CITY OF ST. LOUIS

SOUTH GRAND BOULEVARD TRAFFIC STUDY

UTAH STREET TO CHIPPEWA STREET

SOUTH GRAND BOULEVARD TRAFFIC STUDY

CITY OF ST. LOUIS

FINAL REPORT

TASK ORDER #4
WSP: 30900013.004
DATE: JANUARY 2021

WSP

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1 INTRODUCTION

As requested, WSP has performed a traffic and conceptual development study for South Grand Boulevard in St. Louis, MO. The project objective is to study impacts of traffic lane reconfiguration and implementation of various traffic calming measures on South Grand Boulevard from Utah Street to Chippewa Street including conceptual design of a mid-block pedestrian crossing at 3453 South Grand Boulevard. The purpose of this technical memorandum is to briefly document our study procedures, results of traffic analysis and summary of recommendations for the City of St. Louis. An ADA compliance investigation was also completed for the study area and is documented in a separate technical memorandum.

1.1 STUDY AREA

For this analysis, the study area (**Figure 1.1**) was defined as Utah Street to Chippewa Street on South Grand Boulevard and includes the signalized intersections of Utah Street, McDonald Avenue, Gravois Avenue/Miami Street and Chippewa Street. Within the study area from Utah Street to McDonald Avenue, the cross-section of South Grand Boulevard has one parking lane and a travel lane in each direction with a two-way center turn lane. From McDonald Avenue to Gravois Avenue/Miami Street, South Grand Boulevard has two travel lanes in each direction with a two-way center turn lane. Finally, from Gravois Avenue/Miami Street to Chippewa Street, South Grand Boulevard has one parking lane and two travel lanes in each direction with a two-way center turn lane.

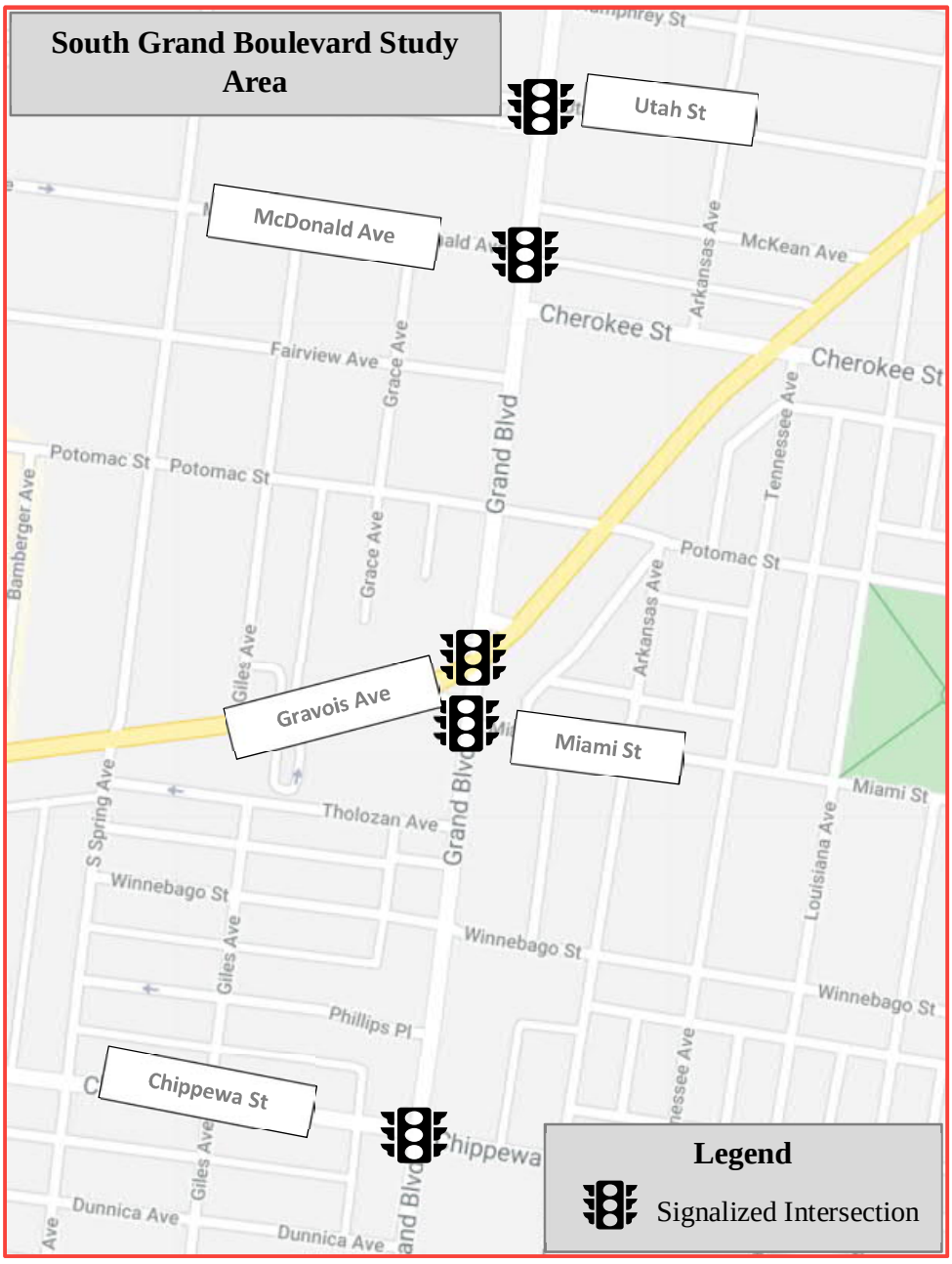


Figure 1.1 – Study Area

1.2 DATA COLLECTION

At the start of the analysis, new traffic count data was collected including turning movement counts at the signalized intersections and mainline speed and volume counts at key locations. The data collection was completed in August of 2020 during the on-going Covid-19 pandemic which has affected traffic levels throughout the region. The historical traffic volumes on South Grand Boulevard at Gravois Avenue was reviewed to determine the effects of Covid-19 on traffic levels when data collection was completed. As can be seen in **Table 1.1**, by August of 2020 daily traffic levels are still reduced and have not reached or

exceeded 2017 levels. The difference in traffic levels from 2017 to 2020 was used to apply a growth factor to each peak period in order to normalize the traffic volumes for each intersection.

Table 1.1
Peak Hour Traffic Volumes Comparison

Intersection Name and Date of Count	Peak Hour Interval	Total
S Grand Boulevard at Gravois Avenue, November 2017	7:30AM - 9:30AM	4,340
	11:00AM - 2:00PM	6,789
	3:30PM - 6:30PM	9,095
S Grand Boulevard at Gravois Avenue, August 2020	7:30AM - 9:30AM	3,274
	11:00AM - 2:00PM	6,506
	3:30PM - 6:30PM	7,773
Percent Change in volumes before/after	AM Peak	-32.6
	MD Peak	-4.3
	PM Peak	-17.0

Using the normalized traffic volumes, the peak hours were determined to be 8:15AM-9:15AM, 1:00PM-2:00PM and 4:45PM-5:45PM for the AM, Midday and PM peak periods, respectively. The peak hour volumes, as seen in **Figure 1.2**, were then used for the traffic analysis. In addition to the traffic count data, existing signal timing information was provided by the City of Street Louis Traffic Department.

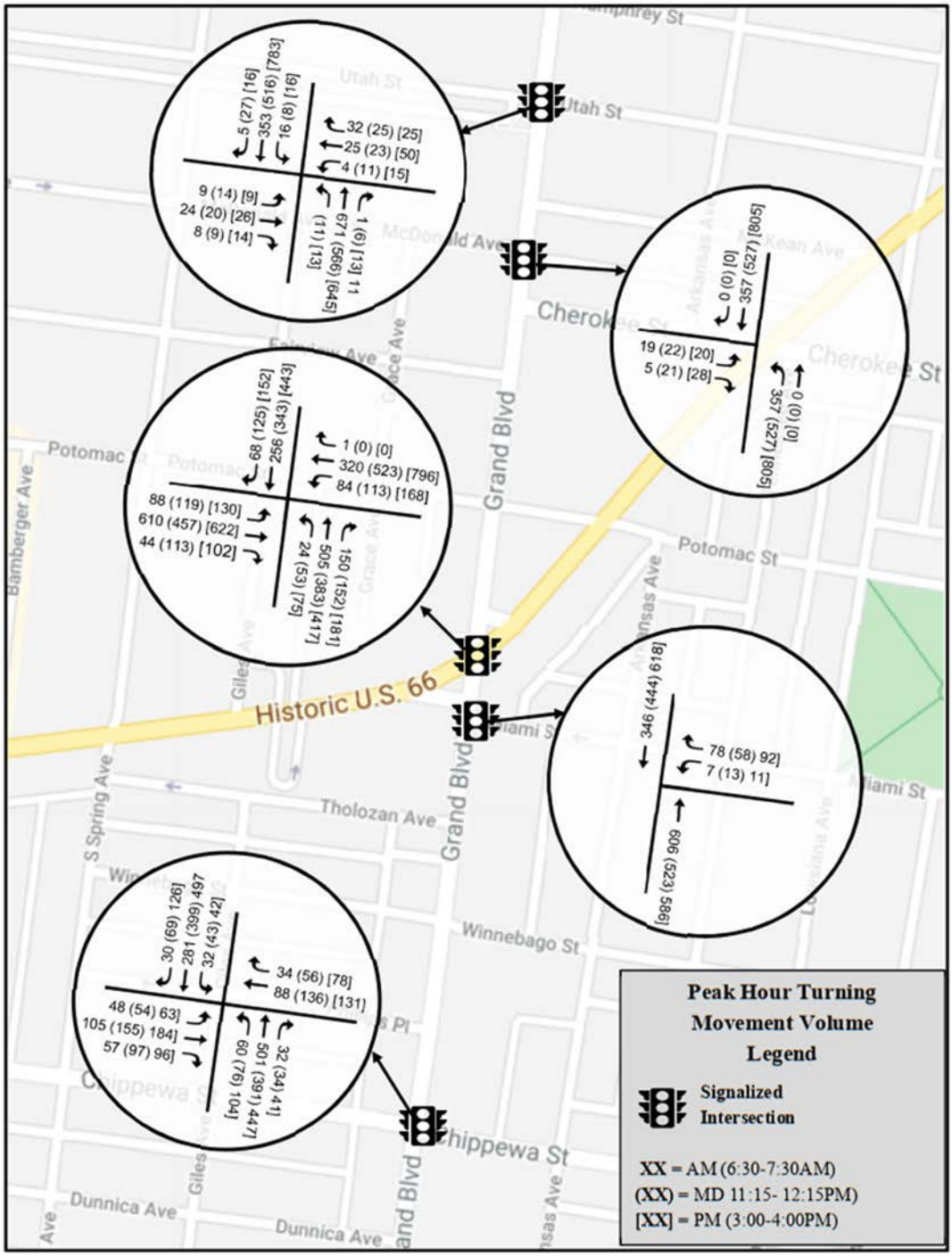


Figure 1.2 – Peak Hour Turning Movement Volumes

2 EXISTING OPERATING CONDITIONS

Within the study area, South Grand Boulevard is a principal arterial serving residential and commercial districts and is intersected by Gravois Avenue, also a principal arterial. The speed limit on South Grand Boulevard is 25 mph north of Gravois Avenue and 30 mph south of Gravois Avenue. The signalized intersections along South Grand Boulevard currently operate in coordination throughout the day. Traffic operating conditions at the study intersections were evaluated using Synchro 10 traffic modeling software with peak hour volumes, existing signal timing and intersection configurations.

The Synchro software uses methodologies outlined in the "Highway Capacity Manual" (HCM) published by the Transportation Research Board. The HCM quantifies the performance intersections using Levels of Service (LOS) which take into account factors such as speed, delay and driver comfort. There are six levels of service ranging from LOS A ("free flow") to LOS F ("oversaturated"). LOS C is commonly used for design purposes while LOS D is typically considered acceptable for peak period conditions in urban and suburban areas. The LOS thresholds for signalized intersections are summarized in **Table 2.1**. Existing operating conditions are summarized in **Table 2.2**.

Table 2.1
Signalized Intersection Level of Service Thresholds

Level of Service	Delay per Vehicle (sec/veh)
A	<10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

As can be seen in Table 2.2, each intersection operates at acceptable levels of service during the AM, Midday and PM peak periods. The intersection of South Grand Boulevard and Gravois Avenue operates with higher delay due to serving two principal arterials and the complexity of the signal configuration. The intersections at Gravois Avenue and at Miami Street operate in conjunction with one signal controller.

Table 2.2 Existing Operating Conditions		
Intersection/Time Period	LOS	Delay (sec/veh)
South Grand Boulevard & Utah Street		
AM Peak	A	6.7
MD Peak	A	6.6
PM Peak	A	9.5
South Grand Boulevard & McDonald Avenue		
AM Peak	A	3.4
MD Peak	A	3.2
PM Peak	A	4.0
South Grand Boulevard & Gravois Avenue		
AM Peak	C	26.2
MD Peak	C	31.1
PM Peak	D	43.7
South Grand Boulevard & Miami Street		
AM Peak	C	30.9
MD Peak	C	30.8
PM Peak	C	29.5
South Grand Boulevard & Chippewa Street		
AM Peak	C	27.7
MD Peak	C	23.4
PM Peak	C	29.1

3 PROPOSED OPERATING CONDITIONS

New lane configurations have been proposed for South Grand Boulevard in order to provide traffic calming and to match the current roadway configuration directly north of the study area. Two options for the proposed conditions have been developed and studied in greater detail.

3.1 OPTION A – FULL ROAD DIET

The first option studied includes a full "road diet" from Utah to Chippewa along with traffic calming elements. North of Gravois Avenue, the cross-section of South Grand Boulevard would include one parking lane and one travel lane in each direction with a two-way center turn lane as seen in **Figure 3.1** and **Figure 3.2**. South of Gravois Avenue, the cross-section of South Grand Boulevard would include a dedicated bike lane, one parking lane and one travel lane in each direction with a two-way center turn lane as seen in **Figure 3.3** and **Figure 3.4**. The dedicated bike lane would provide a connection between existing bike facilities on Gravois Avenue (to the east) and Chippewa Street (to the west). Currently, there are no existing or planned bike facilities on South Grand Boulevard south of Chippewa Street, therefore the bike facility is proposed to turn from South Grand Boulevard onto westbound Chippewa Street. For Additional traffic calming elements would include floating curb extensions at cross street intersections, painted/striped curb extensions at commercial and private driveways, formalized on-street parking, bus pull out areas, street trees and highly visible pedestrian crossings. The attached conceptual drawings were developed to accommodate the use of 60' long buses for the South Grand Boulevard bus routes.

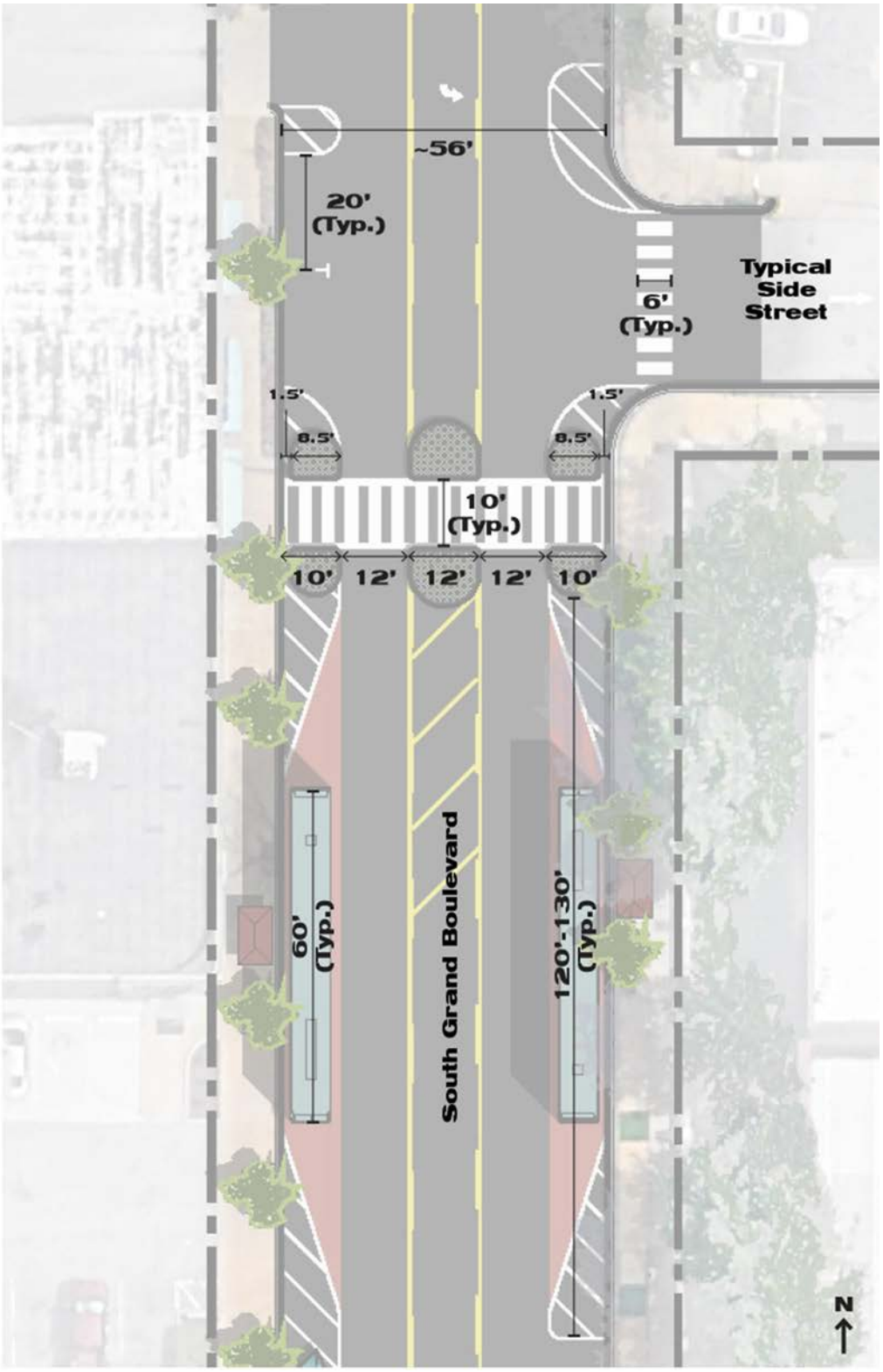


Figure 3.1 – Option A and B Typical Section (Utah Street to Gravois Avenue)

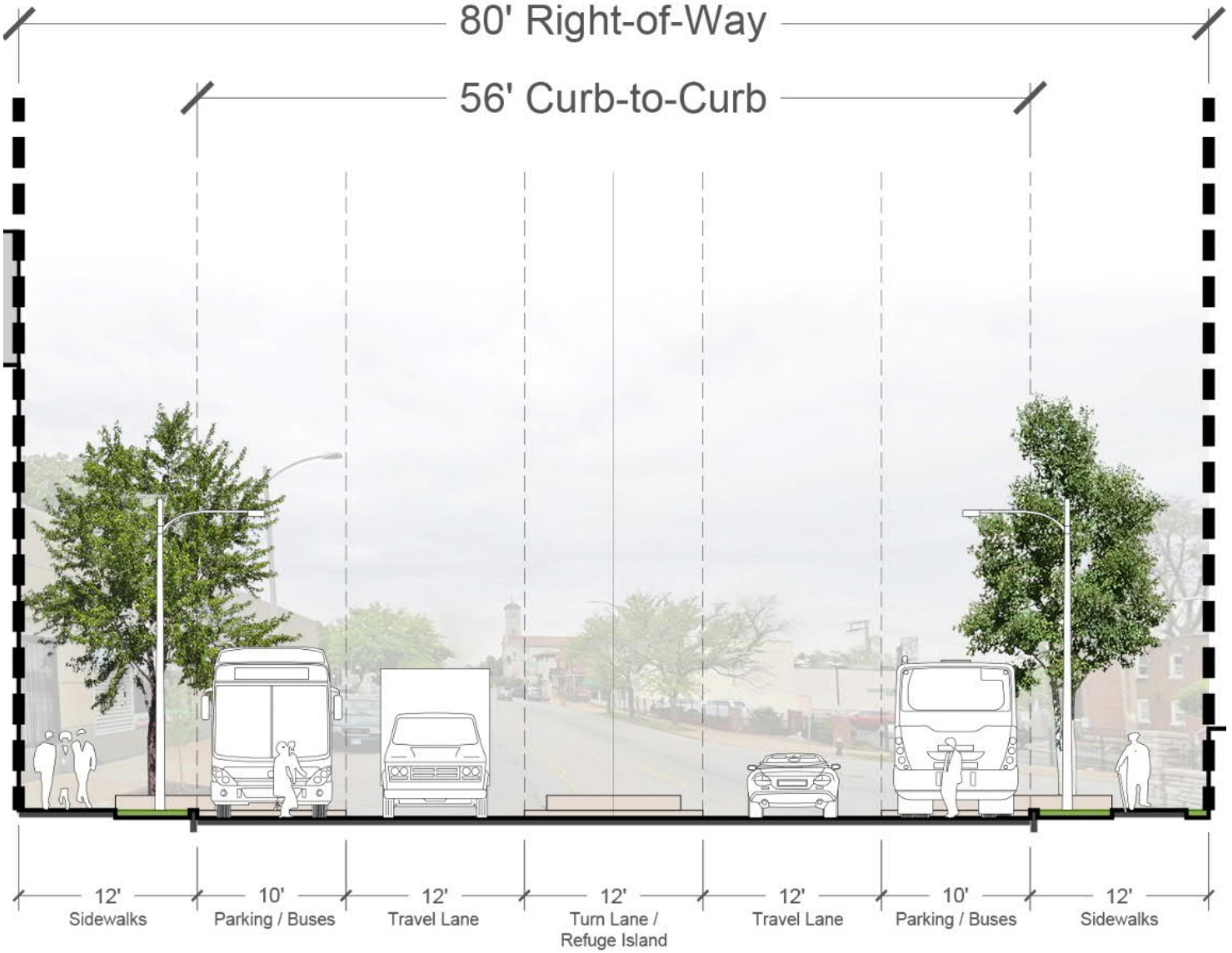


Figure 3.2 – Option A and B Typical Cross-Section (Utah Street to Gravois Avenue)

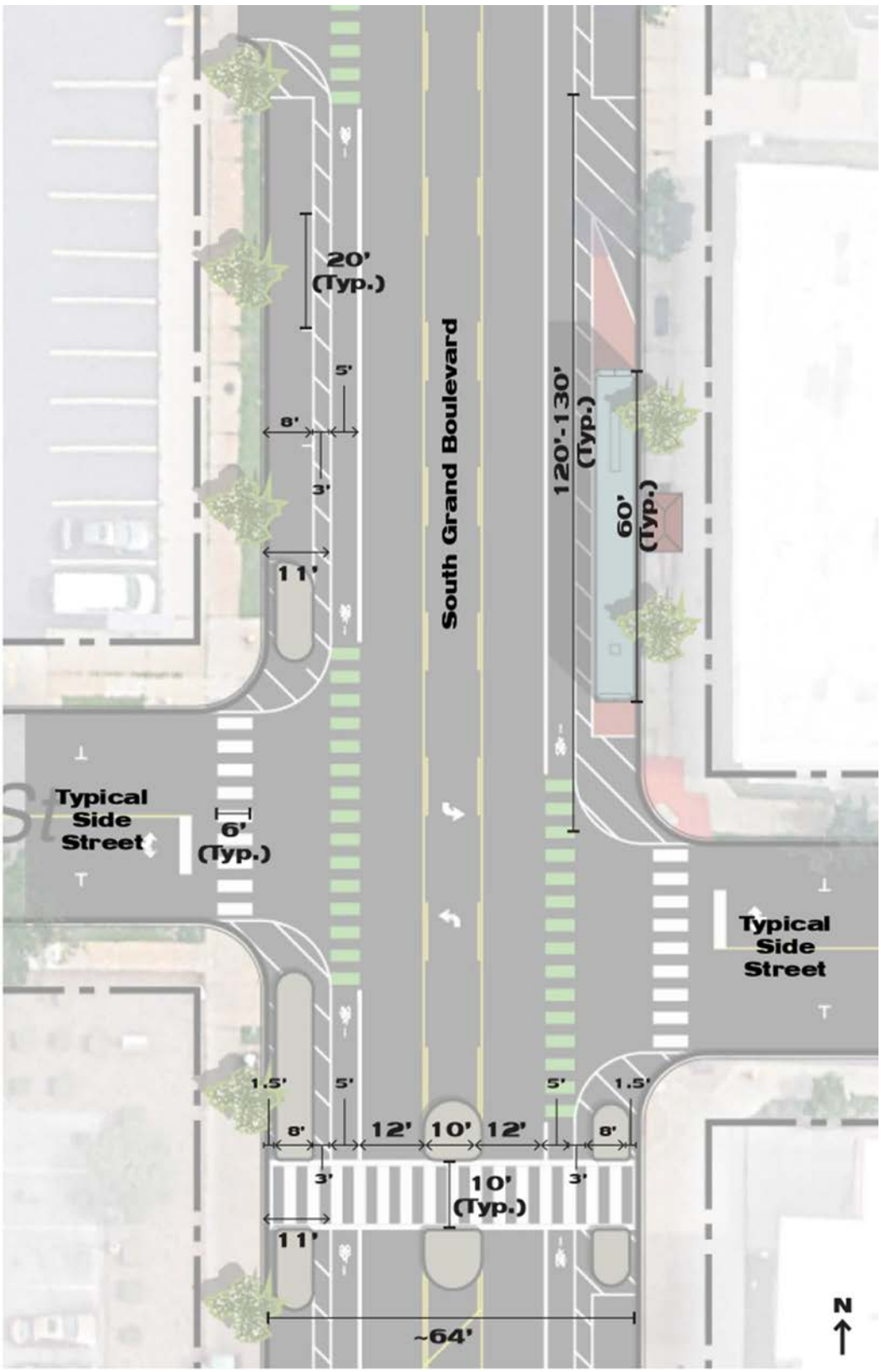


Figure 3.3 – Option A Typical Section (Gravois Avenue to Chippewa Street)

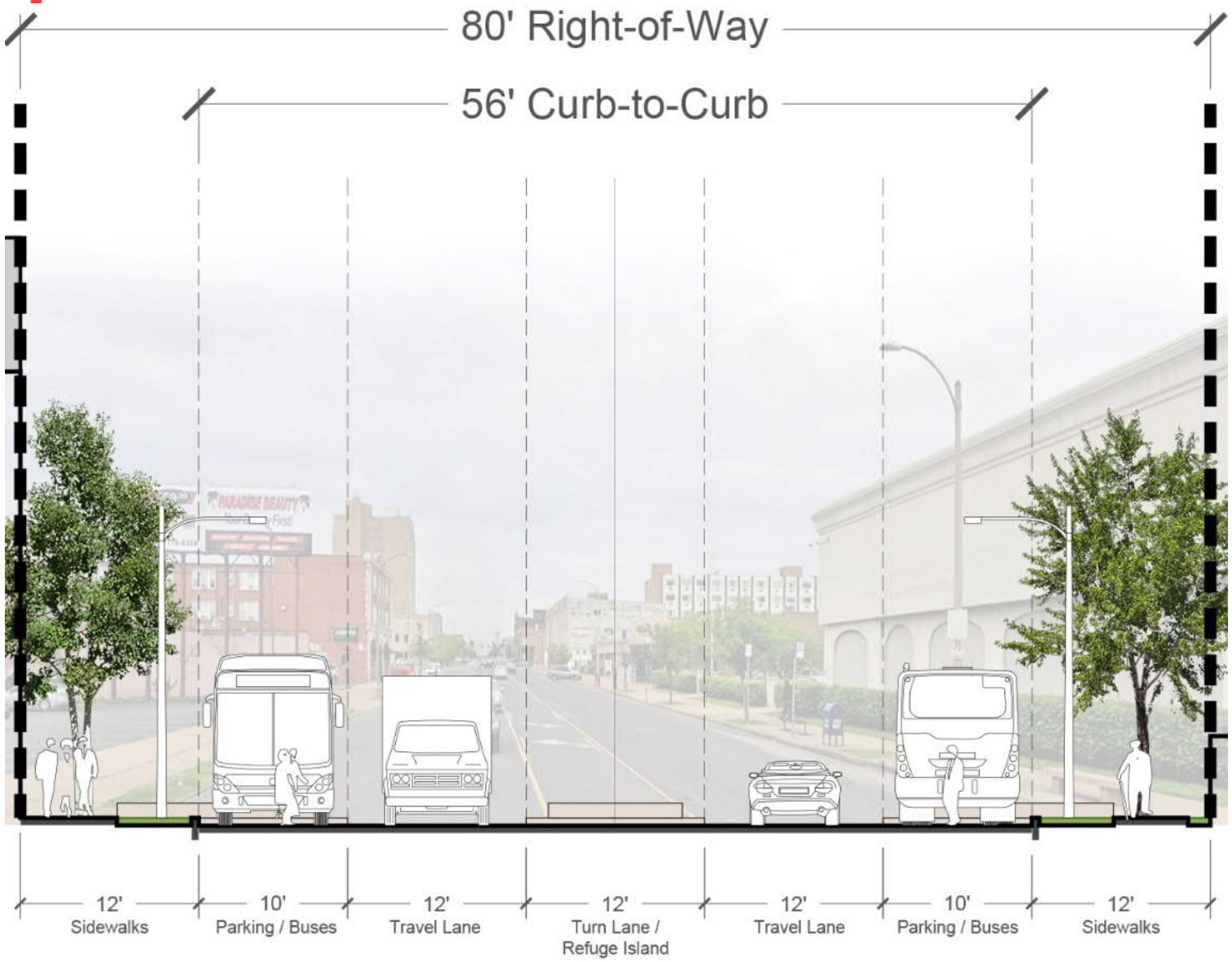


Figure 3.4 – Option A Typical Cross-Section (Gravois Avenue to Chippewa Street)

The location of the bike lane would be positioned between the travel lane and the parking lane. Locating the bike lane between the parking lane and the curb was also considered. The high frequency of buses on the South Grand Boulevard corridor would block the bike lane frequently near the bus stops. Furthermore, the bike lane will connect to bike facilities on Chippewa Street and Gravois Avenue that are positioned between the travel lane and parking lane. Therefore, for this option it was decided to keep the bike lane positioned between the travel lane and parking lane.

This option would require reconfiguration of the intersection at Miami Street including removal of the signal. Miami Street would be converted to two-way and would operate as a right-in/right-out only at South Grand Boulevard. The existing pedestrian crossing on the northside of Miami Street would be moved to the south side of the Gravois Avenue intersection. The removal of the signal at Miami Street would simplify the signal operations at Gravois Avenue thus increasing capacity at Gravois Avenue. A comparison of the proposed operating conditions versus existing conditions is shown in **Table 3.1**.

Table 3.1
Existing vs. Option A Signalized Operating Conditions

	Existing		Option A Proposed	
Intersection/Time Period	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
South Grand Boulevard & Utah Street				
AM Peak	A	6.7	A	6.7
MD Peak	A	6.6	A	6.1
PM Peak	A	9.5	A	9.7
South Grand Boulevard & McDonald Avenue				
AM Peak	A	3.4	A	2.9
MD Peak	A	3.2	A	2.5
PM Peak	A	4.0	A	3.9
South Grand Boulevard & Gravois Avenue				
AM Peak	C	26.2	C	31.1
MD Peak	C	31.1	C	29.7
PM Peak	D	43.7	D	36.2
South Grand Boulevard & Miami Street				
AM Peak	C	30.9	--	--
MD Peak	C	30.8	--	--
PM Peak	C	29.5	--	--
South Grand Boulevard & Chippewa Street				
AM Peak	C	27.7	C	25.9
MD Peak	C	23.4	C	22.8
PM Peak	C	29.1	C	26.8

As can be seen in Table 4, the proposed operating conditions for each intersection would operate at acceptable LOS during each peak period. For Utah Street McDonald Avenue and Chippewa Street, there would be negligible differences versus existing conditions. The intersection of Gravois Avenue would only

operate at acceptable levels of service if Miami Street is removed from the signal operation. Without the removal, Gravois Avenue would operate at failing LOS during the AM and PM peak periods due to a lack of green time for northbound and southbound movements.

3.2 OPTION B – PARTIAL ROAD DIET

The second option studied includes a "road diet" from Utah Street to Gravois Avenue and minor improvements from Gravois Avenue to Chippewa Street. North of Gravois Avenue, the cross-section of South Grand Boulevard would be identical to Option A as shown in **Figure 3.1** and **Figure 3.2** above. South of Gravois Avenue, the cross-section of South Grand Boulevard would match the existing condition with minor improvements and traffic calming elements. The cross-section, as shown in **Figure 3.5** and **Figure 3.6**, would include one parking lanes and two travel lanes in each direction with a two-way center turn lane. Along the entire corridor, traffic calming elements would include floating curb extensions at cross street intersections, painted/striped curb extensions at commercial and private driveways, formalized on-street parking, street trees and highly visible pedestrian crossings. For Option B, the intersection of Miami Street would continue to operate signalized in conjunction with Gravois Avenue. A comparison of the proposed operating conditions versus existing conditions is shown in **Table 3.2**.

Table 3.2
Existing vs. Option B Signalized Operating Conditions

	Existing		Option B Proposed	
Intersection/Time Period	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
South Grand Boulevard & Utah Street				
AM Peak	A	6.7	A	6.2
MD Peak	A	6.6	A	7.7
PM Peak	A	9.5	A	9.4
South Grand Boulevard & McDonald Avenue				
AM Peak	A	3.4	A	5.6
MD Peak	A	3.2	A	4.2
PM Peak	A	4.0	A	4.7
South Grand Boulevard & Gravois Avenue				
AM Peak	C	26.2	C	26.6
MD Peak	C	31.1	D	35.4
PM Peak	D	43.7	D	49.5
South Grand Boulevard & Miami Street				
AM Peak	C	30.9	C	31.8
MD Peak	C	30.8	C	29.1
PM Peak	C	29.5	C	28.7
South Grand Boulevard & Chippewa Street				
AM Peak	C	27.7	C	28.7
MD Peak	C	23.4	C	22.5
PM Peak	C	29.1	C	27.8

As can be seen in Table 5, the proposed operating conditions for each intersection would operate at acceptable LOS during each peak period. For Utah Street McDonald Avenue and Chippewa Street, there would be negligible differences versus existing conditions. The intersection of Gravois Avenue would experience a small increase in delay due to the reduction in southbound through lanes from two to one.

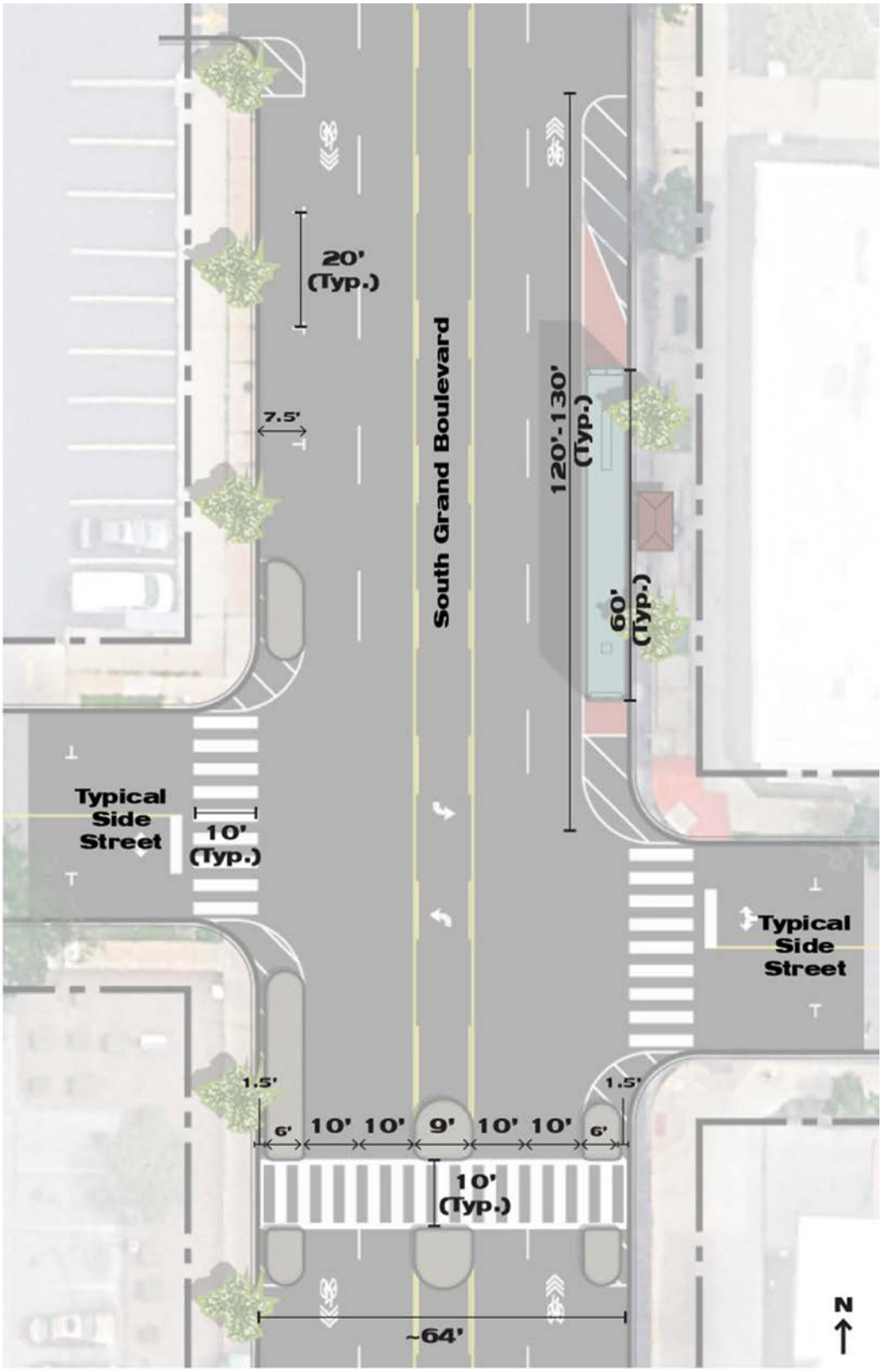


Figure 3.5 – Option B Typical Section (Gravois Avenue to Chippewa Street)

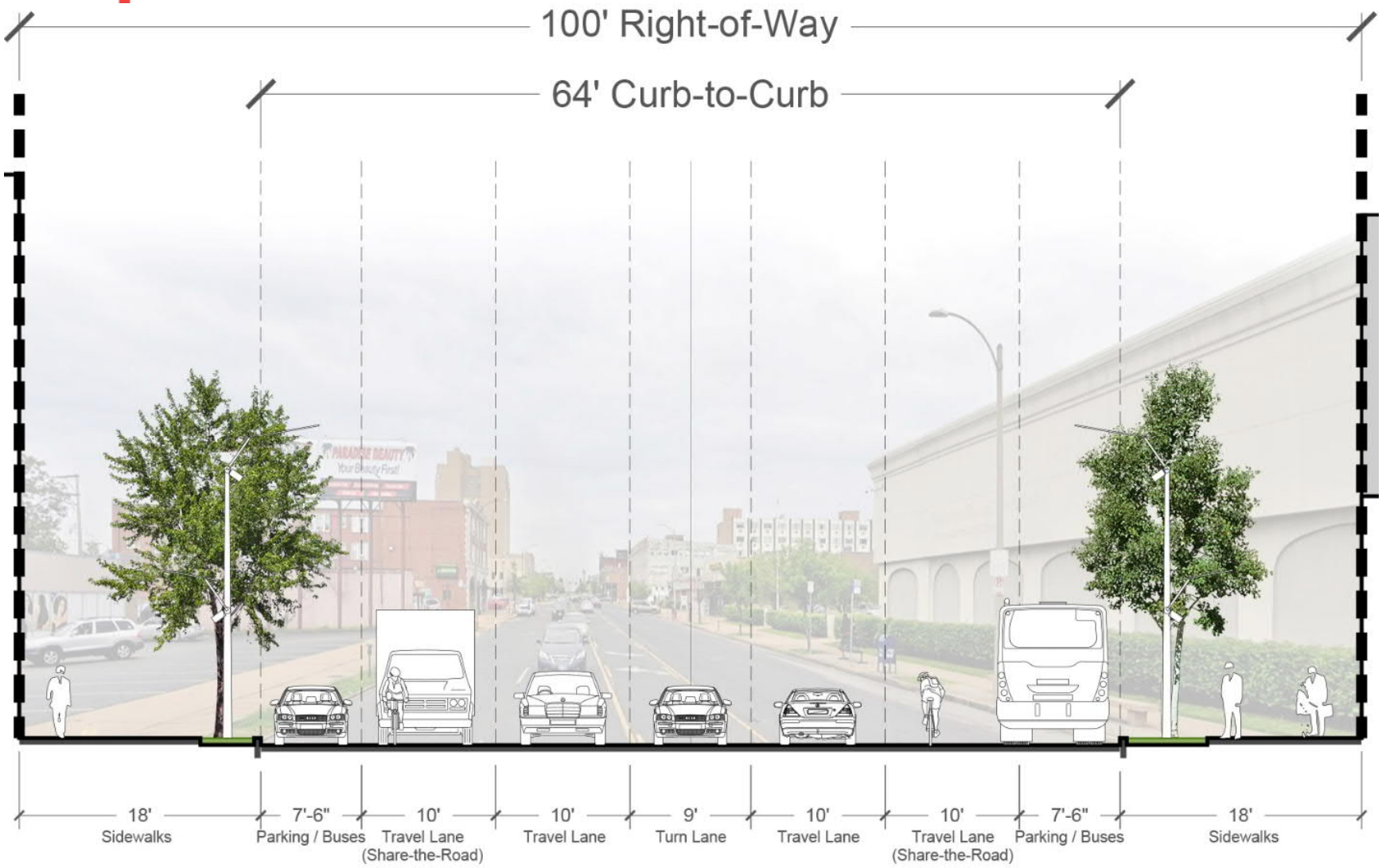


Figure 3.6 – Option B Typical Cross-Section (Gravois Avenue to Chippewa Street)

3.3 COMPARISON OF OPTIONS

Each option studied would have minimal impacts at the intersections of Utah Street, McDonald Avenue and Chippewa Street. The largest impacts for both options would be focused at the combined signalized intersection of Gravois Avenue and Miami Street. **Table 3.3** provides a comparison of the LOS and delay for each movement at these intersections for the PM peak period. The PM peak period experiences the heaviest intersection volumes throughout the day. As can be seen, each option provides acceptable LOS while Option A provides for less delay for northbound and southbound movements.

Table 3.3
PM Peak Hour Operating Conditions for South Grand Boulevard and Gravois Avenue/Miami Street

	Existing		Option A Proposed		Option B Proposed	
Movement	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)
South Grand Boulevard & Gravois Avenue						
EBL	D	45.6	C	31.5	E	59.6
EBT	D	49.4	D	40.4	E	58.1
EBR	A	0.7	A	1.6	A	0.9
WBL	C	33.6	C	28.4	D	52.0
WBT	D	53.4	D	42.7	E	72.3
WBR	A	0.0	A	0.0	A	0.0
NBL	E	72.4	E	76.4	F	87.9
NBT	A	1.0	C	29.9	A	0.7
NBR	A	1.0	A	5.0	A	0.7
SBT	E	74.0	D	53.7	E	77.3
SBR	E	74.0	A	4.9	A	8.0
South Grand Boulevard & Miami Street						
WBL	D	51.2	--	--	E	56.3
WBR	B	13.4	--	--	B	14.5
NBT	D	43.6	--	--	C	34.3
SBT	B	18.1	--	--	C	24.9

4 MID-BLOCK PEDESTRIAN CROSSINGS

As requested, conceptual layouts have been developed for mid-block pedestrian crossings. Specifically, a pedestrian crossing was requested at 3453 South Grand Boulevard at the existing Metro bus stop. In addition, a pedestrian crossing was also considered on South Grand Boulevard near Winnebago Street. These mid-block pedestrian crossings would be recommended and included in both Option A and Option B described above.

There is currently a need for a mid-block pedestrian crossing near 3453 South Grand Boulevard in order to connect the Metro bus stop on the west side of the road with the retail center on the east side of the road. Pedestrians and transit users were observed crossing the street at this location although no pedestrian facilities are present. Conceptual layouts have been developed for a crossing at 3453 South Grand Boulevard and an option for a crossing at Cherokee Street. The crossing at 3453 South Grand Boulevard would require pedestrians destined for the retail center to cross the busy retail entrance. However, the crossing at Cherokee Street would allow pedestrians to enter the retail center without crossing the entrance. With the proposed Cherokee Street crossing it is recommended to move the existing southbound Metro bus stop which would better align with the northbound Metro bus stop. Metro transit agency approval would be required in order to move an existing bus stop.

An additional mid-block pedestrian crossing was identified on South Grand Boulevard near Winnebago Street in order to connect retail centers on each side of the road along with adjacent residential areas. Currently, there is approximately 1,300 feet between pedestrian crossings on South Grand Boulevard between Miami Street and Chippewa Street. For both pedestrian crossings, the conceptual layout provides curb bumpouts to limit the length of the crossing with center refuge islands to allow safe crossing. In addition, rectangular rapid flash beacons (RRFB) are recommended at each mid-block pedestrian crossing to increase driver yielding behavior.

5 ESTIMATE OF COSTS

Conceptual level costs estimates have been developed for the options presented in this report. In general, Option A would be more costly than Option B due to the improvements required at the South Grand Boulevard and Gravois Avenue/Miami Street intersection. The costs have been separated based on improvements north of Gravois Avenue, Gravios Avenue to Miami Street and South of Miami Street. It is anticipated that South Grand Boulevard will be repaved in 2021, however the full extent of these improvements may not be financially feasible at that time. **Table 5.1** below summarizes the conceptual level costs to implement each option based on a traditional design-bid-build project. The cost estimates are based on WSP's professional experience and judgment and shall be deemed to represent the company's opinion. The company has no control over the cost of labor, material, equipment and other relevant factors that could influence the ultimate construction costs. Thus, the company does not guarantee that proposals, bids, or the actual facility cost will be the same as the company's estimate of probable construction cost or that construction costs will not vary from its opinions of probable cost. It should be noted the mill and overlay cost estimate line item has been provided by the City of St. Louis Board of Public Service and it is anticipated that the mill and overlay work would be completed by the Street Department.

Table 5.1 Conceptual Level Cost Estimates Option A and Option B		
Bid Item	Option A	Option B
South Grand Boulevard – Utah Street to Gravois Ave		
1. Mobilization, Traffic Control, Erosion Control	$60,000.00	$60,000.00
2. Removals	$10,000.00	$10,000.00
3. Mill and Overlay*	$95,000	$95,000
4. Mid-Block Ped Crossing with RRFB	$75,000.00	$75,000.00
5. Pavement Markings and Signage	$40,000.00	$40,000.00
6. Miscellaneous Items (Bus Shelters, Cubes, Etc.)	$25,000	$25,000
Total – Utah Street to Gravois Avenue	**$305,000.00**	**$305,000.00**
South Grand Boulevard – Gravois Avenue to Miami Street		
1. Mobilization, Traffic Control, Erosion Control	$30,000.00	$16,000.00
2. Removals	$6,000.00	NA
3. Mill and Overlay*	$14,000	$14,000
4. Signal Modification with crosswalk	$80,000.00	NA
5. Pavement Markings and Signage	$27,500.00	$15,000.00
6. Miscellaneous Items (Bus Shelters, Cubes, Etc.)	$6,000.00	NA
Total – Gravois Avenue to Miami Street	**$163,500.00**	**$45,000.00**
South Grand Boulevard – Miami Street to Chippewa Street		
1. Mobilization, Traffic Control, Erosion Control	$95,000.00	$95,000.00
2. Removals	$17,500.00	$17,500.00
3. Mill and Overlay*	$71,000.00	$71,000.00
4. Mid-Block Ped Crossing with RRFB	$75,000.00	$75,000.00
5. Pavement Markings and Signage	$125,000.00	$80,000.00
6. Miscellaneous Items (Bus Shelters, Cubes, Etc.)	$16,000.00	$16,000.00
Total – Miami Street to Chippewa Street	**$399,500.00**	**$354,500.00**
Project Total	**$868,000.00**	**$704,500.00**

* - Mill and Overlay to be performed by the City of St. Louis Street Department (Cost estimate provided by Board of Public Service)

6 RECOMMENDATIONS

Based on the traffic impact analysis, both options studied would provide acceptable conditions throughout the corridor and at the signalized intersections while providing traffic calming and improved multi-modal benefits. For both options, the proposed changes are identical north of Gravois Avenue and differ south of Gravois Avenue. In addition, both options include mid-block pedestrian crossings to improve safety and connectivity for pedestrians. Option A would require significant changes at the Miami Street intersection in order to mitigate traffic congestion but would allow a full road diet from Gravois Avenue to Chippewa Street with dedicated bike lanes. Conversely, Option B would require less changes but would have less impact in regard to traffic calming. Based on our analysis and conceptual plans of these options we provide the following recommendations:

- South Grand Boulevard north of Gravois Avenue – Implement Option A cross section when South Grand Boulevard is repaved
    - Reduce cross-section to one parking lane, one travel lane in each direction and a two-way center turn lane to match the cross-section north of Utah Street.
    - Implement mid-block pedestrian crossing and traffic calming elements
- South Grand Boulevard south of Gravois Avenue – Implement Option A cross section when South Grand Boulevard is repaved. This recommendation is dependent on available funding and may need to be delayed until funding is available.
    - Reduce cross-section to one parking lane, a dedicated bike lane, one travel lane in each direction and a two-way center turn lane.
    - Remove Miami Street intersection from signal operations at Gravois Avenue
        - Convert Miami Street for two-way traffic with a right-in/right-out at South Grand Boulevard.
        - Reconfigure lane assignments at Gravois Avenue intersection for the northbound approach (one through and one right turn lane) and southbound approach (one left, one through and one right turn lane).
        - Relocate existing pedestrian crossing from Miami Street to the southside of Gravois Avenue. Use highly visible, durable striping material for crossing.
        - Coordinate with Missouri Department of Transportation (MoDOT) for approval of signal modification.
    - If full funding is not available at the time of repaving, it is recommended to implement an interim plan with the existing cross-section and low-cost traffic calming elements as funding allows.

- Traffic Calming Elements included in Option A
    - Install floating curb extensions adjacent to cross streets. Install painted/striped curb extensions with traffic bollards at commercial and private driveways.
    - Reduce travel lane width where the cross-section allows.
    - Formalize on-street parking with striped parking stalls.
    - Street trees – plant trees in existing tree wells and install new tree wells with trees in order to provide consistent coverage across the corridor.

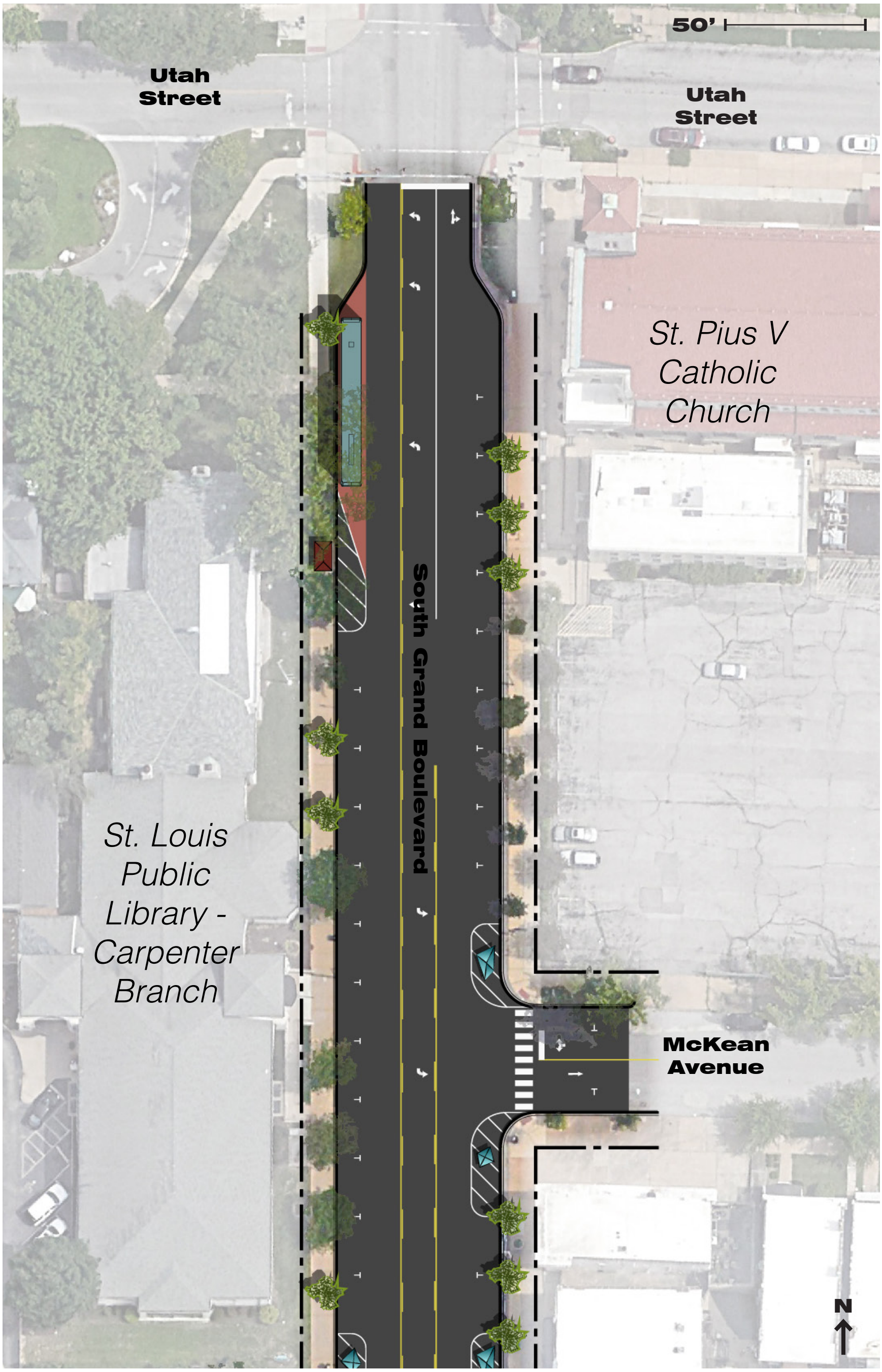
- Mid-Block Pedestrian Crossings – Install two mid-block pedestrian crossings at Cherokee Street and at Winnebago Street.
    - Install floating curb extensions and center refuge islands at each crossing.
    - Install rectangular rapid flash beacons (RRFB) at each crossing
    - Install highly visible, durable striping material for each crossing.
    - Coordinate with Metro transit agency for relocation of the existing bus stop at 3453 South Grand Boulevard.

The attached appendix includes conceptual plans for Option A, from Utah Street to Chippewa Street including proposed mid-block pedestrian crossings. If the City of St. Louis is in agreement with the recommendations above, we recommend iniating coordination with the Missouri Department of Transportation (MoDOT), Metro Transit, and relevant community stakeholders. If you have any questions regarding this analysis or our recommendations, please feel contact Michael Dolde at Michael.Dolde@wsp.com or 314-206-4283.

Thanks,

Michael Dolde, PE, PTOE
Supervising Traffic Engineer

APPENDIX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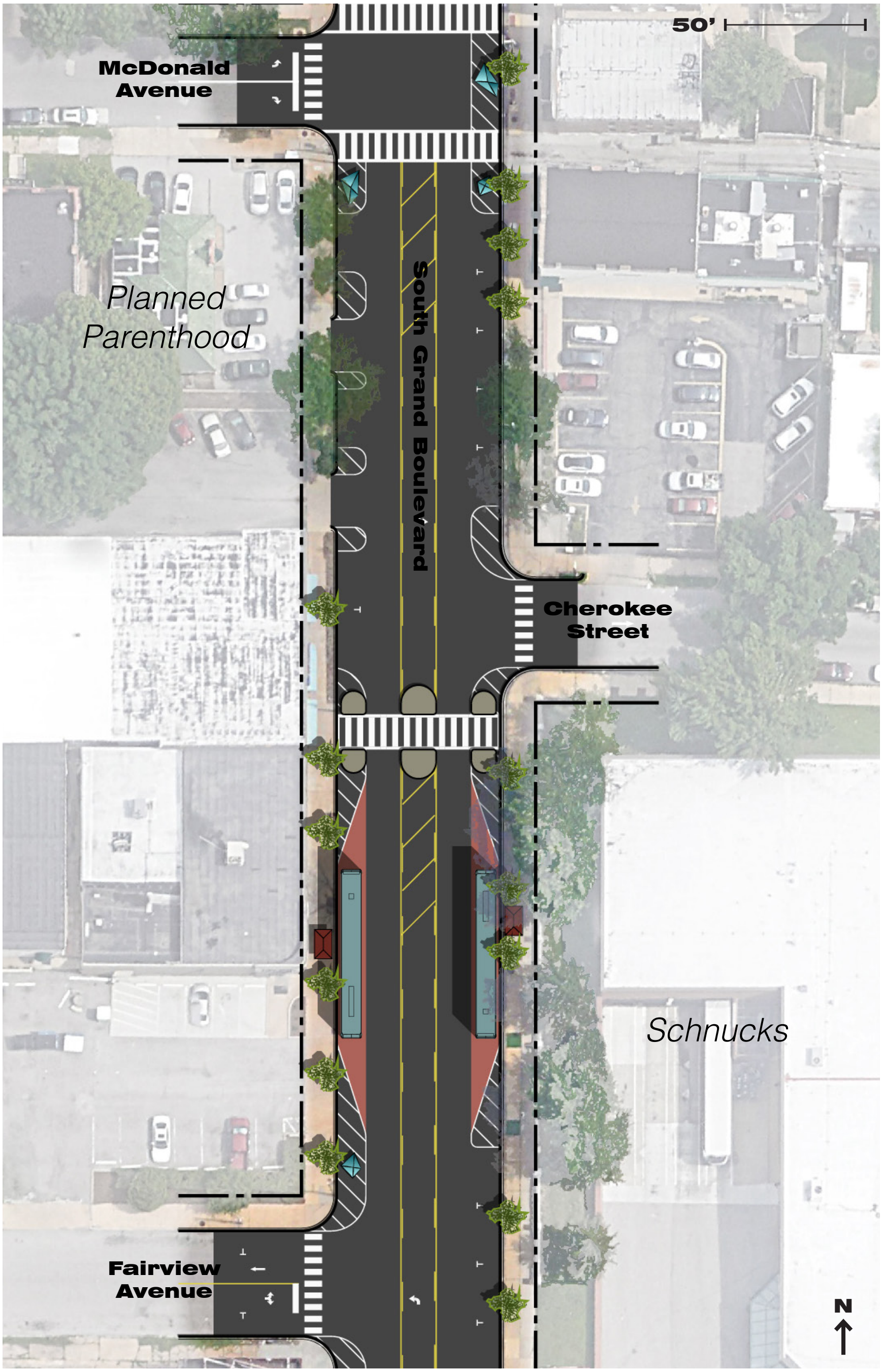
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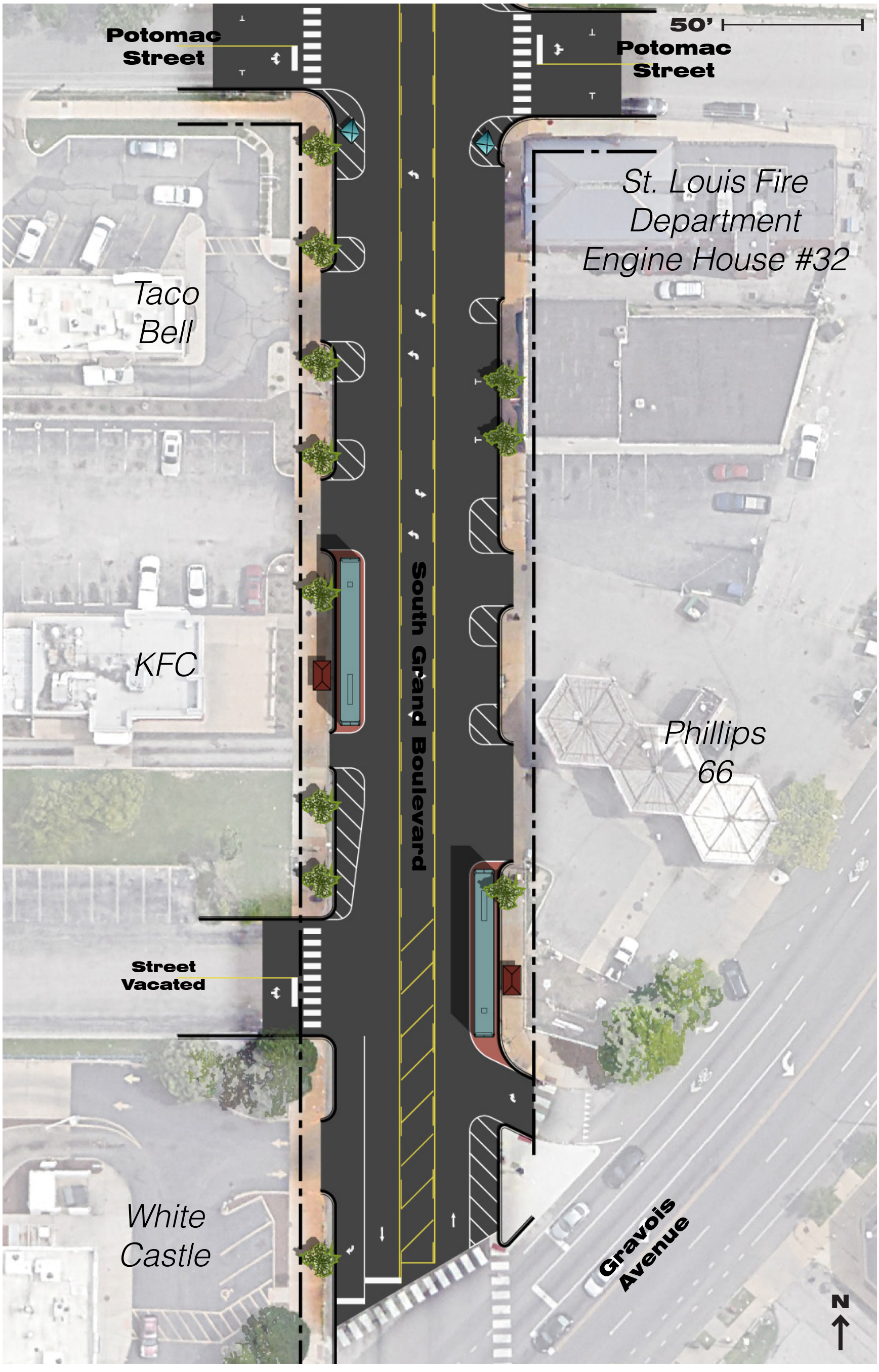
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The Diplomat Apartments
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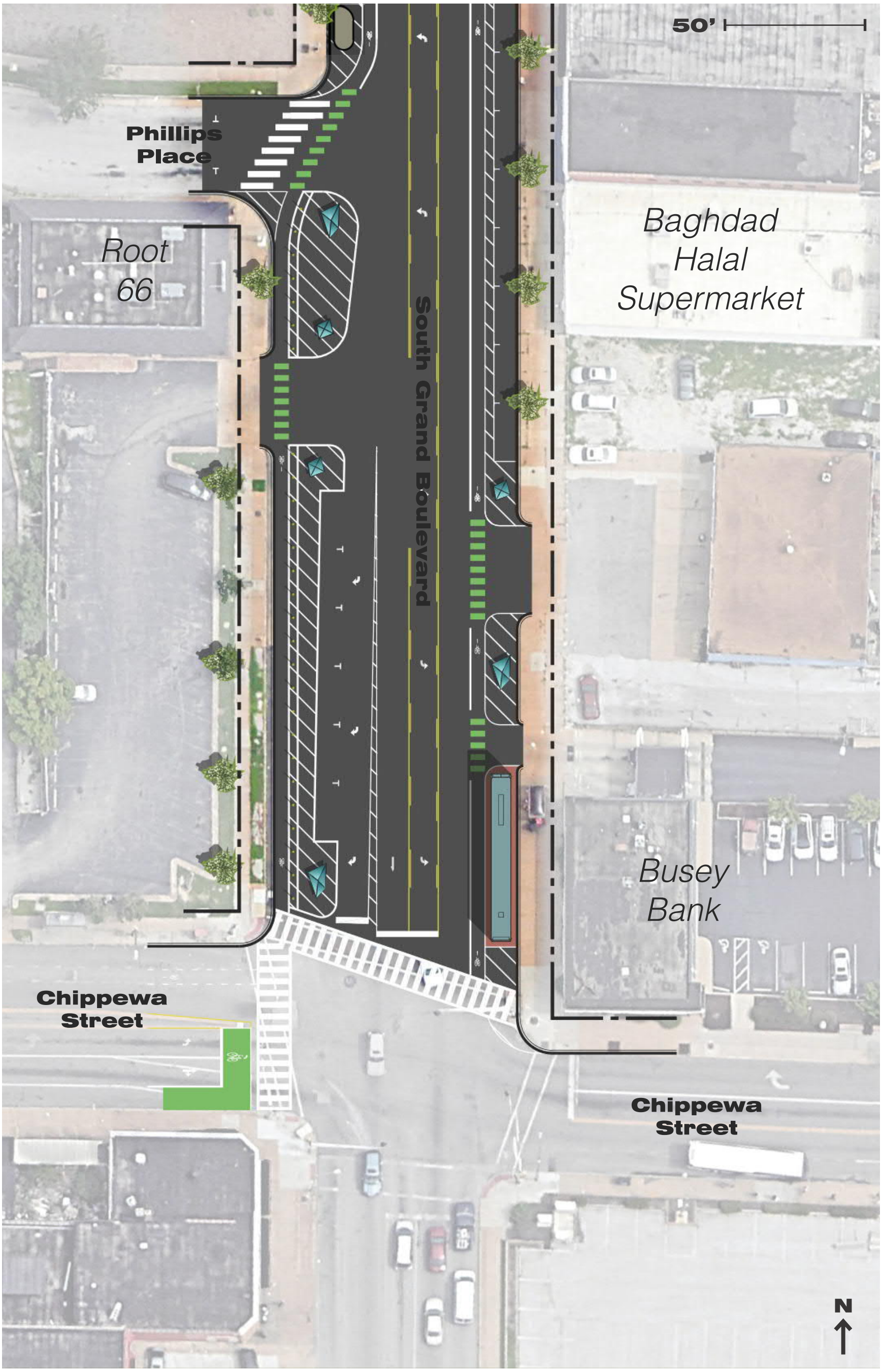
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