

Appendix A

Pre AJR Technical Memos:

**Transportation Plan Technical
Memorandum – December 2010**

**Pre-AJR Briefing Memo 1:
Project Overview – June, 2011**

**Pre-AJR Briefing Memo 2:
Traffic Modeling Approach and
Assumptions – July, 2011**

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

A1 **Transportation Plan Technical Memorandum – December 2010**

Memorandum



To	Deanna Venker (MoDOT) Edward Hassinger (MoDOT) Gregory Budd (FHWA) Kevin Ward (FHWA) Todd Waeltermann (STL Streets)	Date	December 13, 2010
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Subject	JNEM Expansion - Transportation Plan Technical Memorandum Page 1 of 24		

Introduction

The purpose of this Technical Memorandum is to:

1. Provide FHWA with an **overview** of the Jefferson National Expansion Memorial (JNEM) Expansion project and related transportation plan for CityArchRiver 2015;
2. Describe the proposed **transportation interventions** including modifications to city streets, interstate highway ramps and structures and related impacts to interstate highways as part of the transportation plan;
3. Describe **technical details** regarding feasibility of ramp modifications; and,
4. Solicit **Federal Highway Administration feedback** (FHWA) on any critical technical issues, concerns and potential mitigation strategies in order to amend and finalize the JNEM Expansion plan by January 2011 in preparation for full build-out by 2015.

Memorandum

IMPROVE TRAFFIC NETWORK & FLOW

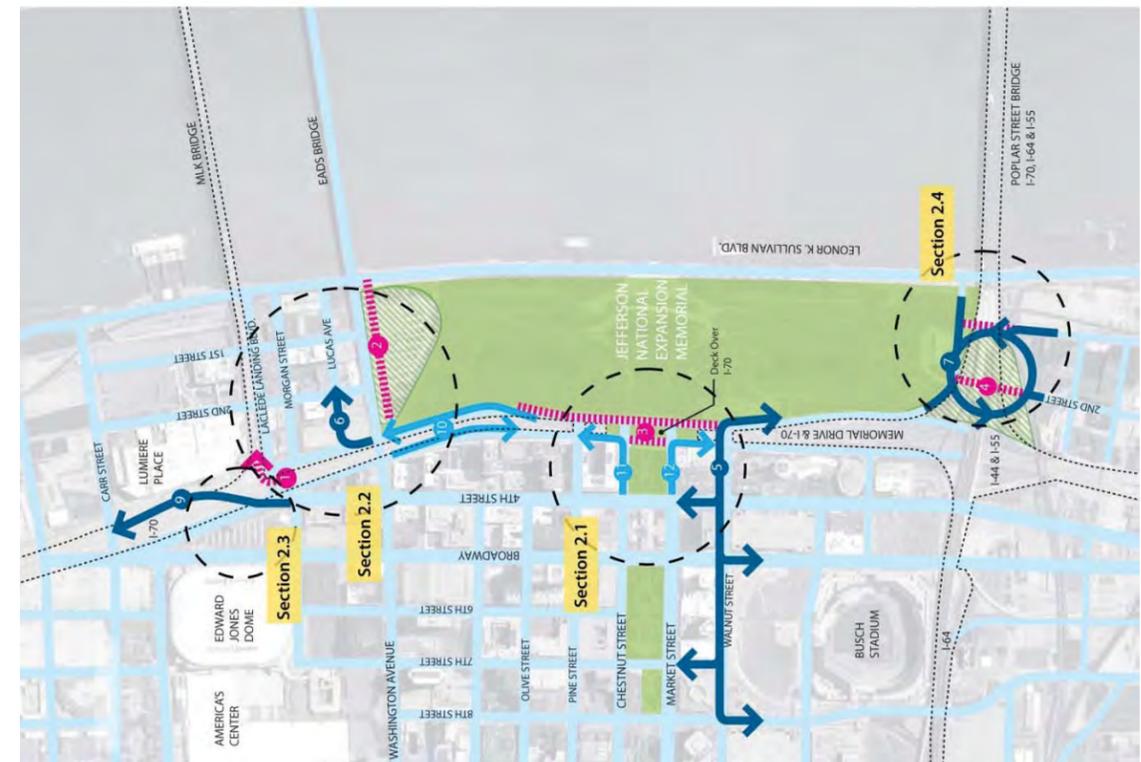
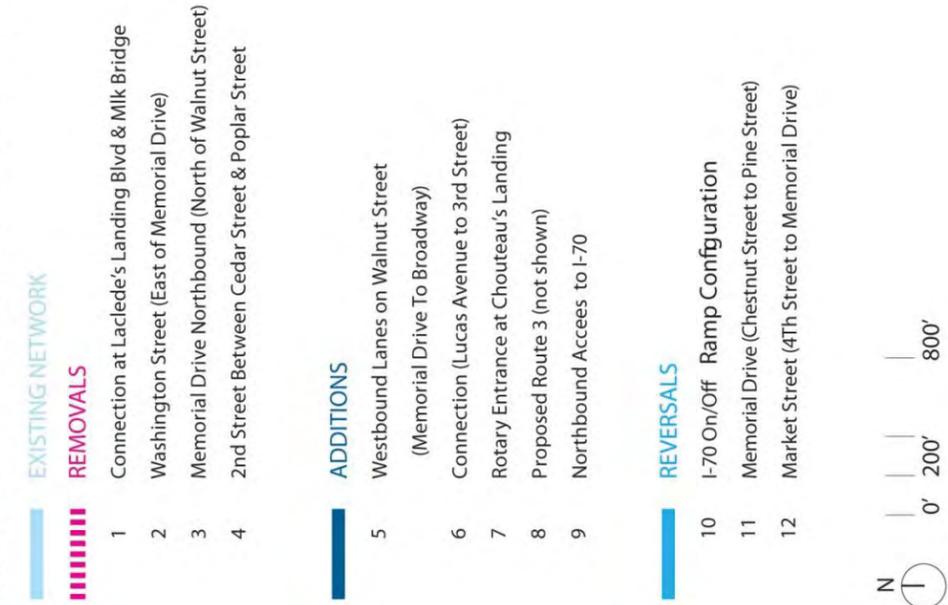


Figure 1: Key Transportation Interventions

1. Project Goals and Transportation Modifications

Surrounded by major roadway infrastructure, the JNEM Park is isolated from the rest of the St. Louis. Additionally, the location of the Arch parking garage creates a condition where visitors arriving by auto are not encouraged to explore City neighborhoods that are otherwise be a short walk from the Arch Grounds. The primary goal of the entire JNEM Expansion project 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.

The project proposes to achieve this goal in part, through modifications to the transportation network. The following initiatives intend to improve pedestrian and vehicular access and circulation:

- Use the areas of Laclede’s Landing, the Old Courthouse and Chouteau’s Landing as gateways into the Arch Grounds, encouraging Arch users to travel through those areas and support local businesses during their visit to the Arch;
- Support visitors’ and commuters’ ability to ‘park once’ then access the Arch Grounds and tour St. Louis as a pedestrian and/or cyclist;
- 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, around the Old Courthouse and to a new parking garage inside the Grounds at Chouteau’s Landing;
- 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; and
- 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.

Figure 1 shows the key transportation interventions for the St. Louis side of the project that support the goals described above. The dashed circles in the diagram indicate specific interventions which may impact interstate highways. These proposed interventions are the focus of this memo and are described in greater detail in their respective sections as indicated in Figure 1.

2 Transportation Interventions

This section details each of the interventions shown in Figure 1 with diagrams of existing conditions, proposed alterations and a description of the changes.

2.1 Reconnect JNEM with the Old Courthouse and Downtown St Louis

PROPOSED

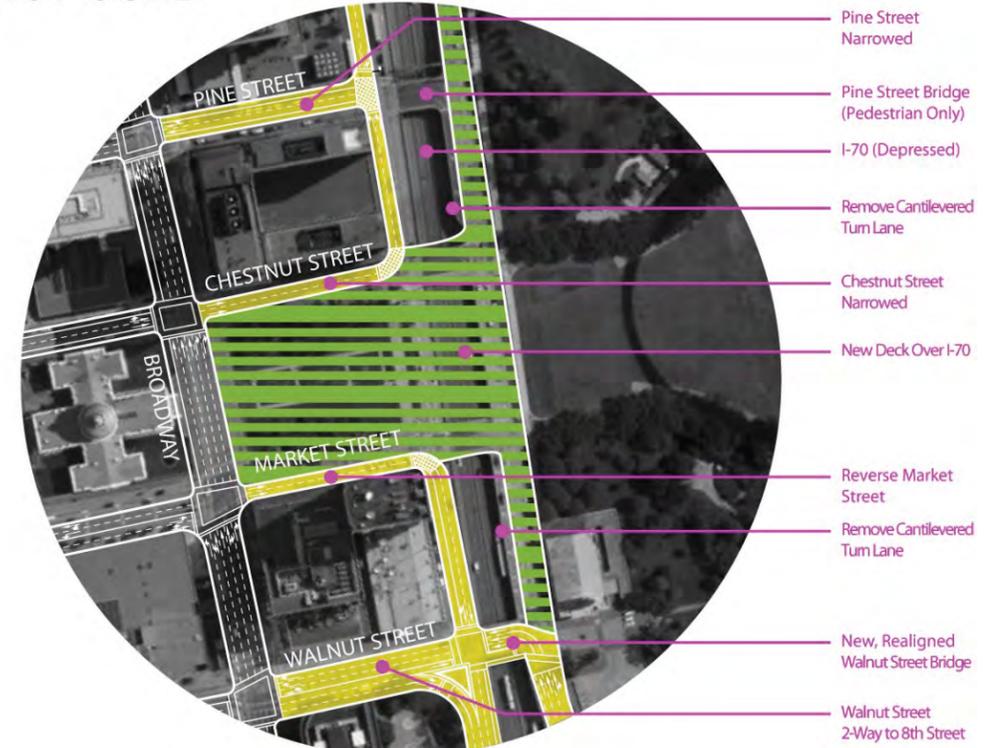


Figure 2: Proposed Downtown Street Network

To reconnect the JNEM with downtown St. Louis, Memorial Drive northbound will be closed from north of Walnut Street to Washington Avenue. Southbound lanes will be closed between Market and Chestnut Streets. With these modifications, the main vehicle gateway from the south will be via Memorial Drive/Market Street and from the North is via Broadway/4th Street. Market and Chestnut Streets on either side of Luther Ely Smith Park will become one-way drop-off and pick-up routes for autos, coaches, RVs as well as handicap parking. These streets will continue to provide access and servicing for adjacent properties. In addition to the Memorial Drive street closures, the bridges connecting Chestnut Street and Pine Street to Memorial Drive northbound will be closed to vehicles.

Walnut Street is planned as a major East-West access street for Downtown St. Louis becoming a 2-way street between Memorial Drive and 8th Street. Reversing Memorial Drive from southbound to northbound for the block between Chestnut Street and Pine Street will provide a route for eastbound vehicles on Chestnut Street where it terminates at Memorial Drive. This will be particularly important

for service vehicles and buses accessing the proposed pick-up and drop-off zone along Luther Ely Park. To maintain access to Market Street between 4th Street and Memorial Drive, traffic operations will be reversed to the eastbound direction for that block. With the traffic flow reversal, vehicles can access Memorial Drive south via Market Street to exit the site. Figure 2 shows the proposed changes west of the Arch Grounds.

EXISTING

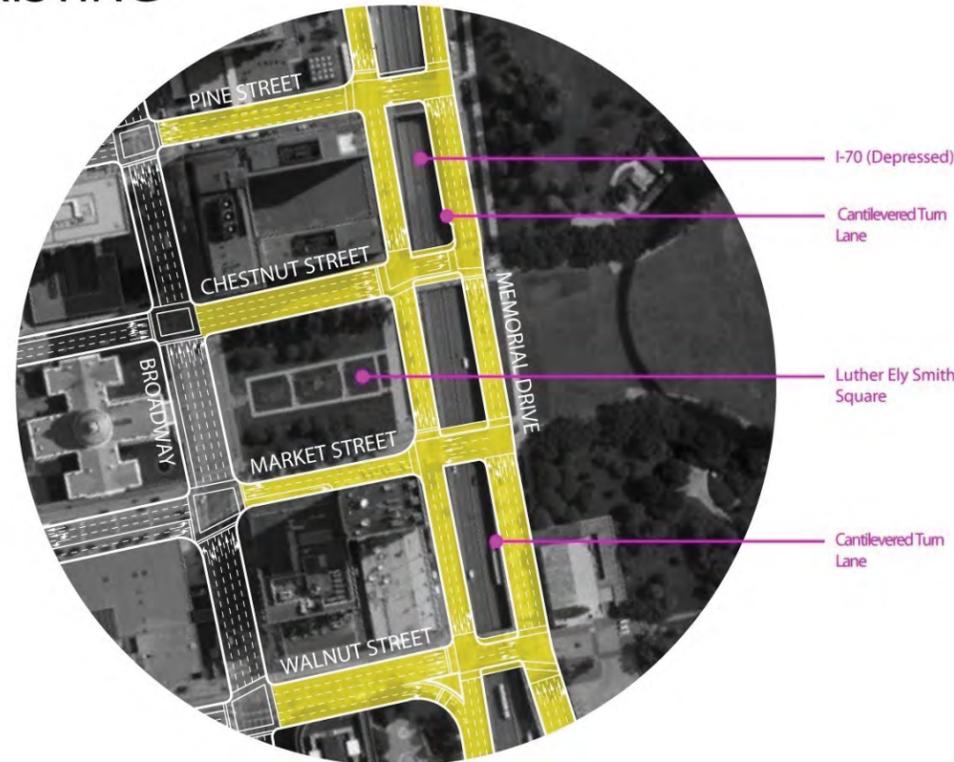


Figure 3: Existing Downtown Street Network

Impact to I-70

- Decking: A segment of I-70 between Walnut Street and Pine Street will be decked over to extend and reconnect the Arch Grounds with the City. The decking will support landscaping, pedestrian and bicycle activity.

Impact to Memorial Drive Bridges

It is understood that these bridges are nearing the end of their design lives and will need to be replaced in the next 5 to 10 years.

- Walnut Street Bridge: In the proposed plan, the Walnut Street Bridge will be replaced and widened to serve traffic that was previously supported on Pine and Market, along with expanded pedestrian crossing capacity.
- Market Street and Chestnut Street Bridges: Both bridges will be removed and replaced by the proposed deck over I-70.
- Pine Street Bridge: The Pine Street Bridge will become a landscaped pedestrian link and gateway to the site but will no longer carry vehicle traffic. As such, it may not require major bridge refurbishment or replacement depending on actual inspected conditions of the existing bridge and the eventual plan for this bridge.

Potential Concerns

- During construction there may be some impact to I-70 for the staging of construction activity.
- This segment of I-70 will be covered from the decking and new bridge(s), highway underpass lighting will be considered for the safety of vehicles traveling through this segment. It is anticipated that the decking will be designed so that if defined as a tunnel by the AASHTO design manual, it will be a 'short tunnel.'

2.2 Improve access to, and connectivity between Laclede’s Landing and the North end of the Arch Grounds

PROPOSED

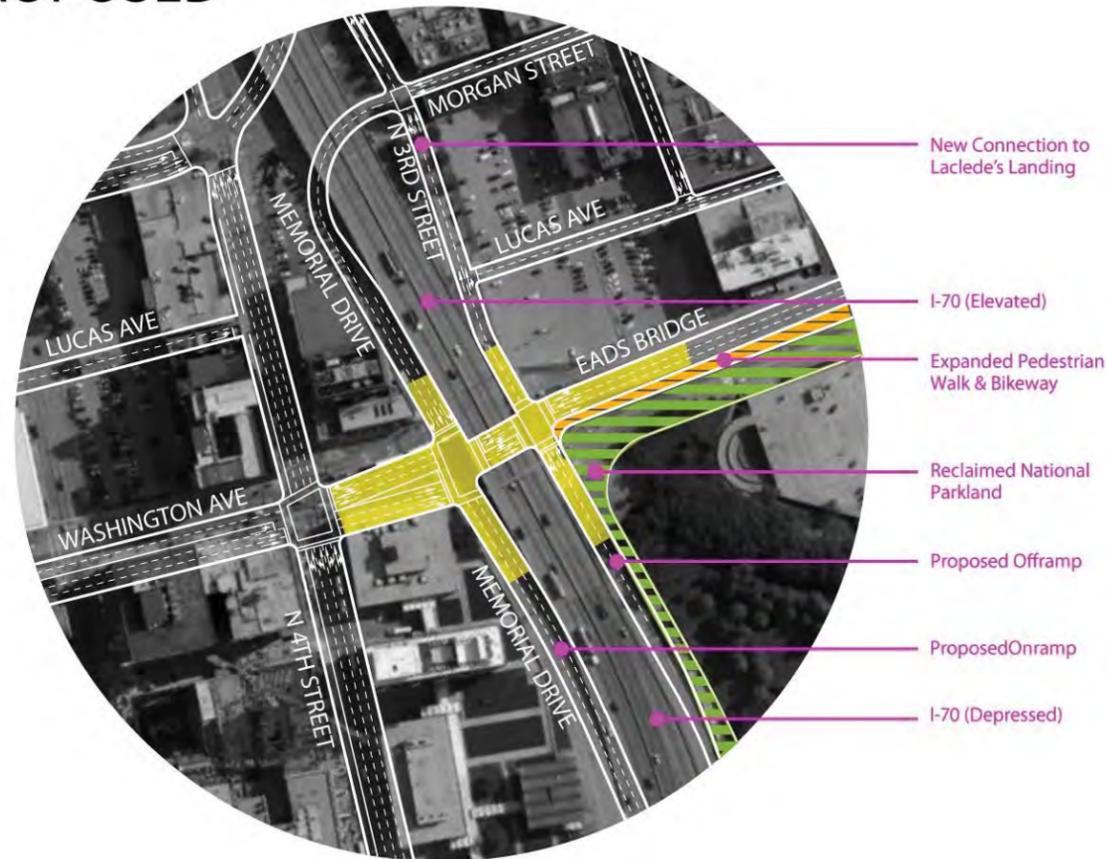


Figure 4: Proposed Washington Avenue Removal and I-70 Ramp Configuration

This section covers three specific interventions:

1. Washington Avenue closure;
2. Flipping interstate ramps; and the
3. Revised Laclede’s Landing street network.

The first intervention in reconnecting the Arch Grounds to Laclede’s landing involves reclaiming Washington Avenue east of Memorial Drive for pedestrians and Park land. The Arch Grounds will extend to the historic edge of the Eads Bridge. Closure of Washington Avenue will simplify the roadway connection and traffic condition at the end of the Eads Bridge intersection. This move will also allow for a strong pedestrian link between the Arch Grounds and the Washington Street retail corridor, America’s Center, the Edward Jones Dome and the Exchange development.

The second intervention involves ‘flipping’ the interstate ramps from northbound on to off and southbound off to on. The partial closure of Memorial Drive at Walnut Street impacts freeway access for vehicles coming from the south to the northern areas of downtown. Access to these destinations is planned through a new off-ramp from I-70 northbound where the current on-ramp is situated. In order to maintain I-70 west access to this area and in accordance with FHWA preference for full interchanges, the I-70 westbound off-ramp is converted to an on-ramp.

The third intervention involves restructuring the streets adjacent to Laclede’s Landing to provide improved access. 3rd Street is planned to continue directly from the new I-70 northbound off-ramp, across the intersection of the Eads Bridge, accessing into a remapped Lucas Ave, then connecting into Laclede’s Landing Blvd. Morgan will act as a main westbound link from Laclede’s Landing back into the City and Memorial Drive southbound. The link from Morgan Street westbound towards the MLK Bridge eastbound is removed to simplify the intersection at the end of the MLK Bridge. Vehicles from Morgan Street will be able to access MLK bridge by turning left on Memorial Drive, right on Washington Avenue, right on 4th Street and then a right onto the MLK bridge.

EXISTING

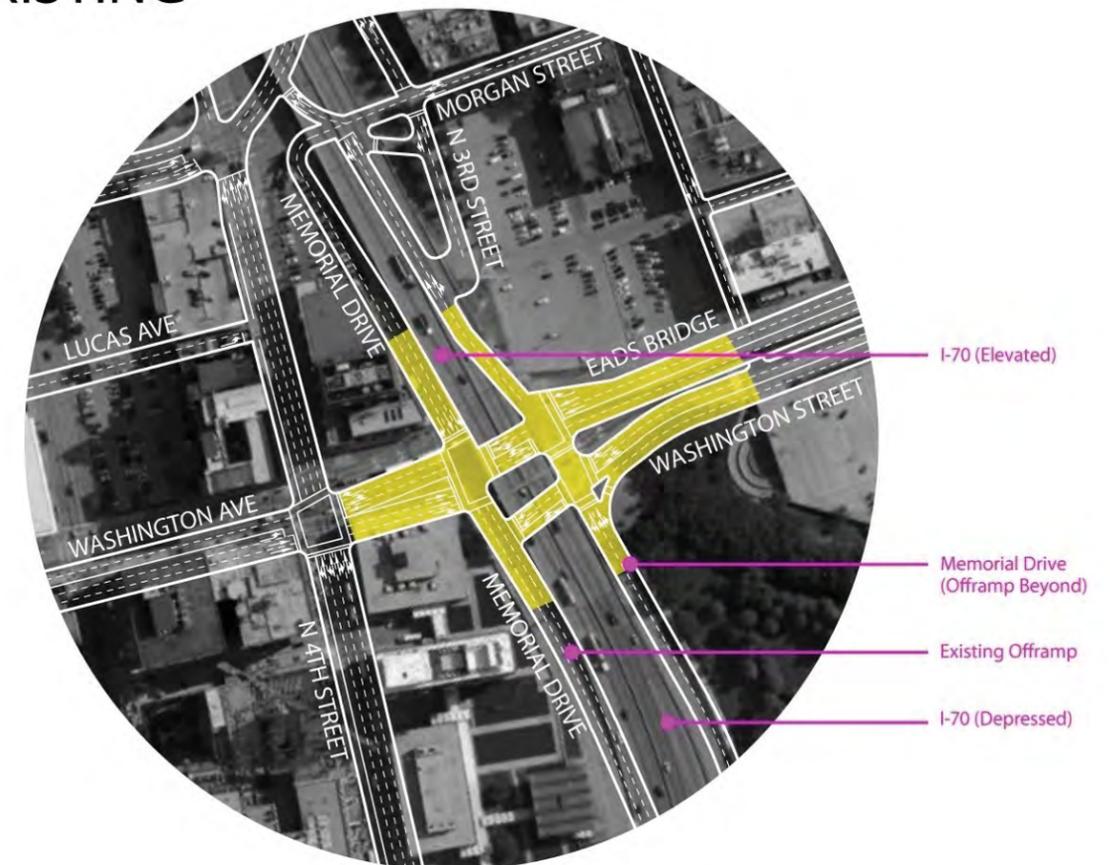


Figure 5: Existing Washington Avenue and I-70 Ramp Configuration

Impact to I-70

- Westbound on-ramp is switched to an off-ramp.
- Eastbound off-ramp is switched to an on-ramp.
- I-70 is two lanes in both directions within the depressed section. The westbound on-ramp currently adds a lane to I-70 just beyond Pine Street. This plan proposes to maintain two lanes from the depressed section through to the elevated section, then add a third lane where the Biddle Street on-ramp joins.
- The I-70 eastbound off-ramp currently removes a lane from the depressed section. A solution for managing this lane drop in the context of the new on-ramp is being studied.

Potential Concerns

- Direct access for the movement from Laclede’s Landing to Illinois across the MLK Bridge is removed and replaced through surface street movements.
- Ramp reversal, interchange classification and ramp alignment proof-of-concepts are described in Section 3.
- Removing the eastbound I-70 off-ramp reduces downtown access to a single point at the Broadway exit. The capacity of the existing ramps and street network to serve the additional traffic is being studied.

2.3 Preserve Westbound I-70 On-Ramp Capacity from Downtown St. Louis

Given the proposed removal of the I-70 westbound on-ramp north of Pine Street, two alternatives are being studied:

1. Add a new connection from Convention Plaza/4th Street at the end of the MLK Bridge between 3rd Street and the existing I-70 westbound on-ramp.
2. Increase the capacity of the existing I-70 westbound on-ramp north of Biddle Street.

PROPOSED

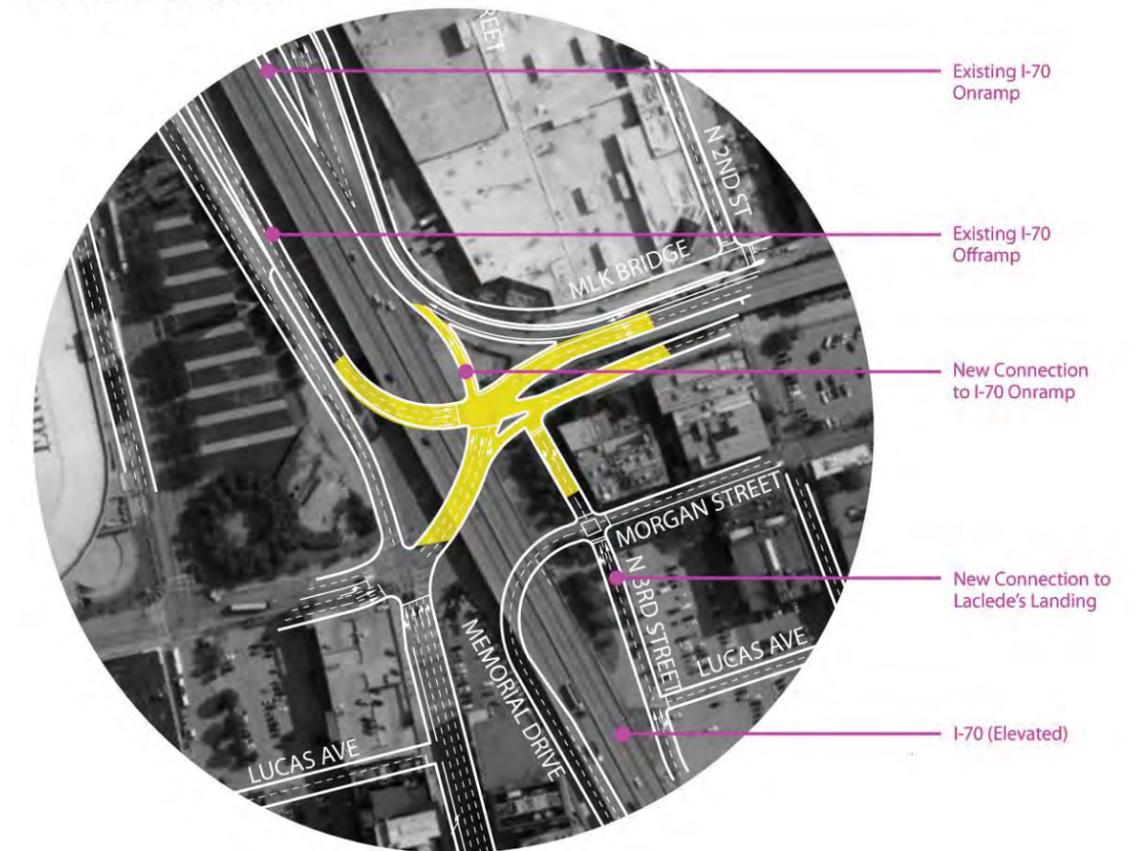


Figure 6: Proposed North 3rd Connection to Westbound I-70 Ramp at MLK Bridge Landing

EXISTING



Figure 7: Existing Conditions, MLK Bridge Landing

Impact to I-70

- The gore of existing westbound on-ramp is unaffected.
- Interstate directional signage from 4th Street northbound and Convention Plaza eastbound currently directs to Carr Street ramps. A revised signage plan will have to be studied.

Potential Concerns

- There is limited distance within which to support weaving movements on N 3rd Street although peak period weaving movements are not expected to be significant. A signal at the end of the MLK Bridge may be required to mitigate this weave.



Figure 8: Proposed Expanded North 3rd Ramp to Westbound I-70 at Biddle



Figure 9: Existing North 3rd Ramp to Westbound I-70 at Biddle

Impact to I-70

- Westbound on-ramp north of Biddle is expanded from one lane to two lanes.

Potential Concerns

- If the design allows adding a third lane, as described in Section 2.3, merging onto westbound I-70 from this modified ramp is simpler if the and will likely not require modifications to the North Broadway structure.
- North Broadway bridge abutment may be impacted.
- Wing wall area under I-70 will likely be impacted to make space for additional on-ramp lane width.

2.4 Improve Access to the South of the Arch Grounds

To establish Chouteau’s Landing as a gateway for the south end of the Arch Grounds, a traffic distribution circulator or rotary is planned. It will provide inbound access from westbound I-70 and 2nd Street to Leonor K Sullivan Blvd. A new parking structure is planned north of the Poplar Street Bridge where the current maintenance building is situated. As shown in Figure 10 below, this concept requires replacement of S. 2nd Street north of Cedar Street and a portion of Cerre Street with a new rotary. A portion of Poplar Street would become the northern edge of the rotary.

PROPOSED

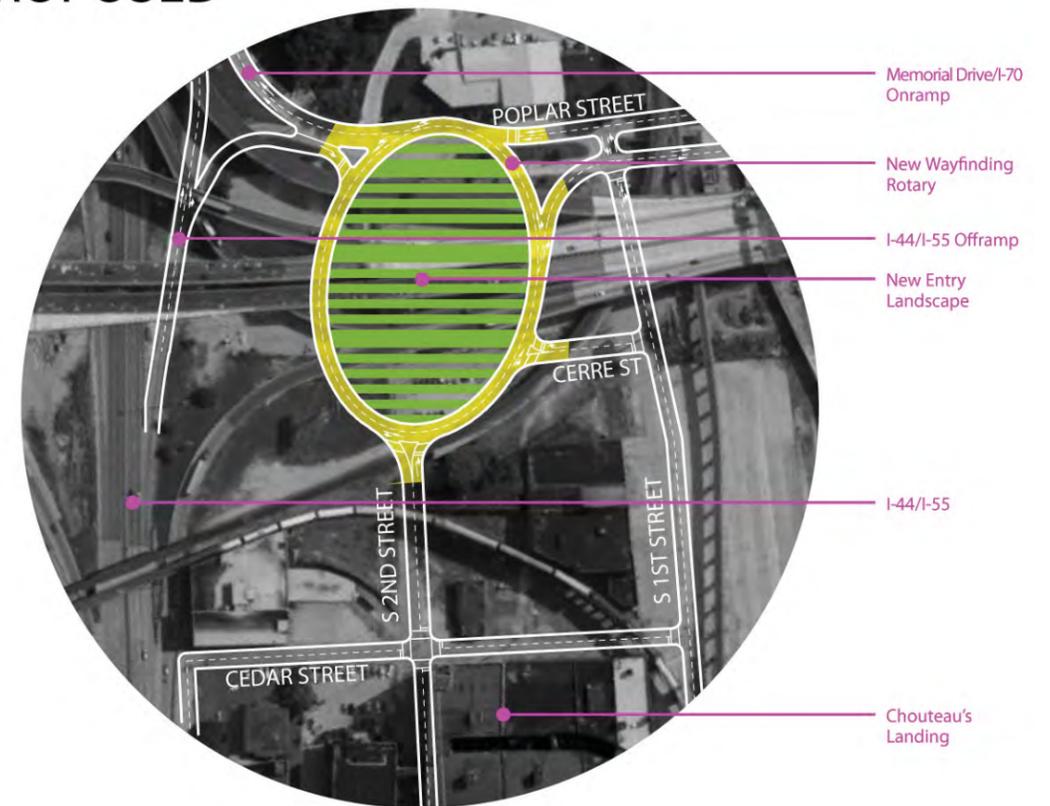


Figure 10: Proposed Chouteau’s Landing Circulation

EXISTING

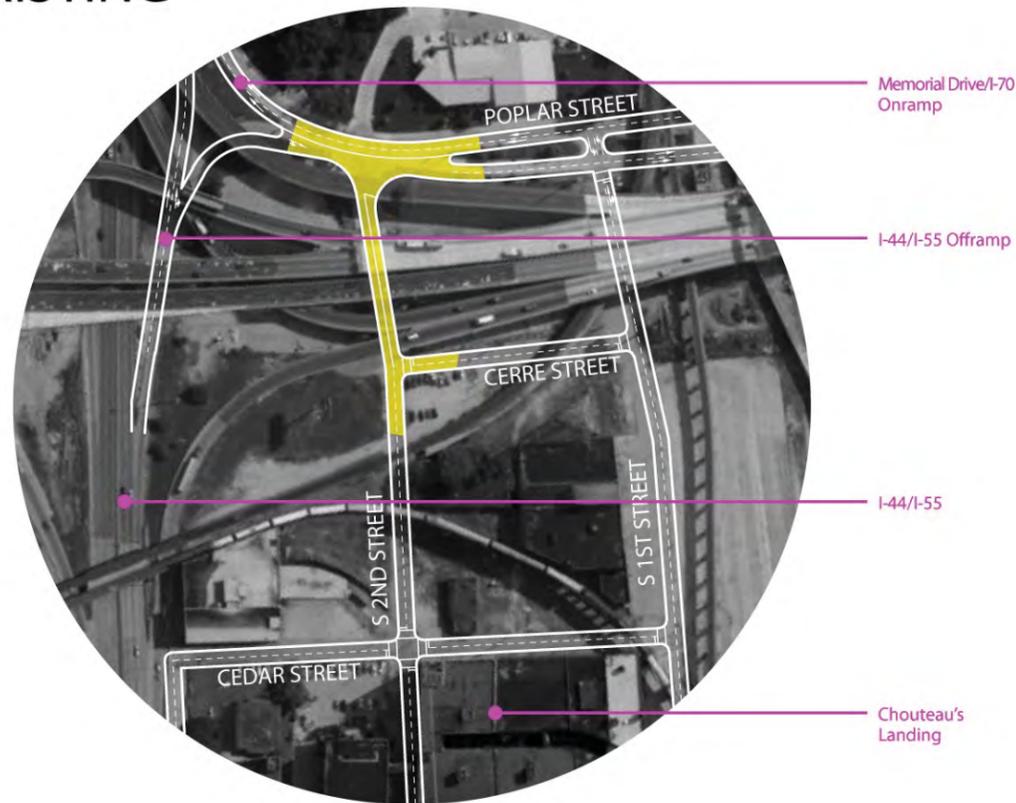


Figure 11: Existing Chouteau's Landing Circulation

Interstate Impacts

- The termination of the existing I-70 Westbound off-ramp will become an entry point into the new rotary, but no changes to the ramp itself should be required.
- At-grade landscaping or hardscaping under the elevated ramps and the Poplar Street Bridge would have minimal or no impact to these structures, but will likely include new lighting elements.
- A parking garage would be located north of the Poplar Street Bridge but not underneath any highway ramps or structures.

Potential Concerns

Implementation of facilities underneath interstate highways and ramps (e.g. permanent hardscape program, temporary public parking, a temporary gathering place or permanent sports facilities such as basketball courts).

2.5 Wayfinding and Signage

This project will redefine how visitors arrive to St. Louis, the Arch and area destinations. As a means to support driver awareness of the various Arch Ground entry points, and as a result of the modified ramps and streets, the project proposes to amend and supplement existing highway signage at a number of scales. While many Arch visitors are currently led to the large garage north of the park, more will be led to downtown parking in the future, requiring an informative and integrated wayfinding system in and around downtown St. Louis.

Interstate highway signs will need to be reviewed at a regional level. Street level pedestrian signage, maps and wayfinding kiosks will direct drivers to parking garages and support pedestrians once they arrive in the City.

Impact to I-70

- Additional and/or amended highway signage.
- Possible dynamic information to display parking availability.

Potential Concerns

- In all cases, appropriate standards and guidelines from USDOT, MUTCD and the St. Louis Regional Wayfinding Signage manual (which has been approved by St. Louis Street Department, MoDOT and local stakeholders) will be reviewed and used as required to develop roadway signs.

3. Technical Details on Ramp Modifications and FHWA Requirements

This section describes further the proposed modifications that directly Interstate 70 and its access ramps, especially as related to meeting AJR requirements.

The U.S. Department of Transportation’s Federal Highway Administration (FHWA) literature uses the term “Interstate System Access Change Request” to describe the formal process to modify or add access points to the interstate system. State DOTs utilize various terms, but the process is the same. Since the Missouri Department of Transportation (MoDOT) has adopted the term Access Justification Report (AJR), this is the term that we will reference in this document.

FHWA specifies the full AJR requirements along with a discussion of the “eight policy requirement” in their publication Interstate System Access Information Guide. The MoDOT Engineering Policy Guide (EPG) section 234 provides some guidance in the preparation of an AJR for interstates in Missouri. The Missouri Division of FHWA also provides some information on agency coordination and AJR approval authorization on their website.

3.1 Interstate Ramps and FHWA Policy

This section focuses on two of FHWA stated requirements and recommendations, including:

- Diamond and half-diamond interchanges; and
- Ramp spacing.

3.1.1 Regional Demand and Ramp Configuration

There are currently six ramps which service the St. Louis CBD from I-70. Four of these ramps (two on-ramps and two off-ramps) serve movements to and from the north, and the other two (one on-ramp and one off-ramp) serve movements to and from the south.

- Ramps serving the south: The one-half diamond interchange associated with the Poplar Street Bridge interchange serves movements to/from the south.
- Ramps serving the north: The one-half diamond interchange in the vicinity of Pine Street serves movements to/from the north. Paired with the Poplar Street Bridge ramps, these ramps form a split-diamond interchange.
- Ramps serving the north: A second one-half diamond interchange in the vicinity of Broadway/Biddle/3rd Street also serves movements to/from the north.

While we do not have historical traffic volumes for each of these movements, it is likely that when I-70 was constructed the predominant movements into the CBD were most likely heavy commuter movements to/from the north, due to the prominence of North St. Louis County during that time. That is most likely why the I-70 reversible lanes were constructed. However, in the decades since, South St. Louis County and Jefferson County have grown significantly. As a result, traffic movements into the St. Louis CBD are much more balanced between the north and the south, with approximately 10% more traffic approaching from the south. It is therefore not unreasonable to justify flipping the middle (Pine Street) interchange in order to provide for traffic movements to and from the south.



Figure 12: Existing Ramp Configuration, Downtown St. Louis

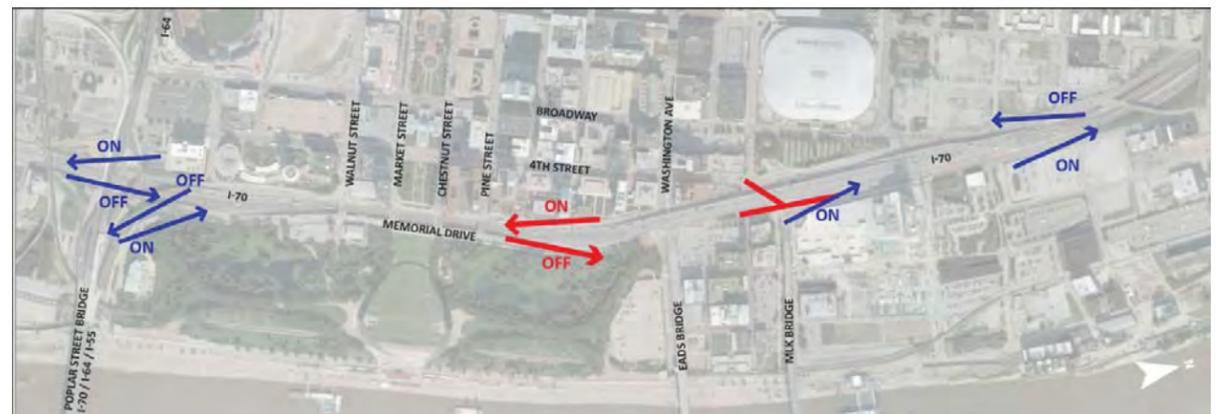


Figure 13: Proposed Ramp Configuration, Downtown St. Louis

3.1.2 Interchange Spacing

FHWA and the American Associate of State Highway and Transportation Officials (AASHTO) both recommend one-mile minimum interchange spacing in urban areas. MoDOT’s Engineering Policy Guide (EPG) recommends a minimum of two miles. Exit 249A (between Pine and Washington) does not meet the current requirements for interchange spacing. The next interchange south of this location is Exit 251A (I-64) at 0.6 miles and the next one north is exit 250A (MLK Bridge) at 0.5 miles. The next interchange north of 250A is 249C (SB I-70 exit onto Broadway) at 0.3 miles away.

It is not anticipated that the proposed I-70 ramp reversals planned for Exit 249A (between Pine and Washington) will be problematic since there is current interstate access at this location and the spacing remains unchanged between adjacent ramps.

FHWA, AASHTO and MoDOT’s goals are to construct interchanges that provide for each of the eight basic turning movements. None of the 4 interchanges listed above currently provide this. Reversing the ramps at Exit 249A will allow this exit when paired with Exit 249C to provide all of the basic movement provided by a complete interchange, thus taking a set to partially satisfy FHWA’s goal.

3.2 Pine Street Ramp Reversal and Adherence to Road Design Criteria

Two options are being considered for the reversal of the I-70 ramps north of Pine Street. Option 1 uses the parallel interchange ramp, and Option 2 uses the taper type. Option 1, shown in Figure 14 below has been tested against the AASHTO criteria. The criteria established are shown below in Table 1.

Option 1: Westbound I-70 Parallel Off-Ramp

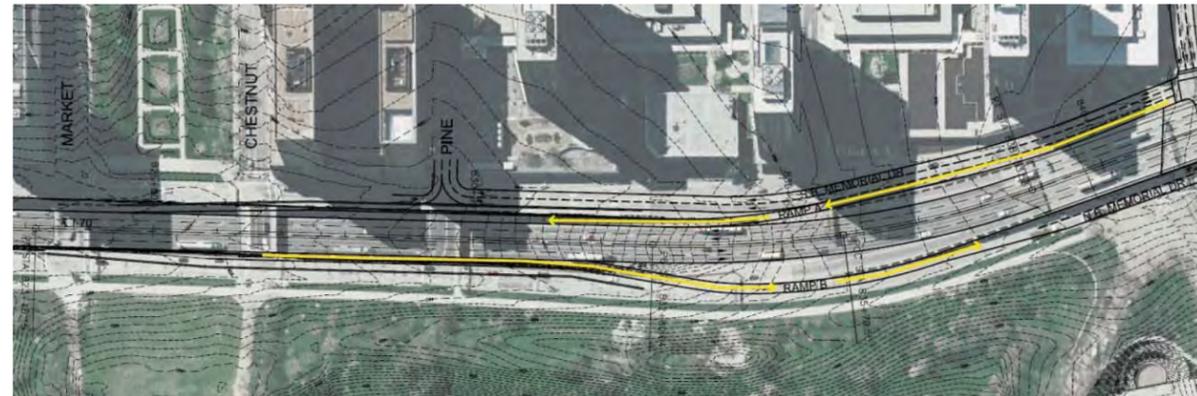


Figure 14: Option 1 Parallel type interchange for proposed I-70 ramp reversal

Alignment and gradient information for Interstate 70 and Memorial Drive was obtained from historic plan and profile drawings. CAD drawings are currently not available. In Exhibit 5 at the end of this document, I-70 stationing is projected onto the ramps. In the profile view, the long dash represents the I-70 profile grade, and the short dashed line represents the existing Memorial Drive grade. The solid line represents the new ramp profile grade. New ramp grades are all less than the allowable maximum of 6%. A grade of 6% is shown on the drawing where the exit ramp ties into the existing I-70 profile.

The AASHTO publication *Geometric Design of Highways and Streets, 2004*, provides design guidance for both the taper and parallel type of interstate interchange ramp. It is understood that MoDOT prefers the parallel type, Option 1 utilizes this for both the on-ramp and off-ramp. The lengths for ramp deceleration and acceleration were extracted from Exhibits 10-70 and 10-73 without any adjustments for grade. The 300-foot closing taper on the acceleration lane and the 250-foot opening taper on the deceleration lane are MoDOT standards. Ramp A (I-70 on-ramp) and Ramp B (I-70 off-ramp) have 550'R horizontal curves. The minimum allowable is 533'R. A tangent has been provided between the reverse curves with enough length to allow for normal super elevation transitions.

The depressed section of I-70 is not wide enough to accommodate the acceleration and deceleration lanes so the retaining walls within these limits will need to be relocated if these lanes are required. Additional lanes will also require reconstruction of the Pine, Chestnut and Market Street bridges above due to required width and relocated retaining walls. A deceleration lane is not required if a Tapered off-ramp design is used, as shown below in Option 2.

Table 1: Roadway Design Criteria

	I-70	Interstate Ramps	Memorial Drive	Market Street	Poplar, Walnut, Chestnut, Washington, Leonor K Sullivan
Functional Classification	Interstate	n/a	Minor Arterial (urban)	Principal Arterial (urban)	Urban Collector
Design Speed	60 mph	40 mph	35 mph	35 mph	35 mph
Horizontal Geometrics					
Radius (min) no S.E	10,000 ft	6,000 ft	510 ft	510 ft	510 ft
Radius (min) 4% S.E	1,500 ft	533 ft	371 ft	n/a	n/a
Lane Width	12 ft	12 ft	12 ft	12 ft	12 ft
Shoulder Width	4 ft LT, 10 ft RT ²	4 ft LT, 8 ft RT	None	None	6 ft
Sidewalks	No	No	Yes	Yes	Yes
Super Elevation (max)	4%	4%	4%	6%	6%
Vertical Geometrics					
Maximum Grade	4%	< 6% ³	8%	8%	8%
Stopping Sight Distance	570 ft	250 ft	250 ft	250 ft	250 ft
Crest Vertical Curve	151	44	29	29	29
K _{min} (Sag Vertical Curve)	136	64	49	49	49
Vertical Clearance	16.5 ft	16 ft	16 ft	16 ft	14 ft

Notes:

1. Minimum acceptable LOS is D
2. Retaining walls should be located no closer than 2-ft beyond the edge of shoulder (AASHTO 2004)
3. The value shown has been provided by MoDOT. See AASHTO 2004 p. 829 for a discussion of ramp grades

Option 2: Westbound I-70 Tapered Off-Ramp

Using the taper type interchange, a preliminary review shows that both ramps could likely be constructed without any design exceptions. Figure 15 shows a plan that includes a full acceleration lane onto I-70 westbound, and deceleration within the tapered section from I-70 westbound. A deceleration lane would not be required if a tapered off-ramp design is used. The Tapered option is still being studied from a geometric standpoint but is assumed to be achievable at this point.

Walnut, Market and Chestnut Street overpass bridges that cross the widened section of I-70 are planned to be removed, so they do not impose any design limitations. The Pine Street Bridge will need to be replaced if acceleration and deceleration lanes are necessary.



Figure 15: Option 2- Tapered type interchange for proposed I-70 ramp reversal

4. FHWA Feedback: Potential Concerns

The following issues have been identified as potential concerns for discussion and agreement with FHWA.

- Decking over I-70, replacement of bridges across I-70, and construction staging adjacent to Downtown St. Louis (Section 2.1);
- Flipping of ramps north of Pine Street and associated requirements for ramp design and number of I-70 through lanes (Sections 2.2 and 3.2). Both parallel and tapered ramps are being studied for the proposed westbound off-ramp;
- Ramp reconfigurations will require an AJR with both MoDOT and FHWA approval. Will the AJR be handled by the Jefferson City, Missouri office or will it be processed in Washington D.C.?
- The project may also require a NEPA action; most likely an amendment to the existing Arch grounds Record of Decision (ROD).
- Adding new link to westbound I-70 and/or increasing existing on-ramp capacity at Biddle Street (Section 2.3);
- Potential program underneath interstate highways and ramps at the south end of the Arch Grounds (Section 2.4);
- Modifications to interstate signage (Section 2.5); and
- FHWA policy requirements for full-diamond interchanges and interchange spacing (Section 3.1). Existing ramp configurations in downtown St. Louis include one split-diamond and one half-diamond (serving trips to/from the north). The proposed I-70 ramp changes would create one half-diamond interchange (serving trips to/from the south) and one split-diamond interchange. The spacing between proposed ramps are less than the recommended distance, but no worse than existing conditions.

Exhibit 1: Study Area

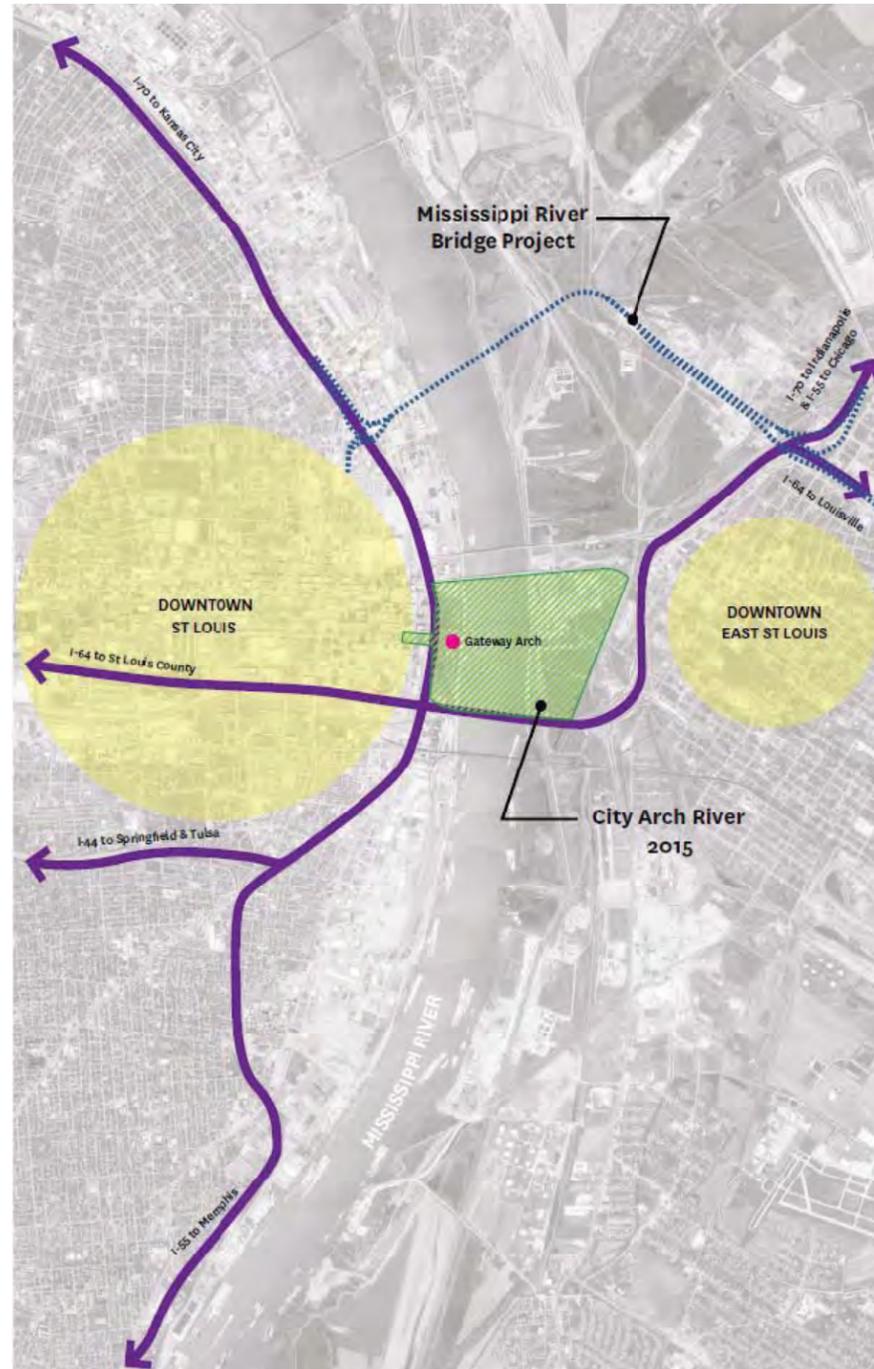


Exhibit 2: I-70 Plan and Profile Studies for Option 1 – Parallel Ramp Type

A2 Pre-AJR Briefing Memo 1: Project Overview – June, 2011

MVVA, Inc.

CAR 2015

Pre-AJR Briefing Memo 1: Project
Overview

Draft 1 | June 2011

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This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 215132-00

ARUP

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Figure 12: Proposed service loop

Figure 13: I-70 Ramp reversal

1 Introduction

1.1 Purpose of this Memo

This is the first in a series of memos of background information setting context for an Access Justification Report (AJR) for the CAR 2015 project. These are stakeholder briefing memos for the Missouri Department of Transportation (MoDOT) and the Federal Highways Administration (FHWA) about the project, its aims and implications.

- Section 1 of this memo provides an introductory overview of the CAR 2015 proposed transportation interventions at regional and local scales.
- Section 2 describes the context of CAR 2015 within the regional network, including other concurrent interstate highway projects in the New Mississippi River Bridge (MRB) and Poplar Street Bridge (PSB) projects, and impacts on CAR 2015.
- Section 3 outlines the local improvements in St. Louis and around the Arch Grounds and details on why they are part of the project.
- Section 4 describes the traffic model scenarios that are being tested to understand the impacts of all of the transportation interventions on traffic flow at the comprehensive network level as well as at the city street level.

Subsequent briefing memos will cover:

- Traffic Modeling Approach and Assumptions;
- 2015 Model Results; and
- 2035 Model Results.



Figure 1: MVVA Rendering of CAR 2015

1.2 Project Overview

The aim of The City + The Arch + The River 2015 project (CAR 2015) is to reconnect the Jefferson National Expansion Memorial (JNEM) and the Gateway Arch to the city, increase parkland and open space and offer an enhanced user experience to visitors, workers and residents in downtown St. Louis. Surrounded by major roadway infrastructure, the JNEM Park (Arch Grounds) is isolated from the rest of the city. Its location and the condition of the infrastructure around it discourages visitor exploration of downtown St. Louis. Conversely, visitors to downtown do not take advantage of the Arch Grounds.

This project originated from a design competition organized by national park supporters, the design community and leadership from Missouri and Illinois, with the following ten project goals in mind:

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 Historic 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 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.

MVVA and the design team propose to achieve these goals through the following initiatives to improve pedestrian and vehicular access and circulation:

- Use the areas of Laclede's Landing, the Old Courthouse and Choteau's Landing as gateways into the Arch Grounds, encouraging Arch users to travel through those areas and support local businesses during their visit to 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, downtown, and around the Old Courthouse;
- 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;
- Support visitors' and commuters' ability to 'park once' then access the Arch Grounds and tour St. Louis as a pedestrian and/or cyclist; and
- 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.

2 CAR 2015 Network Context

2.1 I-70, MRB and PSB Projects

I-70 is an east-west interstate that crosses the country from Baltimore, MD to the western edge of the Fishlake National Forest in central-west Utah. I-70 currently connects Illinois with Missouri via the Poplar Street Bridge over the Mississippi River along the southern edge of the Arch Grounds, shown in Figure 2 below. Upon crossing the river, I-70 continues north, running from an elevated section at the southwest corner of the park to a depressed section along the western edge of the Arch Grounds, then again to an elevated section at the northwest corner of the Arch Grounds, ultimately heading west.



Figure 2: Existing and Future I - 70 Alignments

I-70 is currently undergoing a major realignment to divert the mainline highway to the north of downtown St. Louis. This realignment impacts the CAR2015 project area. In the planned future alignment, I-70 will cross into Missouri along a new Mississippi River Bridge (MRB) further north of the Arch Grounds. Those traveling on I-70 requiring access to downtown St. Louis will be able to exit at Cass Avenue, then travel into the city by several routes including North Tucker Boulevard to the west and North 2nd Street to the east.

Frequent users of I-70 often use the Dr. Martin Luther King Jr. Memorial Bridge (MLK) as a bypass to the PSB when travelling between Illinois and Missouri, especially when traffic is heavy on the PSB. When complete, the MRB will reroute a considerable portion of regional east-west traffic from the depressed section of I-70 between the Arch Grounds and downtown St. Louis, to

the new alignment. The new alignment and MRB will remove these movements from the Poplar Street and MLK bridges reducing overall traffic in the downtown area.

MoDOT's PSB project proposes modification or removal of several ramps at the western end of the PSB:

- Removal of ramp between I-70 depressed section/Memorial Drive southbound to PSB;
- Removal of ramp from PSB westbound to I-70 depressed section;
- Removal and replacement of ramp from PSB westbound to I-55/44 southbound; and
- Retrofit of ramp from I-55/44 northbound to PSB eastbound.

The MRB project is proposed to occur across two phases; Phase I is planned for completion in 2015, Phase II completion is assumed to be in 2035 for the purpose of the CAR 2015 AJR and related studies.

2.2 CAR 2015 Project

The following three Figures describe CAR 2015 transportation modifications within the context of the I-70 corridor in St. Louis, including the MRB and PSB projects. These are described as:

- **Figure 3: Existing conditions (2010)**
Figure 3 on the following page shows the existing I-70 alignment and ramp configurations in more detail in and around the CAR 2015 study area including on- and off-ramps;
- **Figure 4: Build year conditions for PSB, CAR 2015 and MRB Phase I (2015)**
In Phase 1 (2015), the Poplar Street Bridge Ramps will be removed, and access ramps from Carr Street will be added to access the new Mississippi River Bridge; and
- **Figure 5: Full buildout conditions for MRB Phase II and new North City ramps (2035)**
In Phase 2 (2035), additional capacity will be added to the bridge, and a second set of off-ramps will provide direct access from I-70 to northern St. Louis.

The additional ramp modifications within the CAR 2015 project area will be described further in Section 3. Appendix A includes the detailed drawings of the new ramp alignments within the CAR 2015 project area.

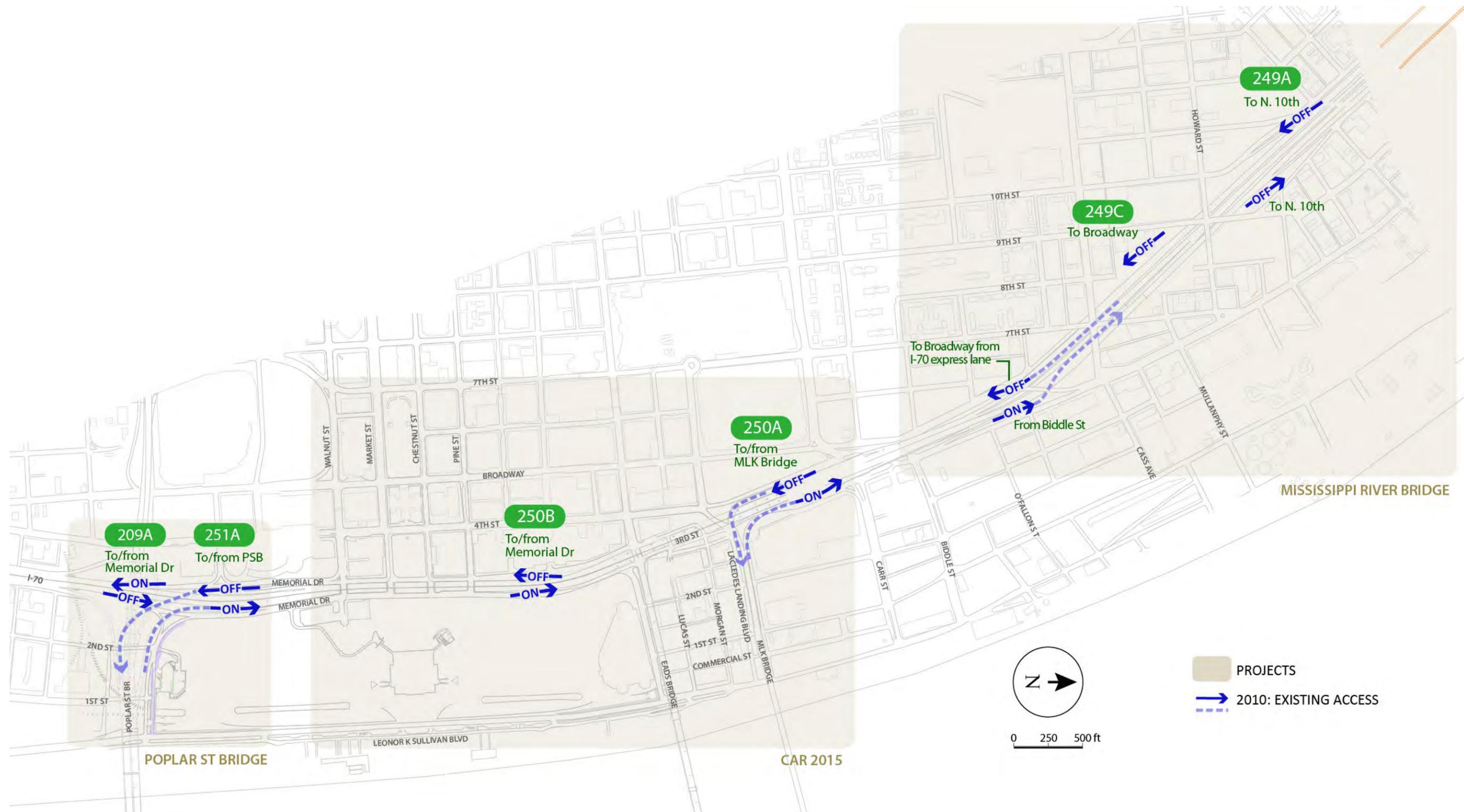


Figure 3: Existing I – 70 Access Ramps

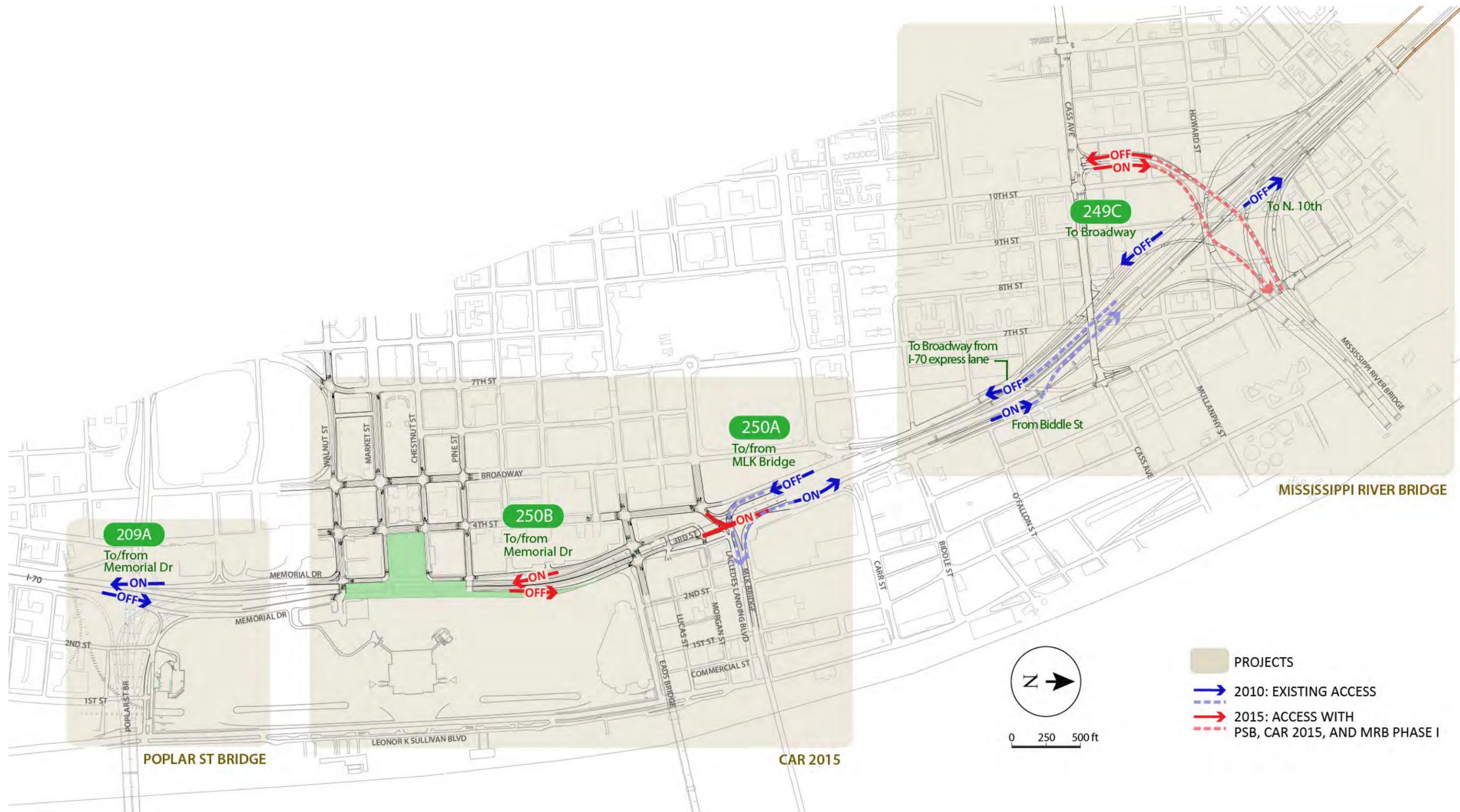


Figure 4: 2015 I – 70 Access Ramps

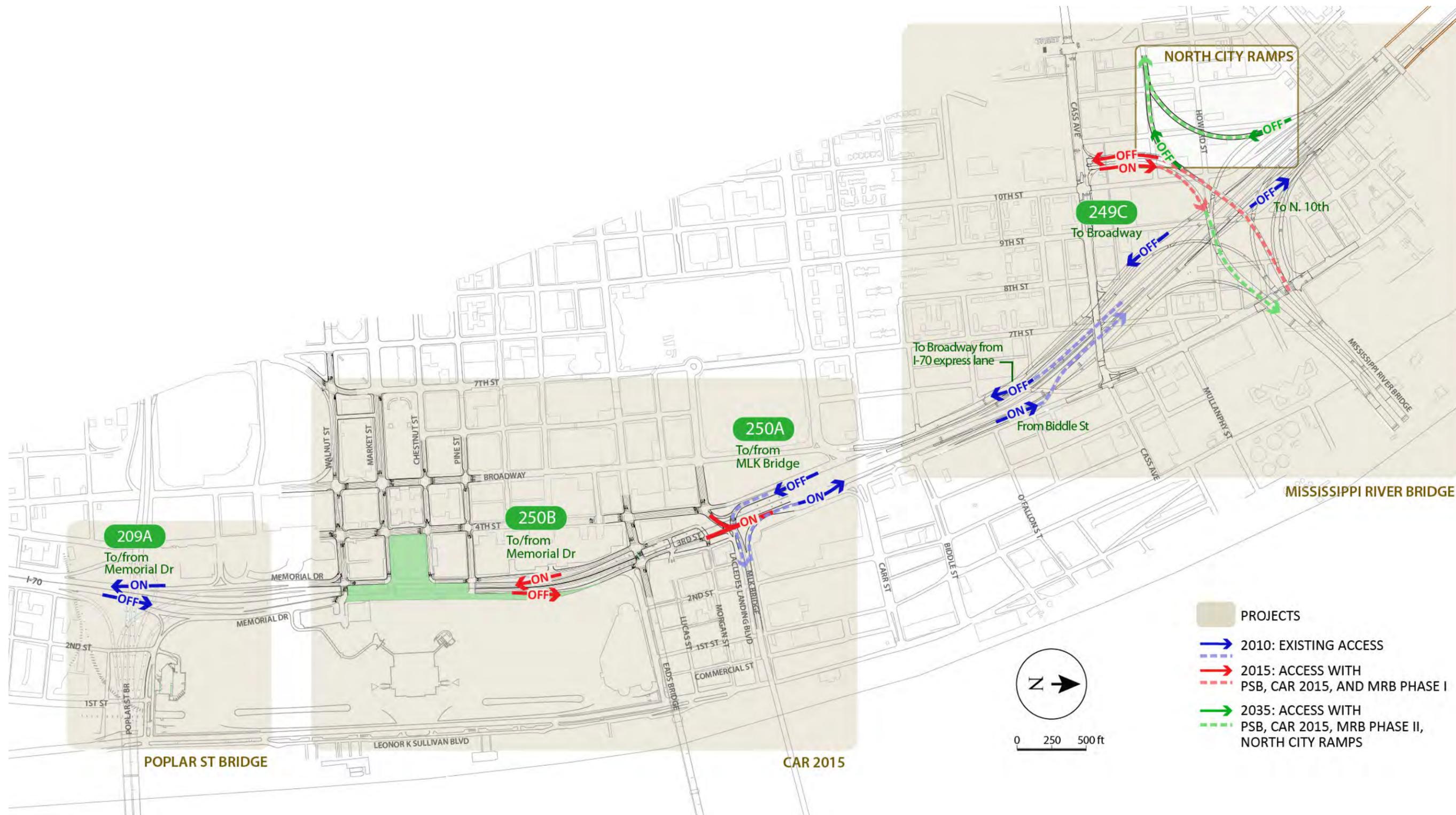


Figure 5: 2035 I - 70 Access Ramps

3 CAR 2015 Transportation Interventions

3.1 Summary of CAR 2015 Transportation Interventions

Figure 22 below shows all of the proposed highway, ramp and street interventions for the CAR 2015 project.

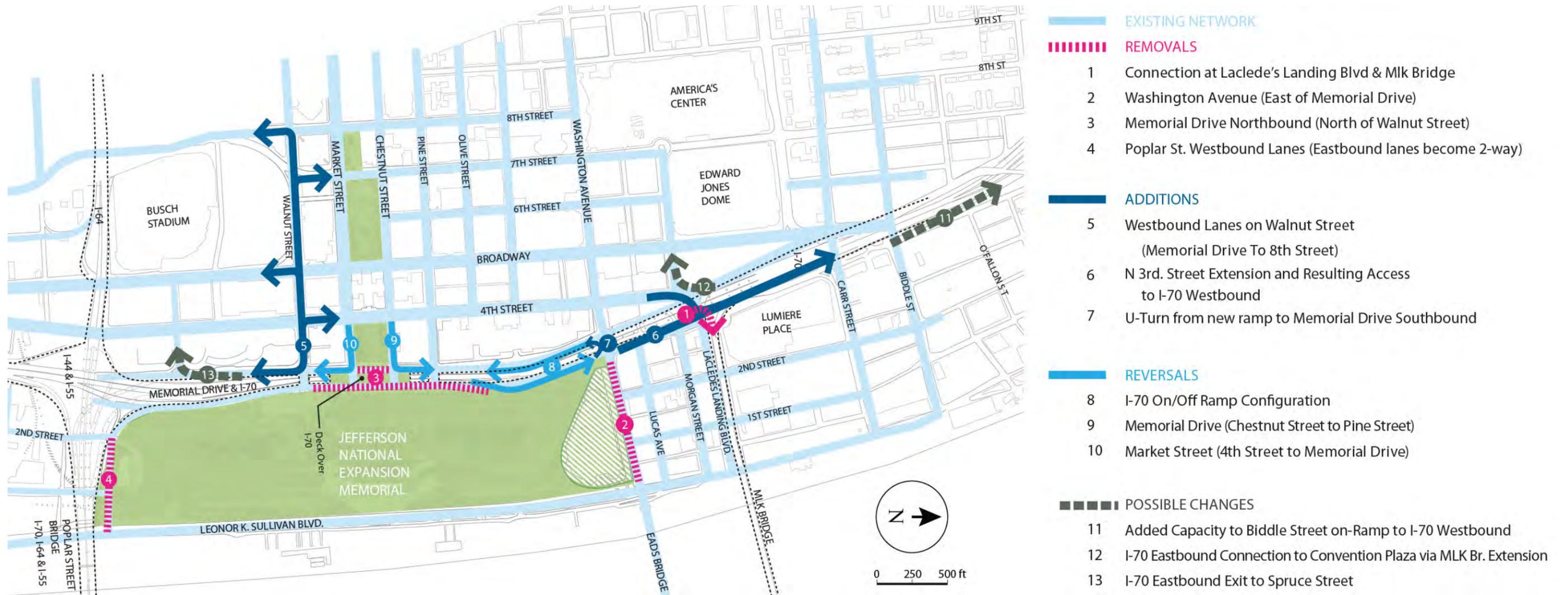


Figure 6: Summary of Transportation Interventions

The following sections step through the existing transportation conditions, issues associated with the current form and the proposed transportation interventions to improve access to the Arch Grounds and reconnect the park to the rest of the City. Conceptual diagrams illustrate each of the issues and proposed modifications in terms of physical changes necessary to serve peak period flows, as well as operational considerations for event periods. Note that in the following figures, north is to the right of the page. I-70 eastbound moves from right to left (i.e. going South) and I-70 westbound moves from left to right (i.e. going North).

3.2 Existing Conditions

As shown in Figure 7, a large, 4-acre parking garage is currently located on the north side of the Arch Grounds. This is the primary access point for visitors who drive in to the park. Washington Street, highlighted below, provides entry and exit into the Arch Ground parking garage from Downtown St. Louis and the Waterfront.

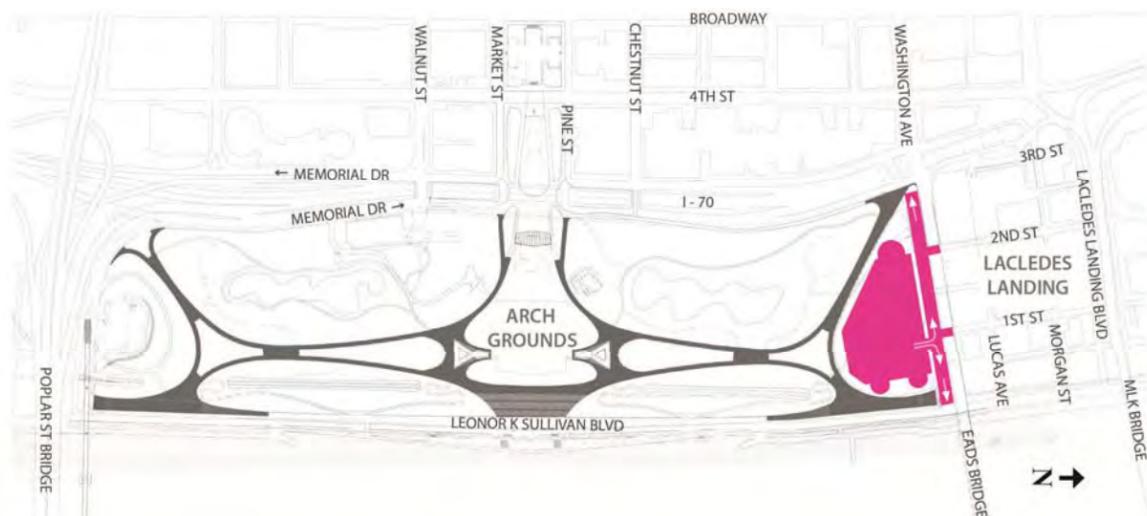


Figure 7: Existing Parking Garage and Washington Street at Arch Grounds

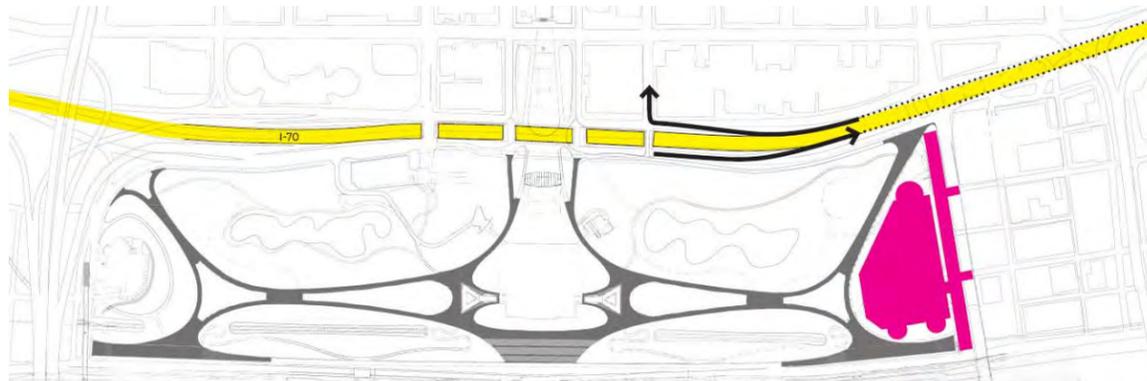


Figure 8: Existing I – 70 Ramps

I-70, highlighted in Figure 8, is a physical barrier between the Arch Grounds and downtown St. Louis to the west. I-70 westbound is currently accessible from an on-ramp from Memorial Drive northbound. An off-ramp into Downtown St. Louis is available from I-70 eastbound.

From I-55/44 northbound and Memorial Drive northbound, access to tourist destinations and businesses north of the Arch, including the America’s (convention) Center, Edward Jones Dome, Laclede’s Landing and the Casino, requires exiting the interstate south of downtown, passing through four signalized intersections (Figure 9), as well as an unorthodox 5-leg intersection at Washington Street (Figure 10). The Washington Street intersection is currently controlled only by a flashing red light. Given Memorial Drive’s design, location, connections and function, it serves as a high-speed, high-volume, vehicle-focused direct link between the interstate and downtown. It is this condition that creates a significant barrier between the City and the Arch

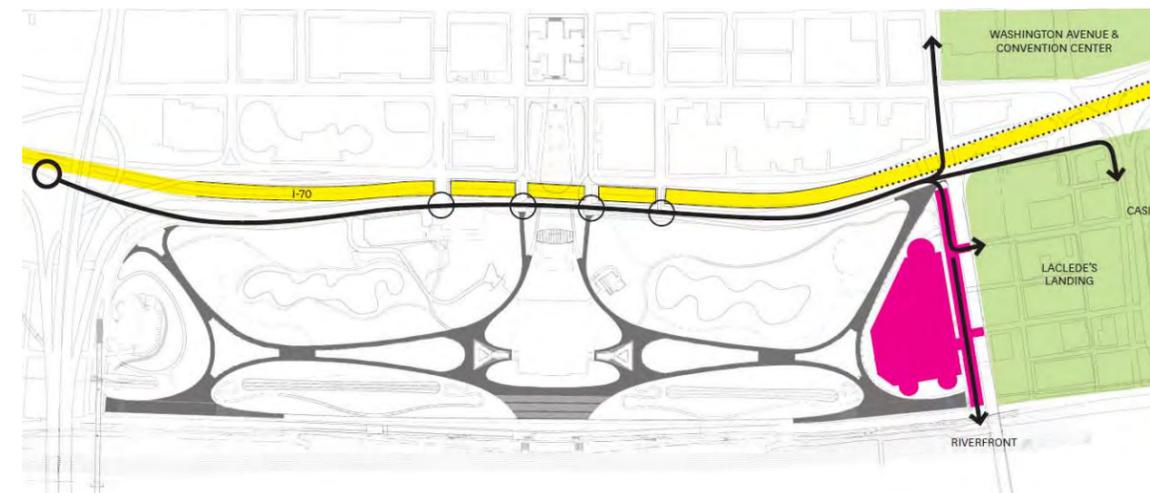


Figure 9: Existing I – 70 Ramps

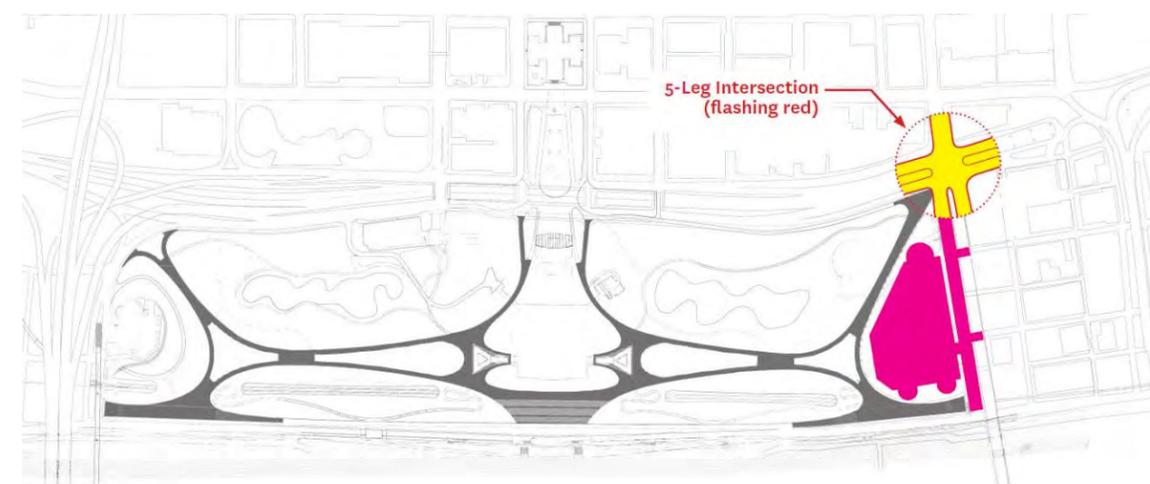


Figure 10: Washington Avenue/Memorial Drive/Eads Bridge Intersection

3.3 Proposed Transportation Interventions

As a first step in reconnecting the Arch Grounds with the rest of downtown St. Louis, the Arch parking garage is proposed for removal. Parking for the Arch will be supported by several garages within walking distance of the Arch entrance, primarily downtown and in Laclede's Landing. This will drastically reduce the demand for Washington Avenue east of I-70 and therefore this segment of Washington Avenue can be reclaimed for pedestrians and park land, extending the Arch Grounds to the historic edge of the Eads Bridge as shown in Figure 11.

Closure of Washington Avenue also allows for the simplification of the 5-leg intersection at the end of Eads Bridge to a standard, signal controlled 4-leg intersection. This move also allows for a strong pedestrian link between the Arch Grounds and the Washington Street retail corridor, America's Center, the Edward Jones Dome, and the Exchange Development.

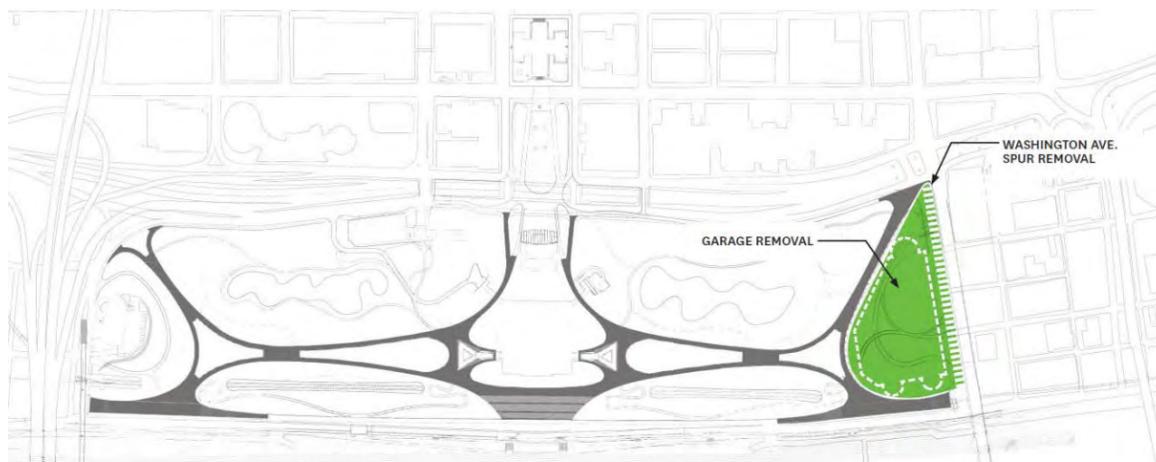


Figure 11: Garage and Washington Avenue spur removal

To maintain vehicle access to 1st and 2nd Streets in Laclede's Landing, and to replace the circulation function of Washington Ave, a service loop is proposed between these streets (Figure 12).

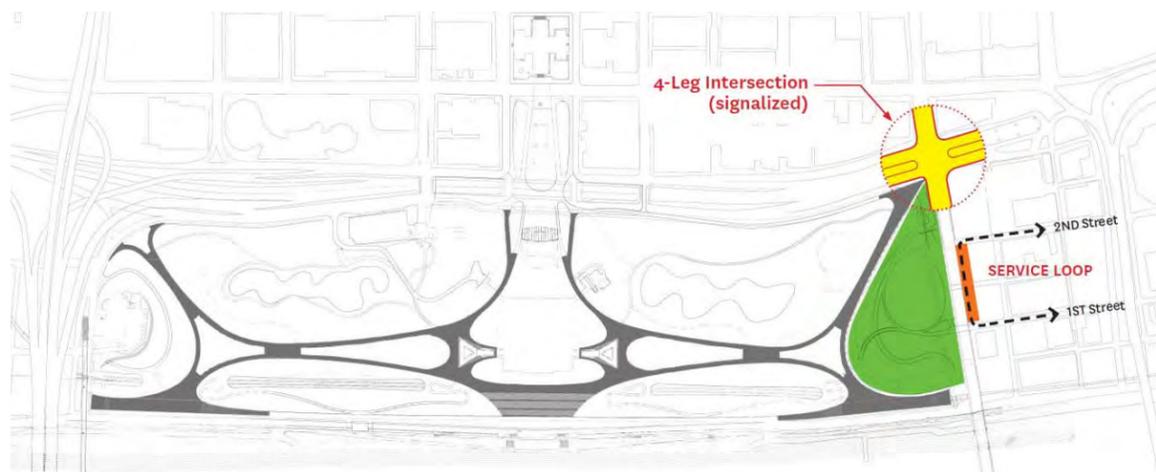


Figure 12: Proposed service loop

The next intervention shown in Figure 13 involves 'flipping' the I-70 interstate ramps from eastbound on to off, and from westbound off to on. To improve access to the northern area of downtown, a new taper style off-ramp from I-70 westbound to Washington Ave is proposed where the current on-ramp from Memorial Drive is situated. In order to maintain I-70 west access to this area and in accordance with FHWA preference for full interchanges, the I-70 eastbound off-ramp to Memorial Drive is converted to a parallel style on-ramp from Washington Ave.

These changes to ramp orientation follow a historic shift of traffic entering downtown from the North, to entering downtown from the South. The overall proportion of users accessing downtown from the South is 10% higher than that from the North. Therefore, the new ramps provide a benefit at the local level while serving the broader, regional traffic movements. Figure 14 shows how access to the central and northern areas of Downtown St. Louis will improve as a result of the ramp reversals and reconfigured intersection.

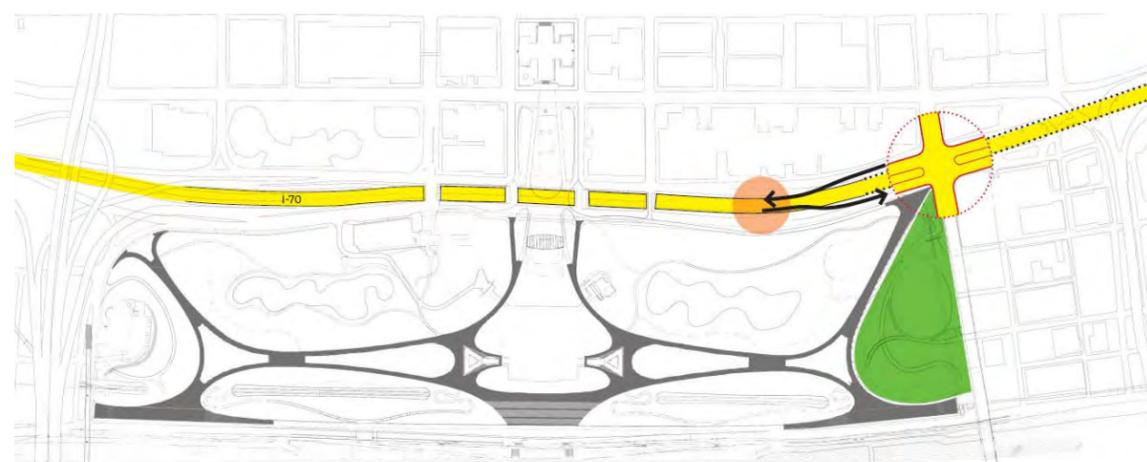


Figure 13: I-70 Ramp reversal

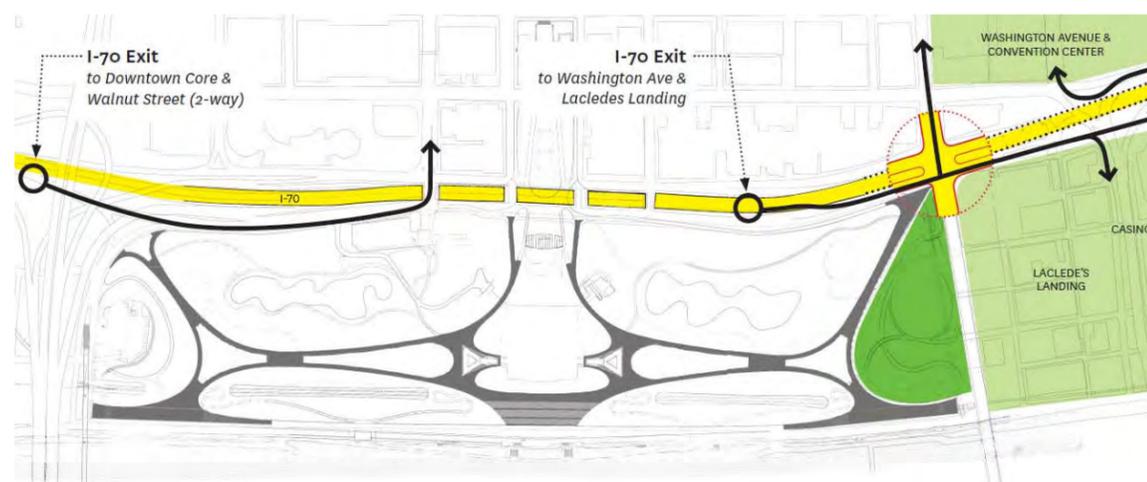


Figure 14: I-70 Access to Downtown St. Louis

Flipping the I-70 ramps provides the opportunity for a major intervention in reconnecting the Arch Grounds to downtown; Memorial Drive northbound will be closed north of Walnut Street to Washington Avenue, and southbound lanes will be closed between Market and Chestnut Streets (Figure 15) and most of the land previously occupied by streets will become Park land. With these modifications, the main vehicle gateway to downtown from the south will be via Walnut Street via the Memorial Drive exit, and from the North will be via the Broadway exit. North-south movements that once used Memorial Drive will now shift to 4th and Broadway. Market and Chestnut Streets on either side of Luther Ely Smith Park will become one-way drop-off and pick-up routes for autos, coaches, RVs as well as handicap parking. These streets will continue to provide access and servicing for adjacent properties. In addition to the Memorial Drive street closures, the deck over I-70 will be primarily for pedestrian access while supporting emergency vehicles and Arch Grounds support vehicles.

Walnut Street is planned as a major East-West access street for Downtown St. Louis, becoming a 2-way street between Memorial Drive and 8th Street. Reversing Memorial Drive from southbound to northbound for the block between Chestnut Street and Pine Street will provide a route for eastbound vehicles on Chestnut Street where it terminates at Memorial Drive. This will be particularly important for service vehicles and buses accessing the proposed pick-up and drop-off zone along Luther Ely Park and for access to the Hyatt Regency. To maintain access to Market Street between 4th Street and Memorial Drive, traffic operations will be reversed to the eastbound direction for that block. With the traffic flow reversal, vehicles can access Memorial Drive south via Market Street to exit the site.

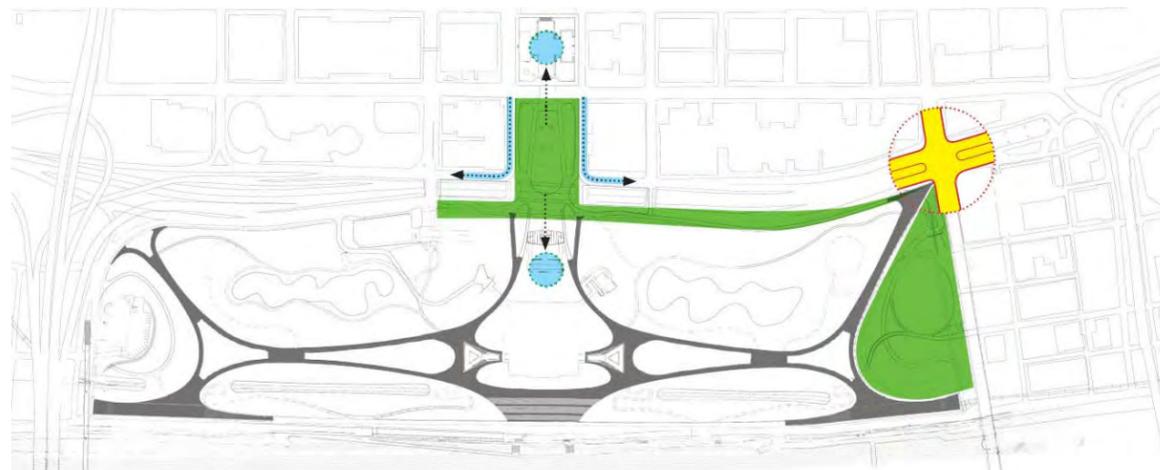


Figure 15: Memorial Drive closure and decking over I-70

Pedestrian access will be vastly improved as a result of the partial Washington Avenue and Memorial Drive closures (Figure 16) due to the removal of unorthodox vehicle movements from the 5-leg intersection, and due to the space gained back through the removal of the connection to Washington Ave. The blue dotted line shows the MetroLink light rail alignment, with a stop adjacent to the Arch Grounds which will now have direct access to the northern edge of the Arch Grounds.

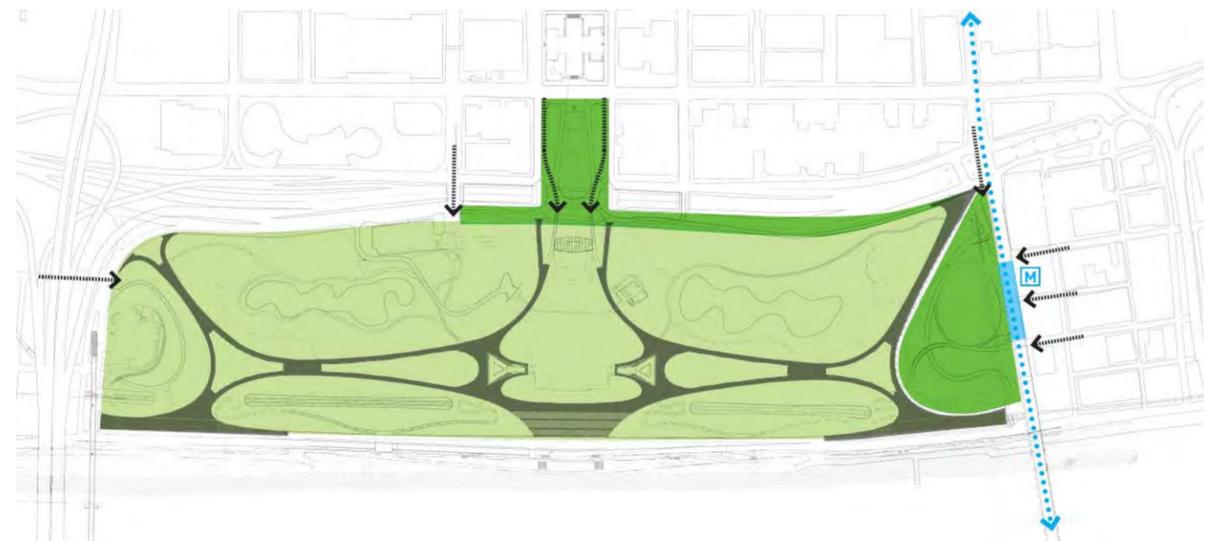


Figure 16: Pedestrian access improvements

Given the new programs planned in and around the Arch Grounds as part of the CAR 2015 project, mobility between destinations for visitors of all ages and abilities will become increasingly important. The size of the park, almost a mile long and about two miles in circumference, combined with the fairly steep east-west grade change makes walking to multiple destinations at opposite ends of the park a challenge for some visitors. A transit circulator will allow visitors to see more of the park by providing convenient and accessible service between major tourist destinations, as shown below in Figure 17. A small electric vehicle is proposed that can run along the edge of the park and seat up to 14 passengers.

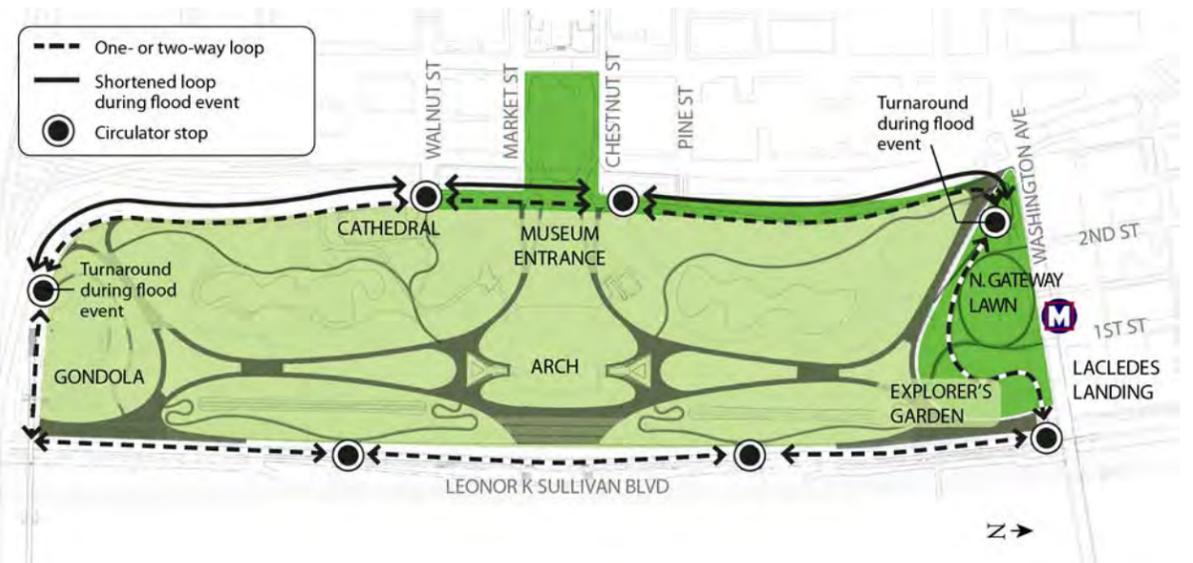


Figure 17: Proposed transit circulator

Finally, to improve access and egress from the north end of Downtown St. Louis, especially during major events, North 3rd Street is proposed to be extended through the intersection with Laclede's Landing Boulevard. This extension will provide a continuous connection from the new I-70 exit at Washington Street to the existing segment of North 3rd Street north of MLK Bridge (Figure 18). The new link will also create a new access from the northeast corner of downtown to I-70 westbound, replacing the movement lost with the removal of the Memorial Drive on-ramp. At a local level, the extension allows access to parking from Lucas Avenue and a link to a proposed taxi stand (Figure 19). Perhaps most importantly, the combination of a regular intersection at Washington and the extension of North 3rd creates opportunity for a new front door and iconic gateway into Laclede's Landing and the Casino (Figure 20).

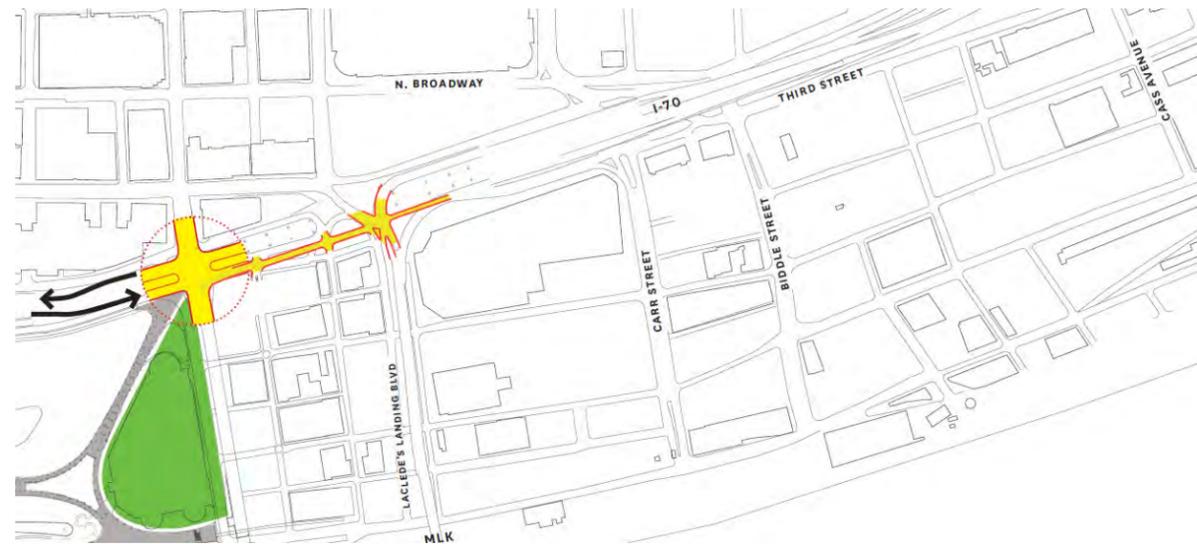


Figure 18: North 3rd Street Extension

During major special events, when the streets of Laclede's Landing are not accessible due to either road closures or throngs of pedestrians, the North 3rd Extension allows the City to manage traffic past Laclede's Landing Boulevard and up to Carr Street. The City will also be able to use the former 5th leg of the Washington Street under I-70 as a u-turn to send traffic down Memorial Drive southbound. During events, the north end of the City will use 3rd Street and other high capacity links for vehicle egress. 1st and 2nd Streets will service internal circulation, and are lower capacity, cobbled roadways that could close down during events for pedestrian use. Figure 21 shows possible egress routes and Figure 22 shows both internal circulation and major vehicular access routes.

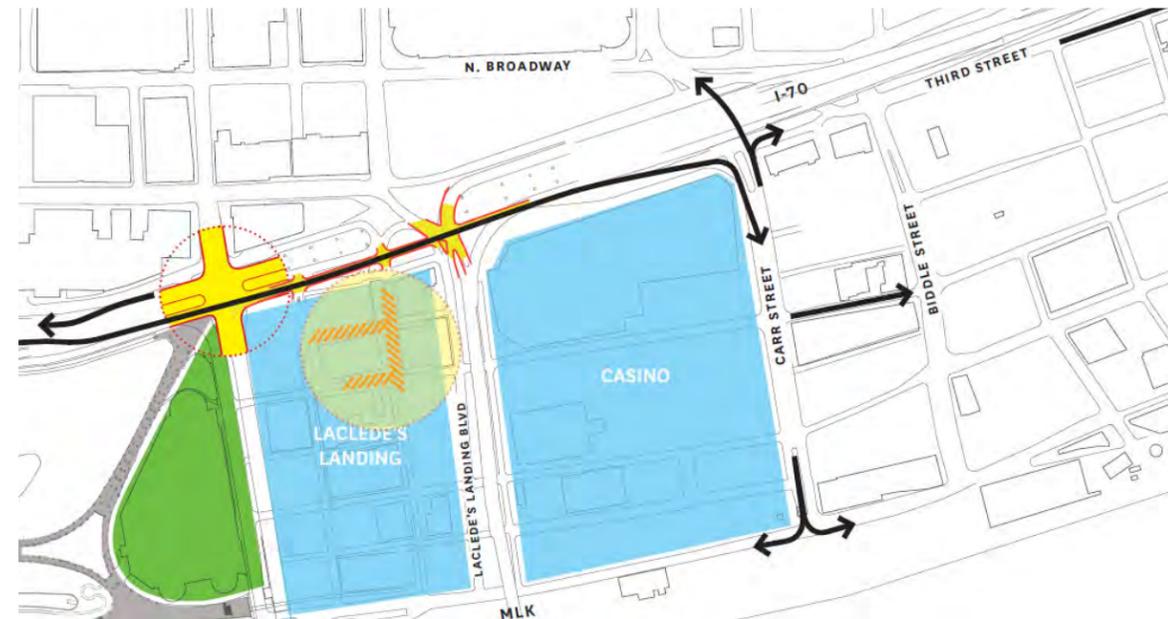


Figure 21: Ingress and egress routes during weekends and special events



Figure 19: Lucas Ave and taxi stand access



Figure 20: Laclede's Landing and Casino access

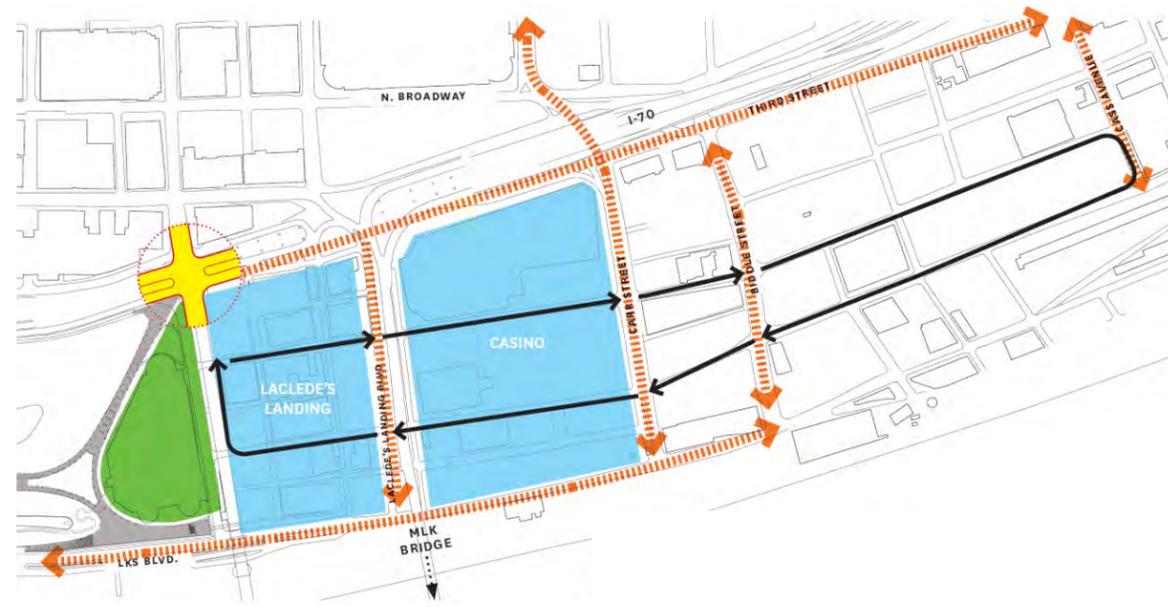


Figure 22: Regional and local circulation

4 Traffic Model Scenarios

As a result of the ramp modifications proposed in CAR 2015, as well as the concurrent MRB and PSB projects on I-70, MoDOT has directed that nine VISSIM model scenarios be tested for inclusion in an Access Justification report (AJR). These scenarios are described in Table 1 below.

Table 1: VISSIM Traffic Model Scenarios

Model	Demand	Comprised of	
1	2010	Existing	
2	2015	CAR2015 no build PSB no build	
4	2015	CAR2015 no build PSB build	
5	2015	CAR2015 build PSB build	
6	2015	CAR2015 build PSB build N. City build	
7	2035	CAR2015 no build PSB no build N. City build	
8	2035	CAR2015 no build PSB build N. City build	
9	2035	CAR2015 build PSB build N. City build	
10	2035	CAR2015 build PSB build N. City build MRB Phase II	

Model 1 will be used to benchmark existing traffic conditions.

Model 2 will demonstrate network performance in 2015 with only MRB project complete.

Model 4 will show impacts of PSB changes to 2015 network.

Model 5 will show impacts of the preferred network with MRB, PSB and CAR 2015.

Model 6 will show impacts of the network with North City ramps.

Model 7 will benchmark network performance in 2035 without PSB ramps and without CAR 2015 project.

Model 8 will show impacts of PSB changes to 2035 network.

Model 9 will show impacts of preferred network with North City Ramps.

Model 10 will demonstrate the ultimate build-out of the project with PSB, CAR 2015, North City ramps and MRB Phase II.

Model notes:

- The model initially denoted as Model 3 was assumed to be not necessary and was deleted.
- All future year models include Phase I of the New Mississippi River Bridge except 10, which assumes Phase II MRB complete.
- CAR2015 includes flipped ramps at Washington, closed Memorial, new Walnut St. bridge, u-turn from Memorial northbound to southbound south of Washington, North 3rd extension and I-70 westbound access.

- PSB includes revised dual lane ramps between PSB and 44/55, removes ramp access from Memorial Drive southbound and PSB westbound to I-70 westbound and removes ramp access from I-70 eastbound to PSB eastbound.
- N. City includes ramps from NMRB westbound and I-70 eastbound (10th St exit) to Mullanphy Street westbound.

A3 Pre-AJR Briefing Memo 2: Traffic Modeling Approach and Assumptions – July, 2011

MVVA, Inc.

CAR 2015

Pre-AJR Briefing Memo 2: Traffic
Modeling Approach and
Assumptions

215132-00

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Figure 3: VISSIM Base Year Model Extents

1 Introduction

1.1 Purpose of this Memo

This is the second in a series of memos of background information providing context for an Access Justification Report (AJR) for The City + The Arch + The River 2015 (CAR 2015) project. These are stakeholder briefing memos for the Missouri Department of Transportation (MoDOT) and the Federal Highways Administration (FHWA) about the project, its aims and implications.

The first briefing memo provided an overview of the CAR 2015 project within the context of St. Louis, the Poplar Street Bridge (PSB) project and the New Mississippi River Bridge (MRB) project. This memo describes the traffic models being developed as part of the planning process, to support the project Access Justification Report (AJR) and environmental documentation being prepared by MoDOT.

- Section 1: Introduction to traffic modeling, why models are required for the CAR 2015 project and what the models will inform;
- Section 2: Model inputs and outputs: inputs necessary to build the models and the performance metrics used to benchmark modeling results;
- Section 3: Base year conditions models;
- Section 4: Base year model calibration process;
- Section 5: Future year models

Subsequent briefing memos will cover:

- 2015 Model Results; and
- 2035 Model Results.

1.2 Traffic Modeling and Simulation

In light of the significant functional modifications proposed by the CAR 2015 project, and the wide geographical area over which they occur, a combination of analysis tools are necessary to adequately investigate and determine how modifications to the transportation system will impact the existing network, and to describe whether proposed changes will meet the project's objectives. In addition to serving the projects' 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.

Analytical/Deterministic Tools (HCM-Based): The platform used to analyze freeway operations was Highway Capacity Software (HCS+), version 5.21, developed by McTrans. This tool 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.

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.

Tools 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 an on and an off-ramps; and
- **Freeway Ramps:** short segments of roadway connecting two roadway facilities.

In order to serve these multiple purposes, a set of VISSIM models were built to investigate freeway movements, ramps and arterials; and a set of SYNCHRO models were constructed to investigate signal timings, intersection and link level of service.

2 Model Inputs and Outputs

2.1 Inputs: Data, Physical Inventory and Operations

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 project.

2.1.1 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 CBB 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) was 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 counts are shown in the Appendix.

2.1.2 Queue Volumes and Observations

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.

2.1.3 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.

2.2 Outputs: Performance Metrics

2.2.1 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 1. Furthermore, given the modeled conditions, a determination was made regarding which critical movement(s) was expected to generate the longest queue.

Table 1: 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

2.2.2 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 2.

Table 2: Basic Freeway Segment Level of Service Criteria (HCM)

Level of Service	Freeway Density (passenger cars/mile/lane)
A	0 – 11
B	> 11 – 18
C	> 18 – 26
D	> 26 – 35
E	> 35 – 45
F	> 45.0

Freeway Weaving:

The HCM defines a weaving segment as, “the crossing of two or more traffic streams traveling 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.”¹ 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 3.

Table 3: 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	> 43.0

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 our study corridor 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.² 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 4.

Table 4: 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

¹ Highway Capacity Manual 2000, Chapter 13 – Freeway Concepts Basic Freeway Segments, page 13

² Highway Capacity Manual 2000, Chapter 25 – Ramps and Ramp Junctions, page 10

3 Base Year Model Development

The based 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 platform.

The figure below shows the general coverage of both the VISSIM and SYNCHRO models including the area of influence of traffic forecasts.

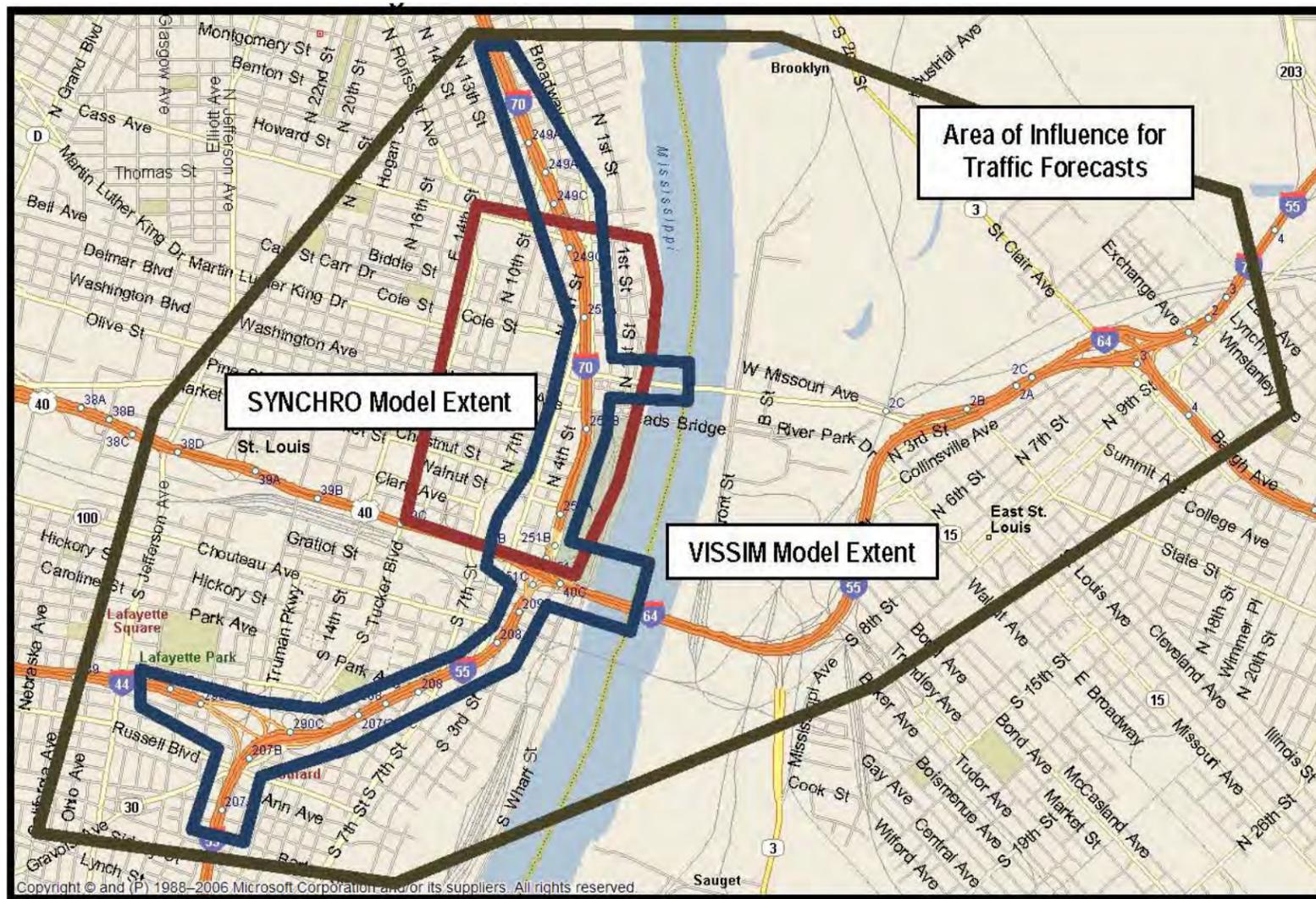


Figure 1: General Extents of VISSIM and SYNCHRO Models

3.1 SYNCHRO Model Development

Year 2010 AM and PM SYNCHRO models of the entire study area were created. 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 timing 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.

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 parameters used within the City of St. Louis' signal timing system and were zones 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 7th Street;
- Convention Plaza with 4th Street and 3rd Street;
- Cole Street with Broadway Avenue and 4th Street; and
- Biddle Street with Broadway Avenue and 3rd Street.

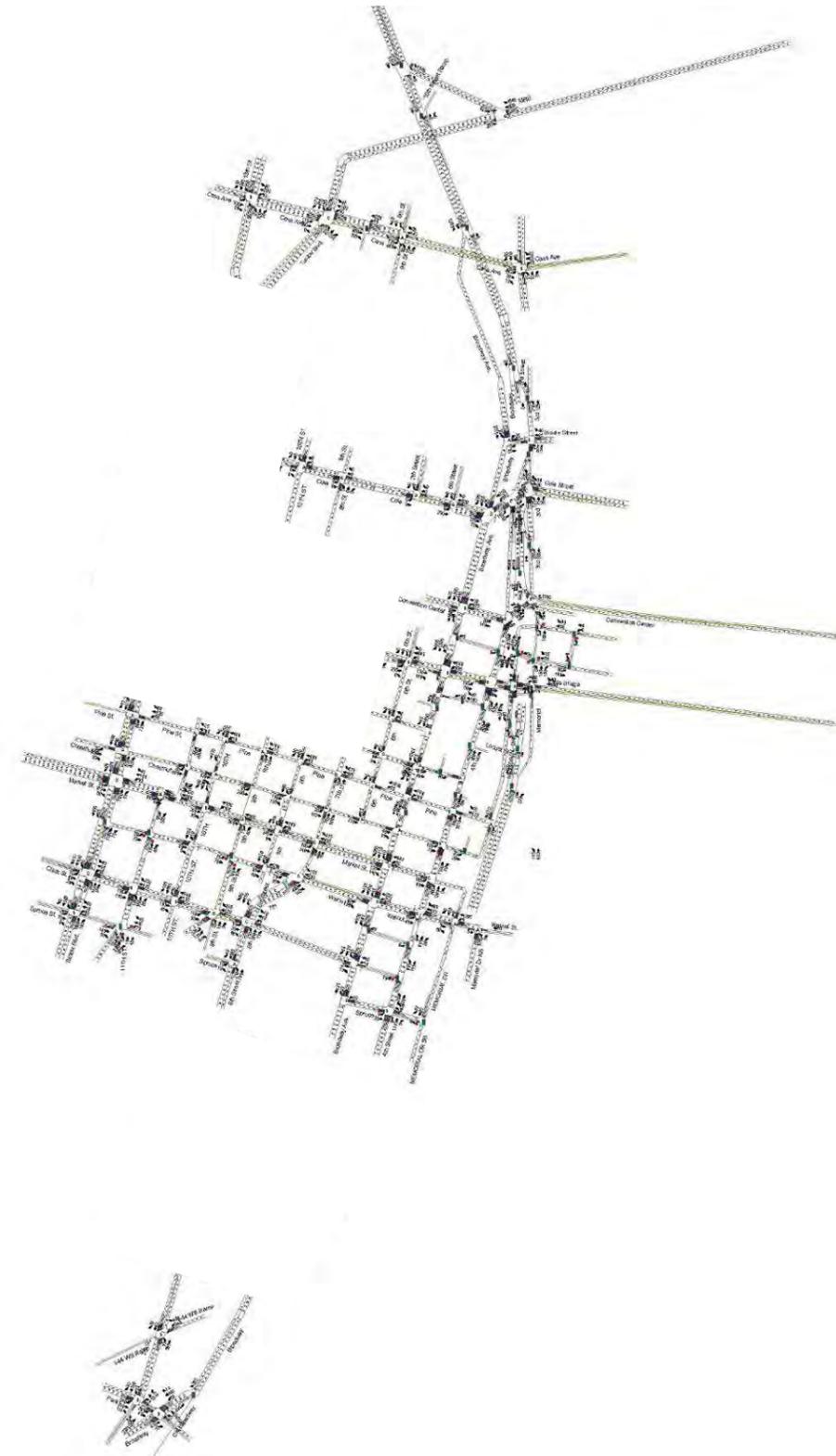


Figure 2: SYNCHRO Base Year Model Extents

3.2 VISSIM Model Development

3.2.1 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.

3.2.2 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.

3.2.3 Traffic Volumes

Traffic can be input in VISSIM using two basic types of routing procedures: 1) origin to destination paths or 2) intersection turning movement volumes. Even though these two methodologies produce the same traffic volumes, it is recommended to use the origin – destination 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 origin – destination 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 "Data Collection" section. The peak period was chosen to capture conditions during the most congested periods of travel over the entire study network.



Figure 3: VISSIM Base Year Model Extents

4 Calibration and Validation

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.

4.1.1 SYNCHRO

The SYNCHRO model was calibrated previously for use on the City’s 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.

4.1.2 VISSIM

As part of the validation process, MoDOT worked with CBB 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 we compared the congestion and queuing patterns observed in the field 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.

4.2 Comparison of SYNCHRO and VISSIM Results

As a final validation measure we compared our SYNCHRO and VISSIM results 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 Future Scenarios

5.1 Future Traffic Generation

5.1.1 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, the following table 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 effects 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: 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%
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%

Despite this downward trend in population, the CAR 2015 modeling effort initially incorporated a 0.8% annual growth to increase the 2010 baseline traffic to the year 2015. This growth rate was based on the AJR for the New Mississippi River Bridge, which was developed from the regional travel demand model (TransEval)³. Upon further review, an assumed growth rate of 0.8% per year in addition to then projected traffic growth due local development was determined by the modeling

³ Mississippi River Crossing AJR, October 2003 – Page 30: “The No Build traffic projections for design year 2030 estimate just over 215,000 vehicles crossing the four existing downtown bridges (McKinley, MLK, Eads and Poplar Street). This is an increase of 21 percent over the 2004 base year crossing. In addition, traffic is expected to increase by 19 percent on the other regional bridges (U.S. Route 67, I-270 and I-255), as shown in Table 10.”

team, in conjunction with MoDOT, to be excessive and out of context with St. Louis’ historic traffic patterns.

Subsequently, the annual growth rate was reduced to 0.2% per annum for the period from 2015 to 2035, in an effort to maintain some level of conservative background growth, but at a less aggressive rate. This lower rate was agreed with MoDOT.

5.1.2 Development Growth

During early project meetings, local developers strongly encouraged the project team to “plan for success”. In other words, to incorporate future traffic growth induced by the completion of a number of proposed development projects in the St. Louis CBD.

After some investigation, the project team identified the following developments scheduled for partial or full completion within the project forecast timelines (Table 1). 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). Forecasts from 2015 to 2035 assume 100% occupancy for all developments.

Table 6: 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.

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 will allow residents and visitors to travel to and from the developments by means other than vehicles and will not generate the AM inbound and PM outbound vehicle trips typical of CBD commercial and office space. Therefore, trip generation projections to the year 2035 include reductions to the standard ITE generation rates based on a successful blend of land uses in downtown. In general these reductions are due to the following:

Internal trip capture – within mixed use developments not all trips generate an incoming or outgoing vehicle trip, some trips are captured internally.

Mode shift – in town residents walk or bicycle to downtown jobs, some trips shift to transit.

Overlap – to avoid double counting increased trips in background growth and those trips associated with specific developments.

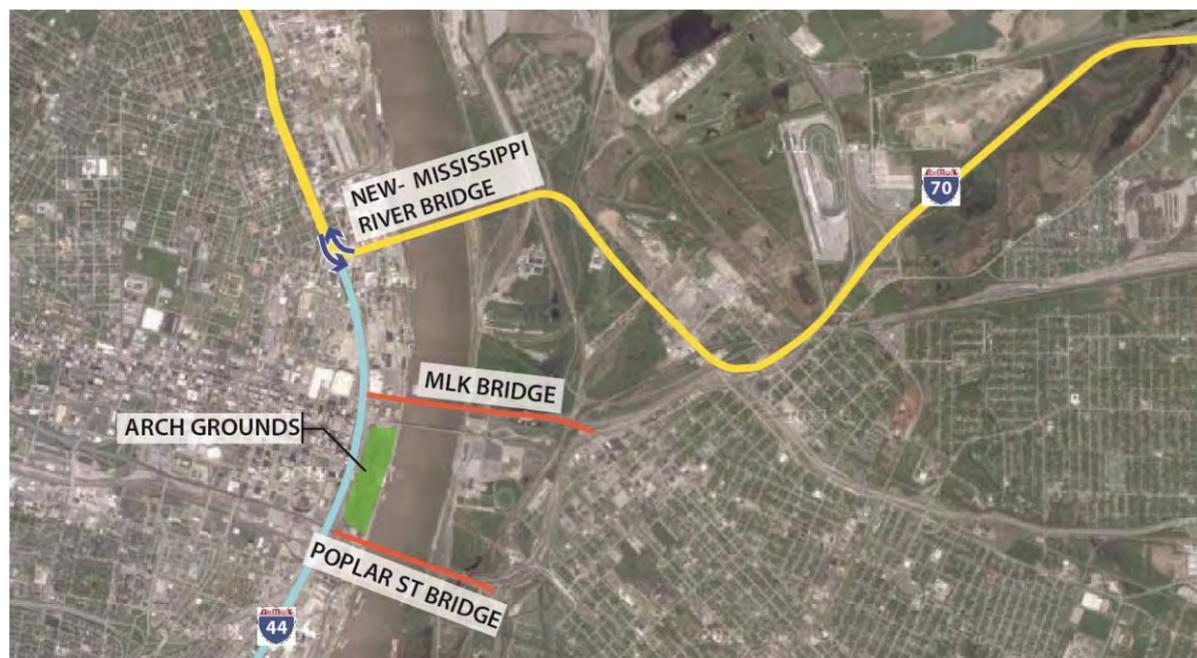
Reductions from ITE trip generation rates were taken as follows:

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	-	-
2035 Development				
Mercantile Exchange	60	20	30	20
Laurel Development	60	20	30	20
Ball Park Village Phase II	60	20	-	-
Bottle District	75	20	30	20
Lumière Casino Phase II	60	-	30	-

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.

5.2 Network Changes and Resulting Traffic Shifts

5.2.1 New Mississippi River Bridge and Interstate 70



Access and Movements

The New Mississippi River Bridge (MRB) is scheduled to open in 2015. This first phase 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). Phase II of the NMRB would incorporate a companion, 4-lane, bridge and connections to/from I-44. There is no construction timeline for Phase II at this time.

I-70 will be rerouted from its existing alignment across the PSB and through the depressed section in downtown, to the new alignment which travels over the new bridge and to the north of downtown St. Louis. 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 along 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 (Poplar Street Bridge, Martin Luther King Bridge) for those people making regional trips between Missouri and Illinois on I-70. Some work 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;
- Martin Luther King Bridge: 50% vehicle reduction, both directions; and
- 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 will continue to utilize the PSB until the NMRB Phase II offers an alternative.

5.2.2 From the North and from the West to Downtown



Access and Movement

Existing movements coming from North and Northwest of St. Louis, eastbound on I-70, currently have access into downtown via four exits:

- Movement A. Exit 249A to North 10th 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

The MRB Project will eliminate the North 10th Street exit (Movement A) to downtown. The CAR 2015 project proposes to remove the Memorial Drive exit (E).

Modeling Assumptions

Within the 2015 traffic models there are three access scenarios being investigated for vehicles that currently use downtown exits:

- No new exit from the north to downtown is added. All vehicles currently using A and E would split to existing exit movements B (50%) and C (50%).
- A new “North City” off-ramp connection to the St. Louis CBD (H) from the MRB. This ramp would potentially build a connection between the I-70 exit to the NMRB and Tucker Boulevard at Cass Avenue. This would provide the option of a new, direct connection into downtown via Tucker and to the west side of the St. Louis CBD. This option would be anticipated to accommodate 100% of the North 10th Street ramp closure volume shift. Although the ramp alignment changes, the location is generally similar to the existing ramp and the access is improved. All vehicles currently using E would split to existing exit movements B (50%) and C (50%).
- A new connection (I) is built from Exit 250A that links into downtown via Convention Plaza (existing movement D links only to the Eads Bridge and Laclede’s Landing). 100% of vehicles using E would utilize this new ramp. In addition, roughly 50% of the traffic currently using the Broadway ramp (B) would shift to this ramp as well due to the increased congestion resulting from the 10th Street ramp (A) closure.

In addition, one other potential scenario may be tested:

- A new ramp (J) which could link to Spruce Street where the existing ramp to PSB currently diverges. 100% of vehicles currently using E may utilize this new ramp. As above, some additional traffic may also shift from B due to the increased congestion on that ramp due to the removal of A.

5.2.3 From the South and from the East to Downtown



Access and Movement

Existing movements into St. Louis from the South (I-70 westbound, I-44 eastbound, and I-55 northbound) access downtown via four main exits:

- Movement E. Exit 208 to Park Avenue / 7th Street
- Movement A. Exit 209A from I-44/I-55 to Memorial Drive northbound
- Movement B. PSB westbound to I-70 westbound and Memorial Drive northbound
- Movement C. Exit 249A to North 10th 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 to replace access to the north end of downtown with a new set of Interstate ramps to Washington Street (F). Vehicles can continue to access downtown via movements A and B, and those desiring the north end of St. Louis and Laclede's Landing will be able to use F from the depressed section of Interstate highway which will become I-44 when I-70 is relocated to its new alignment across the MRB.

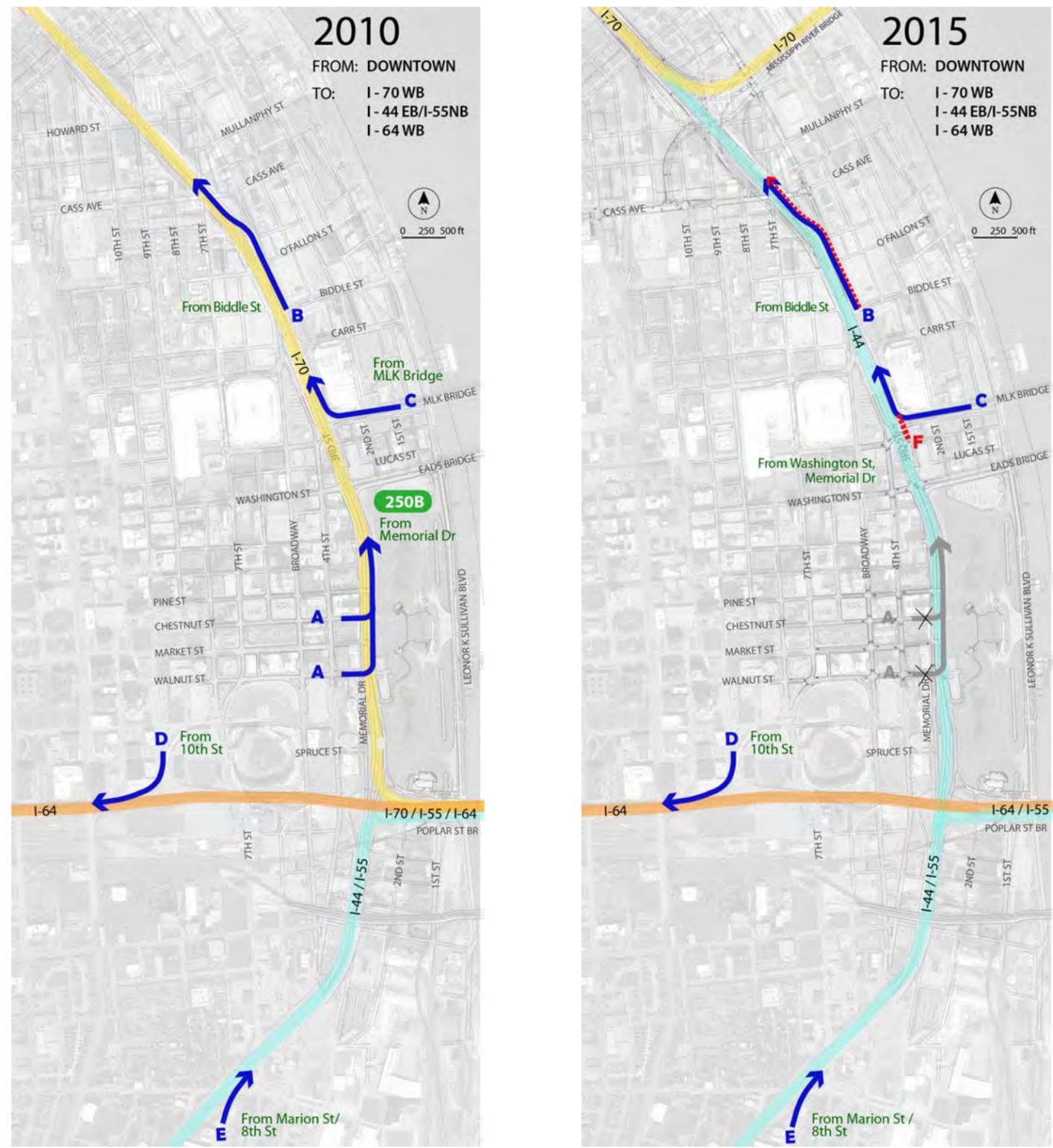
MoDOT's PSB project proposes to remove the connection from PSB westbound to I-70 westbound (designated as I-44 in the future). The I-70 to I-70 movement served by the existing ramp will shift to the MRB along with I-70's new alignment. The movements between the PSB and the depressed section (I-44 westbound) would be removed.

Modeling Assumptions

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

- 40% of vehicles currently using A would shift to F.
- 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.
- 15% of vehicles that currently use Pine Street from Memorial drive northbound would take the new movement F and would utilize the u-turn facility to approach Pine from Memorial Drive southbound.
- 75% of vehicles that use B would continue to utilize B. The other 25% would use G.
- All vehicles currently using C would continue to utilize C.

5.2.4 From Downtown to the North and to the West



Access and Movement

Existing movements departing downtown St. Louis destined for the North and Northwest can currently access the interstate from four areas:

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

The CAR 2015 project proposes to remove the on-ramp from Memorial Drive (A). In order to replace the interstate on-ramp access from downtown, the project proposes to modify North 3rd Street to create a new City street connection between the segment of Memorial Drive that exists west of Lacledes Landing, and the segment west of North 3rd which sits between the Lumiere Casino and the elevated portion of the interstate highway. This link creates new access from the CBD to the existing MLK/North 3rd 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.

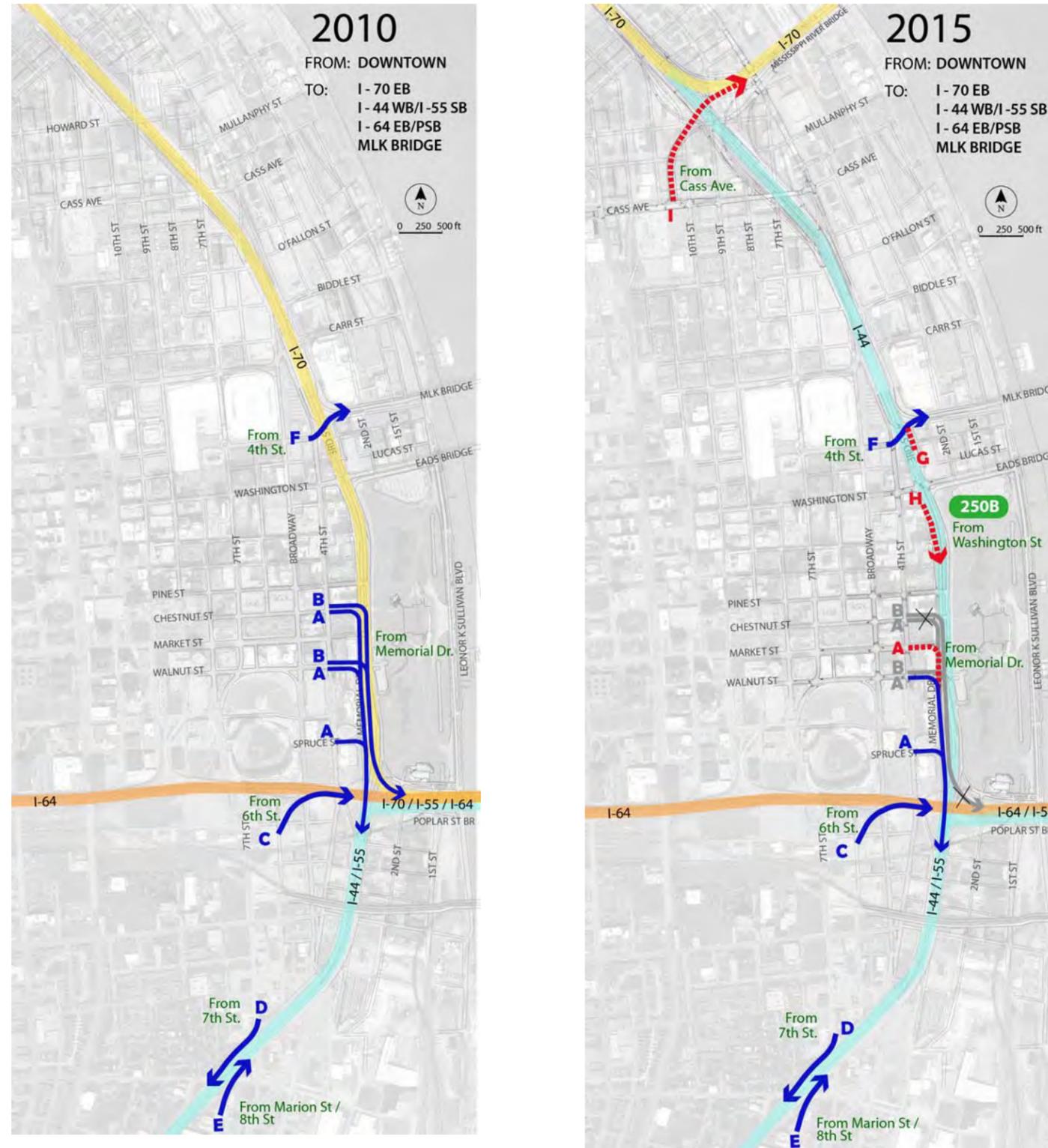
In addition, the capacity of the Biddle Street on-ramp to westbound I-70 is proposed be widened to a 2-lane ramp that merges into a single-lane I-70 entrance.

Modeling Assumptions

Within the 2015 traffic models, it is assumed that the new North 3rd extension (F) and widened Biddle Street on-ramp (B) would serve those movements that formerly used Memorial Drive on-ramp (A):

- 45% shift to F; and
- 55% shift to B.
- The expectation is that F would be a more attractive option for the relocated movements than B. However, the intersection of 4th Street with Convention cannot accommodate the full volume (990 vehicles) as a right-turn movement. Therefore, this projected split was achieved by an iterative process that balanced the impacts of the relocated traffic on the intersections at 4th Street with Convention and 4th with Biddle/Carr. The balancing effort also took into consideration the existing capacity constraints for ramp B (the signalized intersection, and merging movement with I-70).

5.2.5 From Downtown to the South, the East and Illinois



Access and Movement

Existing movements leaving downtown headed to the south or to I-70 eastbound to Illinois currently have several access options:

Movement A. From Memorial Drive southbound to I-44/55

Movement B. From Memorial Drive southbound east across the PSB

Movement C. From 6th Street to I-64 eastbound across the PSB

Movement D. From 7th Street to the south via I-44/55

Movement E. From Marion Street / 8th Street to I-44/55 linking to the PSB

MoDOT's proposed PSB Project would remove the ramp that links Memorial Drive southbound to PSB eastbound, under the assumption that this movement would be replicated by proposed access onto the NMRB from Cass Ave to I-70 eastbound.

The CAR 2015 project proposes to create a new on-ramp into the depressed section from Washington Street (H), leading to I-44/55.

Modeling Assumptions

Within the 2015 traffic models, it is assumed that:

- 25% of the traffic utilizing A would shift to H, based on assumed volumes originating at Olive and Washington two parking garages destined to southbound I-44/55;
- Upon opening of the NMRB, 45% of the existing traffic utilizing B to the PSB is expected to shift to I;
- Upon completion of the proposed PSB project, 100% of the remaining volume from B to the PSB would shift to I-55/44 via the Marion ramp (E). Movements C and E currently operate at or near capacity due to capacity constraints of the PSB approach ramps. MoDOT's PSB project would help to alleviate the approach ramps as bottlenecks, thereby allowing E to become a viable alternative to get to Illinois across the PSB. Within the models Movement F is not anticipated to take on any additional traffic from downtown.

A4 Pre-AJR Briefing Memo 3: FHWA Technical Memorandum – October, 2011

MVVA, Inc.

CAR 2015

**Pre-AJR Briefing Memo 3: FHWA
Technical Memorandum**

ER

Draft 1 | October 2011

Draft

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Job number 215132-00

ARUP

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1 Introduction

1.1 Memo Purpose

The purpose of this memo is to respond to a number of questions posed by the Federal Highway Administration (FHWA) to the The City + The Arch + The River 2015 (CAR 2015) design team and Missouri Department of Transportation (MoDOT) that have come out of the regular Core Team meetings and from the first two AJR Briefing Memos. This memo will also provide FHWA with further description of the proposed improvements of CAR 2015 and Poplar Street Bridge (PSB) projects and, specifically, their interface with the wider highway and interchange network, including the full build-out of the new Mississippi River Bridge (MRB) Phase II, and the Tri-Level interchange in Illinois.

The purpose of this memo is to demonstrate:

- How the CAR 2015 project interfaces with the potential Phase II full build-out of the MRB.
- How the transportation study has considered and assessed origins, destinations and trip change behaviors where access is proposed to be modified or removed as part of the CAR 2015 project.
- How the study has considered and assessed trips across the Mississippi River and whether shifts will impact any elements of the interstate highway system in Illinois, specifically the Tri-Level interchange.
- That the VISSIM micro-simulation modeling extents established with MoDOT at the outset of the project are appropriate and do not need to be expanded because the above issues have been adequately addressed.

It is assumed that the reader has read CAR 2015 Briefing Memos 1 and 2 and is familiar with the proposed changes to the city and highway networks.

1.2 Summary of Findings

This memo demonstrates that the CAR 2015 project does not physically or operationally preclude any part of the proposed “Ultimate Configuration” planned for the I-70 Missouri interchange for the MRB (i.e., Phase II build out). In doing so, the CAR 2015 team suggests that a VISSIM model of MRB Phase II is not necessary for understanding or demonstrating the impacts of the CAR 2015 project to the future highway network.

This memo demonstrates that the CAR 2015 and PSB projects do not create major traffic shifts in Illinois beyond those in existing conditions, and therefore do not generate negative impacts or requirements for further traffic studies extending into Illinois.

2 Project Components

2.1 Mississippi River Bridge

The first phase of the MRB project (Phase I) is being built and will be fully operational in 2014. When complete, the interstate highway designated as I-70 will shift from the PSB to the MRB and I-44 will extend

to comprise the portion of highway vacated by I-70. A second phase of bridge construction (referred to as Phase II in this document) is planned for construction when traffic volumes require it, and when funds are available to build it.

Within the vicinity of downtown St. Louis, Phase I consists of a new crossing of the Mississippi River with connections between Cass Ave and Illinois. Phase II would consist of an additional crossing, parallel to the Phase I crossing, and would provide additional connections between the Bridge and points to the south.

Figure 1 shows MRB Phase I and Phase II components. Figure 2 and Figure 3 show interstate shifts once the MRB opens.

2.2 Poplar Street Bridge

MoDOT’s Poplar Street Bridge ramp improvement project consists of four specific modifications:

- The ramp from the PSB westbound to existing I-44 westbound / I-55 southbound will be rebuilt and expanded from one to two lanes and realigned in order to achieve a safer radius.
- The ramp from the PSB westbound to the depressed highway section (existing I-70 westbound / future I-44 eastbound) will tie into the highway as a fifth auxiliary lane, connecting to the Washington Ave exit ramp proposed within the CAR 2015 project. The depressed section of highway will be restriped from four lanes to five within the existing retaining walls.
- The ramp from the depressed highway section (existing I-70 eastbound / future I-44 westbound) and Memorial Drive southbound to the PSB eastbound will be removed.
- The ramp from existing I-44 eastbound / I-55 northbound to the PSB eastbound will be rebuilt and expanded from one to two lanes.

Figure 4 shows the proposed PSB ramp modifications and related changes to the depressed highway section.

2.3 CAR 2015

The CAR 2015 project includes three specific proposed improvements to the interstate highway system and one that links to the highway system via the surface street network:

- The off-ramp from I-70 eastbound to Memorial Drive southbound would be changed to an on-ramp from Washington Ave to I-44 southbound, into the depressed section of the highway (Figure 5).
- The on-ramp from Memorial Drive northbound to I-70 westbound would be changed to an off-ramp from the depressed section of I-44 eastbound to Washington Ave (Figure 5).
- A new ramp connection is proposed that links the new I-70 eastbound lanes with the I-70 westbound ramp from the MRB to Cass Ave. This connection does not touch the mainline highway but will serve to link I-70 eastbound with Cass Ave and Tucker Blvd and is referred to as the “Tucker Ramp” in this document. This ramp is shown in pink in Figure 6.
- North 3rd Street is proposed to extend across the west landing of the Dr. Martin Luther King, Jr. Memorial (MLK) Bridge to provide a new access point from the City Street network towards I-70 westbound.

Other proposed improvements occur at street level within the City’s downtown street network.



Figure 1: MRB Phase I (2015) and Phase II Improvements; Courtesy: MoDOT

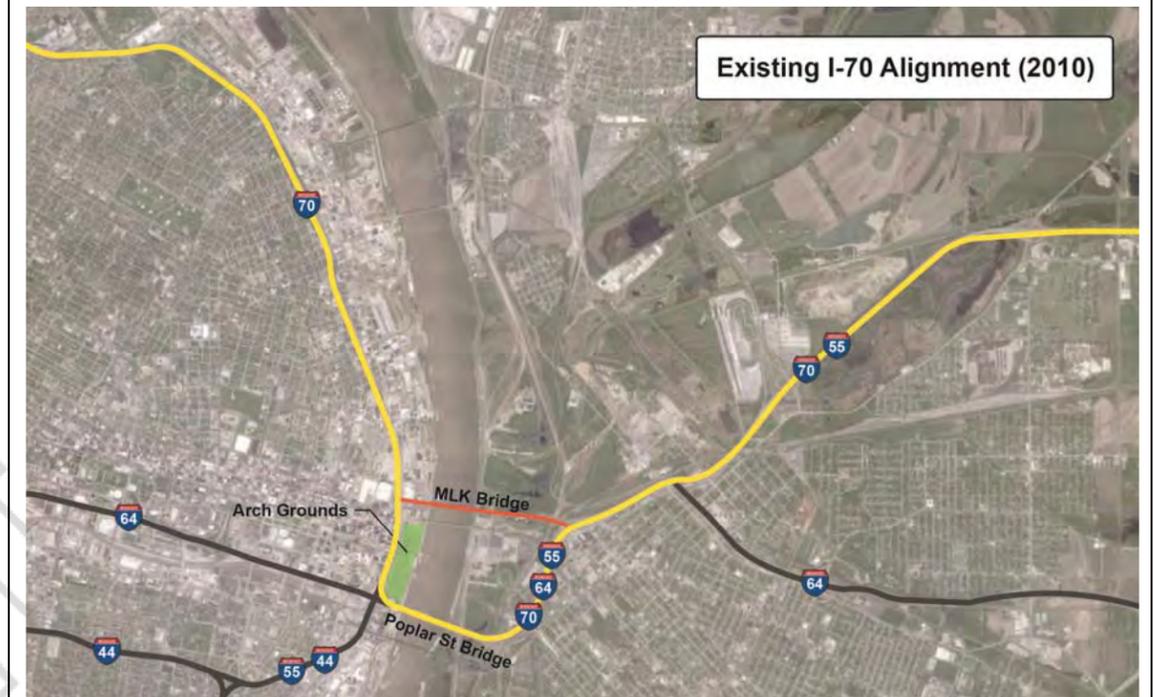


Figure 2: Existing I-70 Alignment



Figure 3: I-70 Alignment when New MRB Phase I Opens



Figure 4: PSB Ramp Project Improvements in the 2015 Preferred Build Scenario; Courtesy: MoDOT

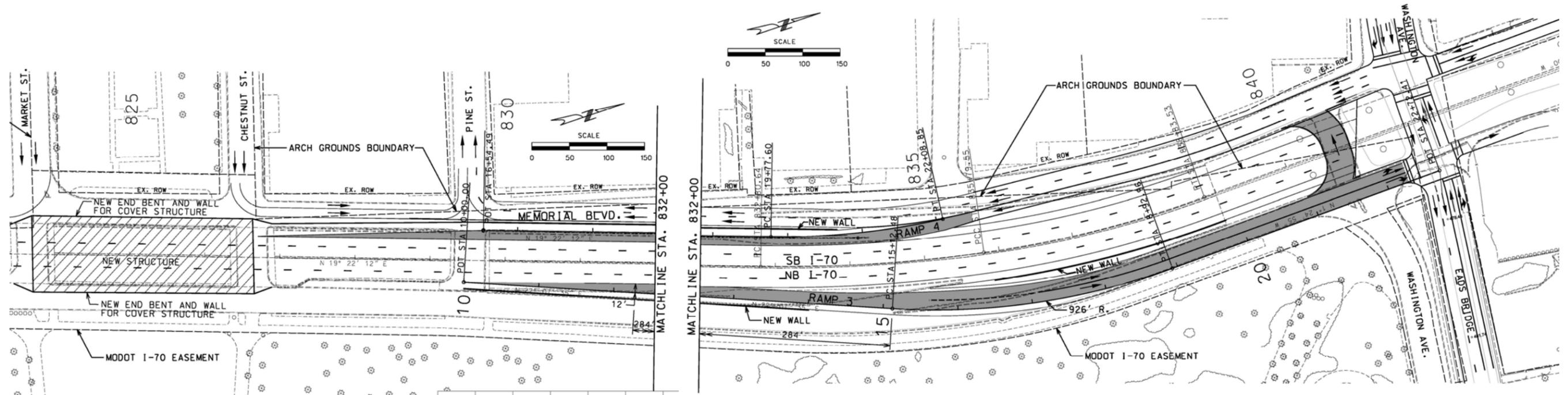


Figure 5: CAR 2015 Ramp Improvements at Washington Ave; Courtesy: URS Corp.

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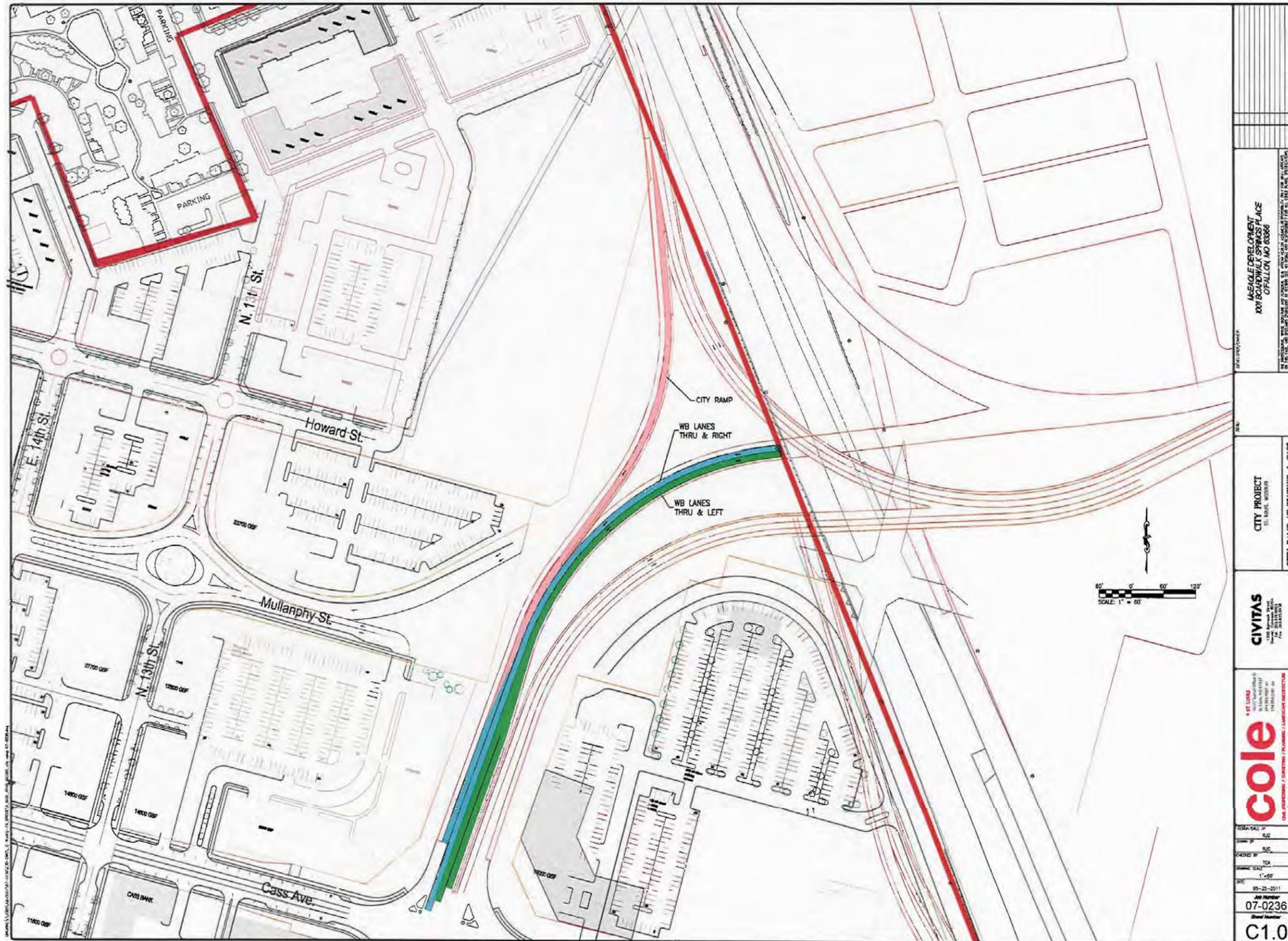


Figure 6: CAR 2015 Proposed Ramp at Tucker Blvd.; Courtesy cole Engineering

3 Project Planning and Analysis

3.1 Project Context and Phasing

The following three Figures illustrate the CAR 2015 transportation modifications within the context of the I-70 corridor in St. Louis, including the MRB and PSB ramp projects. These are described as:

- **Figure 7: Existing conditions (2010)**

Existing I-70 alignment and ramp configurations in and around the CAR 2015 project area, including on- and off-ramps.

- **Figure 8: MRB Phase I and preferred project build (2015)**

In Phase I (2015), MRB Phase I and the PSB and CAR 2015 projects will be complete.

- **Figure 9: Full build-out conditions for MRB Phase II**

In Phase II, additional capacity will be added to the bridge, and a second set of off-ramps will provide direct access from I-70 to northern St. Louis.

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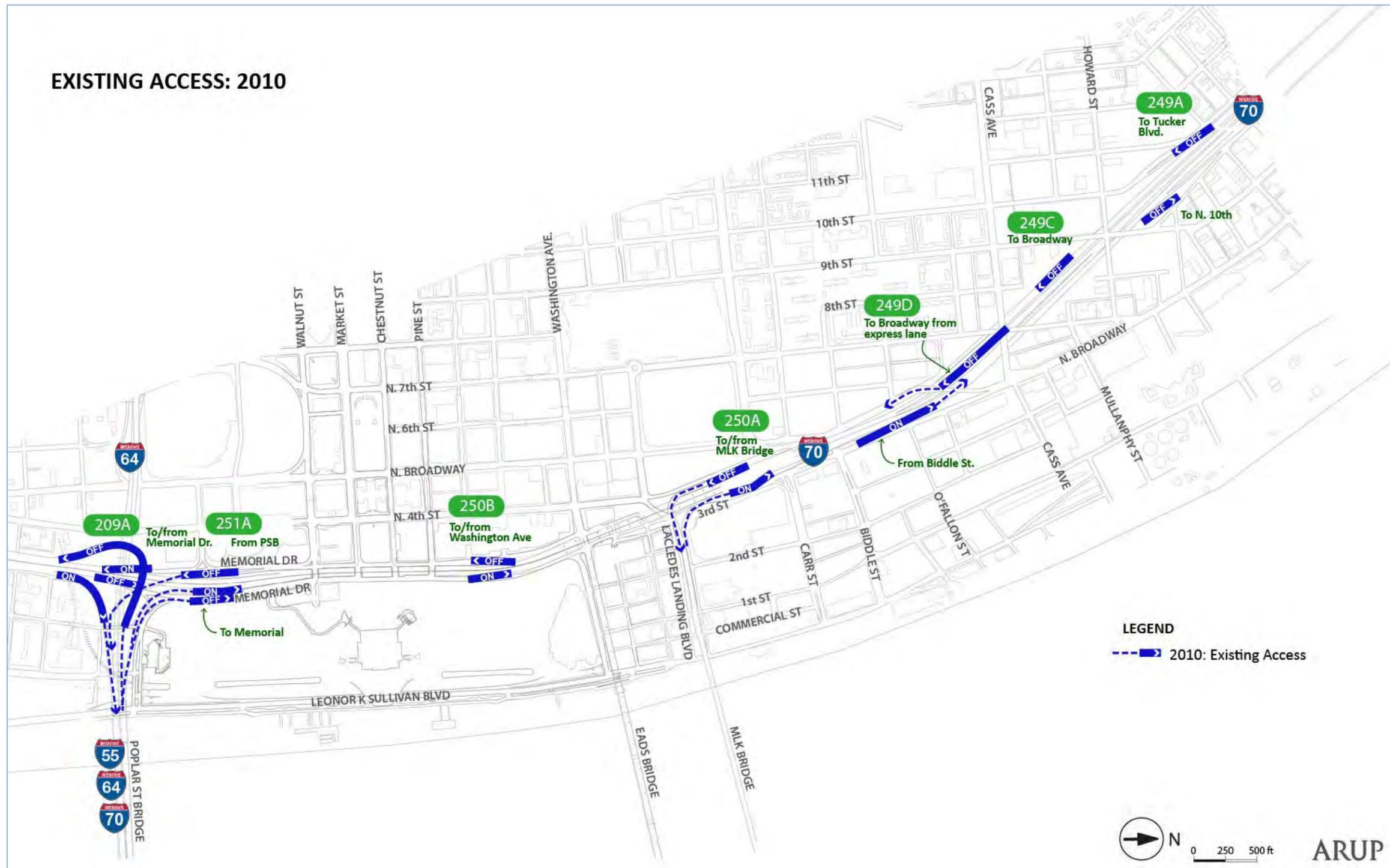


Figure 7: Existing conditions (2010)

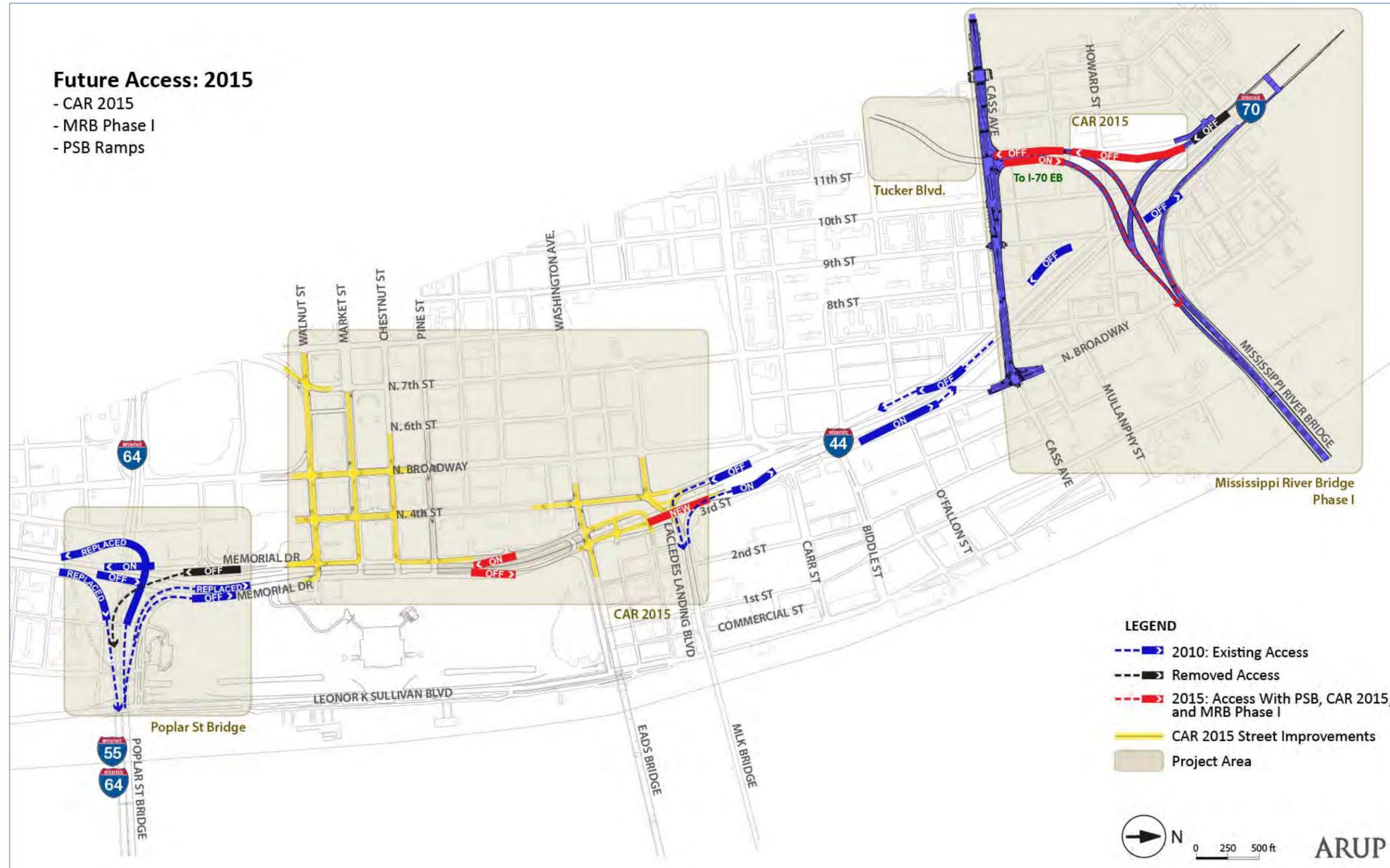


Figure 8 Build year conditions for PSB, CAR 2015 and MRB Phase I (2015)

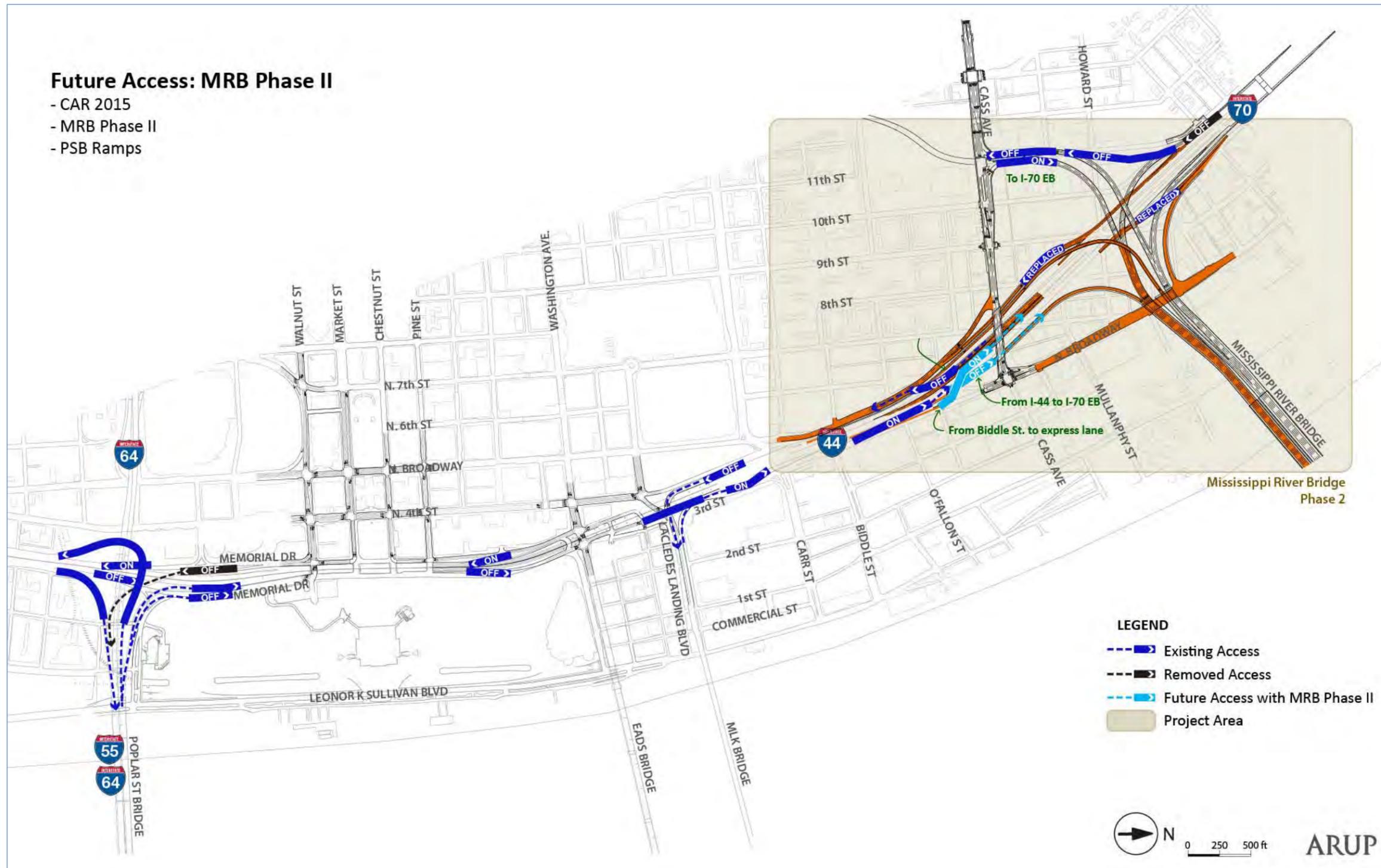


Figure 9 Full build-out conditions for MRB Phase II

3.2 Model Scenarios

As a result of the ramp modifications proposed in CAR 2015, as well as the concurrent MRB and PSB projects on I-70, MoDOT has directed that nine VISSIM model scenarios be tested for inclusion in an Access Justification report (AJR). Components of each scenario are detailed in Table 1 below.

Table 1: VISSIM Traffic Model Scenarios

Model	Demand Year	Comprised of
1	2010	Existing Conditions
2	2015	CAR 2015 No-Build PSB No-Build MRB Phase I
4	2015	CAR 2015 No-Build PSB Build MRB Phase I
5	2015	CAR 2015 Build PSB Build MRB Phase I
6	2015	CAR 2015 Build, Tucker Ramp Build PSB Build MRB Phase I
6A	2015	CAR 2015 Build, Tucker Ramp Build PSB Build with ramp to depressed section MRB Phase I
7	2035	CAR 2015 No-Build PSB No-Build MRB Phase I
8	2035	CAR 2015 No-Build PSB Build MRB Phase I
9	2035	CAR 2015 Build, Tucker Ramp Build PSB Build MRB Phase I
9A	2035	CAR 2015 Build, Tucker Ramp Build PSB Build with ramp to depressed section MRB Phase I

- **Model 1** is used to benchmark existing (2010) traffic conditions.
- **Model 2** demonstrates baseline network performance in 2015 with MRB Phase I complete.
- **Model 3** was assumed to be not necessary and was deleted.
- **Model 4** demonstrates impacts of PSB ramp changes to the 2015 network.
- **Model 5** demonstrates combined impacts of the CAR 2015 project and PSB ramp changes.
- **Model 6** demonstrates impacts of the Model 5 network with the Tucker ramp.
- **Model 6A** – the preferred scenario – demonstrates impacts of all 2015 Build options: CAR 2015 project with the Tucker ramp, PSB project including a ramp from PSB westbound to depressed section of I-44 eastbound, and MRB Phase I.
- **Model 7** demonstrates baseline network performance in 2035 with MRB Phase I complete.
- **Model 8** demonstrates impacts of PSB ramp changes to the 2035 network.
- **Model 9** demonstrates impacts of the CAR 2015 project with the Tucker ramp and PSB ramp changes.
- **Model 9A** – the preferred scenario – demonstrates impacts of all 2035 Build options: CAR 2015 with the Tucker ramp, PSB project including a ramp from PSB westbound to depressed section of I-44 eastbound, and MRB Phase I.

3.2.1 Model Diagrams

Each modeling scenario is graphically depicted in Figures 8 to 17 on the following pages.



Figure 10: Model Scenario 1



Figure 11: Model Scenario 2

Model 1	2010	Existing Conditions	Model 2	2015	CAR 2015 PSB MRB	No-Build No-Build Phase I
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Figure 12: Model Scenario 4



Figure 13: Model Scenario 5

Model 4	2015	CAR 2015 PSB MRB	No-Build Build Phase I	Model 5	2015	CAR 2015 PSB MRB	Build Build Phase I
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Figure 14: Model Scenario 6



Figure 15: Model Scenario 6A

Model 6	2015	CAR 2015 PSB MRB	Build, Tucker Ramp Build Build Phase I	Model 6A	2015	CAR 2015 PSB MRB	Build, Tucker Ramp Build Build with Ramp to Depressed Section Phase I
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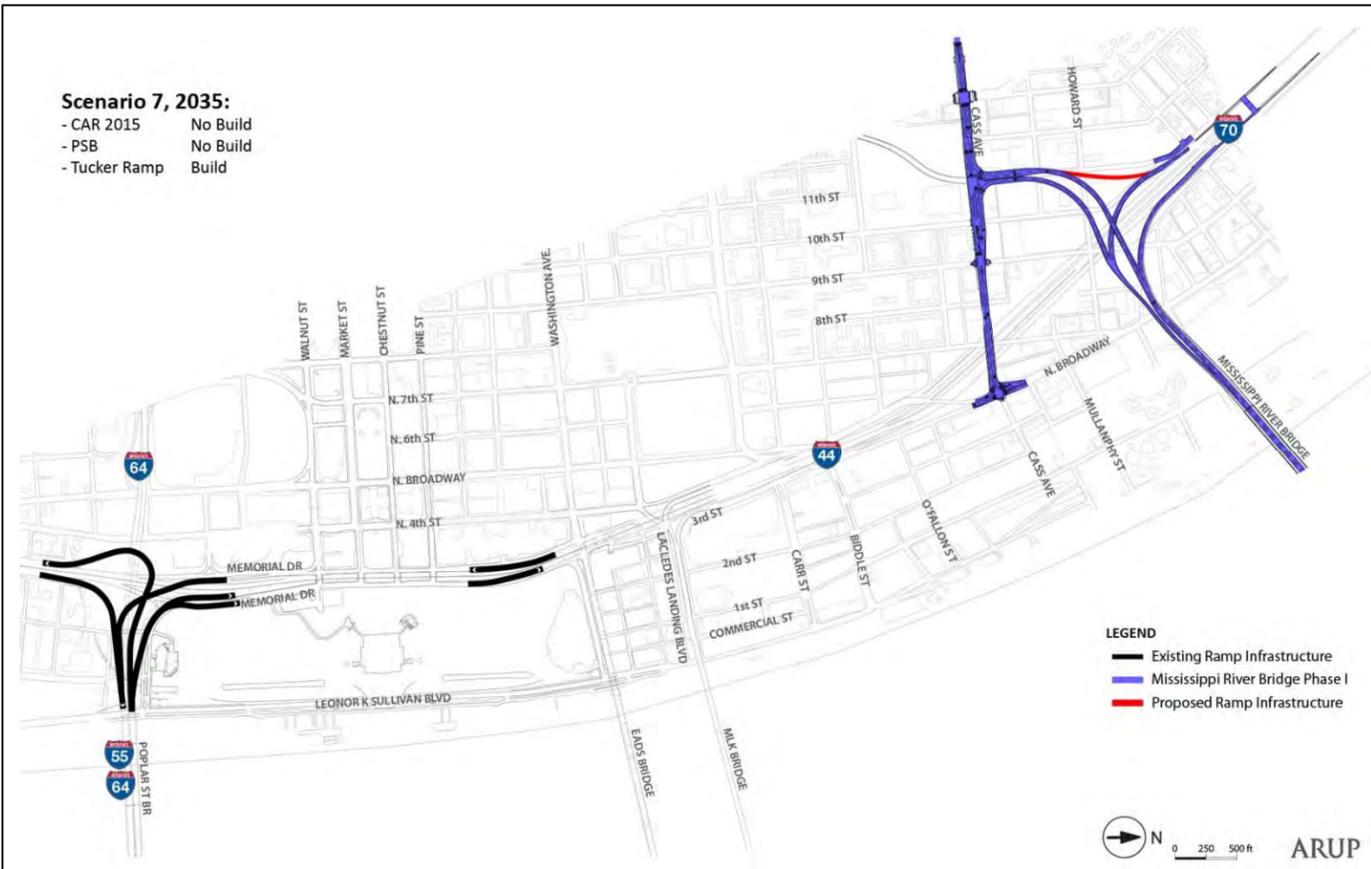


Figure 16: Model Scenario 7

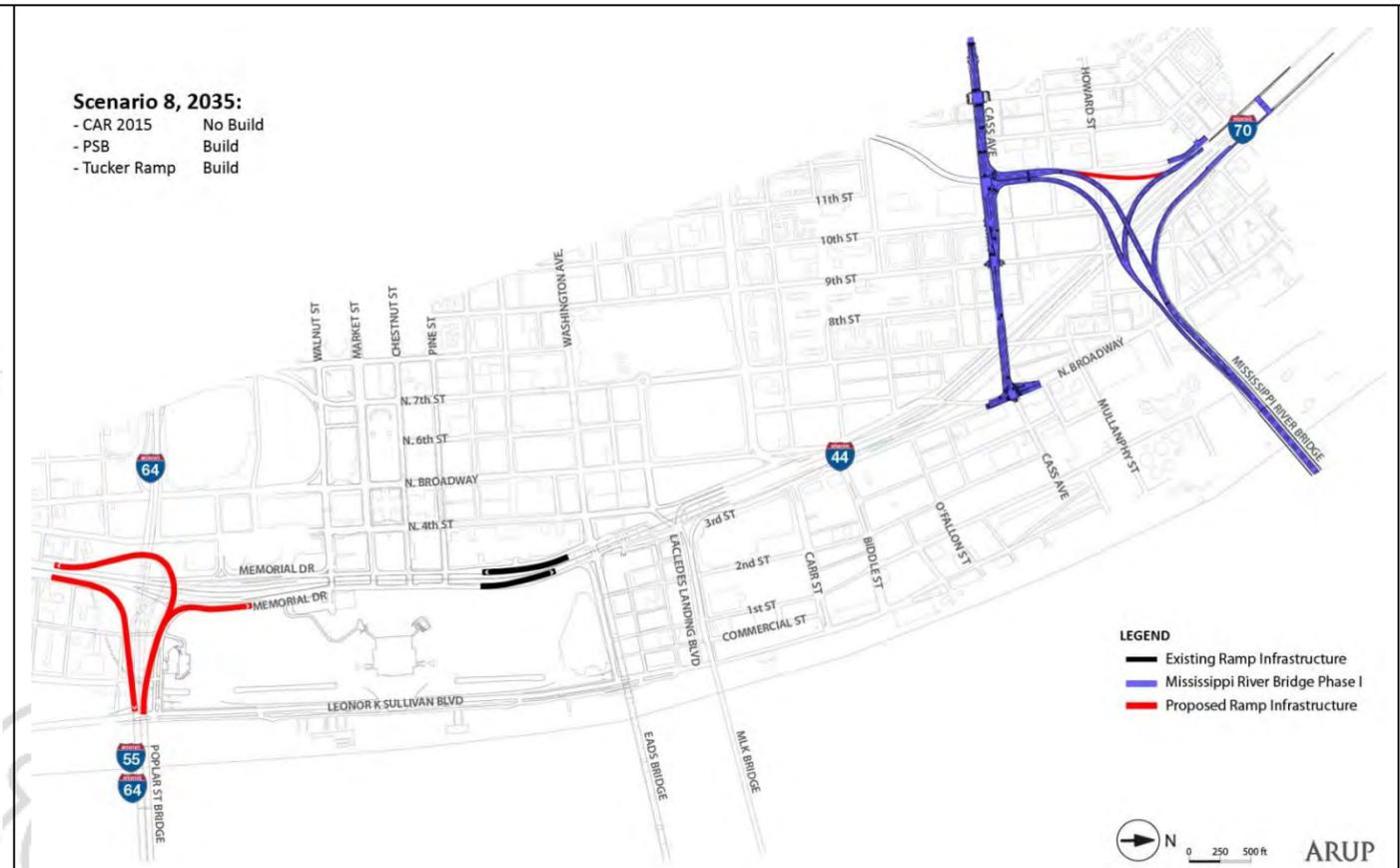


Figure 17: Model Scenario 8

Model 7	2035	CAR 2015 PSB MRB	No-Build, Tucker Ramp Build No-Build Phase I	Model 8	2035	CAR 2015 PSB MRB	No-Build, Tucker Ramp Build Build Phase I
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Figure 18: Model Scenario 9



Figure 19: Model Scenario 9A

Model 9	2035	CAR 2015 PSB MRB	Build, Tucker Ramp Build Build Phase I	Model 9A	2035	CAR 2015 PSB MRB	Build, Tucker Ramp Build Build with Ramp to Depressed Section Phase I
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4 Issues and Responses

4.1 Impact on MRB 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 2nd Street to the east. Those traveling on I-70 from North County will be able to access downtown via the existing Broadway exits or the proposed ramp at Tucker Blvd.

The second phase of the MRB will create a second bridge crossing adjacent to Phase I, with additional new access links between the bridge and points downtown.

MoDOT and FHWA 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 will therefore not preclude the bridge's full Phase II build-out.

Physical Separation

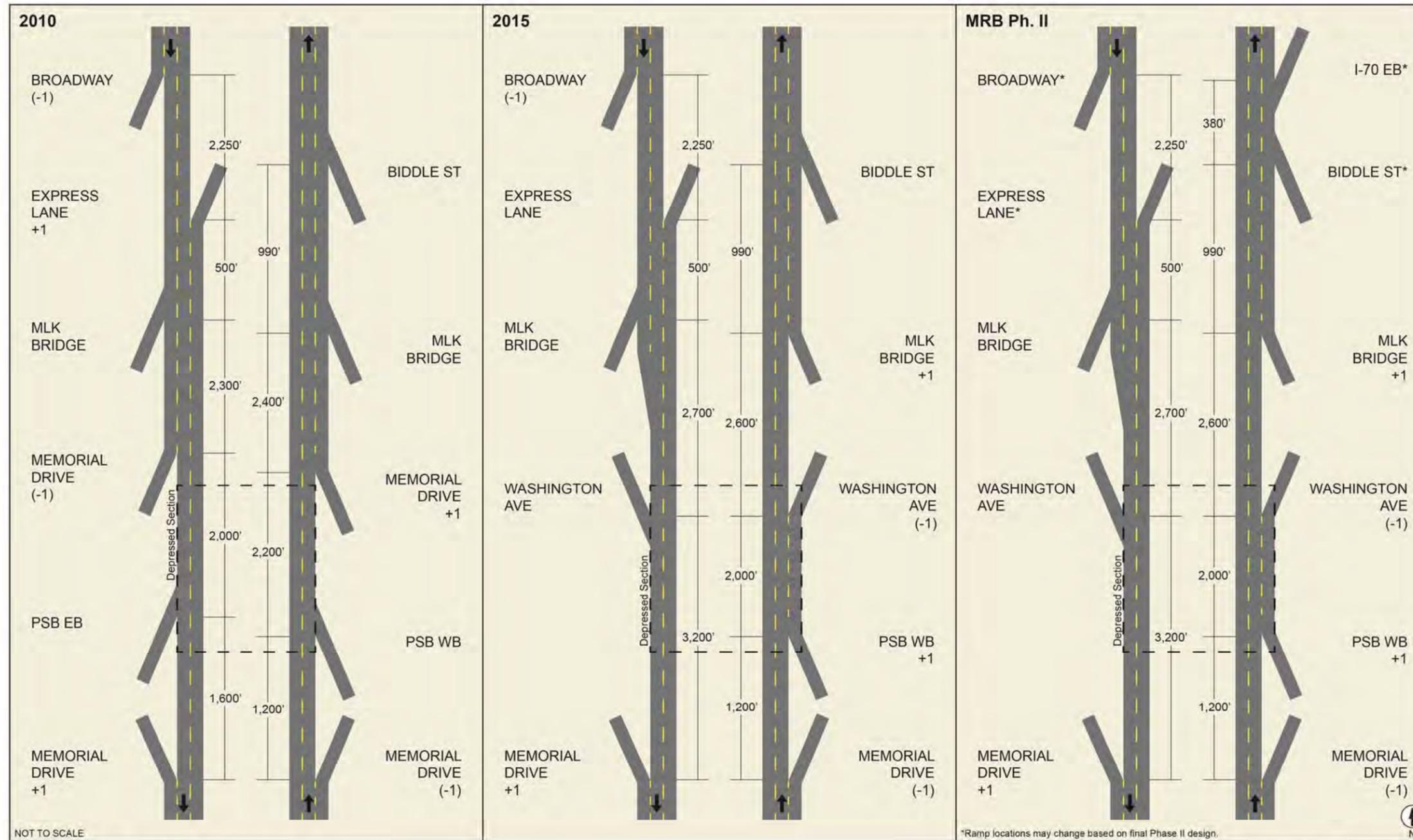
As shown in Figure 8, the northern extents of the mainline CAR 2015 project and the southern extents of the MRB projects are physically separated through the area of the MLK Bridge ramps, Laclede's Landing and the Lumiere Casino. The gore points of the proposed CAR 2015 project elements and MRB interstate ramps are separated by at least two-thirds of a mile in each direction, as shown in Figure 20.

- 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

Operational Independence

The CAR 2015 and PSB projects are operationally independent of the MRB project because the improvements associated with each do not extend north beyond the MLK Bridge ramps, as described above. Highway lane continuity from the northern extents of the CAR 2015 project will 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 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.



I-70, I-44 RAMP SPACING
September 2011



Figure 20: I-70 / I-44 Ramp Spacing in 2010, 2015, MRB Phase II

4.2 Analysis of Origins, Destinations and Trip Change Behaviors

FHWA raised concerns that the PSB and CAR 2015 projects might create changes that could shift traffic in Illinois or somehow increase traffic on the existing river bridge crossings. The next two sections address this issue and demonstrate 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.

Trip behaviors, anticipated to change in response to the roadway network modifications proposed through the CAR 2015, PSB, and MRB 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 MRB 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 do not forcibly shift traffic across the new MRB crossing. Regional travelers will still have route options for traveling between Missouri and Illinois.

MRB

The new MRB 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 MRB 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 MRB 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 percent of east/west traffic will shift to the MRB (1,195 vehicles in the am, 1,600 vehicles in the pm).
- PSB: 10 percent of east/west traffic will shift to the MRB (1,053 am, 1,078 pm).
- Eads Bridge: There is no anticipated change in demand since the Eads serves mainly local trips.

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 Tucker Blvd. which will serve as a replacement to the 10th Street off-ramp which is being removed as part of MRB Phase I. Neither of these access changes will affect river crossings or travellers to/from Illinois.

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 percent 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. Importantly, this change to the existing ramp would direct traffic onto city streets and away from the interstate which could help to reduce impacts to local highway infrastructure.
- 100 percent of vehicles (650 am, 205 pm) that currently use Market Street to enter downtown from Memorial would use Walnut Street which will remain open in the CAR 2015 build scenario.
- 15 percent 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 percent 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 who currently use the PSB, Eads and MLK bridges will continue to have the same choices and opportunities to cross the Mississippi.

From Downtown to the North and West

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

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) will shift north to the MLK, while 100 percent of the vehicles originating from Memorial (135 am, 385 pm) will shift to the south, to the Marion Street on-ramp.

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

4.2.1 MRB

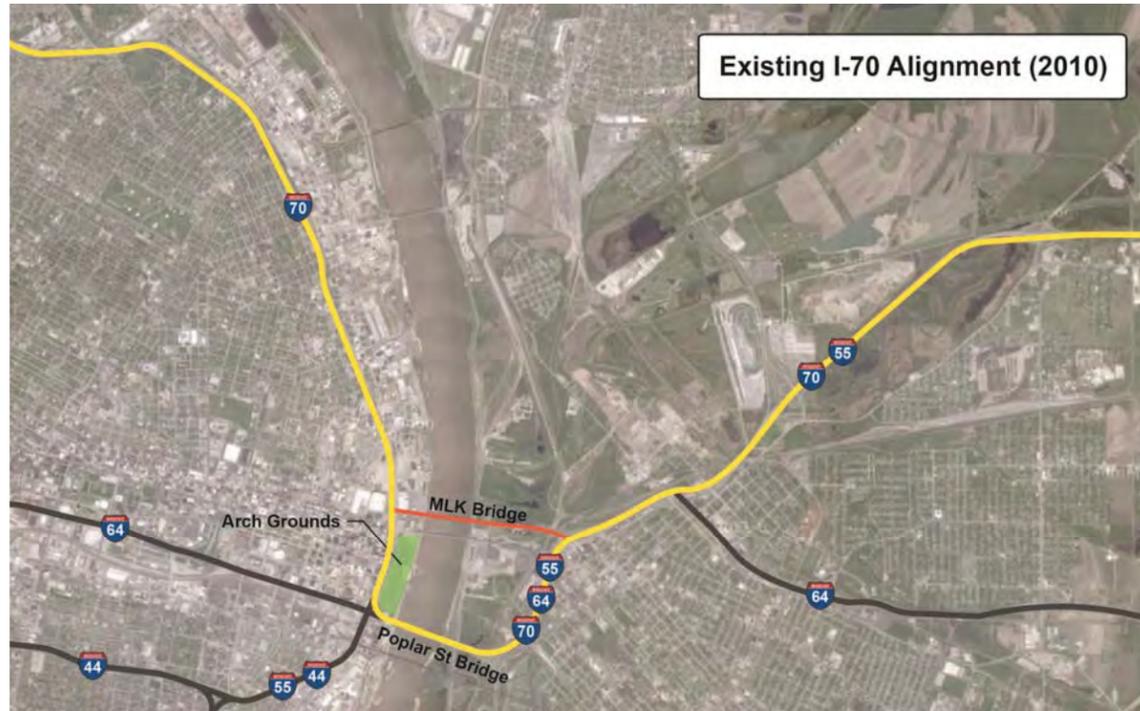


Figure 21: Existing I-70 Alignment over Poplar Street Bridge



Figure 22: Future I-70 Alignment over new Mississippi River Bridge

Access and Movement

The Phase I MRB crossing 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. Phase II of the MRB would incorporate a companion, four-lane bridge and connections to/from I-44. There is currently no construction timeline for Phase II.

As part of the MRB project, I-70 will be rerouted from its existing alignment across the PSB and through the depressed section in downtown St. Louis to a new alignment which travels over the MRB. 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 Avenue into the north end of downtown St. Louis. Interstates 64 and 55 will remain in their existing alignments.

Potential Origin-Destination Shifts

The new bridge and interstate alignment will reduce traffic across the PSB and MLK Bridge for those people making regional trips between Missouri and Illinois on I-70. Some commuter trips that cross the PSB and MLK Bridge into downtown will also shift to the new alignment, though some are still assumed to use the existing crossings. All of the forecasting performed as part of the CAR 2015 project reflects the assumptions put forth in the “Missouri River Crossing AJR” produced by MoDOT in October 2003.

The following shifts were taken into account for modeling purposes based on the Mississippi River Crossing AJR and meetings with MoDOT:

- PSB: 10 percent shift to MRB and resultant vehicle reduction, both directions

	Eastbound	Westbound	Total
AM Trips	483	570	1,053
PM Trips	657	421	1,078

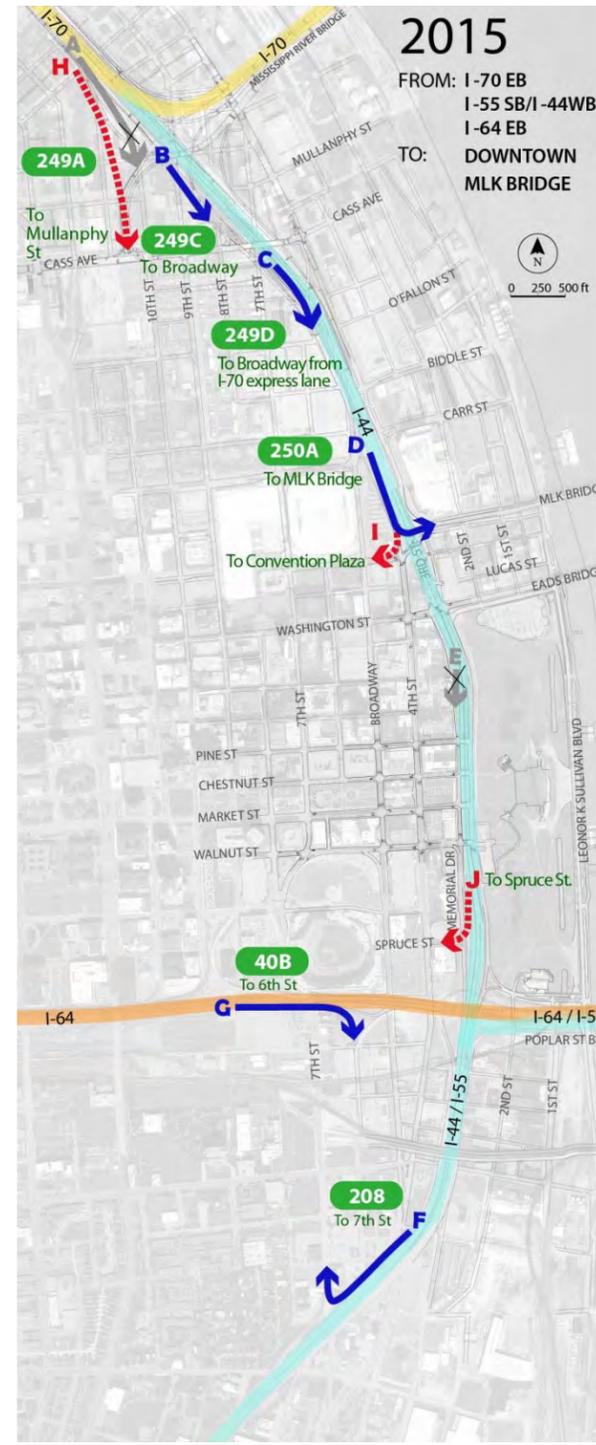
- MLK Bridge: 50 percent shift to MRB and resultant vehicle reduction, both directions

	Eastbound	Westbound	Total
AM Trips	235	960	1,195
PM Trips	1,270	330	1,600

- Eads Bridge: 0 percent reduction. Eads is assumed to serve local trips and connections only.

Traffic with a destination in the southern section of St. Louis will continue to utilize the existing river crossings until the MRB Phase II offers an alternative.

4.2.2 From the North and West to Downtown



Access and Movement

Existing movements from north and northwest of St. Louis, eastbound on I-70, currently access downtown via four exits:

- Movement A Exit 249A to North 10th 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

The MRB project has eliminated the North 10th Street exit (A) to downtown. The CAR 2015 project proposes to remove the Memorial Drive exit (E).

Potential Origin-Destination Shifts

The following shifts in trip patterns were investigated in the preferred scenario for vehicles that currently use downtown exits:

- The new Tucker off-ramp connection to the St. Louis CBD (H) from the MRB would provide a connection between the I-70 ramp to the MRB and Tucker Boulevard at Cass Avenue. This connection to Tucker Boulevard would provide the option of new, direct access to downtown and to the west side of the St. Louis CBD. It is anticipated that this option would accommodate 100 percent of the North 10th Street off-ramp (A) volume (1,080 vehicles in the am, 400 in the pm) when this exit is closed due to construction of MRB Phase I. Although the ramp alignment changes, the location generally remains similar to the existing ramp, and access is improved.
- All vehicles currently using the Memorial Drive exit (E) would split 50/50 (258 am, 30 pm) to existing exit movements B and C.

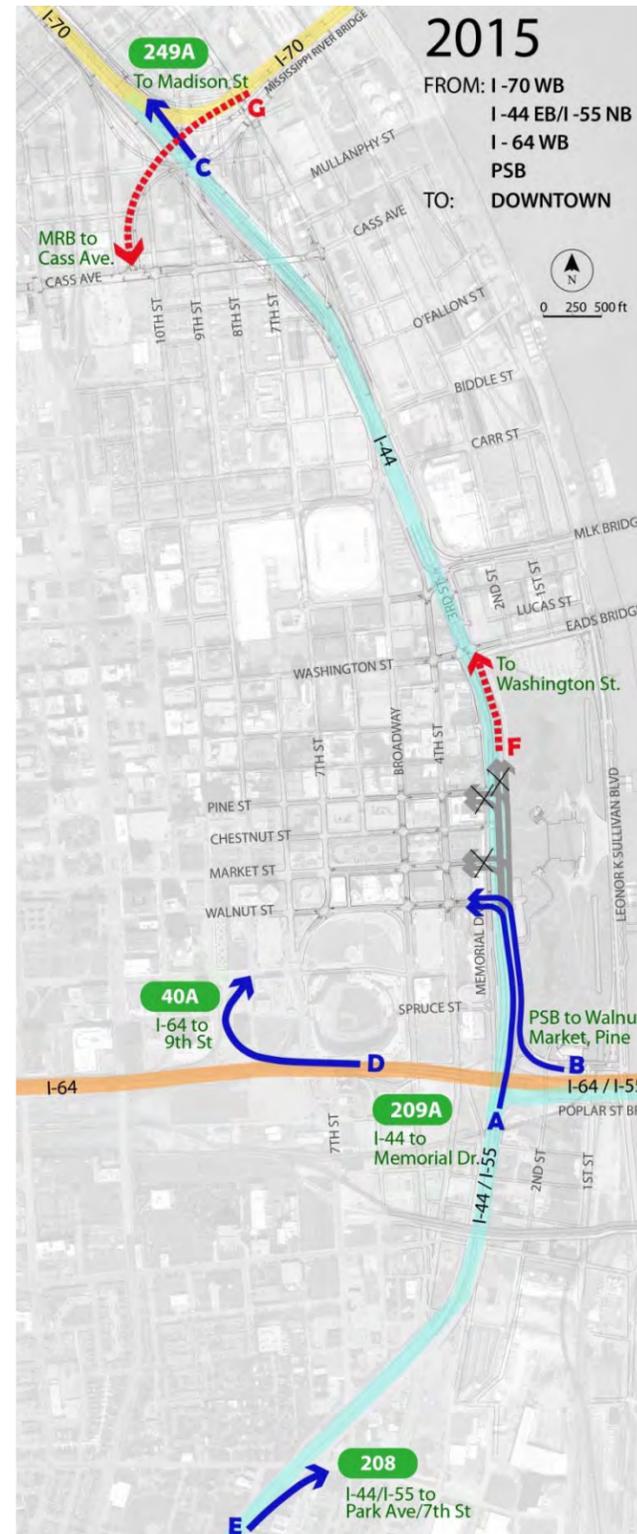
In addition, the following alternative scenarios were studied and rejected:

- In a no-build scenario, where the Tucker ramp (H) from the north to downtown is not built, all vehicles currently using A and E would split 50/50 to existing exit movements B and C.

	To B (am/pm)	To C (am/pm)
From A	540/200	540/200
From E	258/30	258/30

- 100 percent of vehicles using E (515 am, 60 pm) would utilize a new connection (I) from Exit 250A that connects to downtown via Convention Plaza. (Existing movement D links only to the Eads Bridge and Laclede's Landing.) In addition, roughly 50 percent of the traffic currently using B (490 am, 420 pm) would shift to I as well due to the increased congestion resulting from the North 10th Street exit (A) closure.
- 100 percent of vehicles currently using E (515 am, 60 pm) would use a new ramp (J) to Spruce Street, where the existing ramp to the PSB currently diverges. Some additional traffic may shift here from B to avoid increased congestion on that ramp due to the removal of A.

4.2.3 From the South and East to Downtown



Access and Movement

Existing movements into St. Louis from the south (I-70 westbound, I-44 eastbound, and I-55 northbound) access downtown via four main exits:

- Movement E Exit 208 to Park Avenue / 7th Street
- Movement A Exit 209A from I-44/I-55 to Memorial Drive northbound
- Movement B PSB westbound to I-70 westbound and Memorial Drive northbound
- Movement C Exit 249A to Madison Street / North 10th Street

Memorial Drive provides access to downtown via Market and Pine Streets and also to the northern CBD via Washington Avenue.

The CAR 2015 project proposes to remove Memorial Drive northbound between Walnut and Washington Streets and to replace access to the north side of downtown St. Louis with a new interstate off-ramp to Washington Street (F). Vehicles can continue to access downtown via movements A and B, and those looking to access the north side of the CBD or Laclede’s Landing will be able to use F from the depressed section of the interstate (which will become I-44 when I-70 is relocated to its new alignment across the MRB).

Potential Origin-Destination Shifts

The following shifts in trip patterns were investigated in the preferred scenario:

- 40 percent of vehicles currently using A (752 am, 186 pm) would shift to F.
- 100 percent of vehicles that use Market Street to enter downtown (650 am, 205 pm) would now use Walnut Street, based on left turn movement counts on Memorial Drive northbound.
- 15 percent of vehicles that currently use Pine Street from Memorial (116 am, 17 pm) would take the new movement F and would utilize a proposed u-turn facility to approach Pine from Memorial Drive southbound.
- 75 percent of vehicles that use B would continue to utilize B (615 am, 454 pm). The other 25 percent (205 am, 151 pm) would use G.
- All vehicles currently using C would continue to utilize C (325 am, 185 pm).

In addition, the following alternative scenario was studied and rejected:

- An option of MoDOT’s PSB project proposed to remove the connection from the PSB westbound to I-70 westbound (the depressed section, designated as I-44 in the future). If implemented, this I-70 to I-70 movement served by the existing ramp would be removed altogether, and all traffic will shift to the MRB and the new I-70 alignment.

4.2.4 From Downtown to the North and West



Access and Movement

Existing movements departing downtown St. Louis and destined for the north and northwest access the interstate from four points:

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

The CAR 2015 project proposes to remove the on-ramp from Memorial Drive (A). To replace interstate access from downtown, the project proposes to modify North 3rd Street to create a single lane, through connection between the segment of Memorial Drive that exists west of Laclede’s Landing and North 3rd Street between Lumiere Place and the elevated section of the interstate. This new North 3rd extension would create direct access from the northeast corner of downtown St. Louis, the convention center area, and Laclede’s Landing to the existing MLK/North 3rd on-ramp to westbound I-70.

Potential Origin-Destination Shifts

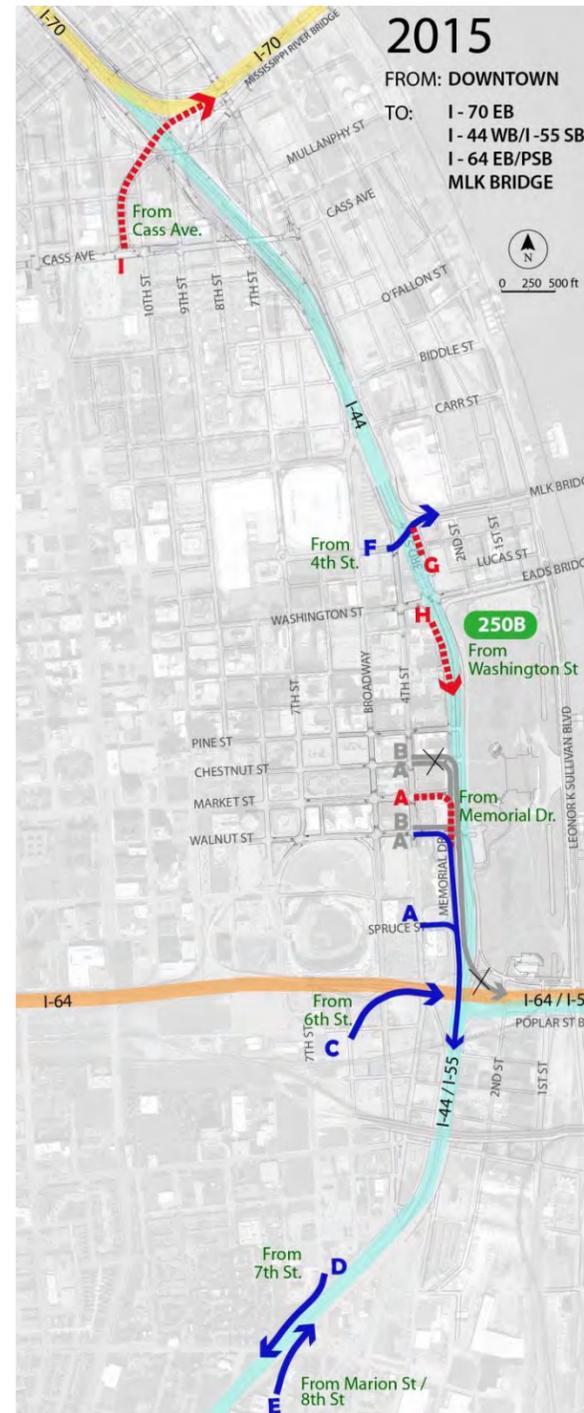
The following shifts in trip patterns were investigated in the preferred scenario:

- The new North 3rd extension (F) and widened Biddle Street on-ramp (B) would serve movements that formerly used the Memorial Drive on-ramp (A):
 - 45 percent of vehicles currently using A (101 am, 466 pm) would shift to F; and
 - 55 percent (124 am, 569 pm) would shift to B.
- The North 3rd Extension (F) may seem like a more attractive option for the relocated A movements than B. However, the intersection of 4th Street with Convention Plaza cannot accommodate the peak volume using A (225 vehicles in the am, 1,035 in the pm). Therefore, the projected split above was achieved through an iterative process that balanced the impacts of the relocated traffic on the intersections at 4th Street/Convention Plaza and 4th/Biddle. The balancing effort also took into consideration the existing capacity constraints on ramp B (the signalized intersection and merging movement with I-70).

In addition, the following alternative scenario was studied and rejected:

- An option to increase the capacity of the Biddle Street on-ramp to westbound I-70 was rejected as an improvement in the CAR 2015 project. The addition of the North 3rd Street extension (F) and the existing capacity of the Biddle Street ramp (B) are sufficient to serve the shift from A.

4.2.5 From Downtown to the South and East



Access and Movement

Existing movements departing downtown St. Louis and destined for the south or to I-70 eastbound to Illinois currently utilize several access points:

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

The CAR 2015 project proposes to create a new on-ramp into the depressed section from Washington Street (H), leading to I-44 westbound/I-55 southbound.

MoDOT's PSB project proposes to remove the ramp that links Memorial Drive southbound to the PSB eastbound, under the assumption that this movement will be replaced by proposed access from Cass Ave to the MRB/I-70 eastbound.

Potential Origin-Destination Shifts

The following shifts in trip patterns were investigated in the preferred scenario:

- 25 percent of vehicles utilizing A (30 am, 453 pm) would shift to new access at H. The remainder stays on A.
- The volume from B, comprised of downtown traffic using the ramp from Memorial Drive southbound to the PSB eastbound (135 am, 385 pm), would shift to I-55/44 via the Marion ramp (E). Note: movements C and E currently operate at or near capacity due to capacity constraints of the PSB approach ramps. To address this, MoDOT will widen the approach ramps at E, allowing it to become a viable alternative to get to Illinois across the PSB.
- Movement I across the MRB is not anticipated to take on any additional traffic from downtown since alternative crossings – in this case, the PSB and MLK – are closer to existing traffic origins.
- Note: 100 percent of the interstate traffic that currently uses the ramp from the depressed section of I-70 eastbound to the PSB eastbound (10 am, 375 pm) would shift to F.

4.3 Analysis of Trans-River Trips and Impacts to Interstate Infrastructure in Illinois

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 Chart 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; and
- Scenario 6A: 2015 conditions with MRB Phase I, PSB ramps, and CAR 2015 projects complete.

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 MRB. From 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 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 will have no impact on trans-river trips and the interstate highway network in Illinois.

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

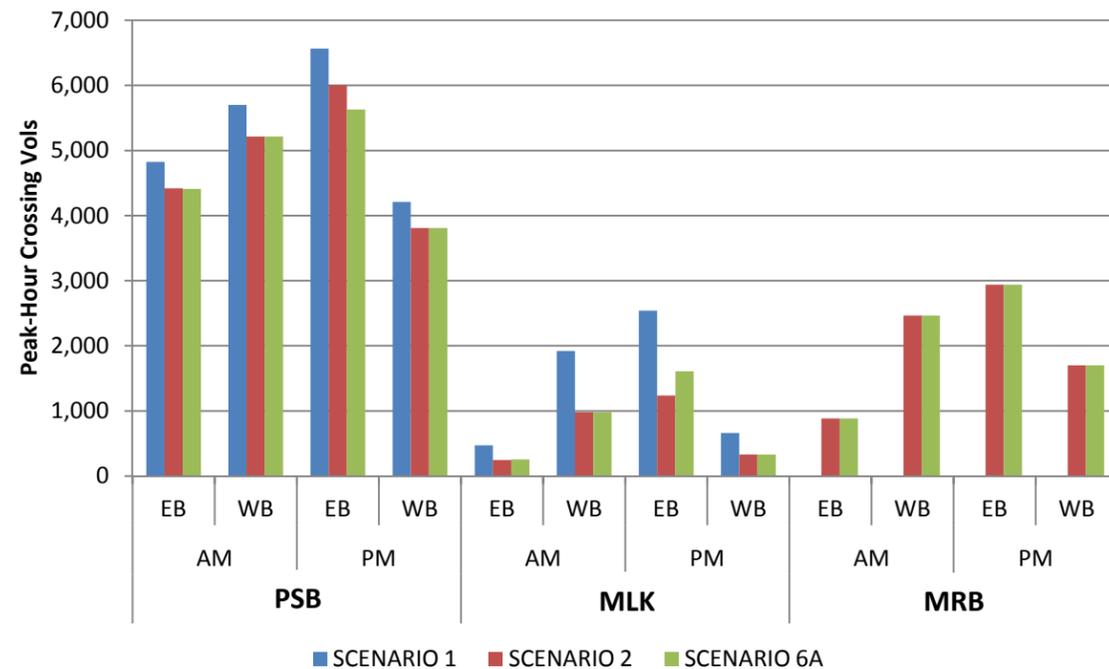


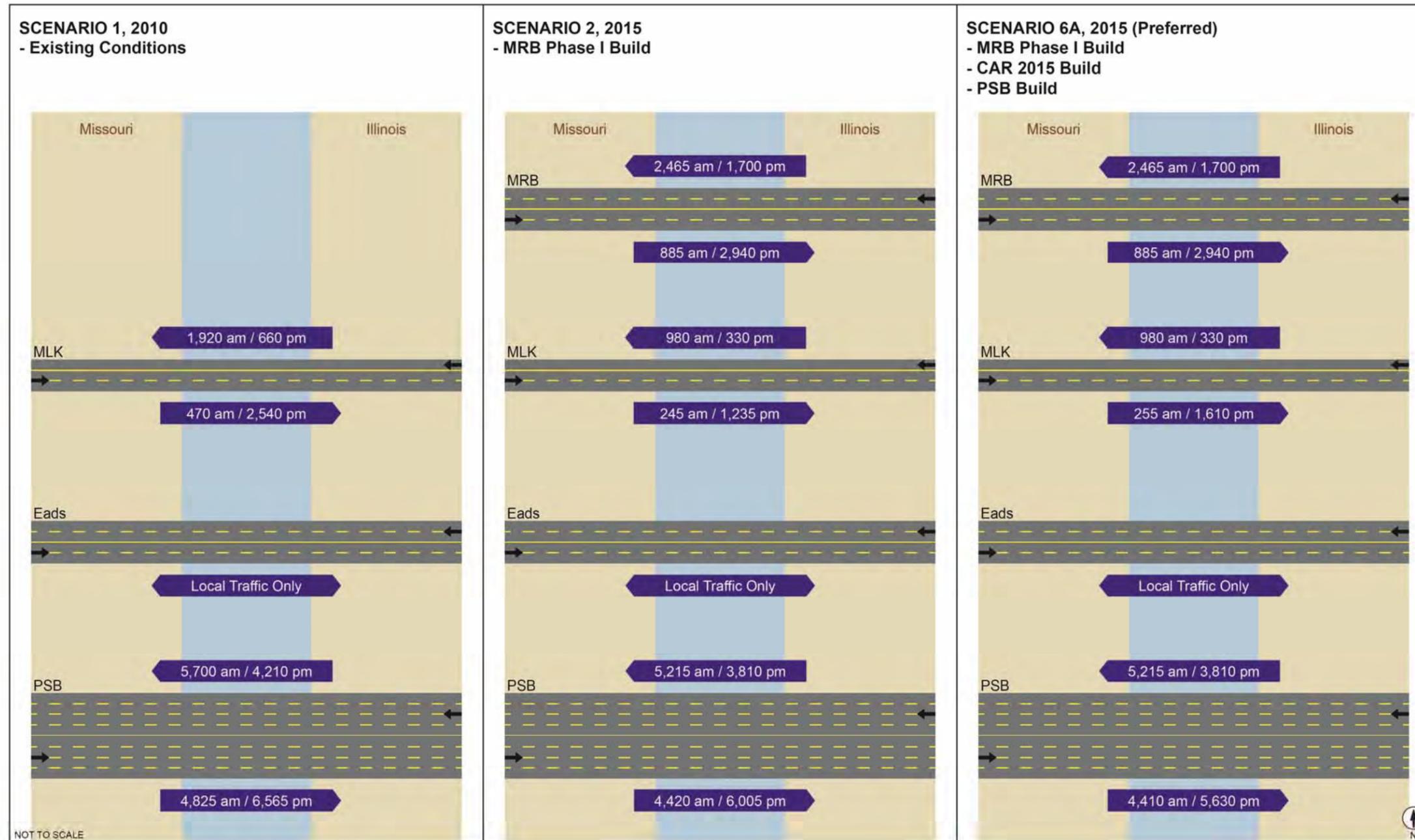
Chart 1: Crossing Volumes by Bridge in Scenarios 1, 2 and 6A (preferred).

Figure 23, 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 percent of the MLK Bridge volumes and approximately 10 percent of the PSB volumes shift north to the MRB. The 2015 volumes shown account for these trips as well as natural increases in demand.
- From Scenario 2 to 6A, in which the CAR 2015 and PSB projects are built out, the MRB volumes are projected to remain the same in both directions. This highlights the minimal impact both projects will have on the MRB and I-70 realignment.
- The westbound pm volumes on the MLK Bridge increase from Scenario 2 to Scenario 6A because it is anticipated that, with the removal of the ramp from I-70 eastbound/Memorial Drive southbound to the PSB eastbound in the PSB build scenario, some westbound trips using the PSB will shift to the MLK. This was addressed in greater detail in Section 4.2.5.

Figure 23 further demonstrates that all river crossings will be of sufficient capacity to handle east/west volumes in 2015 since most existing bridge access will be maintained in the build scenarios, and overall crossing capacity will increase through the preservation of existing travel lanes and the construction of the MRB.

Similar to the relationship between the CAR 2015 and MRB 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 MRB in either direction, the Tri-Level Interchange or other related highway systems in Illinois.



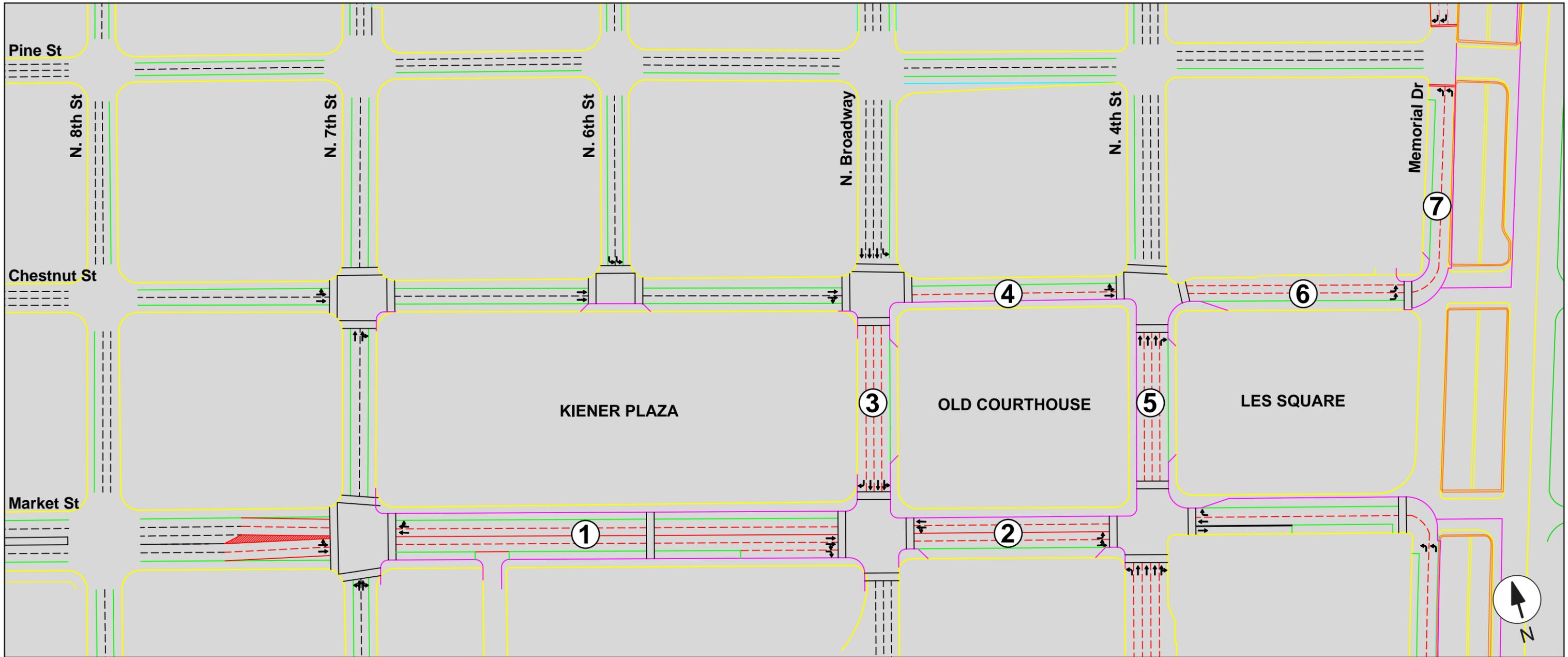
RIVER CROSSING VOLUMES
October 2011



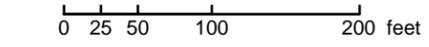
Figure 23: Mississippi River crossing volumes in Scenario 1 (2010 Existing), Scenario 2 (2015 project no-build), and Scenario, 6A (2015 preferred build)

Appendix B

Proposed City Street
Modifications (October, 2011)

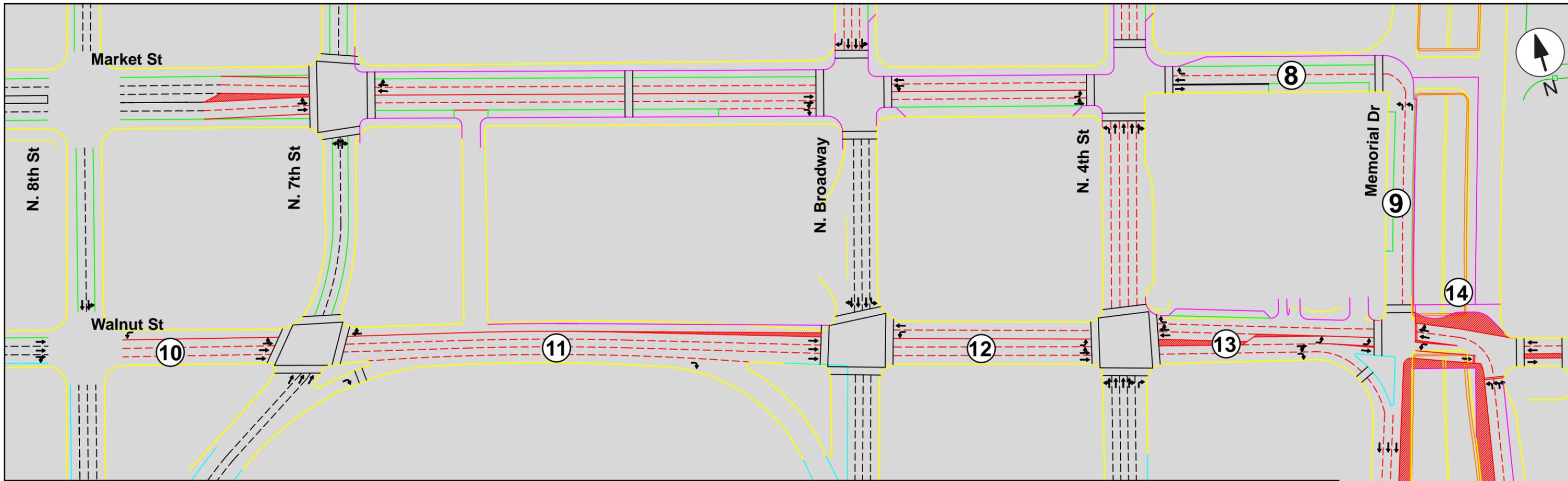


LOCATION	PROPOSED CHANGE	ISSUES	NOTES / OPPORTUNITIES
1. Market between N. 7th and N. Broadway	Roadway narrowing; N and S curb extensions; Median eliminated; New lane alignments at intersection of N. 7th and Market	Placement and treatment of mid-block crossing	On-street parking maintained along N and S curbs; Valet service maintained along S curb
2. Market between N. Broadway and N. 4th	Roadway narrowing; One through lane removed; N curb extension; New turning movements	EB through lane alignment across N. 4th is as existing	New metered on-street parking and/or pick-up/drop-off zone along S curb
3. N. Broadway between Chestnut and Market	Roadway narrowing; E lane removed; Dedicated pick-up/drop-off zone removed from W curb	None	New pick-up/drop-off zone along E curb
4. Chestnut between N. Broadway and N. 4th	Roadway narrowing; S curb extension; One through lane removed	None	On-street parking maintained along N curb
5. N. 4th between Market and Chestnut	Roadway narrowing; W curb extension; Two lanes removed; New turning movements	None	New pick-up/drop-off zone for taxis or horse carriages along E curb
6. Chestnut St "Dogleg"	One-way EB movement; Two through lanes and one bus pick-up/drop-off lane	None	New bus drop-off zone along S curb; Taxi stand and hotel shuttle parking maintained along N curb
7. Memorial Dr "Dogleg"	One-way NB movement; Two through lanes and one parking lane	None	New metered on-street parking and/or ADA parking along W curb



LEGEND

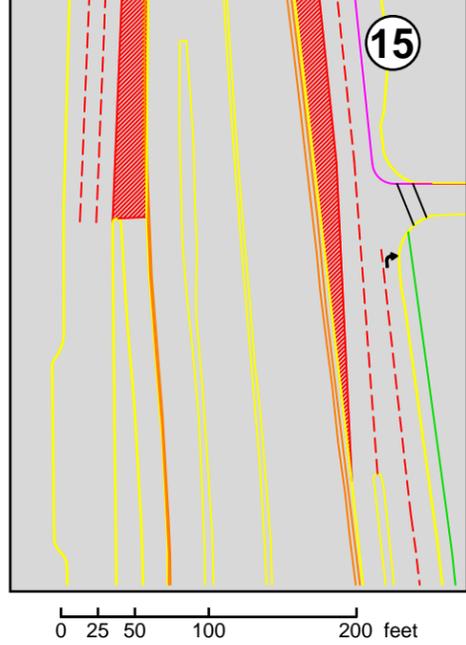
- Existing Curbs
- Proposed Curbs
- Approximate Curbs
- - - Existing Striping
- - - Proposed Striping
- Parking/Pick-up/Drop-off



LOCATION	PROPOSED CHANGE	ISSUES	NOTES / OPPORTUNITIES
8. Market St "Dogleg"	One-way WB movement; Slight roadway narrowing due to N curb extension; Bus pick-up/drop-off on N curb	Angled parking to be converted to parallel parking along S curb	Counterflow lane to parking garage maintained; Some angled parking converted to parallel parking; Additional spaces relocated to Memorial Dr
9. Memorial Dr "Dogleg"	One-way NB movement; Roadway narrowing to two through lanes and one parking lane	None	New KMOX/EWG/ADA parallel parking along W curb
10. Walnut between N. 7th & N. 8th	Reversal of one lane from EB to WB	Removal of two metered on-street parking spaces	None
11. Walnut between N. Broadway & N. 7th	Conversion of hotel parking counterflow lane to WB lane; Possible curb narrowing at NW corner of N. Broadway pending survey data	None	Lane alignments and curbs especially at Broadway intersection need to be reviewed in more detail on survey drawings
12. Walnut between N. 4th & N. Broadway	Reversal of two EB lanes to two WB lanes	Northernmost lane signed as "No Parking" but currently used as non-metered on-street parking	None
13. Walnut between Memorial & N. 4th	Removal of angled parking area and concrete islands along N side of street; Addition of three WB lanes; Reconstruction of N curb and sidewalk	Private, head-in parking to be converted to parallel parking; Entry to private parking garage maintained but accessed from WB direction	Wider sidewalks and enhanced pedestrian approach to Arch Grounds and Old Cathedral along N side of street
14. Walnut St Bridge	Full bridge reconstruction; Elimination of one EB lane; Addition of three WB lanes	None	N edge of bridge is dictated by turning movement of 74' tractor trailer plus sidewalk along N side
15. Memorial Dr NB approach to Walnut	One lane removal; Cantilever over depressed section removed	Lanes from PSB and Memorial Dr ramps are maintained but shift E to facilitate truck turning movements; Lane from Poplar St dropped at JNEM service entrance	None

LEGEND

- Existing Curbs
- Proposed Curbs
- Approximate Curbs
- - - Existing Striping
- - - Proposed Striping
- Parking/Pick-up/Drop-off





DESCRIPTION	PROPOSED CHANGE	ISSUES	NOTES / OPPORTUNITIES
1. Texas U-Turn	The western-most segment of Washington Ave will become a u-turn from the Washington Street exit ramp to Memorial Dr SB.	None	U-turn should remove vehicles/trips to WB Washington Ave., therefore reducing pedestrian-vehicle interactions for those crossing Washington Ave. City Streets Dept also requested U-turn as a way to manage traffic on event days.
2. N. 3rd between Eads Bridge and Lucas Ave	Alignment generally follows existing roadway under the elevated section of highway. Increased sidewalk space at the north edge of Eads Bridge, east of N. 3rd. Create extension of Lucas Ave below elevated highway.	None	Provide for curb cut at Lucas Ave parking lot for ingress and egress. Current alignment avoids columns of existing outriggers.
3. N. 3rd between Lucas Ave and Morgan St	N. 3rd continues as a separated one-way pair in this section (2 NB lanes, 1 SB lane) and continues to follow existing alignment. Intersection at Morgan St is to the east of the elevated highway.	None	Possible location for on-street parking on both sides of SB N. 3rd St in this section. Potential for landscaped buffer between NB and SB lanes.
4. N. 3rd between Morgan St and Laclede's Landing Blvd	N. 3rd continues as a separated one-way pair from Morgan St intersection to connect with Laclede's Landing Blvd. Existing loop road from Morgan to Laclede's Landing Blvd is closed off. Existing island at end of MLK would be cut back to allow NB through movement on N. 3rd.	None	N. 3rd ties into existing signal system at the end of the MLK Bridge, adding a third phase. Existing alignment and lane configuration of other entering streets are unchanged. Possible location for on-street parking on both sides of SB N. 3rd St in this section. Potential for landscaped buffer between NB and SB lanes.
5. N. 3rd from MLK Bridge north	N. 3rd continues as a one-lane, one-way street across the existing plaza to join the MLK Bridge NB off-ramp.	Alignment and connection to be discussed with IDOT	NB movements from N. 3rd and from MLK Bridge do not have concurrent peaks, therefore the potential for weaving is minimized.

0 25 50 100 200 feet

LEGEND

- Existing Curbs
- Proposed Curbs
- Approximate Curbs
- - - Existing Striping
- - - Proposed Striping
- Parking/Pick-up/Drop-off

Appendix C

Peak Hour Traffic Volumes:

Scenario 1 – Existing Conditions
2010

Scenario 2 – No Build, Year
2015

Scenarios 3A, 3B, 3C – CAR
2015 Build, PSB No Build, ,
Year 2015

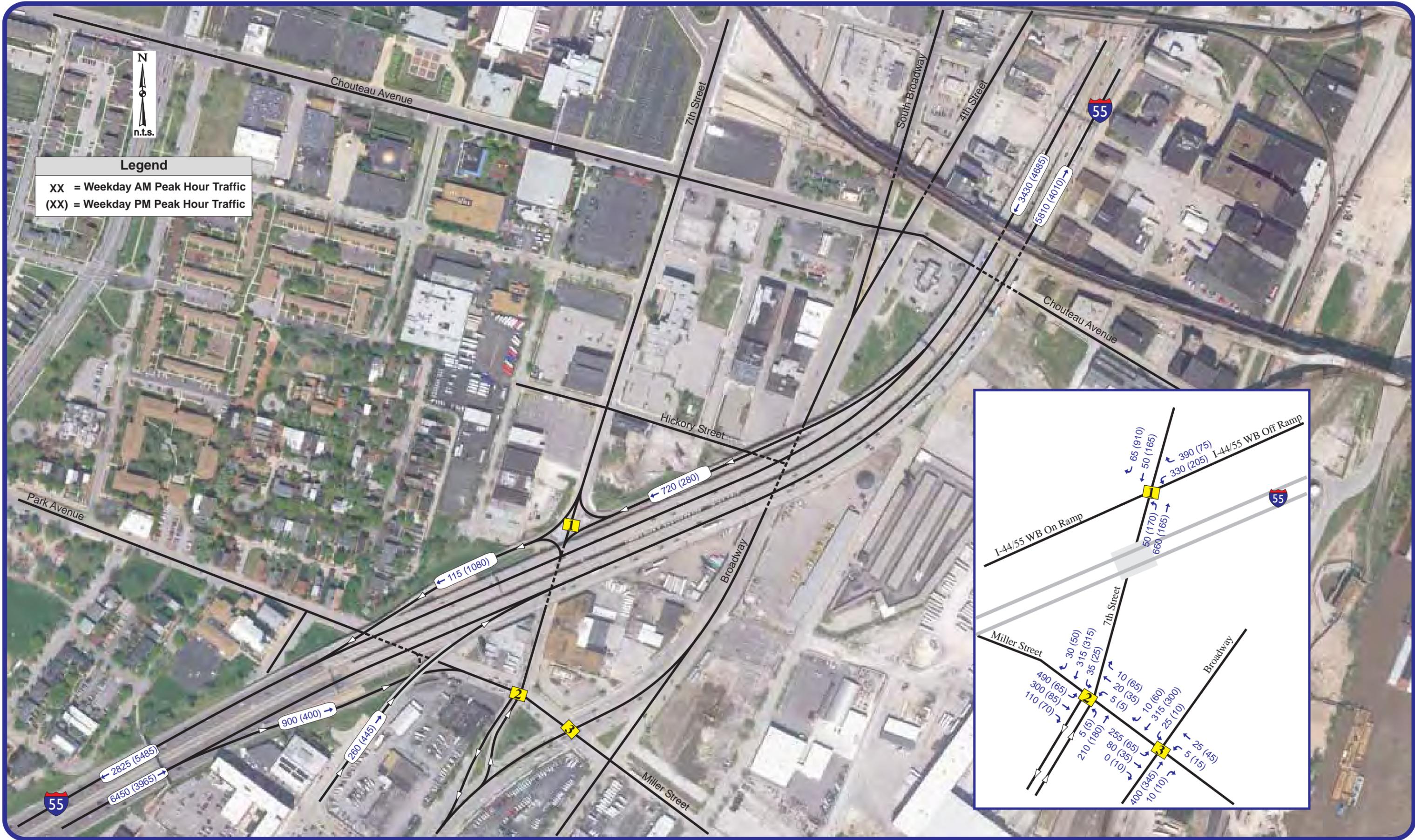
Scenario 6A – CAR 2015 Build,
PSB Preferred Build, Year 2015

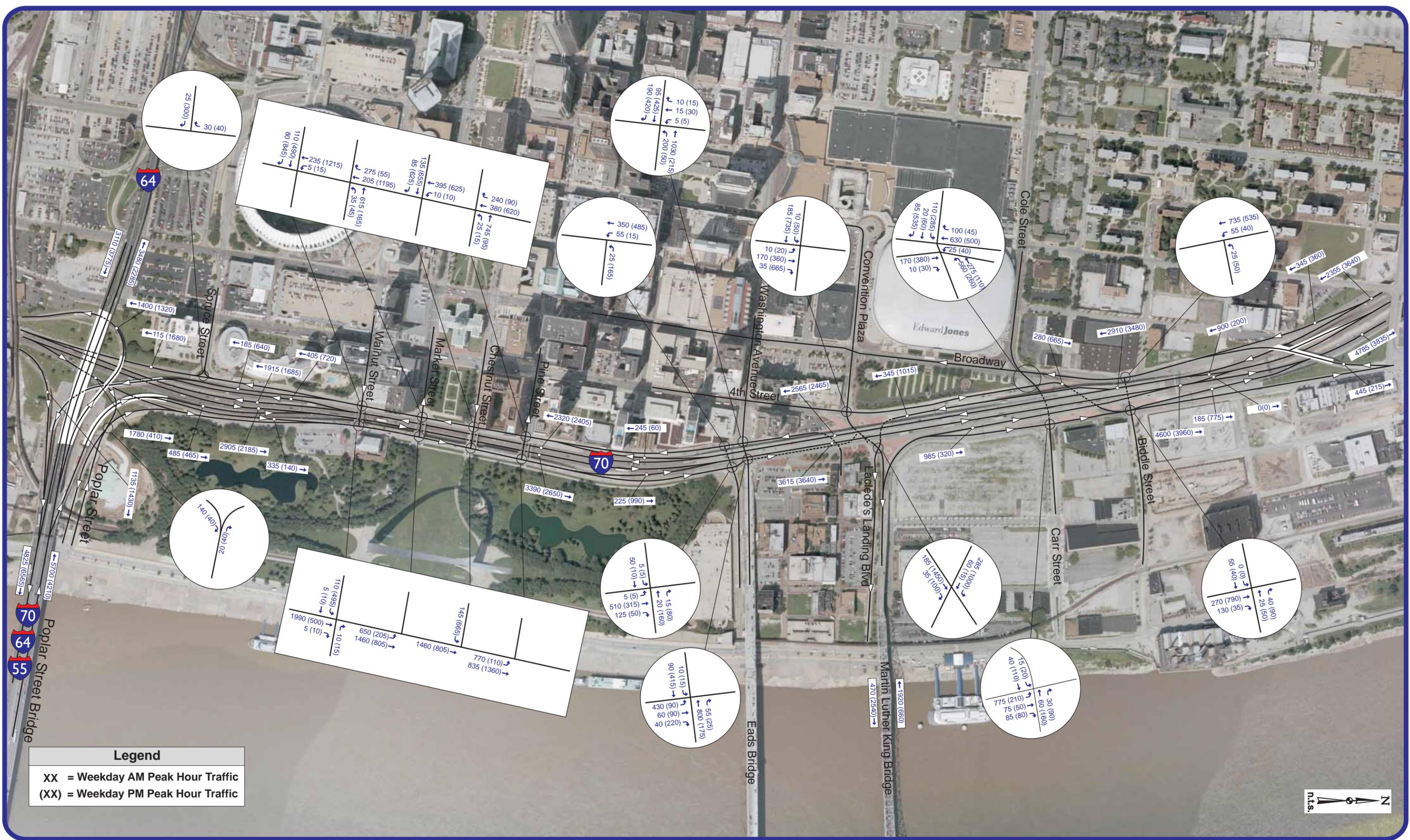
Scenario 7 – No Build, Year
2035

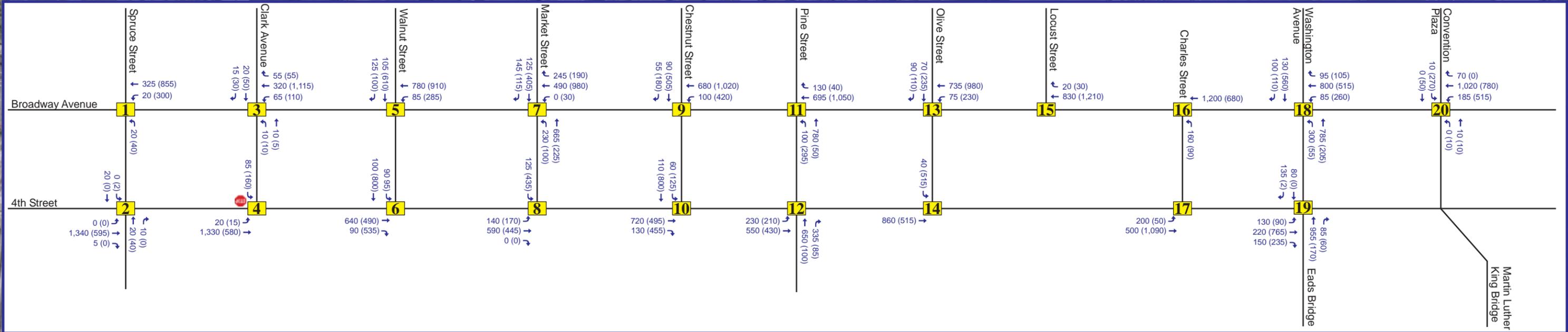
Scenario 9A – CAR 2015 Build,
PSB Preferred Build, Year 2035

Scenarios 10A, 10B, 10C – CAR
2015 Build, PSB No Build, Year
2035



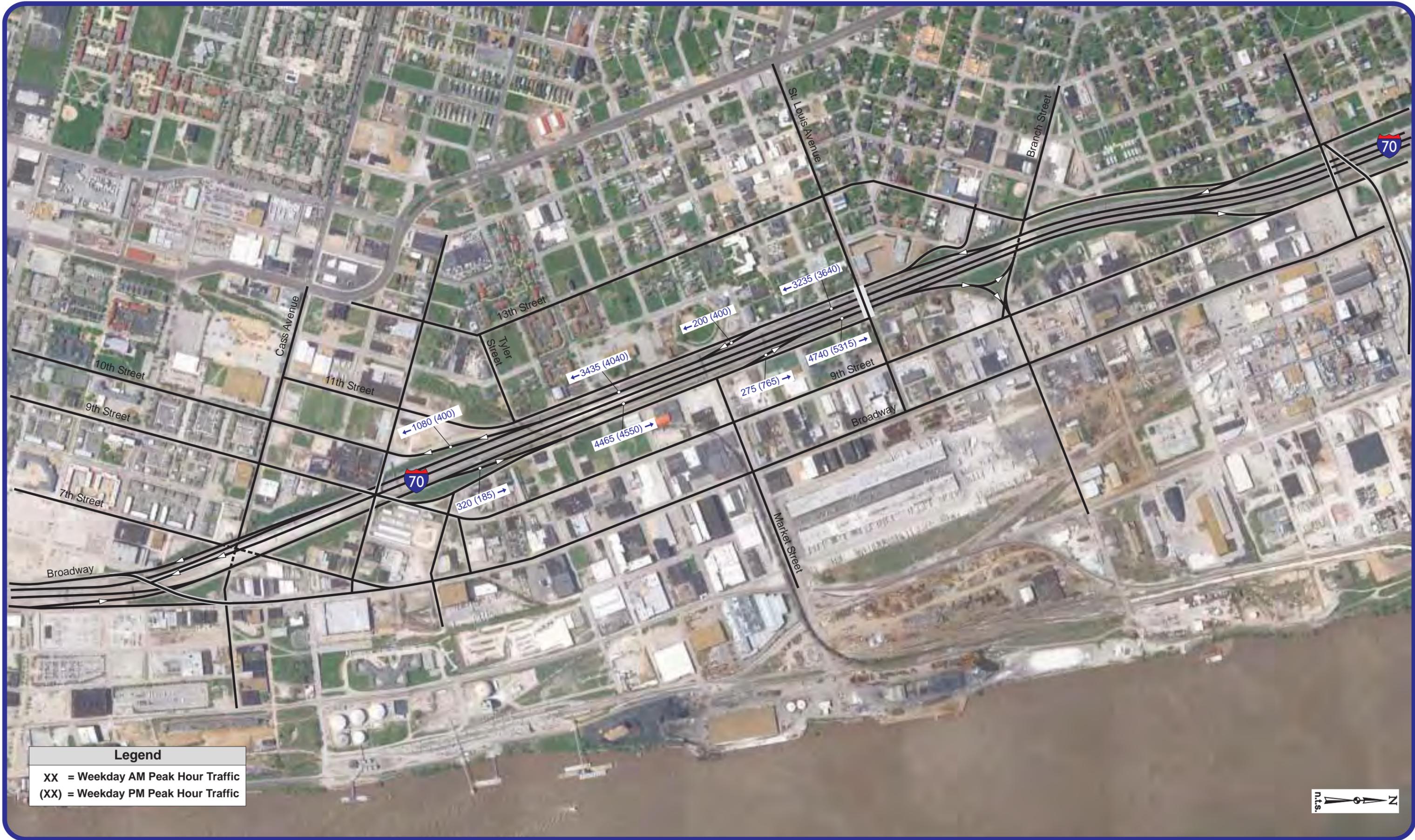






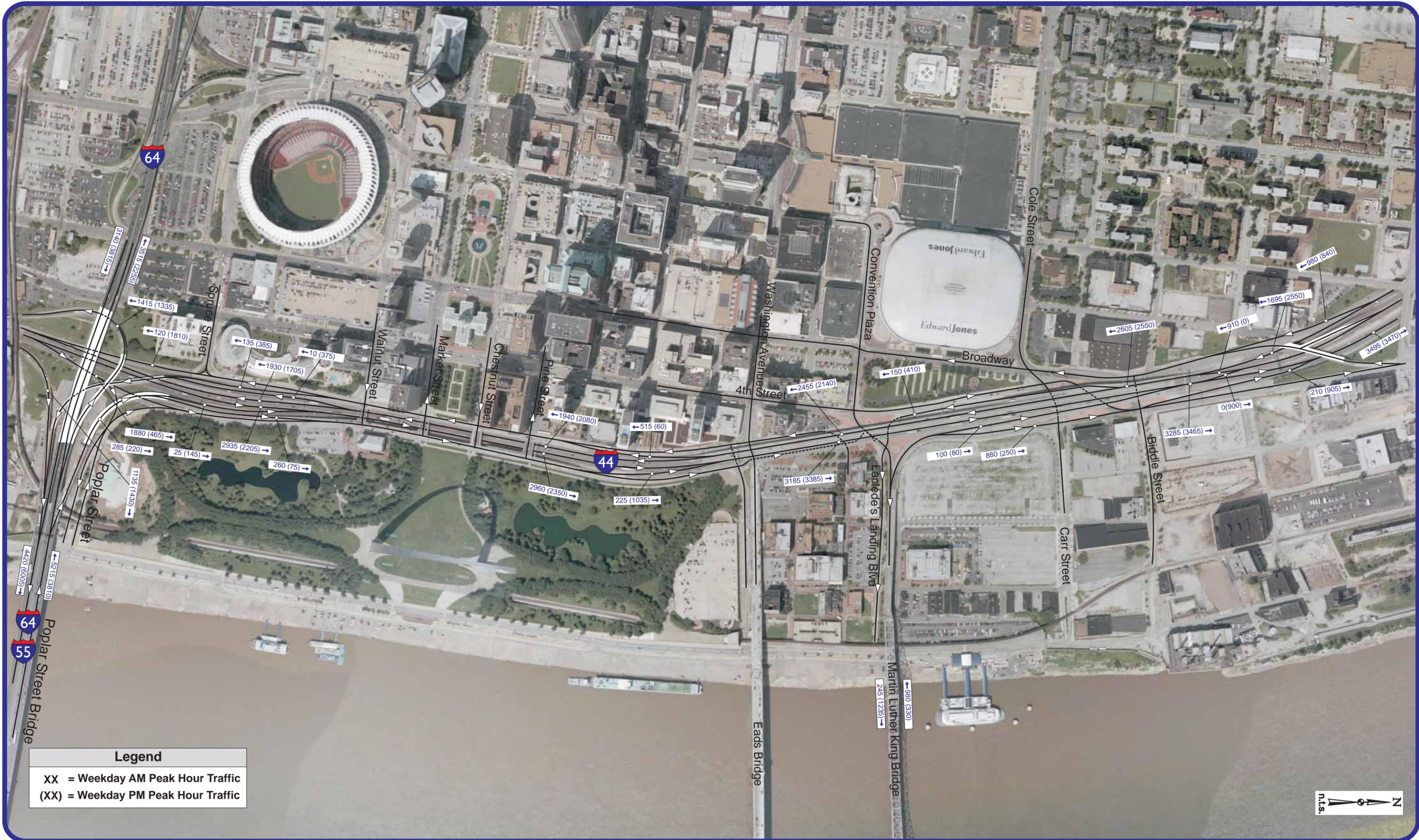
Legend	
XX	= Weekday AM Peak Hour Traffic
(XX)	= Weekday PM Peak Hour Traffic

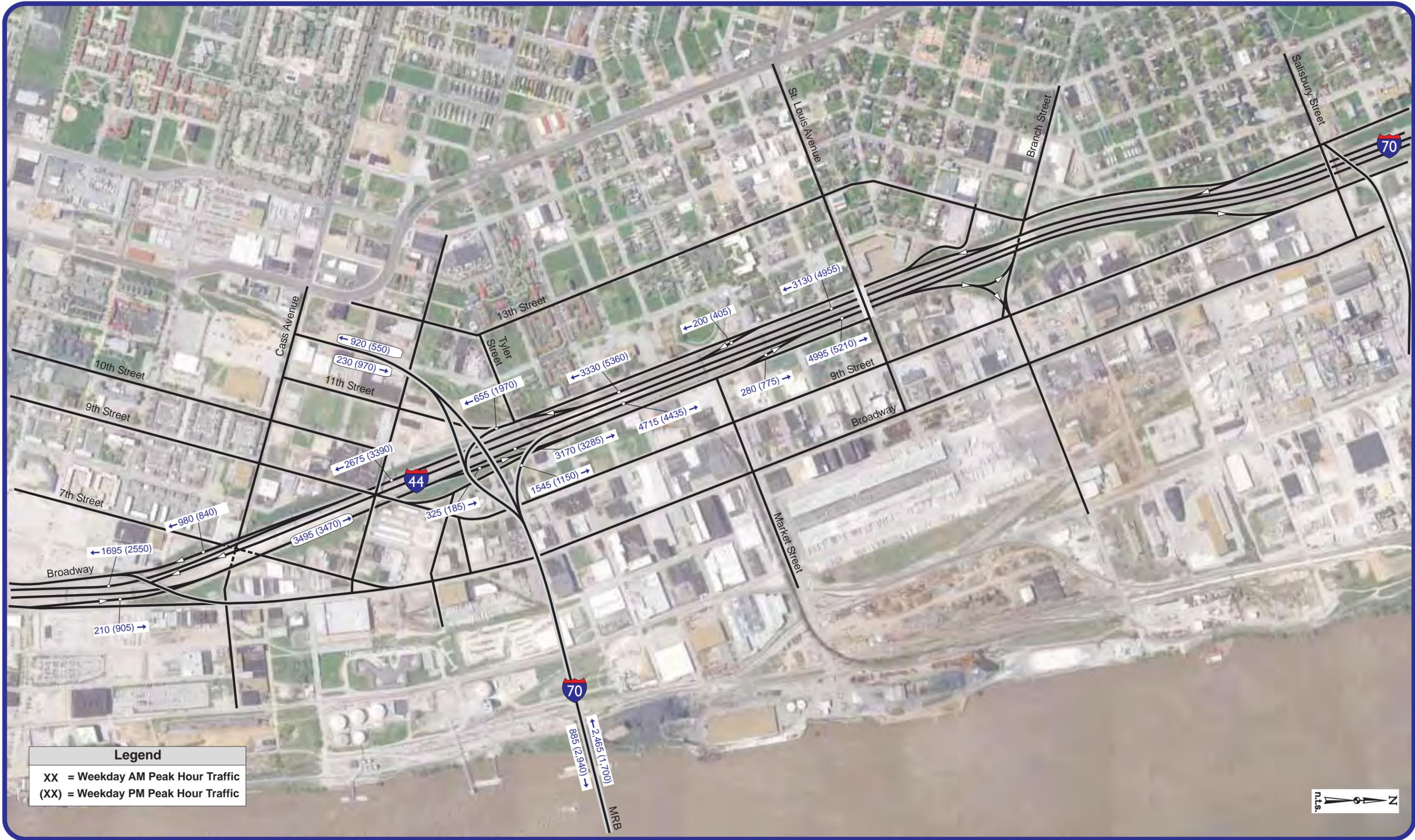




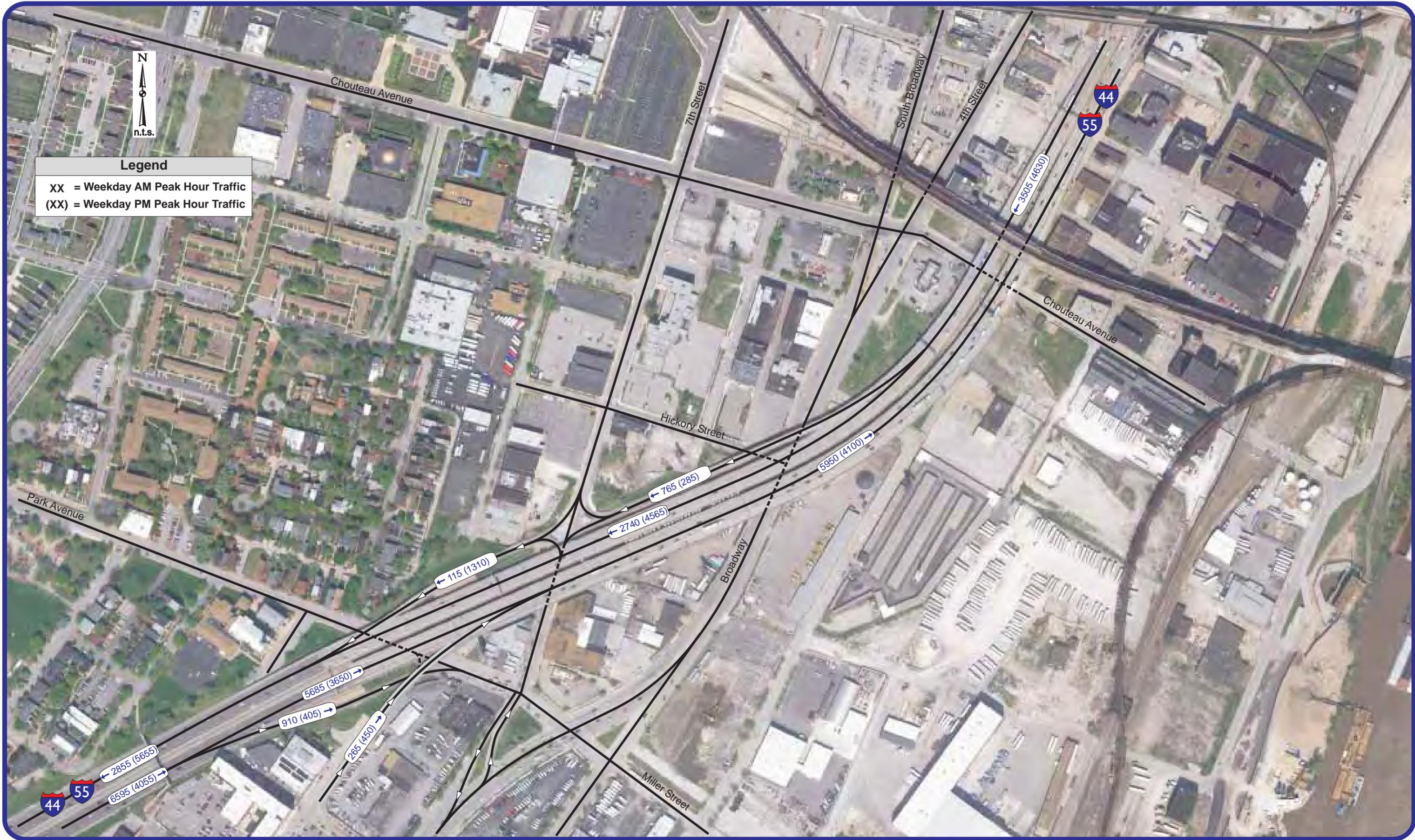


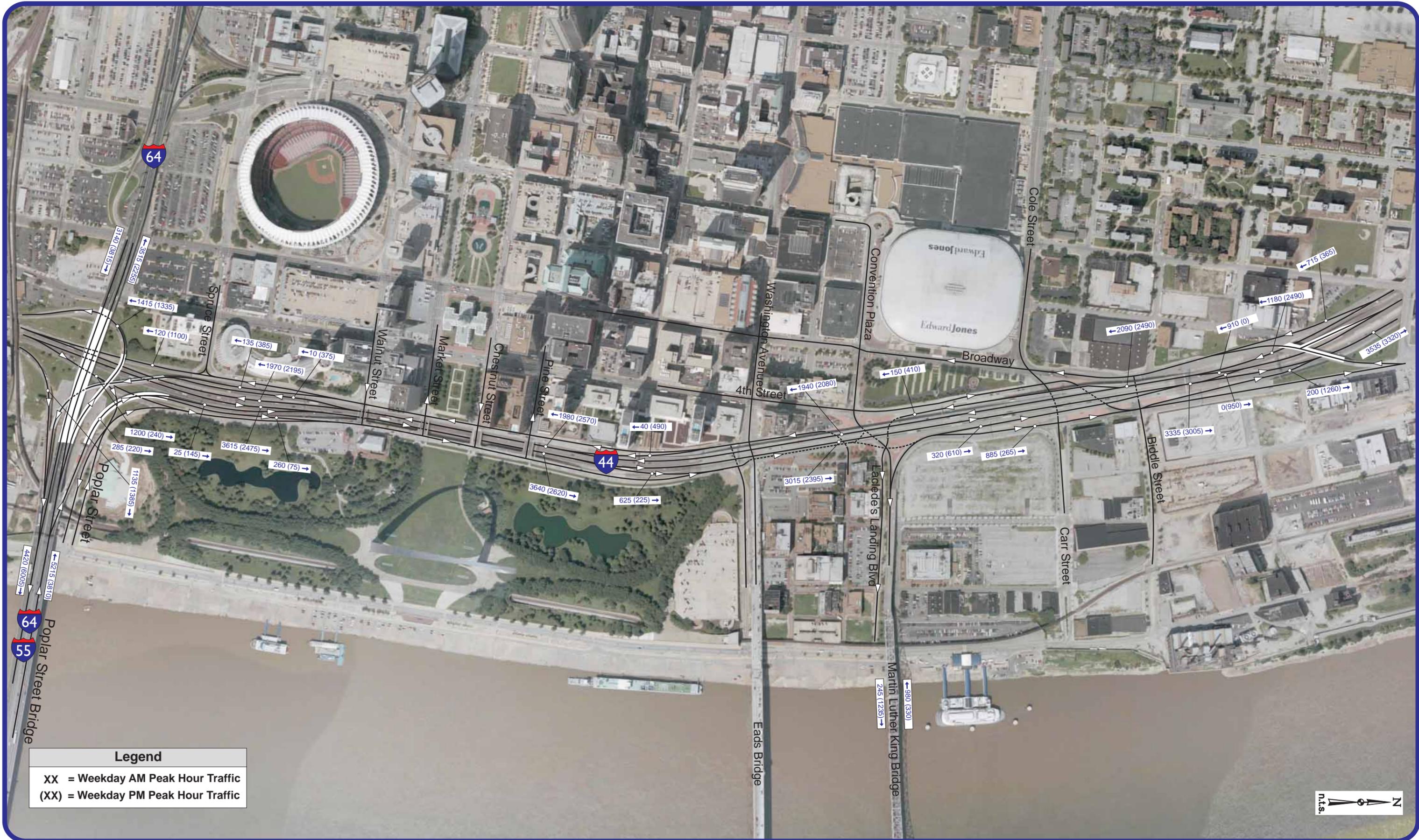


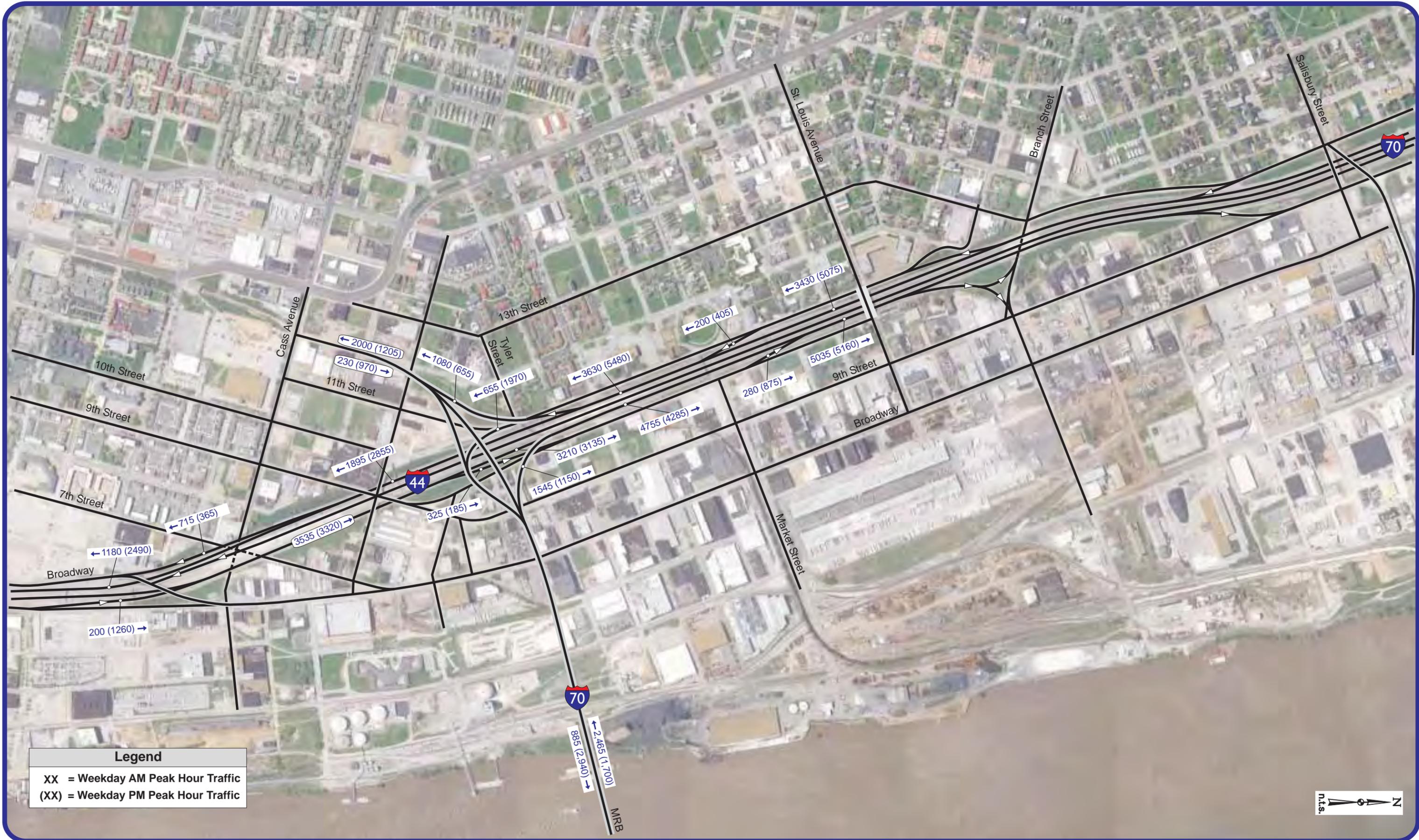








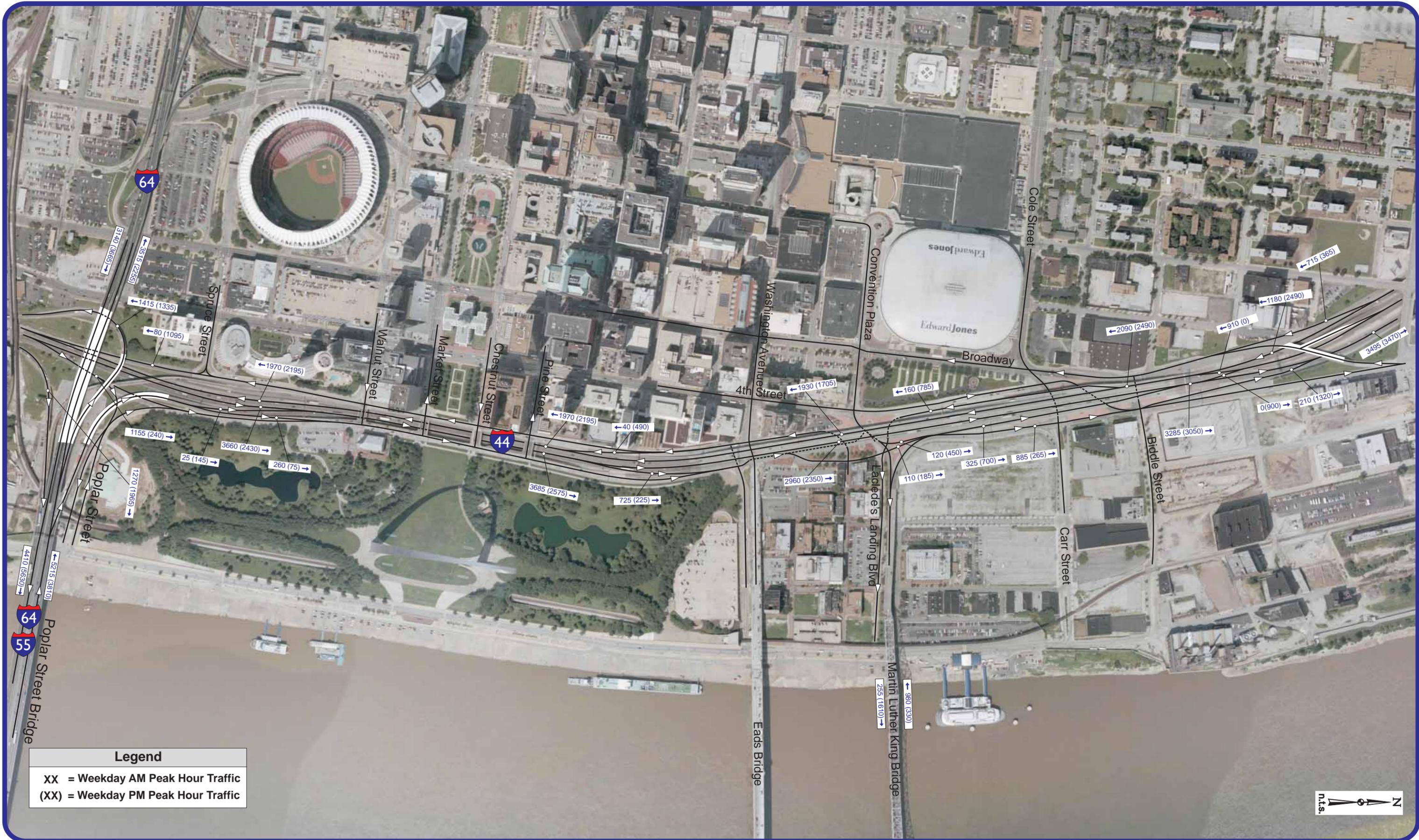


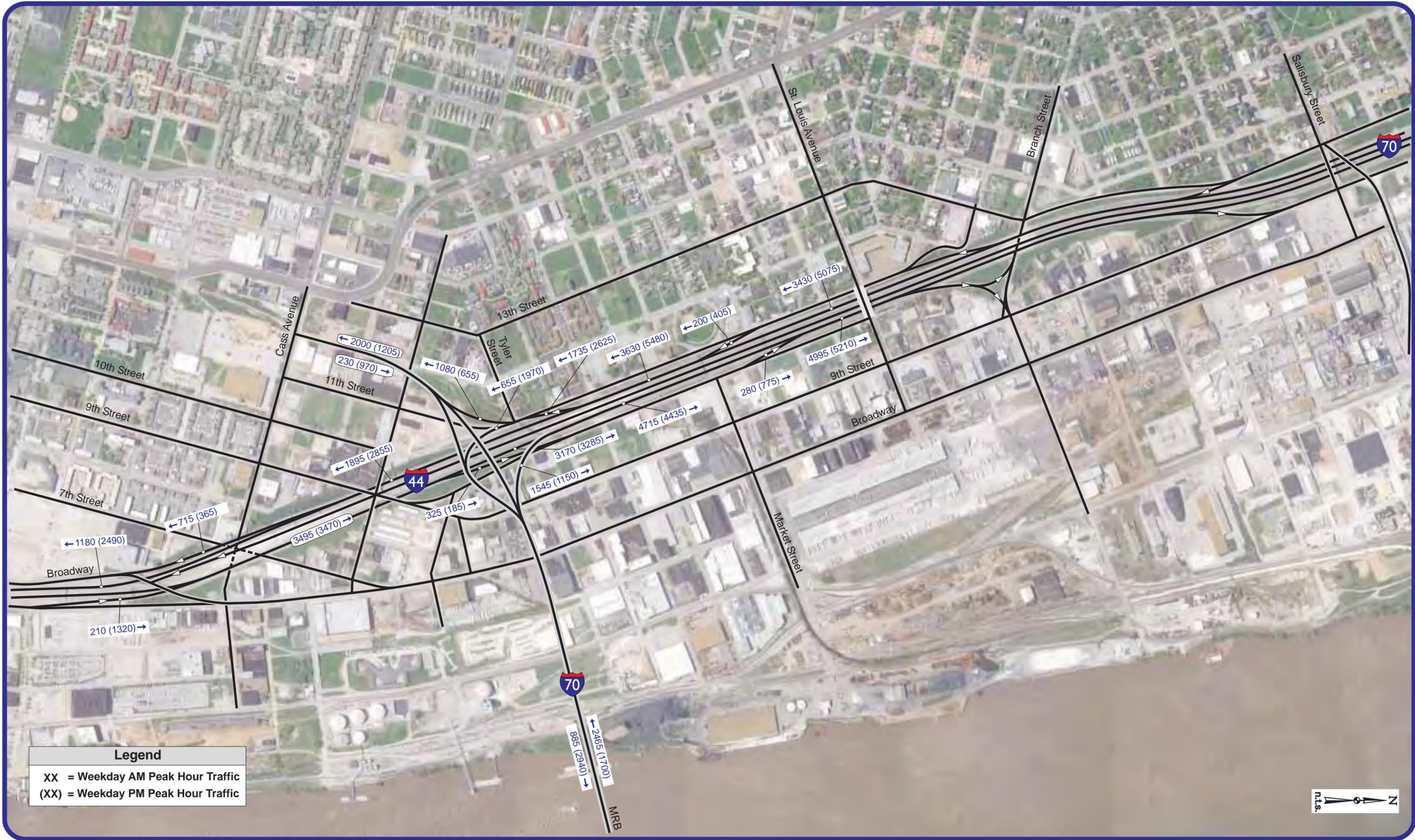






* Scenario 9A, 2035 volumes are 4% higher at all locations







Scenario 6A, 2015 Build with PSB Ramp to Depressed Section Ramp - Sheet 1

* Scenario 9A, 2035 Build with PSB Ramp to Depressed Section volumes are 4% higher at all locations

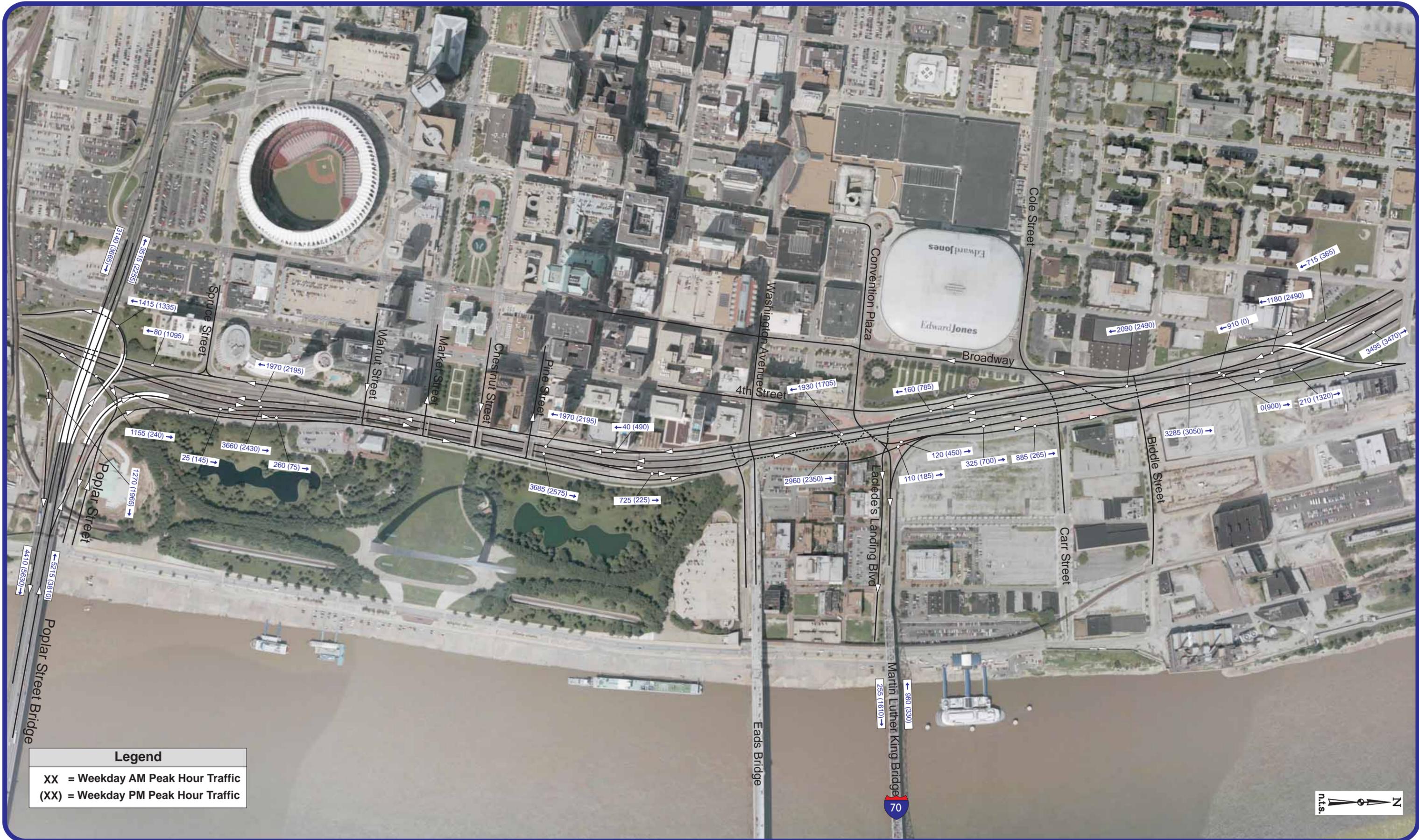
CAR2015
 St. Louis, Missouri
 Job# 144-10
 10/13/11



Scenario 6A, 2015 Build with PSB Ramp to Depressed Section Ramp - Sheet 2

* Scenario 9A, 2035 Build with PSB Ramp to Depressed Section volumes are 4% higher at all locations

CAR2015
 St. Louis, Missouri
 Job# 144-10
 10/13/11



Legend
 XX = Weekday AM Peak Hour Traffic
 (XX) = Weekday PM Peak Hour Traffic

Scenario 6A, 2015 Build with PSB Ramp to Depressed Section Ramp - Sheet 3A

* Scenario 9A, 2035 Build with PSB Ramp to Depressed Section volumes are 4% higher at all locations

CAR2015
 St. Louis, Missouri
 Job# 144-10
 10/13/11





Scenario 6A, 2015 Build with PSB Ramp to Depressed Section Ramp - Sheet 4

* Scenario 9A, 2035 Build with PSB Ramp to Depressed Section volumes are 4% higher at all locations

CAR2015
 St. Louis, Missouri
 Job# 144-10
 10/13/11

Appendix D

Freeway Level of Service Figures



Legend	
LOS Graphic Key	
Existing LOS =	
Scenario 2 LOS =	
Scenario 3C LOS =	
Scenario 6A LOS =	
LOS Color Key	
LOS A-D =	
LOS E =	
LOS F =	



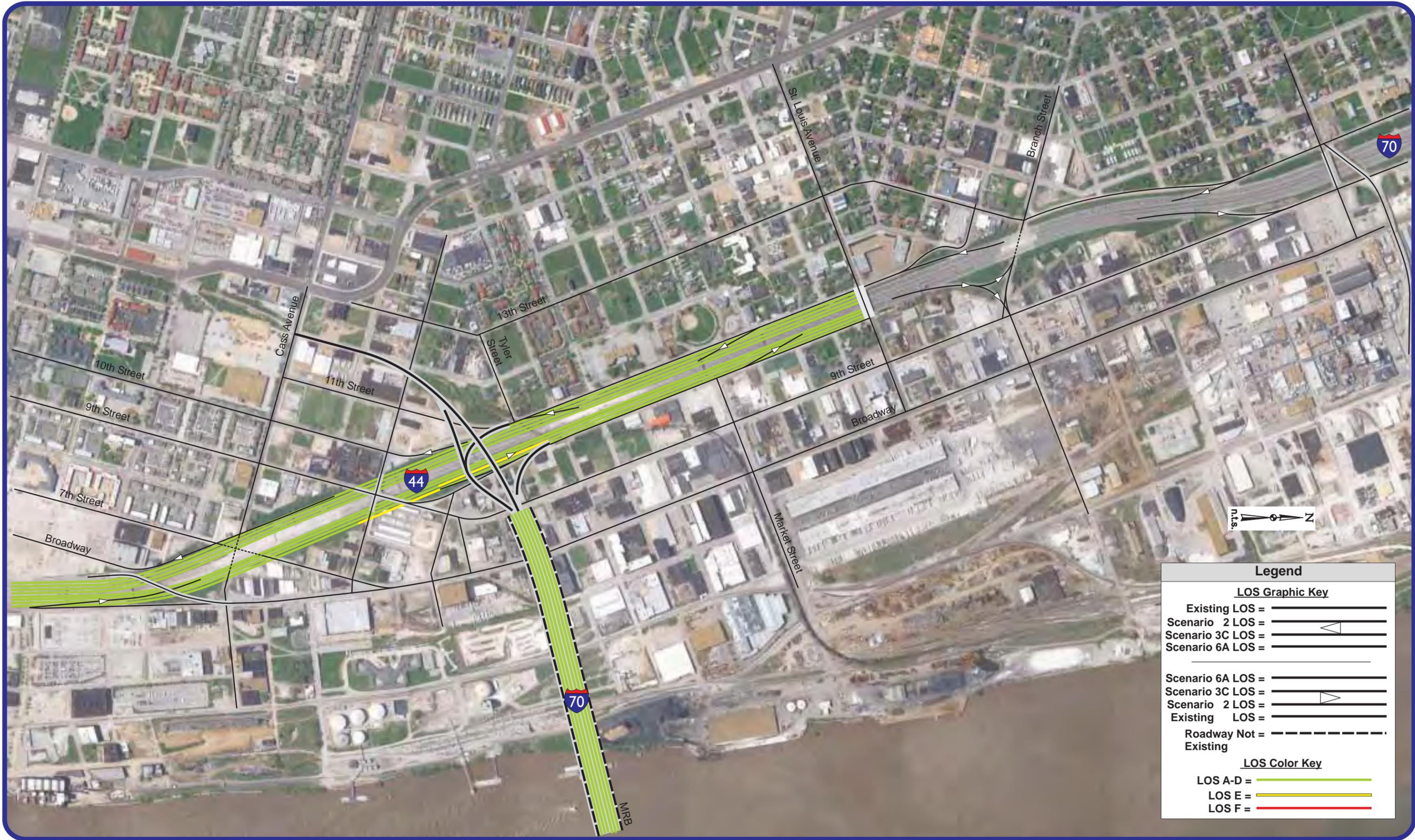
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<u>LOS Graphic Key</u>	
Existing LOS =	—————
Scenario 2 LOS =	—————
Scenario 3C LOS =	—————
Scenario 6A LOS =	—————
Scenario 6A LOS =	—————
Scenario 3C LOS =	—————
Scenario 2 LOS =	—————
Existing LOS =	—————
<u>LOS Color Key</u>	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 2 LOS =	—————▲—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————
Scenario 3C LOS =	—————
Scenario 6A LOS =	—————
Scenario 6A LOS =	—————
Scenario 3C LOS =	—————
Scenario 2 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 2 LOS =	—————▲—————
Existing LOS =	—————
Roadway Not Existing	- - - - -
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————
Scenario 3C LOS =	—————
Scenario 6A LOS =	—————
Scenario 6A LOS =	—————
Scenario 3C LOS =	—————
Scenario 2 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



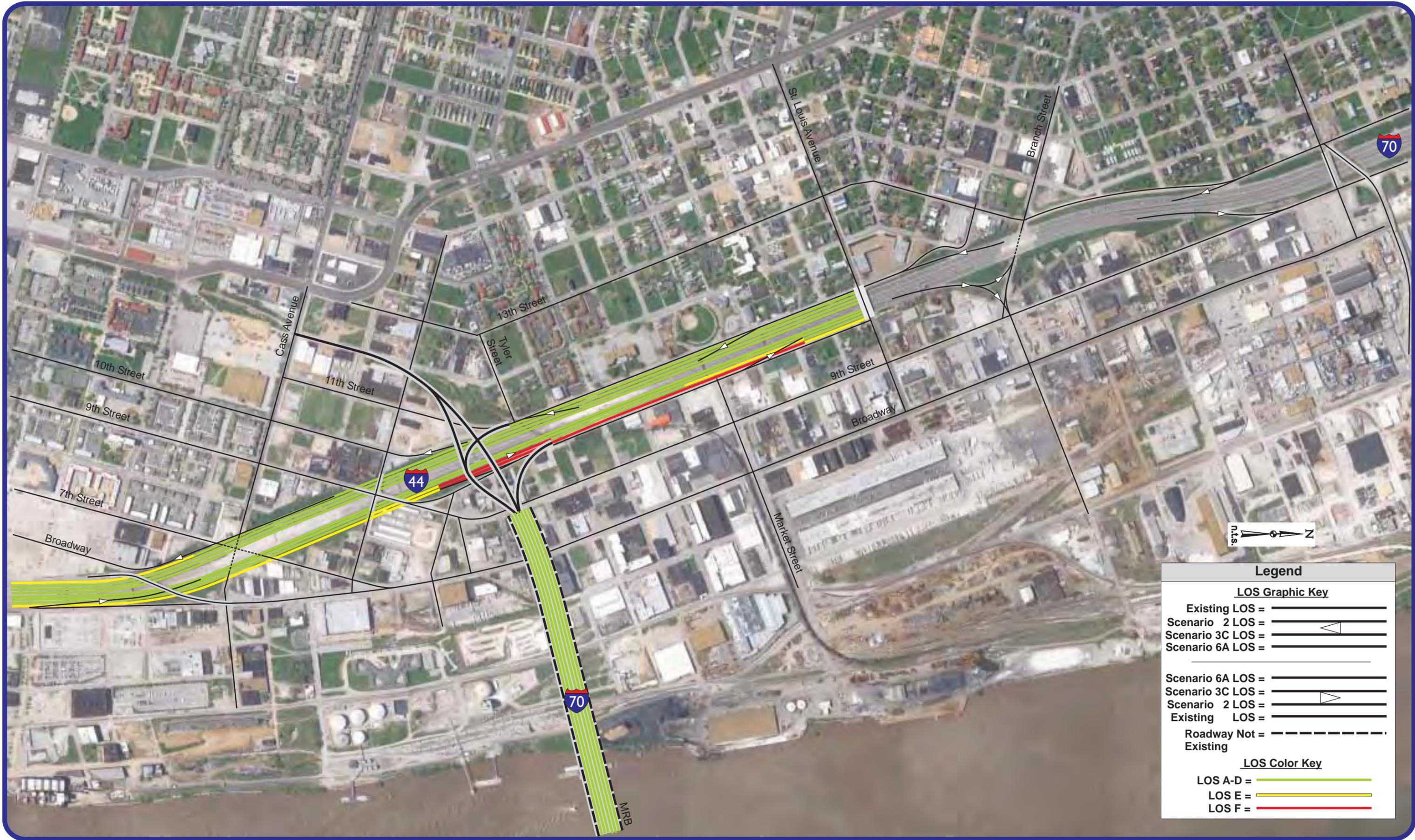
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Scenario 3C LOS =	—————
Scenario 6A LOS =	—————
Scenario 6A LOS =	—————
Scenario 3C LOS =	—————
Scenario 2 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————
Scenario 3C LOS =	—————
Scenario 6A LOS =	—————
Scenario 6A LOS =	—————
Scenario 3C LOS =	—————
Scenario 2 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 2 LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 6A LOS =	—————▲—————
Scenario 3C LOS =	—————▲—————
Scenario 2 LOS =	—————▲—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————





Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————
Scenario 7 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



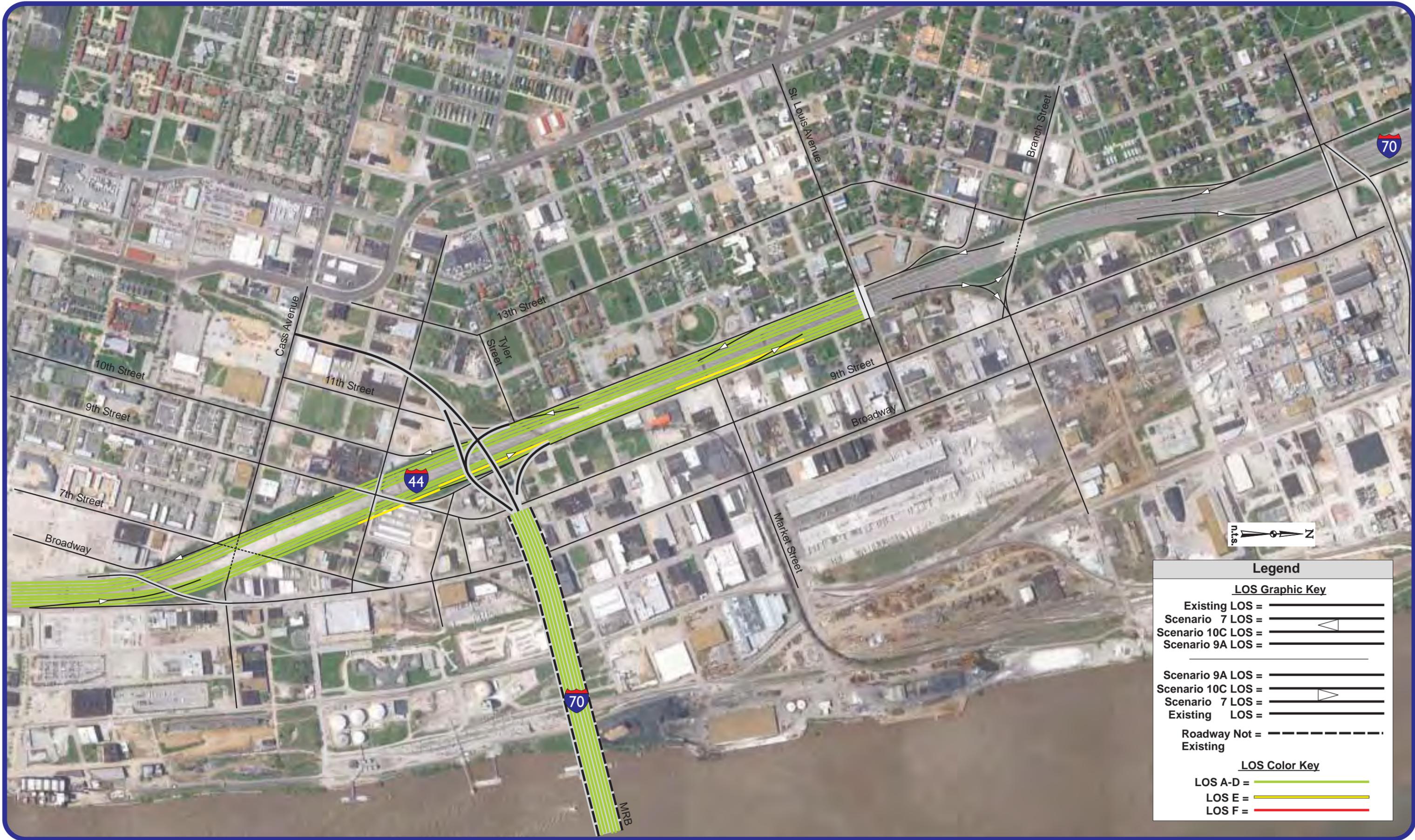
Legend	
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Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————
Scenario 7 LOS =	—————
Existing LOS =	—————
<u>LOS Color Key</u>	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————
Scenario 7 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————▲
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————▲
Scenario 7 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend

LOS Graphic Key

Existing LOS =

Scenario 7 LOS =

Scenario 10C LOS =

Scenario 9A LOS =

Scenario 9A LOS =

Scenario 10C LOS =

Scenario 7 LOS =

Existing LOS =

Roadway Not Existing =

LOS Color Key

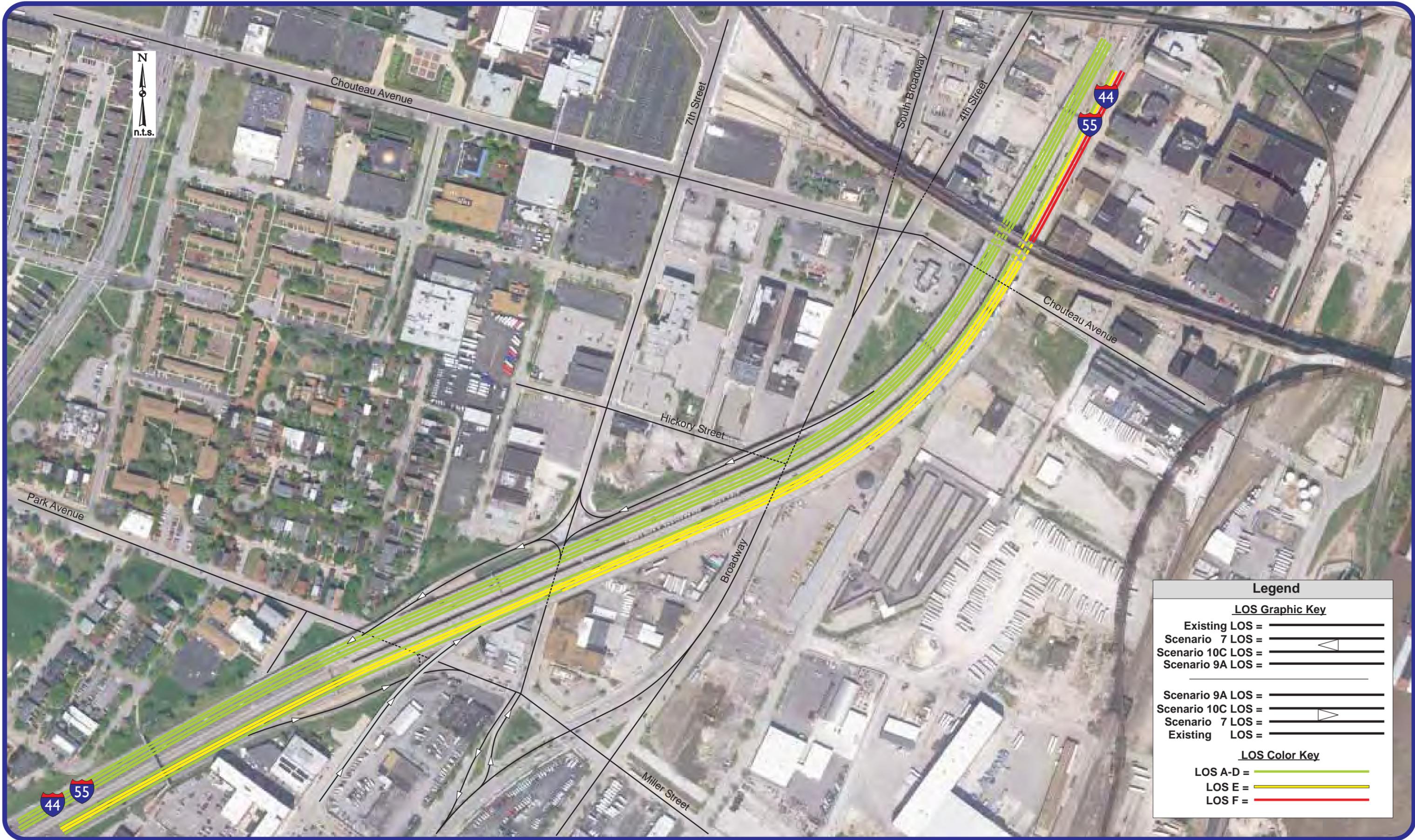
LOS A-D =

LOS E =

LOS F =



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————
Scenario 7 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



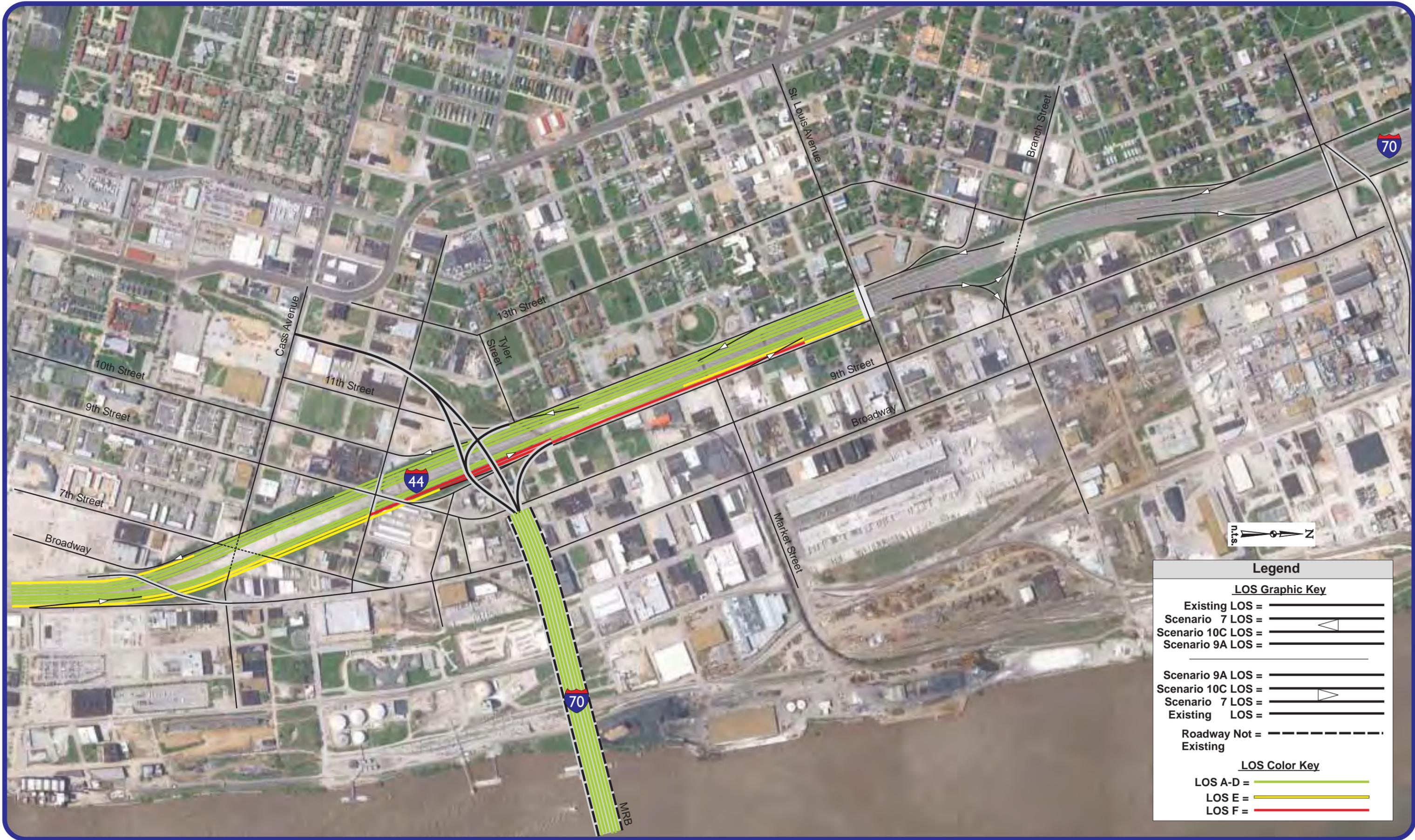
Legend	
<u>LOS Graphic Key</u>	
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Scenario 7 LOS =	—————
Scenario 10C LOS =	—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————
Scenario 7 LOS =	—————
Existing LOS =	—————
<u>LOS Color Key</u>	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————▲—————
Scenario 10C LOS =	—————▲—————
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————▲—————
Scenario 7 LOS =	—————▲—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



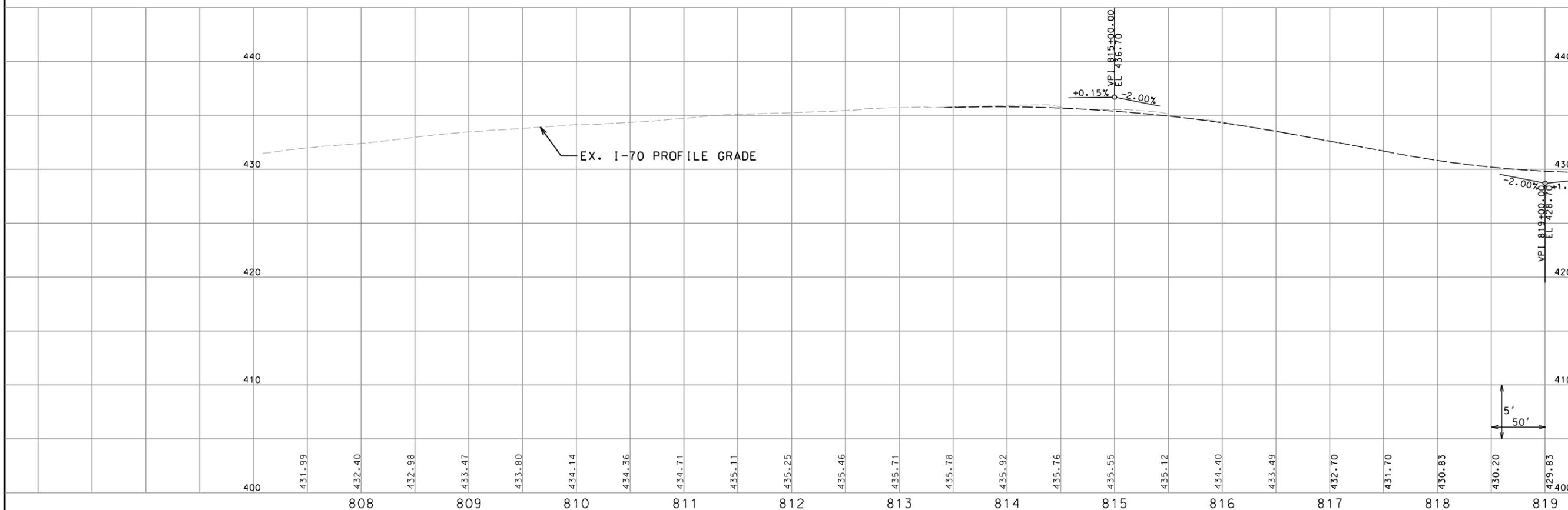
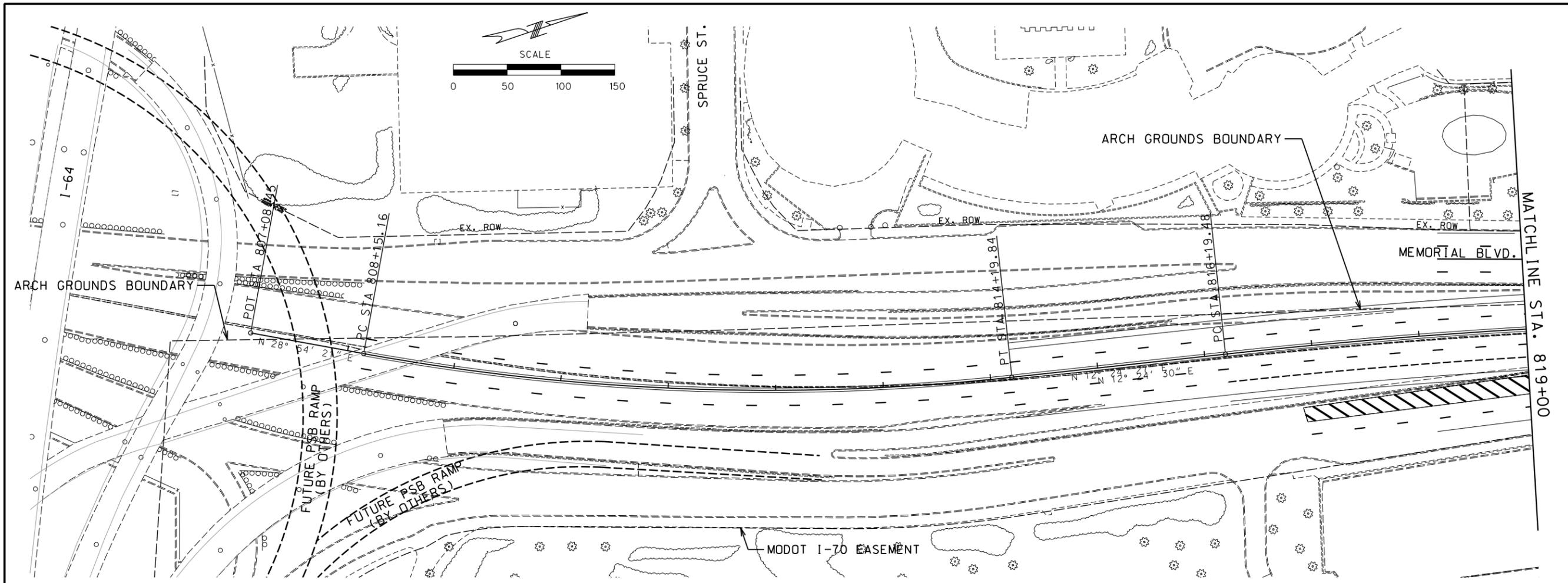
Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	—————
Scenario 10C LOS =	—————▲
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	—————▲
Scenario 7 LOS =	—————
Existing LOS =	—————
LOS Color Key	
LOS A-D =	—————
LOS E =	—————
LOS F =	—————



Legend	
LOS Graphic Key	
Existing LOS =	—————
Scenario 7 LOS =	————— <
Scenario 10C LOS =	————— >
Scenario 9A LOS =	—————
Scenario 9A LOS =	—————
Scenario 10C LOS =	————— >
Scenario 7 LOS =	————— <
Existing LOS =	—————
Roadway Not Existing	- - - - -
LOS Color Key	
LOS A-D =	————— (Green)
LOS E =	————— (Yellow)
LOS F =	————— (Red)

Appendix E

Washington Avenue Ramps
Design Documents



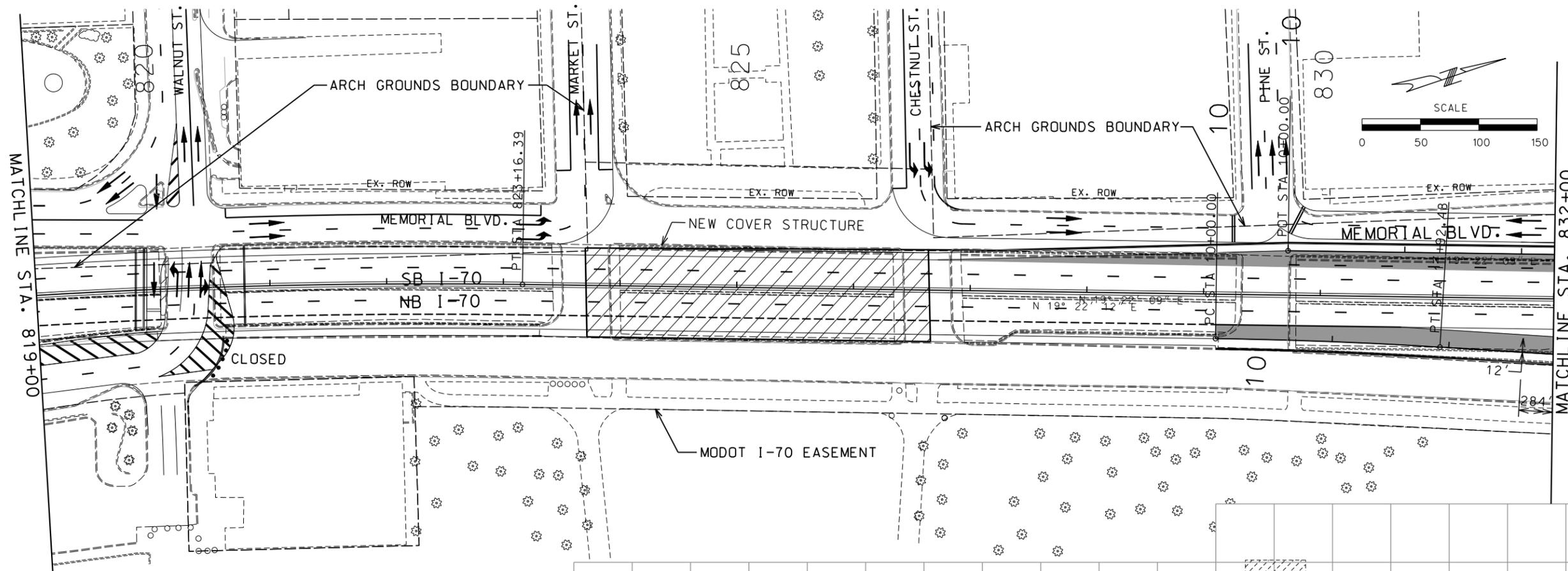
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ROUTE	STATE	170	MO
DISTRICT	SHEET NO.	6	1
ST. LOUIS			
JOB NO.			
CONTRACT ID.			
PROJECT NO.			
BRIDGE NO.			

DATE	DESCRIPTION

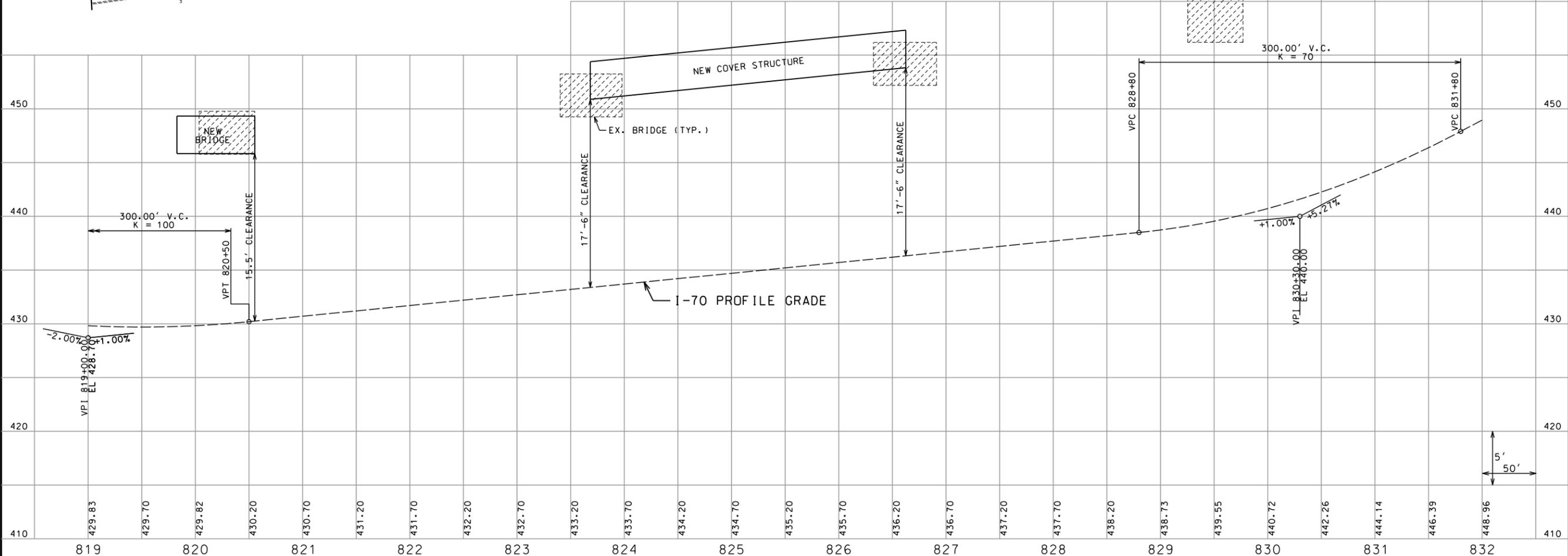
CONCEPTUAL PLANS



CAR - 2015
PLAN AND PROFILE
I-70 (1 OF 3)



SCALE
0 50 100 150



DATE PREPARED 12/16/2011	
ROUTE 170	STATE MO
DISTRICT 6	SHEET NO. 2
ST. LOUIS	
JOB NO.	
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	

DATE	DESCRIPTION

CONCEPTUAL PLANS



CAR - 2015
PLAN AND PROFILE
I-70 (2 OF 3)

Design Criteria - CAR 2015

	Design Criteria	Mainline	Ramps
Roadway Type	Functional Classification	Interstate	-
	Level of Service (Peak Hour)		
	Design Year	2035	2035
	Design Speed (mph)	55	45/40
	Access Control	Full	Full
Cross Section	Lane Widths (feet)	12	15
	Pavement Widths (feet)	60	15
	Paved Shoulders (feet)		
	- left	1	4
	- right	6	8
Superelevation (max)	4%	6%	
SE Transition Length (feet)	96	109	
Geometrics	Horizontal Curvature - Min Radius (feet)	1500	485 (at 40 mph)
	Grades - Max		
	- ascending	3% (4% abs max)	5% (7% abs max)
	- descending	6%	5% (7% abs max)
	- min for drainage	0.5%	0.5%
	Stopping Sight Distance - Min (feet)	570	360
	Vertical Curves - Min K		
	- crest	151	61
- sag	136	80	
Vertical Clearances - Min (feet)			
- over interstate and state rts	15.5	15.5	
- over local streets	15.5	15.5	

DESIGN EXCEPTION INFORMATION

Route: 1-70 County: St. Louis City Job No.:

A. Design Stage:

- Conceptual Plan R/W Certification
 Preliminary Plan Final (PS&E)
 Other ()

B. Provide data for only those items that are proposed to have a design exception.

English Functional Classification: Design ADT:

Type of Data	Existing	Standard	Proposed	Location
1. Design Speed				
2. Lane Width				
3. Shoulder Width				
Inside	1 ft. - 0 in.	6 ft. - 0 in.	1 ft. - 0 in.	
Outside	8ft. - 8in.	10 ft. - 0in.	6 ft. - 0 in.	
4. Bridge(s)				
Loading				
Width				
Rail				
Approach Rail				
5. Horizontal Alignment				
Degree Curve/Radius				
SSD				
6. Vertical Alignment				
Sag K				
Crest SSD				
7. Grade %				
8. Cross Slope				
9. Superelevation				
10. Horizontal Clearance (Clear Zone)				
11. Vertical Clearance	14 ft. - 9 in.	16 ft. - 6 in.	15 ft. - 6 ft.	
12. Other (Describe)				

C. Give reasons for requesting design exceptions for each design element.

3. In order to add an auxiliary lane in the northbound direction, maintain two - 12 foot wide lanes in each direction, and keep the existing retaining walls in place, the outside shoulder width will be reduced. The existing outside and inside shoulders are substandard. The existing outside shoulders are 8 ft.-8 in., and will be reduced to 6 ft.-0 in. The existing inside shoulders are 1 ft -0 in. and will remain at 1 ft.-0 in.

11. The minimum vertical clearance is at the Walnut Street Bridge (14 ft.-9 in.). The standard vertical clearance for Interstate is 16 ft.-6 in. The accepted minimum vertical clearance inside the I-270/ I-255 Loop is 15 ft.- 6in.

Request for Design Exceptions:

(NOTE: Include only for consultant designed projects.)

By: Mel Millenbruck Date: 12-16-2011
 Consultant Project Manager

URS
 Name of Consulting Firm

By: Jim Middleton Date: _____
 MoDOT Transportation Project Manager

By: Kurt Gribbale Date: _____
 MoDOT Structural Project Manager or Structural Liaison

Approved: (Include only applicable signatures.)

By: _____ Date: _____
 District Engineer

By: _____ Date: _____
 State Bridge Engineer

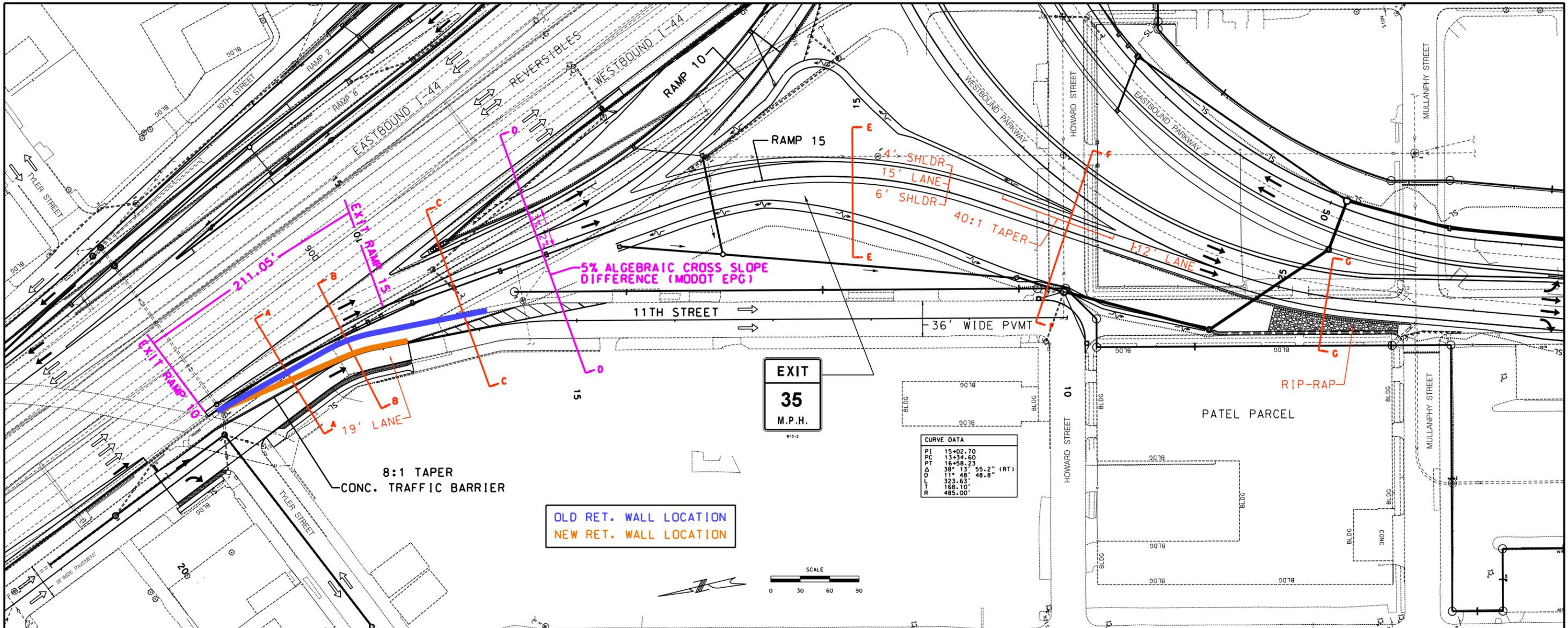
By: _____ Date: _____
 State Design Engineer

By: _____ Date: _____
 Safe and Sound Project Director

By: _____ Date: _____
 FHWA

Appendix F

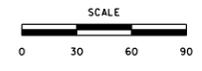
North Tucker Boulevard Off-
Ramp Design Documents



EXIT
35
M.P.H.

CURVE DATA

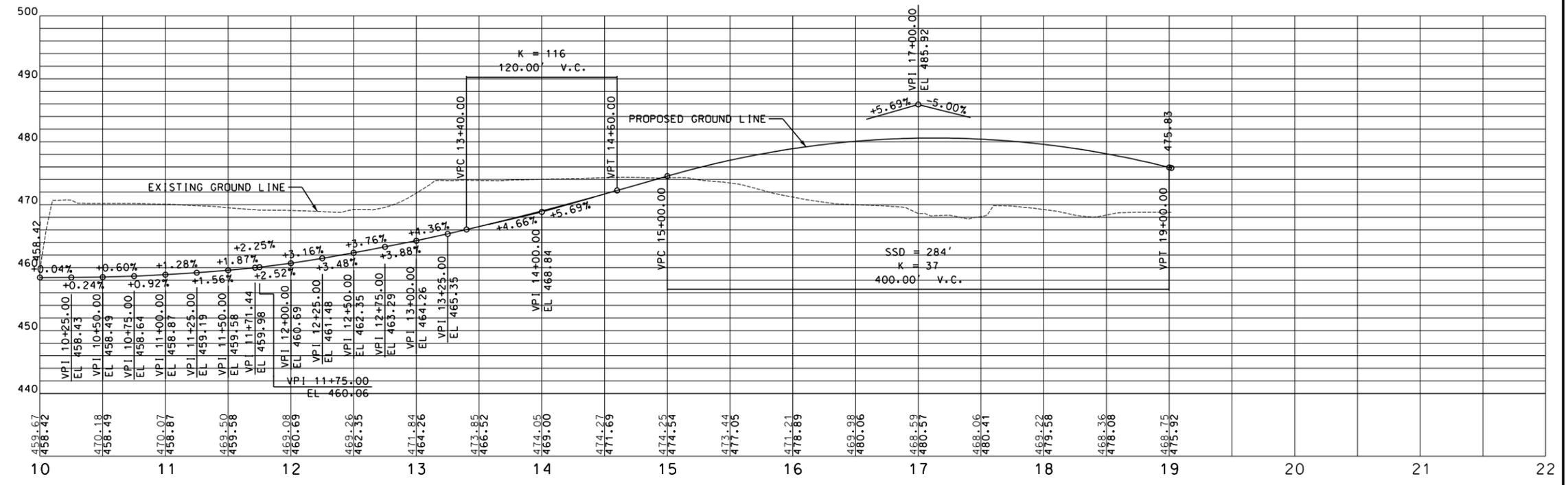
PI	15+02.70
PC	13+34.60
PT	16+58.23
A	38° 13' 55.2" (RT)
D	11° 48' 48.6"
L	323.63'
T	168.10'
R	485.00'



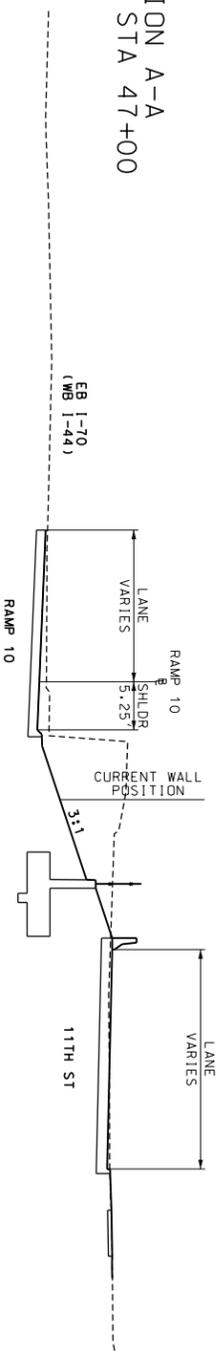
OLD RET. WALL LOCATION
NEW RET. WALL LOCATION

PROPOSED RAMP 15

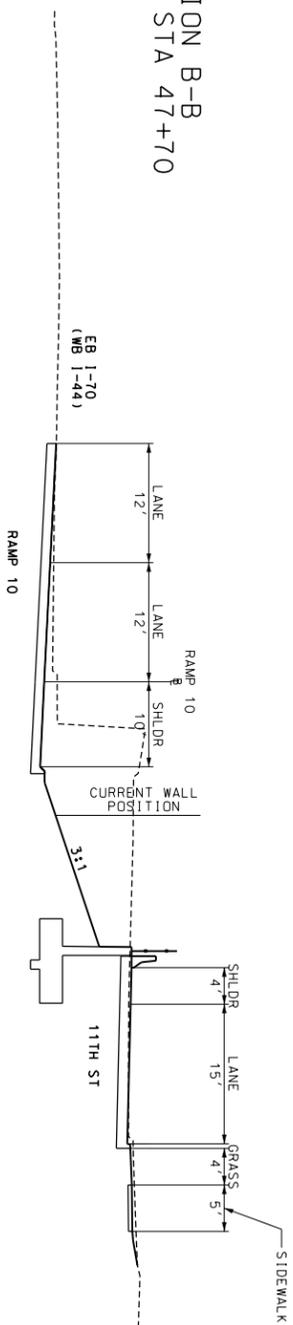
- DESIGN CRITERIA
- 40 MPH HORIZONTAL DESIGN SPEED
 - 35 MPH VERTICAL DESIGN SPEED
 - e = 0.06
 - 5.7% MAX. VERTICAL GRADE (100' AT MAX. GRADE)
 - 15' LANE, 4' LT. SHLDR., 6' RT. SHLDR.
 - 5 DEGREE DEPARTURE ANGLE FROM RAMP 10
- RAMP SPACING CRITERIA
- GREEN BOOK EXHIBIT 10-68
 - 600 FT RECOMMENDED SPACING FOR TURNING ROADWAYS AT SERVICE INTERCHANGES
 - CURRENT DESIGN IS 211 FT - REQUIRES DESIGN EXCEPTION
- NOTABLE CHANGES
- INLET 05-18 SHIFTS NORTH
 - INLET 05-11 SHIFTS NORTH
 - EXTEND TYPE A GUTTER (MOD.) NORTH
 - ADD RIP-RAP TO SLOPE NEAR PATEL PARCEL
- COST COMPARISON
- CIP WALL COST REDUCED
 - 297 LF VS. 208 LF IN LENGTH
 - 5 FT VS. 3 FT AVERAGE HEIGHT
 - INCREASED RAMP PAVEMENT
 - REDUCED 11TH STREET PAVEMENT
 - ADDITIONAL GRADING



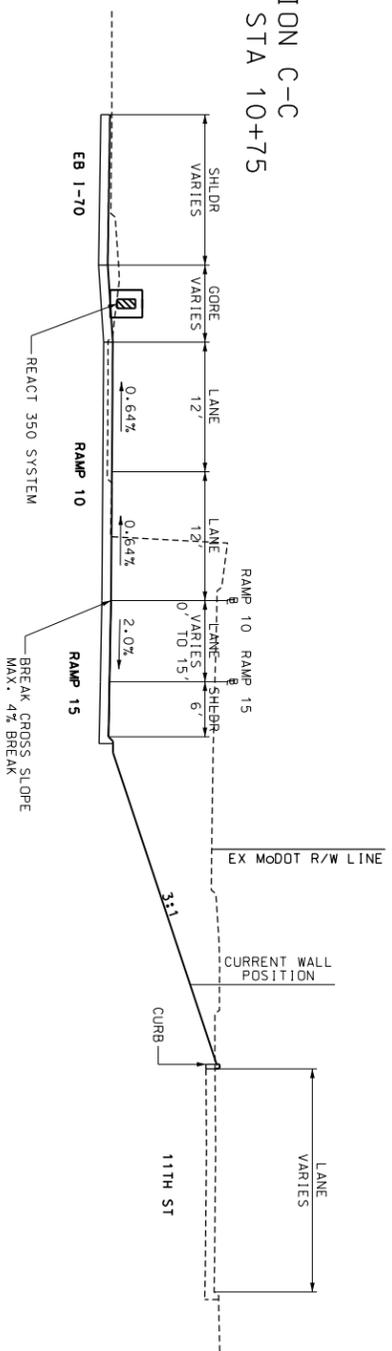
SECTION A-A
RAMP 10 STA 47+00



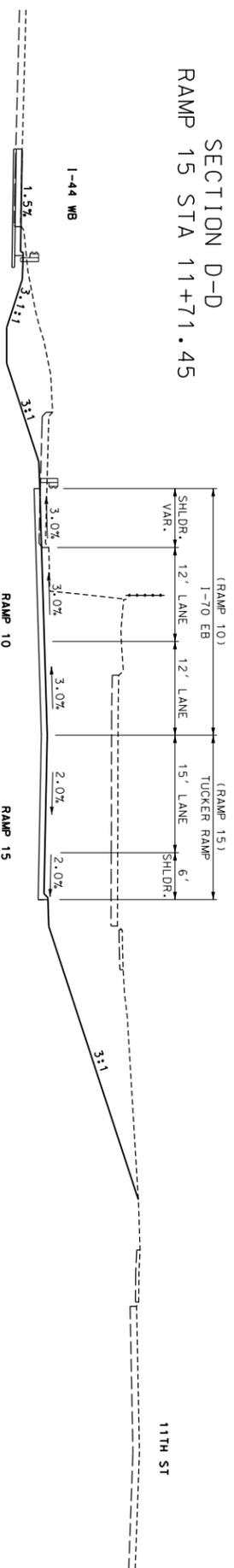
SECTION B-B
RAMP 10 STA 47+70



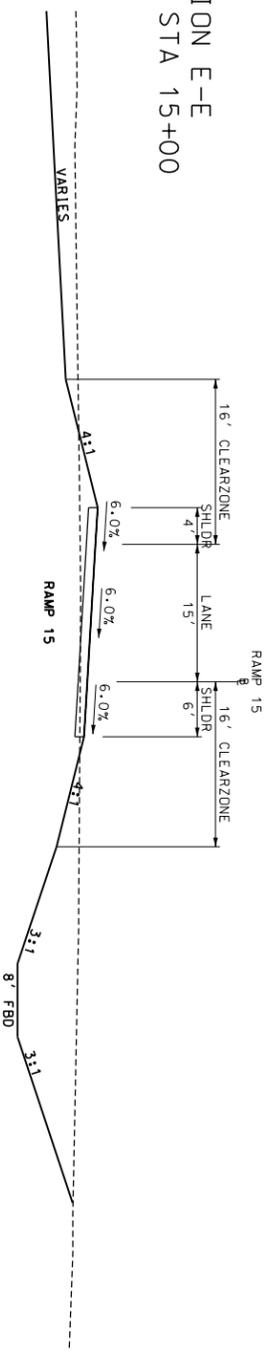
SECTION C-C
RAMP 15 STA 10+75



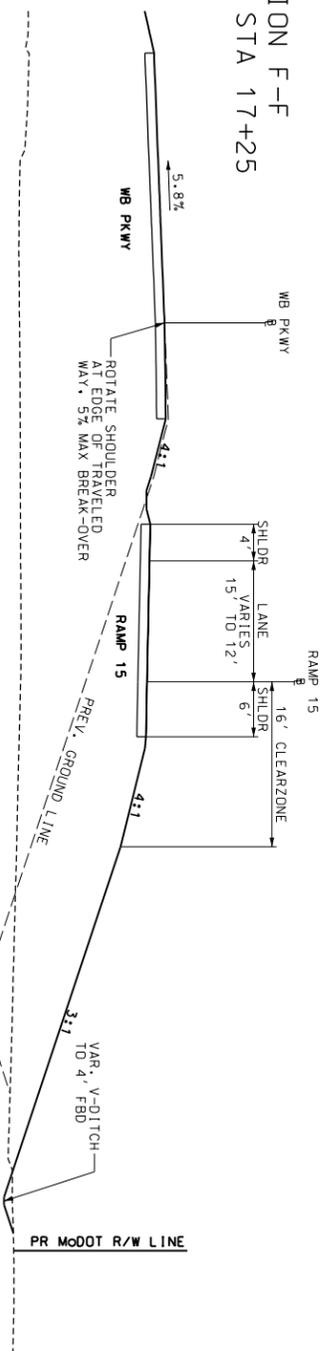
SECTION D-D
RAMP 15 STA 11+71.45



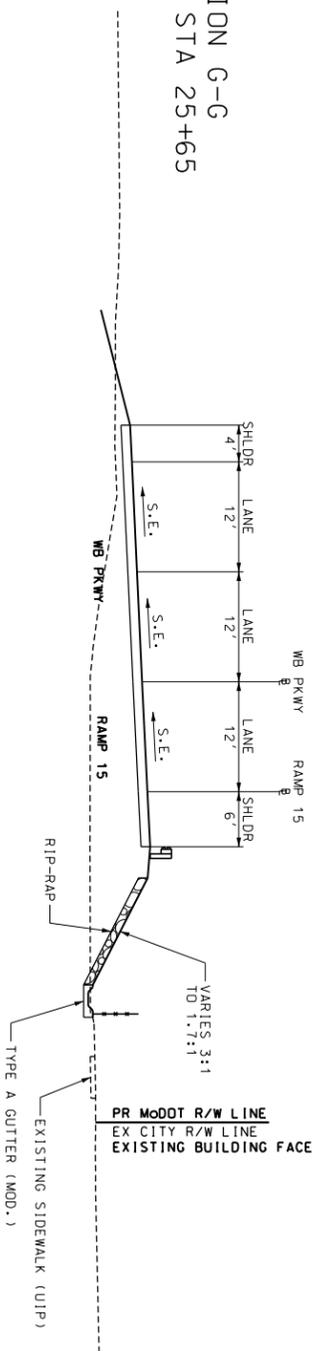
SECTION E-E
RAMP 15 STA 15+00



SECTION F-F
RAMP 15 STA 17+25



SECTION G-G
WB PKWY STA 25+65



DESIGN EXCEPTION INFORMATION

Route: Interstate 70

County: St. Louis City

Job No.: J6I2413

A. Design Stage:

Conceptual Plan R/W Certification

Preliminary Plan Final (PS&E)

Other ()

B. Provide data for only those items that are proposed to have a design exception.

English Functional Classification: Urban Interstate Freeway Design ADT: I-70 WB: 43,744

Type of Data	Existing	Standard	Proposed	Location
1. Design Speed				
2. Lane Width				
3. Shoulder Width Inside Outside				
4. Bridge(s) Loading Width Rail Approach Rail				
5. Horizontal Alignment Degree Curve/Radius SSD				
6. Vertical Alignment Sag K Crest SSD				
7. Grade %				
8. Cross Slope				
9. Superelevation				
10. Horizontal Clearance (Clear Zone)				
11. Vertical Clearance				
12. Other (Describe)	n/a	600 feet spacing between successive ramp terminals	211 feet spacing between successive ramp terminals	I-70 EB / RAMP 10 / RAMP 15

C. Give reasons for requesting design exceptions for each design element.

The Interstate 70 eastbound ramp terminal (RAMP 10) is currently being constructed. A new service ramp terminal (RAMP 15) that exits along RAMP 10 is now being proposed in order to allow local traffic to exit before the next service ramp. AASHTO standards (Exhibit 10-68) state that a minimum length of 600 feet is recommended between successive ramp terminals. Due to several constraints, only 211 feet is obtainable on this downtown urban section of highway. These constraints consist of 1) an existing railroad bridge that would have to be removed and relocated, 2) a City street (11th Street) that would have to be closed due to slope impacts, and 3) cross slope differences explained below.

The 211 feet is a distance that is based upon a 5% algebraic cross slope difference between the RAMP 10 mainline (2-12 foot lanes sloped at -3%) and the RAMP 15 mainline (1-15 foot lane sloped at +2%). This 5% "grade-break" is the maximum allowable in MoDOT's Engineering Policy Guide. If this 211 foot distance was increased, the cross slope difference between the two mainlines would be greater than 5%.

Request for Design Exceptions:

(NOTE: Include only for consultant designed projects.)

By:  Date: 12/14/11
Gregory L. Law, P.E.
Consultant Project Manager

Crawford, Murphy & Tilly, Inc.
Name of Consulting Firm

By: _____ Date: _____
James Middleton, P.E.
MoDOT Transportation Project Manager

Approved: (Include only applicable signatures.)

By: _____ Date: _____
District Engineer

By: _____ Date: _____
State Bridge Engineer

By: _____ Date: _____
State Design Engineer

By: _____ Date: _____
FHWA

Appendix G

**Six Lane I-70 Depressed Section
Design Documents**

"THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT."

DATE

DATE PREPARED
2/1/2012

ROUTE I-70	STATE MO
DISTRICT SL	SHEET NO.

COUNTY
ST LOUIS CITY

JOB NO.
J612377B

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

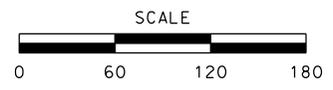
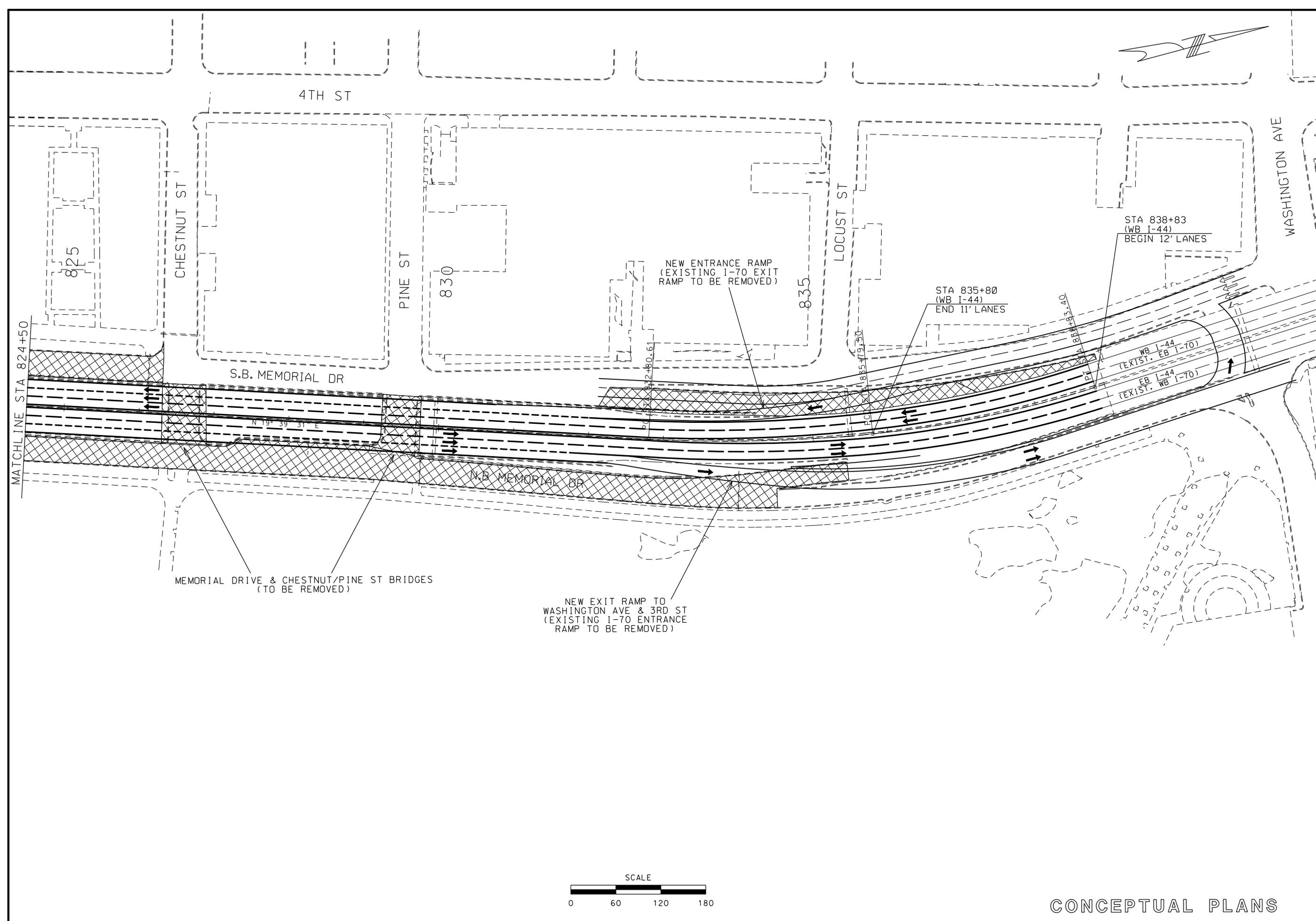
DATE	DESCRIPTION

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION



105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

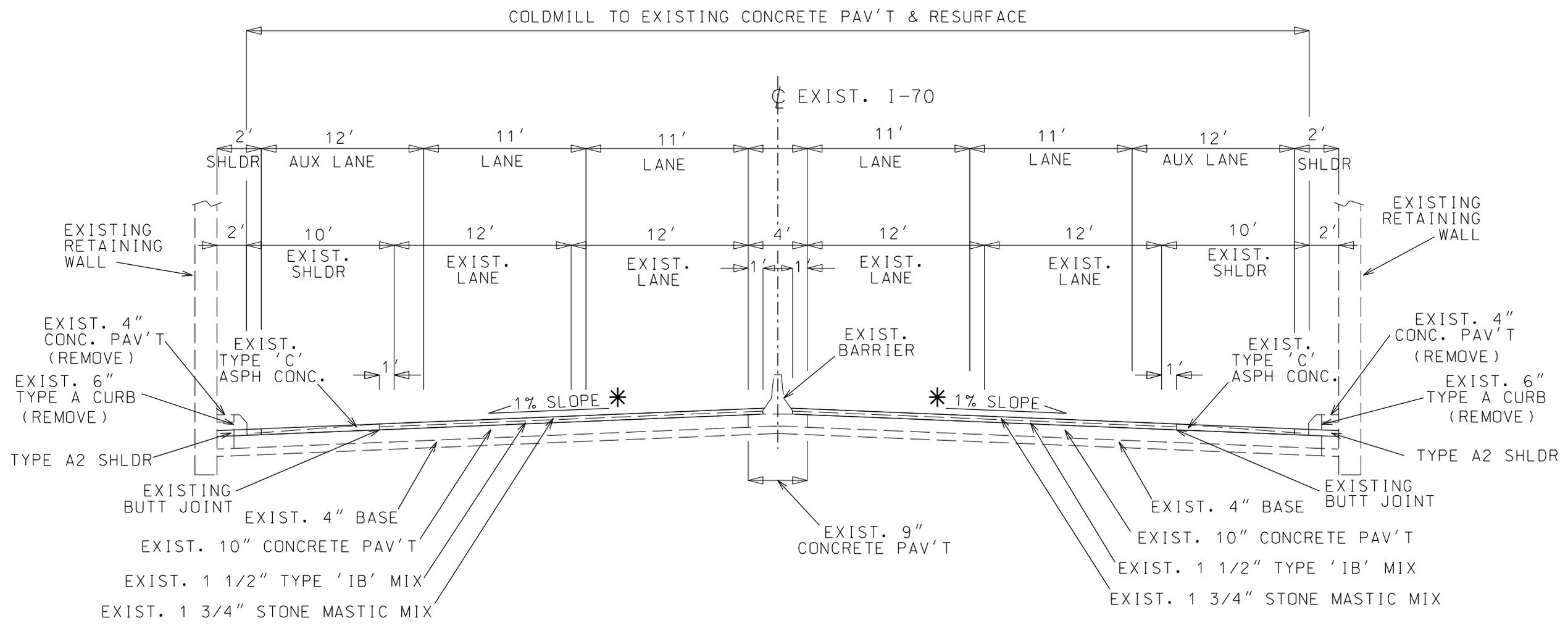
I-70 / I-44 PLAN
6-LANE SECTION
SHEET 2 OF 2



CONCEPTUAL PLANS

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

DATE	
DATE PREPARED	
ROUTE I-70	STATE MO
DISTRICT 6	SHEET NO.
COUNTY ST. LOUIS CITY	
JOB NO. J612377B	
CONTRACT ID.	
PROJECT NO.	
BRIDGE NO.	



SECTION ON TANGENT - DEPRESSED SECTION
EXISTING I-70 (FUTURE I-44)

* MATCH EXISTING X-SLOPE

NOT TO SCALE

CONCEPTUAL PLANS

DESCRIPTION	
DATE	

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

TYPICAL SECTIONS
SHEET 1 OF 1

REV. IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

DESIGN EXCEPTION INFORMATION

Route: I-70

County: St. Louis City

Job No.: J6I2413

A. Design Stage: Conceptual

Conceptual Plan R/W Certification

Preliminary Plan Final (PS&E)

Other ()

B. Provide data for only those items that are proposed to have a design exception.

English Functional Classification: Interstate Design ADT: 48,552

Type of Data	Existing	Standard	Proposed	Location
1. Design Speed				
2. Lane Width	2-12 ft. - 0 in.	12 ft. - 0 in.	1-12 ft - 0 in., 2-11 ft. - 0 in.	I-70 Depressed Section
3. Shoulder Width				
Inside	1 ft. - 0 in.	6 ft.-0 in.	1 ft. - 0 in.	I-70 Depressed section
Outside	10 ft - 0 in.	6 ft.-0 in. auxiliary lane	2 ft. - 0 in. auxiliary lane	
4. Bridge(s)				
Loading				
Width				
Rail				
Approach Rail				
5. Horizontal Alignment				
Degree Curve/Radius				
SSD				
6. Vertical Alignment				
Sag K				
Crest SSD				
7. Grade %				
8. Cross Slope				
9. Superelevation				
10. Horizontal Clearance (Clear Zone)				
11. Vertical Clearance				
12. Other (Describe)				

C. Give reasons for requesting design exceptions for each design element.

Interstate 70 in the center of the central business district in downtown St. Louis is depressed below the surrounding area. The depressed section of I-70 currently carries 2 - 12 ft. lanes in each direction with 10 ft shoulders outside and 1 ft inside. Part of the J6I2413 project will require the addition of an auxiliary lane in both the directions in this area. The auxiliary lanes will extend approximately 1/2 mile from the Poplar Street Bridge Interchange to new I-70 ramps at Washington Avenue just north of the depressed section. The typical section in this area shows that there is 76 ft. - 0 in. from the face of the retaining wall in the northbound direction to the face of the retaining wall in the southbound direction.

Lane Width

In order to facilitate the movement of traffic in this area and to avoid as much disruption to the motoring public as possible during construction, the Missouri Department of Transportation (MoDOT) proposes to add 12 ft. auxiliary lanes on each side of I-70 in this area and to restripe the existing lanes from 12 ft. 0 in. to 11 ft. - 0 in. The inside shoulders will remain as they are, 1 ft. - 0 in. The outside shoulders, adjacent to the auxiliary lanes, will be 2 ft. - 0 in. In addition to the disruption to the motoring public during the construction phase of the project, there are many other obstacles that have led to the decision to request a design exception. Widening I-70 in this area would require removing and replacing at least one of the retaining walls and reconstruction of additional portions of Memorial Drive that were not anticipated on being reconstructed in this project. Additionally, the proposed "Lid" bridge that spans I-70 would have to be lengthened by approximately 14 feet. The additional cost of walls and bridge would be approximately \$10 million.

MoDOT's Engineering Policy Guide (EPG) states, "Although 12 ft. lane widths are desirable on both rural and urban roadways, there are circumstances where more narrow lane widths can be used. In urban areas where pedestrian crossings, right of way, or existing development become stringent controls, the use of 10 or 11 ft. lanes is acceptable." The existing constraints of Memorial Drive on each side of I-70 as well as significant building structures to the west and National Park land and a historic property, The Old Cathedral to the east make widening I-70 in this area exceedingly difficult and expensive.

Shoulder Width

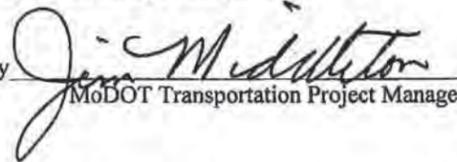
The inside shoulder will remain at their current width of 1 ft. - 0 inches as they have been since this section of road was built. The outside shoulders will be narrowed from 10 feet to 2 feet. The American Association of State Highway and Transportation Official's (AASHTO) Geometric Design of Highways and Streets states that "Where auxiliary lanes are provided along freeway main lanes, the adjacent shoulder should desirably be 8 to 12 ft in width, with a minimum 6 ft wide shoulder considered." Although shoulders narrower than 2 feet are not desirable, drivers in the St. Louis region have become accustomed to them for short distances on many of the major river crossings. The Poplar Street, WB Boone, Blanchette, and Chain of Rocks Bridges all have similar shoulder widths. The depressed section of I-70 is a similar situation to the bridges where it is very difficult and costly to meet the standard and it only affects a short section of the roadway, in this case approximately 1/2 mile.

The five year average crash rate for this section of roadway is 670.84 EB and 539.39 WB. The average statewide rate for interstates in the same time period is 103.97. By adding an auxiliary lane to EB I-70 will eliminate the existing substandard tapered ramp and provide much more space for weaving which should improve safety. According AASHTO's Highway Safety Manual (HSM), the crash modification factor for the entrance will go from 1.04 to 0.46. This equates to approximately a 56% reduction in crashes. It is known that reduced lane and shoulder widths will reduce the safety of this section of roadway. The Highway Safety Manual does not provide information to quantify the safety of reducing lane and shoulder widths on urban interstates but does for rural interstates. The HSM states that for rural divided highways, decreasing the lane width from 12 to 11 feet on roadways with over 2000 ADT is expected to increase crashes by about 3%. Although narrow lanes and shoulders are not ideal, overall the safety of this section of roadway is expected to improve with the addition of the auxiliary lanes.

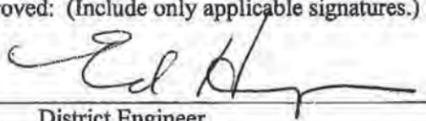
To assist with crashes and prevent secondary incidents, MoDOT's St. Louis District has motorist assist crews that provide assistance to motorists in need for the most heavily traveled times of the day. If a vehicle were to break down in the depressed section, Motorist Assist operators could quickly respond or have it towed. MoDOT also has traffic cameras in the area that are monitored all hour of the day at the Traffic Management Center to constantly observe traffic flow and can send responders within minutes of an incident.

In summary, meeting the design standards for lane and shoulder widths would require the reconstruction of at least one retaining wall and portions of Memorial Drive with impacts to the Jefferson National Expansion Memorial and Historic "Old Cathedral". The traffic impacts and costs associated with this have made reconfiguring the roadway to a six lane section within the current walls the preferred option.

Request for Design Exceptions:

By:  Date: 2/7/12
MoDOT Transportation Project Manager

Approved: (Include only applicable signatures.)

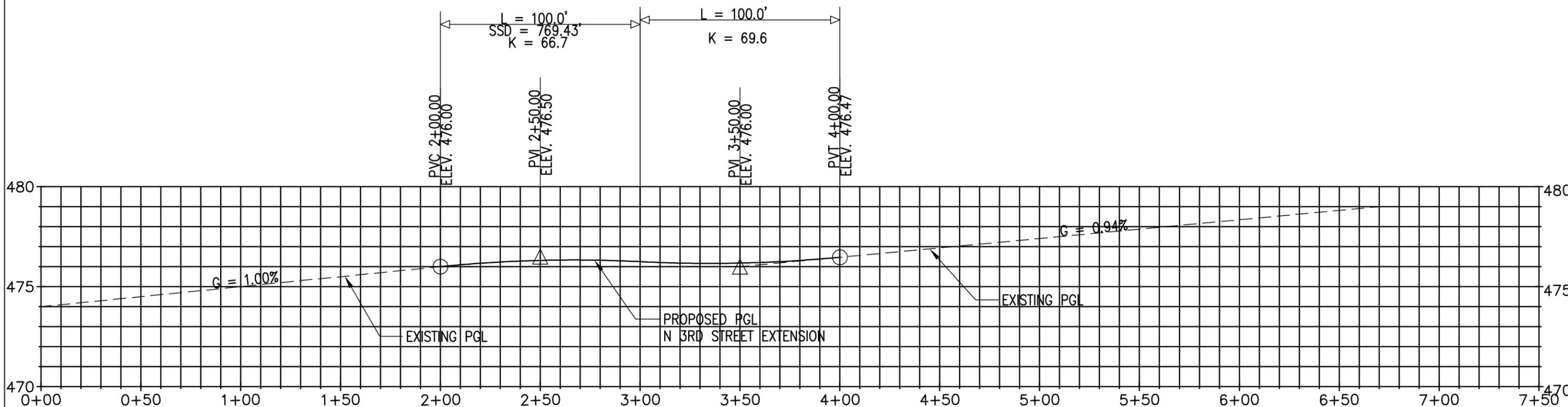
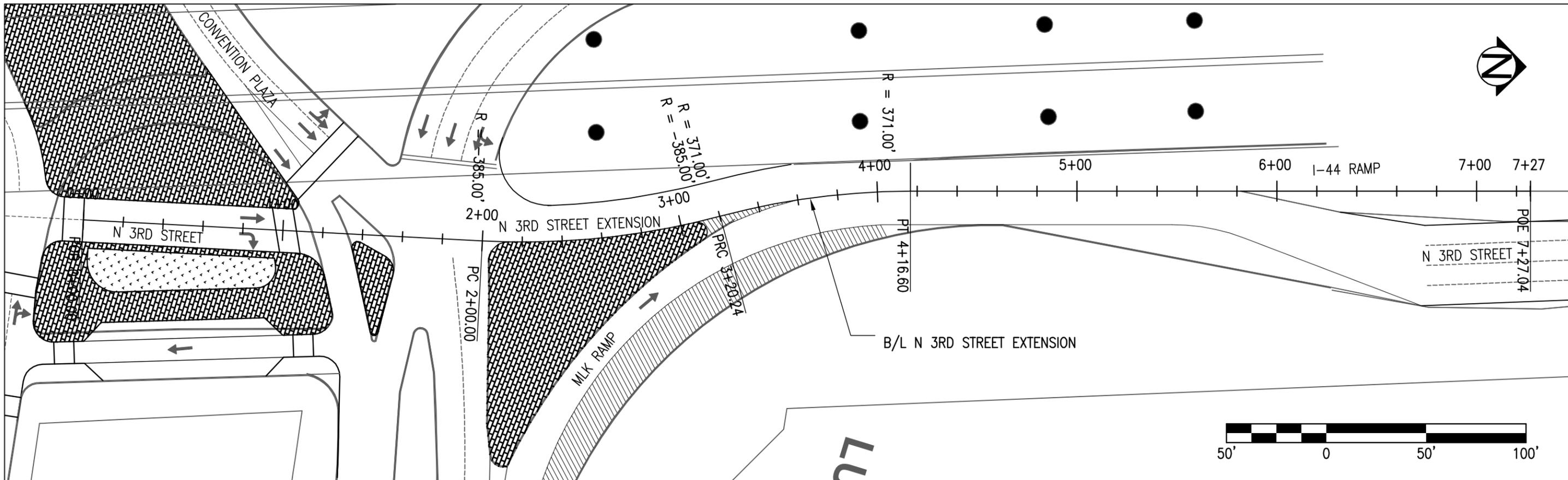
By:  Date: 2/8/12
District Engineer

By: _____ Date: _____
State Design Engineer

By: _____ Date: _____
FHWA

Appendix H

North 3rd Street Extension Plans,
Analysis and Documentation



H: 1"=50' V: 1"=5'

ARUP

155 Avenue of the Americas
New York NY 10013
Telephone 212 229 2669

Ove Arup & Partners Consulting Engineers PC

Drn FR	Date 12/14/11	Scale 1"=50'
Job No 215132-00	Dwg No SK-01	

Memorandum

To	Eric Rivers	Date December 7, 2011
Copies		Reference number 215132-00/3.01
From	Fabiola Rivera x 1429 (NY)	File reference
Subject	St Louis Arch - N 3 rd Street Extension Roadway Study	

1 Introduction

The St Louis Arch project (The project) proposes to extend N 3rd Street to connect to the existing segment of N 3rd Street currently bisected by the I-44/MLK interchange. An engineering study of the N 3rd Street Extension (The Extension) was completed to ensure that this option is feasible. This memo reports the results of this study.

2 Design Criteria

2.1 Standards

Design Criteria were selected in order to produce proposed geometry for The Extension. A design speed of 35 mph was used to allow for operating speed of at least 30mph, as characteristic of urban arterial highways. In addition, 35 mph is the current posted speed on memorial drive. So a 35mph design speed is well within range of the downtown area operational speed. The selected design criteria values are represented in section 2.2. The following Standards were used when selecting the design criteria for The Extension.

- MoDOT Engineering Policy Guide
- MoDOT Standard plans (2009)
- A Policy on Geometric Design of Highways and Streets (“Green Book” AASHTO, 2004)
- Highway Capacity manual (TRB, 2000)
- Roadside Design Guide (“RDG” AASHTO, 2004)

2.2 Design Criteria Table

	Critical Design Element	Standard Criteria	Reference Standard
1.	Functional Classification	Minor Arterial	
2.	Design Speed(mph)	35	Green Book, pg 72
3.	Lane Width (ft)	14' Single Lane	MoDOT 231 Standard Plan D-50H (Diamond Directional Ramp) & D-51L (Loop Ramp)
4.	Shoulder Width (ft)	2	MoDOT 231.4.1
5.	Min Radius (ft)	371	Green Book Exhibit 3-15
6.	Min Horizontal SSD (ft)	250	MoDOT 230.1.6 + Green Book Exhibit 3-53
7.	Cross Slope	2%	Green Book
8.	Superelevation	4%	Green Book Exhibit 3-15
9.	Minimum Curve Length (ft)	300	MoDOT 230.1.
10.	Sag K	49	MoDOT + Green Book Exhibit 3-75
11.	Crest K	29	Green Book Exhibit 3-72
12.	Min Crest SSD (ft)	115	MoDOT 233.2 + Green Book Exhibit 3-1
13.	Max Grade % (Level))	8%	Green Book exhibit 7-10
14.	Horizontal Clearance (Clear Zone)	N/A (<45pmh)	MoDOT 231 + RDG Figure 3.1b
15.	Vertical Clearance (ft)	16	MoDOT 787.7.4.4

Memorandum

2.3 Design Exception

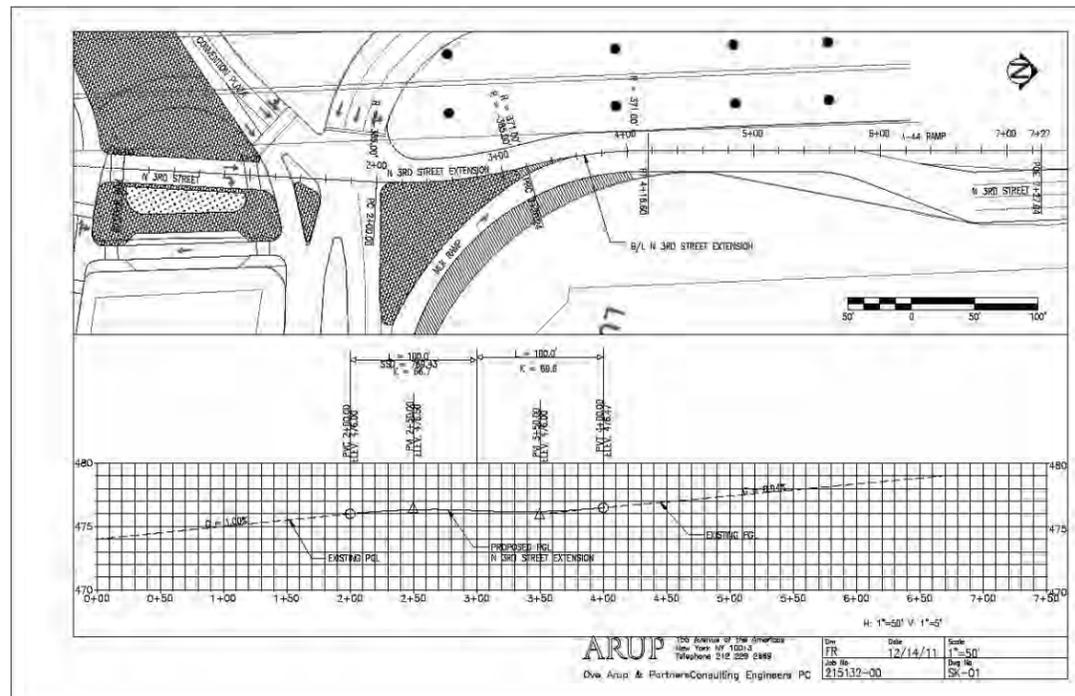
Type of Data	Standard	Proposed	Location	Reason
Min Vertical Curve length	300' or 15V	100'	Intersection of N 3 rd Street Extension and MLK Ramp	The Extension cuts through an existing island adjacent to the MLK Ramp. In order to minimize impact to the existing intersection and upstream I-44 Ramp, the vertical alignment aims to tie into existing pavement just at the island edges. There is not sufficient length to provide a 300 foot vertical curve for The Extension. The K values and SSD well exceed the minimum standard values.

3 Horizontal Layout

The Extension is proposed to be a one lane roadway terminating at the MLK Ramp gore. The horizontal layout is shown on sketch SK-01 below.

4 Profile

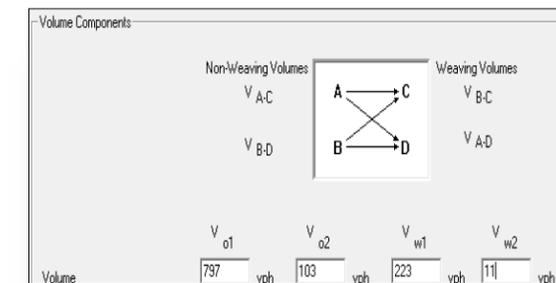
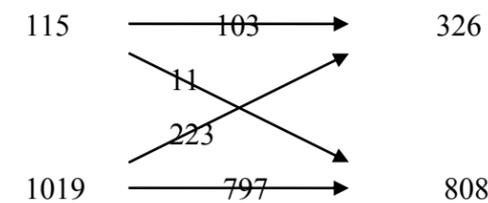
The vertical grade difference within this segment is minimal. The goal is not to impact the existing intersection and the I-44 On Ramp. The proposed construction limits are approximately 217 feet. Sketch SK-01 below shows the profile grade lines of the existing surface as well as for The Extension.



5 Weaving Analysis

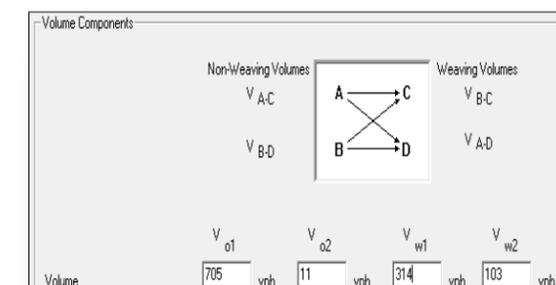
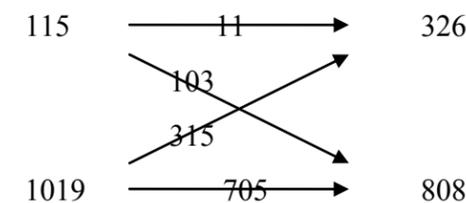
A weaving analysis was performed for the segment of roadway where The Extension and the MLK Ramp run parallel and then split into the existing I-44 Ramp and existing N 3rd Street. In this roughly 200 foot segment of roadway the drivers in each lane have the option to continue in their lanes, or make a lane change maneuver to either get on the I-44 Ramp or go down existing N 3rd Street. The Highway Capacity Software was used to run the weaving analysis for both AM and PM peak hour volumes for three scenarios involving The Extension, the Convention Plaza left turn lane, and the MLK Ramp. All scenarios resulted in LOS C or better. 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) Below are the Volume inputs and LOS outputs for each weave scenario mentioned above.

Scenario #1A - (AM) N. 3rd Street - MLK Ramp (assumed 10% minor rd weave)



RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	29.03 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	21.67 pc/mi/h		1.69	0.61
Level of service, LOS	C	Speeds, S _i	24.28 mph	30.58 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

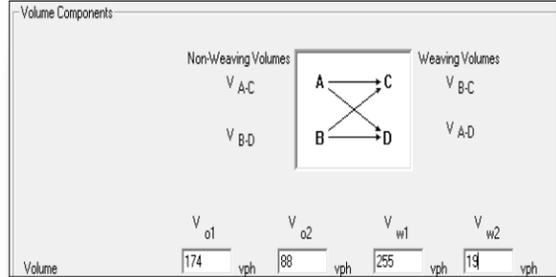
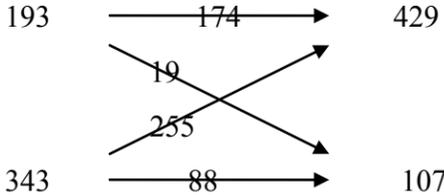
Scenario #1B - (AM) N. 3rd Street - MLK Ramp (assumed 90% minor rd weave)



RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	25.53 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	24.61 pc/mi/h		2.23	1.00
Level of service, LOS	C	Speeds, S _i	22.74 mph	27.50 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

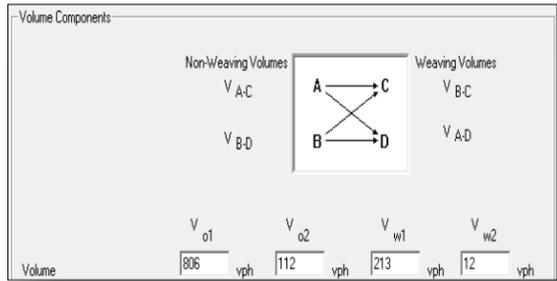
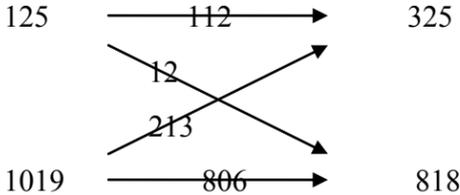
Memorandum

Scenario #1C - (PM) N. 3rd Street - MLK Ramp (assumed 10% minor rd weave)



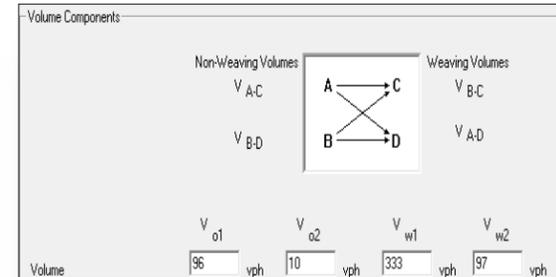
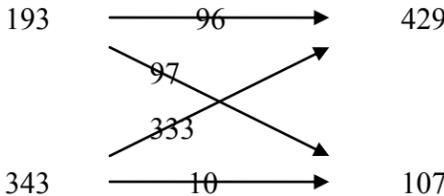
RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	28.01 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	10.60 pc/mi/h		1.34	0.56
Level of service, LOS	B	Speeds, S _i	25.66 mph	30.99 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

Scenario #2A - (AM) Convention Place - MLK Ramp (assumed 10% minor rd weave)



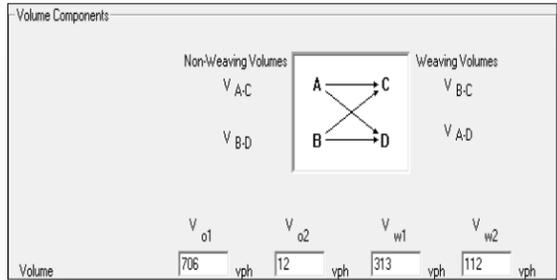
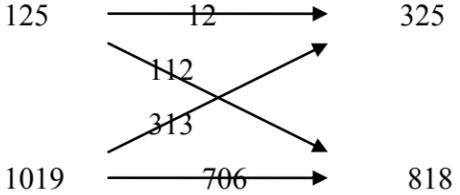
RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	29.20 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	21.71 pc/mi/h		1.68	0.59
Level of service, LOS	C	Speeds, S _i	24.34 mph	30.70 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

Scenario #1D - (PM) N. 3rd Street - MLK Ramp (assumed 50% minor rd weave)



RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	23.97 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	12.38 pc/mi/h		1.98	1.14
Level of service, LOS	B	Speeds, S _i	23.38 mph	26.68 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

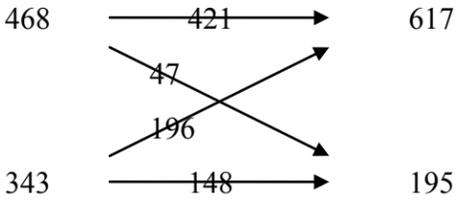
Scenario #2B - (AM) Convention Place - MLK Ramp (assumed 90% minor rd weave)



RESULTS				
Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	25.46 mph	Weaving intensity factor, W _i	Weaving	Non-Weaving
Weaving segment density, D	24.82 pc/mi/h		2.25	1.01
Level of service, LOS	C	Speeds, S _i	22.69 mph	27.42 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

Memorandum

Scenario #2C - (PM) Convention Place - MLK Ramp (assumed 10% minor rd weave)



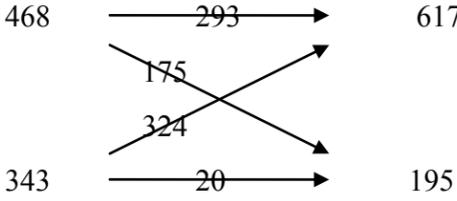
Volume Components

Non-Weaving Volumes	V_{A-C}	V_{B-D}	Weaving Volumes	V_{B-C}	V_{A-D}
Volume	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
	421 vph	148 vph	196 vph	47 vph	

RESULTS

Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	29.27 mph	Weaving intensity factor, WI	Weaving	Non-Weaving
Weaving segment density, D	15.36 pc/mi/h		1.44	0.52
Level of service, LOS	B	Speeds, Si	25.26 mph	31.39 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

Scenario #2D - (PM) Convention Place - MLK Ramp (assumed 90% minor rd weave)



Volume Components

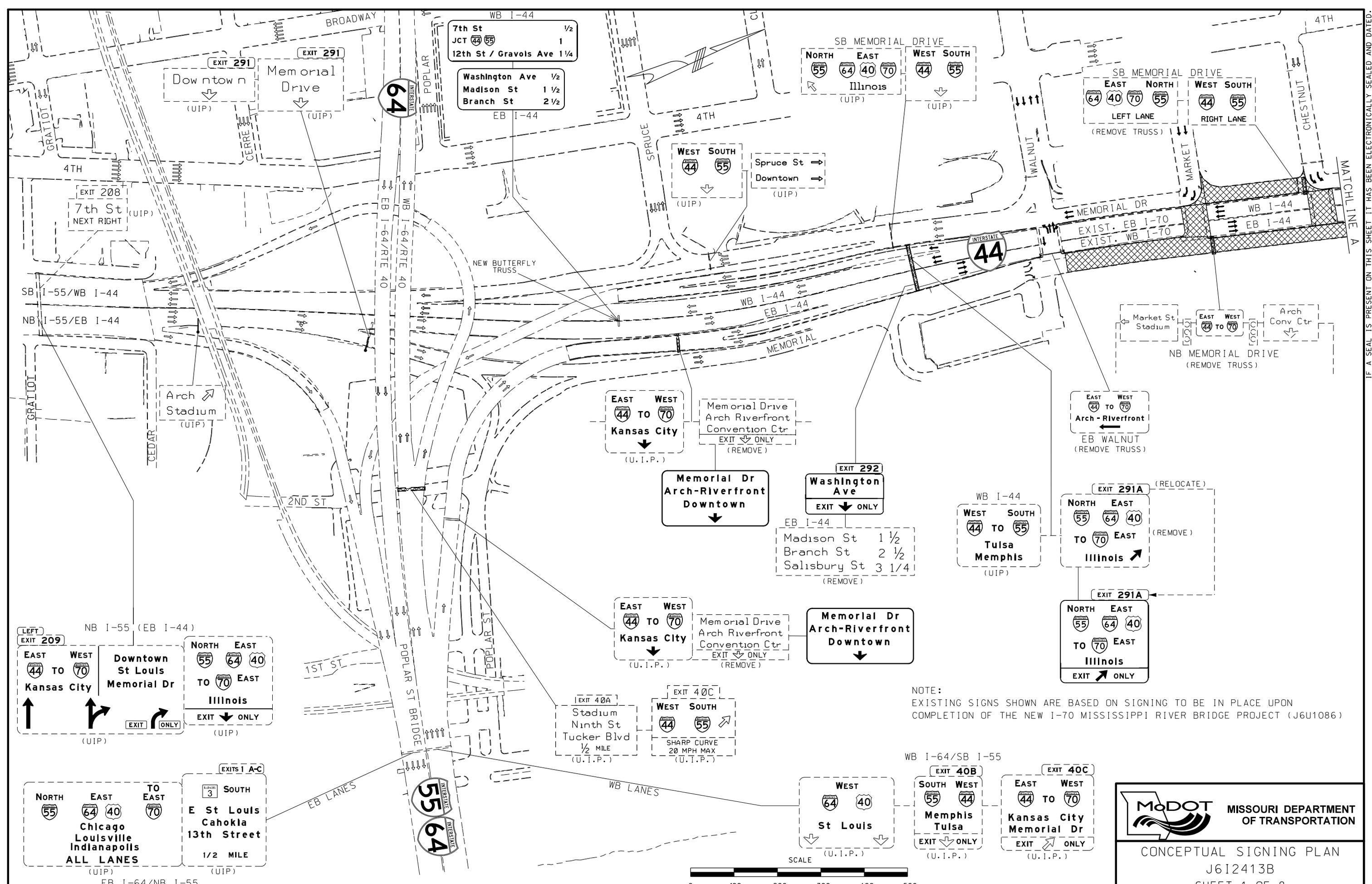
Non-Weaving Volumes	V_{A-C}	V_{B-D}	Weaving Volumes	V_{B-C}	V_{A-D}
Volume	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
	293 vph	20 vph	324 vph	175 vph	

RESULTS

Weaving type	Type A	Type of Operation	Unconstrained	
Weaving segment speed, S	23.75 mph	Weaving intensity factor, WI	Weaving	Non-Weaving
Weaving segment density, D	18.96 pc/mi/h		2.33	1.26
Level of service, LOS	B	Speeds, Si	22.51 mph	26.06 mph
Base capacity for base conditions maximum 15-min flow rates			pc/h	

Appendix I

Conceptual Signing Plans



WB I-44
7th St JCT 44/55 1/2
 12th St / Gravois Ave 1 1/4
 Washington Ave 1/2
 Madison St 1 1/2
 Branch St 2 1/4
 EB I-44

SB MEMORIAL DRIVE
 NORTH EAST WEST SOUTH
 55 64 40 70
 Illinois (UTP)
 44 55
 (UTP)

SB MEMORIAL DRIVE
 EAST NORTH WEST SOUTH
 64 40 70 55
 LEFT LANE RIGHT LANE
 (REMOVE TRUSS)
 44 55

WEST SOUTH
 44 55
 (UTP)
 Spruce St →
 Downtown →
 (UTP)

MEMORIAL DR
 EXIST. EB I-70
 EXIST. WB I-70
 WB I-44
 EB I-44

Market St Stadium
 EAST WEST
 44 TO 70
 Arch Conv Ctr
 NB MEMORIAL DRIVE
 (REMOVE TRUSS)

EAST WEST
 44 TO 70
 Kansas City
 (U.I.P.)

Memorial Drive
 Arch Riverfront
 Convention Ctr
 EXIT ONLY
 (REMOVE)

EXIT 292
Washington Ave
 EXIT ONLY

EB I-44
 Madison St 1 1/2
 Branch St 2 1/2
 Salisbury St 3 1/4
 (REMOVE)

EAST WEST
 44 TO 70
 Arch - Riverfront
 EB WALNUT
 (REMOVE TRUSS)

WB I-44
 WEST SOUTH
 44 TO 55
 Tulsa
 Memphis
 (UTP)

EXIT 291A (RELOCATE)
 NORTH EAST
 55 64 40
 TO 70 EAST
 Illinois
 (REMOVE)

EXIT 291A
 NORTH EAST
 55 64 40
 TO 70 EAST
 Illinois
 EXIT ONLY

EAST WEST
 44 TO 70
 Kansas City
 (U.I.P.)

Memorial Drive
 Arch Riverfront
 Convention Ctr
 EXIT ONLY
 (REMOVE)

EXIT 292
Washington Ave
 EXIT ONLY

EXIT 40A
 Stadium
 Ninth St
 Tucker Blvd
 1/2 MILE
 (U.I.P.)

EXIT 40C
 WEST SOUTH
 44 55
 SHARP CURVE
 20 MPH MAX
 (U.I.P.)

NOTE:
 EXISTING SIGNS SHOWN ARE BASED ON SIGNING TO BE IN PLACE UPON
 COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)

LEFT EXIT 209
 EAST WEST
 44 TO 70
 Kansas City
 Downtown
 St Louis
 Memorial Dr
 (UTP)

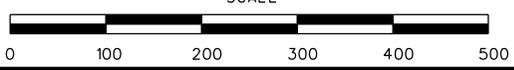
NORTH EAST
 55 64 40
 TO 70 EAST
 Illinois
 EXIT ONLY
 (UTP)

EXITS I A-C
 NORTH EAST TO EAST
 55 64 40 70
 Chicago
 Louisville
 Indianapolis
 ALL LANES
 (UTP)
 SOUTH
 E St Louis
 Cahokia
 13th Street
 1/2 MILE
 (UTP)
 EB I-64/NB I-55

EXIT 40B
 WEST
 64 40
 St Louis
 (U.I.P.)

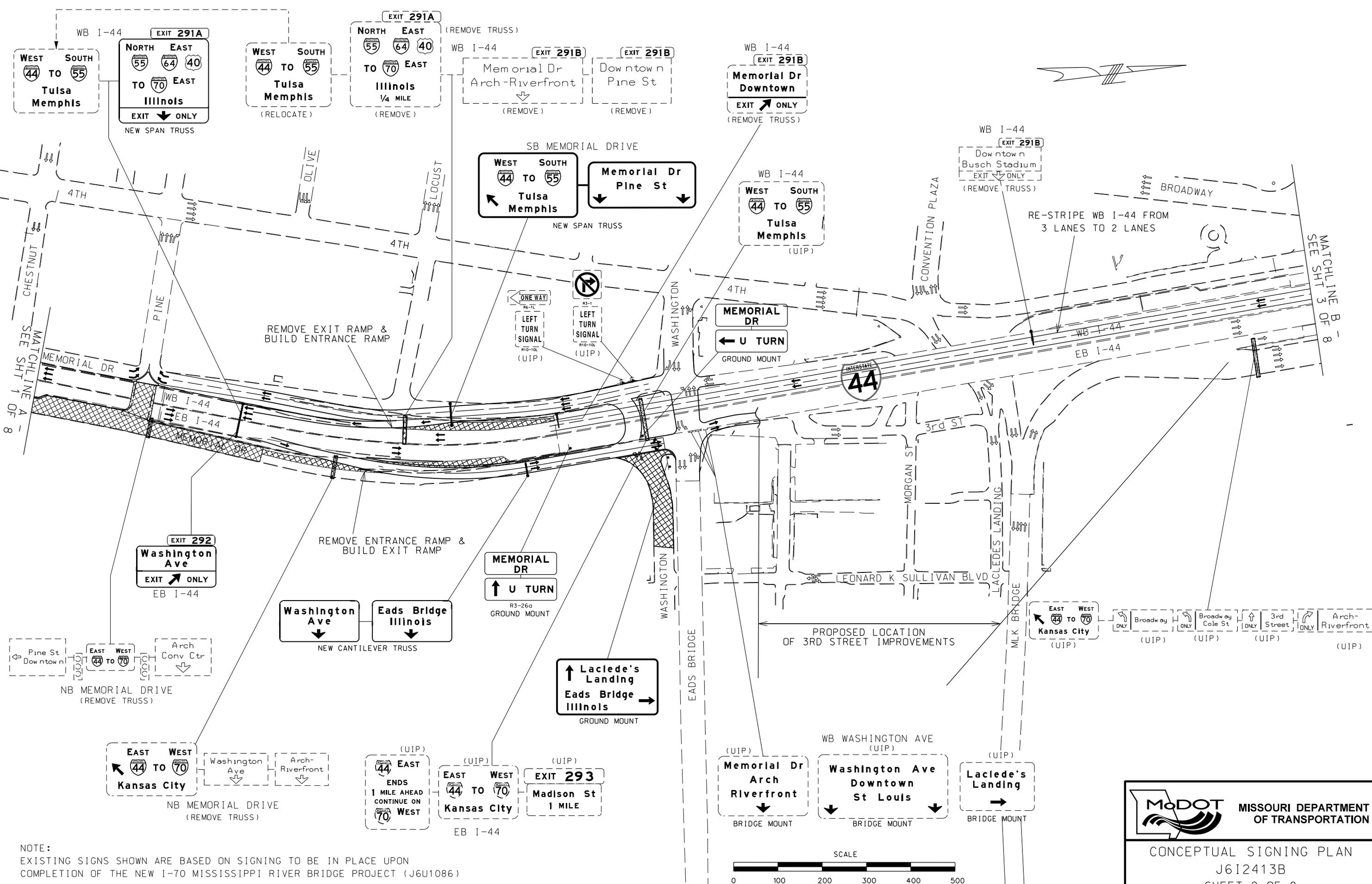
EXIT 40C
 SOUTH WEST
 55 44
 Memphis
 Tulsa
 EXIT ONLY
 (U.I.P.)

EXIT 40C
 EAST WEST
 44 TO 70
 Kansas City
 Memorial Dr
 EXIT ONLY
 (U.I.P.)



CONCEPTUAL SIGNING PLAN
 J6I2413B
 SHEET 1 OF 8

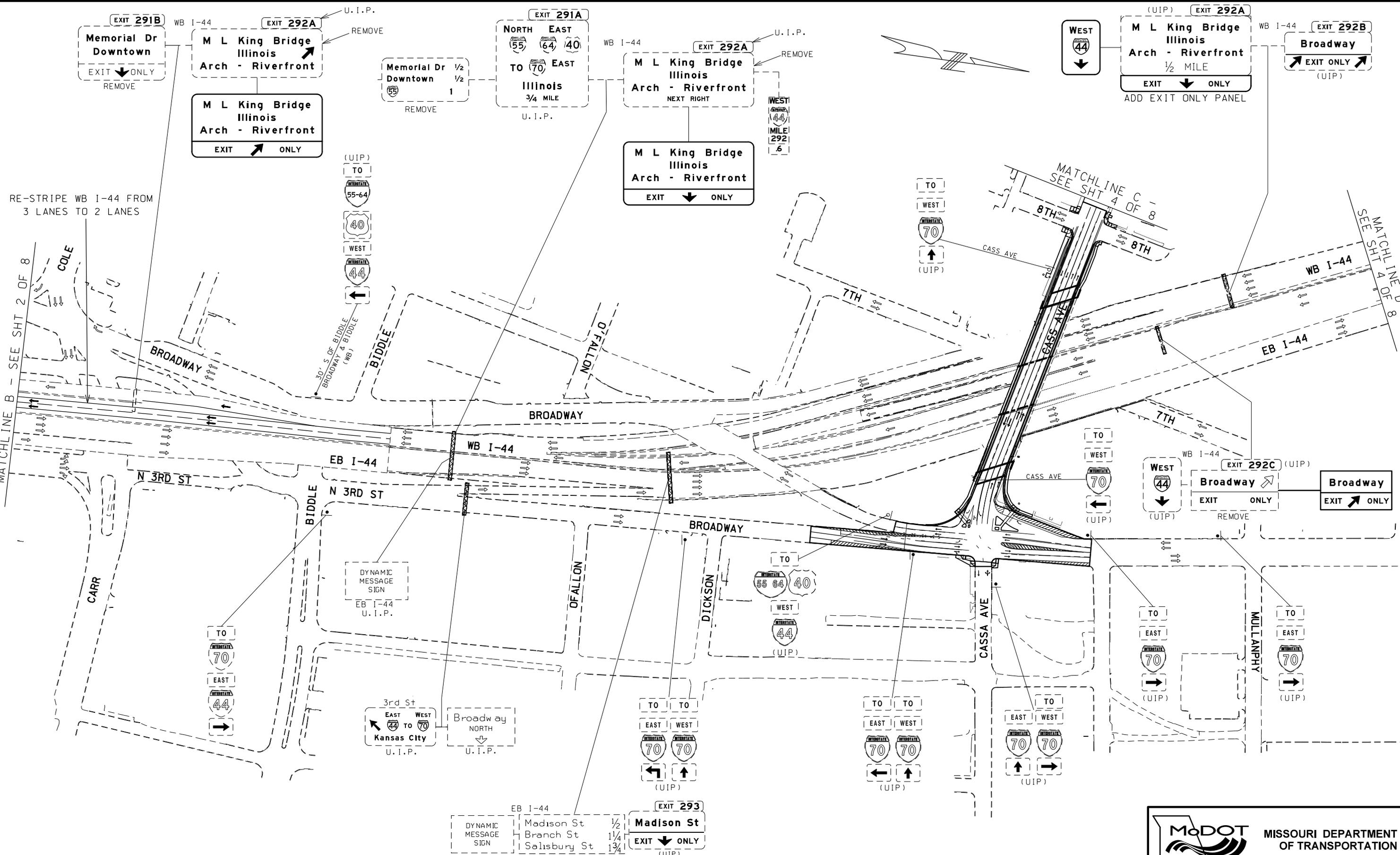
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.



NOTE:
EXISTING SIGNS SHOWN ARE BASED ON SIGNING TO BE IN PLACE UPON
COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



MISSOURI DEPARTMENT
OF TRANSPORTATION
CONCEPTUAL SIGNING PLAN
J6I2413B
SHEET 2 OF 8



RE-STRIPE WB I-44 FROM 3 LANES TO 2 LANES

MATCHLINE B - SEE SHT 2 OF 8

MATCHLINE D - SEE SHT 4 OF 8

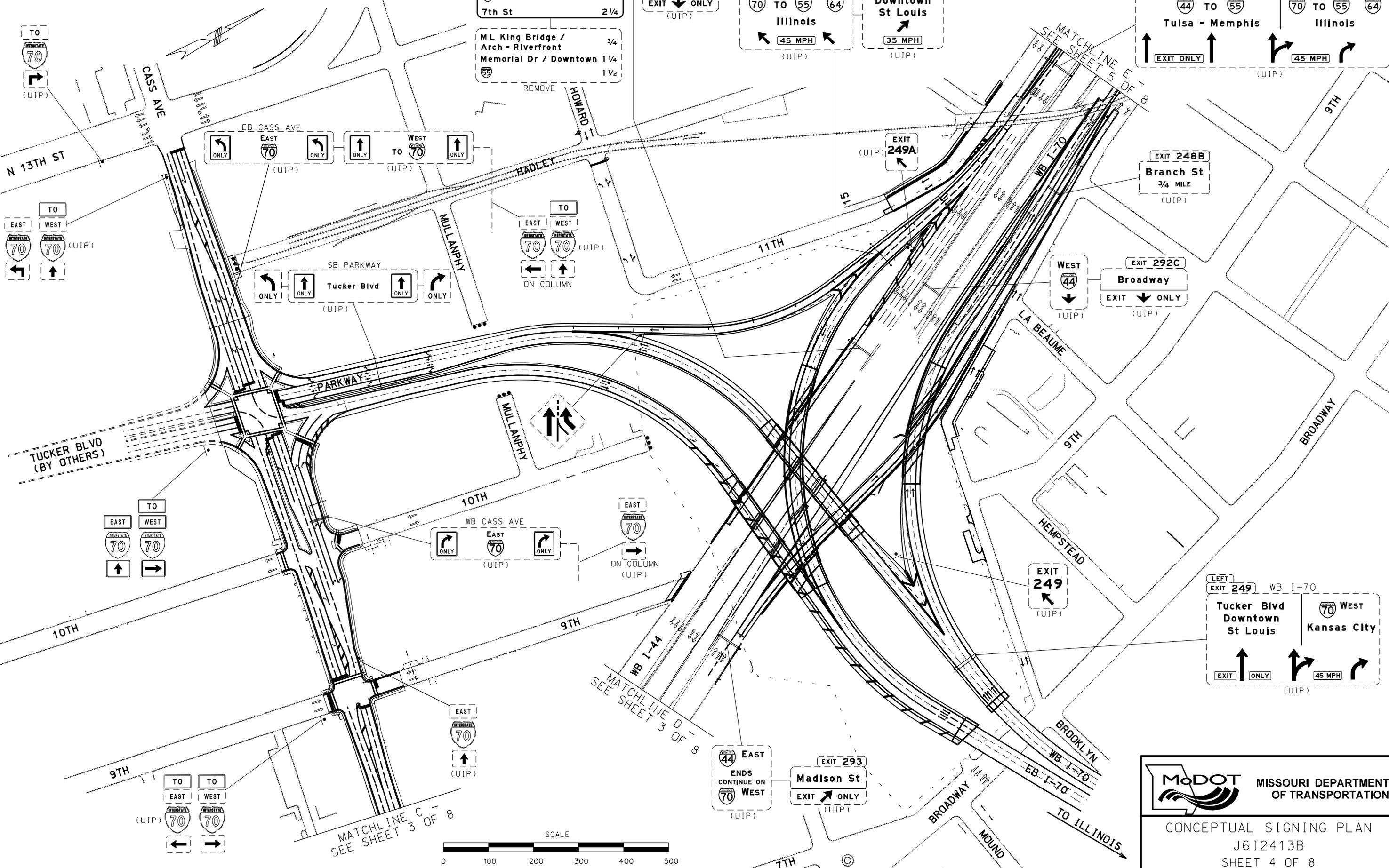
NOTE:
EXISTING SIGNS SHOWN ARE BASED ON SIGNING TO BE IN PLACE UPON COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



CONCEPTUAL SIGNING PLAN
J6I2413B
SHEET 3 OF 8

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

NOTE:
 ALL EXISTING SIGNS SHOWN ARE BASED ON SIGNS TO BE IN PLACE UPON
 COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



MoDOT MISSOURI DEPARTMENT OF TRANSPORTATION

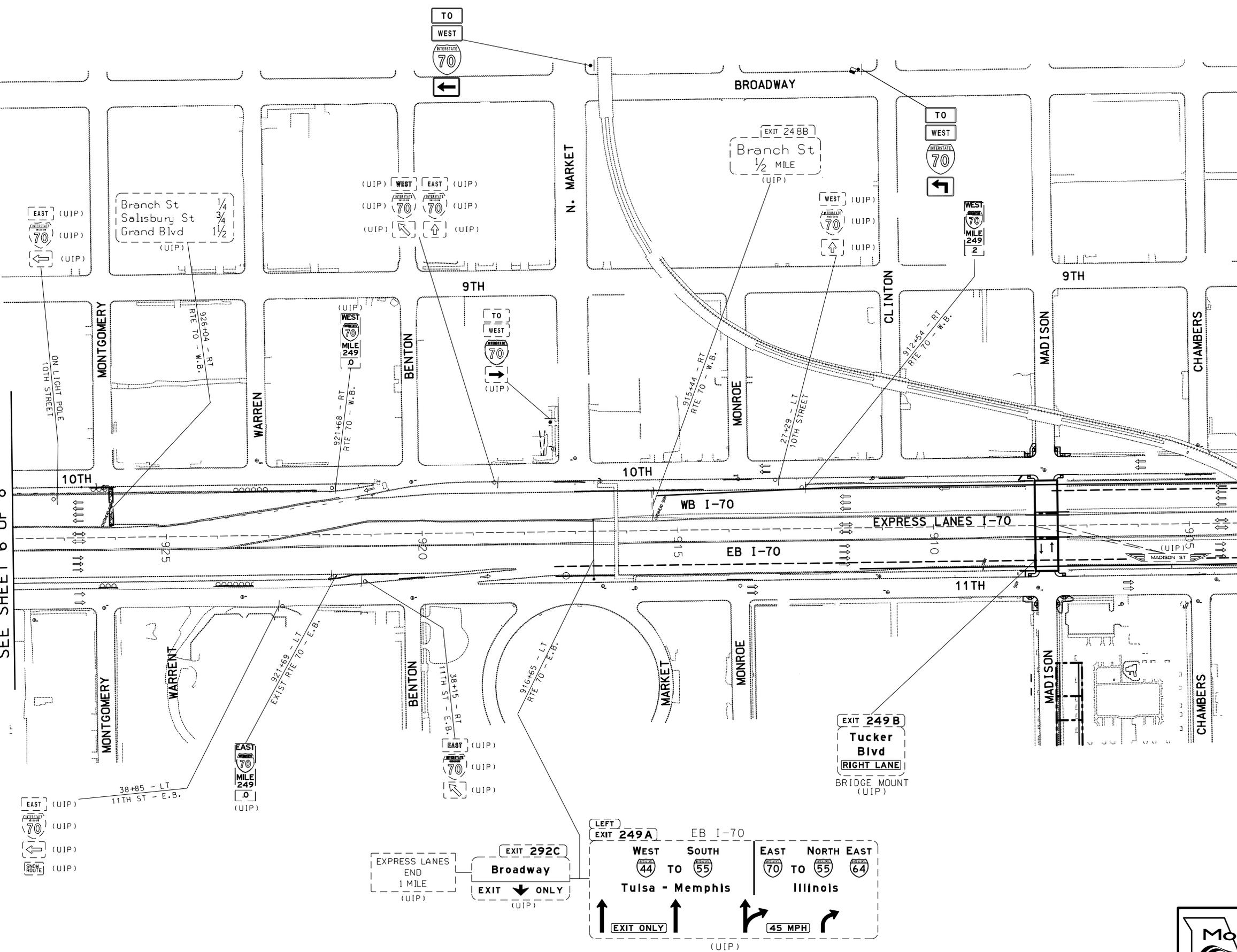
CONCEPTUAL SIGNING PLAN
 J6I2413B
 SHEET 4 OF 8

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

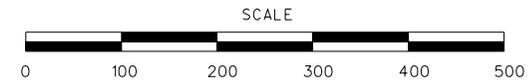
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

MATCHLINE F
SEE SHEET 6 OF 8

MATCHLINE E
SEE SHEET 4 OF 8

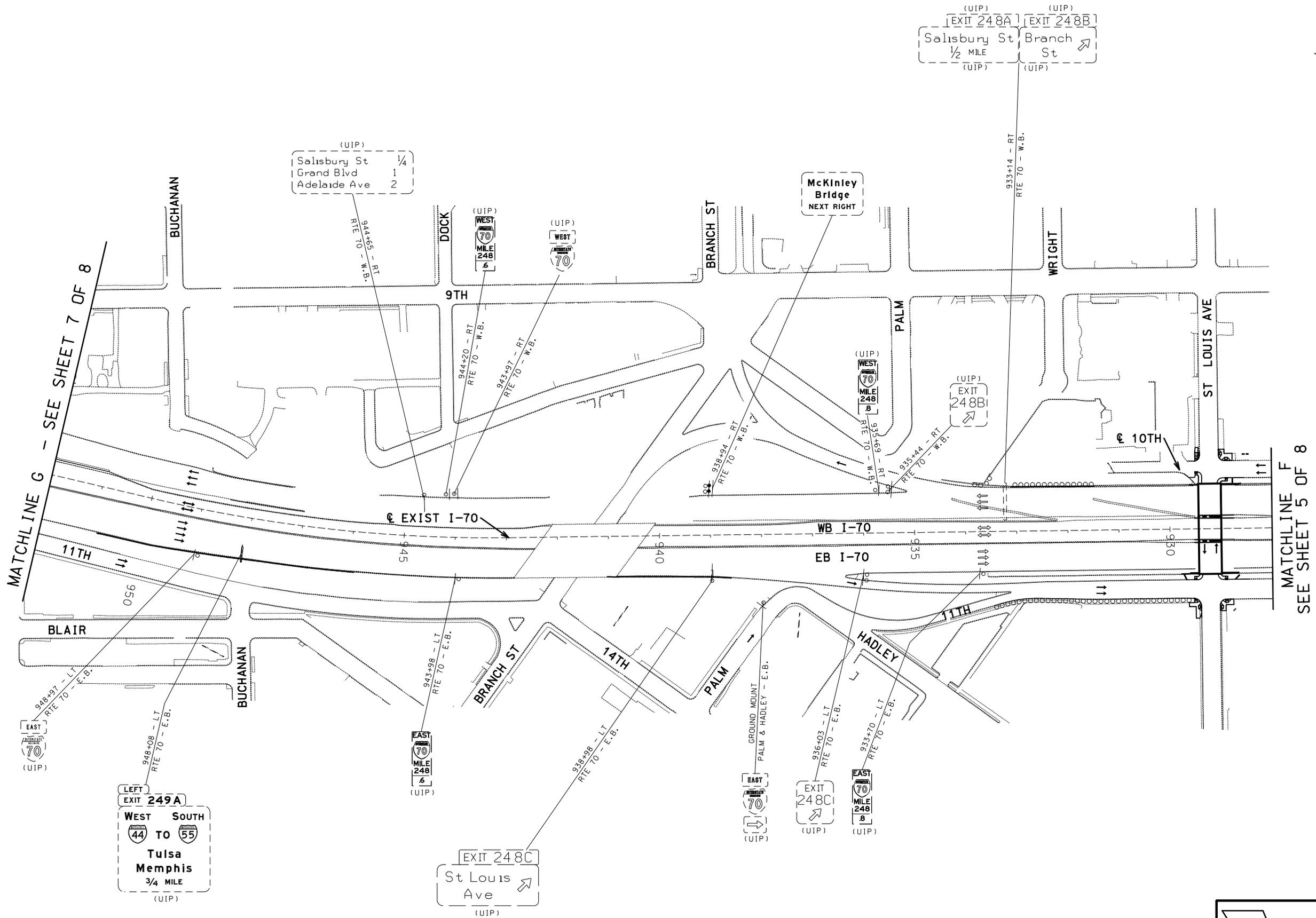


NOTE:
 ALL EXISTING SIGNS SHOWN ARE BASED ON SIGNS TO BE IN PLACE UPON
 COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



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CONCEPTUAL SIGNING PLAN
 J6I2413B
 SHEET 5 OF 8



MATCHLINE G - SEE SHEET 7 OF 8

MATCHLINE F
SEE SHEET 5 OF 8

NOTE:
ALL EXISTING SIGNS SHOWN ARE BASED ON SIGNS TO BE IN PLACE UPON
COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



CONCEPTUAL SIGNING PLAN
J6I2413B
SHEET 6 OF 8

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED: 6/1/2012 12:29:10 PM

MATCHLINE H
SEE SHEET 8 OF 8

MATCHLINE G
SEE SHEET 6 OF 8

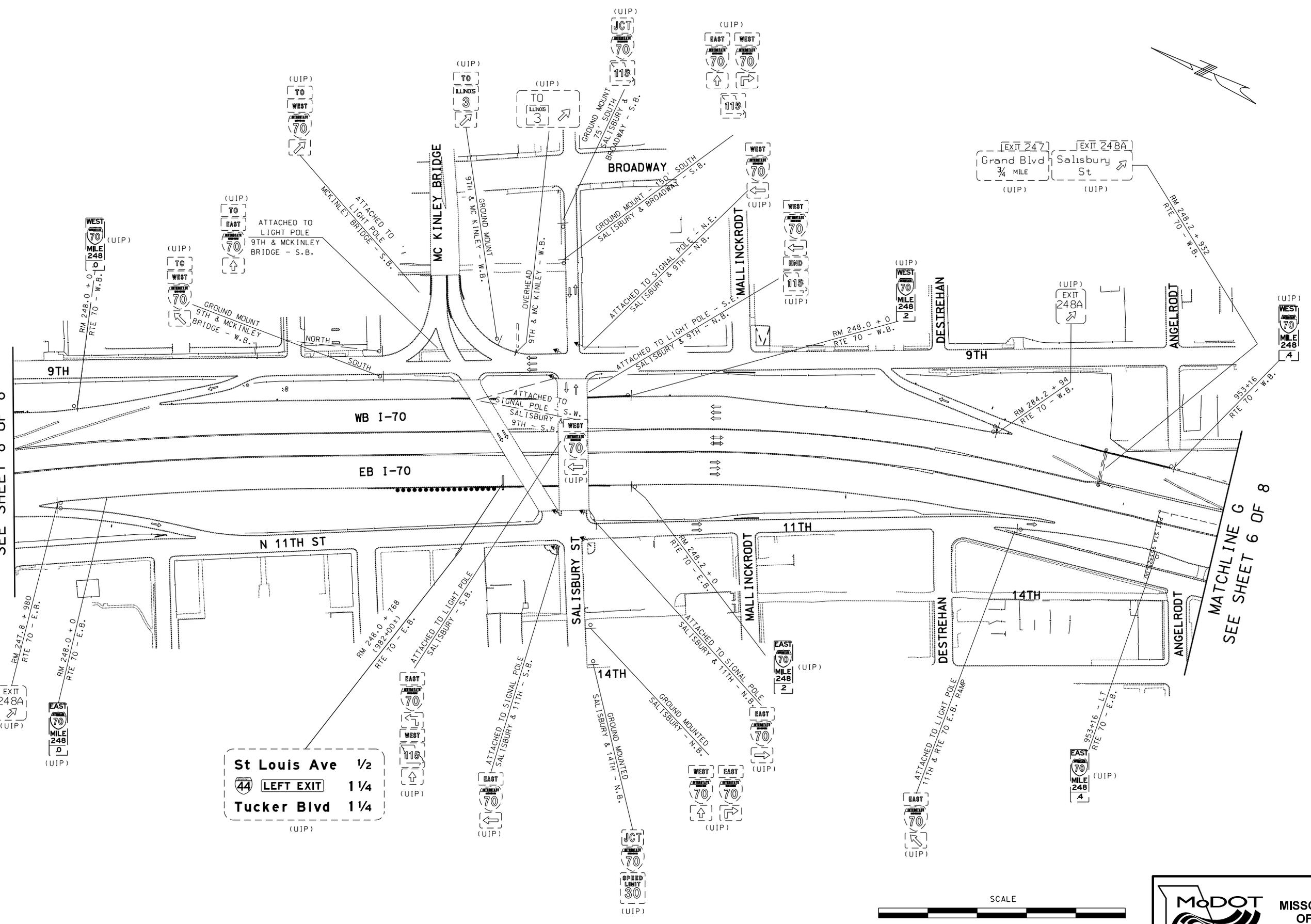
St Louis Ave	1/2
44 LEFT EXIT	1 1/4
Tucker Blvd	1 1/4

(UIP)



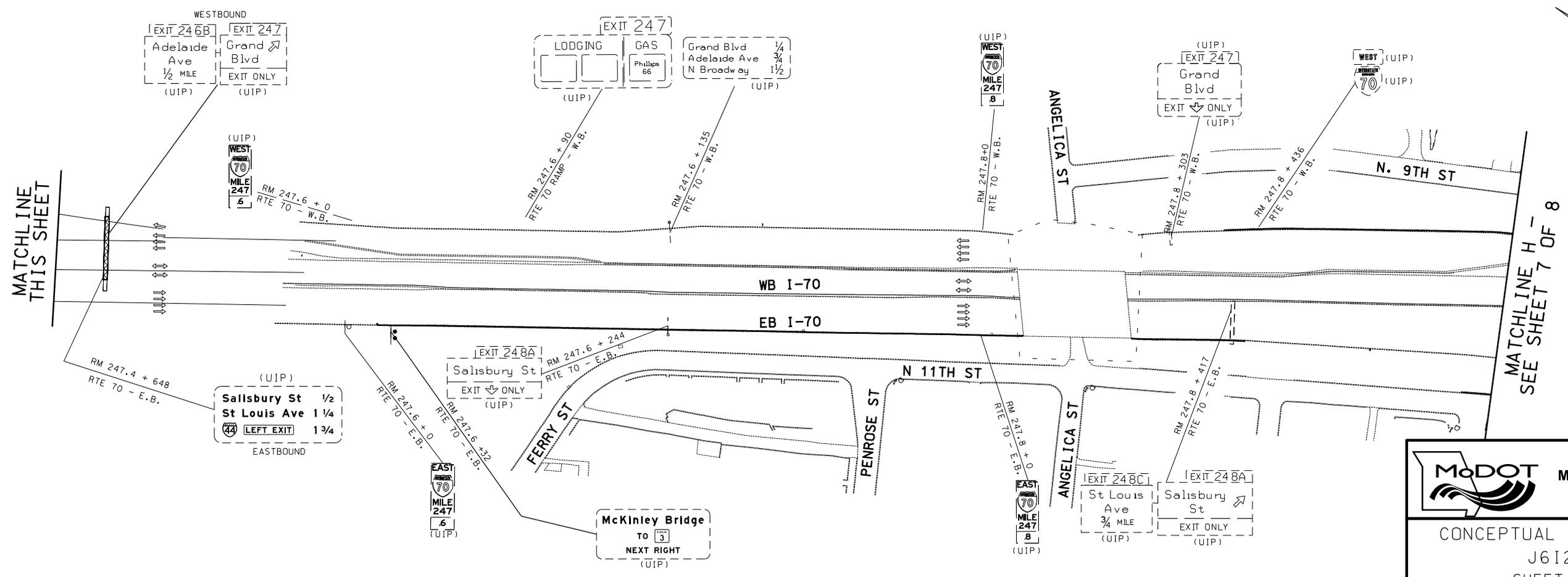
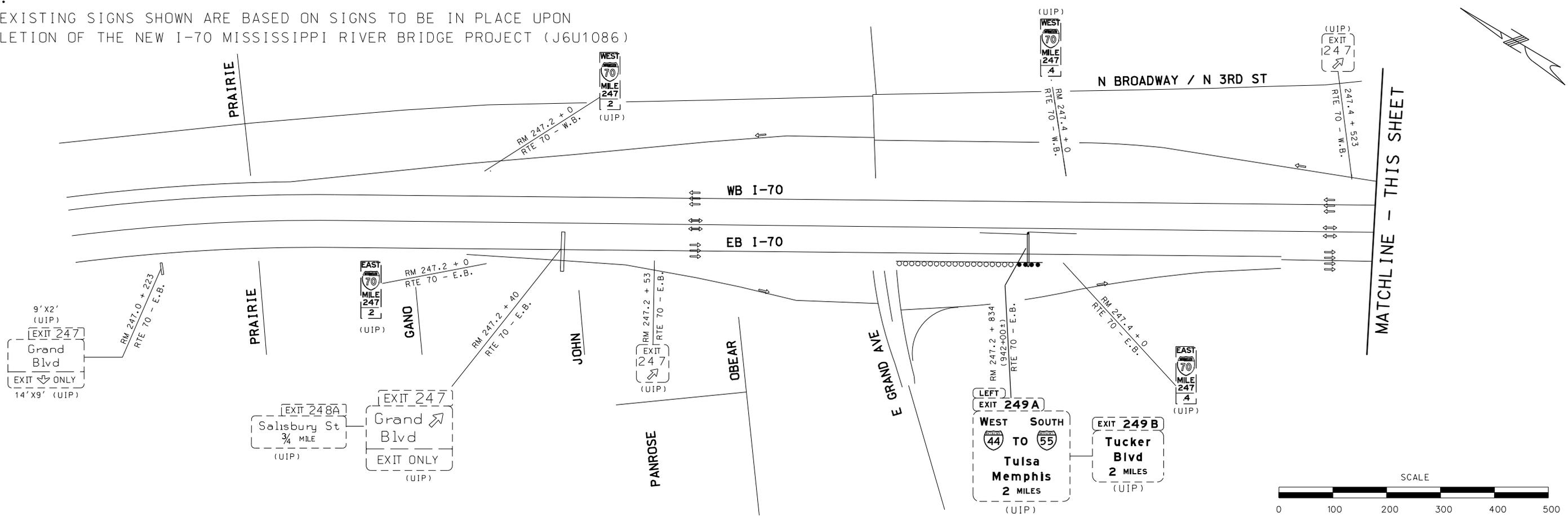
CONCEPTUAL SIGNING PLAN
J612413B
SHEET 7 OF 8

NOTE:
ALL EXISTING SIGNS SHOWN ARE BASED ON SIGNS TO BE IN PLACE UPON
COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED: 6/1/2012 12:29:54 PM

NOTE:
 ALL EXISTING SIGNS SHOWN ARE BASED ON SIGNS TO BE IN PLACE UPON
 COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT (J6U1086)



MoDOT MISSOURI DEPARTMENT OF TRANSPORTATION

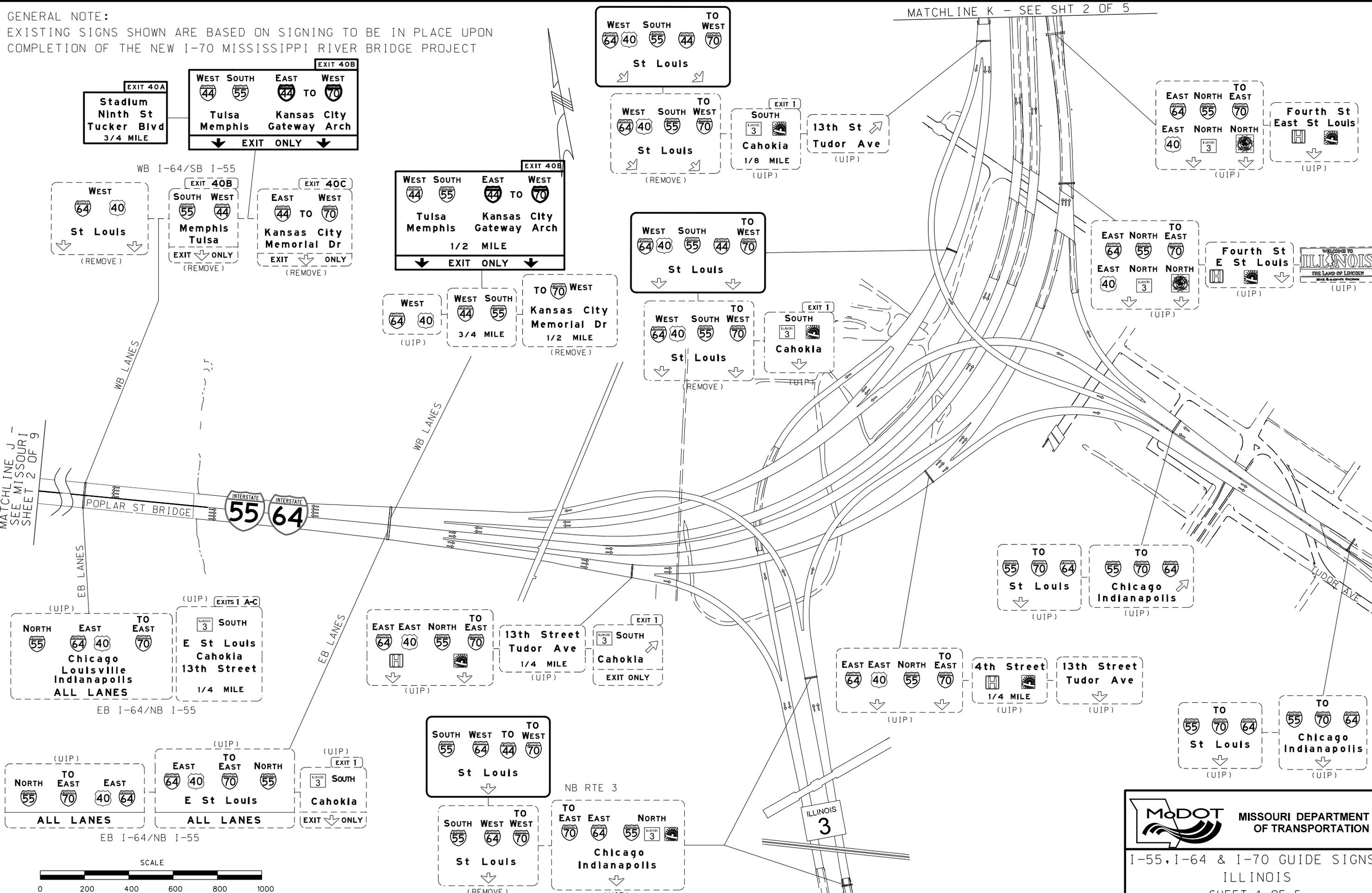
CONCEPTUAL SIGNING PLAN
 J6I2413B
 SHEET 8 OF 8

GENERAL NOTE:
 EXISTING SIGNS SHOWN ARE BASED ON SIGNING TO BE IN PLACE UPON
 COMPLETION OF THE NEW I-70 MISSISSIPPI RIVER BRIDGE PROJECT

MATCHLINE K - SEE SHT 2 OF 5

MATCHLINE J -
 SEE MISSOURI
 SHEET 2 OF 9

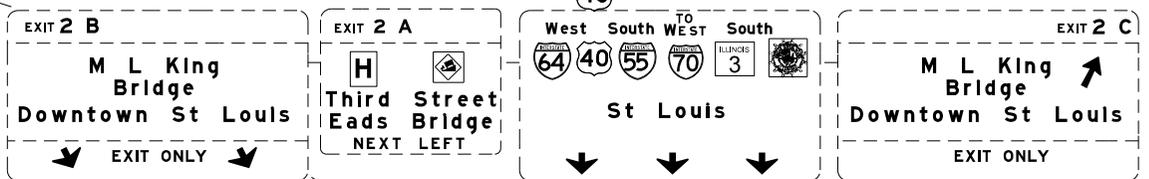
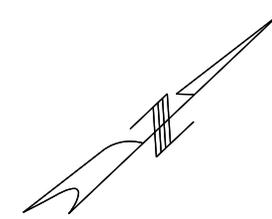
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.



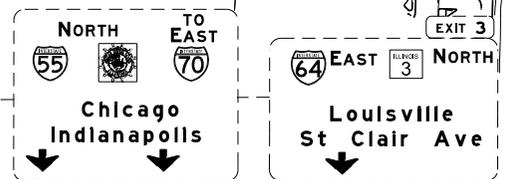
MoDOT MISSOURI DEPARTMENT OF TRANSPORTATION

I-55, I-64 & I-70 GUIDE SIGNS
 ILLINOIS
 SHEET 1 OF 5

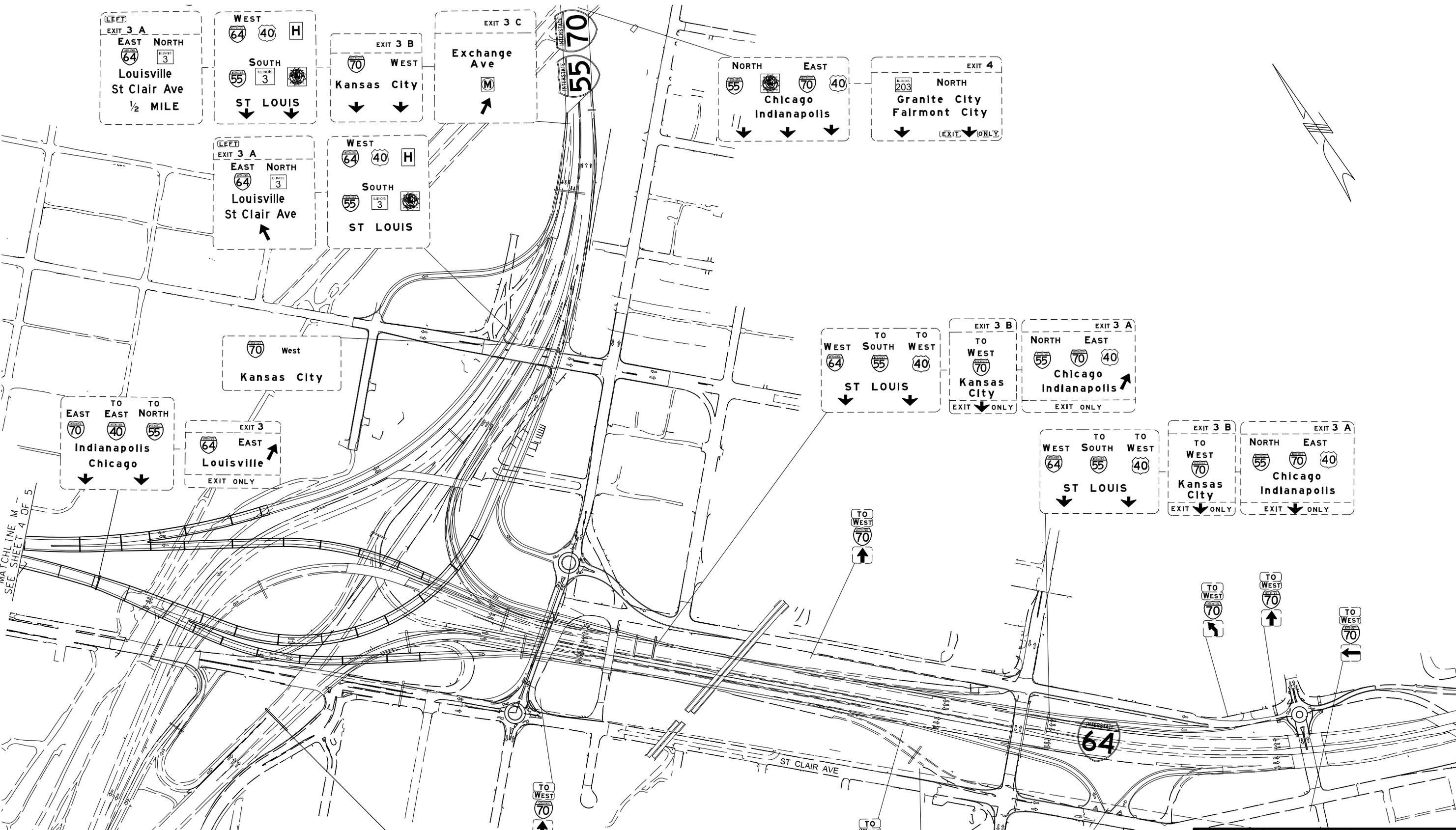
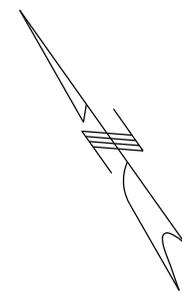
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED. REV.



WELCOME TO ILLINOIS LAND OF LINCOLN From the People of Illinois



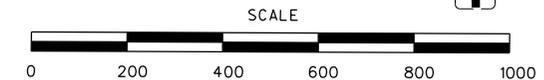
I-55, I-64 & I-70 GUIDE SIGNS ILLINOIS SHEET 2 OF 5



MATCHLINE M - SEE SHEET 4 OF 5

MATCHLINE L - SEE SHEET 2 OF 5

TO		
NORTH	EAST	EAST
ILLINOIS 55	ILLINOIS 40	ILLINOIS 70
Chicago Indianapolis		
EXIT 3		
EAST NORTH		
ILLINOIS 64	ILLINOIS 3	
Louisville St Clair Ave		
EXIT ONLY		



MoDOT MISSOURI DEPARTMENT OF TRANSPORTATION

I-55, I-64 & I-70 GUIDE SIGNS
ILLINOIS
SHEET 3 OF 5

LEFT
EXIT 249

Tucker Blvd
Downtown
St Louis
1 1/2 MILES
EXIT ONLY

INTERSTATE
70 WEST
Kansas
City

MATCHLINE N -
SEE SHEET 5 OF 5

TO TO
SOUTH WEST
55 64

TO WEST
70

TO TO
SOUTH WEST
55 64

TO TO
SOUTH WEST
55 64

TO TO
SOUTH WEST
55 64

TO WEST
70

TO WEST
70

EXCHANGE AVE

LEFT LANE
ENDS
800 FEET

WEST
70
Kansas
City

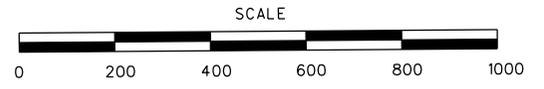
ST CLAIR AVE

TO EAST TO TO
70 40 55
Indianapolis
Chicago

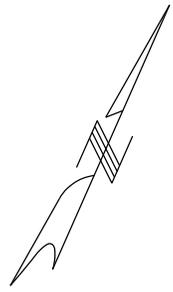
EXIT 3
64 EAST
Louisville
EXIT ONLY

TO TO
SOUTH WEST
55 64

MATCHLINE M -
SEE SHEET 3 OF 5



I-55, I-64 & I-70 GUIDE SIGNS
ILLINOIS
SHEET 4 OF 5



LEFT
EXIT 249

Tucker Blvd Downtown St Louis	INTERSTATE 70 WEST Kansas City
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3/4 MILE

EXIT	↑ ONLY	↘ 45 MPH
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LEFT
EXIT 249 WB I-70

Tucker Blvd Downtown St Louis	INTERSTATE 70 WEST Kansas City
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EXIT ONLY 45 MPH

MATCHLINE 0 -
SEE THIS SHEET

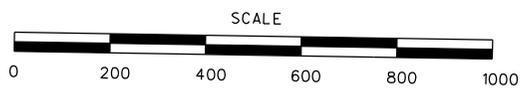
MISSISSIPPI RIVER

NEW MISSISSIPPI RIVER BRIDGE

EXIT 3

INTERSTATE 64 EAST	Louisville 2 MILES
-----------------------	-----------------------

MATCHLINE N -
SEE SHEET 4 OF 5



MoDOT MISSOURI DEPARTMENT OF TRANSPORTATION

I-55, I-64 & I-70 GUIDE SIGNS
ILLINOIS
SHEET 5 OF 5