridge decrease from Scenario 1 to 2 in both directions during both am and pm peak hours given the traffic shift to the NMRB. Between Scenario 2 to 6A, traffic volumes generally remain constant except for a slight increase on the MLK eastbound during the pm peak hour due to the PSB Ramp Modification project. In both future year Scenarios, crossing volumes are lower than current volumes at both the PSB and MLK Bridge, substantiating the claim that the CAR 2015 and PSB projects would have no impact on trans-river trips and the Interstate highway network in Illinois.

The primary change to existing bridge access is the proposed removal of the ramp from I-70/Memorial Drive to eastbound PSB as part of MoDOT’s PSB Ramp Modification project, Preferred Build scenario. As explained, vehicles currently using that movement would shift to other PSB access points or to alternative river crossings. Importantly, those vehicles would use local access points in the St. Louis City street network, causing no impact to areas east of the Mississippi River in Illinois.

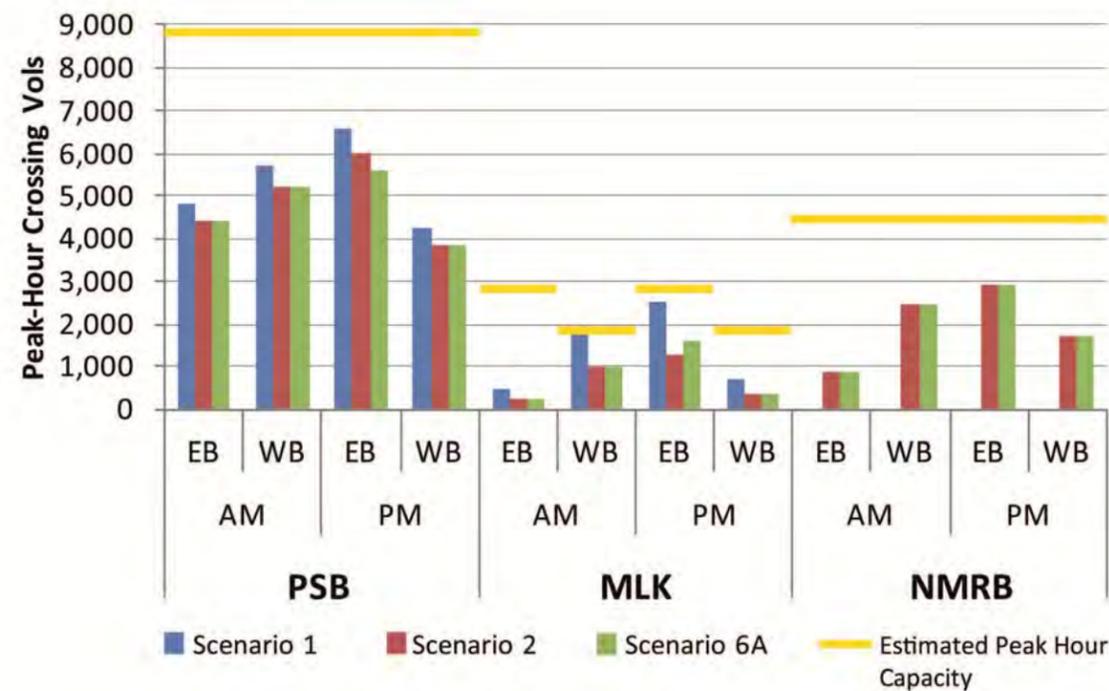


Figure 7.1: Crossing Volumes by Bridge in Scenarios 1, 2 and 6A

Figure 7.2 on the following page graphically depicts the existing and proposed river crossings with associated am and pm peak hour volumes. This diagram shows that:

- In 2015, 50% of the MLK Bridge volumes and approximately 10% of the PSB volumes shift north to the NMRB. The 2015 volumes shown account for these trips as well as natural increases in demand.
- From Scenario 2 to 6A (a full-build of both the CAR 2015 and PSB projects), the NMRB volumes are projected to remain the same in both directions. This highlights the minimal impact both projects would have on the NMRB and I-70 realignment.
- The westbound pm volumes on the MLK Bridge increase from Scenario 2 to Scenario 6A do to the anticipation that some westbound trips using the PSB would shift to the MLK with the removal of the ramp from I-70 eastbound/Memorial Drive southbound to eastbound PSB. This was addressed in greater detail in Section 6.7.5.

Figure 7.2 further demonstrates that all river crossings would be of sufficient capacity to handle east/west volumes in 2015 since most existing bridge access would be maintained in the build scenarios, and overall crossing capacity will increase through the preservation of existing travel lanes and the construction of the NMRB.

Similar to the relationship between the CAR 2015 and NMRB projects, the CAR 2015 interventions and infrastructure east of the Mississippi River are physically separate and operationally independent. Effects from proposed traffic shifts, street closures and ramp modifications are not expected to reach the traffic volumes currently experienced and therefore are not expected to affect the performance of the NMRB in either direction, the Tri-Level Interchange, or other related highway systems in Illinois.

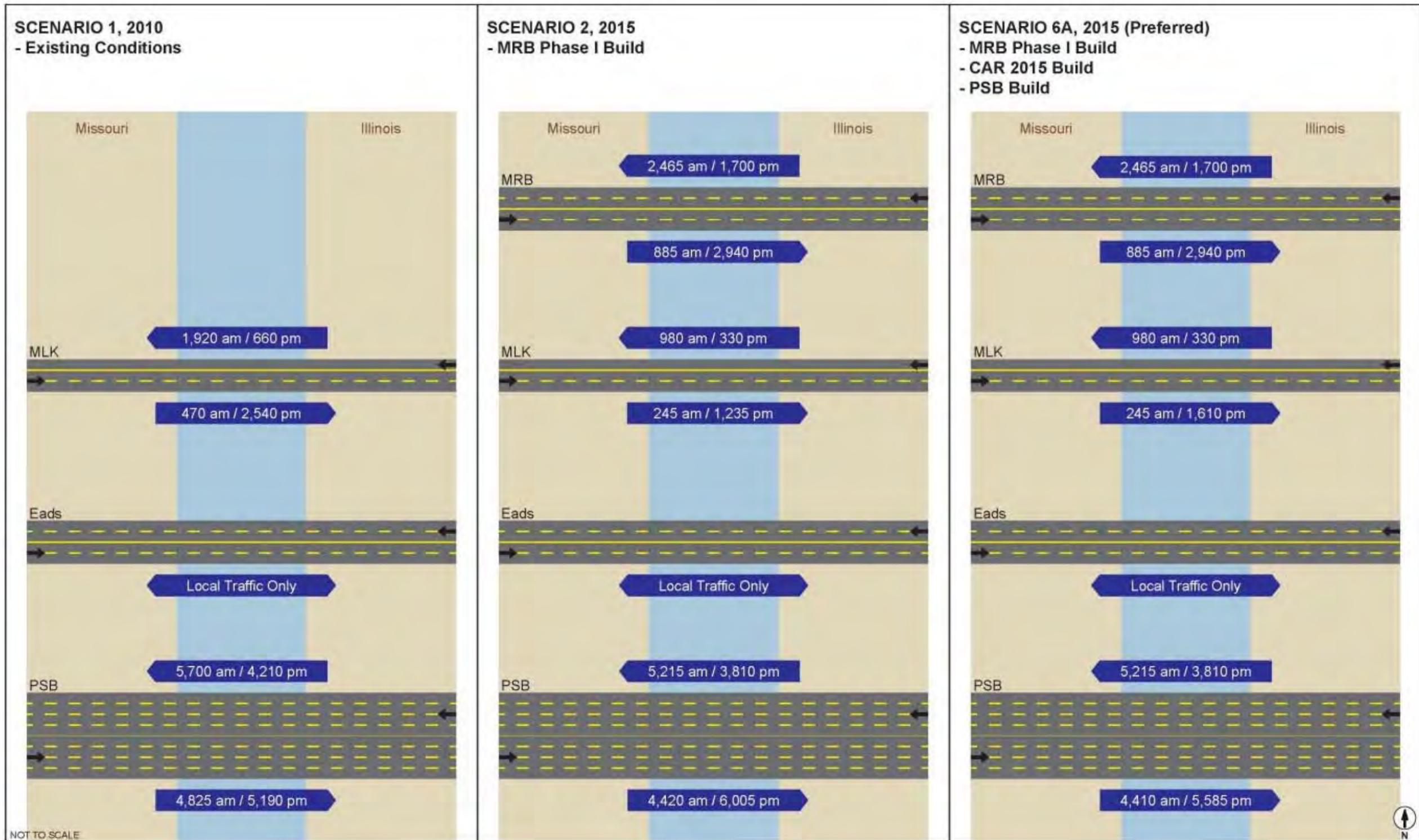


Figure 7.2: River Crossing Volumes by Bridge (Image: Arup)

### 7.6.5 PSB Ramp B Removal and Related Movement Shifts

As part of the PSB Ramp Modification project – Preferred Build Scenario, the proposed closure of Ramp B would necessitate a shift of Illinois-bound traffic. Traffic currently accesses Ramp B from eastbound I-70 at the south end of the depressed section (405 am, 720 pm vehicles per hour) or from the St. Louis central business district (CBD) via Memorial Drive southbound (185 am, 640 pm vehicles per hour).

Traffic projections performed for year 2015 include shifts within the network due to the opening of the NMRB. It is anticipated that once regional shifts occur due to opening of the NMRB, some traffic will still utilize Ramp B. These are:

- From I-70 eastbound: 10 AM and 375 PM vehicles/hour;
- From Memorial Drive southbound: 135 AM and 385 PM vehicles/hour.

For the purposes of this AJR, it was assumed that the full volume of traffic from these origins would shift to the nearest PSB access point. This assumption was made in an effort to test the sensitivity of adjacent facilities to accommodate the Ramp B traffic shifts and is incorporated into modeling Scenarios 6A and 9A.

The full volume of Ramp B traffic via Memorial Drive southbound (originating in the downtown CBD) was shifted to the Marion Ramp accessing I-55 northbound. Due to the proposed widening of the I-55 ramp to the PSB, current congestion in this area is expected to improve dramatically, making I-55 an attractive option for PSB eastbound access. VISSIM and SYNCHRO analysis results indicated that operations in this area will dramatically improve over existing, even when shifts from the CBD are incorporated. Following these rerouted vehicles beyond the Marion Ramp, they ultimately cross the PSB into Illinois as they currently do, so there is no new impact to highway infrastructure in Illinois for this particular movement.

The Ramp B traffic volume from I-70 eastbound was shifted to the MLK bridge (the nearest upstream eastbound exit). The MLK is expected to have additional capacity after the opening of the NMRB as roughly 50% of the current traffic on that facility is projected to shift to the NMRB. VISSIM modeling results confirmed that the MLK exit ramp from I-70 and the MLK Bridge could accommodate the full shift of Ramp B traffic originating from I-70 eastbound. The River bridge crossing analysis in the previous section shows a dramatic decrease in traffic on the MLK Bridge and on associated infrastructure east of the Mississippi.

Should the projections be incorrect and should all Ramp B traffic use the NMRB, the River Bridge Crossing analysis in the previous section shows that the NMRB has sufficient capacity to serve an additional 145 AM and 760 PM eastbound trips. Once across the NMRB, rerouted Ramp B traffic could continue to travel east on I-70 via the future I-70 eastbound to I-70/I-55 eastbound ramp, or further east on I-64 via the I-70 eastbound to I-64 eastbound ramp, both on the “Tri-Level” interchange in Illinois. The I-70 eastbound to I-70 eastbound ramp will be two lanes and is projected to carry 199 am/1297 pm/8349 ADT, with a projected LOS of am/pm = LOS A/B. This suggests sufficient capacity to carry some or all of the rerouted Ramp B trips although at a lower LOS. The I-70 eastbound to I-64 eastbound ramp will be one lane and is projected to carry 858 am/1229 pm/13623 ADT. The projected LOS for this ramp is unavailable.

### 7.6.6 Weaving Analysis at North 3<sup>rd</sup> Street Extension and Existing Interstate On-Ramp

A weaving analysis was performed for the segment of roadway where the North 3<sup>rd</sup> Street extension and the MLK Ramp would run parallel and then split into the existing Interstate on-ramp and existing North 3<sup>rd</sup> Street (adjacent to Lumiere). In this roughly 200 foot long segment of roadway, drivers in each lane would have the option to continue in their lanes, or make a lane change maneuver to either get on the I-44 ramp or go to the existing North 3<sup>rd</sup> Street. FHWA cited this as an area of concern for further review.

The Highway Capacity Software was used for the weaving analysis on both AM and PM peak hour volumes for three scenarios involving movements coming from the North 3<sup>rd</sup> extension, the Convention Plaza left-turn lane, and the MLK ramp. All scenarios resulted in LOS C or better. For this analysis, LOS is based on density within the weaving segment (HCM exhibit 24-2) Density is derived from the average speed for all vehicles in the weaving segment (HCM exhibit 24-6)

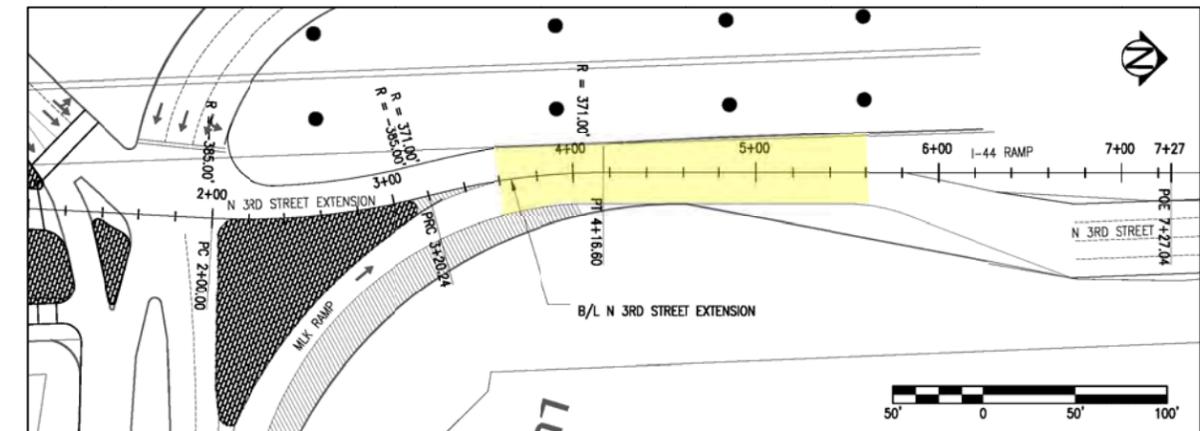


Figure 7.3: North 3<sup>rd</sup> Extension, Area of weaving analysis highlighted in yellow

Review of the VISSIM AM and PM peak hour models also showed no evidence of slowing vehicles, congestion or queuing in the area, corroborating the results of the HCS analysis. More detail on this study is presented in Appendix H.

## 7.6.7 Impact of CAR 2015 and PSB Projects on NMRB Phase II Build Out

The first phase of the new MRB is currently under construction north of downtown St. Louis. When complete, the section of highway designated as I-70 will move from the PSB to the MRB. Those traveling on I-70 from Illinois who require access to downtown St. Louis will be able to exit at Cass Avenue, then travel into the city along several routes including North Tucker Blvd to the west and North 2<sup>nd</sup> Street to the east. Those traveling on I-70 from North County would be able to access downtown via the existing Broadway exits or the proposed ramp at Tucker Blvd.

The second phase of the MRB would create a second bridge crossing adjacent to Phase I, with additional new access links between the bridge and points downtown. MoDOT and FHWA have voiced concern that the PSB and CAR 2015 projects might have some impact on the future full build-out of Phase II MRB. As explained below, the PSB and CAR 2015 projects are **physically separated** from, and are **operationally independent** to the MRB project and would therefore not preclude the bridge's full Phase II build-out.

### 7.6.7.1 Physical Separation

As shown in Figure 7.4, the northern extents of the mainline CAR 2015 project and the southern extents of the MRB projects are physically separated through the area of the MLK Bridge ramps, Laclede's Landing and the Lumiere Casino. The gore points of the proposed CAR 2015 project elements and MRB Interstate ramps are separated by at least two-thirds of a mile in each direction, as shown in Figure 7.4.

- Eastbound, distance between the I-70 Express Lane off-ramp and the new Washington Ave on-ramp: approximately 3,200 feet
- Westbound, distance between the new Washington Ave off-ramp and the Biddle Street on-ramp: approximately 3,590 feet

### 7.6.7.2 Operational Independence

The CAR 2015 project is operationally independent of the MRB project because the Washington ramp improvements do not extend north beyond the MLK Bridge ramps, and the proposed N. Tucker ramp is beyond the limits of the planned MRB Phase II improvements. Highway lane continuity from the northern extents of the CAR 2015 project would be maintained as it currently exists north of the MLK Bridge ramps. On I-70 westbound, this comprises three Interstate lanes from the on-ramp from the MLK Bridge. On I-70 eastbound, this comprises three lanes between the MLK Bridge off-ramp and the Broadway off-ramp from the I-70 express lanes; and two lanes from the express off-ramp to the local Broadway off-ramp.

These lane configurations and alignments do not change in CAR 2015 and PSB preferred build scenarios. MRB Phase I does not affect lane configuration in this area. The current plans for MRB Phase II also do not modify lane configuration in this area.



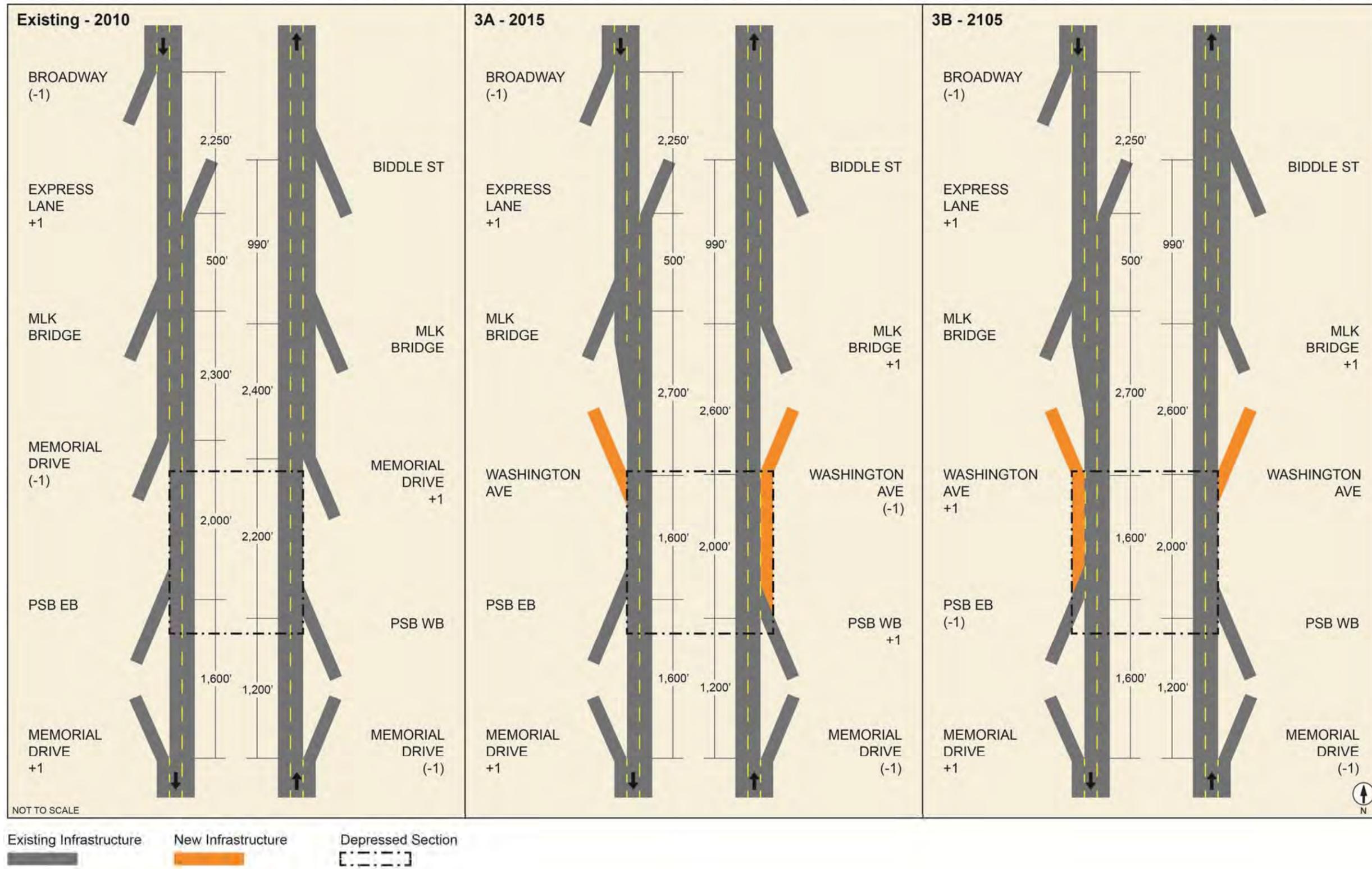


Figure 7.4: I-70 / I-44 Ramp Spacing in 2010, and Scenarios 3A and 3B

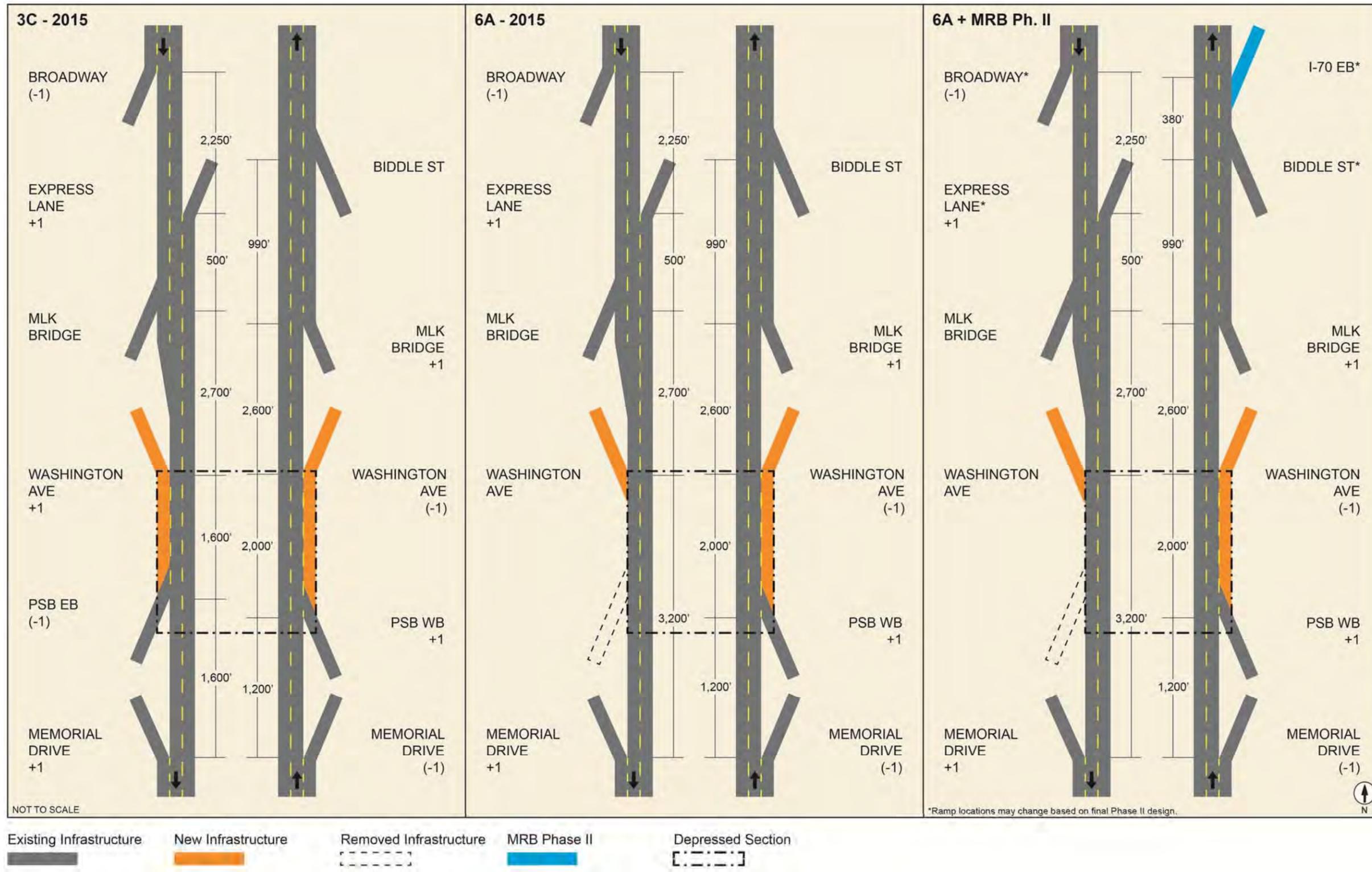


Figure 7.5: I-44 Ramp Spacing in Scenarios 3C, 6A (PSB Preferred Build) and Future 6A with Possible NMRB Phase II Build-out

## 8 Funding and Schedule

### 8.1 CAR 2015 Project Funding

Funding for the CAR 2015 project has been procured as follows:

- **\$20M** fiscal year 2012 TIGER III Grant from the U.S. Department of Transportation. The grant money is to be allocated to “improvements to the I-70 corridor” and project works related to the ramps, bridges and North 3<sup>rd</sup> Street Extension. TIGER III funds must be obligated by September 2013;
- **\$10M** private local match, pledged and committed by local funders;
- **\$25M** allocation to the project within the East-West Gateway Council of Government’s (EWGCOG’s) Fiscal Years 2012-2015 Transportation Improvement Plan (TIP) as MoDOT Project #612413;
- **\$2M** grant funding secured by MoDOT;
- **\$400k** appropriated by the City of St. Louis for the project;

For a total of **\$57,400,000** available funding.

### 8.2 CAR 2015 Project Schedule

MoDOT has procured design consultants for the Washington Avenue ramps and the Park over the highway.

Design for the Washington Avenue ramps will commence in April of 2012. Construction is scheduled to be let at the end of spring 2013 with construction complete by the end of 2014.

The park over the highway is scheduled to be let in the summer of 2013 with completion by the end of 2014.

## 9 Summary and Recommendations

This AJR seeks FHWA approval for Interstate highway ramp modifications proposed as part of the CAR 2015, specifically:

- ‘Flipping’ ramps at Memorial Drive which currently serve traffic from the north of St. Louis, to serve traffic from the south of St. Louis into Washington Avenue;
- Add a new connection between NMRB ramps at N. Tucker Blvd to replace the EB/SB off-ramp movement lost at Memorial Drive; and
- Add a new street network connection to create new access to an existing on-ramp at the MLK Jr. Bridge, which replaces the WB/NB on-ramp movement lost at Memorial Drive.

The proposed Interstate highway modifications and other elements of the CAR 2015 transportation plan improves the St. Louis transportation network at both local and regional

scales to improve traffic movements, access to and from downtown St. Louis, pedestrian mobility and safety, and connections to and from a national treasure, the Jefferson National Expansion Memorial.

This AJR reports on an extensive planning and analysis process which includes:

- Stakeholder engagement to the CAR 2015 project planning process;
- Integration of the CAR 2015 plan with local pedestrian, bicycle and transit initiatives;
- VISSIM traffic micro-simulation models of the project area;
- SYNCHRO traffic signal models for the downtown St. Louis street network;
- Analysis of potential future scenarios of the PSB Ramp Modification project;
- Safety analysis of the existing conditions and proposed action;
- Impacts of the project to adjacent river crossings; and
- Impacts of the project to adjacent proposed projects.

The analysis described in this report confirms that the proposed actions will:

- Support the goals of the CAR 2015 project;
- Maintain or improve highway operations in the vicinity of the project;
- Maintain or improve the operations of the St. Louis street network;
- Maintain or improve access and connectivity for local businesses, residents and workers;
- Maintain or improve safety for motorists and particularly for millions of pedestrians who visit the Arch;
- Not negatively impact existing river crossings or highway operations east of the Mississippi River; and
- Work within the planned future layout and operations of the PSB Ramp Modification Project and the NMRB Phase II plans.

This AJR recommends approval of the proposed CAR 2015 ramp access modifications.

### 9.1 Next Steps

MoDOT is coordinating the NEPA process for the CAR 2015 related improvements. The outputs from this AJR will inform the environmental documentation and the public engagement process going forward. MoDOT is also coordinating design for the proposed highway ramp modifications and the Park over the highway. This process is underway and will continue through 2014. MoDOT will also continue its study of the PSB Ramp Modification Project. The CAR 2015 project has been shown to work with any possible future version of that project.