

# **20<sup>th</sup> / 21<sup>st</sup> Avenue North Traffic Feasibility Study**

Nashville, Davidson County, TN

For

***NDOT***

A horizontal yellow line is positioned directly beneath the letters "NDOT".

Nashville Department of Transportation and Multimodal Infrastructure  
750 S 5th St  
Nashville, TN 37206

By



**Gresham  
Smith**

Gresham Smith  
222 2<sup>nd</sup> Avenue S. Suite 1400  
Nashville, TN 37201

Gresham Smith Project No. 46162.01

December 2023

---

## Executive Summary

The purpose of this report is to examine the traffic impacts of converting 20<sup>th</sup> and 21<sup>st</sup> Avenues from their existing one-way operations to two-way. Two options are examined in this report:

1. Two-Way Traffic between Charlotte Avenue and Broadway (Option A)
2. Two-Way Traffic between Charlotte Avenue and Church Street (Option B)

A summary of the findings is as follows:

- Both options will include buffered bicycle lanes between Charlotte Avenue and Broadway. This is consistent with NDOT's WalknBike Plan.
- 20<sup>th</sup> Avenue will be more motor-vehicle focused and include on-street parking or a two-way left turn lane, turn lanes and 11-foot (minimum) lanes. Transit stops would be placed on 20<sup>th</sup> Avenue.
- 21<sup>st</sup> Avenue will be more multimodal focused and include buffered bicycle lanes with no turn lanes (in order to maintain the bike lanes through all intersections), no on-street parking, and 10-foot lanes.
- NDOT may wish to review the time-restricted on-street parking along West End Avenue and Broadway.
- The opinion of probable construction cost for Option A is \$2.3 million to \$3 million and for Option B is \$1.2 million to \$1.7 million.
- The LOS are similar for all three operational conditions examined (existing operations, Option A, and Option B). All three typically have LOS of B or better, with the only LOS of D being seen utilizing the existing layout of the one-way pair at the intersection of 21<sup>st</sup> at Broadway.
- The pedestrian LOS may improve in Options A and B due to the addition of two signalized intersections.
- The bicycle LOS would be improved for proposed Options A and B since the existing condition does not include bicycle lanes and both proposed options include buffered bicycle lanes.

Key takeaways from the stakeholder meetings are:

- Overall the proposed operational changes to the corridors was positive.
  - Operations for rideshare and valets in the area need to be considered.
  - Access to emergency services needs to consider both ambulance and bus traffic as well as pedestrian access.
  - Needs for the transit system's operations need to be accounted for within the design.
  - Safety for vulnerable user needs to be accounted for within the design.
-

[This page left intentionally blank]

---

## Table of Contents

1.0	Introduction .....	1
2.0	Existing Traffic and Observations .....	3
3.0	Proposed Roadway Modifications.....	10
3.1	Proposed Roadway Configurations.....	10
3.1.1	Two-Way Traffic between Charlotte Avenue and Broadway (Option A).....	10
3.1.2	Two-Way Traffic between Charlotte Avenue and Church Street (Option B) .....	13
3.2	Proposed Option Traffic Distributions.....	17
4.0	Level of Service Analysis.....	20
5.0	Opinion of Probable Construction Cost.....	25
6.0	Stakeholder meetings summary .....	26
7.0	Summary.....	28

### Tables

Table 1: LOS Index.....	20
Table 2: Level of Service Summary.....	24

### Figures

Figure 1: Location Map .....	2
Figure 2: 2022 Existing Traffic Volumes (AM and PM Peak Hours).....	4
Figure 3: West End Ave. at 20 <sup>th</sup> Ave. Looking East.....	5
Figure 4: 21 <sup>st</sup> Ave. Looking South .....	5
Figure 5: 21 <sup>st</sup> Ave. at Patterson St. Looking South .....	6
Figure 6: 20 <sup>th</sup> Ave. Looking South at Church St.....	6
Figure 7: 20 <sup>th</sup> Ave. Looking North.....	7
Figure 8: Existing Lane Configuration .....	8
Figure 9: 21 <sup>st</sup> Ave. Typical Section #1 .....	9
Figure 10: 21 <sup>st</sup> Ave. Typical Section #2 .....	9
Figure 11: 20 <sup>th</sup> Ave. Typical Section.....	9
Figure 12: Option A Lane Configuration .....	11
Figure 13: 21 <sup>st</sup> Ave. Typical Section .....	12
Figure 14: 20 <sup>th</sup> Ave. Typical Section #1 .....	12
Figure 15: 20 <sup>th</sup> Ave. Typical Section #2.....	12
Figure 16: Option B Lane Configuration .....	14
Figure 17: 21 <sup>st</sup> Ave. Typical Section #1 .....	15
Figure 18: 21 <sup>st</sup> Ave. Typical Section #2 .....	15
Figure 19: 20 <sup>th</sup> Ave. Typical Section #1 .....	15
Figure 20: 20 <sup>th</sup> Ave. Typical Section #2.....	16
Figure 21: 20 <sup>th</sup> Ave. Typical Section #3.....	16
Figure 22: 20 <sup>th</sup> Ave. Typical Section #4 .....	16
Figure 23: Example Left Turn Distribution .....	17
Figure 24: Option A Traffic Distribution .....	18
Figure 25: Option B Traffic Distribution .....	19
Figure 26: Intersections in LOS Analysis in Options A and B .....	22
Figure 27: Level of Service Summary .....	23

---

## **1.0 INTRODUCTION**

The purpose of this report is to examine the impacts of converting 20<sup>th</sup> and 21<sup>st</sup> Avenues from their existing one-way operations to two-way operations. These north-south routes provide connectivity between four east-west urban arterials; Charlotte Avenue, Church Street, West End Avenue, and Broadway. Figure 1 provides a location map of the study area. The roadway conversion was initiated by St. Thomas Midtown Hospital to improve access to their medical facilities and improve emergency response times. St. Thomas Midtown Hospital has agreed to have Nashville Department of Transportation (NDOT) investigate the impacts of the conversion. The two options are examined in this report:

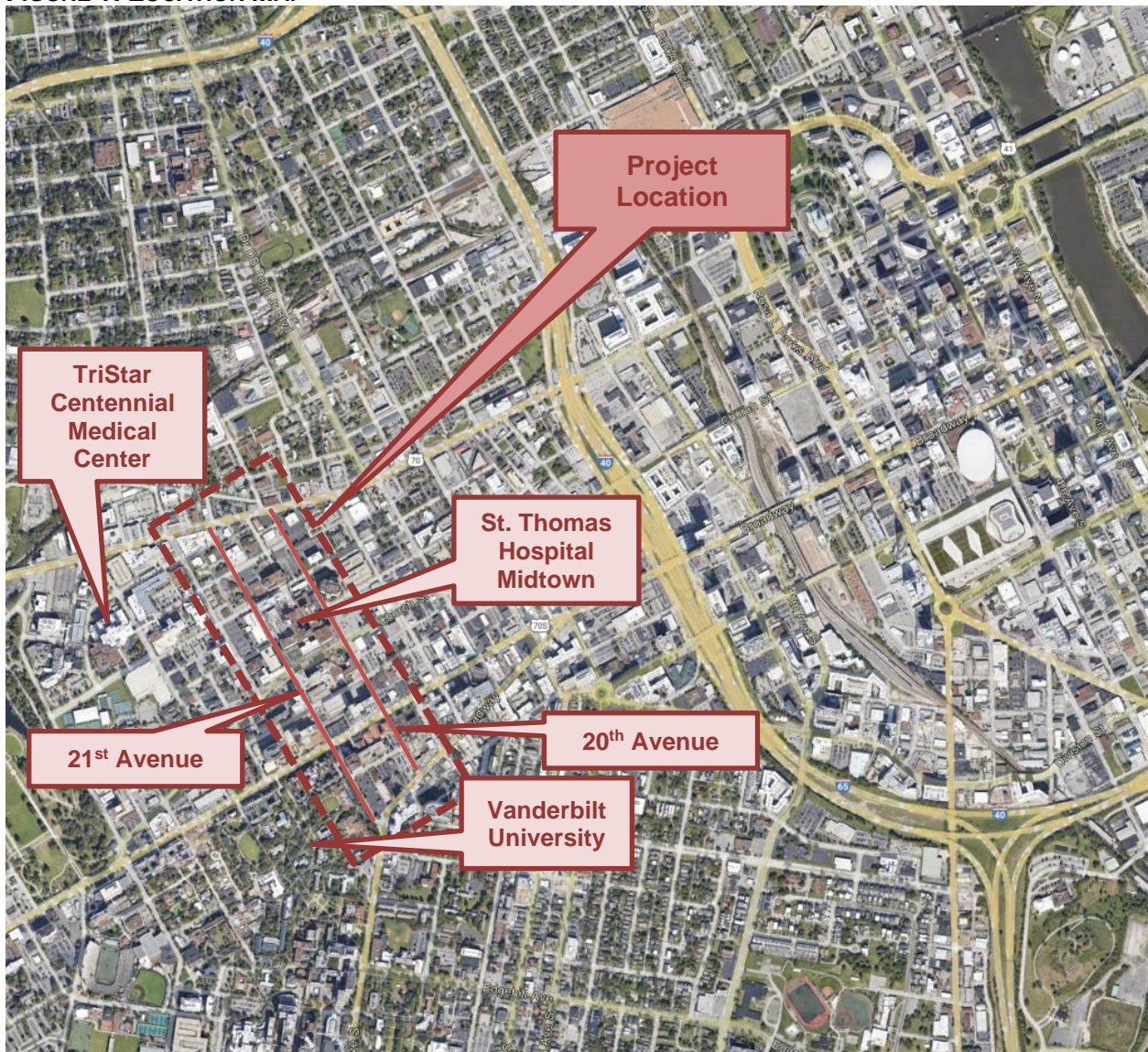
1. Two-Way Traffic between Charlotte Avenue and Broadway (Option A)
2. Two-Way Traffic between Charlotte Avenue and Church Street (Option B)

All transportation mode users are considered in the analysis, including motorists, transit riders, bicyclists, and pedestrians. Impacts to on-street parking were also considered. This report is intended to be a tool to assist NDOT in determining the feasibility of the traffic operations conversion, and not as a finalized Traffic Impact Study. Additional guidance from NDOT on conducting a full Traffic Impact Study will likely include:

- Approval of traffic distribution methodology
- Determination if additional intersections must be included in the analysis including all-way stops and / or major driveways
- Determination if a design / future year analysis is needed
- Input concerning proposed developments in the study area and any ongoing traffic impact studies
- Input concerning Option A vs. Option B travel lane configurations
- Input concerning proposed bike facilities design
- Stakeholder / public coordination requirements for adjacent businesses and organizations

The 20<sup>th</sup> and 21<sup>st</sup> Avenues are each 2/3 of a mile long extending between Charlotte Avenue and Broadway. The roadways connect the St. Thomas Midtown area with Vanderbilt University. Each one-way road is 33 feet wide from curb-to-curb. Sidewalks are located directly behind the curb. At intersections, each roadway typically includes three travel / turning lanes that are each 11 feet wide. Away from intersections, each roadway typically includes two continuous travel lanes with intermittent on-street parking. There are currently no bicycle lanes on either road. NDOT's WalknBike Plan (2017) calls for a "Major Separated Bikeway" connection between Charlotte Avenue and Broadway within the study area. Transit stops for WeGo Route 25 are located along both roadways.

FIGURE 1: LOCATION MAP



## **2.0 EXISTING TRAFFIC AND OBSERVATIONS**

Traffic data was collected on Wednesday November 16, 2022. Existing traffic data collected on Thursday February 17, 2022 was used for Division Street at Broadway. Turning movement data was collected from 6 to 9 AM and 3 to 6 PM. The data was collected at the following nine intersections:

1. 21st Avenue at Charlotte Ave
2. 21st Avenue at Church Street
3. 21st Avenue at West End Avenue
4. 21st Avenue at Broadway
5. 20th Avenue at Broadway
6. 20th Avenue at West End Avenue
7. 20th Avenue at Church Street
8. 20th Avenue at Charlotte Ave
9. Broadway at Division Street

All intersections where data was collected are signalized except 21<sup>st</sup> Avenue at Charlotte and 20<sup>th</sup> Avenue at Broadway. Traffic data was collected at these two unsignalized intersections because they are located at the study area's termini and will need to be signalized with the proposed options.

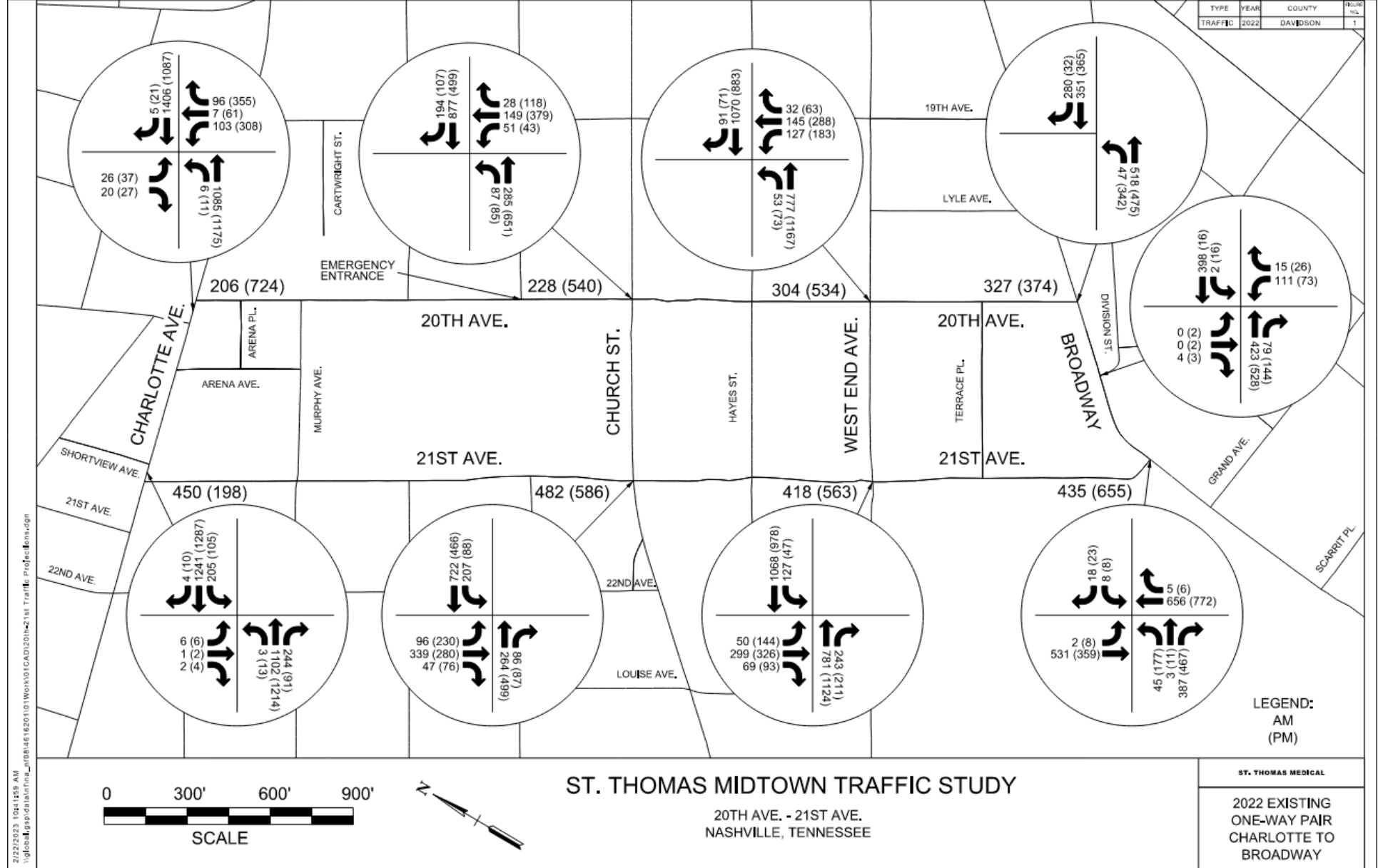
The turning movement data is reflected in the traffic analysis in the Appendix. Figure 2 summarizes the turning movement volumes. Reviewing Figure 2, some volumes were not as expected. West End Avenue's volumes are higher traveling away from downtown during the AM Peak and into downtown during the PM Peak. Church Street and Charlotte Avenues' PM Peak traffic volumes are evenly split heading towards and away from downtown. In general, the traffic volumes are lower than expected in the study area.

A previously conducted site visit during the morning rush hour from 7:30 to 8:30 on Friday, December 13th, 2019 corroborate with the findings of the traffic count data. Photos from within the study area are shown in Figure 3 through Figure 7. Figure 3 demonstrates considerably more traffic traveling away from downtown during the AM Peak than traveling towards downtown along West End Avenue. Several other images demonstrate excess capacity along 20<sup>th</sup> and 21<sup>st</sup> Avenues. Likely reasons include traffic is metered by the congested 31<sup>st</sup> Avenue intersection to the west and by I-40/I-65 to the east. The full demand cannot reach the study area.

Time-restricted on-street parking is located along West End Avenue and Broadway. Parking is not allowed along the inbound lanes during the AM Peak or the outbound lanes during the PM Peak. NDOT may wish to review the on-street parking times based upon the findings discussed above.

The existing lane configurations along 21<sup>st</sup> and 20<sup>th</sup> Avenues are depicted in Figure 8. Figure 9 through Figure 11 show typical cross sections for 21<sup>st</sup> and 20<sup>th</sup> Avenues.

FIGURE 2: 2022 EXISTING TRAFFIC VOLUMES (AM AND PM PEAK HOURS)





**FIGURE 3: WEST END AVE. AT 20<sup>TH</sup> AVE. LOOKING EAST**  
Demonstrates heavier flows from downtown in AM



**FIGURE 4: 21<sup>ST</sup> AVE. LOOKING SOUTH**  
Demonstrates excess capacity and on-street parking in AM



**FIGURE 5: 21<sup>ST</sup> AVE. AT PATTERSON ST. LOOKING SOUTH**  
Demonstrates indirect ambulance route to 20<sup>th</sup> Ave. Emergency Room



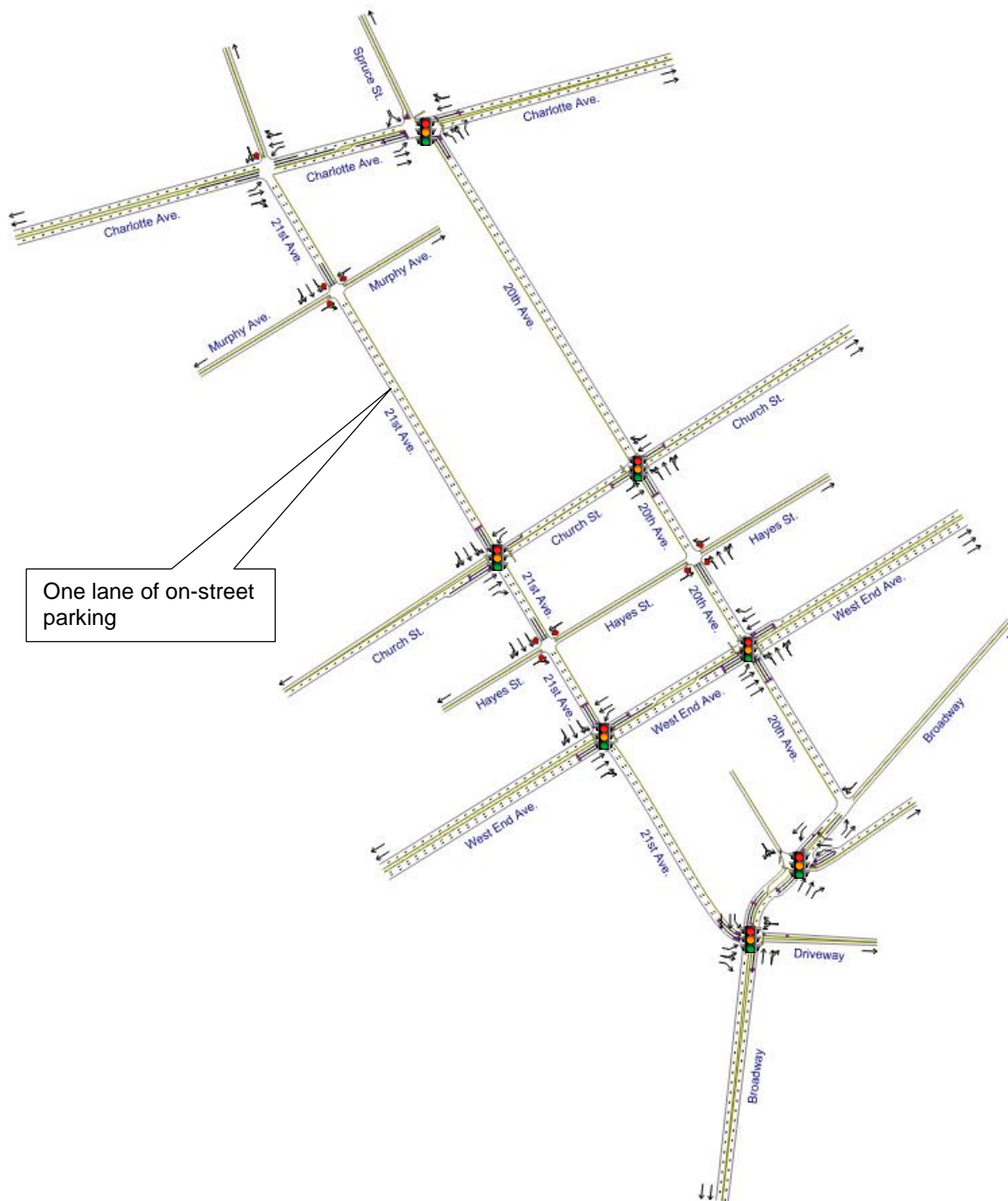
**FIGURE 6: 20<sup>TH</sup> AVE. LOOKING SOUTH AT CHURCH ST.**  
Demonstrates manageable queues in AM



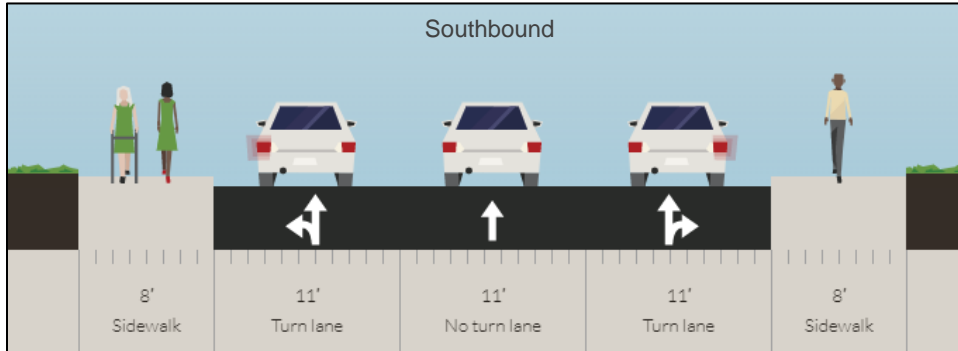
**FIGURE 7: 20<sup>TH</sup> AVE. LOOKING NORTH**  
Demonstrates excess capacity in AM



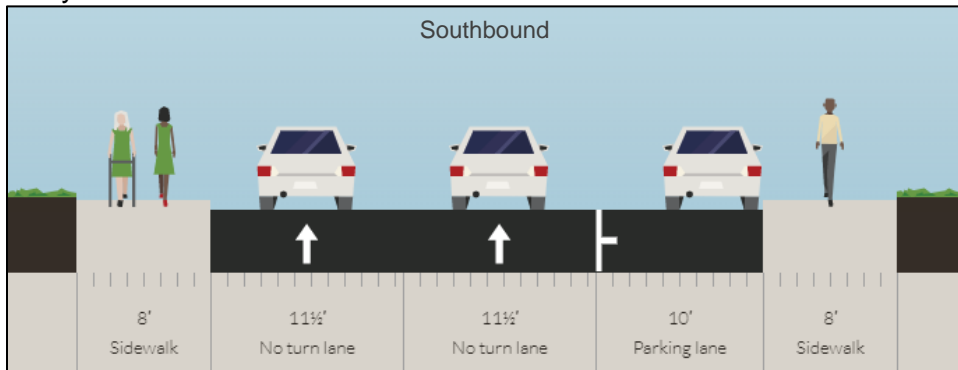
FIGURE 8: EXISTING LANE CONFIGURATION



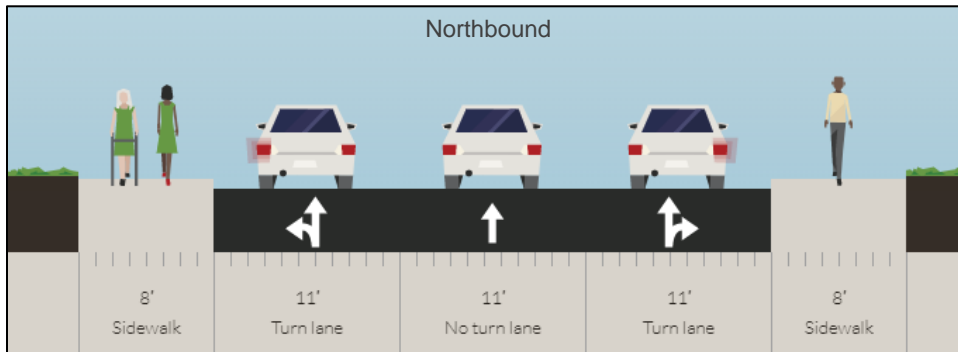
**FIGURE 9: 21<sup>ST</sup> AVE. TYPICAL SECTION #1**  
At intersections



**FIGURE 10: 21<sup>ST</sup> AVE. TYPICAL SECTION #2**  
Away from intersections



**FIGURE 11: 20<sup>TH</sup> AVE. TYPICAL SECTION**  
Entire corridor



## **3.0 PROPOSED ROADWAY MODIFICATIONS**

### **3.1 PROPOSED ROADWAY CONFIGURATIONS**

The proposed roadway modifications convert 20<sup>th</sup> and 21<sup>st</sup> Avenues from their existing one-way operations to two-way operations. These north-south routes provide connectivity between four east-west urban arterials; Charlotte Avenue, Church Street, West End Avenue, and Broadway. Two options are examined in this report:

1. Two-Way Traffic between Charlotte Avenue and Broadway (Option A)
2. Two-Way Traffic between Charlotte Avenue and Church Street (Option B)

Both options will include buffered bicycle lanes between Charlotte Avenue and Broadway. This is consistent with NDOT's WalknBike Plan (2017), which calls for a "Major Separated Bikeway" connection within the study area. With both options, 20<sup>th</sup> Avenue will be more motor-vehicle focused and include on-street parking, turn lanes and wider 11-foot (minimum) lanes. Transit stops would be placed on 20<sup>th</sup> Avenue. Making 20<sup>th</sup> Avenue more motor-vehicle focused aligns with existing traffic patterns. 21<sup>st</sup> Avenue will be more multimodal focused and include buffered bicycle lanes with no turn lanes (in order to maintain the bike lanes through all intersections), no on-street parking, and narrower 10-foot lanes. Each option is described in more detail in Section 3.1.1 and Section 3.1.2.

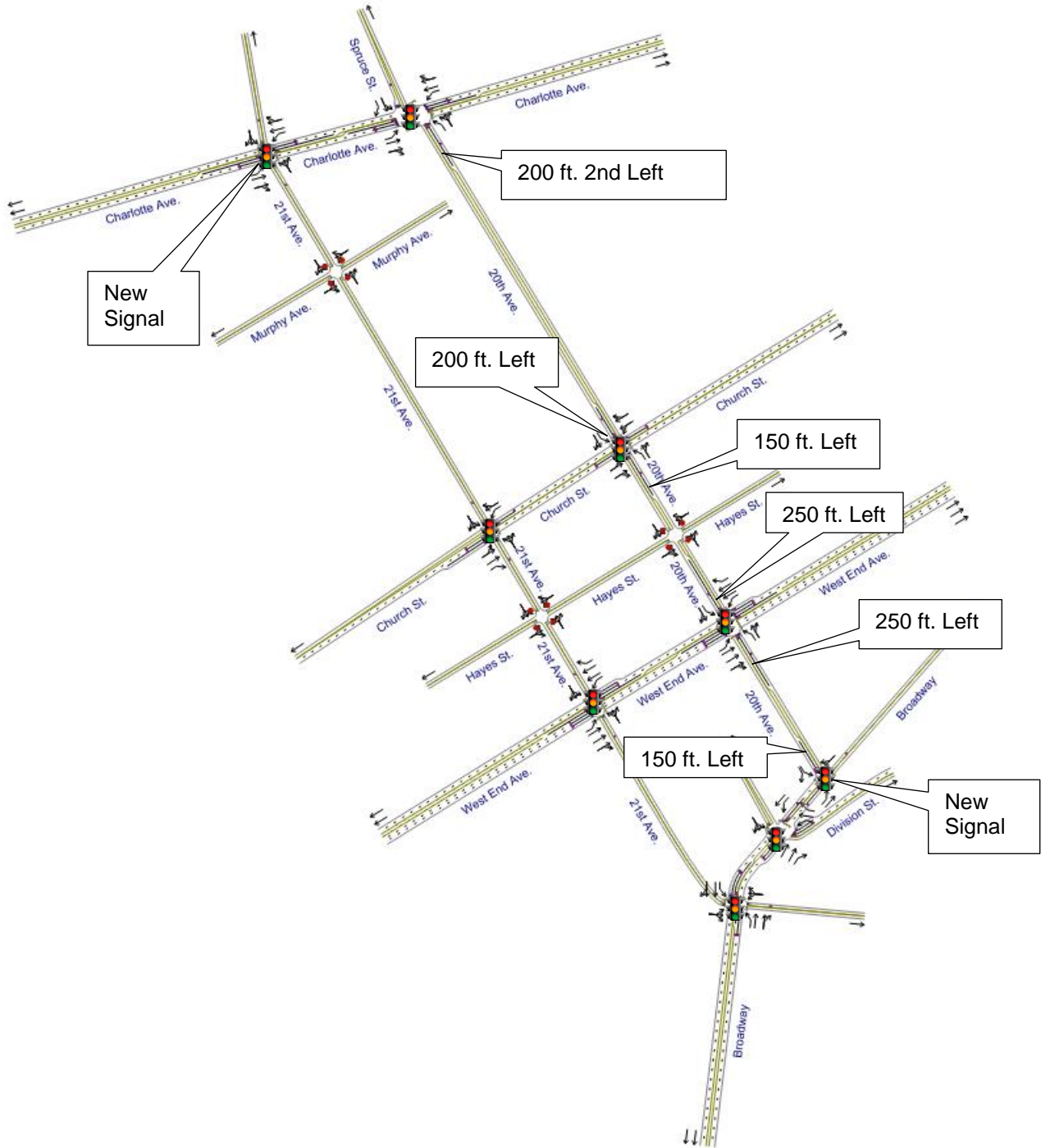
#### **3.1.1 Two-Way Traffic between Charlotte Avenue and Broadway (Option A)**

Option A would convert 20<sup>th</sup> and 21<sup>st</sup> Avenues from one-way to two-way operations for the entire 2/3 of a mile corridor between Charlotte Avenue and Broadway. Figure 12 depicts the proposed lane configurations along 20<sup>th</sup> and 21<sup>st</sup> Avenues. Recommended turn-lane lengths along 20<sup>th</sup> Avenue are shown in Figure 12.

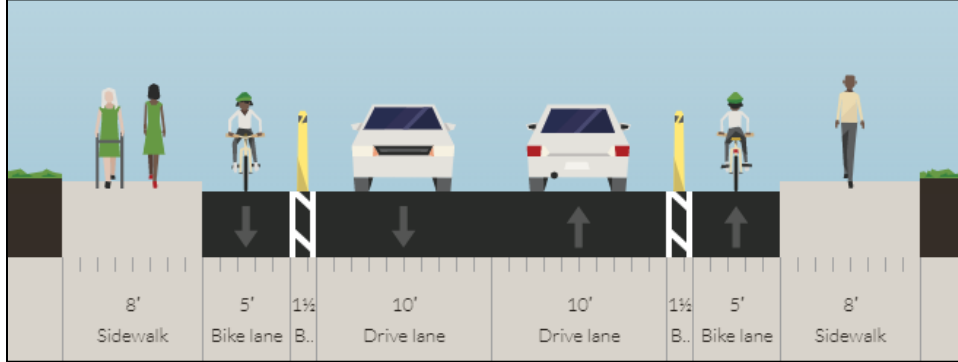
Along 21<sup>st</sup> Avenue, option A would include buffered bicycle lanes with no turn lanes (to maintain the bike lanes through all intersections) and no on-street parking. Figure 13 depicts the proposed typical section, showing 21<sup>st</sup> Avenue is 33 feet wide between curbs. The typical section includes 5-foot wide bicycle lanes, 1.5-foot wide buffers between the bicycle lanes and adjacent motor-vehicle lanes, and 10-foot wide motor-vehicle lanes. Raised delineators are recommended at even intervals along the buffers.

Along 20<sup>th</sup> Avenue, option A would include on-street parking, transit stops, and turn lanes. Figure 14 and Figure 15 depicts the proposed typical sections. 20<sup>th</sup> Avenue is 33 feet wide between curbs. The typical section includes 11-foot wide (minimum) motor-vehicle lanes with left-turn lanes at all signalized intersections and major driveways. The left-turn lanes would range between 150 and 250 feet in length, as shown in Figure 12. On-street parking is recommended away from intersections, or a two-way left-turn lane could be substituted for the on-street parking.

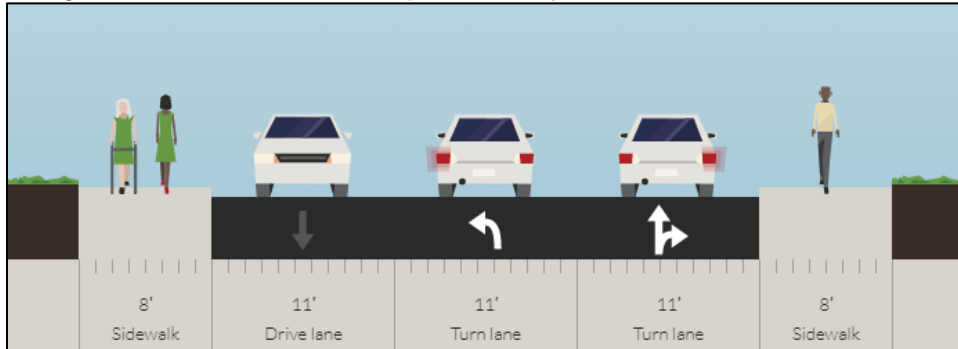
**FIGURE 12: OPTION A LANE CONFIGURATION**  
Two-Way Traffic between Charlotte Ave and Broadway



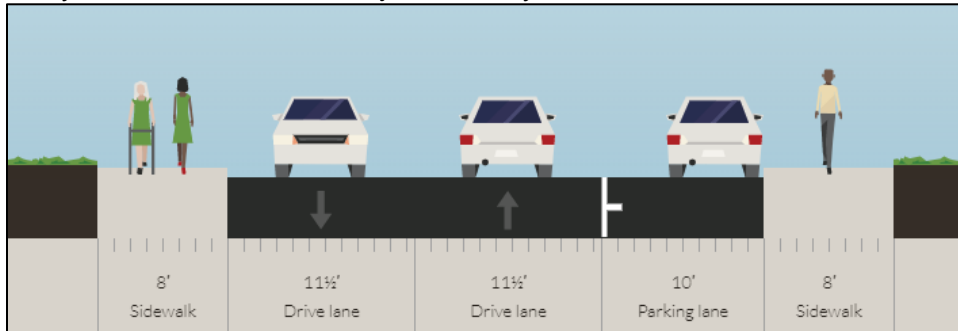
**FIGURE 13: 21<sup>ST</sup> AVE. TYPICAL SECTION**  
Entire Corridor



**FIGURE 14: 20<sup>TH</sup> AVE. TYPICAL SECTION #1**  
At signalized intersections / major driveways



**FIGURE 15: 20<sup>TH</sup> AVE. TYPICAL SECTION #2**  
Away from intersections / major driveways





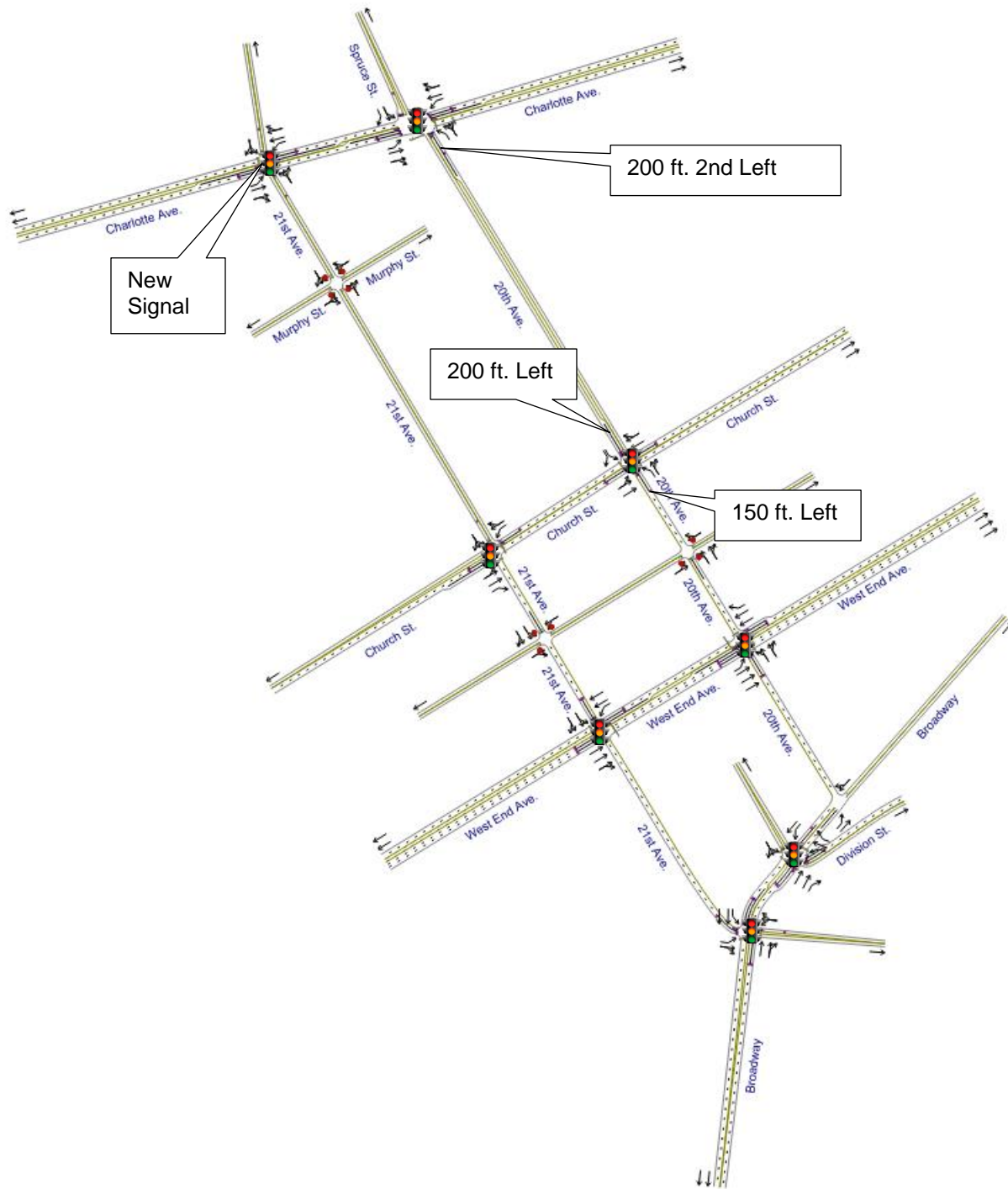
### **3.1.2 Two-Way Traffic between Charlotte Avenue and Church Street (Option B)**

Option B would convert 20<sup>th</sup> and 21<sup>st</sup> Avenues from one-way to two-way operations for 1/3 of a mile between Charlotte Avenue and Church Street. Both 20<sup>th</sup> and 21<sup>st</sup> Avenues would remain one-way between Church Street and Broadway. However, the pavement markings and traffic signals would be modified to accommodate bicycle lanes (as required to align with the NDOT WalknBike Plan). Figure 16 depicts the proposed lane configurations along 20<sup>th</sup> and 21<sup>st</sup> Avenues. Recommended turn-lane lengths along 20<sup>th</sup> Avenue are shown.

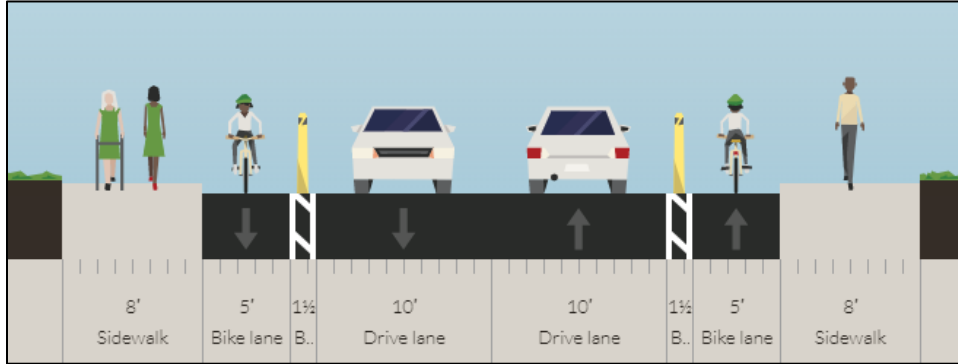
Along 21<sup>st</sup> Avenue, option B would include buffered bicycle lanes with no turn lanes (to maintain the bike lanes through all intersections) and no on-street parking. Figure 17 depicts the proposed typical section with two-way operations between Charlotte Avenue and Church Street. 21<sup>st</sup> Avenue is 33 feet wide between curbs. The typical section includes 5-foot wide bicycle lanes, 1.5-foot wide buffers between the bicycle lanes and adjacent motor-vehicle lanes, and 10-foot wide motor-vehicle lanes. Raised delineators are recommended at even intervals along the buffers. Figure 18 depicts the proposed typical section with existing one-way operations between Church Street and Broadway. The typical section shows 5-foot wide bicycle lanes and 1.5 foot wide buffers proposed in order to provide the bicycle route connection between Church Street and Broadway.

Along 20<sup>th</sup> Avenue, option B would include on-street parking and turn lanes. Figure 19 and Figure 20 depicts the proposed two-way typical sections between Charlotte Avenue and Church Street. 21<sup>st</sup> Avenue is 33 feet wide between curbs. The typical section includes 11-foot wide (minimum) motor-vehicle lanes with left-turn lanes at all signalized intersections and major driveways. The left-turn lanes would range between 150 and 250 feet in length, as shown in Figure 126. On-street parking is recommended away from intersections, or a two-way left-turn lane could be substituted for the on-street parking. Figure 21 and Figure 22 depicts the one-way typical sections between Church Street and Broadway. The typical sections include 11.5-foot wide motor-vehicle lanes and on-street parking.

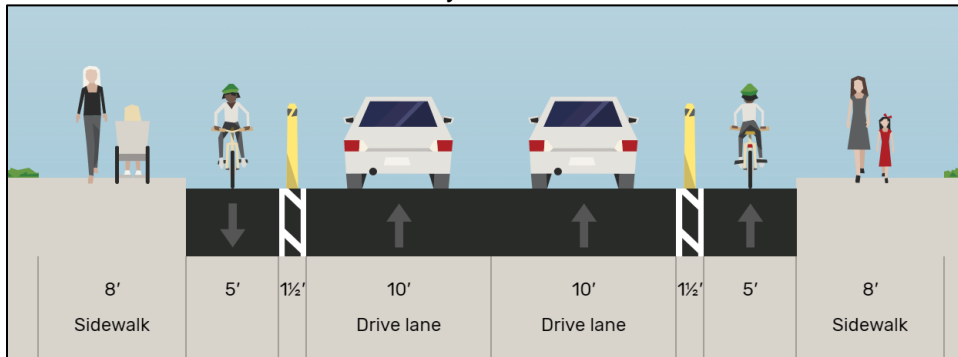
**FIGURE 16: OPTION B LANE CONFIGURATION**  
Two-Way Traffic from Charlotte to Church St.



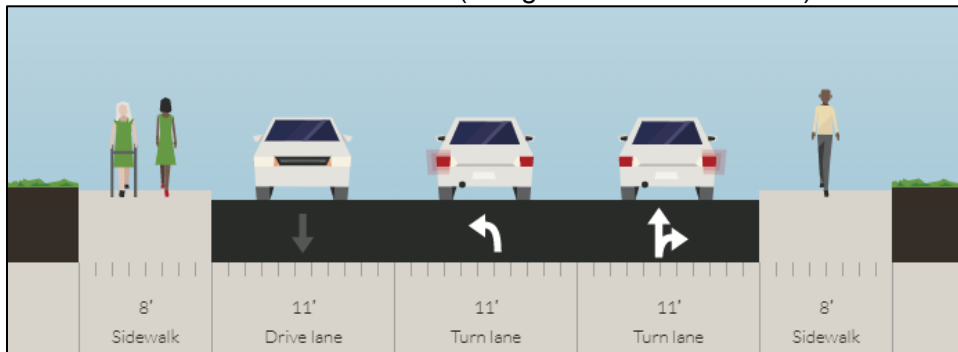
**FIGURE 17: 21<sup>ST</sup> AVE. TYPICAL SECTION #1**  
Between Charlotte and Church St.



**FIGURE 18: 21<sup>ST</sup> AVE. TYPICAL SECTION #2**  
Between Church St. and Broadway

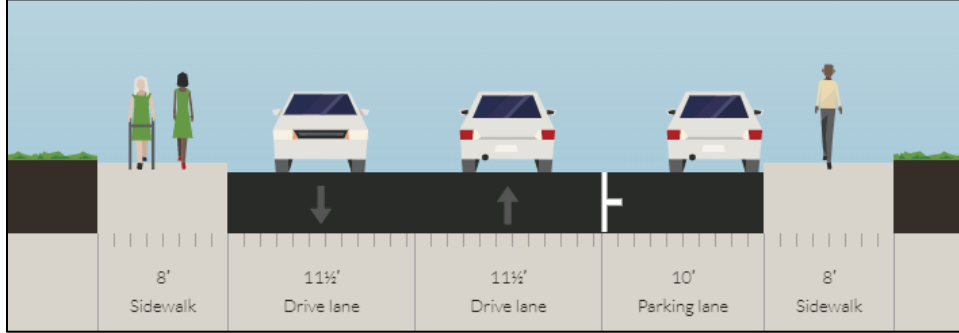


**FIGURE 19: 20<sup>TH</sup> AVE. TYPICAL SECTION #1**  
Between Charlotte and Church St. (at signalized intersections)



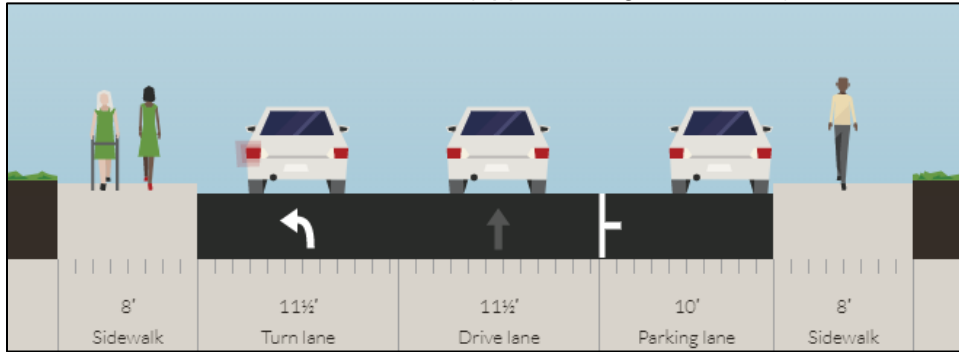
**FIGURE 20: 20<sup>TH</sup> AVE. TYPICAL SECTION #2**

Between Charlotte and Church St. (away from signalized intersections / major driveways)



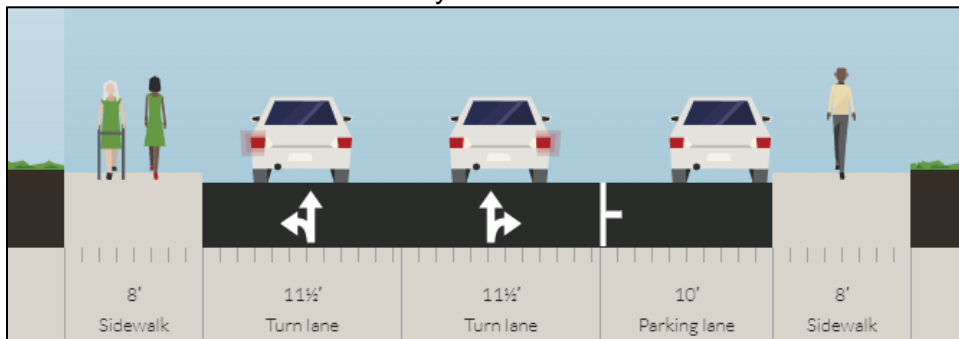
**FIGURE 21: 20<sup>TH</sup> AVE. TYPICAL SECTION #3**

Between Church St. and West End (approaching Church St.)



**FIGURE 22: 20<sup>TH</sup> AVE. TYPICAL SECTION #4**

Between West End and Broadway



### 3.2 PROPOSED OPTION TRAFFIC DISTRIBUTIONS

Converting 20<sup>th</sup> and 21<sup>st</sup> Avenues from their existing one-way operations to two-way operations will modify traffic patterns within the study area. To the estimated effects:

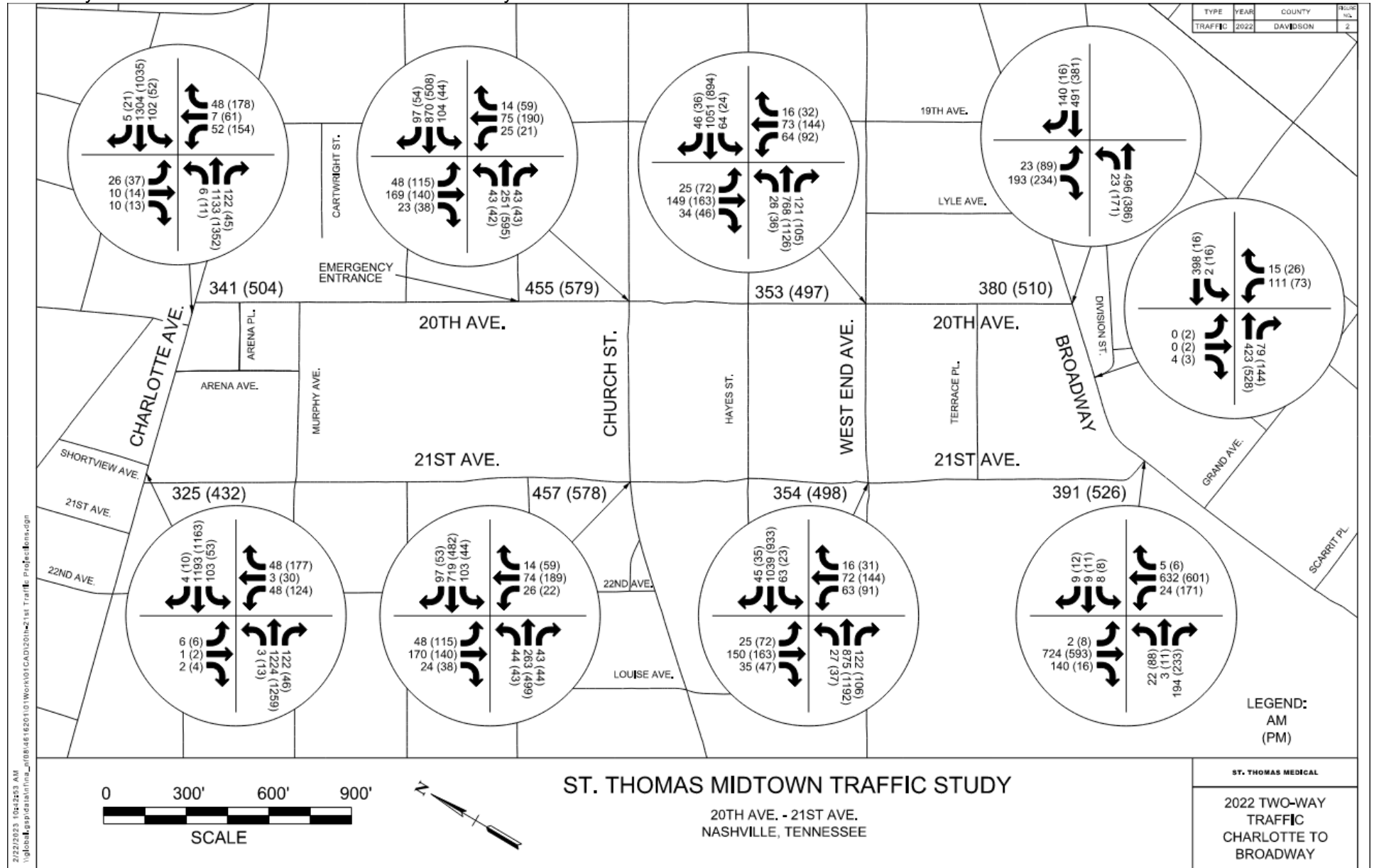
- For each left-turn movement onto a single existing one-way street, half of the left-turning volume was distributed to each of the two proposed two-way streets (see example in Figure 23)
- For each right-turn movement onto a single existing one-way street, half of the right-turning volume was distributed to each of the two proposed two-way streets.
- Volumes entering and exiting the study corridor were held the same between the existing one-way and proposed two-way conditions.

The results of the traffic distributions are provided in Figure 24 and Figure 25.

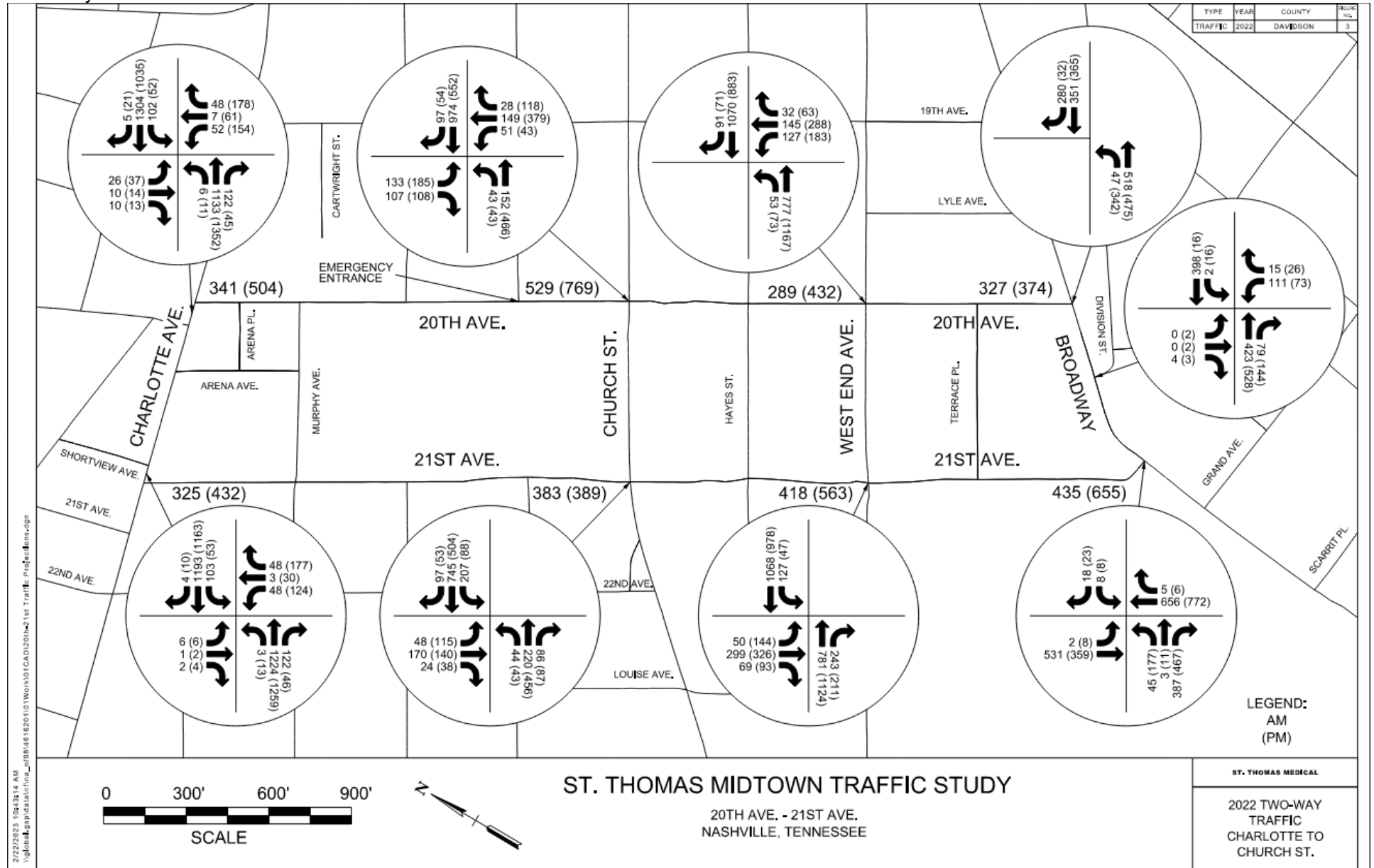
**FIGURE 23: EXAMPLE LEFT TURN DISTRIBUTION**



**FIGURE 24: OPTION A TRAFFIC DISTRIBUTION**  
Two-Way Traffic between Charlotte Ave and Broadway



**FIGURE 25: OPTION B TRAFFIC DISTRIBUTION**  
Two-Way Traffic between Charlotte Ave and Church St.



## 4.0 LEVEL OF SERVICE ANALYSIS

A traffic operations level of service (LOS) analysis was developed for the following intersections:

1. 21st Avenue at Charlotte Ave
2. 21st Avenue at Church Street
3. 21st Avenue at West End Avenue
4. 21st Avenue at Broadway
5. 20th Avenue at Broadway
6. 20th Avenue at West End Avenue
7. 20th Avenue at Church Street
8. 20th Avenue at Charlotte Ave
9. Broadway at Division Street

The following conditions are examined in this report:

1. One-way operations along 20<sup>th</sup> and 21<sup>st</sup> Avenues (Existing Condition)
2. Two-Way Traffic between Charlotte Avenue and Broadway (Option A)
3. Two-Way Traffic between Charlotte Avenue and Church Street (Option B)

Traffic analysis was developed with the Synchro software application, Version 11. Synchro follows the methodology found in the 2010 Highway Capacity Manual (HCM). The traffic analysis output is provided in the Appendix.

LOS is a qualitative traffic capacity measure that is used to gauge the operational performance of an intersection or roadway segment. There are six (6) levels ranging from 'A' to 'F' with 'F' being the worst. Each level represents a range of operating conditions. Table 1 defines the traffic flow conditions and approximate driver comfort at each LOS.

**TABLE 1: LOS INDEX**

LOS	TRAFFIC FLOW CONDITIONS
A	Progression is extremely favorable and most vehicles do not stop at all.
B	Good progression, some delay.
C	Fair progression, higher delay.
D	Unfavorable progression, congestion becomes apparent.
E	Poor progression, significant delay.
F	Poor progression, extreme delay.



This report is intended to be a tool to assist NDOT determine the feasibility of the traffic operations conversion, and not as a finalized Traffic Impact Study. The intersections studied include all signalized intersections within the study area and those at the termini of the study area (see Figure 26). The following all-way stop controlled intersections were studied for delay and queue length, but not LOS analysis due to being unsignalized:

- 20<sup>th</sup> Avenue at Hayes Street
- 21<sup>st</sup> Avenue at Murphy Avenue
- 21<sup>st</sup> Avenue at Hayes Street

Additionally, driveways to significant traffic generators and some side streets may need to be converted to right-in/right-out where left-turn lanes are not provided. This would include the entire length of 21<sup>st</sup> Avenue with either Option A or B since the inclusion of bicycle lanes excludes the inclusion of turn lanes.

Figure 27 summarizes the existing year (2022) LOS traffic analysis for the three alternatives A, B, and existing one-way pair. Table 2 provides additional information, including intersection delay, the LOS for each approach to the intersection, and the maximum volume to capacity (v/c) ratio for each intersection. For stop sign-controlled intersections where the primary route is free-flowing there is no “entire intersection” LOS. The LOS calculations for the signalized intersections are provided in the Appendix.

The LOS are similar for all three operational conditions examined. All three typically have LOS of B or better, with the only LOS of D being seen utilizing the exiting layout of the one-way pair at the intersection of 21st at Broadway.

A pedestrian or bicycle LOS analysis was not developed as part of this study. The pedestrian LOS may improve in Options A and B with the addition of two signalized intersections. The bicycle LOS would be improved for proposed Options A and B since the existing condition does not include bicycle lanes and both proposed options include buffered bicycle lanes.

FIGURE 26: INTERSECTIONS IN LOS ANALYSIS IN OPTIONS A AND B

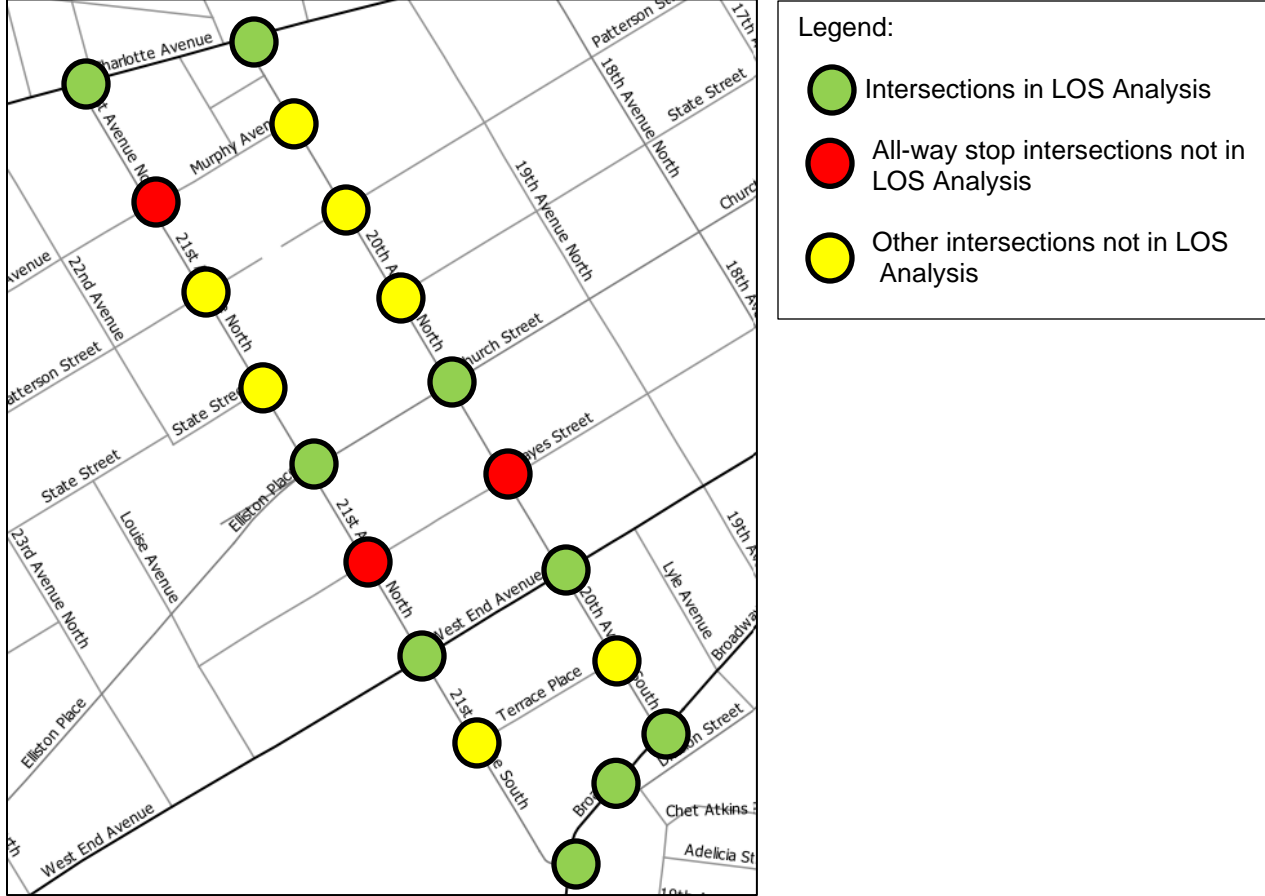
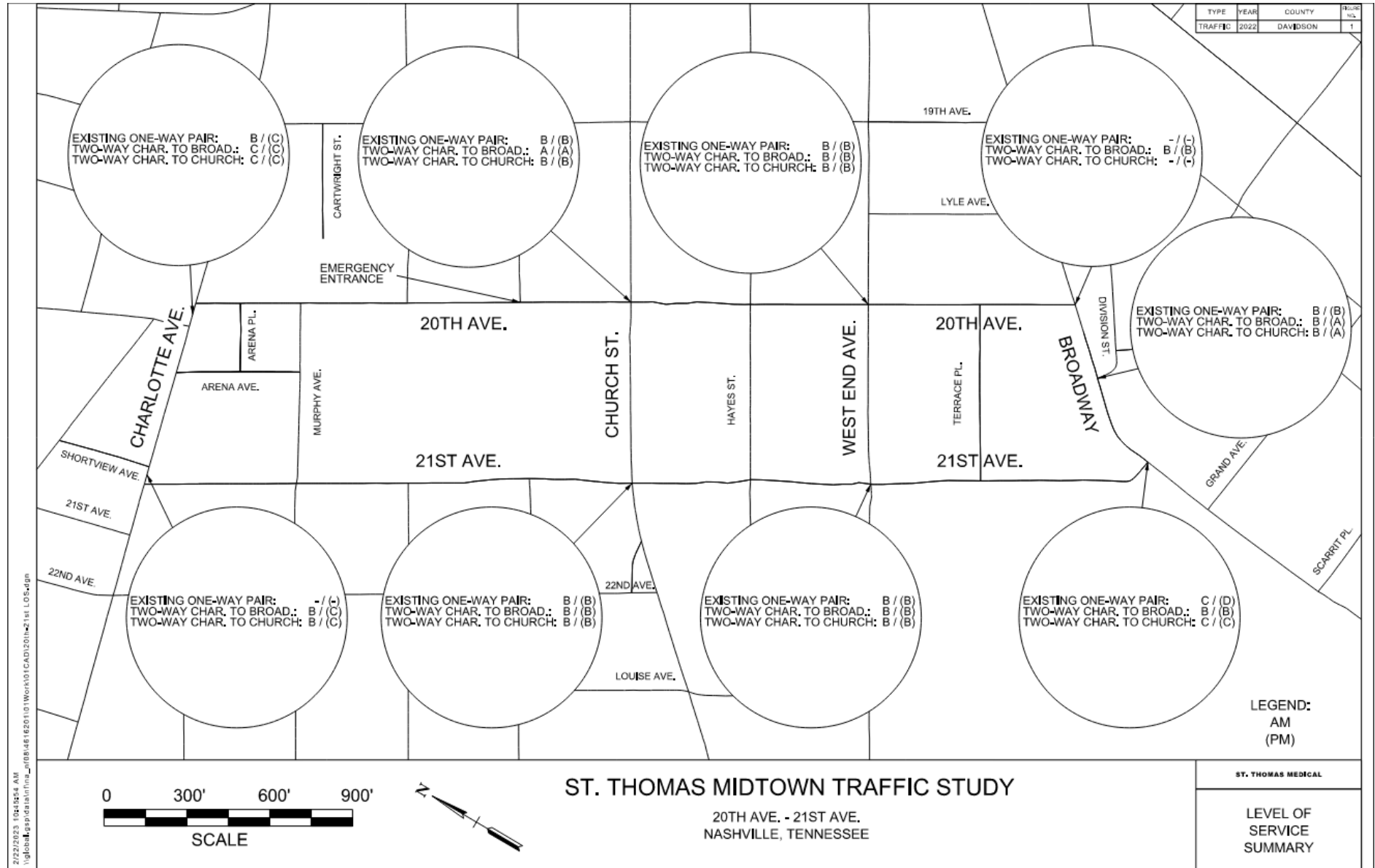


FIGURE 27: LEVEL OF SERVICE SUMMARY



**TABLE 2: LEVEL OF SERVICE SUMMARY**

Intersection/Option		2022 AM								2022 PM							
		Overall Intersection			Approach LOS				Overall Intersection			Approach LOS					
	Notes	LOS	Delay	Max v/c	EB	WB	NB	SB	LOS	Delay	Max v/c	EB	WB	NB	SB		
<b>#1: 21st. Ave. at Charlotte Ave.</b>																	
A. Existing One-Way Pair Charlotte to Broadway	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	12.5	0.63	B	A	D	D	<b>C</b>	23.2	0.78	C	B	C	C		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	12.5	0.63	B	A	D	D	<b>C</b>	23.6	0.76	C	B	D	C		
<b>#2: 21st Ave. at Church St.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	17.1	0.58	B	A	-	D	<b>B</b>	16.2	0.51	B	A	-	C		
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	12.1	0.63	A	A	D	D	<b>B</b>	16.4	0.64	C	A	C	C		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	12.5	0.73	B	A	-	D	<b>B</b>	13.8	0.58	B	A	-	C		
<b>#3: 21st Ave. at West End Ave.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	11.1	0.50	B	A	-	C	<b>B</b>	12.8	0.61	B	A	-	D		
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	15.5	0.57	B	B	D	D	<b>B</b>	14.9	0.75	C	A	C	C		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	18.7	0.54	B	B	-	D	<b>B</b>	14.8	0.65	B	A	-	D		
<b>#4: 21st Ave. at Broadway</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>C</b>	28.2	0.82	E	E	C	A	<b>D</b>	41	1	E	E	C	B		
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	11.3	0.89	E	D	A	A	<b>B</b>	12.7	0.89	E	D	A	A		
C. Two-Way Traffic Charlotte to Church St.		<b>C</b>	23.6	0.93	E	D	B	A	<b>C</b>	33.1	0.94	E	E	C	A		
<b>#5: 20th Ave. at Broadway</b>																	
A. Existing One-Way Pair Charlotte to Broadway	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	16.3	0.68	A	B	-	D	<b>B</b>	16.9	0.64	A	B	-	C		
C. Two-Way Traffic Charlotte to Church St.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<b>#6: 20th Ave. at West End Ave.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	10.3	0.61	A	B	C	-	<b>B</b>	11.1	0.55	A	B	D	-		
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	11.9	0.53	A	B	D	D	<b>B</b>	10.8	0.60	A	B	C	C		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	11.6	0.52	A	B	D	-	<b>B</b>	14.1	0.79	A	B	D	-		
<b>#7: 20th Ave. at Church St.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	12.1	0.48	A	A	D	-	<b>B</b>	16.1	0.48	B	A	C	-		
B. Two-Way Traffic Charlotte to Broadway		<b>A</b>	8.7	0.49	A	A	D	D	<b>A</b>	8.1	0.41	A	A	C	C		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	12.7	0.85	A	A	E	-	<b>B</b>	18.8	0.93	A	B	D	-		
<b>#8: 20th Ave. at Charlotte Ave.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	14.4	0.74	B	B	D	A	<b>C</b>	27.3	0.69	C	C	D	D		
B. Two-Way Traffic Charlotte to Broadway		<b>C</b>	30.9	0.83	D	C	C	D	<b>C</b>	30.6	0.80	C	C	E	E		
C. Two-Way Traffic Charlotte to Church St.		<b>C</b>	30	0.77	C	C	D	E	<b>C</b>	31.5	0.81	C	C	D	E		
<b>#9: Broadway at Division St.</b>																	
A. Existing One-Way Pair Charlotte to Broadway		<b>B</b>	14.4	0.74	A	E	A	A	<b>B</b>	10.3	0.64	D	E	A	A		
B. Two-Way Traffic Charlotte to Broadway		<b>B</b>	14.5	0.73	A	E	A	A	<b>A</b>	9.1	0.64	D	E	A	A		
C. Two-Way Traffic Charlotte to Church St.		<b>B</b>	13.7	0.73	A	E	A	A	<b>A</b>	9	0.64	D	E	A	A		

**Notes:**

1. Unsignalized intersections do not have an overall LOS.

## 5.0 OPINION OF PROBABLE CONSTRUCTION COST

Detailed construction costs were not developed. However, general guidance on construction costs are provided below in order to provide an “order of magnitude” cost for the improvements. These costs do not include engineering or project development costs, which will add to the expense.

- A new traffic signal costs approximately \$375,000
- A modified traffic signal costs approximately \$180,000
- Signing costs approximately \$6,000 per mile
- Pavement markings cost approximately \$12,000 per lane mile
- Milling and overlaying pavement costs approximately \$160,000 per lane mile
- Additional items 20% contingency

*Two-Way Traffic between Charlotte Avenue and Broadway (Option A)* would require two new traffic signals, modify six existing signals, 1.3 miles of signing, and four lane-miles of pavement markings. The opinion of probable construction cost for Option A is therefore \$2.3 million. If milling and overlaying of the existing pavement (four lane-miles) is required, the cost would increase to \$3 million.

*Two-Way Traffic between Charlotte Avenue and Church Street (Option B)* would require one new traffic signal, modify three existing signals, 2/3 of a mile of signing, and three lane-miles of pavement markings. The opinion of probable construction cost for Option B is therefore \$1.2 million. If milling and overlaying of the existing pavement (four lane-miles) is required, the cost would increase to \$1.7 million.

Opinion of probably engineering design cost is approximately \$300,000. This added expense results in a cost estimate of \$3.3 million for Option A and \$2 million for Option B.

## **6.0 STAKEHOLDER MEETINGS SUMMARY**

Two stakeholder meetings were held to gather feedback on the proposed conversion of the 20<sup>th</sup> and 21<sup>st</sup> Avenue corridors. These meetings were held on June 29, 2023 and on September 26, 2023.

The first meeting was attended by Cathedral of Incarnation, Vanderbilt University, Ascension St. Thomas Hospital, and Elliston Place Soda Shop staff. In this meeting, attendees were introduced to the project via a PowerPoint presentation and provided an opportunity to share their thoughts on the project and express any concerns they had. The project was well received by those in attendance.

- It was noted that near the Vanderbilt University campus there were some buildings being currently constructed on 20<sup>th</sup> Avenue and that vulnerable user safety was a priority for the University.
- The Cathedral staff noted that there concerns were with congregation members entering and exiting their facility, and noted that this activity was heaviest on the weekends.
- Elliston Place Soda Shop noted that they had parking on this side of their facility but did not have concerns about the project.
- Ascension St. Thomas discussed their interest in the project and its impacts on the Emergency Room. They did not have any concerns about the project. All participants noted that they would like to see more of the intended design to understand the projects impacts in greater detail.

The second meeting was attended by WeGo, Graduate Hotel, Hampton Inn Nashville, Ascension St. Thomas Hospital, Vanderbilt University, Healthcare Realty, and Select Medical staff. Similar to the first meeting, an introduction to the project via a PowerPoint presentation was conducted. The group was then presented with roll plot that showed a more detailed view of the proposed changes to the two project corridors. Attendees were given a chance to review and respond to the roll plots. Below is a synopsis of the discussion attendees had during the meeting.

- The Graduate Hotel expressed concerns with their current rideshare drop-offs and valet operations along 20<sup>th</sup> Avenue being limited due to the proposed changes. They noted that they also had concerns about the ability for delivery vehicles to access their facility which may need to back into the alley near the property.
- Ascension St. Thomas and their related staff discussed their emergency services operations and noted that around 40 ambulances per day were accessing their Emergency Room. They noted that drivers have express that they have issues currently crossing the existing three lanes of traffic to access the Emergency Room and that the change in roadway operation would create the need to be also cross opposing traffic.
- Vanderbilt University staff expressed that they were in favor of the changes proposed that would provide connectivity improvements that were needed in the area. They noted that the University had plans to expand the campus towards 19<sup>th</sup> Avenue and that they have a lot of pedestrian activity around the Hayes Street and Terrace Place corridors.
- WeGo noted that they would like to see a one foot buffer with a physical barrier for the bicycle lanes. They also noted that Americans with Disabilities Act (ADA) upgrades were

needed on 20<sup>th</sup> Avenue and State Street. They also noted that near the Ascension St. Thomas Emergency Room, having bus stops located near the entrance would provide better access for riders. At the intersection of Spruce Street/20<sup>th</sup> Avenue and Charlotte Pike, there is a need to restripe the left turn lane on Spruce Street. They also noted that reviewing the ability of buses to make the turns at the intersection of 20<sup>th</sup> Avenue and Broadway was needed.

- The group as a whole discussed the overall project, as well, and noted that there was a need to improve the bicycle connection within the area. It was suggested that bicycle signals with leading intervals be added to the project to provide safety for cyclists making right and left turns. They also noted that considerations that would optimize the available road space for transportation alternatives was noted as a need for the area, including removal of or conversions to existing parking, would be important.

Using the information heard at both meetings, the design for the corridors has been reviewed and updated.

## **7.0 SUMMARY**

The purpose of this report is to examine the traffic impacts of converting 20<sup>th</sup> and 21<sup>st</sup> Avenues from their existing one-way operations to two-way. Two options are examined in this report:

1. Two-Way Traffic between Charlotte Avenue and Broadway (Option A)
2. Two-Way Traffic between Charlotte Avenue and Church Street (Option B)

A summary of the analysis findings is as follows:

- Both options will include buffered bicycle lanes between Charlotte Avenue and Broadway. This is consistent with NDOT's WalknBike Plan.
- 20<sup>th</sup> Avenue will be more motor-vehicle focused and include on-street parking or a two-way left turn lane, turn lanes and 11-foot (minimum) lanes.
- Transit stops would be placed on 20<sup>th</sup> Avenue.
- 21<sup>st</sup> Avenue will be more multimodal focused and include buffered bicycle lanes with no turn lanes (in order to maintain the bike lanes through all intersections), no on-street parking, and 10-foot lanes.
- NDOT may wish to review the time-restricted on-street parking along West End Avenue and Broadway.
- The opinion of probable construction cost for Option A is \$2.3 million to \$3 million.
- The opinion of probable construction cost for Option B is \$1.2 million to \$1.7 million.
- The LOS are similar for all three operational conditions examined (existing operations, Option A, and Option B). All three typically have LOS of B or better, with the only LOS of D being seen utilizing the existing layout of the one-way pair at the intersection of 21<sup>st</sup> at Broadway.
- The pedestrian LOS may improve in Options A and B due to the addition of two signalized intersections.
- The bicycle LOS would be improved for proposed Options A and B since the existing condition does not include bicycle lanes and both proposed options include buffered bicycle lanes.

Key takeaways from the stakeholder meetings are:

- Overall the proposed operational changes to the corridors was positive.
- Operations for rideshare and valets in the area need to be considered.
- Access to emergency services needs to consider both ambulance and bus traffic as well as pedestrian access.
- Needs for the transit system's operations need to be accounted for within the design.
- Safety for vulnerable user needs to be accounted for within the design.