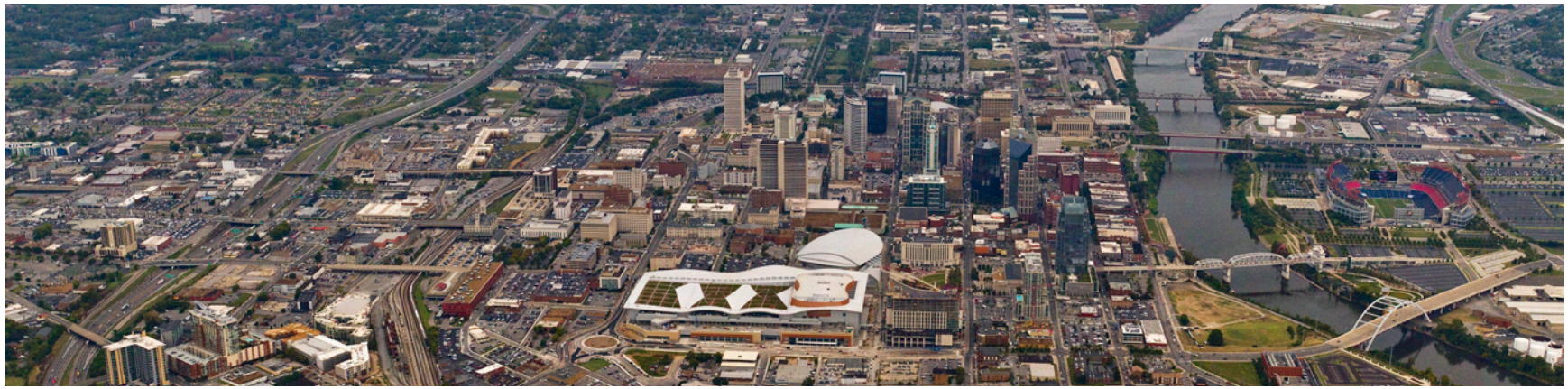
MULTIMODAL MOBILITY STUDY





Metro Nashville Public Works
Improving the Quality of Life for Nashvillians and our Visitors

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“As the avenues and streets of a city are nothing less than its arteries and veins, we may well ask what doctor would venture to promise bodily health if he knew that the blood circulation was steadily growing more congested!”

- Hugh Ferriss, *The Metropolis of Tomorrow*

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1 EXECUTIVE SUMMARY

The Multimodal Mobility Study was conducted to establish a mobility action plan for all modes of transportation in the Nashville region for the next 10 years. The study seeks to answer questions such as: How can Metro Public Works accommodate the mobility needs of existing and future residents, workers, and visitors considering the current high level of economic development in the region and in downtown Nashville?

1.1 Extensive Data Collection

As a part of the mobility study, the project team collected an extensive amount of data that included vehicular, bicycle, and pedestrian counts at 115 intersections, on-street and off-street parking supply and demand counts on 221 downtown blocks, 24-hour tube counts on all major entry and exit points for downtown, and an infrastructure inventory that included sidewalk widths, presence of bicycle facilities, and transit stop amenities. In addition, three years of crash data was also obtained in order analyze pedestrian, bicycle, and vehicle crashes in the study area. This data helped to establish the current state of traffic, parking, pedestrian, bicycle, and transit/shuttle mobility in downtown Nashville.

1.2 Extensive Public Input

In addition to collecting quantitative data, one of the major efforts of the study was to solicit public comments and input throughout the course of the study. The project team organized three open house events at various stages of the project to present the project's progress to the public and give an opportunity to provide feedback. In addition to the open houses, an online survey was widely distributed that resulted in participation from approximately 400 respondents who answered 15 questions regarding their experience traveling in and around downtown Nashville. The survey revealed that parking and traffic congestion were the two main mobility challenges, while a vast majority of the respondents preferred to walk or take a bus to travel in the downtown area. The respondents pointed out that the high price of parking was their primary parking concern while traffic progression and flow were their main traffic concerns. With regards to pedestrian issues, conflict with vehicles was the biggest issue identified in the survey results. Bicycle related responses also highlighted issues such as conflicts with vehicles as well as inadequate bicycle facilities and poor connections to/from downtown. As for transit service, infrequency of service was raised as the primary concern.

TABLE 1. COMPARISON OF DEVELOPMENT FORECASTS

	Downtown/ SoBro Market Analysis[1]	Scenario 1 [2]	Scenario 2 [2]
Residential (units) [3]	8,035	4,035	8,885
Retail (sf)	732,000	544,790	1,098,790
Office (sf)	1,045,000	3,167,440	4,207,440
Hotel (rooms)	2,740	2,020	3,420

The project team also conducted one-on-one interviews with key stakeholders including representatives of the Nashville Downtown Partnership, Chamber of Commerce, Music City Center, Metro Police Department, Walk/Bike Nashville, Metro Transportation and Licensing Commission, Metro Transit Authority, Metro Planning Department, and Metro Planning Organization to obtain their detailed input on mobility issues in the study area. The concerns and suggestions obtained through the stakeholders interviews, online survey, and open houses were taken into consideration in development of the recommendations of the study.

1.3 Existing Conditions Analysis

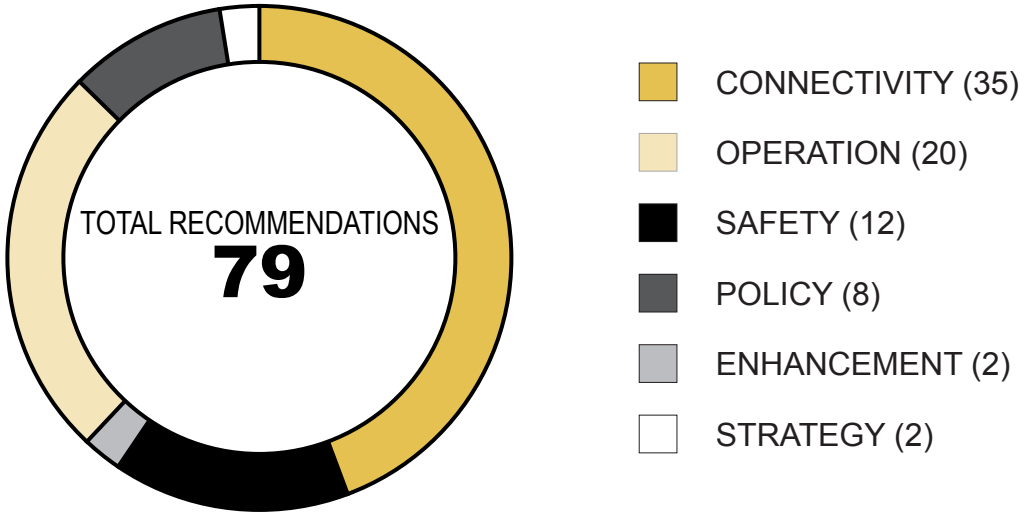
How well do the various modes of transportation currently operate in the study area? The answer to this question established the baseline for the study. Pedestrian, bicycle, and vehicle levels-of-service analyses were conducted in order to quantify and describe the existing operating conditions for these various modes of transportation. The parking data identified locations with high parking demands.

1.4 Future Development Scenarios

Future development projections were generated so that the impacts of future growth could be identified. The development projections were based on actual development plans for projects that are planned and proposed in downtown Nashville. This information was collected from the Metro Planning Department and other steering committee members to ensure that publically announced projects, as of December 2013, were included in the analysis. Hence, instead of relying on future employment or population forecasts, the future development projections were based on actual projects, which are expected to be completed over the next several years.

Two development scenarios were developed. Projects that were already under construction, had building permits, or were under Metro review were included in Scenario 1, (in addition to assuming occupancy of existing vacant spaces). Projects that had been publically announced and most likely to move forward with development were added in Scenario 2. The development scenarios were compared with the 2012 Downtown/SoBro Market Analysis to gauge the level of development that is currently planned in the area. The comparison, as presented in the table below, showed that the level of planned residential, retail, and hotel development (Scenario 1) is below the 2012 market forecast. However, if all development that has been announced is constructed (Scenario 2), the resulting cumulative development will far exceed the 2012 market analysis forecast. In particular, the planned office development is projected to greatly exceed the 2012 market

FIGURE 1. RECOMMENDATIONS BY CATEGORY



analysis forecast. These development forecasts validate the need to take positive steps to improve mobility in the study area.

1.5 Future Mobility Impact

The mobility impacts of the two development scenarios were quantified by estimating the pedestrian and vehicle trips that will be generated by each of the developments. The pedestrian trip generation helped to identify areas with high future pedestrian activity. This information was used to recognize pedestrian infrastructure that will need future enhancements. The vehicle trips were distributed throughout the downtown roadway network to identify intersections that will require capacity improvements in the future. Furthermore, roadways that are most suitable for bicycle infrastructure were identified based on anticipated future vehicular traffic volume and bicycle connectivity. Future parking demand management strategies were also identified in the analysis.

1.6 Conclusions and Recommendations

In addition to the results of the quantitative analysis, the mobility study incorporated several suggestions from the public, like the bicycle connections to downtown Nashville, transit service improvements, and innovative parking solutions. A total of 79 short-, mid- and long-term projects, policies and strategies were identified in the study. The recommendations were categorized by type, mode of transportation and sub-area. Results are shown in the following graphs.

In conclusion, the implementation of the recommendations outlined in the Multimodal Mobility Study are designed to greatly improve the mobility environment for downtown Nashville. These recommendations provide a clear direction for Metro Nashville to effectively accommodate the mobility needs of all users as the economic vitality of the region continues to expand in the future.

FIGURE 2. RECOMMENDATIONS BY MODE

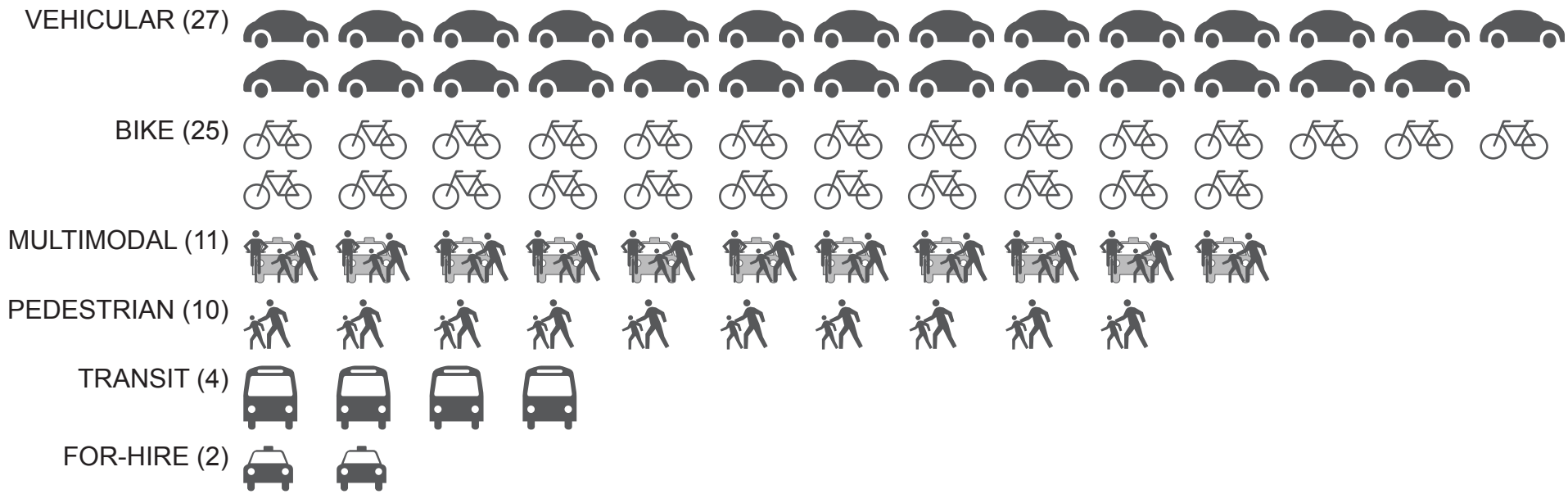
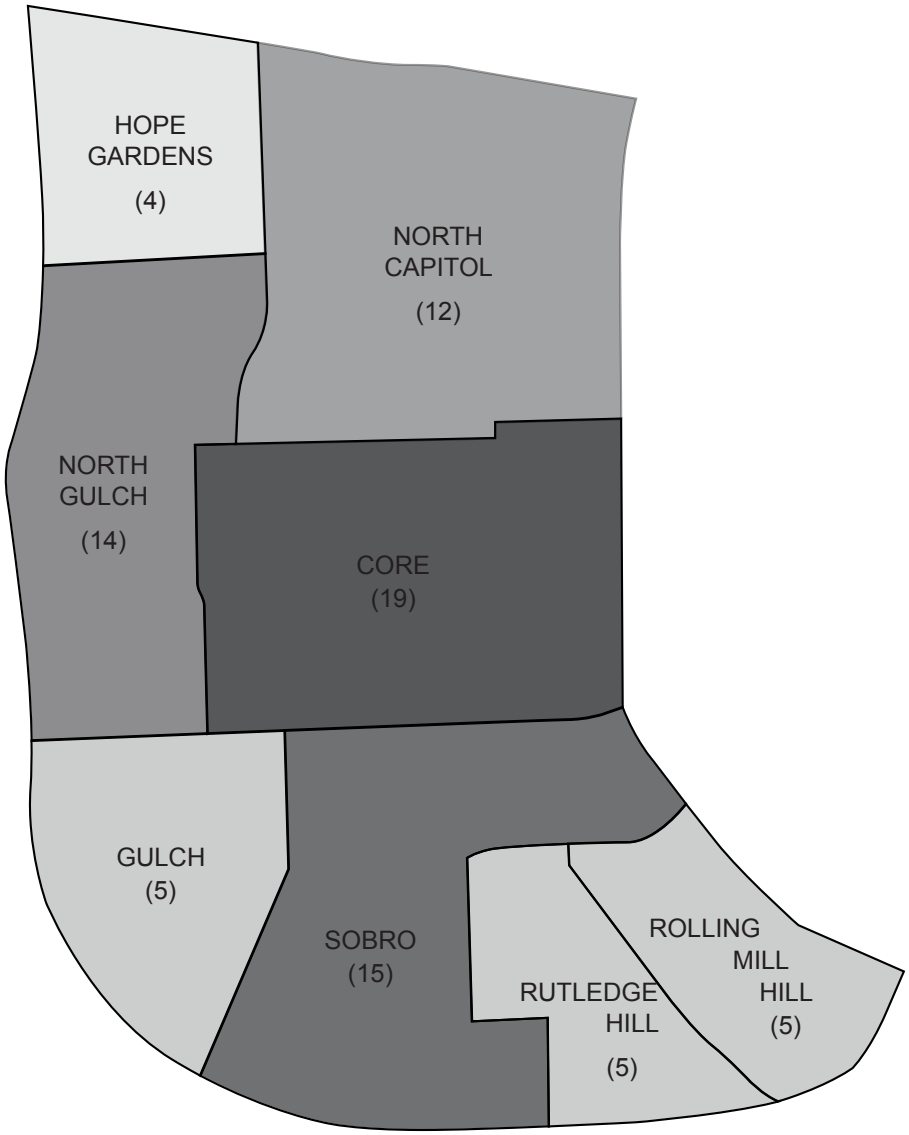
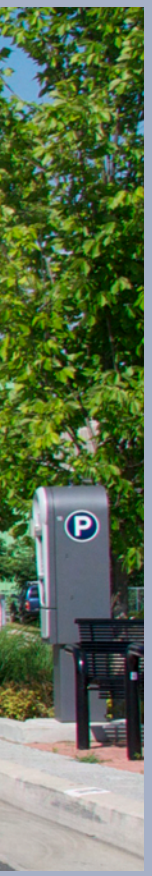


FIGURE 3. RECOMMENDATIONS BY SUB-AREA



Cyclist on Korean Veterans Boulevard Bike Lanes

2 INTRODUCTION



‘We need all forms of transportation. As soon as we stop treating the various modes of transportation as special interest groups, the sooner everyone will enjoy getting around Downtown Nashville.’

-Survey Respondent

Deaderick Street Streetscape

The goal of the Multimodal Mobility Study is to establish a mobility action plan for all modes of transportation in the region for the next 10 years. The study focuses on the downtown area, as it is the region's center of commerce and activity. The study is integrated with other plans for the region, including the Metropolitan Planning Organization's (MPO's) Regional Transportation Plan, Metro Transit Authority's (MTA's) Strategic Transit Master Plan, the Music City Center Vision Plan, the SoBro Master Plan, and Metro's Strategic Plan for Sidewalks and Bikeways. One of the key questions the study seeks to answer is: How can Metro Public Works accommodate the mobility needs of existing and future residents, workers and visitors considering the high level of economic development that is currently taking place in the region and in downtown Nashville?

This overarching goal of the mobility study was accomplished by first examining the current state of traffic, parking, pedestrian, bicycle, and transit/shuttle mobility in downtown Nashville. After examining the base year scenario in 2013, future growth scenarios for 2023 were evaluated based on proposed and potential development plans. Finally, by taking into consideration public input, stakeholder interviews and extensive technical

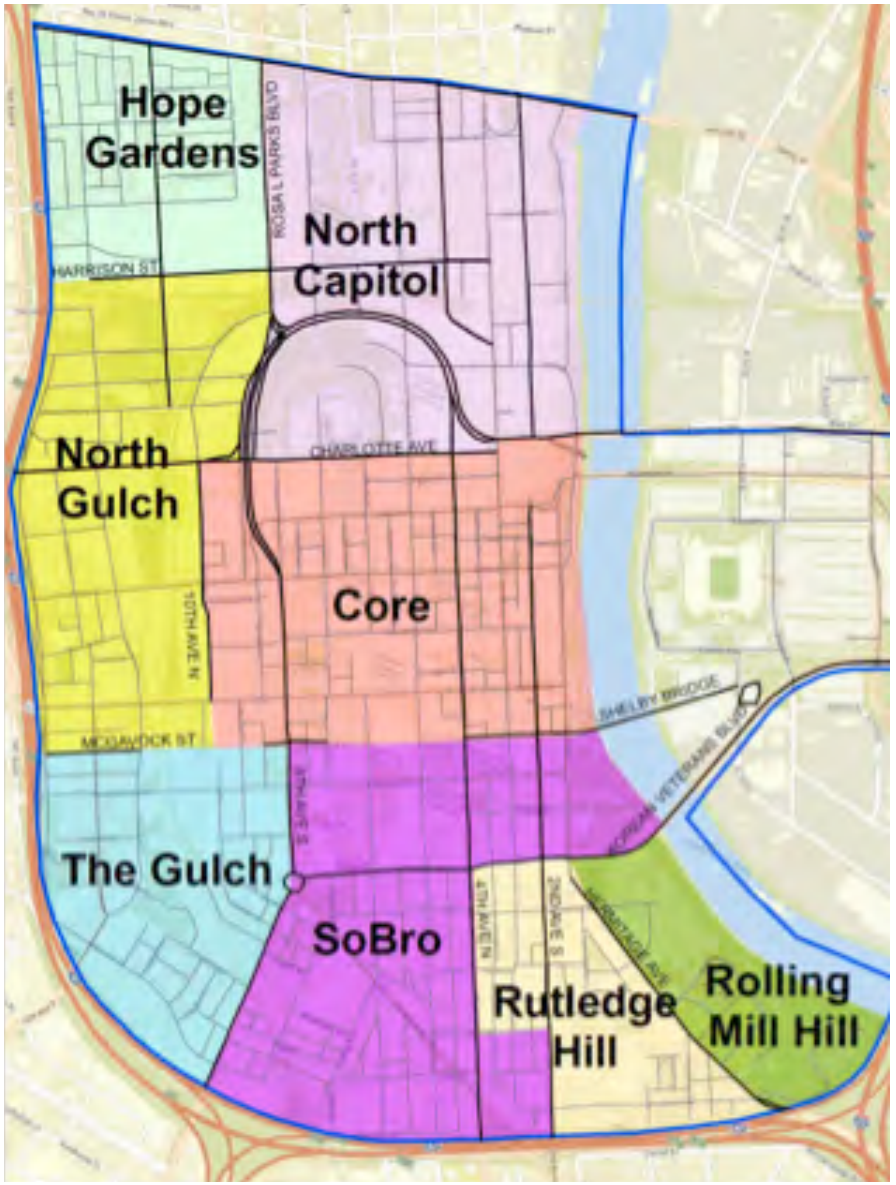
Sidewalk Scene on Lower Broadway

analysis of the various modes of transportation, a final recommended list of projects and polices was prepared to address the mobility needs created by continued economic growth within the study area. Specifically the mobility study addresses the following issues:

- Determining the “extent and balance” of all transportation modes to address projected growth
- Strategies for increasing non-auto trips and facilitating mobility in the study area
- Formulating parking management and investment strategies that meet the future parking demand
- Projecting and analyzing future traffic conditions and determining optimum street designs for accommodating all modes

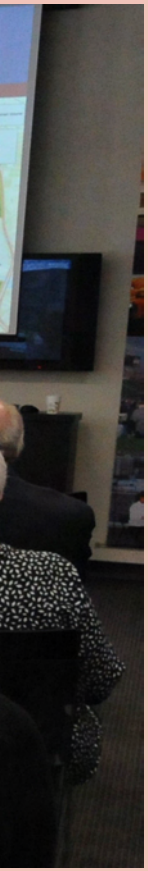
The study area covers approximately two square-miles and approximately 81 miles of roadway. In order to conduct a detailed analysis of all modes of transportation, the study area was divided into eight zones, or sub-areas. The sub-areas roughly correspond with the sub-districts of the Downtown Code, developed by the Metro Planning Department, but more closely with the areas used by Nashville Downtown Partnership in their studies. Figure 4 shows the locations of the sub-areas used in the multimodal mobility study.

FIGURE 4. SUB-AREA MAP



Public Open House No.3

3 PUBLIC OUTREACH



‘I appreciate the bike share program, but I want to feel safe biking around downtown and elsewhere in the city.’

-Survey Respondent

Public Open House Presentation

The Multimodal Mobility Study was designed to obtain extensive input from the public. This was achieved by providing numerous avenues for the public to provide comments, concerns, and suggestions regarding multimodal mobility in the study area. The opportunities for public input are described below:

• Focus Group Interviews: The study team conducted one-on-one interviews with a number of stakeholders to solicit their input. These stakeholders included representatives of the Nashville Chamber of Commerce, Metro Police Department, Metro Planning Organization, Metro Planning Department, Metro Transportation Licensing Commission, TDOT Office of Community Transportation, Nashville Civic Design Center, Walk/Bike Nashville etc. Tech Memo 1 provides a summary of the interviews.

The interviews revealed specific concerns of the stakeholders as well as potential concepts and strategies for improved mobility in the study area. For example, the Nashville Chamber of Commerce discussed the challenge of ensuring that adequate parking is available for prospective employers considering a move to downtown Nashville. The Metro Transportation Licensing Commission (MLTC) identified the challenges of providing enough taxi and horse carriage stands and safe loading and unloading zones. Similarly, the Nashville Civic Design Center and Walk/Bike Nashville were concerned about bicycle and pedestrian connections, as well as upgrading multimodal infrastructure.

• Public Open House: The study included three public open house events to solicit input from the general public. The open houses were scheduled at different stages of the study to provide the public several opportunities to comment on the process and help guide the study. The open

Word Cloud of Survey Respondents' Comments

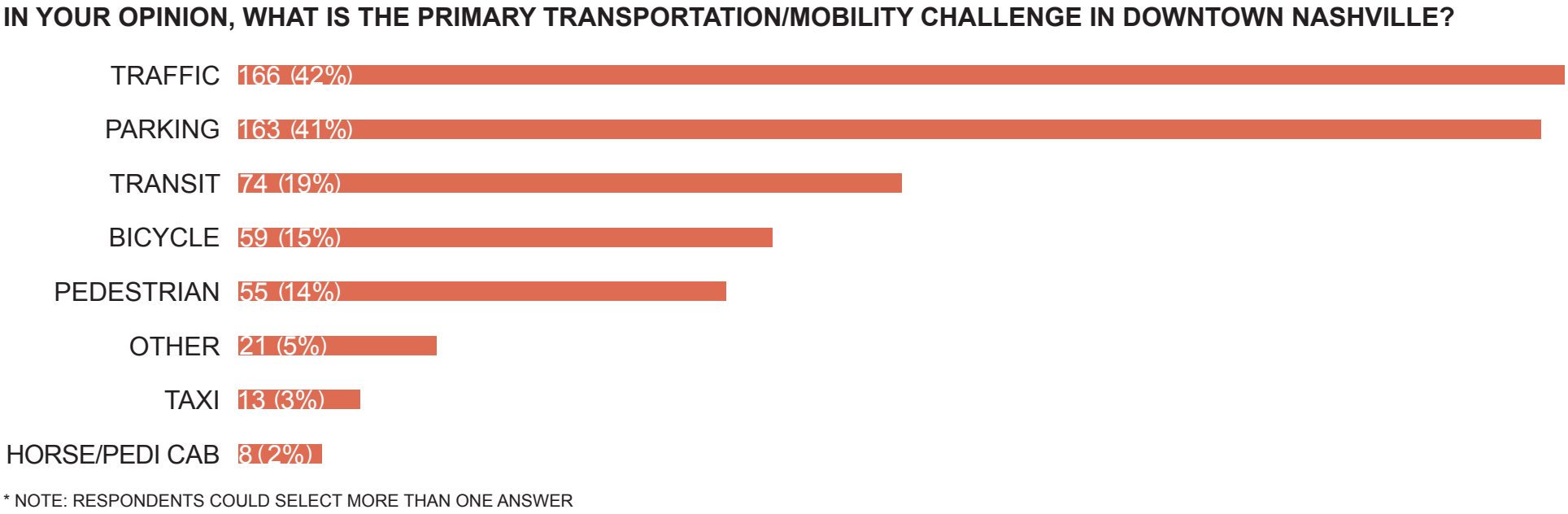
houses were widely advertised through the local media, press releases, mailing lists and via Twitter and Facebook social medias. Table 2 provides information regarding the open houses.

During the events, the study team presented an overview of the project and the progress made on study tasks. Display boards were used to convey the results of the analyses as well as improvement concepts. The meetings were designed to encourage active participation from meeting attendees and valuable comments were received at each meeting. These comments were analyzed and from these comments, ideas

TABLE 2. PUBLIC OPEN HOUSES

Name	Study Schedule	Date Time	Venue
Open House 1	After Inventory and Existing Condition Analysis	10/10/2013 5:30 pm – 7:30 pm	Music City Center
Open House 2	After Future Condition Analysis	01/30/2014 11:30 am – 1:00 pm	Downtown Partnership
Open House 3	After draft recommendations	04/29/2014 11:00 am – 1:30 pm	Downtown Partnership

FIGURE 5. SURVEY PARTICIPANT RESPONSE

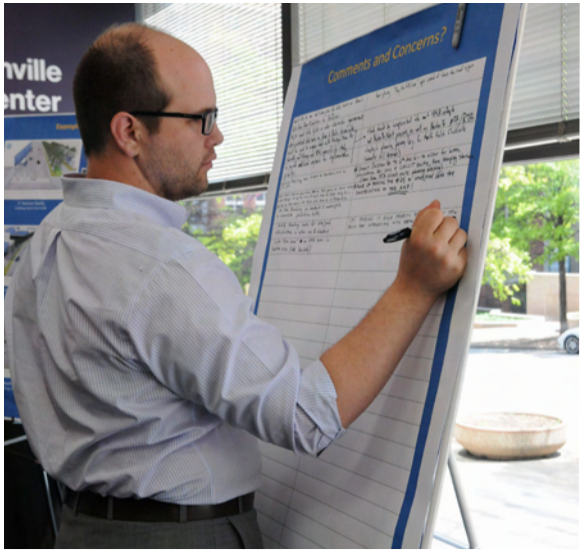


* NOTE: RESPONDENTS COULD SELECT MORE THAN ONE ANSWER

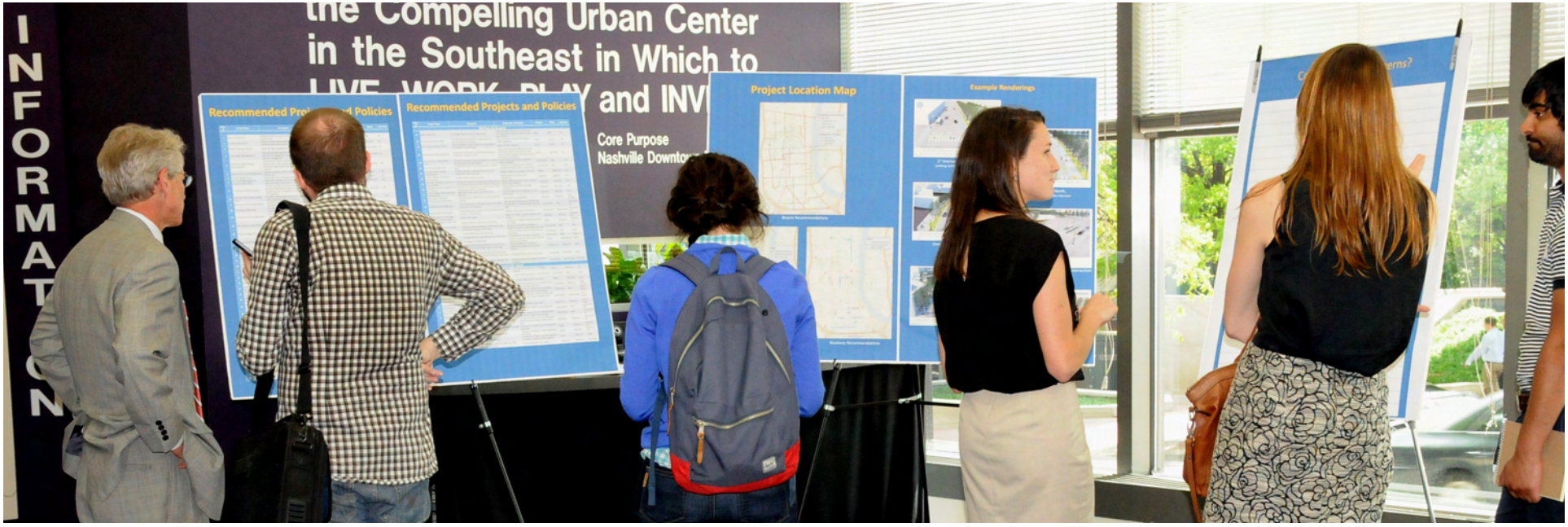
that had merit were incorporated in the final recommendation and implementation report. Tech Memo 9 provides a summary of the public open houses and comments received.

• Online Customer Survey: The study team also created an online survey that was widely distributed to the public through various e-mail lists, in press releases, social media, public open houses, etc. Almost 400 respondents participated in the online survey and answered questions related to automobile traffic, parking, pedestrians, bicycles, taxi service, horse carriages, and transit. The detailed results of the survey are provided in Tech Memo 9. A brief summary of the survey results is presented in Figure 5 and 6.

The survey revealed that the majority of respondents identified traffic and parking as the two major challenges in the study area, while walking was identified by 67% of the respondents as a preferred way of traveling around downtown Nashville. When asked what the main issue with parking in the downtown area is, 58% of respondents said that parking is too expensive. Interestingly, an analysis of monthly and hourly parking rates showed that parking rates in downtown Nashville were comparable with those



Public comment at open house



Public Open House

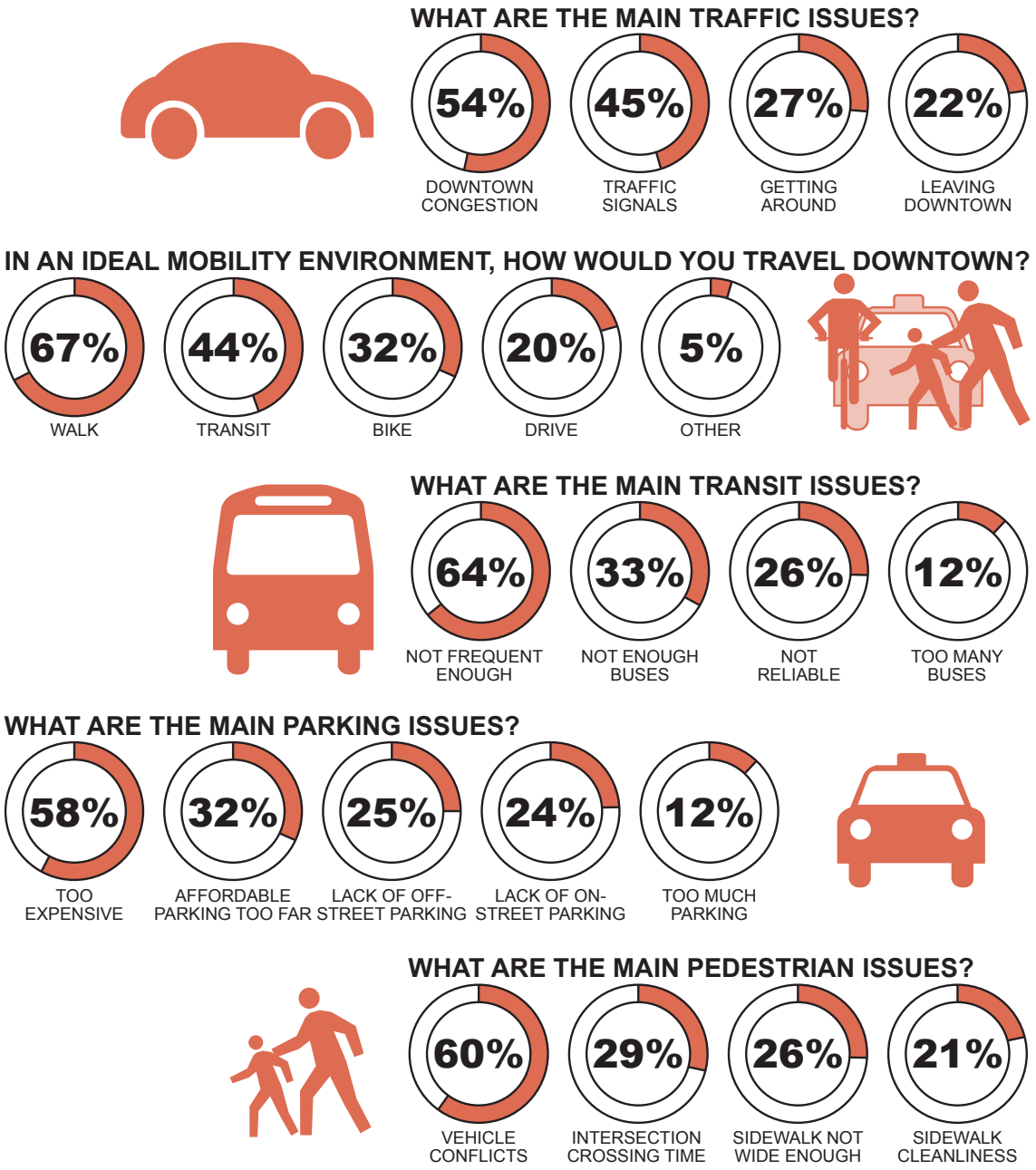
of other comparable cities around the nation. However, it should be noted that it is common for downtown visitors to pay high event parking rates due to the large number of events in downtown Nashville.

With regards to traffic issues, 54% of respondents cited congestion as the main issue, while 45% also cited progression through traffic signals as a problem. Both of these responses reflect the need to improve traffic flow in the study area.

In response to transit questions, 64% of respondents felt that transit service is not frequent enough, while 33% also said more buses are needed. Both of these responses reflect the need to upgrade transit service in downtown Nashville.

Similarly, in response to pedestrian and bicycle related questions, 60% and 58% of respondents, respectively, highlighted that conflicts with vehicles are major issues for both pedestrians and cyclists. These concerns highlight the need to implement innovative solutions that improve safety and comfort for pedestrians and bicyclists as well as measures to make motorists more aware of the presence of pedestrians and bicyclists. Furthermore, the bicycle questions also highlighted the desire of the respondents for more bicycle lanes and bicycle connections to other areas in Nashville.

FIGURE 6. CUSTOMER SURVEY RESULTS



400 SURVEY RESPONDENTS

Aerial rendering of SoBro Master Plan (Rendering by Urban Design Associates)

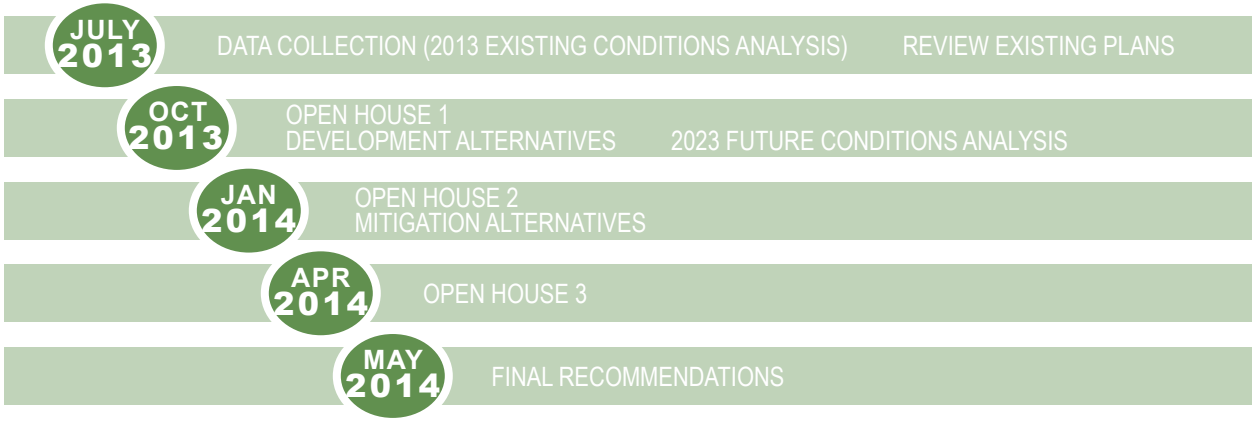
4 STUDY PROCESS

‘I would like to see greater density in downtown Nashville with more diversity of restaurants and shops’

-Survey Respondent

Birdseye view of downtown Nashville

FIGURE 7. PROJECT TIMELINE



The Multimodal Mobility Study followed a study process that was comprehensive and deliberate to ensure that all modes of transportation and user viewpoints were incorporated. In addition to the public outreach described in the previous section, the project team implemented a sequential process that analyzed historic as well as current data collected as part of the study. Figure 7 shows the work flow diagram that identifies major project steps and timelines.

4.1 DATA COLLECTION

The project team collected an extensive amount of data to help understand the existing multimodal conditions of the study area. A brief description of the data is provided in the sections below.

4.1.1 Historic Traffic Data

Analyzing historic traffic data helps to understand the travel patterns in the study area as well as the impact of past roadway network changes. It also helps to explain the broad relationship between economic growth and changes in travel behavior of Nashvillians. Nationally, Vehicle Miles Traveled (VMT) reached a peak in 2007 and declined over the next three years before stabilizing according to data collected by the Federal Highway Administration (FHWA). The project team reviewed the Average Daily Traffic (ADT) volumes on all the major entry and exit points of the study area and found similar patterns where in many cases recent ADTs are lower than in previous years. Tech Memo 4 provides detailed information on the traffic volume profiles. Figure 8 shows an example of historic traffic data on four of the major roadways analyzed.

4.1.2 24-Hour Traffic Profile

The project team also analyzed the hourly bi-directional traffic volumes on all the major entry and exit points in the study area for a 24 hour periods. Detailed analyses of the hourly volumes show how much the traffic volumes fluctuate throughout a typical day. The traffic volume profiles showed that while the traffic volumes on Jefferson Street and James Robertson Parkway increase sharply in the weekday morning and evening peak hours, the traffic volume on other roadways, like Broadway, is fairly consistent throughout the day and have lower peaking characteristics. The analysis of these hourly traffic volume profiles provided the project team and Metro Public Works with a better understanding of travel patterns in the study area and helped to identify recommended improvements. Figure 9 shows the 24-hour traffic volume profile on Jefferson Street, west of the Cumberland River.

4.1.3 Peak Hour Turning Movement Count

The study collected turning movement counts (TMC's) at 115 intersections in the study area during the morning peak (7:00 a.m. – 9:00 a.m.) and evening peak (4:00 p.m. – 6:00 p.m.) hours. These traffic volumes were used to evaluate the existing traffic conditions of the study intersections and identify locations operating at poor level-of-service. In addition, the TMC's were also used in the future condition analysis to identify future capacity constraints in the transportation network.

4.1.4 Pedestrian Volume

In addition to collecting the vehicular turning movement counts at the study intersections, the study also collected pedestrian volumes at each crosswalk of the intersections. This provided the

FIGURE 8. EXAMPLE OF HISTORIC ADT

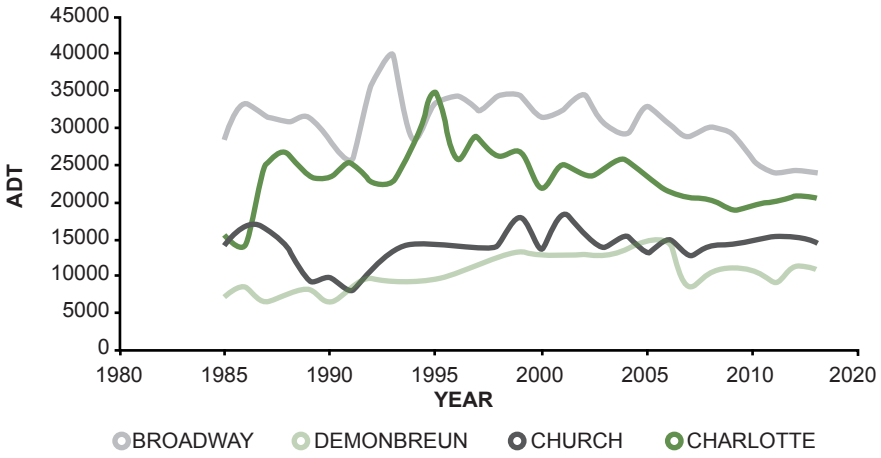
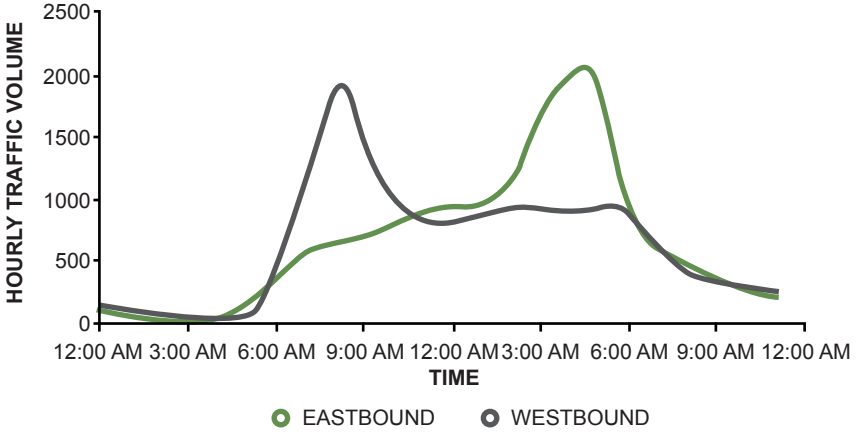


FIGURE 9. EXAMPLE OF 24-HOUR TRAFFIC VOLUME PROFILE



project team with comprehensive pedestrian activity data that was used to conduct analysis such as the pedestrian corner circulation calculation which identifies the density of pedestrians at each intersection quadrant. These analyses were used to determine intersections that would require a higher level of pedestrian accommodations and solutions such as leading pedestrian intervals at traffic signals and pedestrian scramble signal phasing. Figure 10 shows the pedestrian volume at study intersections during the weekend p.m. peak hour.

4.1.5 Bicycle Volume

Bicycle volumes were collected using both the intersection counts and data from Nashville's bikeshare program, B-Cycle. The bike counts at the study intersections helped to identify intersections with high bike traffic volume, while the B-Cycle data was used to identify routes that were most extensively used by B-Cycle users. This data enabled the project team to identify locations where bicycle infrastructure improvements will be needed.

4.1.6 Parking Occupancy Count

Parking is one of the key drivers of mobility and user experience in downtown Nashville. As highlighted by the customer survey, parking is one of the top challenges for downtown patrons. The project team collected detailed parking data on the 221 city blocks that constituted the study area. The data was collected between 9:00 a.m. and 3:00 p.m. on typical weekdays, which represented the typical peak weekday time periods for downtown employees and tourists.

Data was collected for on-street parking as well as for off-street parking lots and garages. In addition to determining parking supply by counting the number of spaces available, the study also collected parking demand by counting the number of occupied spaces.

4.1.7 Crash Data

Vehicular crashes are an indication of potential safety issues at a location. Safety issues on a street or at an intersection can be a result of a geometric deficiency which may be fixable, or human error, which can be difficult to identify and resolve. The project team collected three years' worth of crash data at all intersections in the study area and compared this data to statewide averages to highlight locations that have relatively high crash rates. The intersections with crash rates above the statewide average were further evaluated to determine the need for potential improvements.

4.1.8 Transit Boarding Data

In order to understand the transit usage in the study area, the project team obtained weekday boardings data at all transit stops in the study area. This data helped identify locations of high transit use. The project team then co-related the data with the amenities (benches, shelters, etc.) provided at the stop to identify stops with inadequate or sub-par amenities.

4.1.9 Infrastructure Inventory

In addition to specific data on various modes of transportation, the project team also inventoried

FIGURE 10. PEDESTRIAN VOLUME, WEEKDAY PM PEAK HOUR

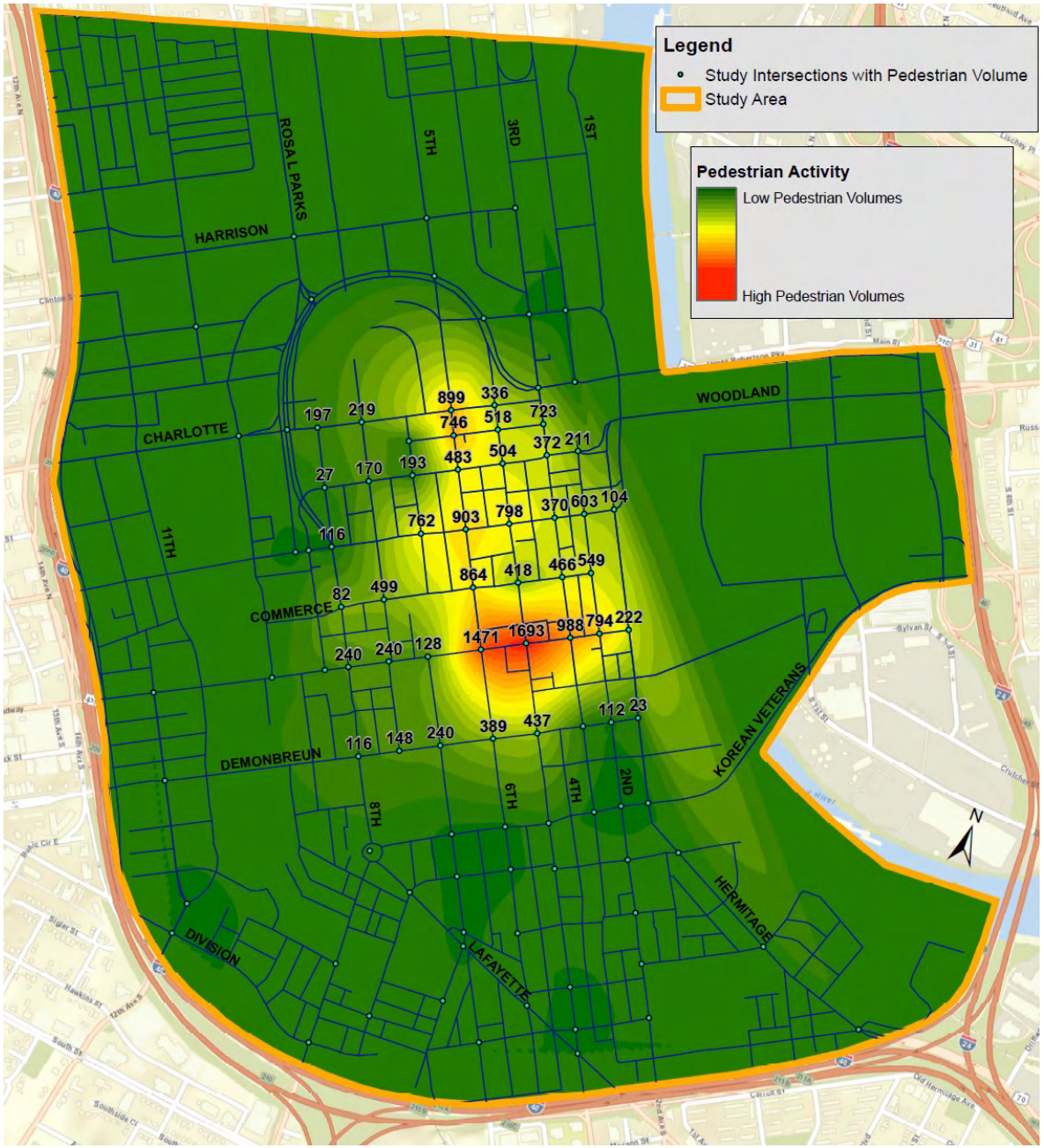
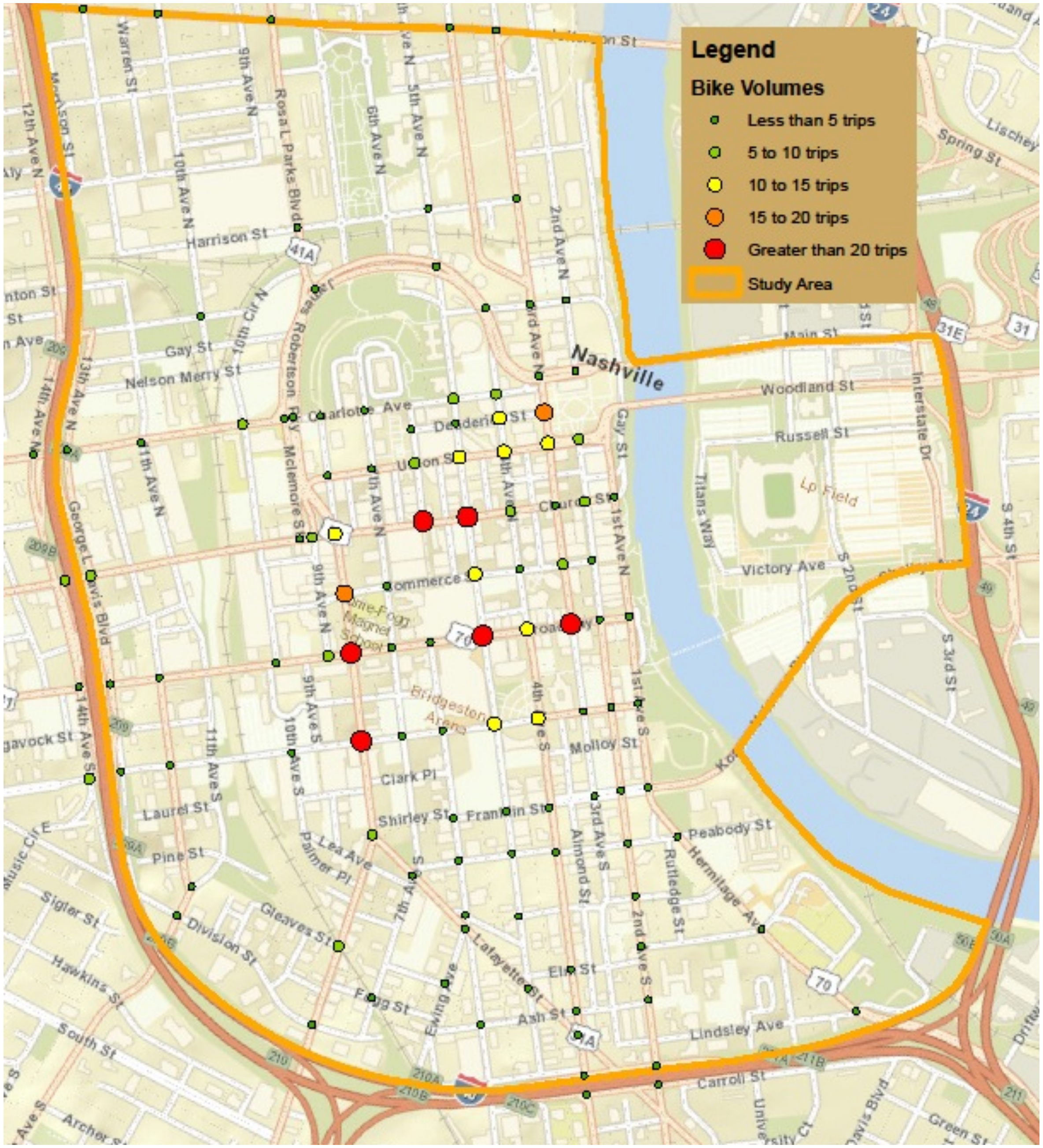


FIGURE 11. BICYCLE VOLUME, WEEKDAY AM AND PM PEAK HOUR COMBINED



all the roadways in the study area. Data that was collected included the roadway's Major and Collector Street Plan (MCSP) classification, number of through lanes, presence/absence of on-street parking, buffer width, sidewalk width and presence/absence of bike lanes. Tech Memo 4 provides the detailed information from this inventory.

4.2 EXISTING CONDITIONS ANALYSIS

Having collected extensive data as highlighted in the previous section, the study evaluated each mode of transportation using the latest analytical software available. The section below highlights the methodologies and the key results of the analysis.

4.2.1 Pedestrian and Bicycle Level-of-Service

The Multimodal Mobility Study included detailed analyses of the pedestrian and bicycle modes of transportation within the study area to better understand existing levels-of-service (LOS). LOS can be evaluated at two levels; the network level and the intersection level. The network level analysis is used in identifying corridor specific improvements for a certain mode to ensure that mode connectivity across the study area is maintained. Meanwhile, the intersection level analysis is used to identify location-specific improvements that will enhance connectivity. Evaluating LOS at these two levels provides a comprehensive evaluation of the different modes of transportation within the study area.

The project team conducted the network level analysis by utilizing a qualitative methodology consisting of public input; stakeholder interviews; and understanding the travel patterns of downtown employees, residents, and tourists. In addition, the pedestrian and bicycle counts provided the basis for the quantitative analysis. As previously mentioned, Figures 10, 11, and 12 show the pedestrian volume, bicycle volume, and B-cycle activity maps in the study area, respectively. These maps show very high pedestrian activity in the Lower Broadway area, from 5th Avenue to 1st Avenue. In addition, high bicycle activity is shown on Demonbreun Street, Broadway, Church Street, 1st Avenue, 3rd Avenue, and 5th Avenue.

The project team utilized the Highway Capacity Manual's Pedestrian and Bicycle Level-of-Service methodology to determine Bicycle-Level-of Service (BLOS) and Pedestrian Level-of-Service (PLOS) results in high activity areas. The analysis was conducted for each segment of the road that was analyzed, in both directions. The analysis was used to identify areas with existing poor levels-of-service.

The existing PLOS and BLOS results for the roadway segments are shown in Figures 13

FIGURE 12. B-CYCLE ACTIVITY MAP

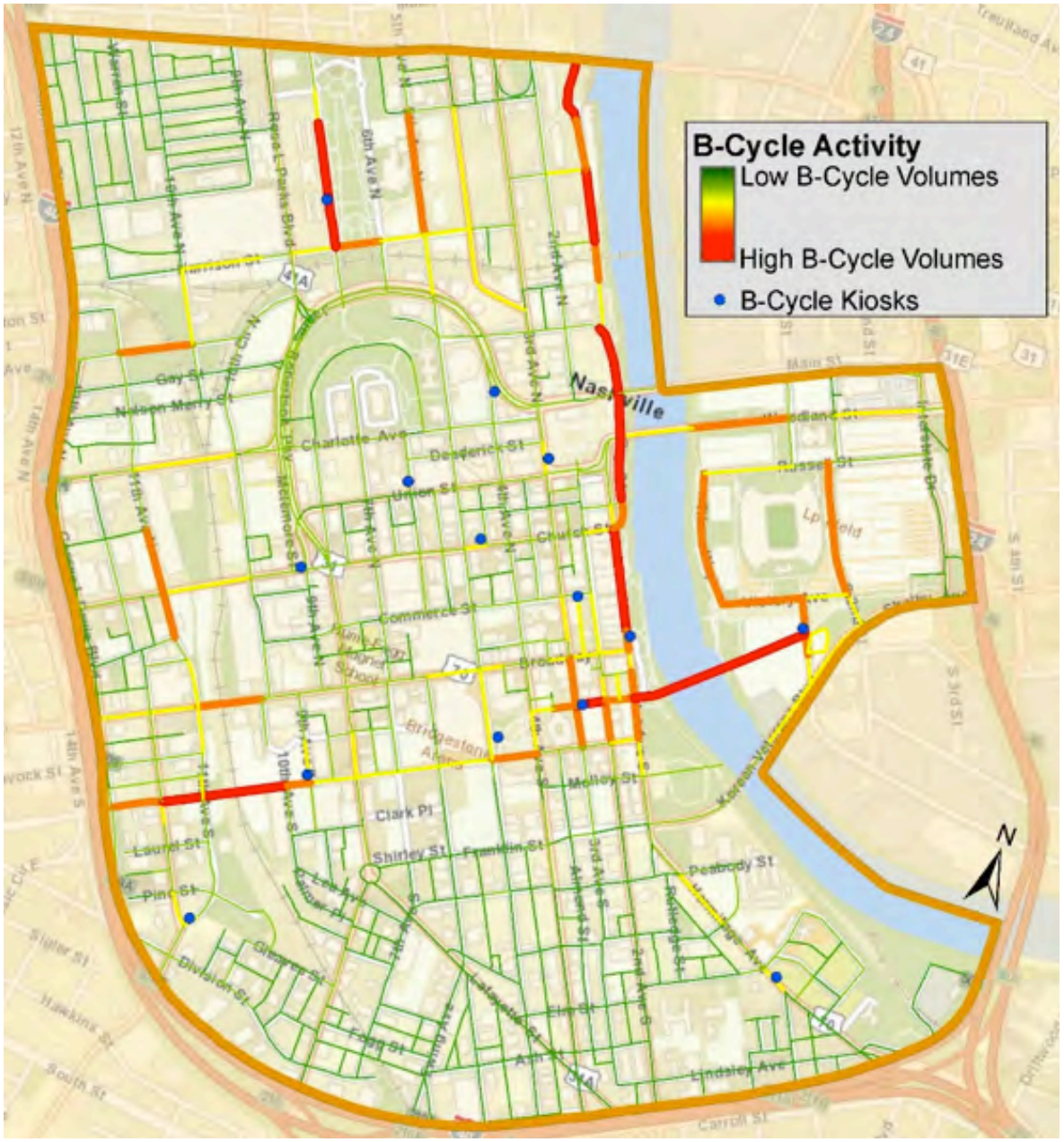
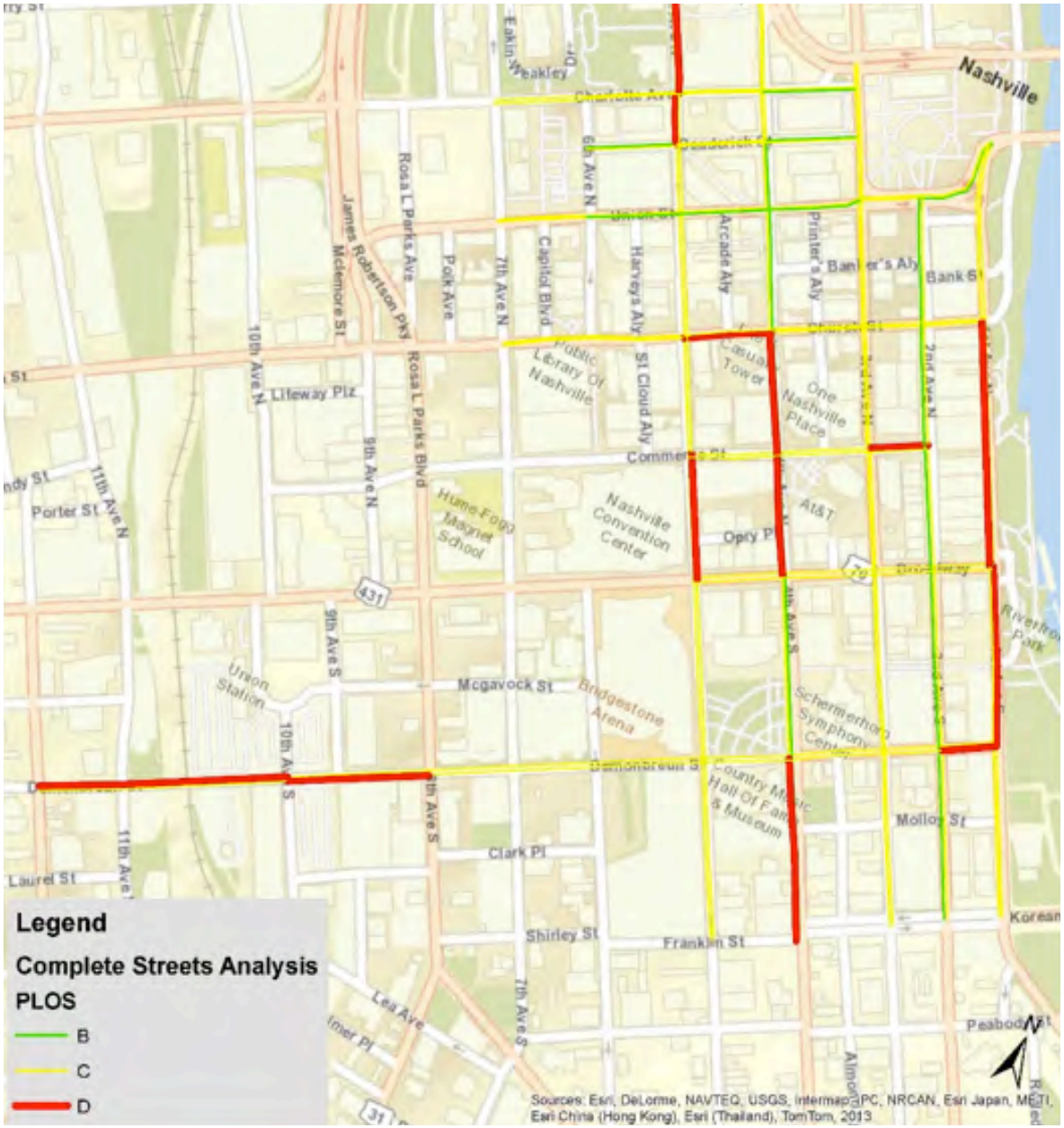


FIGURE 13. EXISTING PLOS OF ROADWAY SYSTEM



and 14, respectively. As shown, there are a few segments in the study area that have PLOS D. As shown Figure 14, several roadway segments in downtown experience BLOS E operation. These segments with BLOS E are:

- Broadway, eastbound from 5th to 4th Avenue and from 3rd to 2nd Avenue
- 1st Avenue, northbound and southbound from Broadway to Demonbreun Street
- 1st Avenue, southbound from Union Street to Church Street
- 3rd Avenue, northbound from Demonbreun Street to Broadway
- 3rd Avenue, southbound from Union Street to Church Street
- Charlotte Avenue, westbound from 4th Avenue to 5th Avenue
- Commerce Street, westbound from 3rd Avenue to 4th Avenue

A number of the BLOS E results may be attributed to not having a dedicated bicycle facility as well as having a short block length with numerous curb cuts on the block. Numerous curb cuts on a short block length make the segment uncomforable to bicyclists and thus results in a lower BLOS score for the segment.

Charlotte Avenue from 6th Avenue to 7th Avenue has BLOS F. The poor BLOS score on this segment can be attributed to the street segment's very short segment length, the lack of a dedicated bicycle facility, and the high vehicular traffic volume.

4.2.2 Pedestrian Corner Circulation

In addition to conducting the BLOS and PLOS analysis, the study evaluated the pedestrian corner circulation at high-activity intersections by determining the density of pedestrians at each quadrant of the specific intersections. The results of this analysis were used to evaluate and identify the locations where the corner space area was deficient for the level of pedestrian activity experienced at the intersections. Table 3 shows the locations with poor corner circulation.

4.2.3 Pedestrian and Bicycle Crash Analysis

Pedestrian and bicycle safety is a major concern for a dense urban area like downtown Nashville, especially since many of the city's streets are narrow with relatively high vehicular traffic volumes. Safety analyses were conducted by collecting pedestrian and bicycle crash data from 2010 to 2013 and identifying locations with

FIGURE 14. EXISTING BLOS OF ROADWAY SYSTEM

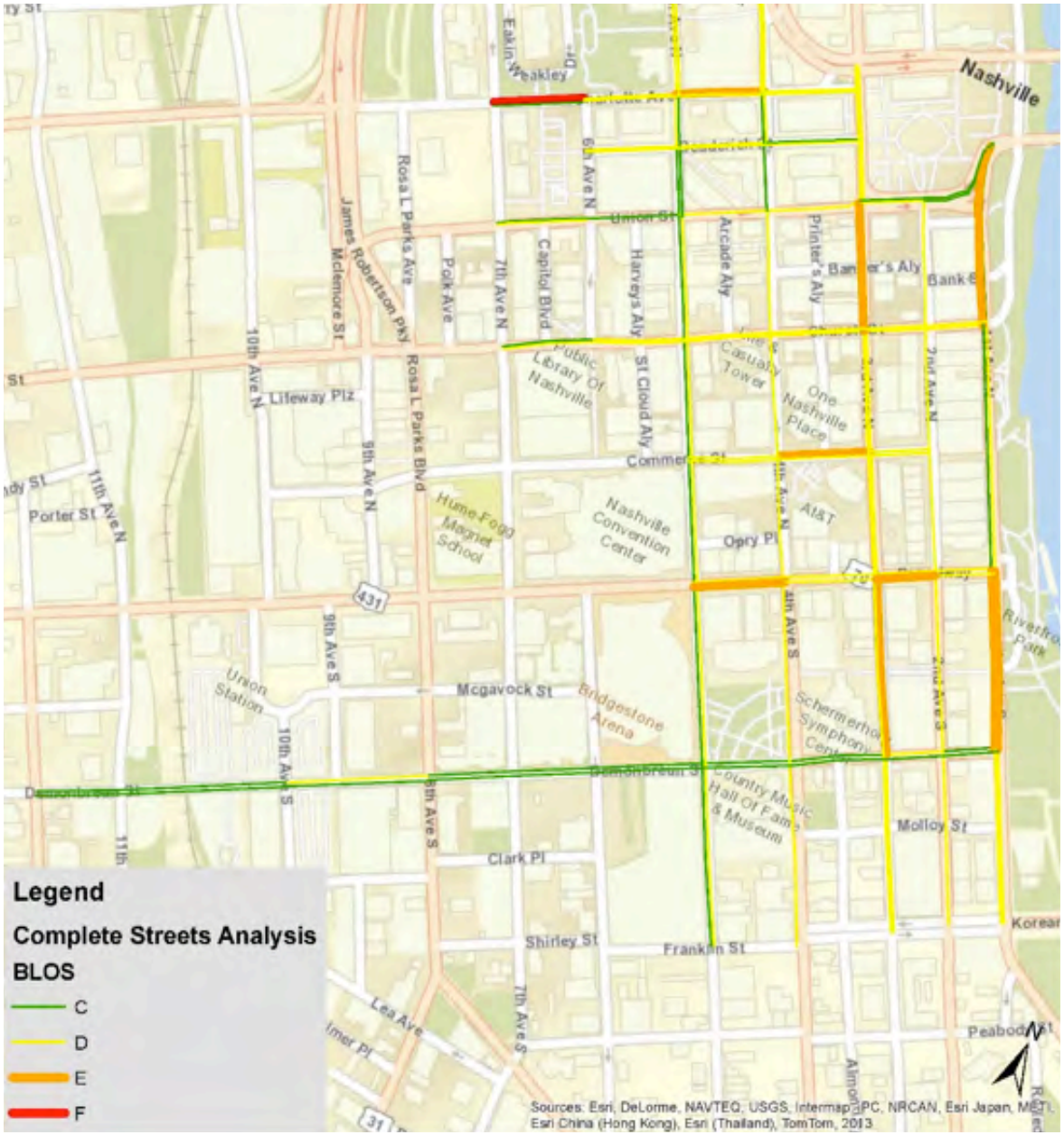


TABLE 3. LOCATIONS WITH POOR CORNER CIRCULATION

Intersection	Corner	Contributing Factors
Broadway & 2nd Avenue	SE	• High Pedestrian Demand • Narrow intersecting sidewalks
Broadway & 4th Avenue	SW	• High Pedestrian Demand • Narrow 4th Ave sidewalk (west side)
Broadway & 5th Avenue	NE	• High Pedestrian Demand • Narrow 5th Ave sidewalk (east side) • Sidewalk clutter
Church Street & 2nd Avenue	NE	• Narrow intersecting sidewalks
Church Street & 3rd Avenue	NW	• Narrow 3rd Ave sidewalk (west side)
	SW	• Narrow 3rd Ave sidewalk (west side)
Church Street & 5th Avenue	NW	• High Pedestrian Demand (restaurant)
	SW	• High Pedestrian Demand
	SE	• High Pedestrian Demand
Church Street & 6th Avenue	SW	• High Pedestrian Demand
Union Street & 4th Avenue	SW	• Narrow Union St sidewalk (south side) • Sidewalk clutter
Union Street & 5th Avenue	SW	• Narrow Union St sidewalk (south side) • Sidewalk clutter
	SE	• Narrow 5th Ave sidewalk (east side) • High Pedestrian Demand (restaurant)
Charlotte Avenue & 5th Avenue	SE	• High Pedestrian Demand (bus stop) • Narrow intersecting sidewalks • Sidewalk clutter
Demonbreun Street & 4th Avenue	SE	• Narrow intersecting sidewalks • Sidewalk clutter • High Pedestrian Demand

high crashes. Locations with more than four pedestrian crashes or more than two bicycle crashes are highlighted below.

- 2nd Avenue North between Church Street and Broadway
- 5th Avenue North and Union Street
- Broadway between 3rd and 6th Avenue
- Broadway between I-40 WB / I-65 NB ramp and 11th Avenue
- Charlotte Avenue and 8th Avenue North
- Charlotte Avenue between 3rd and 5th Avenue
- Church Street between 4th Avenue and Printers Alley
- Jefferson Street between Rosa L Parks Boulevard and 7th Avenue North
- Rosa Parks Avenue between Union Street and Charlotte Avenue
- 2nd Avenue South between Demonbreun Street and Peabody Street
- 6th Avenue North between Church Street and Commerce Street
- 8th Avenue South between Broadway and Demonbreun Street

- Broadway between 3rd and 1st Avenue
- Charlotte Avenue and 5th Avenue
- Church Street between YMCA Way and 8th Avenue
- Jefferson Street between Warren Street and Rosa L Parks Boulevard

The study reviewed these locations and identified potential solutions to improve pedestrian and bicycle safety. The recommended projects and policies list, which is presented in Section 5 of this report, includes solutions for these locations, where feasible.

4.2.4 Vehicular Level-of-Service

The project team updated the existing Synchro traffic model used by Metro Public Works by using a newer software model, called VISTRO that has additional features, which allow users to track vehicular trips generated by specific future development projects. The model was used to determine intersection level-of-service (LOS) based on the Highway Capacity Manual (HCM) 2010 methodology. While the overall intersection level-of-service was found to be acceptable for the majority of the intersections for existing conditions, several critical intersection movements were found to be operating at or over capacity (LOS E

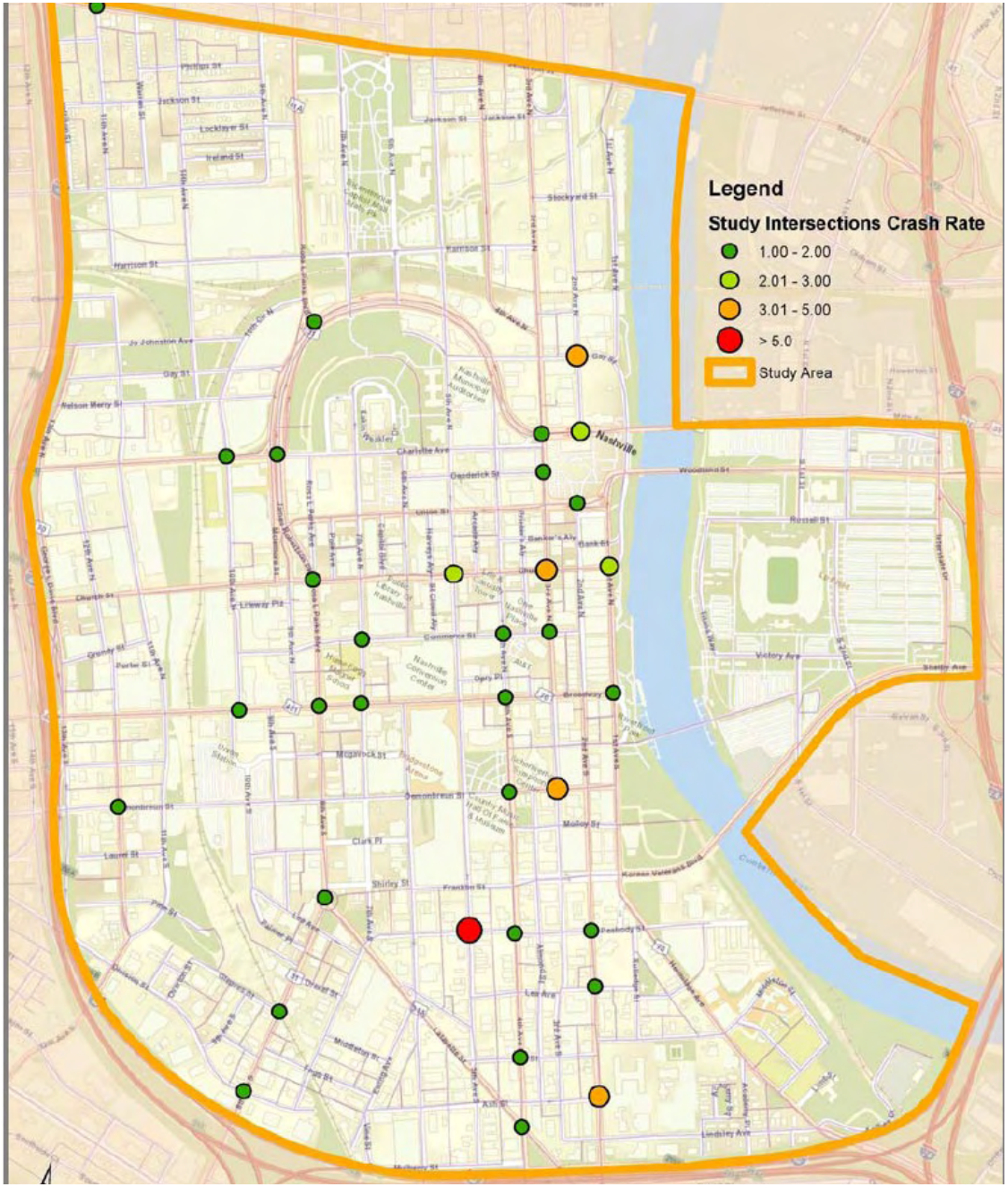
TABLE 4. OPERATION OF CRITICAL MOVEMENTS WEEKDAY PM PEAK HOUR

Intersection	Movement	v/c	Delay	LOS
Broadway / 1st Avenue	WBLT-TH-RT	0.67	62.8	E
Broadway / 4th Avenue	SBRT	1.06	71.1	F
Broadway / 7th Avenue	EBTH	1.05	67.9	F
Broadway / 8th Avenue	EBTH	1.10	86.1	F
Broadway / 10th Avenue	NBTH	1.51	280.2	F
	SBTH-RT	1.02	61.6	F
Church St / Rosa Parks Blvd	EBTH	0.82	59.3	E
Demonbreun / 4th Avenue	NBLT	0.78	55.3	E
Division Street / 12th Avenue	SBTH	1.07	62.3	F
JR Parkway / 5th Avenue	SBLT	1.07	107.2	F
	NBTH	1.01	62.1	F
KVB / 1st Avenue	EBTH	0.96	53.1	F
	NBRT	1.01	55.7	F
Union Street / 3rd Avenue	NBTH	1.05	55.2	F
	SBLT	1.06	64.6	F
Charlotte Ave / I-40 EB / I-65 SB Ramp	EBRT	1.05	58.7	F
Charlotte Ave / I-40 WB / I-65 NB Ramp	EBLT	1.25	149.8	F
Church St / I-40 EB / I-65 SB Ramp	WBLT	1.44	232.1	F
Broadway / I-40 EB / I-65 SB Ramp	WBLT	1.45	240.7	F
Broadway / I-40 WB / I-65 NB Ramp	EBLT	1.05	68.5	F
	WBR	1.13	99.6	F
Demonbreun / I-40 EB / I-65 SB Ramp	EBRT	1.01	49.5	F
I-40 EB Ramp / 4th Avenue	SBLT	1.05	50.3	F

TABLE 5. 2010 - 2012 CRASH DATA

Description		Year 2010	Year 2011	Year 2012
Total No. of Crashes		1447	1449	1679
Injury	Crashes with Injury	334	327	307
	No. of Injuries	470	447	428
Fatalities	Crashes with fatality	3	2	1
	No. of Fatalities	6	2	3
Type of Collision	Angle	509	505	448
	Head on	48	51	60
	Side Swipe	298	322	407
	Rear End	407	379	578
Pedestrian Crashes		33	32	45
Bicycle Crashes		5	14	12

FIGURE 15. INTERSECTIONS WITH SIGNIFICANT CRASH RATE



or worse) in the study area. Table 4 shows the intersections and their movements with LOS E and F during weekday p.m. peak hours.

The table shows that several of the critical movements have poor levels-of-service. However, given the right-of-way constraints in downtown, it is not feasible to provide added capacity to reduce delays at several of these locations, for example, at the interstate ramps. At these locations, the most viable option to reduce delays would involve better signal coordination, updating signal timings, and better management of travel demand by increasing transit and bicycle usage. At other locations where additional capacity can be achieved, for example at the Korean Veteran's Boulevard (KVB) and 1st Avenue South intersection, lane improvements are recommended.

4.2.5 Crash Rate Analysis

Safety is a top priority for Metro Public Works. One of the methodologies used to assess the safety of the roadway network involved analyzing the number and pattern of crashes to identify locations where geometric deficiencies might have contributed to a particular crash problem. The project team gathered three-years of crash

data collected by the Metro Police Department's Central Precinct, calculated crash rates and compared those rates with statewide averages to identify locations with above average crash rates.

Table 5 shows the crash data collected for the study area for years 2010, 2011, and 2012. The data shows that while the overall number of crashes increased from 2010 to 2012, the crashes with injuries decreased. These results suggest a decrease in severity of the crashes. In addition, Table 4 shows that the number of pedestrian and bicycle crashes has increased since 2010. This may be attributed to higher numbers of pedestrian and bicycles using the streets in the study area.

The study calculated crash rates by relating the number of crashes to the number of vehicles using the roadway facility. Using this approach the locations with a relatively high number of crashes were identified. Using TDOT's Highway Safety Improvement Program (HSIP) statewide crash averages for urban areas, several intersections with higher than average crashes per million-entering-vehicles were identified.

Figure 15 shows the high crash rate locations. The intersection with the highest crash rate was identified as Peabody Street / 5th Avenue South. A review of the crash dates showed that the majority of the crashes occurred when this intersection was part of the construction zone for the construction of the Music City Center. As a result, the crashes at this intersection are anticipated to be lower now that the convention center is open, and construction in the immediate area has ceased.

4.2.6 Parking Analysis

The foundation of a parking supply and demand study is an inventory of the existing parking supply. With this inventory, the existing parking

TABLE 6. EXISTING PARKING SUPPLY SUMMARY

Sub-Area	On-Street	Off-Street Private Surface	Off-Street Private Structured	Off-Street Public Surface	Off-Street Public Structured	Overall
Hope Gardens	570	428	0	17	0	1,015
North Gulch	545	2,665	0	105	0	3,315
The Gulch	470	1,308	0	1,522	562	3,862
Sobro	535	2,290	0	1,649	1,797	6,271
Rutledge Hill	331	893	691	728	0	2,643
Rolling Mill Hill	72	749	0	0	0	821
The Core	767	4,103	1,049	3,413	10,848	20,180
North Capitol	603	5,431	0	804	400	7,238
Stadium	70	6,694	0	265	0	7,029
Total Supply	**3,963**	**24,561**	**1,740**	**8,503**	**13,607**	**52,374**

supply can be compared to the parking demand to quantify the existence of a parking surplus or deficit. A surplus exists when the supply exceeds the demand; a deficit exists when the supply is inadequate to meet the demand. The project team conducted this analysis on a block-by-block basis within the study area, segmenting the demand by block.

Based on the data collected, there are a total of 52,374± spaces in the study area. Following is a breakdown of these spaces: 3,963± are on-street and 48,411± are off-street. Of the off-street spaces, 22,110± are open to the public and 26,301± are private or restricted-use spaces. The parking spaces that are categorized as public may be owned by either a private or a public entity. However, general public are allowed to park in these spaces. Private spaces are restricted to specific user, e.g. employee of certain buildings, etc., and are not open to the general public. The table below summarizes the parking supply by subarea. A complete block-by-block listing of the parking supply is listed in Tech Memo 2.

Figure 16 shows the total parking supply by type. The largest percentage of available parking in the study area is located in private off-street parking lots. Public parking, including on- and off-street, accounts for half of available parking in downtown Nashville.

Parking occupancy counts were also conducted to determine what percentage of available parking supply was actually occupied during a mid-day of a typical work week. Table 6 shows the parking occupancy summary for both on- and off-street parking spaces by sub-area.

As shown in the table, the parking occupancy rates as a whole do not indicate a shortage of parking. However, several individual blocks do exceed 80% occupancy rate, which is generally

FIGURE 16. EXISTING PARKING SUPPLY BY TYPE

considered to be optimum demand of a parking lot. Figure 17 shows the occupancy map for all the blocks where data were collected. Blocks in red have the highest occupancy rate. The highest occupancy rates were observed in The Core and North Capitol sub-areas, where the highest concentrations of office and retail/entertainment uses are located. The Rutledge Hill and North Gulch subareas also experienced occupancy rates above 50 percent. Additionally, the lowest occupancies were observed in the Hope Gardens and Stadium subareas, with 32 percent and 21 percent of the overall available supply occupied. The low occupancy rate in the Stadium subarea is assumed to be the result of a lack of special event rather than a surplus of parking in the area.

Parking adequacy is the ability of the parking supply to accommodate the parking demand. The total parking supply was adjusted to identify the "effective parking supply", which accounts for the fact that 100 percent of the total parking supply of capacity is not always usable due to the need for parkers to find parking by circulating within a facility or around a block and to accommodate maneuvering into and out of the paces, or maintenance. The observed occupancy was subtracted from the effective supply to determine the adequacy for the study area. As shown in Table 8, as a whole, the current parking system has a parking surplus during typical weekday conditions, with no sub-area experiencing a parking deficit. However, some parking types, like on-street parking and parking in the Core sub-area are trending towards higher occupancy rates compared to off-street parking and parking outside the Core.

Since on-street parking is more readily visible than off-street parking and for some users, preferred, the heavy usage of some on-street spaces can lead parking patrons into

TABLE 7. EXISTING PARKING OCCUPANCY SUMMARY

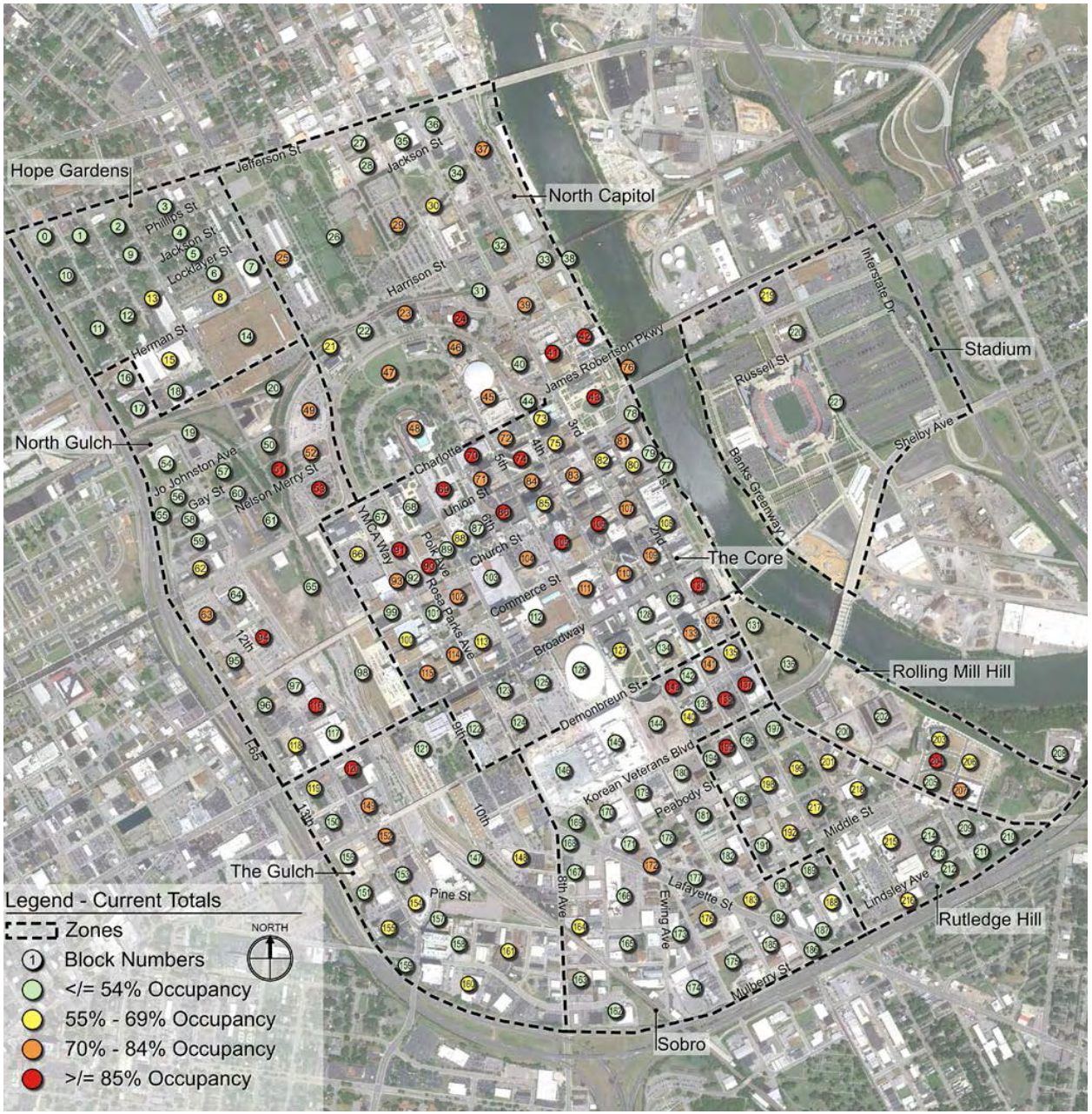
Sub-Area	Inventory	Occupancy	Percent Occupied
Hope Gardens	1,015	322	32%
North Gulch	3,315	1,983	60%
The Gulch	3,862	1,976	51%
Sobro	6,271	2,740	44%
Rutledge Hill	2,643	1,582	60%
Rolling Mill Hill	821	396	48%
The Core	20,180	14,087	70%
North Capitol	7,238	4,651	64%
Stadium	7,029	1,486	21%

TABLE 8. EXISTING PARKING ADEQUACY SUMMARY

Sub-Area	Effective Supply	Occupancy	Adequacy
Hope Gardens	907	322	585
North Gulch	3,090	1,983	1,107
The Gulch	3,518	1,976	1,542
Sobro	5,736	2,740	2,996
Rutledge Hill	2,441	1,582	859
Rolling Mill Hill	773	396	377
The Core	18,385	14,087	4,298
North Capitol	6,756	4,651	2,105
Stadium	6,657	1,486	5,171

believing that there is a shortage of parking, when in fact, plenty of off-street spaces exist. Motorists cannot see into parking structures and so it would behoove the city to develop effective communication methods to let people know about the abundance of parking through Advanced Parking Guidance Systems (APGS), parking apps, maps, space availability signage, real-time parking availability via a city parking website, good public relations, etc. The city would benefit by marketing its availability of parking. In other words, most people will not independently conclude that plenty of parking is available. Rather, an effective marketing

FIGURE 17. EXISTING PARKING OCCUPANCY RATE BY BLOCK



campaign will be needed to educate the public about parking availability in the area.

4.3 FUTURE DEVELOPMENT SCENARIOS

As part of the study, past studies and current development applications were reviewed to determine anticipated future development within the study area. The methodology used in the mobility study is not a land-use planning exercise, but rather a realistic look at actual development proposals and their mobility impact in the study area. Hence, instead of using a planning estimate based on forecasted population, employment or other variables, the study utilized actual development applications and planned projects announced as of December 2013. This methodology ensures that the future trip generation projections are based on actual projects that are expected to occur. Using this methodology, two development scenarios were identified, as described below. Tech Memo 8 "Development Scenario Report" provides further details on the scenarios.

Scenario 1:

This scenario assumes that existing vacant building space within the study area will be occupied. Also, this scenario includes projects that are "In Progress". The "In Progress" projects are either near completion, under construction, or expected to be under construction in the next few years. Table 9 shows the projected development by use and by intensity for each of the sub-areas for Scenario 1.

TABLE 9. SCENARIO 1: DEVELOPMENT SUMMARY

Subarea	Residential (units)	Retail (sf) [1]	Office (sf) [2]	Hotel (rooms) [3]
Core	60	96,745	1,358,255	0
Gulch	310	41,030	729,270	125
Hope Gardens	230	0	0	0
North Capitol	1,500	20,000	94,440	0
North Gulch	1,145	280,000	700,000	240
Rolling Mill Hill	490	19,000	0	0
Rutledge Hill	0	4,215	5,885	200
SoBro	300	83,800	279,590	1,455

[1] Includes 160,250 sqft. of vacant retail space
[2] Includes 1,743,300 sqft of vacant office space
[3] Includes 800 room Omni Music City Center

FIGURE 18. SCENARIO 1 TOTALS

RESIDENTIAL (units) RETAIL (sf) OFFICE (sf) HOTEL (rooms)

Scenario 2:

This scenario includes the developments from Scenario 1, plus "Potential" future projects that have been publically announced, but do not have a firm timeline for development. Table 10 shows the projected total development by use and intensity in each of the sub-areas for Scenario 2. This represents the level of development that can potentially occur in the different sub-areas of the study area in the next 10 years.

As shown in Tables 9 and 10, the two development scenarios assume substantial development to occur in the study area in the next 10 years. In addition, as shown in Table 10, Scenario 2 assumes a fairly high level of growth, compared to Scenario 1. A review of this information shows that the current development projects have more office space and fewer residential units proposed than previous land use projections. This difference

TABLE 10. SCENARIO 2: DEVELOPMENT SUMMARY

Subarea	Residential (units)	Retail (sf) [1]	Office (sf) [2]	Hotel (rooms) [3]
Core	1,010	340,745	2,198,255	0
Gulch	1,810	141,030	729,270	125
Hope Gardens	230	0	0	0
North Capitol	1,500	20,000	94,440	0
North Gulch	1,445	330,000	700,000	240
Rolling Mill Hill	790	49,000	0	0
Rutledge Hill	0	4,215	5,885	200
SoBro	2,100	213,800	479,590	2,855

[1] Includes 160,250 sqft. of vacant retail space
[2] Includes 1,743,300 sqft of vacant office space
[3] Includes 800 room Omni Music City Center

FIGURE 19. SCENARIO 2 TOTALS

RESIDENTIAL (units) RETAIL (sf) OFFICE (sf) HOTEL (rooms)

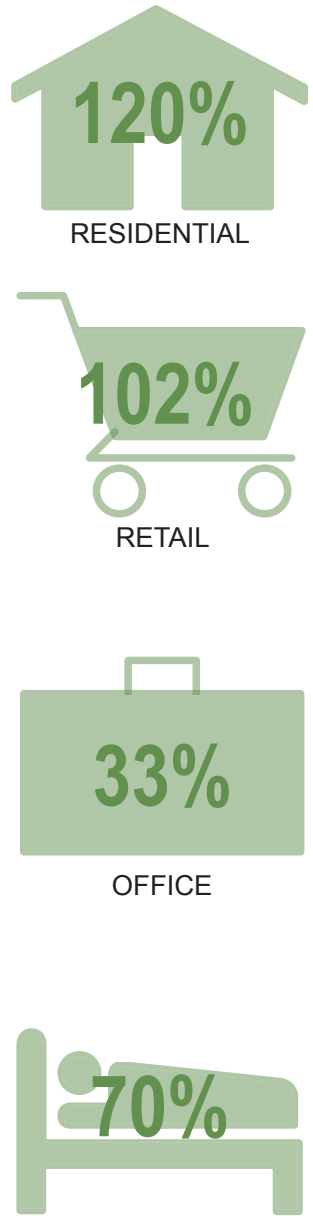
is highlighted in Table 11 which shows the comparison between Scenario 1, Scenario 2, and the 2012 Downtown/SoBro Market Study prepared by Randall Gross Development Economics on behalf of Metro Development and Housing Agency (MDHA). As shown in the table, the "In-Progress" development projects included in Scenario 1 do not meet the market demand for residential, retail, and lodging land uses, while cumulatively they far exceed the

TABLE 11. COMPARISON OF DEVELOPMENT FORECASTS

	Downtown/ SoBro Market Analysis [1]	Scenario 1 [2]	Scenario 2 [2]
Residential (units) [3]	8,035	4,035	8,885
Retail (sf)	732,000	544,790	1,098,790
Office (sf)	1,045,000	3,167,440	4,207,440
Hotel (rooms)	2,740	2,020	3,420

[1] This represents the total of 2012-2017 & 2018-2022 projections from the Downtown/SoBro Market Analysis. Includes targeted recruitment estimate for Office
[2] Includes existing vacancies for Retail (160,000 sqft) and Office (1.74 million sqft)
[3] These numbers are totals and do not account for varying unit types

FIGURE 20. Growth between scenarios



market demand for office space. Scenario 2 represents a more intense projection of future development than what has been presented in previous studies.

4.3.1 Trip Generation Projections

Using the development intensities for the two scenarios, the study developed vehicular and pedestrian trip projections. The vehicular trips were projected using procedures documented in ITE's Trip Generation manual, while the pedestrian trip generation projections were based on RPM's non-motorized model that takes into consideration the proximity of different types of land uses and the propensity of trips being made by walking. The projections were determined for specific zones in the study area. In order to ensure compatibility and comparison in the future these zones matched the Traffic Analysis Zones (TAZs) used in the MPO long-range transportation model.

FIGURE 21. SCENARIO 1: VEHICULAR TRIPS ESTIMATE

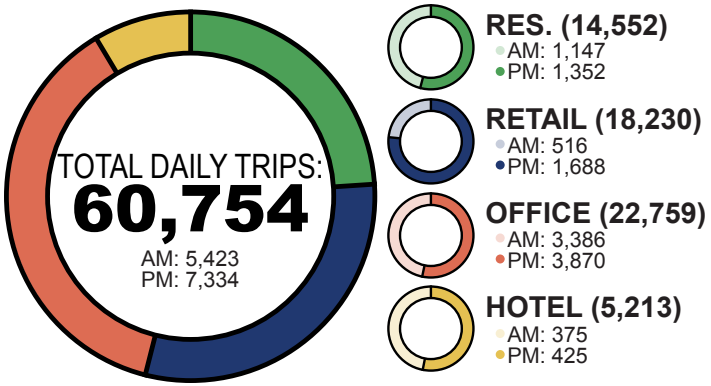


FIGURE 22. SCENARIO 1:VEHICULAR TRIP GENERATION ESTIMATE

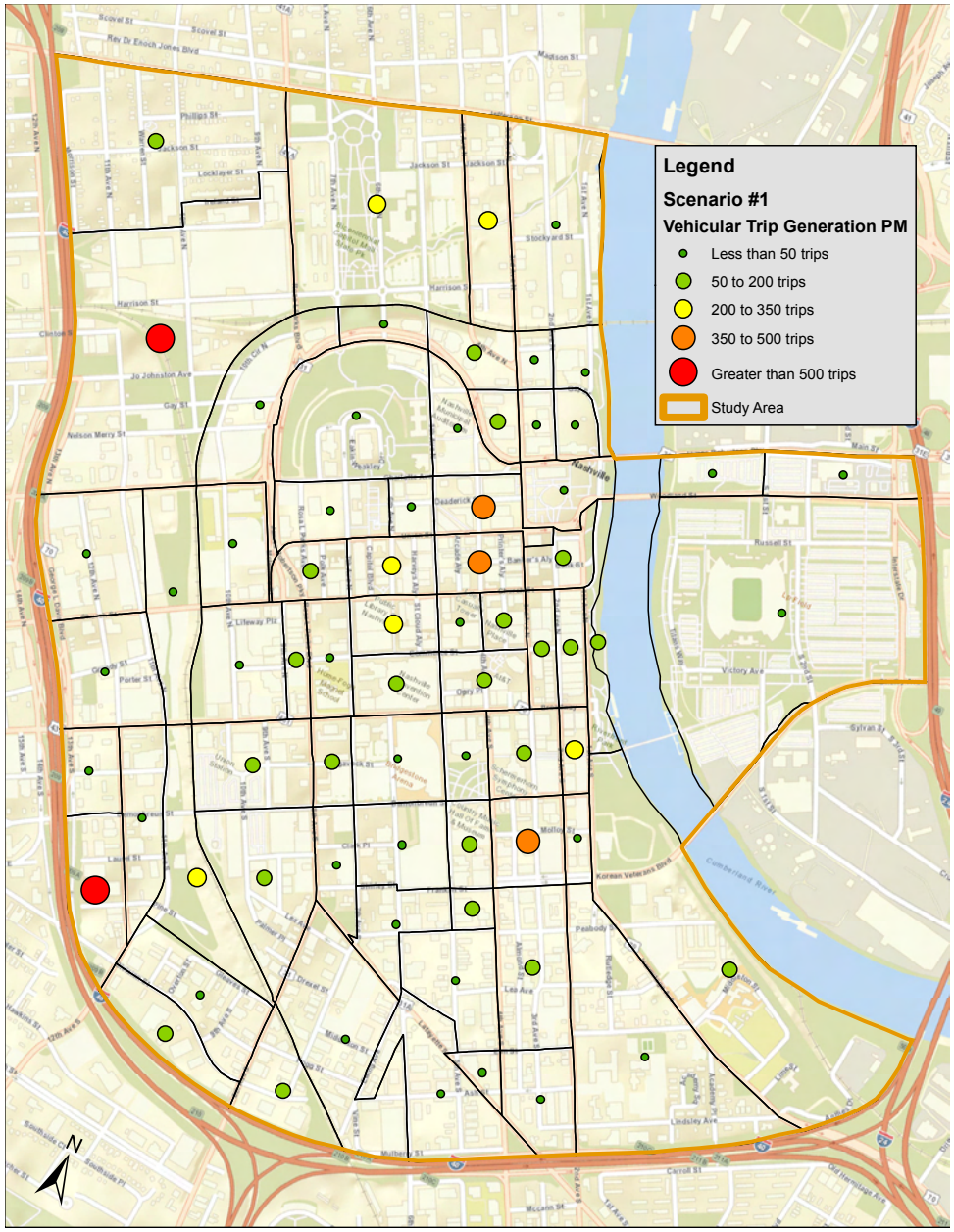
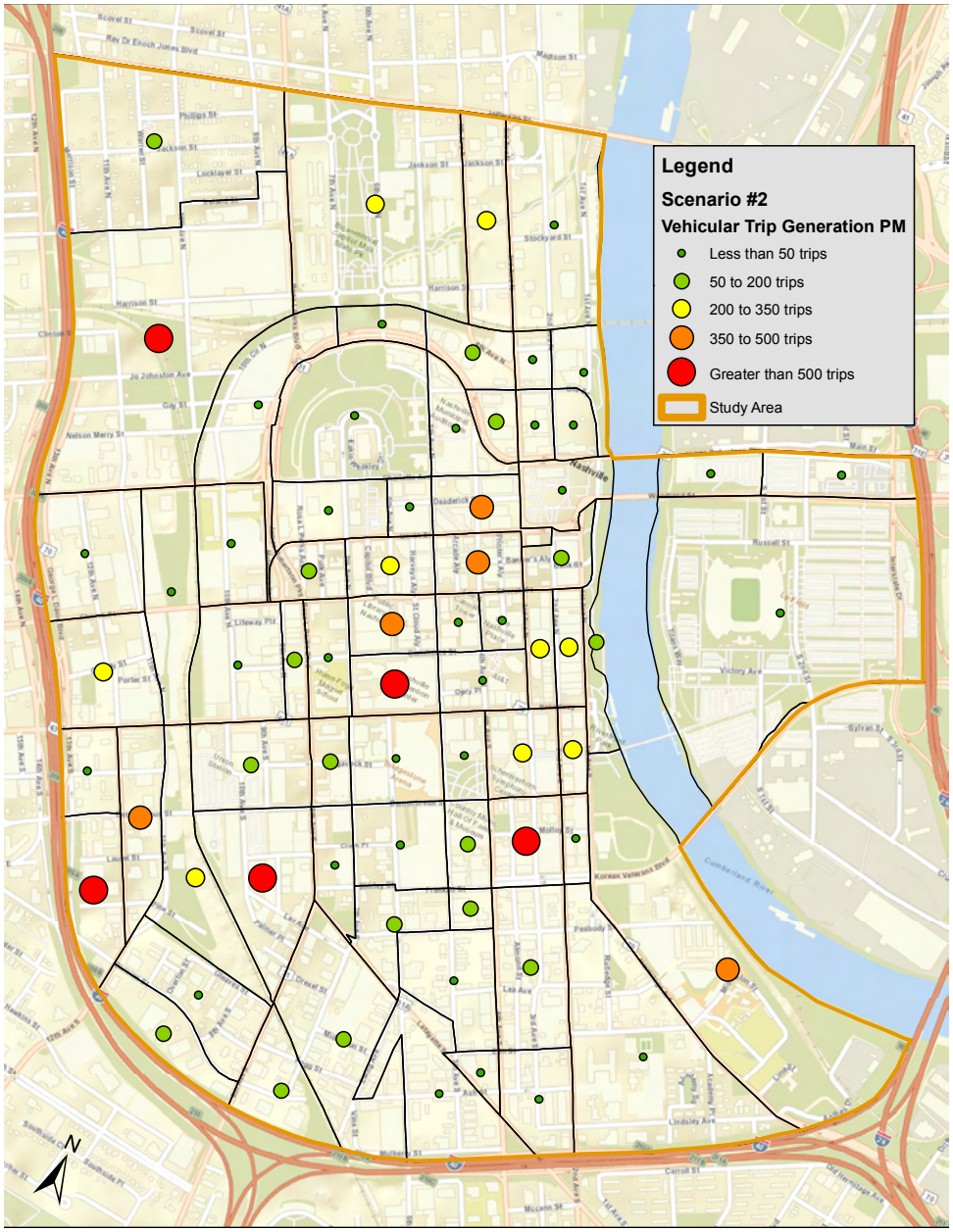


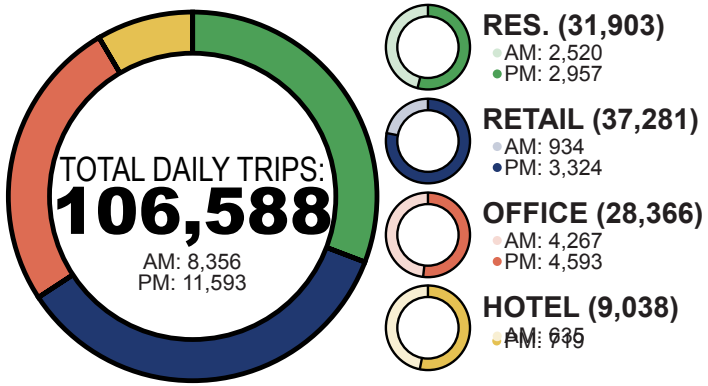
FIGURE 23. SCENARIO 2:VEHICULAR TRIP GENERATION ESTIMATE



Figures 21 and 24 show the estimated vehicular trips that will be generated by the developments anticipated with Scenario 1 and 2, respectively. As shown in Figure 21, the occupancy of existing buildings and development of in-progress projects in the study area is anticipated to generate approximately 60,754 new vehicular trips per day, 5,424 trips during the weekday a.m. peak hour and 7,334 trips during the weekday p.m. peak hour. Similarly, as shown in Figure 24, the study projects that, in addition to the occupancy of existing vacant buildings and in-process developments, the potential projects that have been publically announced will increase the daily trip projection to 106,588 vehicle trips. Also, 8,356 trips and 11,593 trips are projected during the weekday a.m. and p.m. peak hours, respectively for Scenario 2.

Comparing the projected average daily traffic (ADT) in the table with the current ADT measured

FIGURE 24. SCENARIO 2: VEHICULAR TRIPS ESTIMATE



on all the major entry points into the study area (349,500 vehicles), Scenario 1 and Scenario 2 are anticipated to increase the overall ADT by 17.4% and 30.5%, respectively. This amounts to 1.7% and 3.05% annual growth in ADT over 10 years attributed to the projected development within the study area, notwithstanding any other future developments not currently identified that may occur inside or outside of the study area.

Figures 22 and 23 shows the spatial distribution of the vehicular trip generation projections for the weekday p.m. peak hour using the TAZ boundaries. As shown in the figure, the majority of the vehicular trips are anticipated to be generated in the North Gulch, the Gulch, Core and SoBro sub-areas in Scenario 1. In Scenario 2, the redevelopment of the old convention center on Broadway, new developments around the KVB roundabout, the KVB and 3rd Avenue South intersection and the Gulch are anticipated to

FIGURE 25. SCENARIO 1: PEDESTRIAN TRIPS ESTIMATE

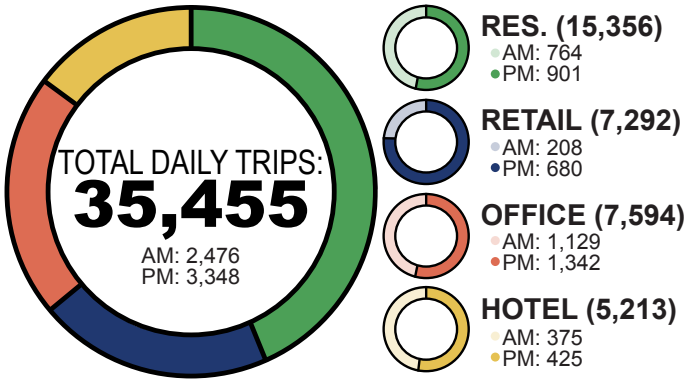


FIGURE 26. SCENARIO 1:PEDESTRIAN TRIP GENERATION ESTIMATE

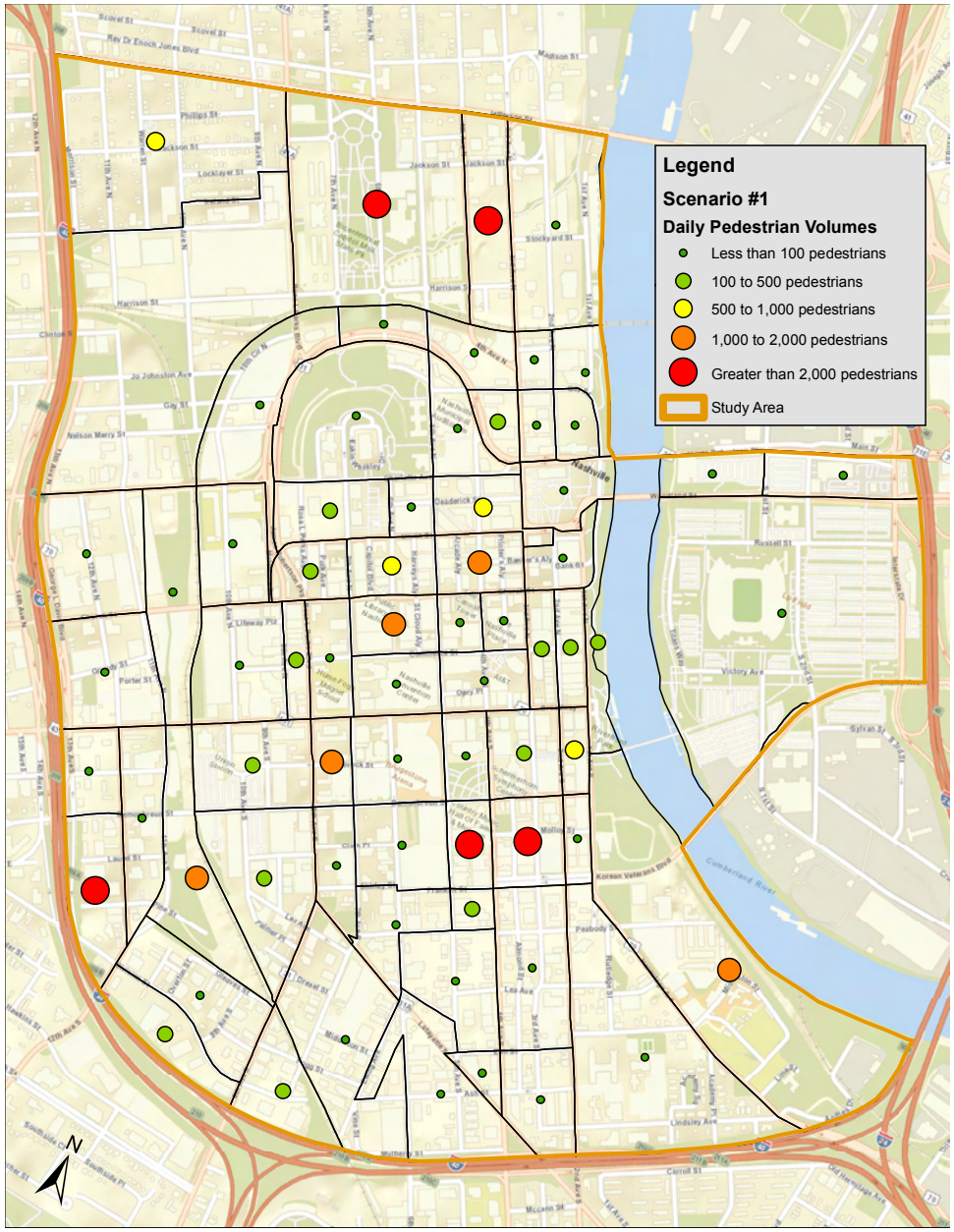
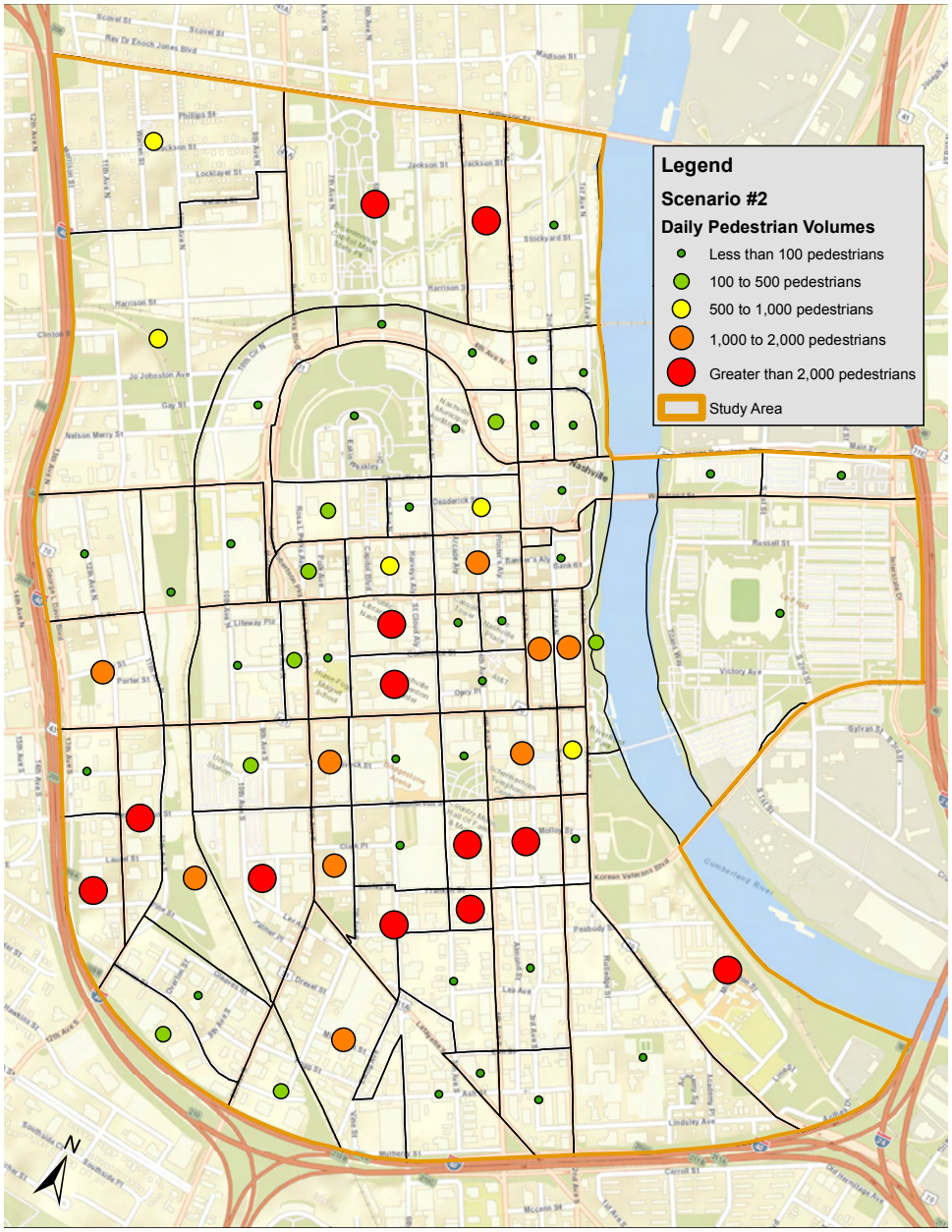


FIGURE 27. SCENARIO 2: PEDESTRIAN TRIP GENERATION ESTIMATE

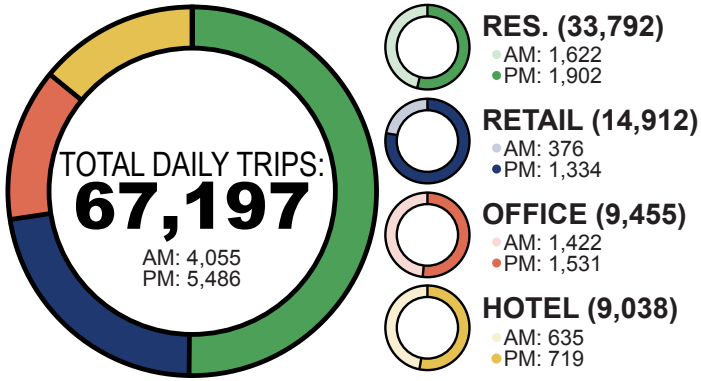


generate the majority of the new vehicular trips. These concentrations of development in certain areas of the study contribute to projections of higher congestion in the future at the intersections near the developments.

Figures 25 and 28 show the pedestrian trip generation projections for Scenario 1 and 2, respectively for the future development in the study area. As mentioned previously, the daily pedestrian trip projections were based on a non-motorized model developed by RPM that projects walking trips based on the proximity of various uses. For weekday a.m. and p.m. peak hour trips, projected pedestrian trips are based on the estimation that approximately 20% of retail, 25% of office, 40% of residential, and 50% of hotel trips will be made by walking.

Figures 26 and 27 show the spatial distribution of the daily pedestrian trip generation projections. As

FIGURE 28. SCENARIO 2: PEDESTRIAN TRIPS ESTIMATE



shown in the figure, the majority of the pedestrian trips are anticipated to be generated in the North Gulch, the Gulch, SoBro and North Capitol sub-areas in Scenario 1. Similarly, in Scenario 2, in addition to the sub-areas in Scenario 1, the area around KVB and the Core sub-areas is anticipated to generate high volumes of pedestrian trips. These results indicate the need to provide wider than average sidewalks and other pedestrian amenities in these areas as pedestrian volumes likely to increase substantially from current levels.

4.4 FUTURE INTERSECTION OPERATIONAL ANALYSIS

Based on the trip generation projections of future development scenarios presented in the previous section, the study distributed the vehicular traffic volumes from each of the 41 TAZs in the study area to the study roadway network based on travel patterns that the development traffic is most likely to undertake. This trip distribution and assignment took into consideration the proximity to regional facilities like I-40, I-65, and I-24 ramps, as well as principal arterials like Rosa Parks Boulevard, Lafayette Street, Hermitage Avenue, Broadway/West End Avenue, etc. Tech Memo 6 provides the detailed traffic analysis of the future condition including the total final traffic volumes for each of the study intersections.

The future condition analysis for Scenarios 1 and 2 identified several intersections that are likely to experience capacity constraints in the future. These capacity constraints will result in

TABLE 12. FUTURE OPERATIONAL RESULT: INTERSECTIONS WITH LOS E AND F

Intersection Name	Weekday AM Peak Hour			Weekday PM Peak Hour		
	V/C*	Delay (sec/veh)	LOS	V/C*	Delay (sec/veh)	LOS
1st Ave S / KVB	0.70	27.4	C	1.04	68.8	E
2nd Ave S / Lea Ave (Two-way Stop)	0.18	>85	F	0.53	>85	F
2nd Ave S / Middleton St (Two-way Stop)	0.68	>85	F	0.67	46.0	E
3rd Ave N / JR Parkway	0.99	72.6	E	1.00	77.0	E
3rd Ave N / Commerce St.	0.57	23.0	C	0.76	55.2	E
3rd Ave S / KVB	1.01	19.9	B	1.08	72.4	E
3rd Ave / JR Parkway	0.99	72.6	E	1.26	>85	F
3rd Ave / Jefferson St	0.88	>85	F	0.62	21.5	C
3rd Ave N / Union Street	0.89	47.6	D	1.06	67.9	E
4th Ave S / Ash St (Two-way Stop)	0.63	28.2	D	3.59	>80	F
4th Ave S / KVB	0.65	22.8	C	1.27	>85	F
4th Ave S / Peabody St (Two-way Stop)	0.05	16.8	C	0.47	>80	F
4th Ave S / Elm St (Two-way Stop)	0.08	18.3	C	2.22	>80	F
5th Ave N / Church St	1.09	>85	F	1.07	47.4	D
6th Ave N / Church St	0.89	72.2	E	0.90	17.4	B
7th Ave / Broadway	0.51	68.3	E	0.94	71.3	E
7th Ave / Charlotte Ave	0.83	>85	F	0.72	18.9	B
8th Ave / Broadway	0.73	53.3	D	0.90	67.4	E
8th Ave N / Charlotte Ave	0.53	34.1	C	0.47	>85	F
8th Ave N / Church St	1.33	>85	F	2.49	>85	F
8th Ave S / Gleaves St (Two-way Stop)	0.08	20.8	C	0.12	44.4	E
10th Ave N / Jo Johnston Ave (Two-way Stop)	0.01	16.7	C	0.04	46.6	E
Rosa Park Blvd / JR Parkway	0.54	33.5	C	0.77	76.6	E
9th Ave N / Church St	0.81	14.1	B	4.98	89.1	F
YMCA Way / Church St (Two-way Stop)	0.29	>80	F	0.73	>80	F
12th Ave S / 11th Ave S	0.62	22.2	C	1.22	>85	F
12th Ave S / Demonbreun St.	0.95	>85	F	1.23	>85	F
12th Ave S / Division St	0.65	20.6	C	1.56	>85	F
Hermitage Ave / Lindsley Ave	0.13	>80	F	0.02	>80	F

TABLE 13. SHARED PARKING RATIOS

Land Use	Base Demand Ratio[1]	Time of Day Adj[2]	Captive Ratio Adj[3]	Drive Ratio[4]	Absorption Rate by 2023			Adjusted Demand Ratio by 2023		
					Existing Vacancies	Planned Projects	Potential Projects	Existing Vacancies	Planned Projects	Potential Projects
Retail	3.60	70%	80%	75%	90%	80%	60%	1.36	1.21	0.91
Residential	1.65	100%	100%	100%	95%	80%	60%	1.57	1.32	0.99
Office	2.80	100%	85%	88%	85%	75%	60%	1.78	1.57	1.26
Hotel	1.25	60%	100%	70%	N/A	75%	60%	N/A	0.39	0.32

1. ULI recommended base parking ratios, per 1000 rentable square foot for retail and office, per unit for residential and per room for hotel.
2. Assumed peak demand occurred around 11:00 a.m.
3. Assumed the residential and hotel land uses would be the primary demand generators
4. The US Census data indicated an 88% drive ratio for employees in Nashville, TN. Adjusted the census data based on our experience.

high delays for motorists. Table 12 shows the intersections with level-of-service (LOS) E and F without any mitigation.

Because of their poor projected traffic operations, these intersections represent the critical intersections that are most likely to need mitigation in the future as the additional projected development occurs. Some of unsignalized intersections are anticipated to experience high delays and these intersections should be monitored in the future for potential signalization. For existing signalized intersections, the study has recommended improvements where feasible. Table 12 does not include the on- and off-ramp intersections to the I-40 and I-65 interstates which are also expected to operate at a poor level-of-service.

4.5 FUTURE PARKING ANALYSIS

The development scenarios included several proposed urban renewal and new downtown development projects that may directly impact parking in downtown Nashville. The land use data of the existing vacancies, in progress/ planned projects, and potential projects in the scenarios were used to conduct future parking analysis on three planning horizons – 2016, 2018, and 2023.

In order to forecast future parking demand for the study area, the project team used the recommended parking demand ratios from the

Urban Land Institute as a base parking ratio. The base ratio was then adjusted to account for peak time of day, non-captive ratio (reduction due to shared use of parking) and drive ratio (reduction due to use of non-auto modes). In addition, an absorption rate that took into consideration the time it takes for a project to be fully leased or occupied, was used to provide a realistic parking demand scenario. Table 13 shows the shared parking ratio used in the future parking analysis.

As shown in Table 13, for example, the existing vacant retail spaces are anticipated to require 1.36 parking spaces per 1,000 square feet of rentable space. Similarly, in-progress/planned residential projects are anticipated to require 1.32 spaces per residential unit, and potential office and hotel proejcts are anticipated to require 1.26 spaces per 1000 square feet of leasable space and 0.32 spaces per room, respectively. Other demand ratio shown in Table 13 can be interpreted in similar way.

The study area falls under the jurisdiction of the Downtown Code which does not specify a minimum or a maximum parking space requirement for new developments within its boundary. Nonetheless, most of the developments are expected to provide parking that meets their commercial need. Hence, for the purpose of the mobility study, the future parking supply was based on the assumption that development projects in the study area will provide parking spaces based on the requirements in the Urban Zoning Overlay (UZO) district of the Metro's zoning code. The project team analyzed future parking adequacy under year 2016, 2018 and 2023 corresponding with different levels of economic development. In an effort to conduct a conservative analysis, no new parking supply was assumed in the 2016 parking condition, while the demand for parking is expected to be generated by the equivalent of occupancy of existing vacancies of office and retail spaces. As shown in Table 14, all the sub-areas are anticipated to have adequate parking spaces under the 2016 parking condition when considering the availability of both public and private parking supply. Detailed analysis, as outlined in Tech Memo 7, showed that while demand for private parking in the Core sub-area is likely to exceed supply, the availability of public parking is expected to meet the excess demand.

For the 2018 parking condition, the existing vacancies and in-progress/planned development, i.e. development Scenario 1, were assumed to generate additional parking demand in the study area. Similarly, the 2023 parking condition assumed that, in addition to existing vacancies and in-progress/planned development, all the potential developments that were included in Scenario 2 are anticipated to generate the demand for additional parking. As shown in Table 15 and 16, the future parking analysis showed that, as a whole, all the sub-

TABLE 14. 2016 PARKING ADEQUACY

Sub-Areas	Effective Supply	Demand	Adequacy
Rolling Mill Hill	772	402	370
Hope Gardens	906	327	579
Rutledge Hill	2,441	1,684	757
North Gulch	3,089	1,990	1,099
The Gulch	3,515	2,078	1,437
North Capitol	6,759	4,783	1,976
The Core	18,384	16,054	2,330
Sobro	5,734	2,828	2,906
Stadium	6,657	1,486	5,171

TABLE 15. 2018 PARKING ADEQUACY

Sub-Areas	Effective Supply	Demand	Adequacy
Rolling Mill Hill	1,428	907	521
Hope Gardens	1,181	558	623
Rutledge Hill	2,644	1,777	867
North Gulch	3,089	1,993	1,096
North Capitol	6,759	4,812	1,947
The Gulch	5,524	3,398	2,126
The Core	18,906	16,764	2,142
Sobro	7,242	3,498	3,744
Stadium	6,657	1,486	5,171

TABLE 16. 2023 PARKING ADEQUACY

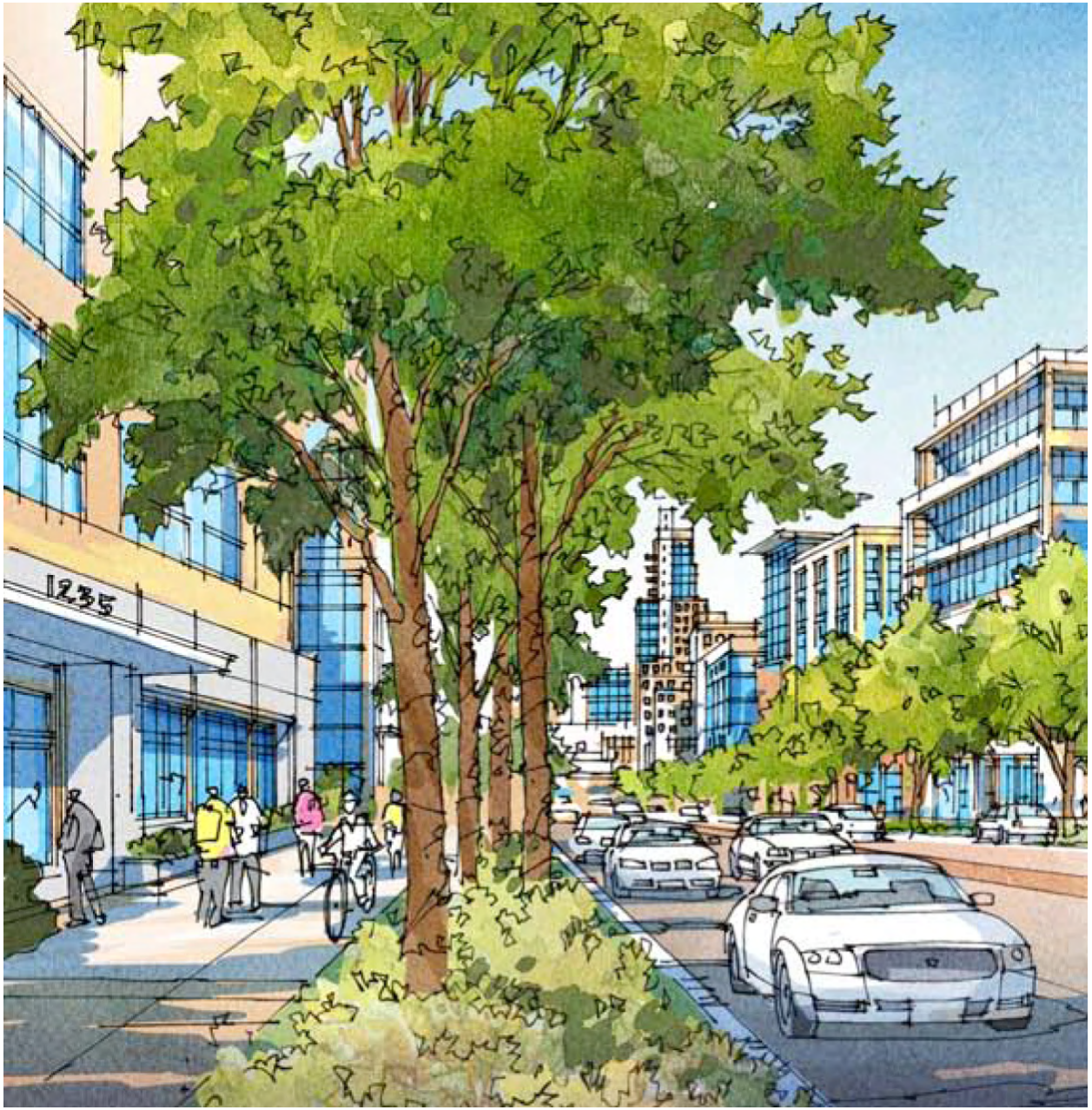
Sub- Areas	Effective Supply	Demand	Adequacy
Rolling Mill Hill	1,917	1,399	518
Hope Gardens	1,181	636	545
Rutledge Hill	2,644	1,812	832
North Capitol	8,626	6,345	2,281
North Gulch	7,438	4,681	2,757
The Gulch	8,859	6,011	2,848
The Core	23,252	19,618	3,634
Sobro	10,429	5,617	4,812
Stadium	6,657	1,486	5,171

areas will have adequate supply of parking to meet the projected demand. However, as outlined in Tech Memo 7, the demand for private parking spaces in the Core sub-area will likely exceed the supply under Scenario 1. However, the deficiency in private parking spaces can be accommodated due to the availability of public parking spaces in the Core sub-area.

In addition, as shown in Table 17, the highest overall parking occupancy is anticipated to be 81% for the Core sub-area in the 2018 parking condition. Hence, in summary, the future parking analysis showed that if the future developments provide parking spaces that meet the requirements of the UZO, the supply will adequately meet the demand for parking in the study area. As such, the major parking concern in the future would be the management of parking spaces, its impact on surrounding transportation network and ensuring that the cost of parking is maintained at reasonable levels.

TABLE 17. PARKING OCCUPANCY FORECAST

Sub-Areas	2016	2018	2023
Hope Gardens	32%	43%	49%
North Gulch	60%	60%	59%
The Gulch	54%	57%	63%
Sobro	45%	45%	50%
Rutledge Hill	64%	62%	63%
Rolling Mill Hill	49%	60%	69%
The Core	80%	81%	78%
North Capitol	66%	66%	69%
Stadium	21%	21%	21%



Rendering of downtown street scene from SoBro Master Plan showing future development. (Rendering by Urban Design Associates)

Union Street Enhancement Rendering

5 CONCLUSIONS AND RECOMME

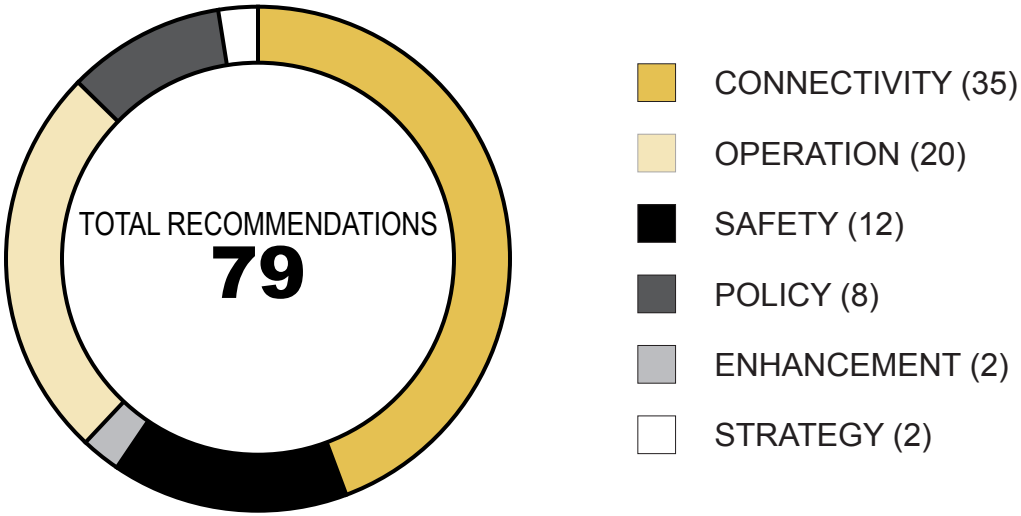
‘The various forms of transportation need to work together as opposed to in competition with one another… It’s not about one versus another; it’s about forming a healthy system.’

-Survey Respondent

NDATIONS

Division Street Enhancement Rendering

FIGURE 29. RECOMMENDATIONS BY CATEGORY



The Multimodal Mobility Study included a comprehensive evaluation of all modes of transportation in the study area. The evaluation included extensive public input, data collection and analysis. A summary of the efforts is presented below.

Public Open Houses: The study conducted three public open houses to solicit input from the general public at various stages of the project. Comments and recommendations from the public were incorporated in the final recommended projects and policies list.

Customer Survey: An online survey was distributed through various channels to give the public an opportunity to express their concerns regarding mobility in the study area. Approximately 400 people participated in the survey, which highlighted parking (too expensive) and traffic (high congestion) as the two main mobility concerns in downtown Nashville. The survey showed that the majority of the respondents considered walking as the preferred mode of travel for the downtown area, while there was also strong support for improvements to bicycle connectivity and infrastructure.

Stakeholder Interviews: Interviews were conducted with major stakeholders in the study area to obtain their input and record their issues regarding mobility in the study area. The interviews provided rich qualitative information on specific concerns of the stakeholders, as well as potential improvements. The information was taken into consideration as the final recommendations were formulated.

Roadway Connectivity Review: The study area was divided into 8 sub-areas to enable a focused review of the public infrastructure network. The review highlighted the need to improve roadway connectivity in several areas, especially for east-west travel within the sub-areas as well as travel across the study area. Several roadway connections and realignments are included in the recommended projects and policies list.

Data Collection: Vehicular, pedestrian and bicycle data were collected for 115 study intersections. In addition, parking data that included both supply and demand (occupancy) for parking lots, garages and on-street parking, were collected on 221 blocks within the study area. Other data that was collected included roadway inventory, three-year crash data, transit weekday boardings, bus stop locations and their amenities, taxi stand locations, horse carriage stand locations, B-cycle station locations, etc. The study also collected historic ADT as well as 24-hour tube counts on all major entry and exit points of the study area.

Complete Streets LOS Analysis: The study conducted PLOS and BLOS analysis of existing non-motorized infrastructure in the study area. The analysis helped identify existing gaps in

non-motorized infrastructure and locations for improved pedestrian and bicycle facilities.

Vehicular LOS Analysis: The study conducted vehicular level-of-service (LOS) analyses at 115 study intersections during existing weekday a.m. and p.m. traffic conditions. In addition, the study also included future vehicular LOS analyses that quantified the vehicular impact of planned development projects and anticipated future growth within the study area.

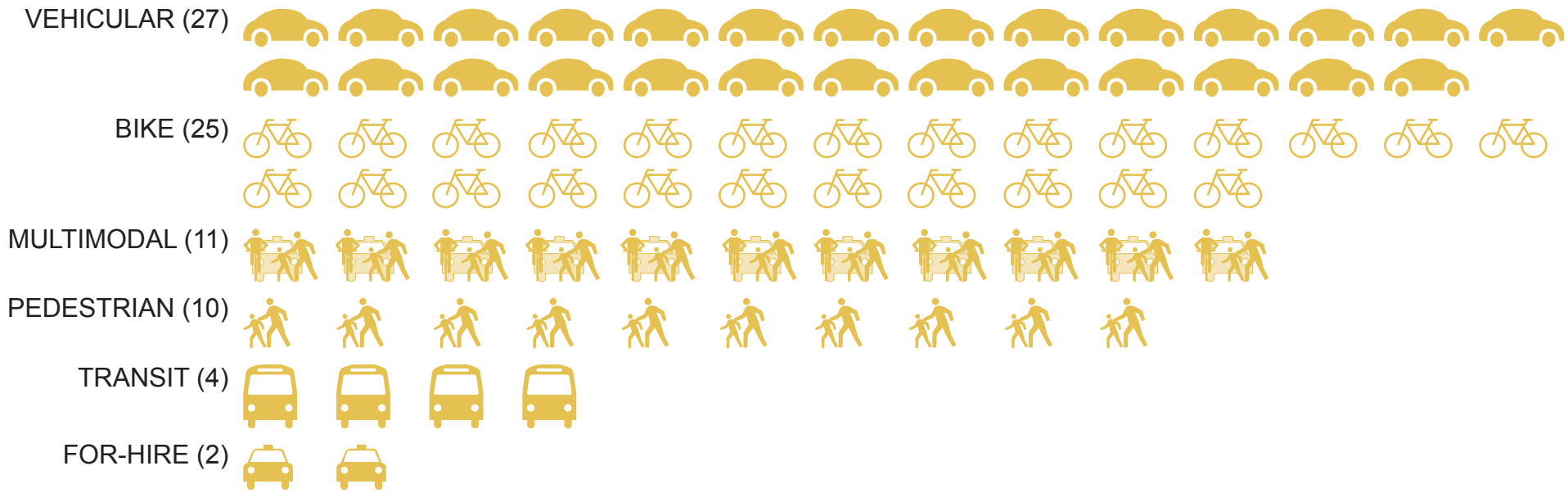
Crash Data Analysis: The three-year crash data for all study intersections was obtained from the Central Precinct of the Metro Police Department. The data was used to calculate crash rates at intersections and these crash rates were compared with statewide averages to determine intersections with above average crash rates.

Parking Data Analysis: The on-street and off-street parking occupancy data identified several blocks in the downtown core with almost 100% occupancy rates during typical weekdays. A future parking analysis was conducted based on anticipated demand and supply of parking spaces for the future developments.

Transit Data Analysis: The analysis of the MTA weekday boarding and bus stop amenities data identified several high activity bus stops that would benefit from additional amenities, such as shelters, benches, and improved signing. In addition, the need to increase the frequency and quality of current transit service was identified by the public input received for the project.

Future Development Review: The study reviewed past studies such as the Downtown/ SoBro Market Study, the SoBro Master Plan, etc., and utilized information from these studies to determine the intensity and types of future

FIGURE 30. RECOMMENDATIONS BY MODE



developments that are anticipated to occur in the study area. Furthermore, the study collected data on actual in-progress and potential developments that are expected to be constructed in the next 10 years. The development programs for each of the future projects were used to estimate the pedestrian and vehicular trips that are expected to be generated. The distribution and assignment of these trips were used to identify the future public infrastructure needs in the study area.

Based on the review of public input, evaluations of the extensive data that was collected and detailed technical analysis as well as the compilation of future planned development in the study area, it was clear that a comprehensive set of multimodal improvements is needed to accommodate the growth in vehicular, pedestrian and bicycle traffic. With this overall understanding, the Multimodal Mobility Study presents 79 project and policy recommendations that will help accommodate mobility needs and support the future economic development of the study area. The detailed descriptions of the recommendations as well as implementation strategies and cost levels are provided in Tech Memo 10. Figures 29-32 show the number of the recommendations by various types.

Table 18 provides the full list of the study's recommended projects and policies. The recommendations are divided into three

FIGURE 31. RECOMMENDATIONS BY SUB-AREA

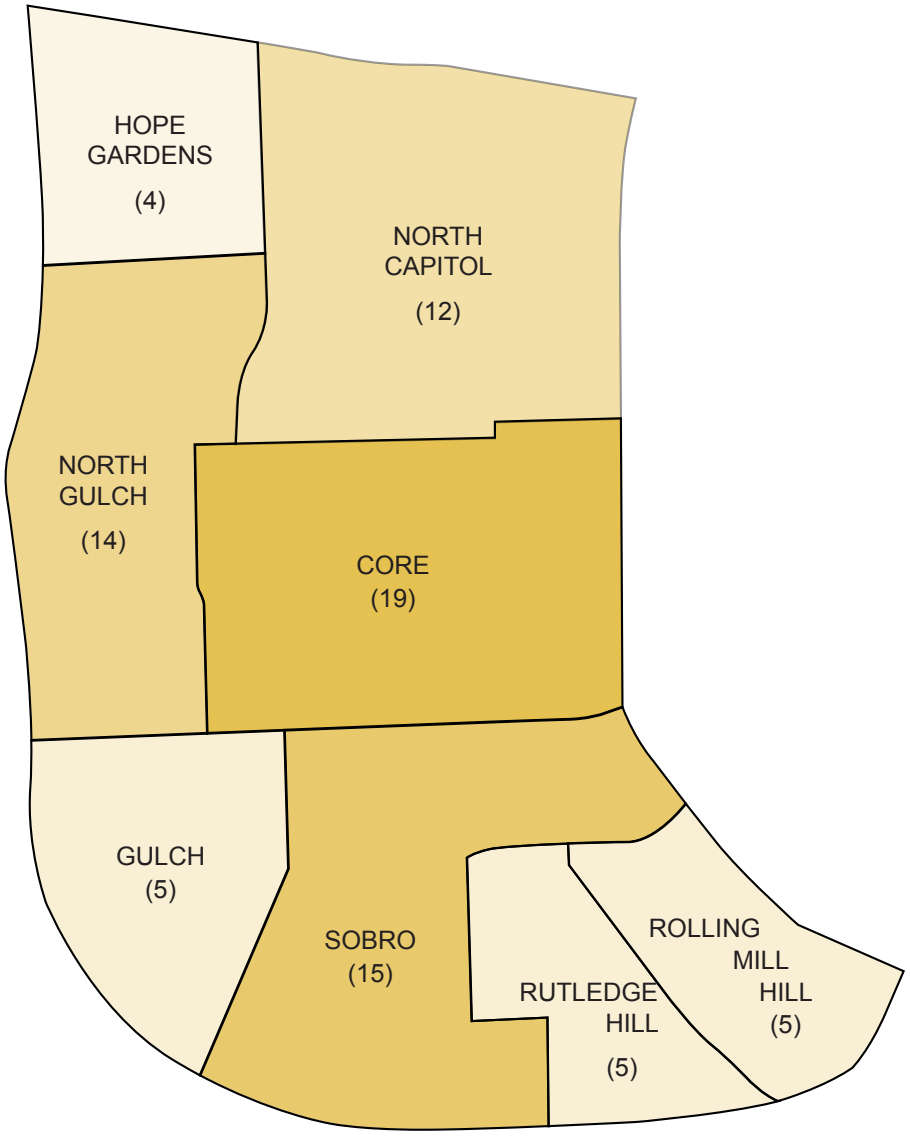


FIGURE 32. BICYCLE PROJECT RECOMMENDATION

time frames based on estimates of when the projects or policies might be expected to be implemented. In addition, conceptual designs of many of the projects were developed in order to better understand the project's feasibility and to identify preliminary constraints. The alignments and layouts shown in the conceptual designs are not intended to represent a final design as further engineering study and detailed design will be required to implement the projects. Appendix A shows the conceptual designs for the recommended projects and Appendix B shows example renderings.

Figures 32, 33 and 34 show the locations of the bicycle, pedestrian (and greenways) and vehicular project recommendations, respectively. The following section provides an overview of the recommended projects and policies for each mode.

5.1 Bicycle Recommendations

A primary goal of the bicycle recommendations in the mobility study is to significantly enhance the existing bicycle network by implementing protected bike lanes, standard bike lanes, and shared bike routes. In addition, the recommendations are envisioned to provide safe bicycle connections to areas outside the study area by identifying bridges over the Cumberland River and I-40 / I-65 interstate which are most suitable to accommodate bike facilities. Some highlights of the bicycle recommendations are as follows:

- The recommended bikeway projects include 5.27 miles of protected / buffered bike lanes, 4.11 miles of regular bike lanes, and 3.77 miles of shared bike routes.
- Improved bicycle connectivity to other areas of Nashville is recommended via protected bike lanes on the Korean Veteran's Boulevard bridge, Woodland Street bridge, Demonbreun Street bridge, Rosa Parks Boulevard and the 6th Avenue South connection to Fort Negley Boulevard and the Adventure Science Center.

- Bike lanes are recommended on roadways with relatively lower traffic volumes, like 3rd Avenue, 7th Avenue, Commerce Street and Church Street, which ensures that major thoroughfares like 2nd Avenue, 4th Avenue, Broadway, and Charlotte Avenue can continue to provide adequate capacity for vehicular traffic.

- Bike parking and bike center policies are recommended to encourage higher bike ridership and to help reduce vehicular traffic and parking demand in the study area.

5.2 PEDESTRIAN AND GREENWAY RECOMMENDATIONS

The study area of the Multimodal Mobility Study includes the downtown core which has very high pedestrian traffic volumes. In addition, future developments are anticipated to expand the

FIGURE 33. PEDESTRIAN AND GREENWAYS PROJECT RECOMMENDATIONS

pedestrian activity to the SoBro sub-area. As a result, the study recommends several pedestrian and multi-modal improvements that will enhance the pedestrian environment. The highlights of the recommended improvements are as follows:

- Connect the existing Music City Bikeway and Rolling Mill Hill greenway, and enhance the pedestrian environment of the downtown core and SoBro area via the implementation of the Riverfront Master Plan.

- Improve pedestrian mobility in the Lower Broadway area from 5th Avenue to 1st Avenue by expanding the pedestrian path of travel via removal of sidewalk clutter.

- Improve sidewalks in the SoBro area on streets such as Peabody Street and Lea Avenue to accommodate higher levels of pedestrian activity in the future.

- Improve pedestrian signal timing and implement advanced techniques like leading pedestrian intervals (LPIs), pedestrian scramble phases or pedestrian hybrid beacons (HAWK) to facilitate pedestrian crossings at intersections with high pedestrian volumes.

5.3 TRANSIT RECOMMENDATIONS

The Multimodal Mobility Study shows that the level of economic activity anticipated in the study area in the next decade cannot be accommodated by simply increasing roadway capacity. In fact, given the right-of-way constraints in downtown Nashville, there are very few areas where roadway capacity can be significantly increased. Furthermore, the study showed that the signalized intersections at the interstate ramps are anticipated to experience extremely high levels of delay with very few options to improve operations. As a result, the study recommends several transit-related improvements to make it more attractive for commuters and help reduce vehicular traffic demand in the study area. The highlights of the transit recommendations are as follows:

- Increase the frequency and coverage of regular transit bus service to raise transit commuter ridership and reduce the number of single occupancy vehicle trips in the study area.

- Implement a robust transportation demand management (TDM) program with the help of downtown employers to assist employees in using transit service.

- Improve reliability and expand service of the Music City Circuit to encourage downtown patrons not to drive within the study area.

- Implement transit signal priority to improve reliability of the transit service.

- Establish and implement a bus stop redundancy and amenities policy to improve transit service.

5.4 PARKING RECOMMENDATIONS

Parking is one of the most critical aspects of downtown mobility. It impacts both the economic viability as well as visitor experience in downtown Nashville. Hence, the mobility concerns facing the study area cannot be adequately addressed without addressing the demand, supply and operation/management of parking. The mobility study evaluated the existing and future demand for parking by analyzing existing parking occupancy data as well as parking demands for future development scenarios. Based on the analysis, the highlights of the parking recommendations are as follows:

- Evaluate the feasibility of establishing a parking authority or other entity which owns and manages public parking assets with the help of an enterprise fund to preserve parking revenues, segregate parking expenses, and establish a parking operating budget.

- Help reduce parking demand by establishing transportation demand management (TDM) programs, encouraging high-occupancy commuter travel, like transit, and encouraging non-motorized travel like bicycling and walking, where feasible.

- Encourage the implementation of innovative parking technologies like smart parking meters, sensors to monitor empty parking space, etc., to improve parking turn-over and reduce the number of vehicles circulating in search of a parking space.

- Implement innovative parking strategies to help reduce the cost of parking such as demand-responsive pricing and unbundling parking rates from the cost of renting or owning residential units, etc.

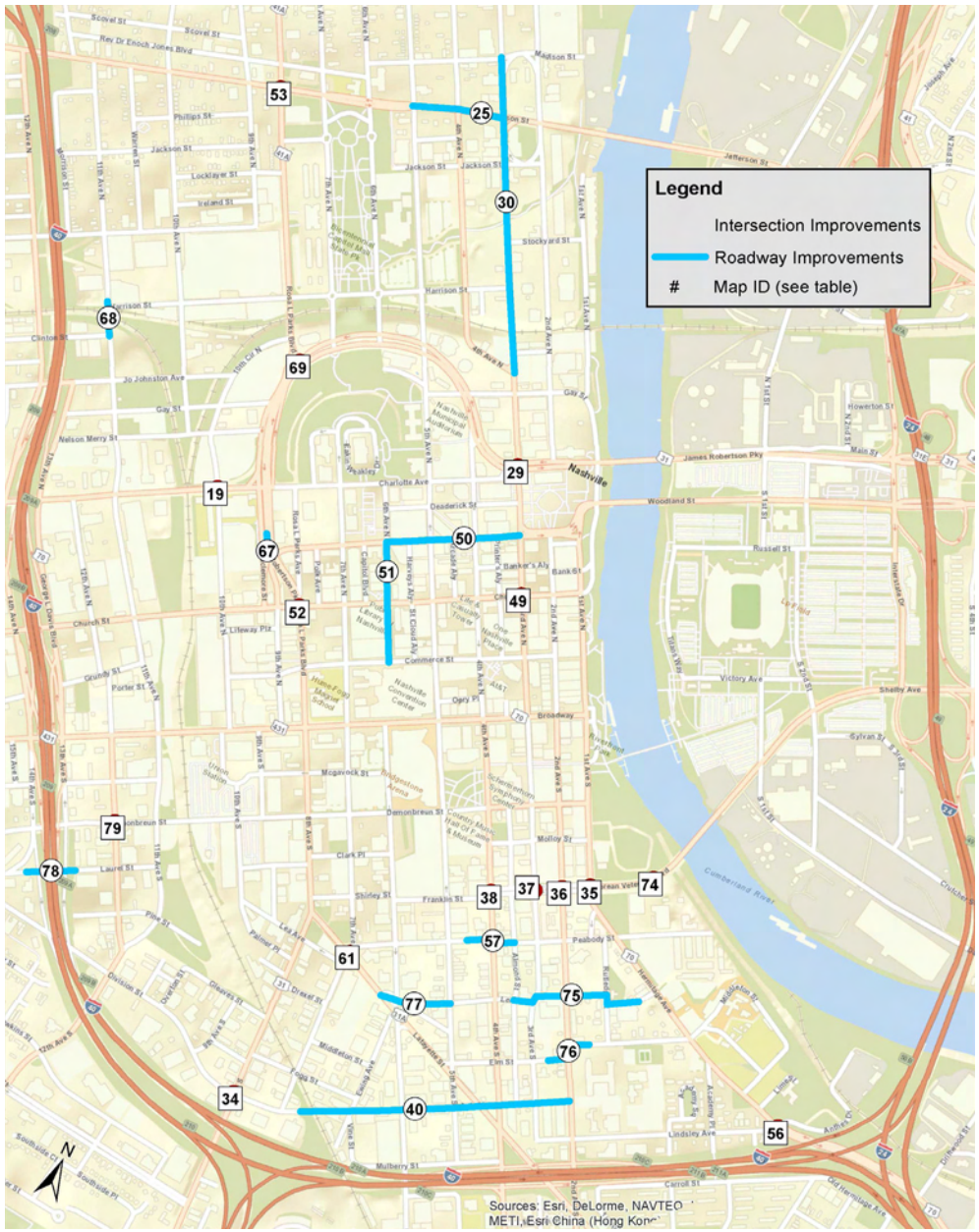
- Encourage shared use parking spaces between compatible uses like daytime employers and restaurants with heavy evening use.

5.5 VEHICULAR RECOMMENDATIONS

The vehicular recommendations in the mobility study are limited to a few roadway connections, some intersection widening and signal retiming improvements. The highlights of the recommendations are:

- Establish a policy to retime traffic signals every three to five years to accommodate changing travel patterns and improve traffic progression on key corridors like Broadway, Lafayette Street, Korean Veteran's Boulevard, Charlotte Avenue, 2nd Avenue, 4th Avenue and 8th Avenue.

FIGURE 34. VEHICULAR PROJECT RECOMMENDATIONS



- Convert one-way segments of Union Street and 6th Avenue to two-way operation to improve local traffic circulation and reduce out-of-direction travel.
- Realign several intersections in the SoBro area (see Table 16 for details) to help improve safety, operations and east-west connectivity.
- Add turn lanes at several intersections (see Table 16 for details) to increase intersection capacity, where feasible.
- Extend 11th Avenue North from Hope Gardens to the North Gulch to improve north-south connectivity from Jefferson Street to Division Street.
- Extend Laurel Street westward over I-40/I-65 to improve connectivity and reduce traffic congestion in the Gulch sub-area.

5.6 FOR-HIRE MODE RECOMMENDATION

The for-hire transportation modes such as taxi, horse-carriage, pedi-cabs, etc., provide important mobility options for the high number of out-of-town visitors who spend time in downtown Nashville. While these for-hire modes undoubtedly enhance the vitality of the downtown core, their proper management is important to ensure that they provide high quality service to their patrons while preserving proper flow of traffic for all other modes. The highlights of the recommendations for the for-hire services are as follows:

- Establish a taxicab stand policy to improve the visibility of taxis and increase the number of stands, where feasible, especially around high activity areas like hotels and event centers.
- Continue working with other for-hire mode operators to establish safe and convenient locations to load and unload passengers, in addition to managing operating hours, zones, and routes.

In conclusion, the implementation of the recommended projects and policies of the Multimodal Mobility Study will assist the Metro Government of Nashville and Davidson County in accommodating the current and future mobility needs of downtown Nashville over the next decade.

5.7 DESCRIPTION OF SHORT TERM RECOMMENDATIONS

The proposed recommended projects and policies of this study are divided into three implementation time periods; short-term, mid-term, and long-term. The short-term projects are those which are most likely to be implemented in the 0-5 years after the completion of this study, i.e. from year 2014 - 2019. Some of these projects may have recently been undertaken by various Metro departments. The section below describes the recommended projects and policies in detail.

5.7.1 Bike Parking Policy

The Multimodal Mobility Study has identified enhancing bicycle infrastructure as a key strategy for managing future mobility issues facing downtown Nashville. Without continued focus on bicycle and non-motorized transportation, traffic congestion will likely get worse. Hence, this recommendation calls for establishing a bike parking policy to encourage bike ridership and enhance convenience for cyclists. During the focus group meetings and based on public comments, the lack of bicycle parking was identified as a barrier for bike riders in Nashville. A new bike parking policy can systematically increase the bicycle mode-share in the future.

5.7.2 Taxicab Stand Policy

The lack of taxicab stands was identified as one of the major issues by taxicab operators during focus group meetings as well as during interviews conducted as part of a previous study on taxi services in the city. Nashville has become a prime tourist destination in the country and the management of taxicabs has become an essential part of mobility in downtown Nashville. This policy recommends increasing the number of taxicab stands in high activity areas like near hotels and event centers, as well as better signage of

taxicab stands. Policy ideas that were discussed included providing taxicab stands every second block in the core sub-area and every fourth block in other areas of downtown.

5.7.3 Wayfinding Sign Program

This is an ongoing program that is listed in the 2013 MPO Transportation Improvement Program (TIP). The project's goal is to install signs and develop guidance programs for bicycles, pedestrians, and vehicles to improve navigation through downtown.

5.7.4 Encourage TDM Measures

One effective strategy to reduce single-occupancy vehicle use in downtown is to establish a robust transportation demand management (TDM) program for employees of downtown businesses. Several states and cities have effectively used these TDM programs as a tool to manage mobility. Nashville has some on-going programs and infrastructure to implement various TDM tools. For example, MTA/RTA administers the EasyRide program where employers pay for bus passes for employees who choose to take transit to commute to work. Tennessee State government, which is the largest employer in downtown, offers vanpools and car-share programs for its employees in addition to the EasyRide program. Experience from other jurisdictions has shown that the effectiveness of a TDM program is greatly increased by providing dedicated resources to monitor specific targets for employers to meet in order to reduce single occupancy commuters.

5.7.5 Pedestrian Signal Timing

Several intersections in downtown Nashville have very high pedestrian volume, especially in the Core sub-area. In addition, the pedestrian corner circulation analysis and pedestrian crash data analysis identified several intersections that need improvements to assist pedestrians crossing the roadways. This recommendation calls for retiming traffic signals at critical intersections to provide better protection for pedestrians. Some of the techniques that can be implemented include: leading pedestrian interval (LPI) where the pedestrian walk signal is turned on a few seconds before the adjacent vehicle green signal; pedestrian scramble phase where the pedestrian walk signal is turned on for all approaches at the same time, maximizing the pedestrian signal time; coordinating pedestrian signals to reduce pedestrian delay at intersections, etc. Some of the corridors that would benefit from pedestrian signal timing adjustments are; Broadway from 1st Avenue to 5th Avenue, Charlotte Avenue from 4th Avenue to 5th Avenue and Church Street from 2nd Avenue to 8th Avenue.

5.7.6 Music City Circuit Improvement

MTA is currently in the process of making improvements to the routing of the Music City Circuit. In addition to changing the route, there may be a need to expand the service as ridership increases in the future. Several public comments raised the issue of reliability and the need to extend the service to Jefferson Street, which will likely require additional resources, specifically more buses.

5.7.7 Transit Signal Priority

Transit is likely to play an ever increasing role in providing transportation mobility in Nashville. Hence, continually improving transit service is vital to expand the multi-modal mobility environment. One of the concerns raised by the public regarding transit was its frequency and reliability. Some of these concerns can be addressed by incorporating a transit signal priority system, which provides additional green time to traffic signal phases serving a bus that is running behind schedule.

5.7.8 Retiming Traffic Signals

Traffic signals need to be retimed at regular intervals to ensure that the timing reflects the changes in traffic patterns as growth occurs. This recommendation calls for reviewing traffic signal timings at closely spaced intersections and areas where recent travel pattern changes have occurred. Potential locations for retiming of signals include Charlotte Avenue from 10th Avenue North to 7th Avenue North, Broadway from 10th Avenue to 7th Avenue, Korean Veterans Boulevard from 1st Avenue South to 6th Avenue

South, 4th Avenue from Charlotte to KVB, and 5th Avenue from Charlotte Avenue to Broadway.

5.7.9 Innovative Parking Solutions

Parking was identified as one of the main issues facing commuters and visitors to the study area. The main public complaint was high parking prices, even though the base parking pricing is comparable with other cities. This is likely attributed to higher parking prices during events, which occur regularly in downtown. In order to address this issue, this strategy calls for further evaluating innovative parking strategies such as demand responsive pricing, better monitoring of parking pricing, unbundling parking rates, review parking requirement of the Downtown Code, and/or other innovative solutions. In addition, implementing new parking infrastructure like solar powered parking meters that read credit cards, mobile apps that allow pay by phone for meters and sensors that identify empty parking spaces would greatly improve parking experience and mobility in downtown.

5.7.10 Riverfront Protected Bike Lane

A master plan is currently being updated for the west bank of the Cumberland River. As a part of the master plan, a two-way protected bike lane, on the east side of 1st Avenue is recommended in the plan. This protected bike lane will connect to the Music City Bikeway and Rolling Mill Hill Greenway via the proposed amphitheater project on the northeast quadrant of the KVB and 1st Avenue South intersection. This project will greatly enhance the biking experience for bike commuters in downtown, as well as for tourists. Figure A1 in Appendix A shows the design concept for the proposed recommendation.

5.7.11 8th Avenue Shared Bike Route

8th Avenue has been identified for a bike facility in several past studies due to its regional connections. However, given its regional connectivity, the route is also used heavily by motor vehicles at relatively higher speeds. Furthermore, given the limited right-of-way available on the roadway, the study recommends designating the roadway as a shared bike route only.

5.7.12 7th Avenue Bike Lane from Charlotte Avenue to Demonbreun Street

The Multimodal Mobility Study strives to extend the bicycle infrastructure in the study area so medium and short distance trips can be safely and easily made by non-motorized modes. One way to help achieve the goal is to provide bike facilities on roadways that carry lower traffic volume and have slower speeds, rather than on roadways with high traffic volume and speeds. 7th Avenue parallels the more heavily travelled 8th Avenue in the study area. As such, this project calls for providing bike lanes on 7th Avenue from Charlotte Avenue to Demonbreun Street. This will likely require removing on-street parking from at least one side of the roadway. Figure A2 in Appendix A shows the design concept for the proposed recommendation.

5.7.13 3rd Avenue Shared Bike Route

Continuing with the strategy of providing bike facilities on lower volume roadways rather than on higher volume roadways, this project calls for designating 3rd Avenue as a shared bike route from James Robertson Parkway to Korean Veterans Boulevard. Because of the lack of additional right-of-way and heavily used on-street parking, it may not be possible to provide bike lanes in this section of 3rd Avenue. However, this shared bike route can be extended as a bike lane south of KVB and north of James Robertson Parkway.

5.7.14 9th Avenue North Shared Bike Route

Instead of providing bike lanes on 8th Avenue in the downtown area, this project calls for providing bike lanes on 9th Avenue, from Church Street to Demonbreun Street, as 9th Avenue has lower traffic volumes and slower speeds. This will likely require removing on-street parking on 9th Avenue due to the narrow pavement width.

5.7.15 Horse Carriage Policy

Horse carriages are a part of the downtown environment that supports the vitality of the area, particularly for tourism. The operation of horse carriages is based on the time of operation, zone

or route where they are permitted to operate and availability of designated stands. The calls by operators for increasing the operating time of the horse carriages are understandable given the growth in tourist activities. However, it may be advisable to restrict their operation during peak commuting hours in the evening, i.e. between 4:00 p.m. to 6:00 p.m. This recommended policy calls for Public Works working with the MTLC to establish a more defined policy for determining appropriate locations for additional horse carriage stands in downtown. Currently, MPW is working to overhaul the on-street parking spaces in Lower Broadway, from 5th Avenue to 1st Avenue, which is anticipated to include locations for horse carriage stands.

5.7.16 Lower Broadway Improvements

Lower Broadway, from 5th Avenue to 1st Avenue, is one of the prime destinations for tourists in Nashville. As such, the pedestrian activity in the area is extremely high, especially during the evenings and events. Even though the existing sidewalk on Broadway is approximately 12-14 feet wide, street furniture, parking meters, business signs, and street performers occupy a substantial portion of the sidewalk. Due to the popularity of numerous establishments in the area, the sidewalk often becomes congested. This creates safety concerns for the police as patrons spill from the sidewalk to the roadway. In addition, the pedestrian corner circulation analysis conducted as part of the study identified corners of the intersection with LOS D or worse. As such, this project recommends improving pedestrian mobility on Broadway from 5th Avenue to 1st Avenue by reducing sidewalk clutter and improving the pedestrian path of travel.

5.7.17 Pedestrian Safety Improvement on 2nd Avenue, Broadway to Church Street

2nd Avenue North, from Broadway to Church Street has several popular establishments that attract many patrons. It also has numerous trees that block the street lighting from reaching the sidewalk. This recommendation calls for increasing or modifying the lighting, and replacing or trimming the vegetation to improve pedestrian safety of the area.

5.7.18 Pedestrian Safety Improvement on Church Street, 4th Avenue to Printer's Alley

The narrow width of Church Street plus on-street parking makes it a pedestrian-friendly street. However, it also experiences high vehicle use during peak times. The section of Church Street from 4th Avenue to Printer's Alley was identified as one of the top pedestrian crash locations. A potential solution is to include a pedestrian scramble phase at the intersection of Church Street and 4th Avenue North and provide additional signage on Church Street near Printer's Alley to warn vehicles of pedestrians in the alley.

5.7.19 Charlotte Avenue / 10th Avenue North Intersection Improvement

The parking lots and on-street parking on the north side of Charlotte Avenue near the intersection of Charlotte Avenue and 10th Avenue North / 10th Circle North are used extensively by the state employees, TSU students and visitors. However, the eastbound left-turn movement at the intersection, which serves vehicles arriving from the interstate ramps on Charlotte Avenue, is restricted between 6 a.m. – 9 a.m. and 3 p.m. - 6 p.m. This forces left turning traffic to the intersection of Charlotte Avenue at 11th Avenue North. This improvement calls for constructing an eastbound left-turn lane within the median on Charlotte Avenue at the intersection of 10th Avenue North, as well as removal of the existing left-turn time restrictions. Figure A3 in Appendix A shows the conceptual layout of the improvement, highlighting its feasibility.

5.7.20 10th Avenue North Shared Bike Route

10th Avenue forms part of the Music City Bikeway in the Hope Gardens sub-area. In order to increase the multimodal connection to the Music City Bikeway, this project recommends designating 10th Avenue as a shared bike route from Harrison Street to Jefferson Street.

5.7.21 Jefferson Street Bike Lane

This project recommends providing a dedicated bike lane on Jefferson Street east of Rosa Parks

Boulevard. Doing so is expected to greatly improve the multi-modal mobility of the area and encourage people to ride their bikes. Figure A4 in Appendix A shows the conceptual design of the proposed recommendation, which shows that 11' travel lanes can be maintained while providing 5' bike lanes.

5.7.22 3rd Avenue North Bike Lane

3rd Avenue is an ideal street for a bike facility because of its low volume and speed. In addition, it provides connection from the SoBro sub-area, through the downtown Core and the North Capitol sub-area, all the way to Metrocenter. Hence, this project calls for providing a bike lane on 3rd Avenue North from Jefferson Street to James Robertson Parkway to help designate 3rd Avenue as the main north – south bike route. Figure A5 in Appendix A shows the conceptual design of the proposed recommendation.

5.7.23 4th Avenue North Bike Lane

The section of 4th Avenue North from 3rd Avenue North to the Music City Bikeway provides an opportunity to connect the bike facility in the study area to the Music City Bikeway. Furthermore, this connection also provides a multi-modal connection to the planned ballpark and would help reduce vehicle parking demand for games. Figure A6 in Appendix A shows the conceptual design of the proposed recommendation.

5.7.24 Charlotte Avenue Shared Bike Route

Charlotte Avenue carries a fairly high traffic volume as it provides access to several large parking garages in the area. Hence, dedicating the roadway space for a bike lane would require reducing the number of travel lanes for vehicles which will create additional delays for vehicles. As such, this project recommends designating Charlotte Avenue as a shared bike route from 3rd Avenue to 14th Avenue.

5.7.25 Jefferson Street Improvements- 3rd Avenue to 5th Avenue

With the proposed conversion of 3rd Avenue North to two-way operation, the lane configuration of the Jefferson Street / 3rd Avenue North intersection will need to be modified. The intersection will likely require an additional eastbound through lane and a westbound left-turn lane. The conceptual design of the recommended improvement is shown in Figure A4 in Appendix A.

5.7.26 4th Avenue Sidewalk Improvement

4th Avenue North is likely to be one of the main pedestrian access points to the planned Nashville Ballpark in the Sulphur Dell area. It provides pedestrian connection from Germantown to the North Capitol area. This projects calls for improving the sidewalk on 4th Avenue North from Jefferson Street to Jackson Street.

5.7.27 Pedestrian Improvement on Jefferson Street – 7th Avenue to Rosa Parks

Jefferson Street from 7th Avenue North to Rosa Parks was identified as one of the high pedestrian crash locations. As development density and as a result, pedestrian activity continues to increase in this area, the potential for pedestrian crashes increases. As such, installing a high visibility cross-walk at 7th Avenue as well as potentially installing pedestrian crossing signals like a HAWK crossing may be suitable.

5.7.28 Pedestrian Improvement at the Charlotte Avenue / Rosa Parks Avenue Intersection

This intersection was also identified as one of the high pedestrian crash locations. Even though detailed crash reports were not available, the short throat distance on the southbound approach of the intersection where several driveways merge close to the intersection, may have contributed to the high number of crashes at the intersection. As redesign of the driveway is a long-term solution; in the short-term, installing a STOP sign at the driveways and "Yield to Pedestrian" signs may help mitigate the situation.

5.7.29 3rd Avenue North / James Robertson Parkway Intersection Improvement

During the morning peak hour, commuters using the I-24 interchange at James Robertson Parkway and those traveling from East Nashville

use 3rd Avenue North to access businesses in the downtown core. This movement adds pressure on the westbound left-turn movement at the 3rd Avenue North / James Robertson Parkway intersection, which backs up to 2nd Avenue North and beyond in the morning. This projects calls for installing a second westbound left-turn lane within the median. In order to reduce delays during off-peak hours, a flashing yellow arrow may be installed to allow a permitted left turn phase for the dual left-turn movement. Figure A7 shows the conceptual design of the improvement.

5.7.30 Two-way Conversion of 3rd Avenue North

3rd Avenue North provides a vital connection in the SoBro, Core and North Capitol sub-areas. It is part of a one-way pair with 4th Avenue, north of James Robertson Parkway. However, the average AADT volume on each of the two roadways is only about 2,000 vehicles per day. This low traffic volume does not need the added capacity of a one-way pair. In addition, the new Nashville Ballpark project is designed to terminate 4th Avenue from Jackson Street to Harrison Street. As a result, it is important to convert 3rd Avenue to a two-way roadway with bike lanes to facilitate the mobility of the area. Figure A5 shows the conceptual design of the improvement along with the bike lane improvement.

5.7.31 Extend Korean Veterans Boulevard Bike Lane

The existing bike lanes on Korean Veterans Boulevard terminate on 1st Avenue South. This project recommends extending bike lanes across the KVB Bridge to Shelby Avenue to provide a vital bicycle connection to East Nashville and help encourage bike ridership. Figure A8 in Appendix A shows the conceptual design of the proposed recommendation.

5.7.32 Demonbreun Street Bike Lane Connection

Currently there are bike lanes east of 12th Avenue South and west of 14th Avenue South on Demonbreun Street; however, the dedicated facilities are interrupted through the I-40/I-65 interchange area making it difficult for cyclists cross the area. This project recommends continuing the bike lanes through the interchange area from 12th Avenue to 14th Avenue. Figure A9 in Appendix A shows the conceptual design of the proposed recommendation.

5.7.33 Thermal Site Greenway

The Thermal site, located on the northeast quadrant of the 1st Avenue South / KVB intersection is currently being redesigned to include a riverfront park with amphitheater. As a part of the project, a multi-use path and greenway is recommended that connects to the Rolling Mill Hill Greenway and eventually to the Music City Bikeway.

5.7.34 Division Street / 8th Avenue South Intersection Improvement

The proposed Division Street extension is anticipated to increase the traffic volume on Division Street substantially. The northbound and southbound approaches of the Division Street / 8th Avenue South intersection lack left-turn lanes, which reduces the capacity of the intersection and increases delay. Hence, as part of the Division Street extension project, northbound and southbound left-turn lanes are recommended. Figure A10 in Appendix A shows the conceptual design of the proposed recommendation.

5.7.35 1st Avenue / KVB Intersection Improvement

The 1st Avenue South / Korean Veterans Boulevard intersection is a critical intersection that serves as a gateway to the SoBro area from I-24 and East Nashville. It also provides connection to Lebanon Pike and Nolensville Pike in southeast Davidson County. During the weekday a.m. and especially p.m. peak hours, the intersection operates with long delays and queues. Hence, this recommendation calls for providing a second southbound through lane, an eastbound left-turn lane, and dual westbound left-turn lane. Figure A8 in Appendix A shows the conceptual design of 1st Avenue from Demonbreun Street to Peabody Street. The design shows the lane transitions necessary to accommodate the reversible lanes on Hermitage Avenue. In addition, it also

shows a northbound bike lane, which may be accommodated in the Riverfront project as a protected bike lane.

5.7.36 2nd Avenue / KVB Intersection Improvement

Korean Veterans Boulevard is the main roadway in the SoBro area while 2nd Avenue provides access to the downtown core from the I-40 interstate ramps. This creates the need for providing an eastbound left-turn lane on KVB to facilitate vehicles turning to go to the downtown Core. Because of the short distance between 2nd Avenue and 3rd Avenue in the area, the turn lane will keep the turning vehicles out of the through lane, which will maximize the effective storage distance between the two intersections. Figure A8 in Appendix A provides the conceptual design of the proposed recommendation.

5.7.37 3rd Avenue / KVB Intersection Improvement

The area around the 3rd Avenue South / KVB intersection is anticipated to experience very high growth in the near future. This will create the need to provide additional capacity at the intersection for vehicular, bicycle and pedestrian traffic. As 3rd Avenue has been identified as a designated route for bicycle traffic, it will be desirable for future developments, especially with large parking garages, to provide access on 2nd Avenue or 4th Avenue, instead of on 3rd Avenue. The intersection of 3rd Avenue South / KVB will likely require left-turn lanes on the eastbound, westbound and southbound approaches. Figure A8 shows the conceptual design of the turn lanes.

5.7.38 4th Avenue / KVB Intersection Improvement

During the weekday p.m. peak hour, both KVB and 4th Avenue South carry relatively high volumes of traffic exiting downtown. Especially, with the closely spaced intersections of 1st Avenue / KVB, 2nd Avenue / KVB, 3rd Avenue / KVB, and 4th Avenue / KVB, the signal coordination between intersections is vital to reduce delays and queues. Without turn lanes at the intersections, the effectiveness of signal coordination is reduced as turning vehicles block the through lanes. Hence, to help improve the operation of the signals on KVB, an eastbound right-turn lane is recommended at the 4th Avenue / KVB intersection. This will likely require removing a portion of the on-street parking between 4th Avenue and 5th Avenue as well as the curb-extension on the southwest quadrant of the intersection. Figure A8 in Appendix A provides the conceptual design of the proposed recommendation.

5.7.39 Lindsley Avenue Protected Bike Lane

Lindsley Avenue provides direct connection between recommended bike facilities on Hermitage Avenue and 3rd Avenue South. Hence, to complete the bicycle connectivity in the area, the project recommends providing protected bike lanes on Lindsley Avenue. Figure A11 shows the conceptual design of the protected bike lanes.

5.7.40 Division Street Extension

Division Street currently ends east of 8th Avenue South. Several previous planning projects have recommended extending Division over the CSX rail yard to the SoBro sub-area. This roadway connection will provide a vital east-west connection between the Gulch and SoBro sub-areas and reduce out-of-direction travel. It will be desirable to extend the roadway to 2nd Avenue North to increase the connectivity to the Core and East Nashville. The project is currently in the design phase and likely to be implemented in the near future.

5.7.41 11th Avenue Complete Street

11th Avenue connects the Gulch and the North Gulch sub-areas, and also has potential to connect to the Music City Bikeway. It also travels under the Broadway and Church Street viaducts, which makes it ideal for a non-motorized connection. This recommendation calls for redesigning 11th Avenue as a Complete Street with cycle tracks and sidewalk from Laurel Street to Charlotte Avenue. Furthermore it also calls for providing a bike connection to the Music City Bikeway on Jo Johnston Avenue via a shared bike route.

5.8 DESCRIPTION OF MID-TERM RECOMMENDATIONS

The recommended mid-term projects and policies represent those that are likely to be implemented in 6 – 10 years' time period, which is from year 2020 – 2024. Given the uncertainty of future budget availability and priorities, some of the projects may be implemented early or at a later date.

5.8.42 Bike Center Policy

The future mobility concerns in downtown Nashville need to be addressed by providing multiple transportation options for people, as relying solely on motor vehicles or transit will limit opportunities for a more efficient transportation system. Creating viable options requires providing infrastructure for cyclists so that it is convenient to ride bicycles for short and medium length trips. This policy calls for establishing a bike center or bike centers that provide bike services like bicycle repair, bike parking, changing facilities, etc.

5.8.43 Bus Stop Amenities Policy

In addition to frequency and reliability of transit service, bus stop amenities also play an important role in the commuter experience. Providing adequate bus stop amenities will enhance safety and encourage increased ridership. This recommendation calls for providing benches and shelters for stops with more than 40 weekday boardings.

5.8.44 Bus Stop Redundancy Policy

The location of bus stops is an important consideration in designing bus routes. However, bus stops should not be located too close to one another as unnecessary increases in travel time and operational costs can result. Research conducted by various jurisdictions around the country has indicated that most transit riders are willing to walk up to 0.25 mile to access transit service. This policy calls for identifying stops that are redundant and removing them to help improve transit service reliability.

5.8.45 Establishment of Parking Authority

As downtown grows, parking is likely to continue to be one of the main concerns regarding downtown mobility. Addressing future parking needs will require additional resources and funds to address adequately. Based on a review of parking management practices in other cities and input from public and stakeholder interviews, it is desirable to further evaluate the establishment of a parking authority and/or an enterprise fund that will provide a dedicated source of revenue to handle critical parking issues. The implementation of this recommendation will require analysis of the implications on Metro's budget and operation.

5.8.46 Commerce Street Bike Lane

Commerce Street provides a local connection in the downtown core but it lacks the vehicular connectivity of other parallel streets like Broadway or Church Street. In addition, it also has a wide right-of-way. This makes the roadway a good candidate for providing bike lanes or other bicycle facility to improve bicycle access downtown. Figure A12 in Appendix A shows one of the potential design concepts of the proposed recommendation.

5.8.47 Church Street Bike Lane

One of the comments from the public was related to providing bike connectivity to and from downtown Nashville. Given that Church Street has lower traffic volume than other roadways that cross the interstate, it is a candidate for providing a bicycle facility. In addition, Church Street was also identified as a high bike crash location. As such, this project calls for providing bike lanes on Church Street to provide a safe and efficient route into downtown. Figure A13 in Appendix A shows the conceptual design of the bike lanes on Church Street.

5.8.48 Herman Street Sidewalk Improvement

Herman Street connects the Hope Gardens sub-area to the Marathon Village area under the I-40 / I-65 interstate bridge. MTA bus service is also provided on the roadway. However, the lack of sidewalks makes it difficult for residents in the area to access the service. This project recommends providing new sidewalks on Herman Street from 10th Avenue North to 14th Avenue North.

5.8.49 Church Street / 3rd Avenue Improvement

During the weekday p.m. peak hour, the eastbound traffic on Church Street is high since commuters traveling east are not able to use Union Street, which is one-way in the westbound direction. This creates long delays and queues at the Church Street / 3rd Avenue North intersection. This improvement provides an exclusive eastbound left-turn lane at the intersection. As shown by the conceptual design in Figure A14, this will require removing on-street parking on the south side of Church Street from Printer's Alley to 3rd Avenue North and reconstructing the curbs at the intersection.

5.8.50 Evaluation of Two-way Conversion of Union Street

Currently, Union Street is a westbound one-way street from 3rd Avenue to 6th Avenue. As a result, eastbound traffic must use Church Street or Deaderick Street to access 3rd Avenue and eventually James Robertson Parkway and the Woodland Street Bridge. During the weekday p.m. peak hour, this creates heavy traffic pressure on Church Street, which experiences long delays. This project calls for evaluating the impact of converting Union Street to two-way operation from 3rd Avenue to 6th Avenue and providing bike lanes. Figure A15 in Appendix A provides a conceptual design of the proposed recommendation.

5.8.51 Evaluation of Two-way Conversion of 6th Avenue

Currently, 6th Avenue is a southbound one-way street from Union Street to Commerce Street. As a result, northbound traffic must use 5th Avenue and 7th Avenue to access Charlotte Avenue and James Robertson Parkway. 5th Avenue was recently converted to a two-way street. This project calls for evaluating the impact of converting 6th Avenue to two-way operation from Union Street to Commerce Street. Figure A16 in Appendix A provides the conceptual design of the proposed recommendation.

5.8.52 Church Street / Rosa Parks Blvd Intersection Improvement

The westbound through movement of the Church Street / Rosa Parks Boulevard intersection is not aligned with its receiving lane. This improvement calls for aligning the westbound through movement and potentially eliminating the westbound left-turn movement at Church Street / 9th Avenue North intersection. Ideally, an additional eastbound right-turn lane should be provided so that side-by-side left-turn movements at the Rosa Parks Boulevard and 9th Avenue North intersection on Church Street can be implemented. Figure A13 shows the conceptual design of the improvement.

5.8.53 Rosa Parks / Jefferson Street Intersection Improvement

The eastbound movement of the Rosa Parks Boulevard / Jefferson Street intersection experiences long delays and queues due to the limited lane configuration. The intersection needs a second eastbound through-right turn lane to improve its operation. This improvement will require obtaining additional right-of-way from the property located on the south side of Jefferson Street from Rosa Parks Boulevard to 9th Avenue North. Figure A4 in Appendix A shows the conceptual design of the improvement.

5.8.54 Middleton Street Bike Lane

During the sub-area connectivity review, it was determined that the SoBro area lacks good east-west connections. The proposed Division Street Extension will provide a vital connection in the area. However, it is not anticipated to extend to Hermitage Avenue and the Rolling Mill Hill sub-area. Middleton Street is a likely candidate to continue the east-west connection. Hence, this project calls for providing bike lanes on Middleton Street to connect the multi-use path on the Division Street Extension to the Rolling Mill Hill Greenway. Figure A17 shows the conceptual design of the proposed recommendation.

5.8.55 Rolling Mill Hill Greenway

This project calls for maintaining and extending the Rolling Mill Hill Greenway north to the proposed Riverfront park and eventually to the Music City

Bikeway. The extension of the greenway is essential to improve the multi-modal mobility of the area as it provides an alternate route to access the Rolling Mill Hill sub-area and make connections between the residential developments in the sub-area to businesses in the downtown core.

5.8.56 Traffic Signal at Hermitage Avenue / Lindsey Avenue

Lindsey Avenue is used extensively by large interstate trucks that use the ramps on 2nd Avenue and 4th Avenue to access the industrial area on Lebanon Pike. As a result, the intersection of Hermitage Avenue and Lindsey Avenue serves high truck volume, and experiences long delays and queues. This project recommends installing a traffic signal at the intersection to help facilitate the vehicular movement through the intersection

5.8.57 Realign Peabody Street / 4th Avenue Intersection

As the SoBro sub-area develops in the near future, the traffic volume on several roadways is likely to increase significantly. This increase in traffic volume will likely amplify the operational and safety concerns of the intersections that are currently not aligned. Hence, this projects recommends aligning the intersection of Peabody Street / 4th Avenue to improve its safety and operation. Figure A18 in Appendix A shows the conceptual design of the realignment. As shown, the realignment will impact the property located on the southwest quadrant of the intersection.

5.8.58 6th Avenue South Protected Bike Lane

As mentioned previously, one of the strategies of the Multimodal Mobility Study is to provide non-motorized facilities on roadways with low vehicular traffic volume and speed. 6th Avenue South is such a roadway that also connects to the Adventure Science Center south of downtown. Hence, this project recommends providing protected bike lanes on 6th Avenue South from Demonbreun Street to Oak Street and the Adventure Science Center. This enhanced facility will connect downtown Nashville to the Adventure Science Center and encourage riders of all ages to use the facility. Figure A19 in Appendix A shows the conceptual design of the protected bike lane. At the intersections that require turn lanes, the protected bike lane is shown to transition to a multi-use path. As the areas around the intersections develop, it will be desirable to provide additional space for the turn lanes, protected bike lanes and sidewalks.

5.8.59 Lafayette Street Road Diet

Currently, Lafayette Street is a six-lane facility that carries relatively low traffic volume in comparison to the available capacity. The traffic pattern on the facility is directional with higher traffic volumes in the northwest bound direction during the weekday a.m. peak hour and even higher traffic volume in the southeast bound direction during the weekday p.m. peak hour. Nonetheless, reducing the roadway geometry to a five-lane cross-section with a center turn lane and bike lanes will provide adequate capacity for the roadway. Figure A20 in Appendix A shows the conceptual design of the proposed road diet.

5.8.60 3rd Avenue Bike Lane from KVB to Ash Street

As mentioned previously, the Multimodal Mobility Study has identified 3rd Avenue as one of the recommended designated bike routes due to its relatively low traffic volume and speed. As such, this project calls for providing bike lanes on 3rd Avenue from Korean Veterans Boulevard to Ash Street in the SoBro sub-area. This will likely require removing on-street parking on at least one side of 3rd Avenue. Figure A21 in Appendix A shows the conceptual design of the bike lanes on 3rd Avenue South.

5.8.61 Lafayette Street / Peabody Street / 7th Avenue Intersection Improvement

The current footprint of the Lafayette Street / Peabody Street / 7th Avenue intersection is extremely large, which creates operational and safety issues for pedestrians and motor vehicles alike. This recommended improvement reduces the size of the intersection, provides better delineation for motor vehicles, and reduces crossing distance for pedestrians. Figure A20 in Appendix A shows the conceptual layout of the proposed improvement.

5.8.62 Lea Avenue Sidewalk Improvement

Sidewalk on the south side of Lea Avenue from Hermitage Avenue to the alley between Hermitage Avenue and Rutledge Street is missing. Because of the anticipated increase in pedestrian and bicycle traffic in the future as this area grows, this project recommends providing the missing sidewalk in this section of Lea Avenue.

5.8.63 Peabody Street Sidewalk Improvement

As mentioned previously, the SoBro area south of Korean Veterans Boulevard is anticipated to experience high growth in the near future. This will increase both the pedestrian and vehicular traffic in the area, which will create an undesirable pedestrian environment where there are no sidewalks. This project calls for upgrading the existing sidewalk and constructing new sidewalk where it is missing on Peabody Street from 7th Avenue to Hermitage Avenue.

5.8.64 The Gulch Pedestrian/Bike Connection

Access to the Gulch sub-area is limited primarily to the 12th Avenue South / Division Street intersection, the 12th Avenue South / Demonbreun Street intersection and 11th Avenue North. Given the high density of development in the area, these access points, especially the two intersections on 12th Avenue South, are likely to continue experiencing high delays, because the limited right-of-way and geometric constraints at these intersections preclude significant capacity additions. One effective way to reduce congestion at these intersections is to provide a direct multi-modal connection between the Gulch, SoBro, and downtown Core sub-areas so that visitors and residents do not have to drive for short distance trips. This project recommends providing a pedestrian/bike bridge connecting the Gulch to the SoBro sub-area and designating a shared bike route on 10th Avenue and Lea Avenue to complete the connection.

5.9 DESCRIPTION OF LONG-TERM RECOMMENDATIONS

The long-term recommendations represent projects and policies that are likely to be implemented in the 10+ year time frame, that is from year 2025 or later. Given the uncertainty of future budget availability and priorities, some of the projects may be implemented earlier or at a later date.

5.9.65 Evaluating Parking Enterprise Options

Whether or not a separate parking authority is established by year 2025, parking is likely to continue to be a major concern in downtown, given the anticipated growth in the area. This project calls for continuing to evaluate parking enterprise options and implementing innovative technologies and policies that are designed to alleviate parking constraints in the study area.

5.9.66 Woodland Street Bridge Bike Facility

Woodland Street Bridge is currently four lanes wide and carries the lowest volume of traffic of all the bridges crossing the Cumberland River. It provides connection to the Five Points area of East Nashville, the Music City Bikeway, and the downtown Core. This makes the Woodland Street Bridge a preferred route for a bike facility. However, the proposed AMP bus rapid transit route is planned to use the Woodland Street Bridge in mixed traffic, i.e. without a dedicated bus lane, across the bridge. Hence, including a bike facility on Woodland Street Bridge would require repurposing at least one of the four travel lanes for bike traffic. Given the higher traffic volume during the p.m. peak hour, it would be desirable to provide two eastbound travel lanes, one westbound travel lane for vehicle and bus traffic, and one travel lane for two-way bike traffic. Figure A22 in Appendix A shows the conceptual design of the proposed recommendation.

5.9.67 YMCA Way / Rosa Parks Ramp Improvement

The existing configuration of the YMCA Way / Rosa Parks Ramp intersection includes a sharp angle at which the ramp intersects YMCA Way. The goal of this project is to realign the intersection to provide improved operation. An alternative is to install all-way STOP control at the intersection. Figure A23 shows the conceptual design of the proposed recommendation.

5.9.68 11th Avenue North Roadway Connection

11th Avenue North is the only roadway that provides a direct connection between the Gulch and the North Gulch sub-areas as it travels under the Demonbreun Street, Broadway, and Church Street viaducts. In addition, the roadway has the potential to connect to the Hope Gardens sub-area with a road connection and bridge, which will help relieve traffic volumes at the Rosa Parks Boulevard/Jefferson Street intersection. The project also provides access to the interstate ramps on Charlotte Avenue for the industrial uses near Herman Street. This project will require providing a grade separated railroad crossing.

5.9.69 Rosa Parks Boulevard Protected Bike Lane

Rosa Parks Boulevard is a state facility that will likely experience higher pedestrian, bicycle and vehicular traffic volume in the future with continued growth in Germantown, Hope Gardens and the construction of the proposed Nashville ballpark. This will also mean greater use of the Music City Bikeway and the Bicentennial Mall. Hence, this project recommends providing a two-way protected bike lane on the east side of Rosa Park Boulevard from James Robertson Parkway to Jefferson Street by taking the existing space between the sidewalk and the parking lot of the Farmer's Market. The loss of landscaping may be recovered by providing a landscaped median on Rosa Parks Boulevard while still providing turn lanes at the intersections. At Locklayer Street, the median will provide pedestrian refuge for crossing Rosa Parks Boulevard, connecting the Hope Gardens sub-area to the Farmer's Market for pedestrians. Figure A24 shows the conceptual design of the recommended improvement.

5.9.70 10th Circle North Multi-Modal Improvement

10th Circle North follows the CSX rail tracks with approximately a 60-foot buffer between the two. This space may be redesigned to provide multi-modal connection between the Music City Bikeway and the North Gulch Greenway.

5.9.71 Rosa Parks Boulevard / JR Parkway Intersection Improvement

The eastbound left-turn movement at the Rosa Parks Boulevard / James Robertson Parkway intersection currently experiences long vehicular queues and is likely to experience longer queues and delay in the future. As such, this project recommends providing dual eastbound left-turn lanes by removing the median. In addition, the intersection area may also be redesigned to reduce the size so that there is a longer weaving distance to the Charlotte Avenue ramp, located only about 100 feet to the south of the southbound right-turn lane. Also, this improvement will reduce the distance for pedestrians to cross the intersection. Figure A24 shows the conceptual design of the improvement.

5.9.72 Hermitage Avenue Multi-Use Path

The current three-lane cross-section of Hermitage Avenue has been designated as a shared bike route. However, as Hermitage Avenue has a reversible center lane that changes direction during the morning and evening peak hours, providing a separate multi-use path or a two-way protected bike lane next to the sidewalk will help improve the operation and safety of both bicyclists and vehicles. Figure A25 shows the conceptual design of the proposed recommendation.

5.9.73 2nd Avenue Protected Bike Lane

In an effort to connect the proposed Division Street Extension to the Rolling Mill Hill Greenway, this project recommends providing a two-way protected bike lane on the east side of 2nd Avenue from Ash Street to Middleton Street.

Figure A26 shows the conceptual design of the proposed recommendation.

5.9.74 Rolling Mill Hill RIRO/LI Access

The sub-area connectivity review identified limited access to the Rolling Mill Hill sub-area, which currently can only be accessed via Hermitage Avenue. This creates long delays at the accesses and especially at 1st Avenue / KVB intersection. This project recommends providing right-in/right-out/left-in access on KVB so employees and residents in the sub-area have an alternate way to enter and exit the area, and hence, relieve traffic pressure from Hermitage Avenue. Figure A8 shows the conceptual design of the proposed recommendation.

5.9.75 Lea Avenue Realignments

The Rutledge Hill and SoBro sub-areas lack good east-west connectivity. This issue is likely to be exacerbated with anticipated growth in the area. Hence, this project recommends realigning Lea Avenue at 3rd Avenue South and Rutledge Street to provide better local access and circulation. Figure A27 shows the conceptual design of the proposed realignments.

5.9.76 Elm Street / Middleton Street Intersection Realignment

In order to provide better east-west connection in the area, this project recommends realigning Middleton Street to Elm Street. Figure A17 shows the conceptual design of the proposed realignment.

5.9.77 Lafayette Avenue / Lea Avenue / 6th Avenue Improvement

The intersection of Lafayette Avenue / Lea Avenue / 6th Avenue is complex due to the misalignment of Lea Avenue. The operation and safety of the intersection will be improved by aligning Lea Avenue on the east side of 5th Avenue. This realignment also improves the east-west connection in the area and reduces out-of-direction travel. Furthermore, as 6th Avenue is designated as a preferred bike route, this alignment improves safety for bicyclists as well. Figure A28 shows the conceptual design of the proposed improvement.

5.9.78 Laurel Street Extension

The Gulch sub-area is anticipated in continue to grow in the foreseeable future which will add traffic pressure on the few roadways that currently provide access to the area, namely 12th Avenue South, 11th Avenue South, Demonbreun Street and Division Street. Future traffic analysis showed that without an alternate access to the Gulch sub-area, the operation of these roadways will continue to deteriorate. Given that there is limited right-of-way to add capacity on these roadways, the mobility study recommends extending Laurel Street over I-40/I-65 to connect 12th Avenue South to Division Street. This connection will greatly alleviate the traffic pressure on Demonbreun Street and Division Street. In addition, the extension will potentially open the opportunity to cap I-40/I-65 between the recommended extension and Division Street or Demonbreun Street and use the space for a public park, additional vehicular parking or other use that would benefit the residents, employees and visitors to the Gulch and Music Row districts to the west. Figure A29 shows the conceptual design of the proposed realignment.

5.9.79 Demonbreun Street / 12th Avenue South Improvement

The anticipated growth of the Gulch sub-area is likely to put increasing traffic pressure at the Demonbreun Street / 12th Avenue South intersection. Due to limited availability of right-of-way around the intersection, the proposed recommendation will require cooperation with property owners. Figure A9 shows the conceptual design of the proposed improvement that calls for providing additional through lanes for the westbound and southbound approaches.

TABLE 18. RECOMMENDED PROJECTS AND POLICIES

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
Short Term (0-5 years)						
1	Bike Parking Policy	Establish a policy to increase bike parking in high activity areas.	Provide adequate bike facilities to help increase bike ridership	Policy	Bike	All
2	Taxicab Stand Policy	Increase taxicab stands near high activity areas including near hotels, event centers, etc.	Improve for-hire service in downtown	Policy	For-Hire	All
3	Wayfinding Sign Program	Install ITS, sign and guidance system.	Improve wayfinding and mobility. Included from MPO-TIP	Enhancement	Multi-Modal	All
4	Encourage TDM Measures	Have appropriate organization such as RTA study the need for TDM programs to encourage transportation demand management.	Improve overall mobility of all modes by reducing single occupancy vehicles	Strategy	Multi-Modal	All
5	Pedestrian Signal Timing Improvements	Implement LPI, ped scramble, or maximize ped signal times in areas with poor pedestrian corner circulation, high crash frequency or high ped volume.	Improve pedestrian mobility & safety by allowing pedestrian to start crossing ahead of vehicles; increase pedestrian signal times, where appropriate	Safety	Pedestrian	All
6	Music City Circuit Improvements	Improve reliability, STOP visibility, expansion of service, etc.	Improve ridership and visitor experience	Connectivity	Transit	All
7	Transit Signal Priority	Implement TSP to increase service reliability.	Improve transit reliability	Operation	Transit	All
8	Retime Traffic Signals To Improve Traffic Flow	Determine corridors for retiming of traffic signals, especially with closely spaced intersections.	Poorly timed closely spaced intersections create high delay in corridors.	Operation	Vehicular	All
9	Innovative Parking Solutions	Further evaluate innovative parking solutions like demand responsive pricing, smart parking meters, monitoring, etc., to determine appropriate policies to implement.	Improve parking efficiency, parking turnover at meters	Strategy	Vehicular	All
10	Riverfront Park Protected Bike Lane	Provide 2-way protected bike lane from Union to KVB, on the east side of 1st Avenue. See Figure A1.	Extend bike network where bike activity is high.	Connectivity	Bike	Core
11	8th Avenue Shared Bike Route	Provide shared bike route on 8th Avenue, South of Broadway.	Improve regional bicycle network.	Connectivity	Bike	Core

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
12	7th Avenue Bike Lane	Provide bike lane on 7th Avenue from Demonbreun to Charlotte. See Figure A2.	Extend bike network where pavement width is available.	Connectivity	Bike	Core
13	3rd Avenue Shared Bike Route	Evaluate the feasibility of providing shared bike route or exclusive lane on 3rd Avenue from JR Parkway to KVB.	Need North/South bike lane connection	Connectivity	Bike	Core
14	9th Avenue N Shared Bike Route	Designate 9th Avenue from Church to Demonbreun as shared bike route.	Provide bike connection between two east/west connections, i.e. Church and Demonbreun	Connectivity	Bike	Core
15	Horse Carriage Policy	Work with MTLC to establish more defined policy for determining appropriate locations for additional horse carriage stands in downtown.	Improve for-hire service; Enhance visitor experience	Policy	For-Hire	Core
16	Lower Broadway Improvement	Achieve better pedestrian mobility from 5th Avenue to 1st Avenue by reducing sidewalk clutter and improving pedestrian path of travel.	High pedestrian volumes	Enhancement	Pedestrian	Core
17	Pedestrian Improvement on 2nd Ave - Broadway to Church	Increase lighting, investigate replacing street trees or trimming vegetation.	Improve pedestrian safety	Safety	Pedestrian	Core
18	Pedestrian improvement on Church St. - 4th to Printer's Alley	Install ped scramble phase at Church & 4th, and sign to warn vehicles of pedestrians in alley.	Improve pedestrian safety	Safety	Pedestrian	Core
19	Charlotte Avenue / 10th Avenue N Improvement	Provide eastbound left-turn lane. See Figure A3.	Improve vehicular circulation for the area	Operation	Vehicular	Core
20	10th Avenue N Shared Bike Route	Designate 10th Avenue N from Harrison to Jefferson as shared bike route.	Extend bike network and connect to Music City Bikeway	Connectivity	Bike	Hope Gardens
21	Jefferson Street Bike Lane	Provide bike lane on Jefferson Street, east of Rosa Parks. See Figure A4.	Included from Bikeways Program	Connectivity	Bike	Hope Gardens
22	3rd Avenue N Bike Lane	Provide bike lane on 3rd Avenue from Jefferson to JR Parkway. See Figure A5.	Improve bicycle network by providing continuous North/South bike connection	Connectivity	Bike	North Capitol
23	4th Avenue N Bike Lane	Provide bike lane from Music City Bikeway to 3rd Avenue. See Figure A6.	Improve bicycle connection to Music City Bikeway	Connectivity	Bike	North Capitol
24	Charlotte Avenue Shared Bike Route	Provide shared bike route on Charlotte Ave from 3rd Avenue to 14th Avenue.	Improve bicycle network by connecting to existing bike lane on Charlotte.	Connectivity	Bike	North Capitol

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
25	Jefferson Street Improvements- 3rd Avenue to 5th Avenue	Provide additional EBTH and WBLT lane at 3rd Avenue. Modify traffic signals at 4th and 5th. See Figure A4.	Improve operation and circulation to accommodate ballpark project	Operation	Multi-Modal	North Capitol
26	4th Avenue Sidewalk Improvement	Rehabilitate existing and provide new sidewalk on 4th Avenue from Jefferson Street to Jackson Street.	Improve pedestrian mobility to connect Germantown to downtown	Connectivity	Pedestrian	North Capitol
27	Pedestrian Improvement on Jefferson - 7th to Rosa Parks	Increase visibility of crosswalk at 7th. Include "Yield to Ped in Crosswalk" sign. Potentially install HAWK ped signal.	Improve pedestrian safety	Safety	Pedestrian	North Capitol
28	Pedestrian Improvement at Charlotte & Rosa Parks	Add STOP sign at exit of state parking lot, "Yield to Ped" sign.	Improve pedestrian safety	Safety	Pedestrian	North Capitol
29	3rd Avenue N / JR Parkway	Provide dual westbound left-turn lane. See Figure A7.	High WBLT volume, queues	Operation	Vehicular	North Capitol
30	Two-Way Conversion of 3rd Avenue N	Convert 3rd Avenue N to two-way from Madison Street to 4th Avenue N and add bike lanes. See Figure A5.	Improve circulation for the area	Operation	Vehicular	North Capitol
31	Extend KVB Bike Lane	Provide bike lane on KVB bridge to Shelby Avenue. See Figure A8.	Improve bicycle connection to East Nashville	Connectivity	Bike	SoBro
32	Demonbreun Street Bike Lane Connection	Provide buffered bike lane on Demonbreun Street from 12th Avenue to 14th Avenue. See Figure A9.	Provide bike connection across the I-40/I-65 interchange area	Connectivity	Bike	SoBro
33	Thermal Site Greenway	Provide greenway along the Cumberland River.	Improve multi-modal connectivity	Connectivity	Multi-Modal	SoBro
34	Division St / 8th Avenue S Improvement	Provide NBLT and SBLT lanes. See Figure A10.	Improve operation and safety	Operation	Vehicular	SoBro
35	1st Avenue / KVB Improvements	Provide EBLT, dual WBLT and 2nd SBTH lane. See Figure A8.	Reduce delay and queue at the intersection	Operation	Vehicular	SoBro
36	2nd Avenue / KVB Intersection Improvement	Provide EBLT lane. See Figure A8.	Reduce delay and queue at the intersection	Operation	Vehicular	SoBro
37	3rd Avenue / KVB Intersection Improvement	Provide EBTH-RT, SBLT turn lanes. See Figure A8.	Improve operation and safety	Operation	Vehicular	SoBro
38	4th Avenue / KVB Intersection Improvement	Provide EBTH-RT lane. See Figure A8.	Improve operation and safety	Operation	Vehicular	SoBro
39	Lindsley Avenue Protected Bike Lane	Provide protected bike lane on Lindsley Ave. from 2nd to Hermitage Ave. See Figure A11.	Provide bike connectivity in Rutledge Hill from 3rd to Hermitage Ave.	Connectivity	Bike	Rutledge Hill

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
40	Division Street Extension	Extend Division Street from 8th Avenue S to 2nd Avenue S.	Improve connectivity between the Gulch and Sobro	Connectivity	Multi-Modal	The Gulch
41	11th Avenue Complete Streets	Provide cycle track and sidewalk on 11th Avenue from Charlotte Avenue to Pine Street.	Improve multi-modal connectivity	Connectivity	Multi-Modal	The Gulch
Mid-Term (6-10 years)						
42	Bike Center Policy	Encourage establishment of a bike center.	Improve bicycle infrastructure in the City and make it more user friendly to help increase bike ridership	Policy	Bike	All
43	Bus Stop Amenities Policy	Provide adequate amenities at stops with more than 40 weekday boardings.	Help improve bus ridership and reduce traffic congestion	Policy	Transit	All
44	Bus Stop Redundancy Policy	Conduct detailed study to determine the potential to combine or remove stops.	Improve transit reliability	Policy	Transit	All
45	Establishing Parking Authority	Evaluate the desirability of establishing a parking authority or enterprise fund.	To generate revenues sufficient to cover operating expenses and debt servicing associated with capital improvements such as new parking facilities	Policy	Vehicular	All
46	Commerce St. Buffered Bike Lane	Evaluate the impact of providing bike lane with parking from 2nd Avenue to 9th Avenue. See Figure A12.	Extend bike network where pavement width is available	Connectivity	Bike	Core
47	Church Street Bike Lane	Provide bike lane on Church Street west of YMCA Way. See Figure A13.	Improve bicycle network where ROW is available and lower traffic volumes exist	Connectivity	Bike	Core
48	Herman Street Sidewalk Improvement	Provide sidewalk on Herman Street from 10th Avenue N to 14th Avenue N.	Improve pedestrian mobility in the area	Safety	Pedestrian	Core
49	Church Street / 3rd Avenue Improvement	Provide eastbound left-turn lane. See Figure A14.	Reduce delay and queue at the intersection.	Operation	Vehicular	Core
50	Evaluate Two-Way Conversion of Union Street	Evaluate the impact of converting one-way section of Union Street from 3rd to 6th to 2-way and add bike lane. See Figure A15.	Reduce traffic on Church, improve circulation, improve bike network	Operation	Vehicular	Core
51	Evaluate Two-Way Conversion of 6th Avenue	Evaluate the conversion of one-way section of 6th Avenue from Union to Commerce. See Figure A16.	Reduce traffic on 5th Avenue, improve circulation	Operation	Vehicular	Core
52	Church Street / Rosa Parks Blvd Improvement	Align WBTH Lane. Additional ROW may be required. See Figure A13.	Improve alignment and operation at the intersection	Operation	Vehicular	Core

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
53	Rosa Parks / Jefferson Intersection Improvement	Provide exclusive EBTH-RT lane. Additional ROW required. See Figure A4.	Reduce EB queue spill back	Operation	Vehicular	Hope Gardens
54	Middleton Street Bike Lane	Provide bike lane on Middleton Street from RMH Greenway to 2nd Ave. See Figure A17.	Provide bike connection from Rolling Mill Hill greenway to Division Street multi-use path	Connectivity	Bike	Rolling Mill Hill
55	Rolling Mill Hill Greenway	Provide greenway along the Cumberland River and connect to Thermal site.	Improve multi-modal connectivity	Connectivity	Multi-Modal	Rolling Mill Hill
56	Traffic signal at Hermitage Avenue / Lindsey Avenue	Install traffic signal.	High truck traffic. Improve operation and safety	Operation	Vehicular	Rutledge Hill
57	Realign Peabody Street / 4th Avenue S	Realign Peabody Street to improve safety. See Figure A18.	Currently misaligned. Improve operation and safety	Safety	Vehicular	Rutledge Hill
58	6th Avenue S Protected Bike Lane	Provide protected bike lane on 6th Avenue from Demonbreun Street to Oak Street. See Figure A19.	Improve multi-modal connection to Adventure Science Center from downtown	Connectivity	Bike	SoBro
59	Lafayette Street Road Diet	Provide bike lane and 5 travel lanes. See Figure A20.	Improve bicycle network by reducing one-travel lane	Connectivity	Bike	SoBro
60	3rd Avenue Bike Lane	Provide bike lane on 3rd Avenue from KVB to Ash Street. See Figure A21.	Provide north/south bike connection	Connectivity	Bike	SoBro
61	Lafayette St / Peabody / 7th Ave Improvement	Redesign the intersection. See Figure A20.	Currently oversized intersection. Improve operation and safety	Safety	Multi-Modal	SoBro
62	Lea Avenue Sidewalk Improvement	Rehabilitate existing sidewalk and provide new sidewalk from Rutledge Street to Hermitage Avenue.	Improve pedestrian mobility, if realignment project #75 does not move forward.	Connectivity	Pedestrian	SoBro
63	Peabody Street Sidewalk Improvement	Rehabilitate existing sidewalk and provide new sidewalk on the north side of Peabody from 5th to 6th.	Some section do not have sidewalks as, existing building is built to the street	Connectivity	Pedestrian	SoBro
64	The Gulch Pedestrian/Bike Bridge	Provide non-motorized connection between the Gulch and SoBro.	Improve connectivity between the Gulch and Sobro	Connectivity	Multi-Modal	The Gulch
Long-term (10+ years)						
65	Evaluate Parking Enterprise Options	Continue to evaluate parking solutions to address on-going parking concerns.	Improve parking options and manage parking	Policy	Vehicular	All
66	Woodland Street Bridge Improvement	Provide bike facility on Woodland Street Bridge. See Figure A22.	Improve bike connection to East Nashville	Connectivity	Bike	Core

Map ID	Project Name	Description	Justification / Comment	Category	Mode	Sub-Area
67	YMCA Way / Rosa Parks Ramp Improvement	Realign intersection or install All-way Stop. See Figure A23.	Improve safety at the intersection	Safety	Vehicular	Core
68	11th Avenue N Roadway Connection	Connect 11th Avenue N from Hope Gardens to North Gulch (will require railroad crossing)	Provides continuous road connection from Jefferson Street to the Gulch	Connectivity	Vehicular	Hope Gardens
69	Rosa Parks Blvd Protected Bike Lane	Provide protected bike lane on east side of Rosa Park Blvd from Jefferson Street to JR Parkway. See Figure A24.	Improve bicycle network by connecting to existing shared route on JR Parkway.	Connectivity	Bike	North Capitol
70	10th Circle N Multimodal Improvement	Provide multi-use path on west side of 10th Circle N.	Improve pedestrian mobility for TSU and state employees and provide connection between Gulch Greenway and Music City Bikeway	Connectivity	Multi-Modal	North Capitol
71	Rosa Parks / JR Parkway Improvement	Provide dual eastbound left turn lane, and reconstruct intersection. See Figure A24.	Improve operation and safety	Operation	Vehicular	North Capitol
72	Hermitage Avenue Multi-use Path or Protected Bike Lane	Provide multi-use path or protected bike lane on Hermitage Avenue. See Figure A25.	Improve safety with separation of riders and motorists	Connectivity	Bike	Rolling Mill Hill
73	2nd Avenue Protected Bike Lane	Provide 2-way protected bike lane from Middleton to Ash Street, on east side of 2nd Avenue. See Figure A26.	Provide 2-way connection between RMH and Division Street multi-use path	Connectivity	Bike	Rolling Mill Hill
74	Rolling Mill Hill Access	Provide Right-In/Right-out/ Left-In Access from KVB. See Figure A8.	Increase secondary access to Rolling Mill Hill sub-area and reduce traffic on 1st / KVB	Operation	Vehicular	Rolling Mill Hill
75	Lea Avenue Realignments	Realign Lea Avenue at 3rd Avenue and at Rutledge Street. See Figure A27.	Currently misaligned. Improve operation and safety	Safety	Vehicular	Rutledge Hill
76	Elm Street & Middleton Street Realignment	Align Elm Street & Middleton Street. See Figure A17.	Currently misaligned. Improve operation and safety	Safety	Vehicular	Rutledge Hill
77	Lafayette St / Lea Ave / 6th Ave Improvement	Redesign the intersections. See Figure A28.	Currently misaligned. Improve operation and safety. Additional ROW required	Safety	Vehicular	SoBro
78	Laurel Street Extension	Construct new bridge over I-40/I-65 to provide alternate access to the Gulch at Laurel Street. See Figure A29.	Reduce congestion and delays for 12th Avenue intersections at Division and Demonbreun Streets	Connectivity	Multi-modal	The Gulch
79	Demonbreun Street / 12th Avenue S Improvement	Provide additional WBTH and SBRT lane. Will require additional ROW. See Figure A9.	Improve operation and safety.	Operation	Vehicular	The Gulch

APPENDIX

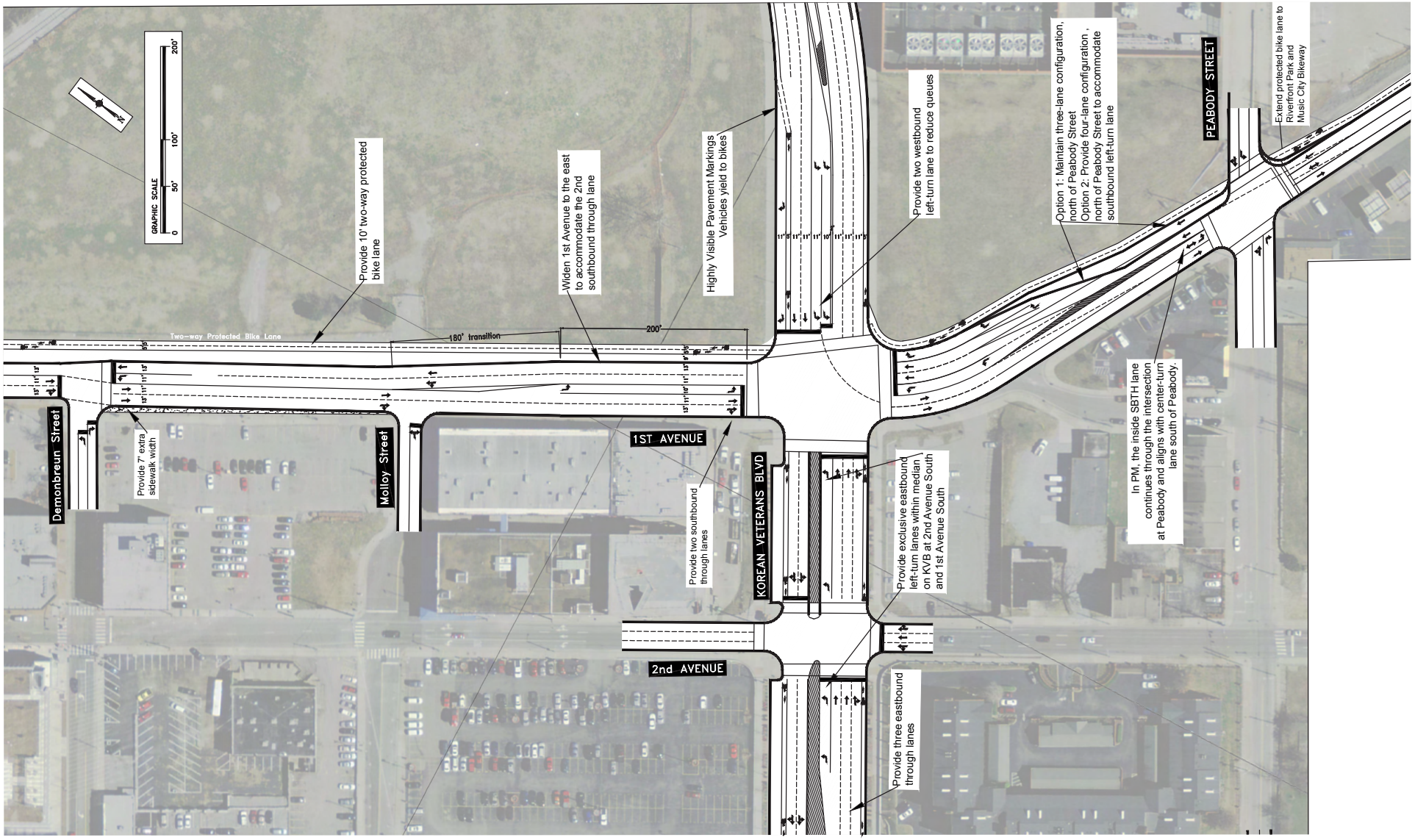


FIGURE A1. Conceptual Design: 1st Avenue and Korean Veterans Boulevard

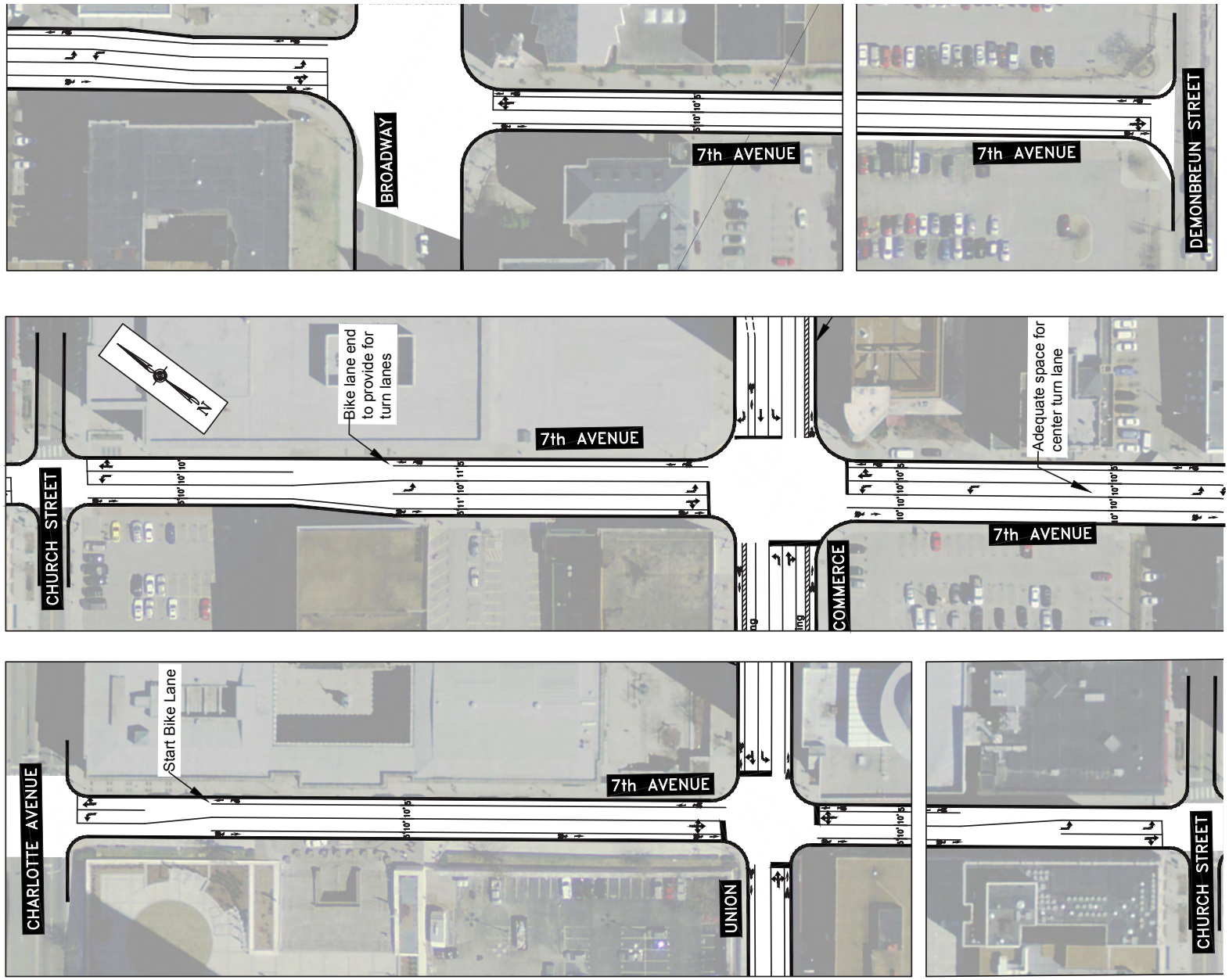


FIGURE A2. Conceptual Design: 7th Avenue

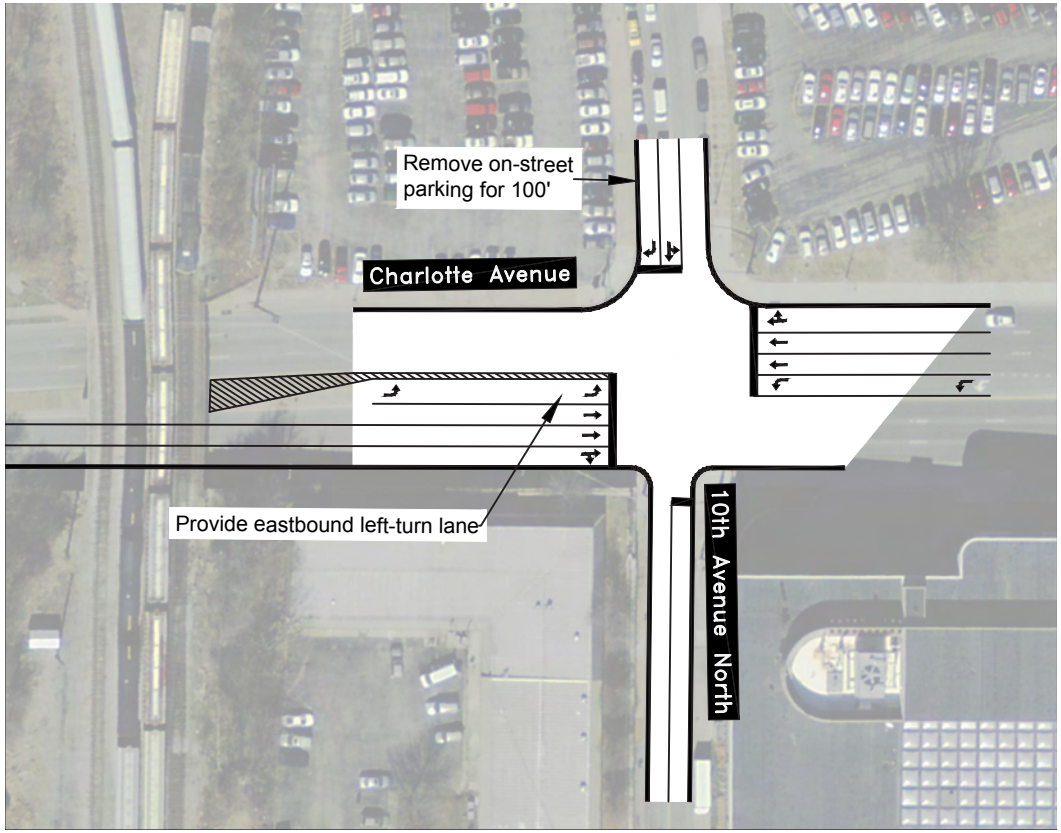


FIGURE A3. Conceptual Design: 10th Avenue and Charlotte

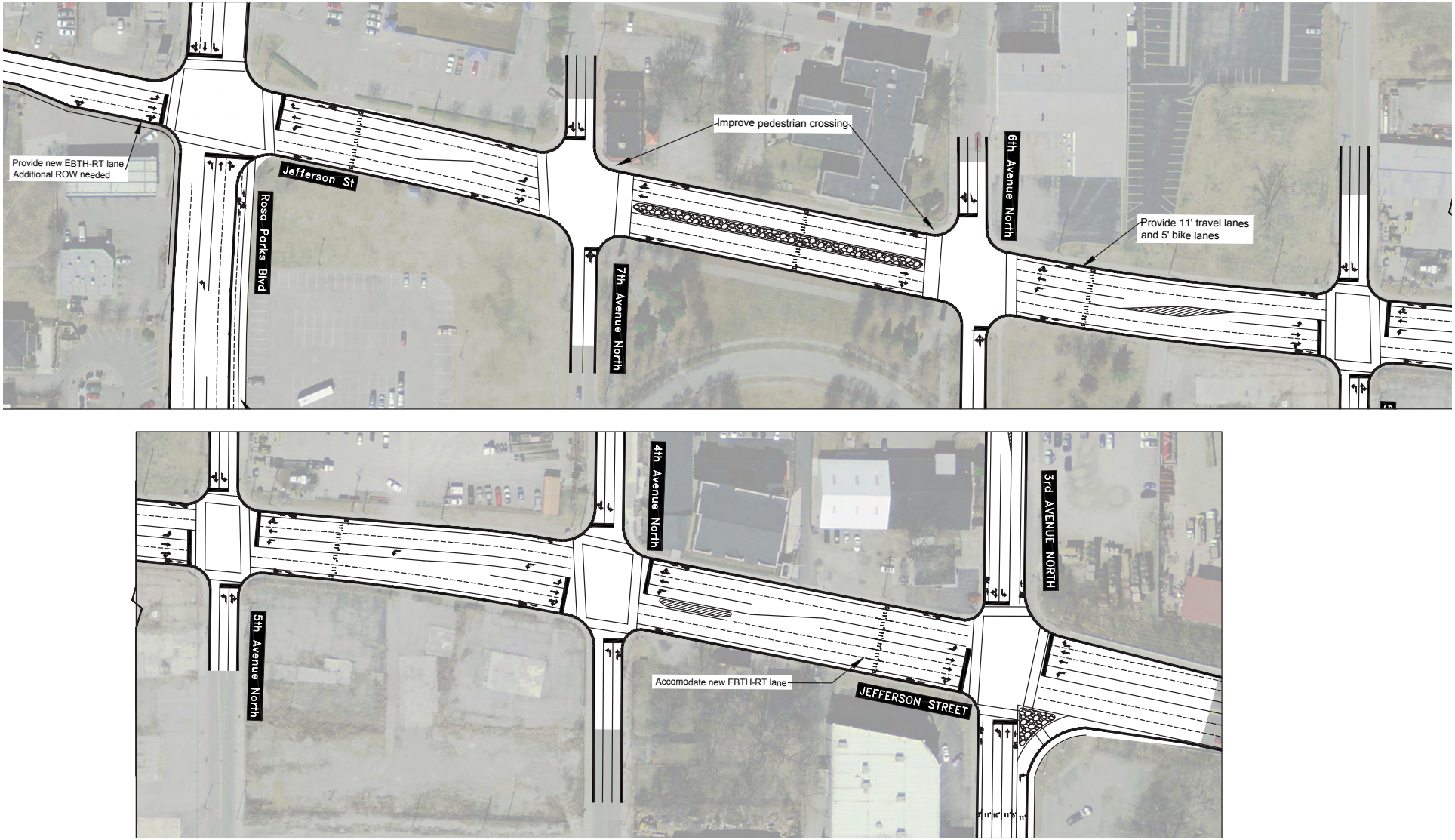


FIGURE A4. Conceptual Design: Jefferson Street

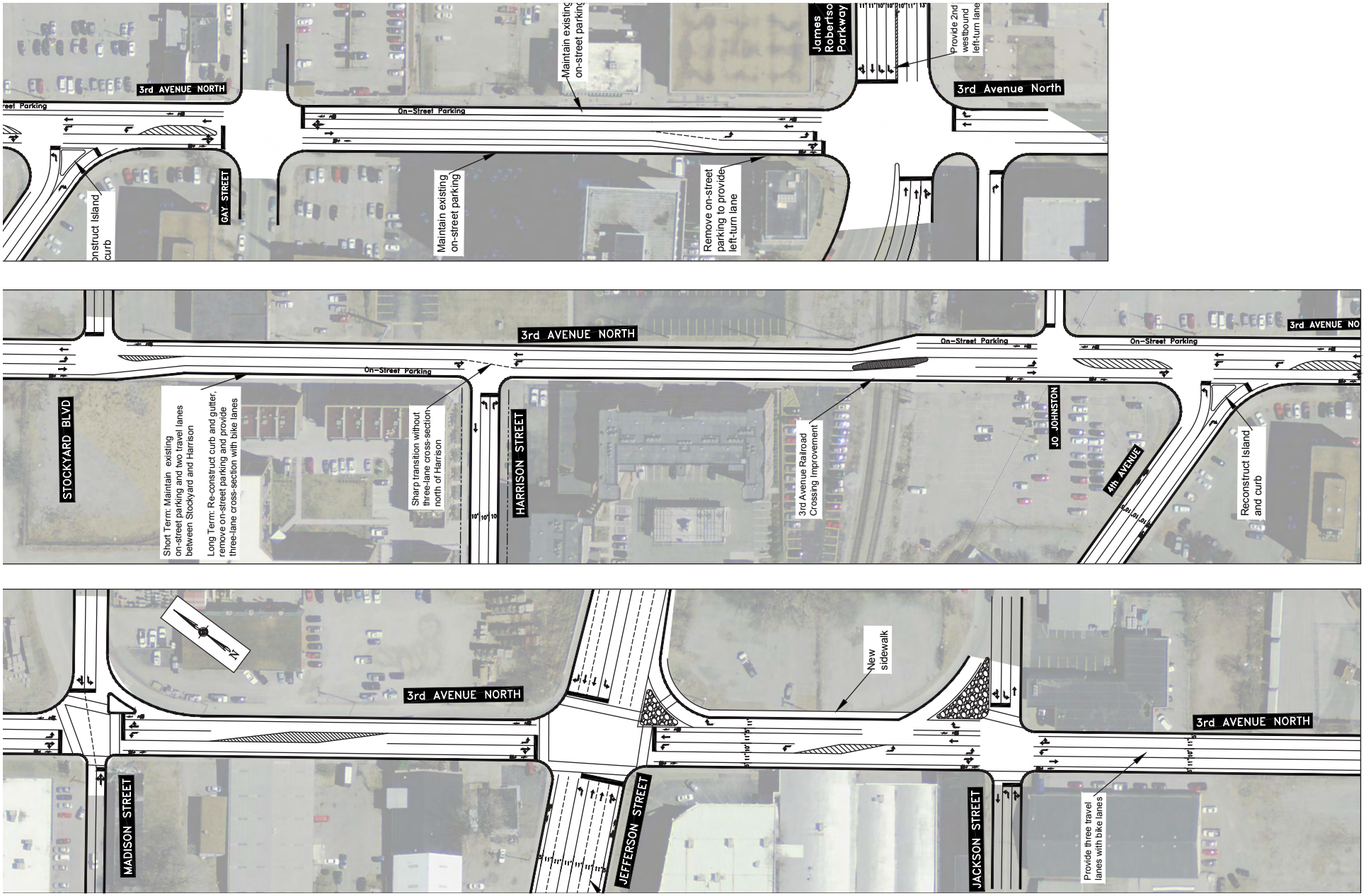


FIGURE A5. Conceptual Design: 3rd Avenue North

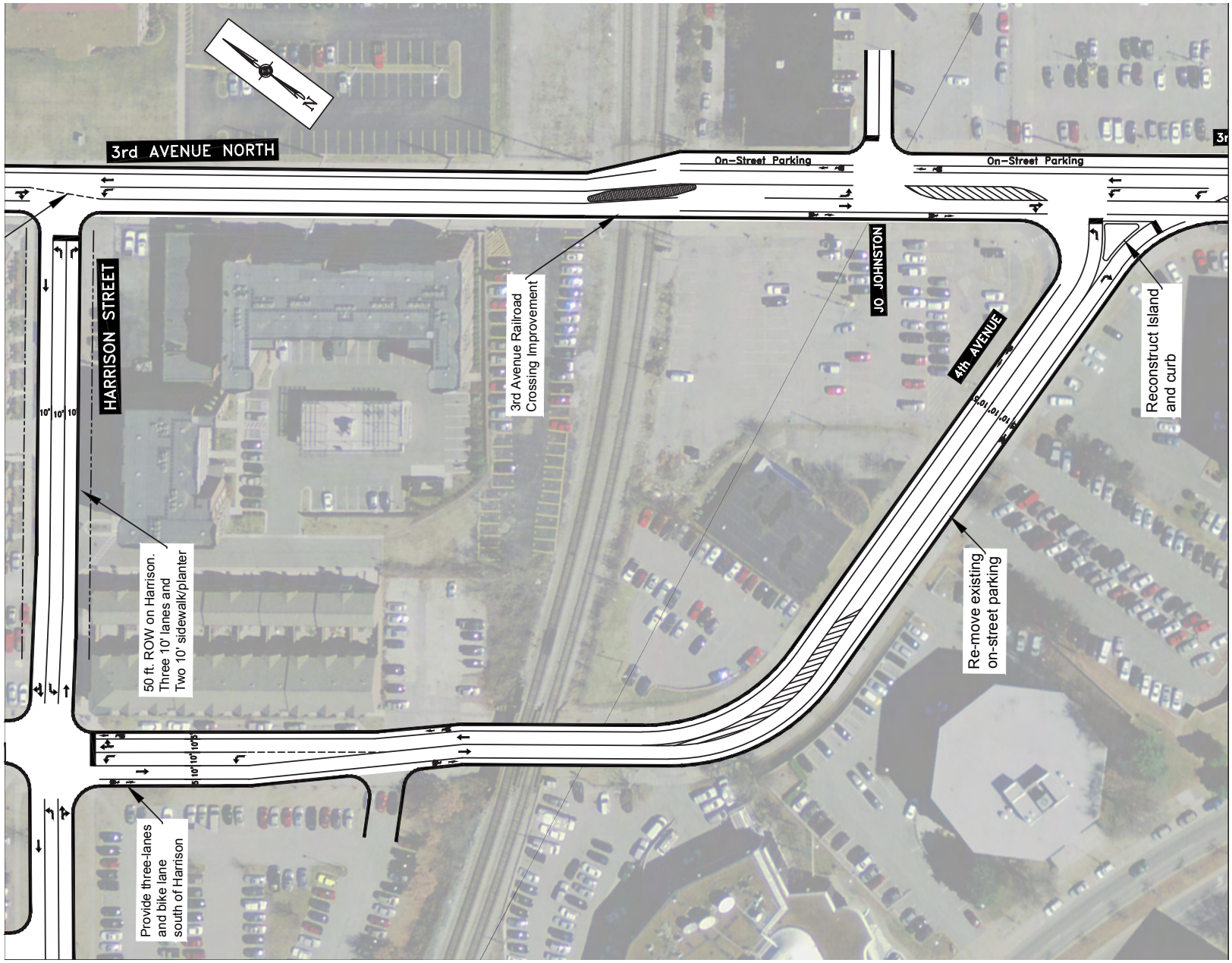


FIGURE A6. Conceptual Design: 4th Avenue

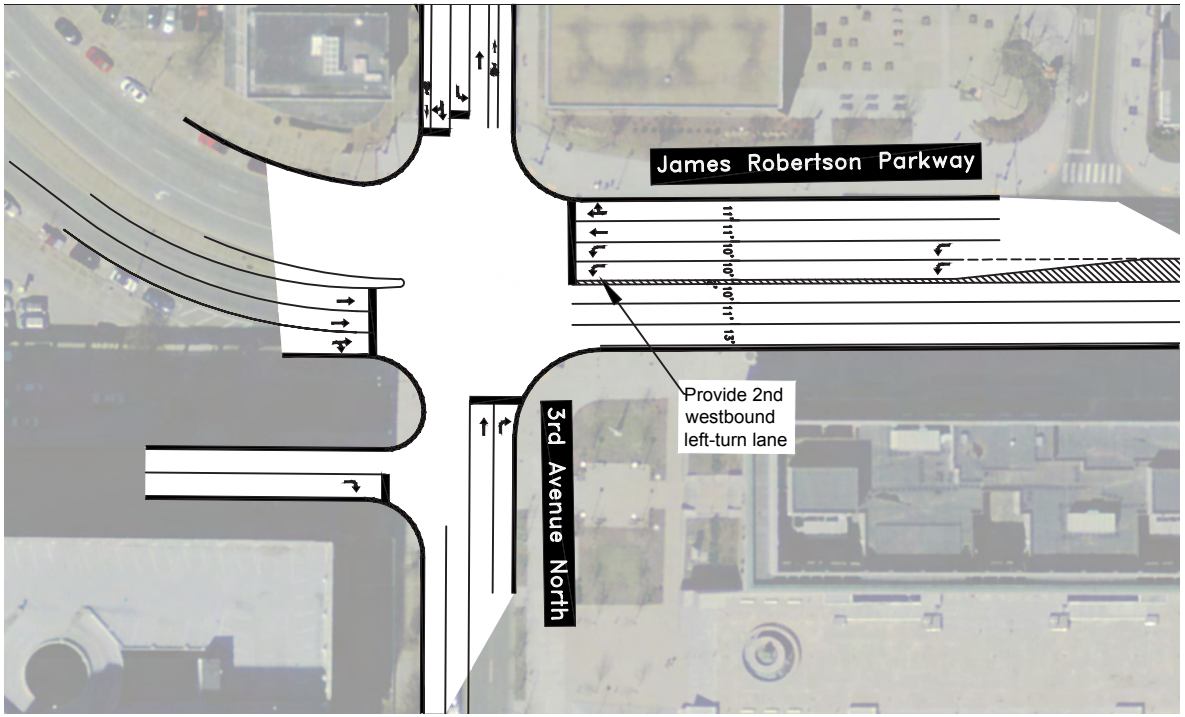


FIGURE A7. Conceptual Design: 3rd Avenue and JR Parkway

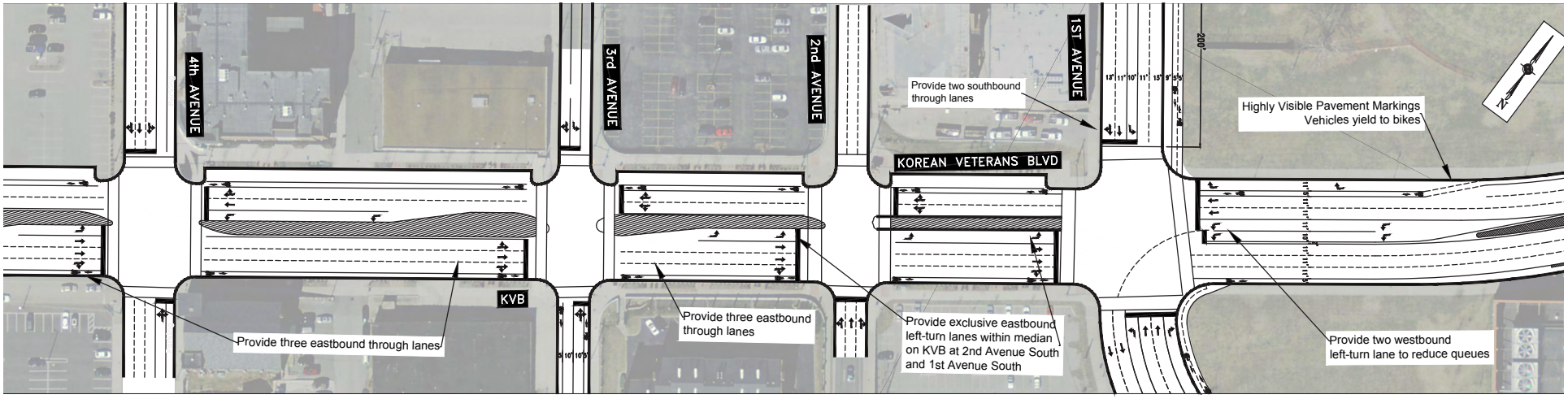


FIGURE A8-1. Conceptual Design: Korean Veterans Boulevard

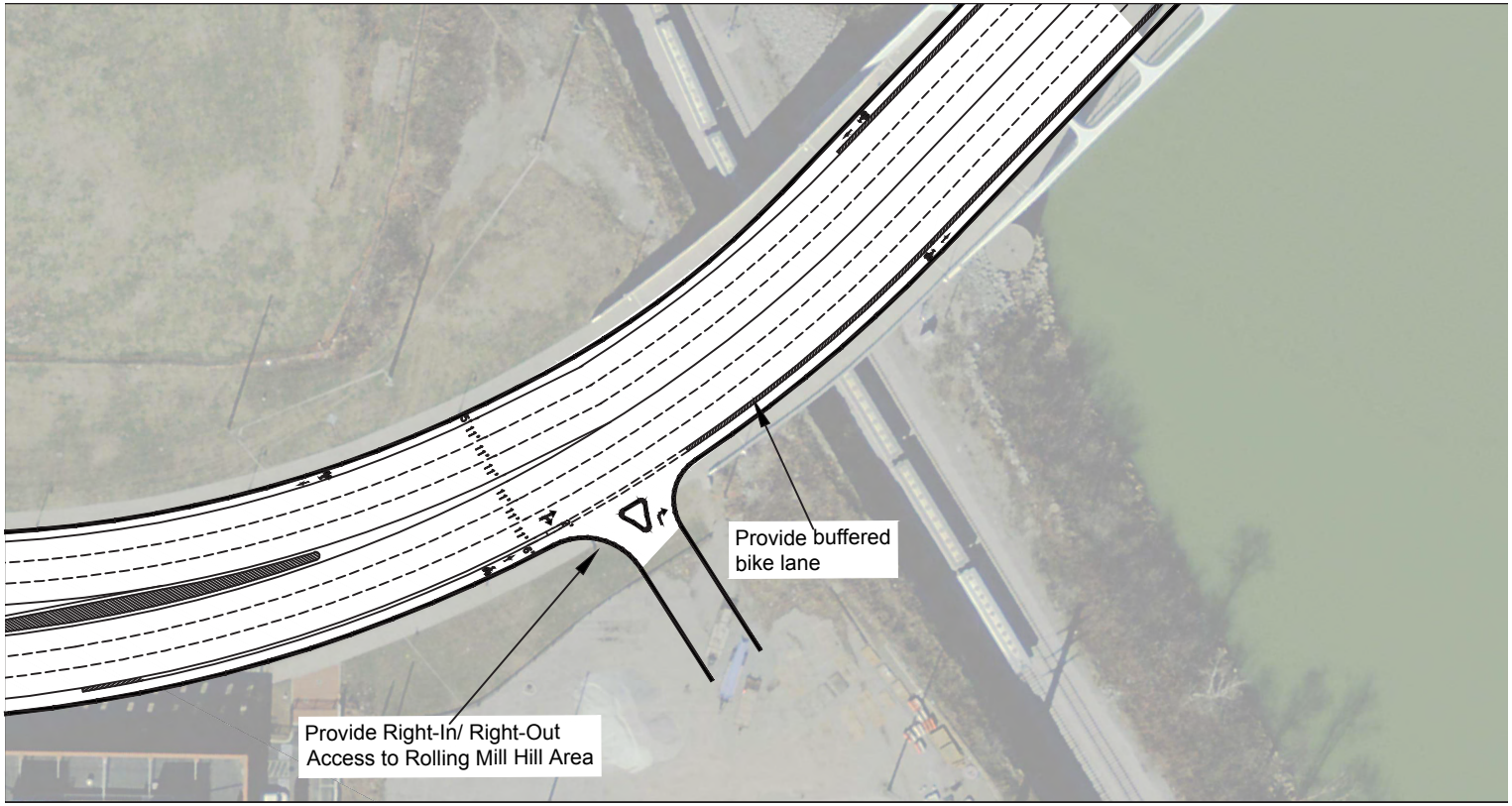


FIGURE A8-2. Conceptual Design: Korean Veterans Boulevard

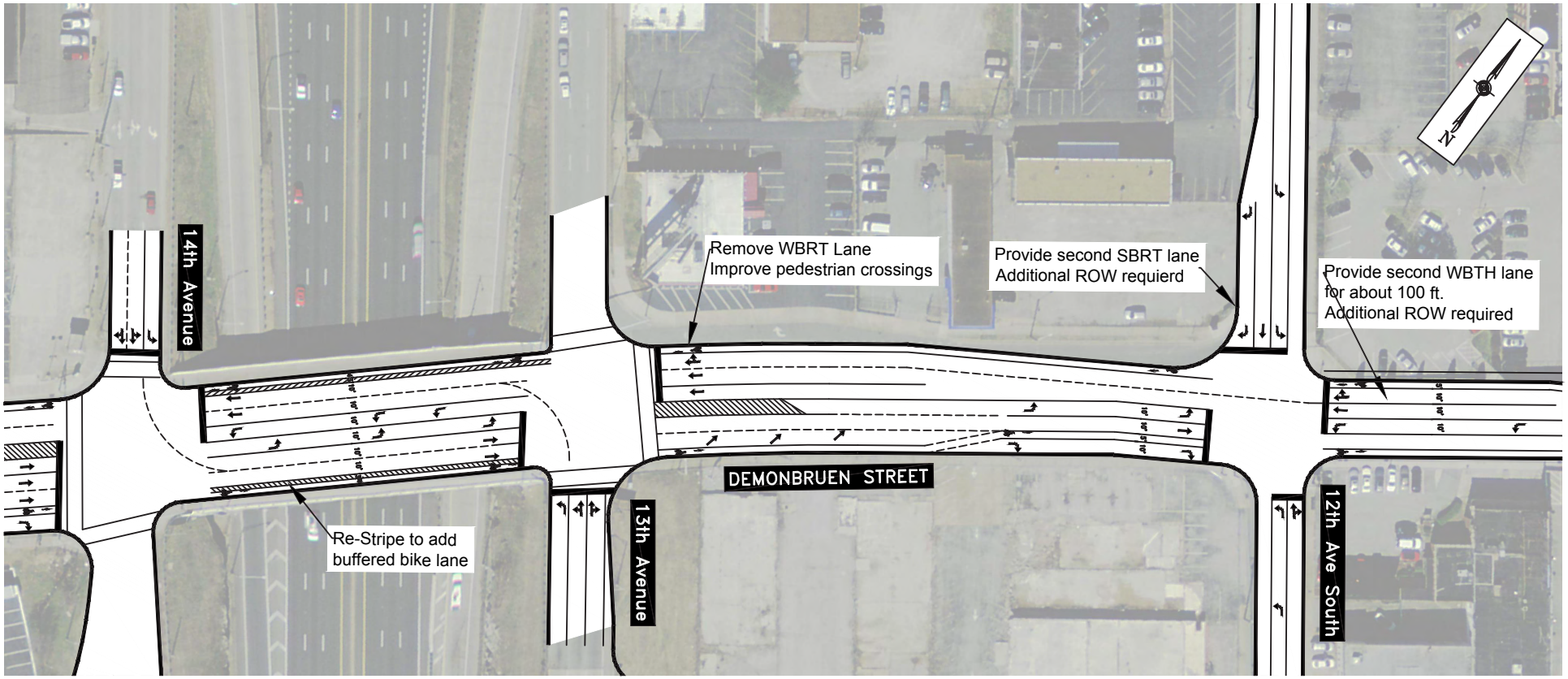


FIGURE A9. Conceptual Design: Demonbreun Street

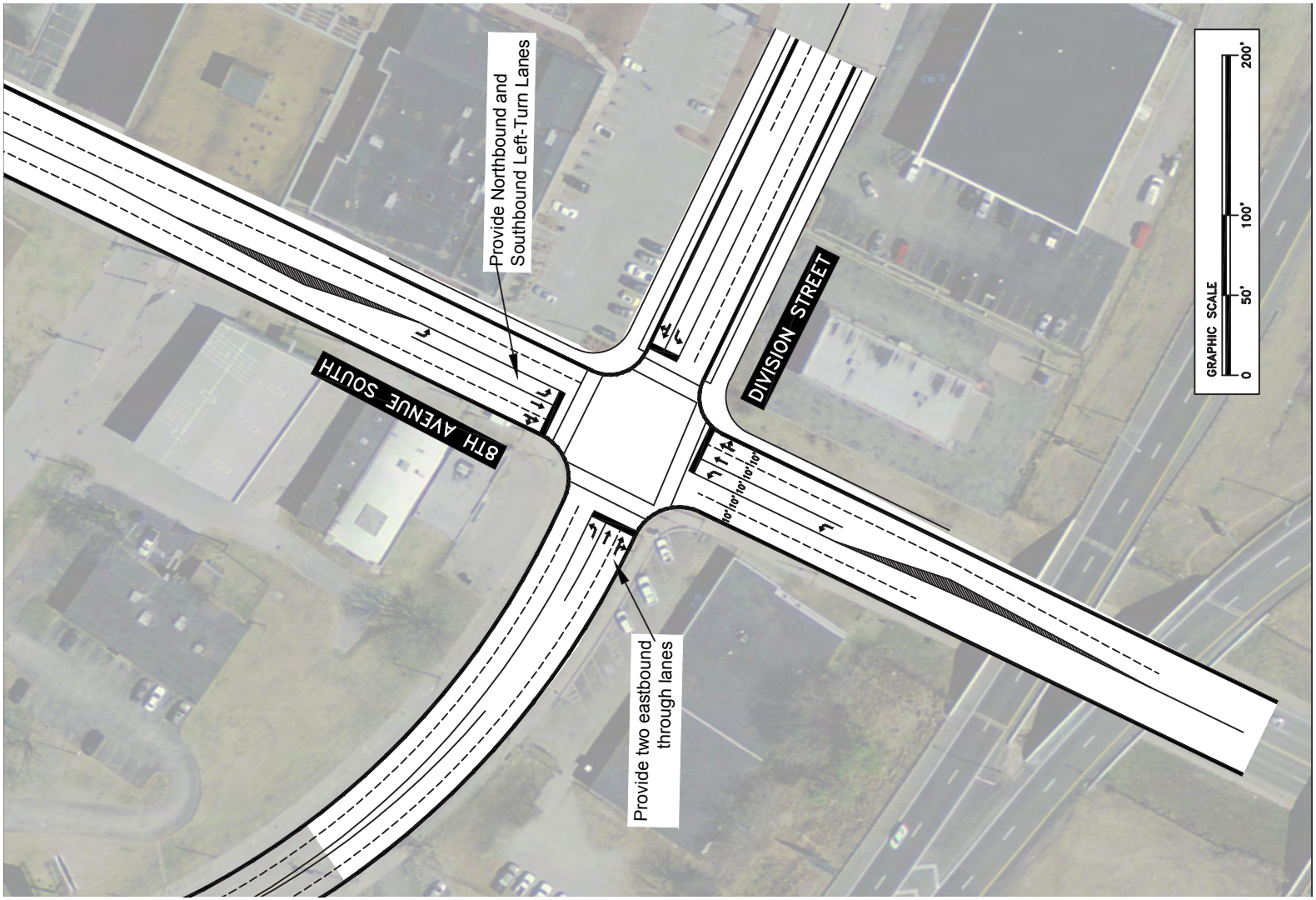


FIGURE A10. Conceptual Design: 8th Avenue and Division Street

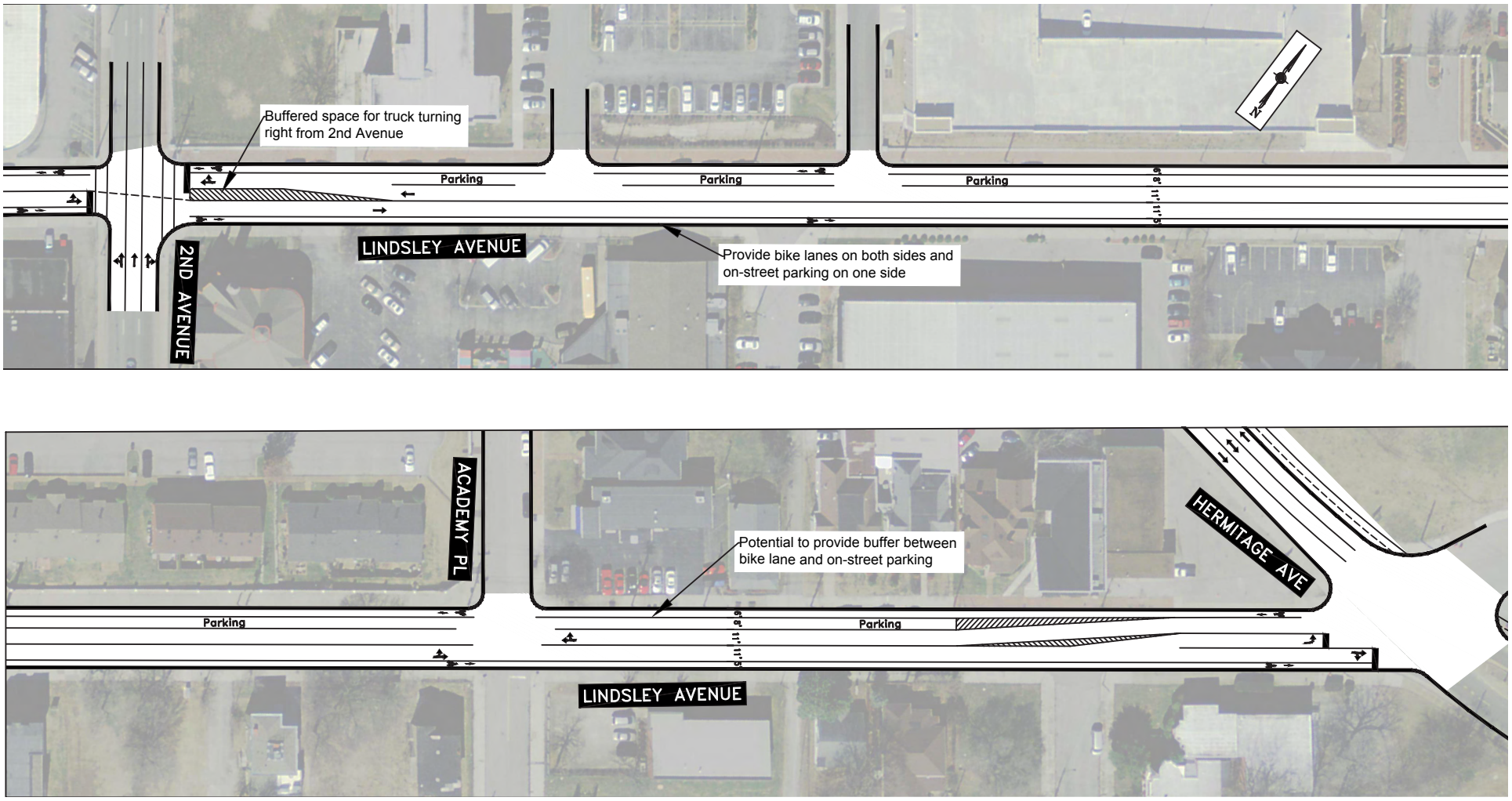
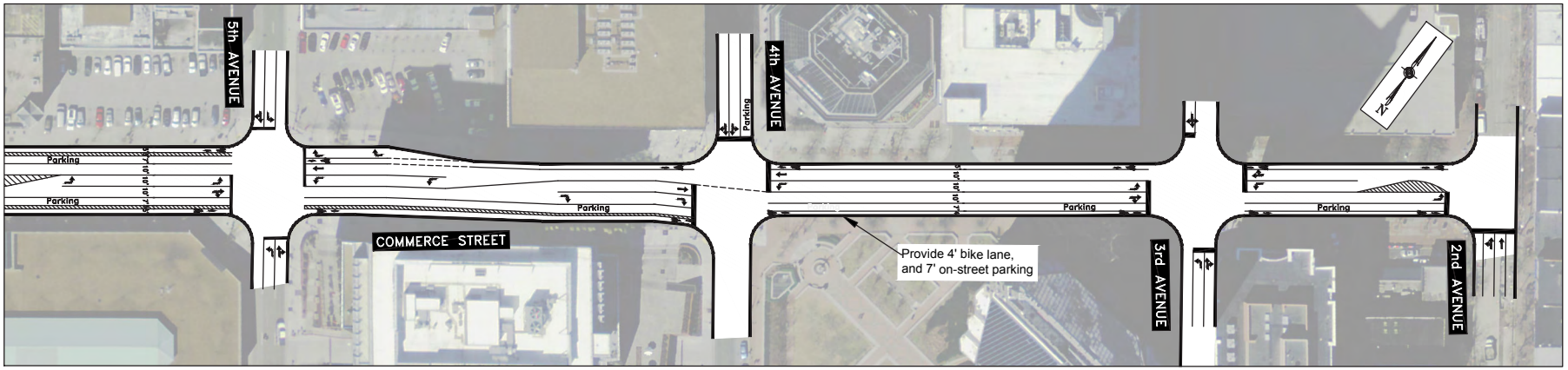


FIGURE A11. Conceptual Design: Lindsley Avenue



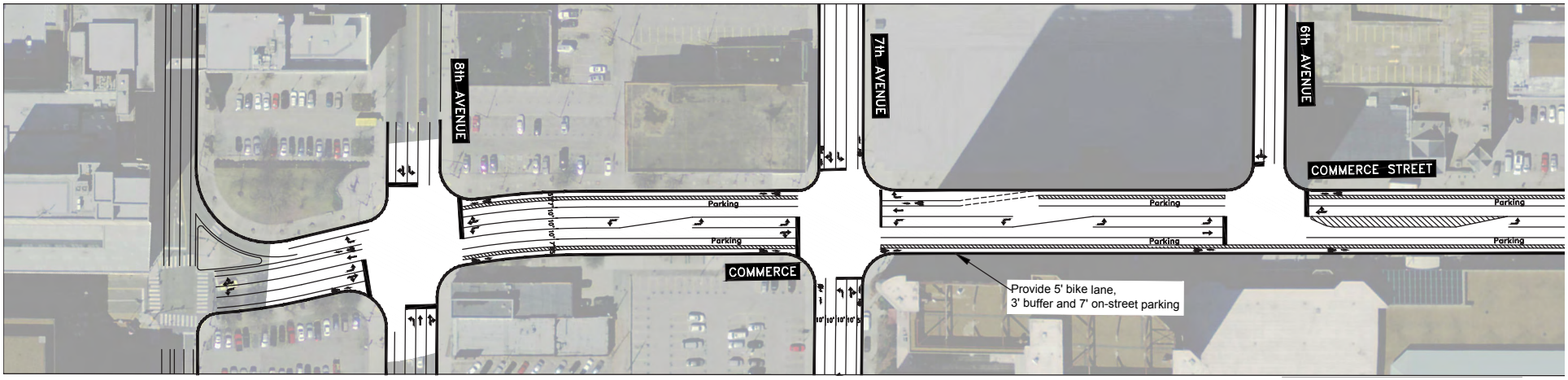


FIGURE A12. Conceptual Design: Commerce Street

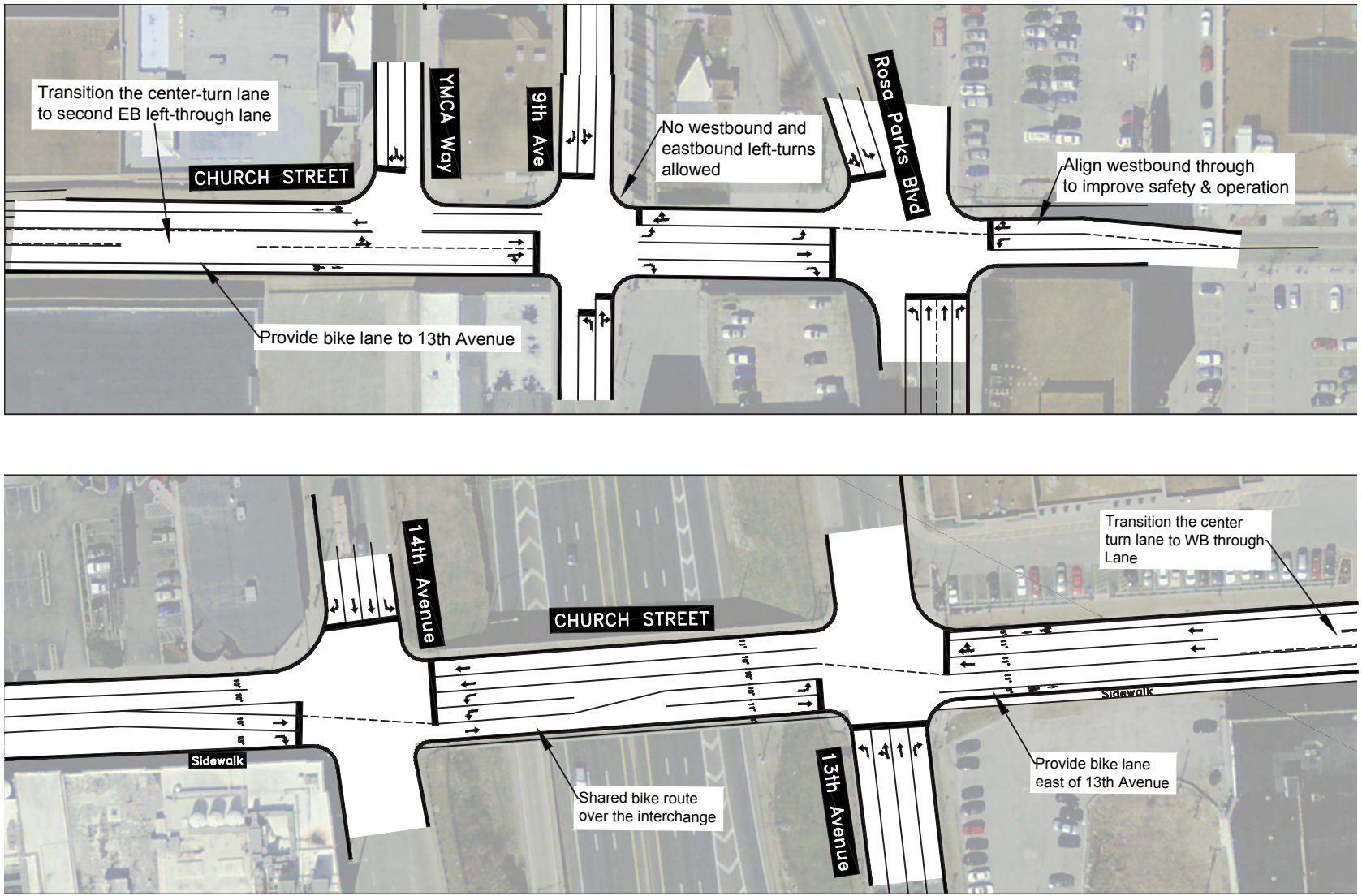


FIGURE A13. Conceptual Design: Church Street

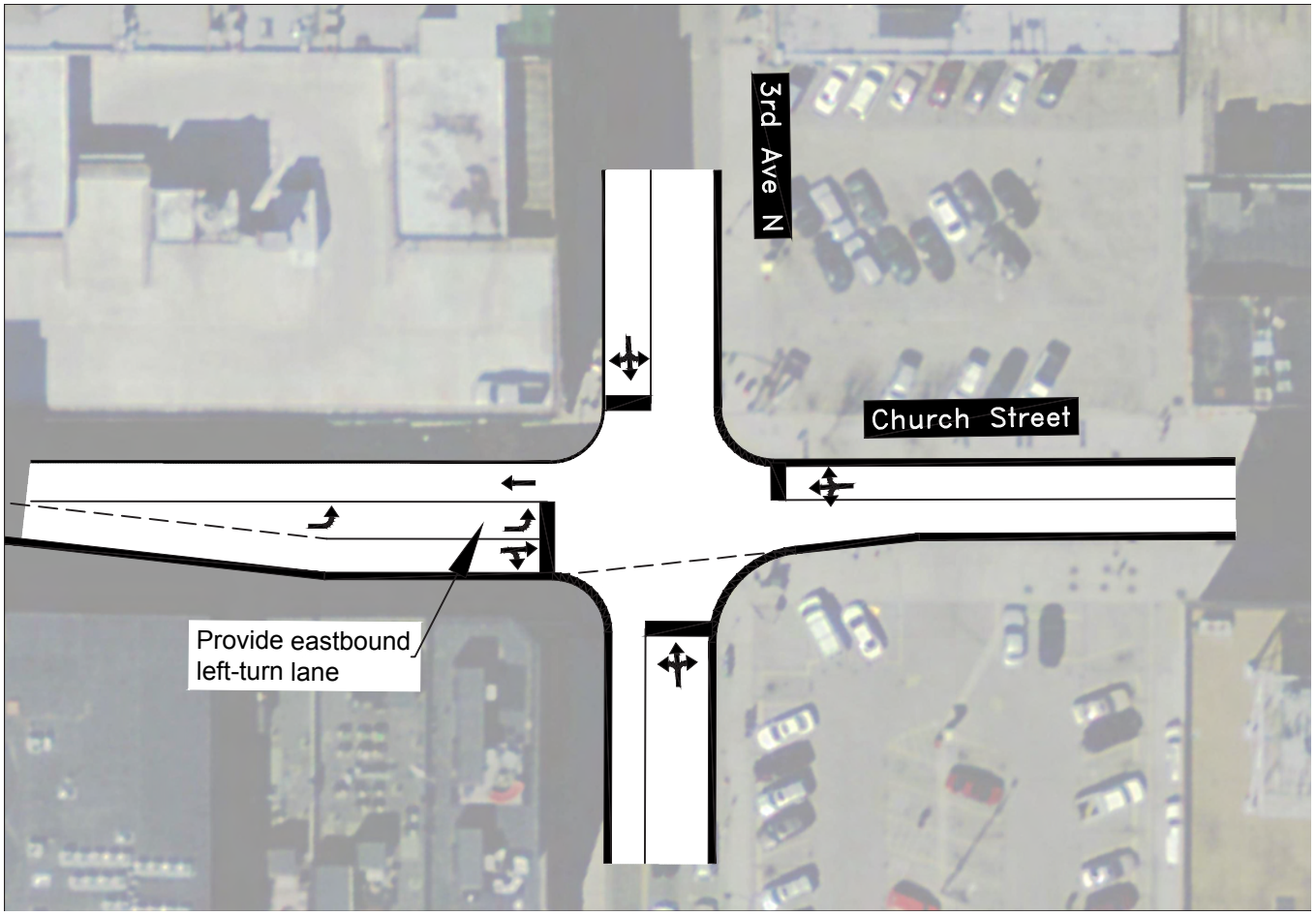


FIGURE A14. Conceptual Design: 3rd Avenue and Church Street

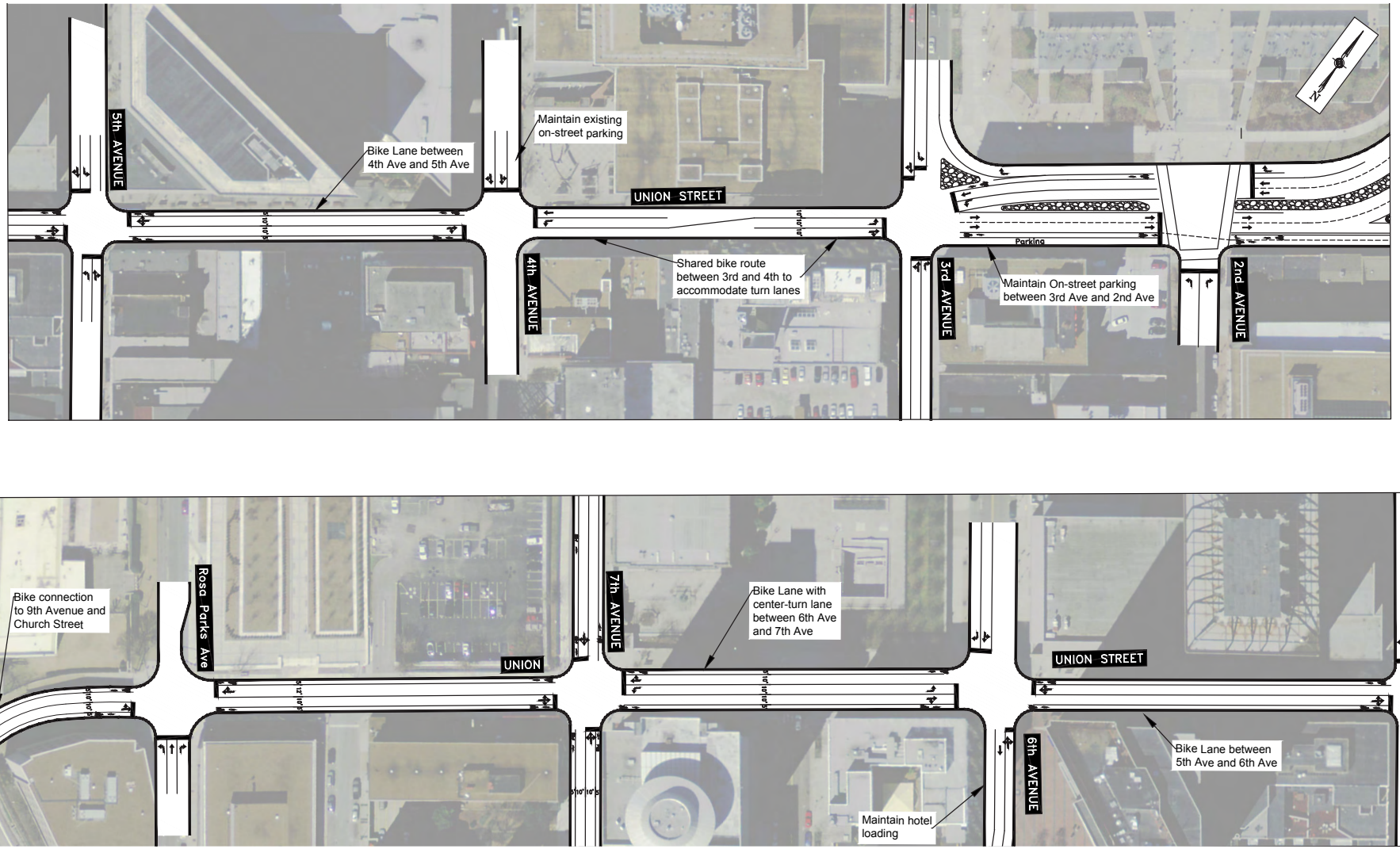
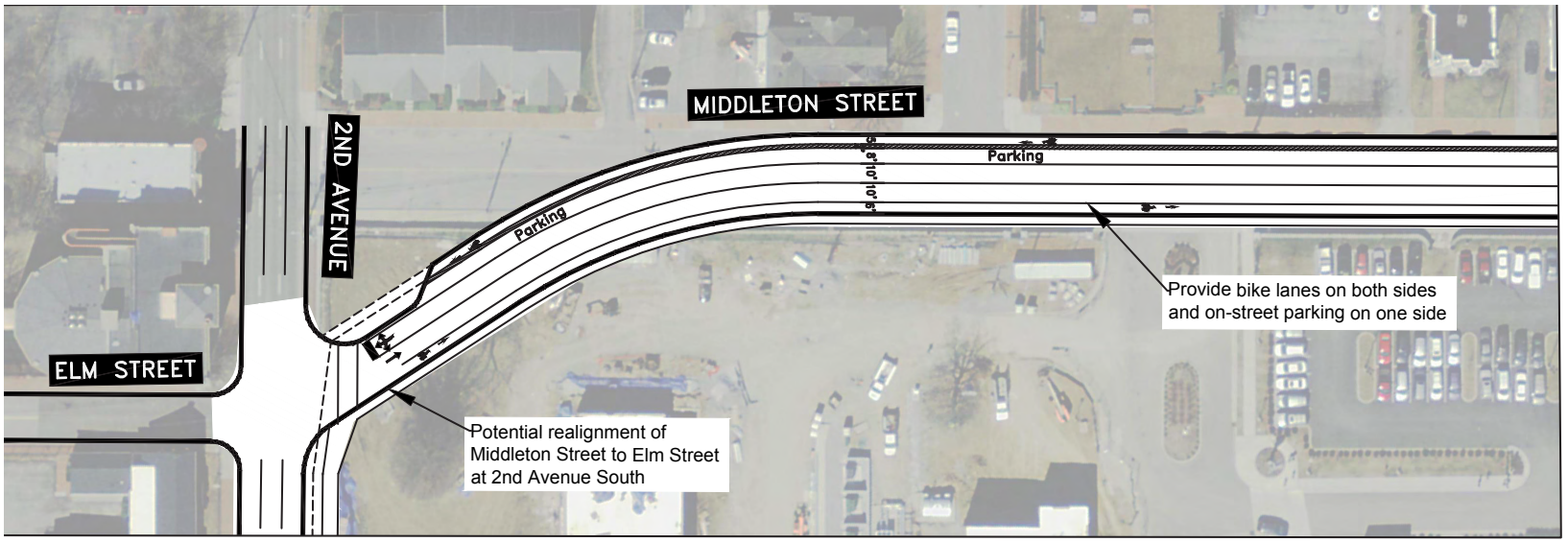


FIGURE A15. Union Street

FIGURE A16. Conceptual Design: 6th Avenue



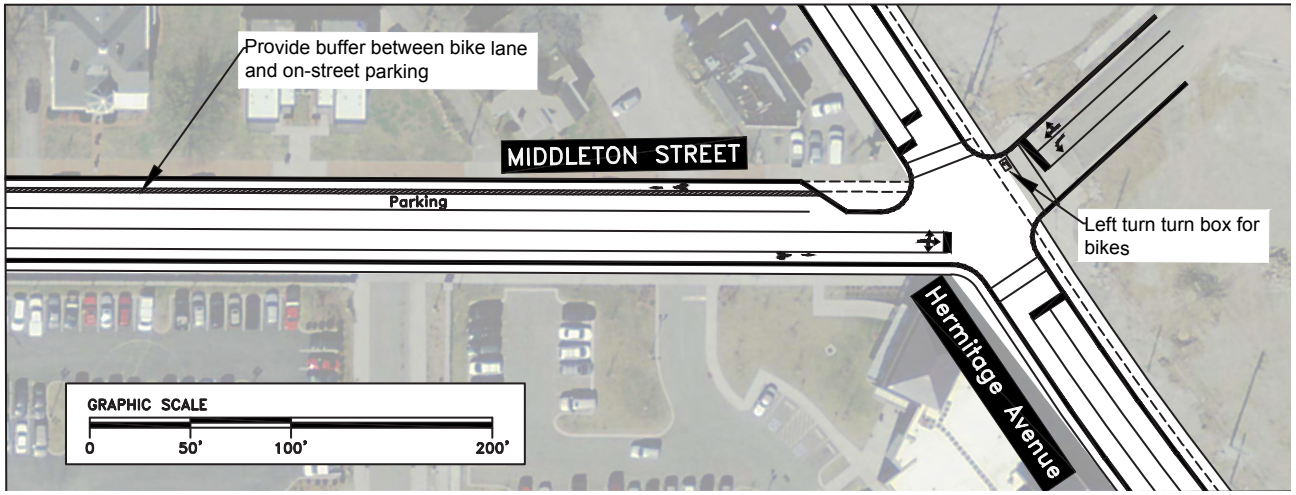


FIGURE A17. Conceptual Design: Middleton Street

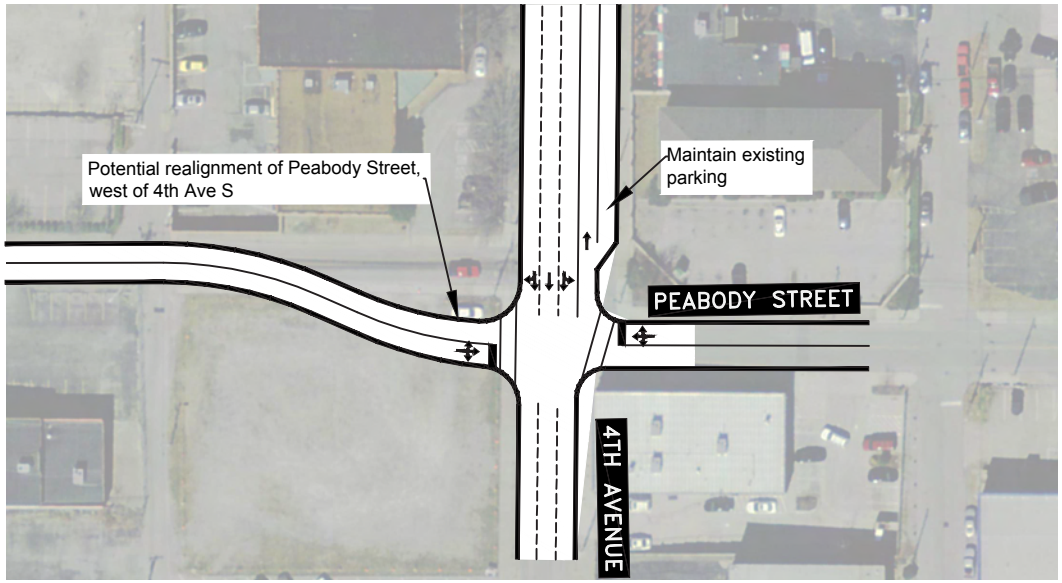


FIGURE A18. Conceptual Design: 4th Avenue South and Peabody Street

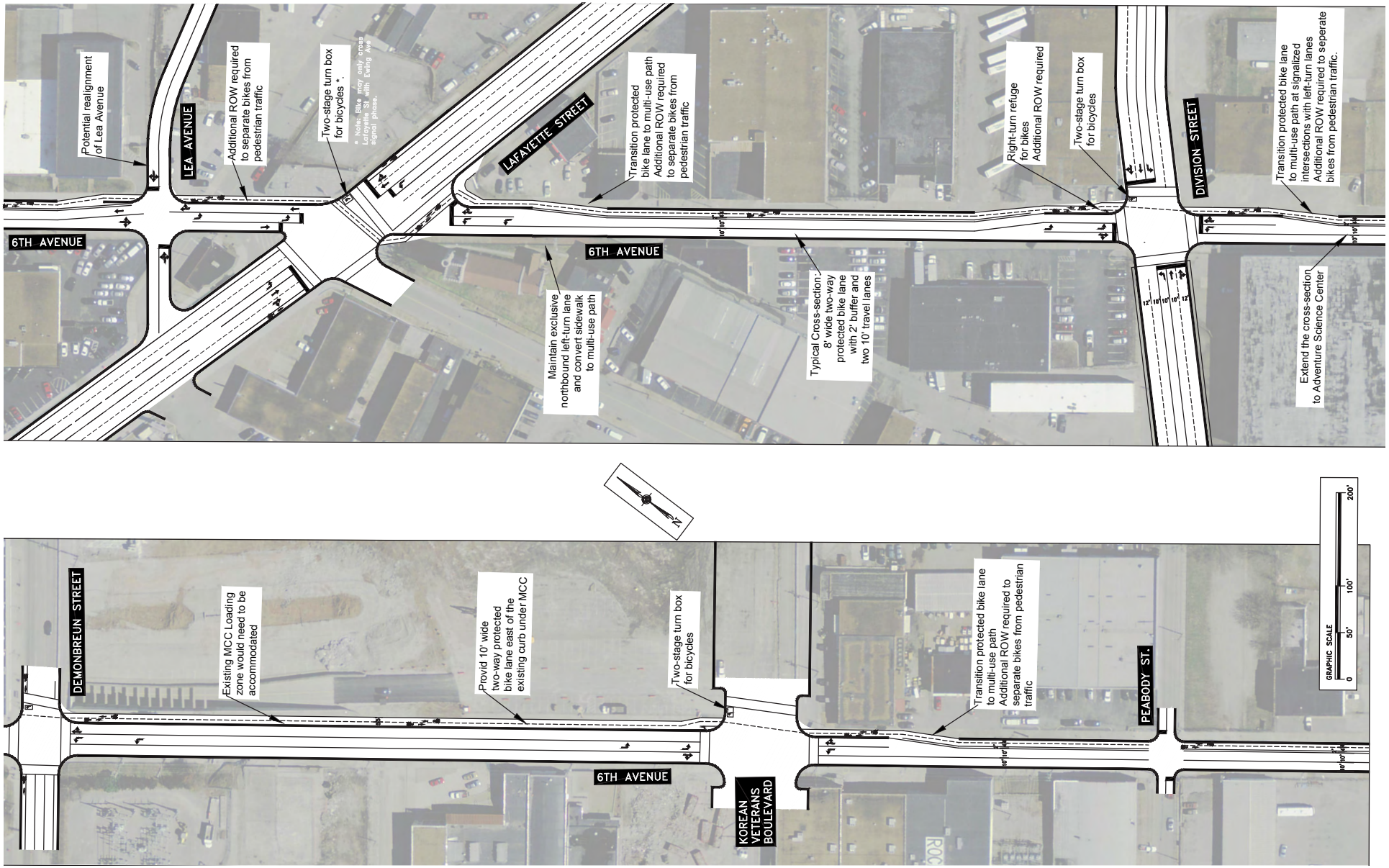
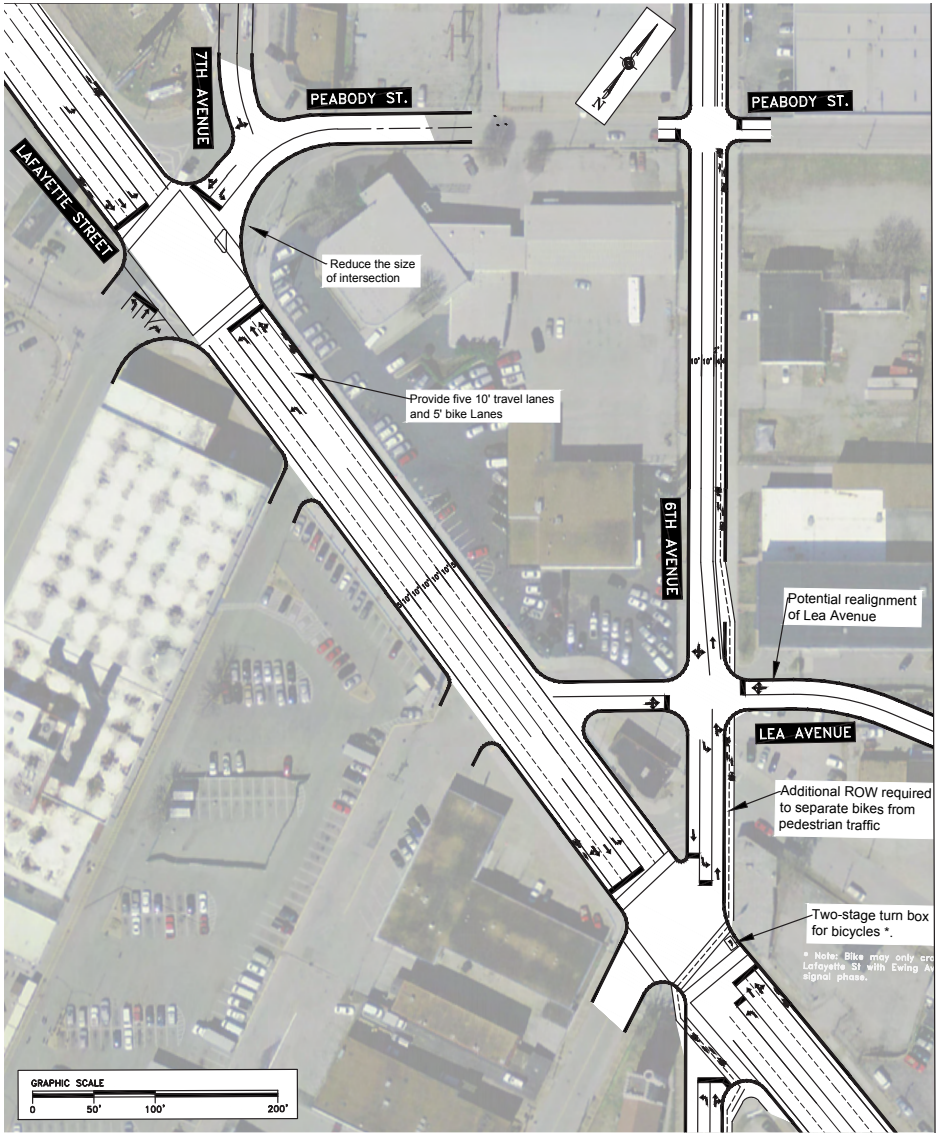


FIGURE A19. Conceptual Design: 6th Avenue



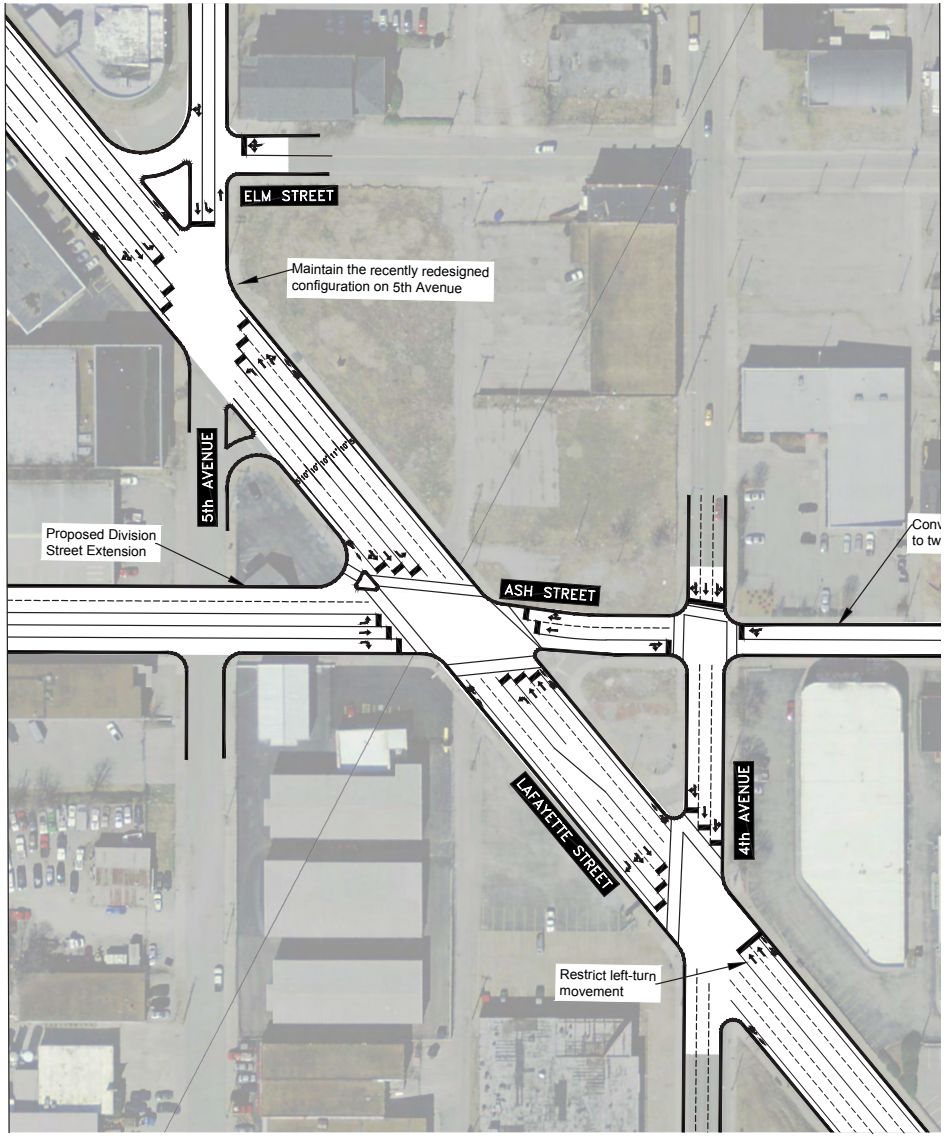


FIGURE A20. Conceptual Design: Lafayette Street

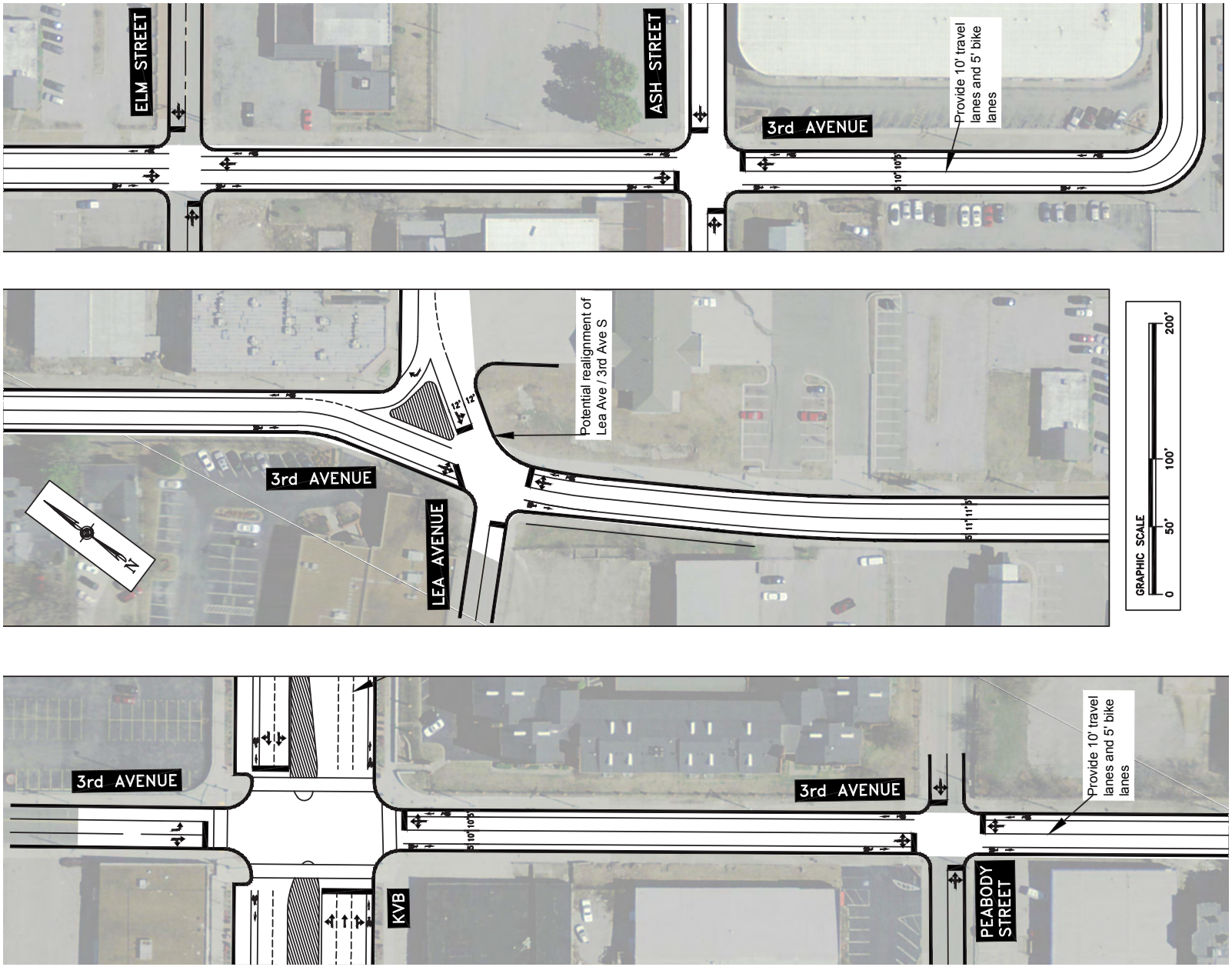


FIGURE A21. Conceptual Design: 3rd Avenue

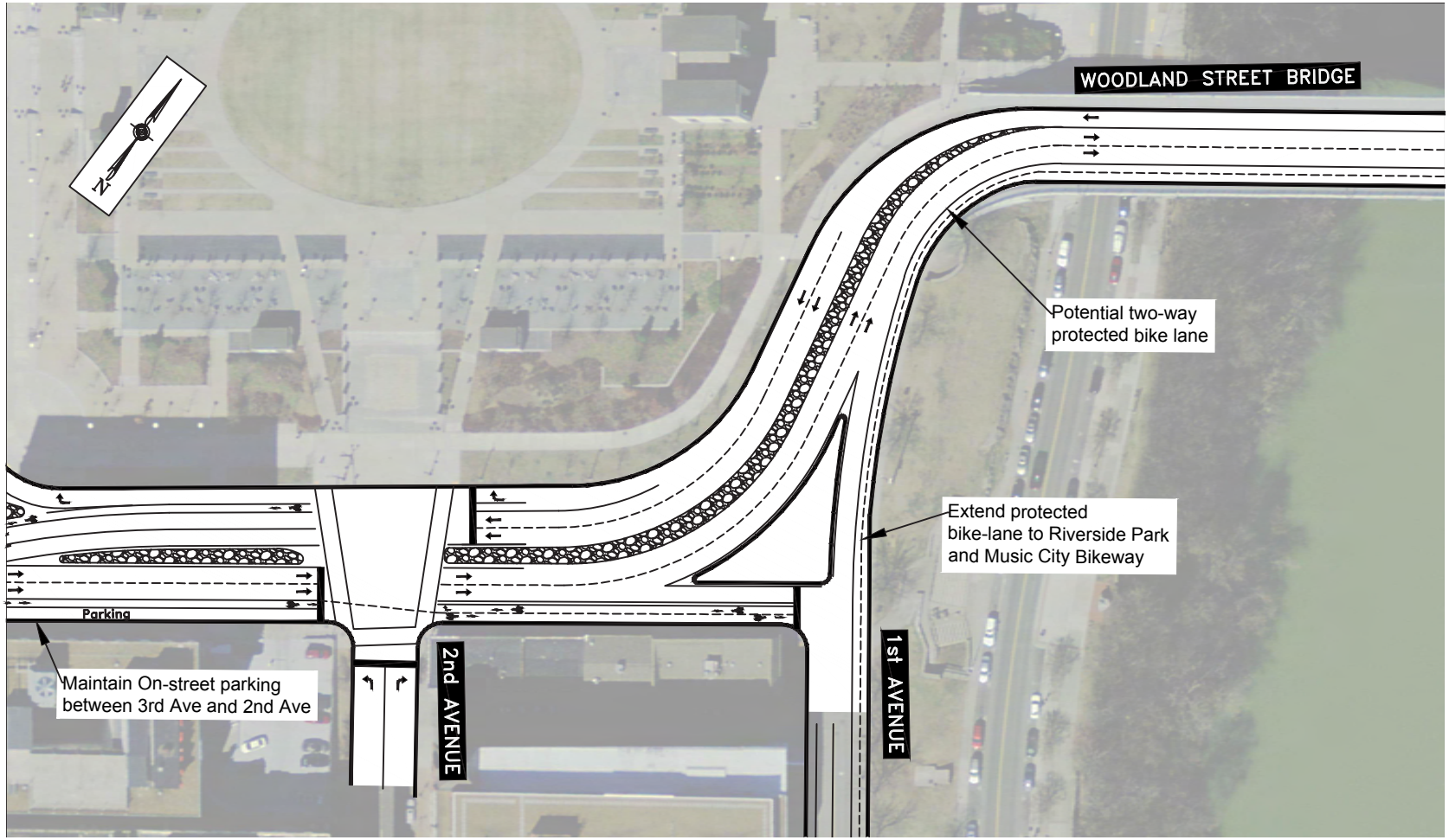


FIGURE A22. Conceptual Design: Woodland Street Bridge

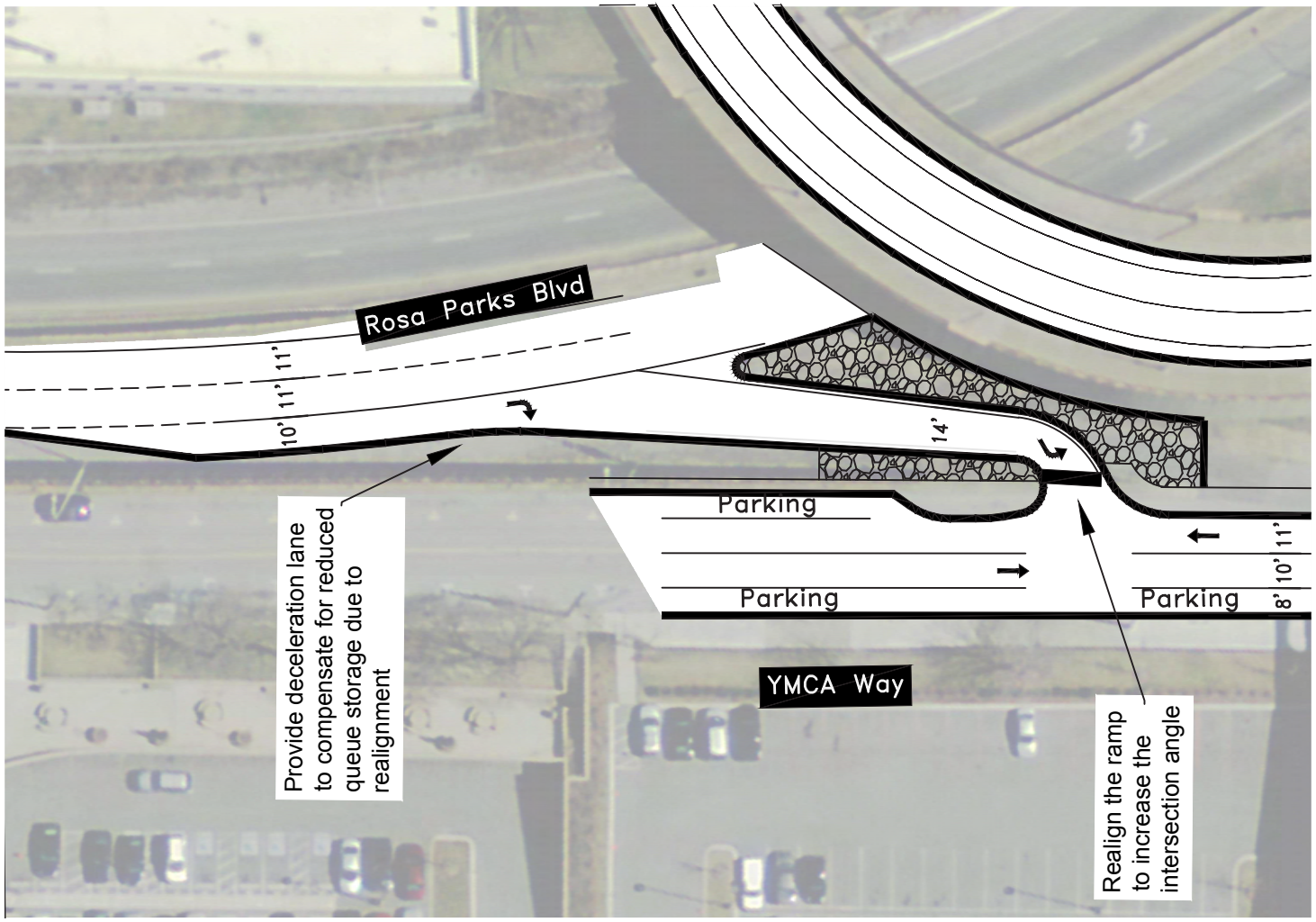


FIGURE A23. Conceptual Design: YMCA Way and Rosa Parks

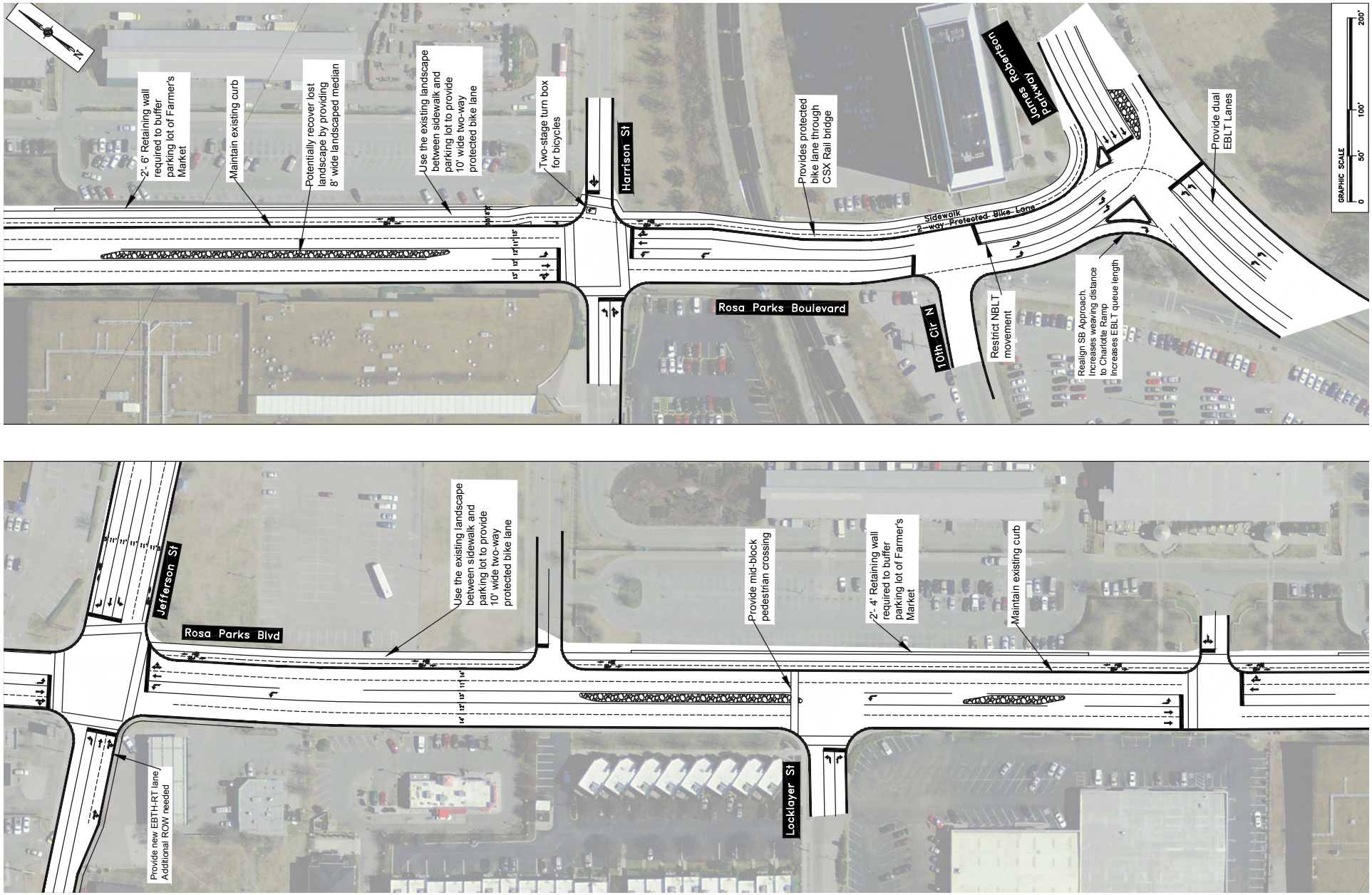


FIGURE A24. Conceptual Design: Rosa Parks Boulevard

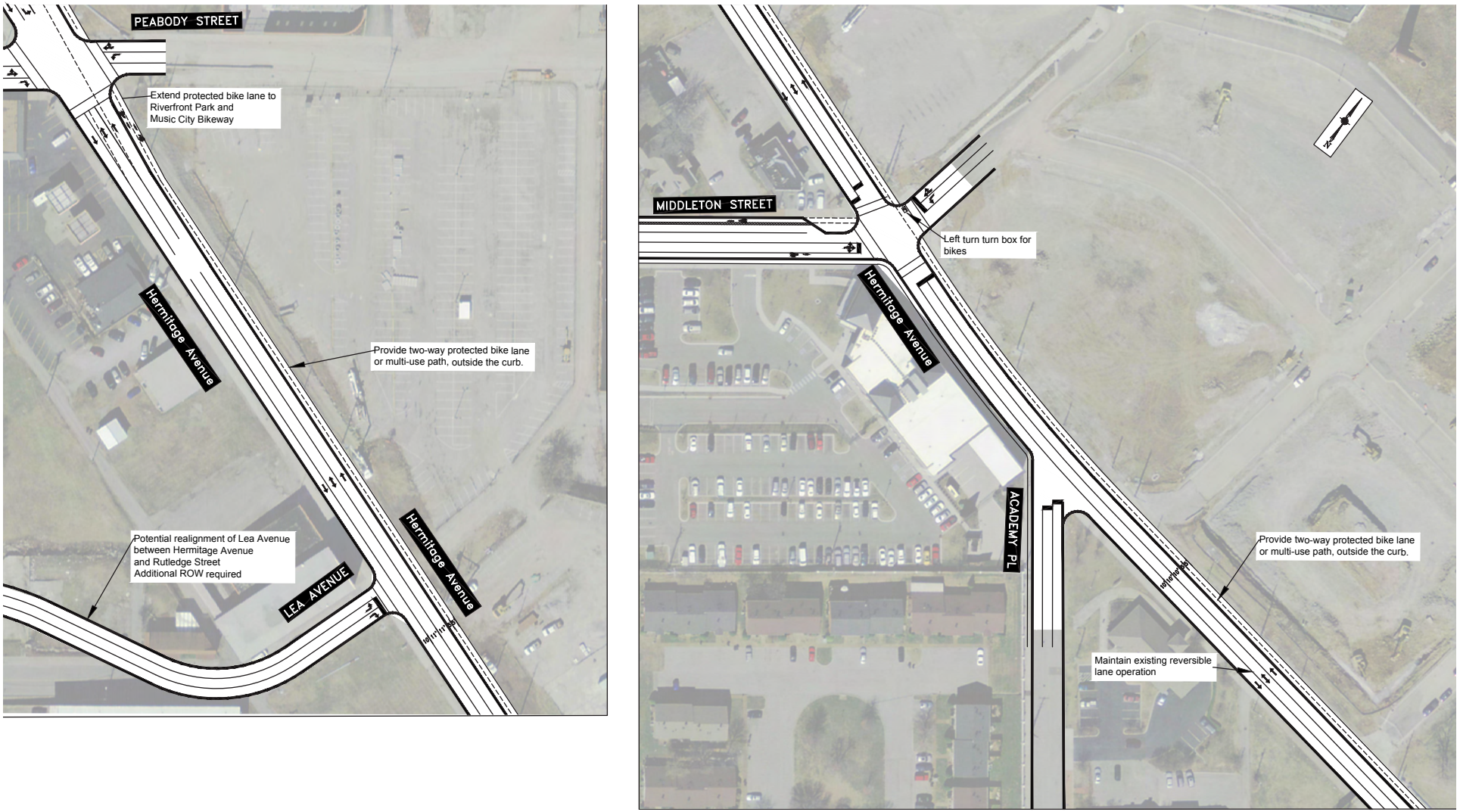


FIGURE A25. Conceptual Design: Hermitage Avenue

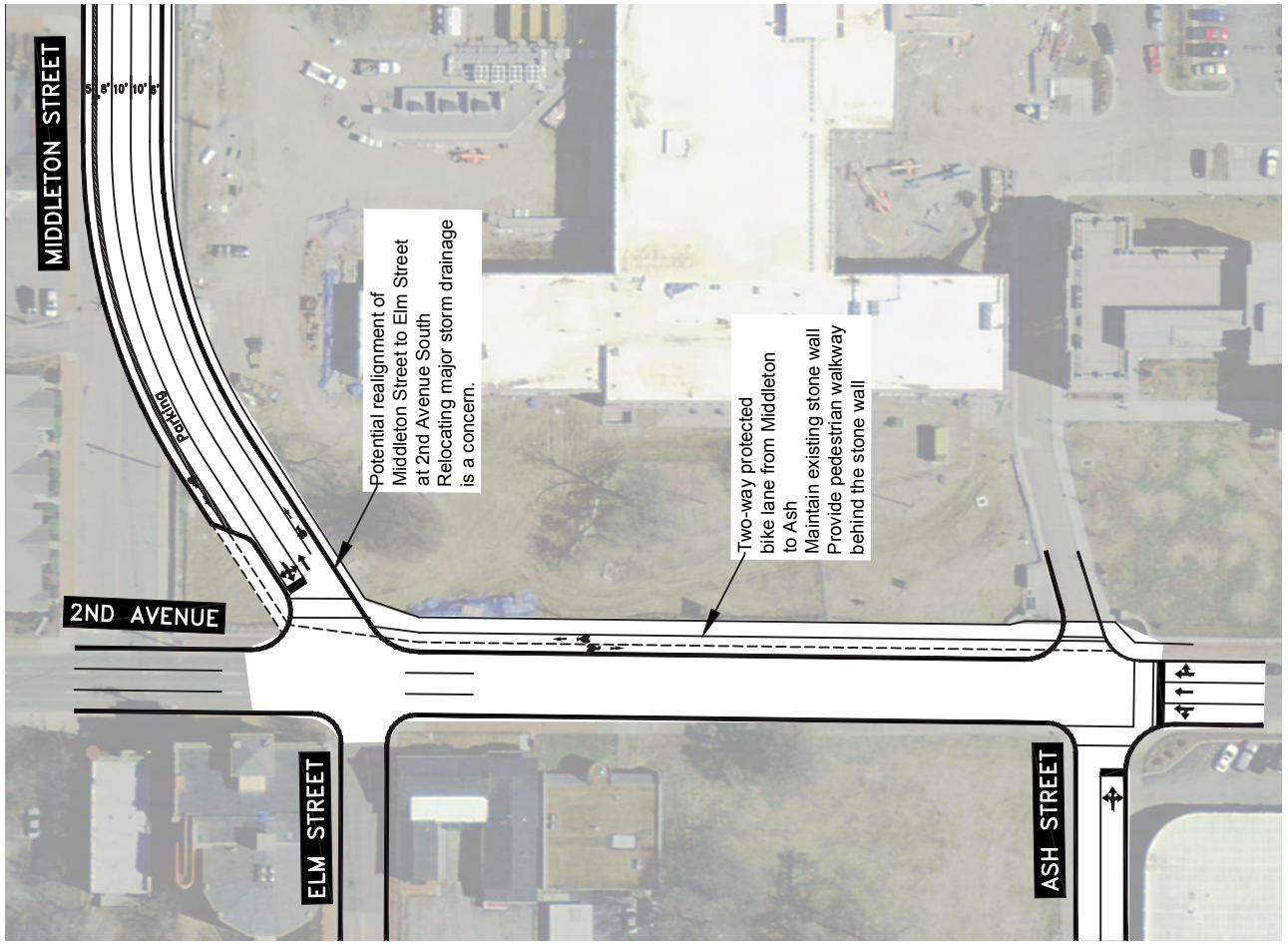
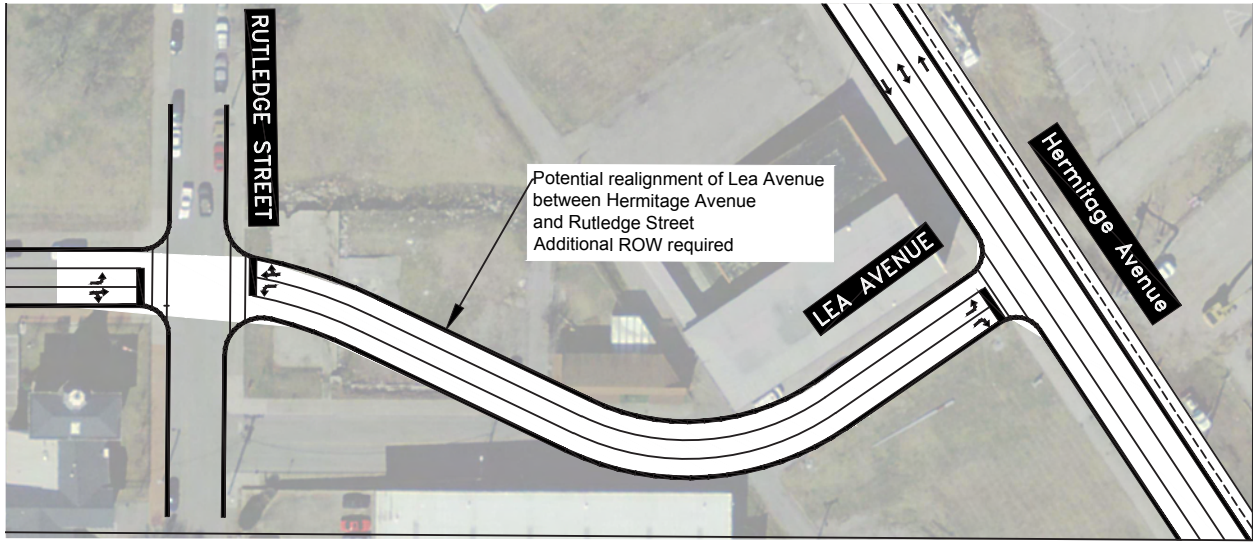


FIGURE A26. Conceptual Design: 2nd Avenue



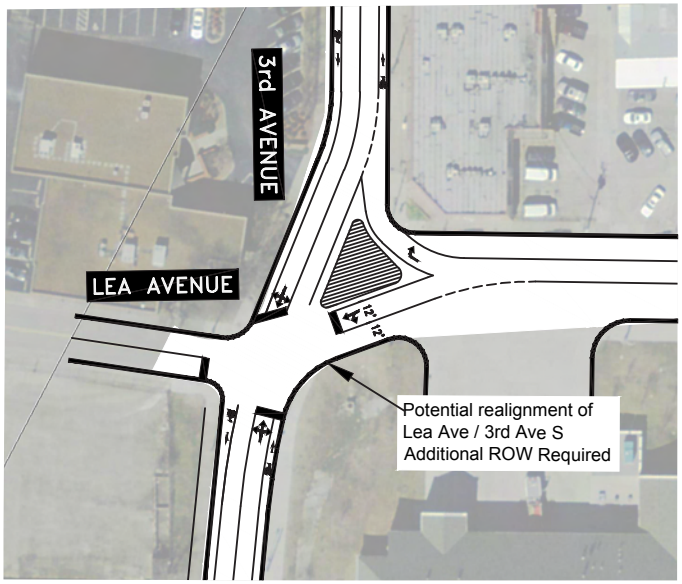


FIGURE A27. Conceptual Design: Lea Avenue

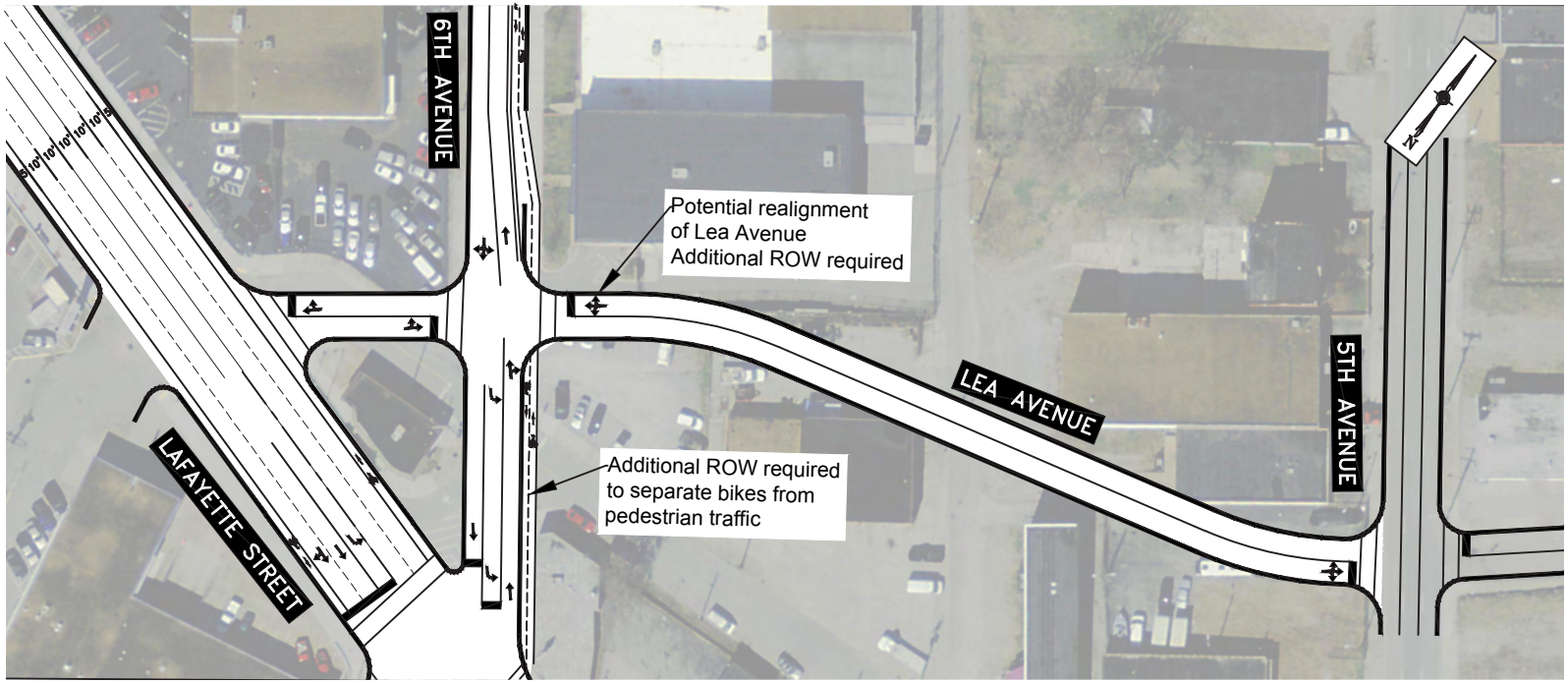


FIGURE A28. Conceptual Design: Lafayette Street, Lea Avenue, and 6th Avenue

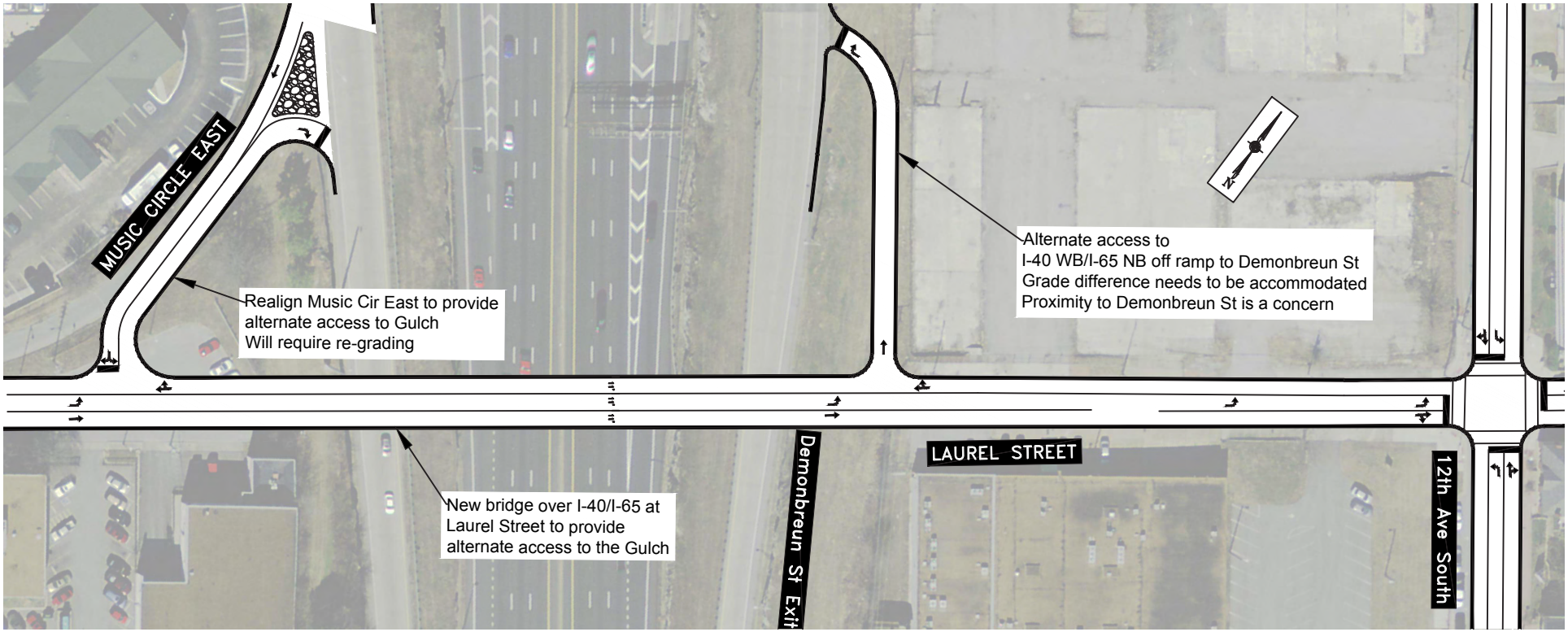
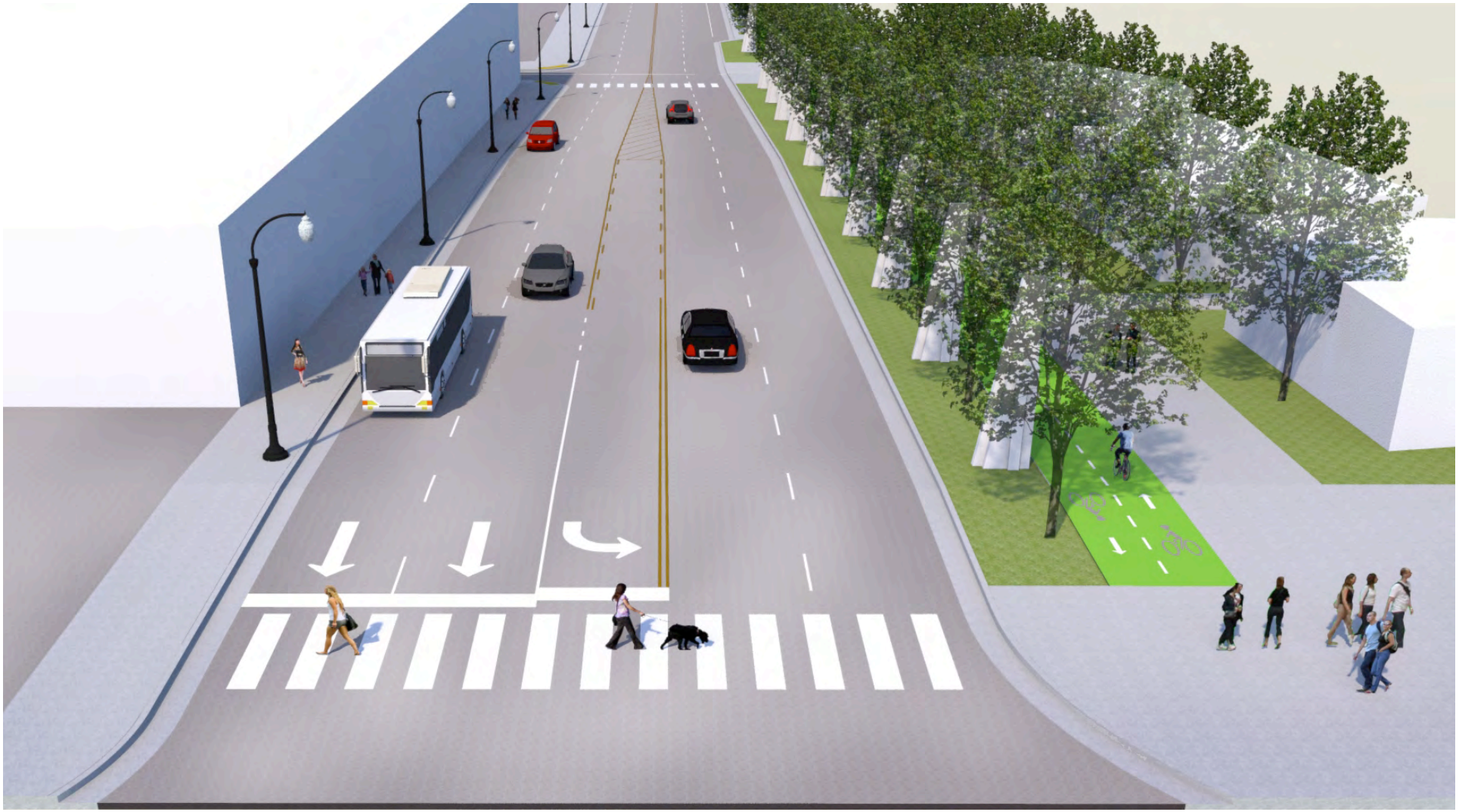
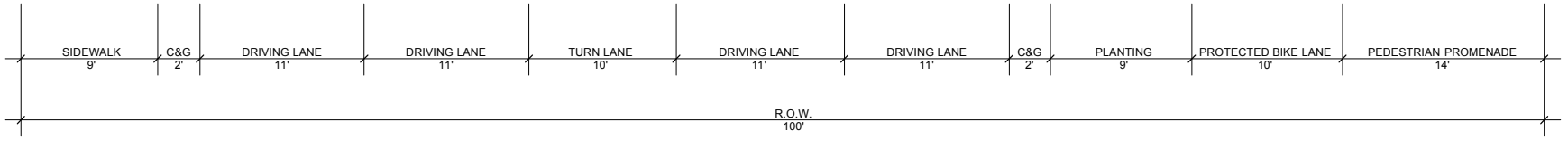


FIGURE A29. Conceptual Design: Laurel Street

B APPENDIX

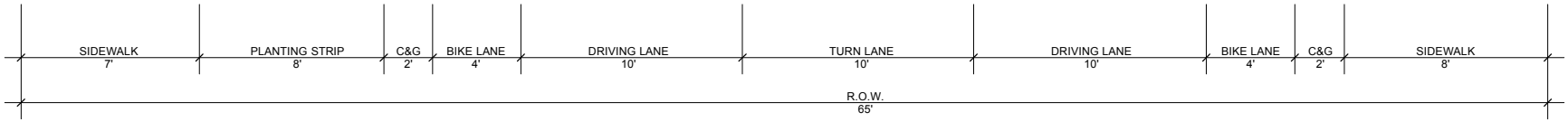
NOT FOR CONSTRUCTION





FIRST AVENUE
PROJECT NO. 35

NOT FOR CONSTRUCTION



FOURTH AVENUE
PROJECT NO. 26

NOT FOR CONSTRUCTION

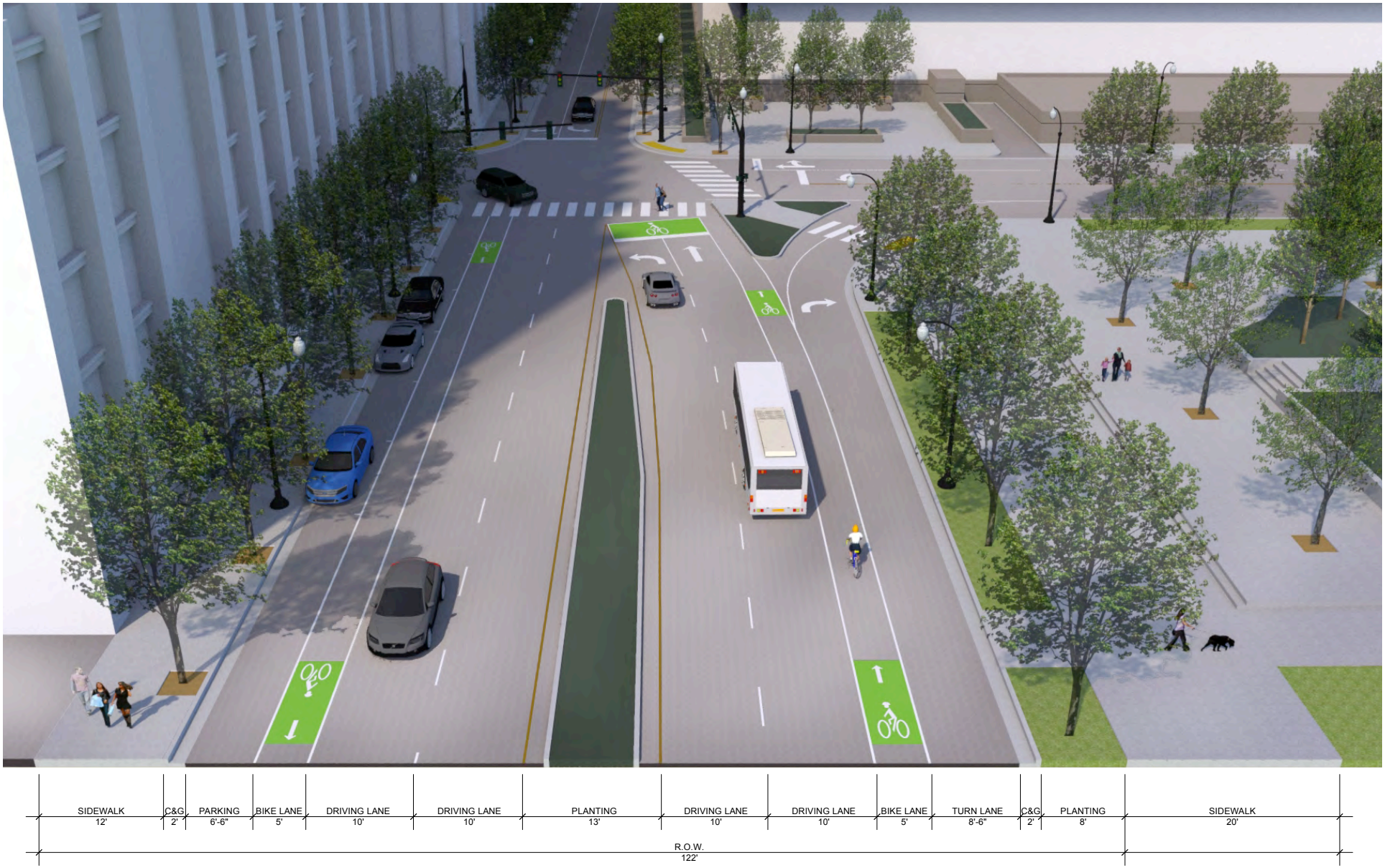
DIVISION STREET
PROJECT NO. 40

NOT FOR CONSTRUCTION

FOURTH AVENUE AND THIRD AVENUE
PROJECT NO. 30

LAFAYETTE STREET
PROJECT NO. 59

NOT FOR CONSTRUCTION



UNION STREET

PROJECT NO. 50