FRAZIER AVENUE TIME DELAY STUDY REPORT
2/05/2024

Background

After the tragic accident on Frazier Avenue, on November 25th of 2023, that took the life of a family from Florida visiting our city, it was determined that the City of Chattanooga should evaluate the lane configuration of the road in an effort to improve pedestrian safety. The accident occurred when a vehicle, traveling over the speed limit of 35 mph, tried to pass on the narrow 4-lane road and lost control, running off of the road and striking the family who were walking on the sidewalk.

Frazier Avenue is an active urban commercial neighborhood adjacent to some of the most popular parks in the city, so pedestrian activity is common. The existing conditions of the street are two lanes in each direction, with on-street parking for much of the length. The travel lanes are narrow, approximately 9', and the parking lanes are narrow as well, approximately 7'. Due to the narrowness of the travel and parking lanes, the traveling public often staggers themselves in the lanes in order to avoid sideswiping another car traveling on the street or parked adjacent to the travel lane. Even so, sideswipes are still very common, 16 in the last year, see attached collision diagram. Several years ago, the City had prepared an alternative street configuration that reduced the number of travel lanes, reduced the number of on-street parking spaces and added bike facilities, however, the plan was not implemented due to strong opposition from the neighborhood. A speed study was performed on the street on November 28th that measured an 85th percentile speed of 29 mph in both directions. The speed limit was reduced to 25 mph on December 4th.

The CDOT Time Delay Study

After the tragic accident, the City felt that it should look again at improvements to the street that would increase pedestrian safety. As an immediate response to the accident, CDOT installed temporary traffic control devices that mostly blocked the inside lane in each direction, leaving only a small pocket for left turning traffic. The traffic control devices were left in place for weekends and holidays in December. In January, the traffic control devices were kept in place during weekdays as well from Jan 2nd through Jan 10th. The traffic control devices provided a quick and easily removable option for slowing traffic in the area and showed what traffic might look like with only one lane in each direction. A permanent solution that utilizes pavement markings will be much more user friendly especially when it comes to left turns, access to adjacent parking lots, emergency vehicles, and maneuvering around stopped delivery trucks or buses.

It was determined that CDOT should take the opportunity of the new traffic pattern, with the traffic control devices in-place, to study the time delay traveling along Frazier Avenue with fewer travel lanes. The route that was selected went from the intersection of Manning Street and Cherokee Blvd, along Cherokee Blvd and Frazier Avenue, then along Barton Avenue to the Island Avenue intersection. The route was timed in both directions and encompassed more than just Frazier Avenue so that congestion leading to Frazier Avenue could be taken into account. A summary of the CDOT Time Delay Study data is attached.

Results and Observations from the CDOT Time Delay Study

The general observation in the field was that the travel time was much more contingent on the timing of the traffic signals than on the lane configuration. The most congested times were during the afternoon peak, especially in the westbound direction. The traffic signals are very close together, and are not synchronized, so sometimes a driver has to stop at a red signal when they can see that the next light has a green signal, then they get the green signal just in time for the next signal to go red. Also, when the road is most congested, the driver cannot move through the green signal due to the congestion.

Speed studies were performed with and without the traffic control devices once the speed limit was reduced to 25 mph. The 85th percentile speed with the traffic control devices in place was 24 mph in the eastbound direction and 22 mph in the westbound direction. The 85th percentile speed without the traffic control devices in place, the existing condition, was 28 mph in both directions. Speed does not appear to be a problem on a consistent basis, in either scenario, four-lane or three-lane. It should be noted that there is a high rate of sideswipe accidents in the current four-lane configuration, even with speeds below 30 mph.

Obviously, pedestrians are desired on Frazier Avenue, but the signal timing that helps pedestrians has the opposite effect on vehicular traffic. The Forest Avenue signal has a “pedestrian scramble phase”, which stops vehicular traffic in all directions while pedestrians cross in all four directions. The Woodland Avenue signal has a “leading pedestrian phase”, which is a signal phase that allows pedestrians to cross prior to the phase allowing vehicles to cross in the same direction. These phases are actuated by pushbuttons, so when there is more pedestrian activity, there will be more stop conditions for vehicles.

Weekends: The weekends were timed midday, between 11:30 AM and 3:30 PM. Total times averaged between 3 min 40 seconds and 5 min 3 seconds with the traffic control devices in place, and between 2 minutes 56 second and 4 minutes 56 seconds without the traffic control devices. The eastbound traffic averaged between 2 and 46 seconds longer with the traffic control devices in-place. The westbound traffic was inconsistent, the 1:00 to 1:29 PM travel time averaged 2 minutes and 7 seconds longer with the traffic control devices in-place, but the other times were actually 12 to 46 seconds shorter with the traffic control devices in place. As mentioned previously, the travel time was mostly related to traffic signal timing and increased pedestrian activity on weekends resulting in more signal red-time on the vehicular lanes. In general, the vehicular traffic on the weekend was not enough to see significant congestion with the reduced capacity of one lane in each direction.

Weekday Mornings and noon: The weekday mornings were timed between 7:00 AM and 9:30 AM. Total times averaged between 3 minutes 0 seconds and 3 minutes 41 seconds with traffic control devices in place and between 2 minutes 21 seconds and 3 minutes 33 seconds without the traffic control devices. The largest difference in either direction, with or without traffic control devices was 39 seconds. Significant congestion was not observed in the mornings, likely due to the fact that very few pedestrians were crossing Frazier Avenue. Total travel time at noon averaged between 4 minutes 23 seconds and 5 minutes 10 seconds with traffic control devices in place and 3 minutes 35 seconds and

4 minutes 17 seconds without traffic control devices in place. The travel times averaged between 47 and 53 seconds longer with traffic control devices in place. In general, the vehicular traffic at noon was not enough to see significant congestion with the reduced capacity of one lane in each direction.

Weekday Afternoons: The weekday afternoons were timed between 3:30 and 6:30 PM. Total times in the eastbound direction averaged between 3 minutes 41 seconds and 4 minutes 56 seconds with traffic control devices in place and between 3 minutes 35 seconds and 4 minutes 12 seconds without the traffic control devices. Total times in the westbound direction averaged between 4 minutes 11 seconds and 6 minutes 4 seconds with traffic control devices in place and between 3 minutes 23 seconds and 4 minutes 41 seconds without the traffic control devices. The largest differences were 1 minute 7 seconds in the eastbound direction and 1 minute 54 seconds in the westbound direction. Traffic congestion was more noticeable in the afternoon with the westbound direction being more significant. As mentioned elsewhere, lack of synchronization of the closely spaced traffic signals was observed to have more bearing on travel times than capacity due to the number of lanes.

The RPA Report

The RPA took data from the Travel Demand Model (TDM) for the nine Traffic Analysis Zones (TAZ) that make up the Northshore area and looked at how modifications to Frazier Avenue could impact travel time on the streets nearby. The study looked at 2019 data with projections for 2050. The RPA report shows that speed limit changes and lane reduction on Frazier Avenue have very little effect on Cherokee Boulevard and Manufacturers Road. The report does show that a speed reduction to 25 mph, along with a capacity reduction from four lanes to three lanes, would result in increased travel times on Frazier Avenue of approximately 17 seconds in the near term and 19 seconds with the 2050 projections. It should be noted that the travel time delays listed in the RPA report are just along Frazier Avenue, and not along the longer CDOT study route. The RPA report shows a decrease in the Level Of Service (LOS) for vehicular traffic on Frazier Avenue from a LOS-A to a LOS-B if the road is reconfigured from a four-lane roadway to a three-lane roadway. The report shows no LOS change on Cherokee Boulevard or Manufacturers Road associated with modifications to Frazier Avenue. The full RPA report is attached.

The UTC Report

UTC's Center for Urban Informatics and Progress (CUIP) reviewed turning movement data from the City's traffic signal system along Frazier Avenue and observed a drop in the vehicle count, of between 5% and 15%, while the traffic control devices were in-place. This is likely due to some drivers avoiding the street due to the traffic control devices and some increased congestion during peak travel times. UTC's brief report is attached.

Conclusions and Recommendations Overall

The speed on Frazier Avenue was reduced by the lane reduction with the traffic control devices in place. The RPA study shows a reduction in the LOS on Frazier Avenue from a LOS-A to a LOS-B should be expected with a lane reduction to a three-lane section.

The reduction to LOS-B is acceptable, as LOS-B constitutes “reasonably free flow”, and roadways are typically designed to a LOS C or D, per the Highway Capacity Manual and AASHTO. The largest effect on travel time appeared to be the lack of signal synchronization in the closely spaced traffic signals. The signal synchronization can be improved. Therefore, it is our recommendation to improve the synchronization of the traffic signals while preserving and improving pedestrian signal phases as well. A city-wide signal timing grant is currently being negotiated.

If the number of travel lanes are reduced on Frazier Avenue some increased congestion can be expected, and some drivers may opt to take a different route in order to avoid the congestion. That being said, some increased vehicular congestion means that the traffic will be slow and thus safer for pedestrians. Though the travel times were longer with fewer travel lanes, the driving experience wasn’t significantly impacted. The RPA’s report reflected a drop in the vehicular LOS to a LOS-B, which is still good, but it is likely that the LOS for pedestrians would be improved.

It is CDOT’s recommendation to revise the lane configuration of Frazier Avenue from a four-lane facility, with two narrow (9’) lanes in each direction and occasional narrow (7’) parking lanes, to a three-lane facility, with one (10’) lane in each direction, a 10’ center turn lane, buffered bike facilities, and occasional 8’ parking lanes or loading zones where width allows. Some of the reasoning is as follows:

As mentioned in the background above, in the existing condition, due to the narrowness of the travel and parking lanes, drivers often stagger themselves in the lanes in order to avoid sideswiping another car, so the additional lanes are not fully utilized. Additionally, the lack of a left turn lane causes left turning traffic to stop in a travel lane, disrupting the flow of traffic.

The slightly wider lanes should reduce sideswipe accidents without being so wide as to encourage excessive speeds, and a center turn lane would allow left turning traffic to be able to get out of the flow of traffic in order to make their turn.

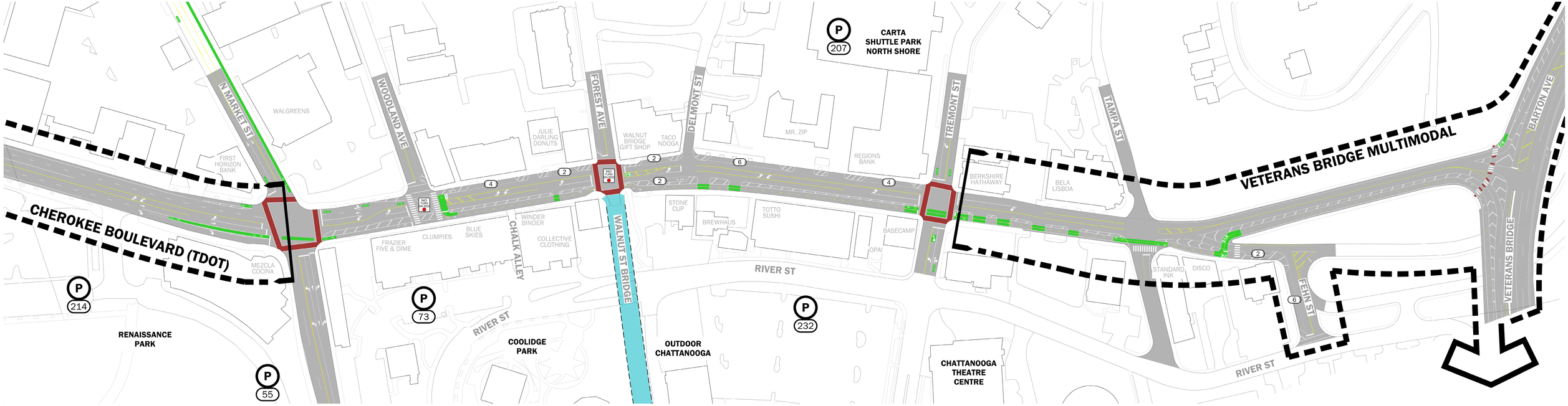
Buffered bike facilities will not only improve utilization by bikes, but it will also provide a buffer between the motorized vehicles and pedestrians.

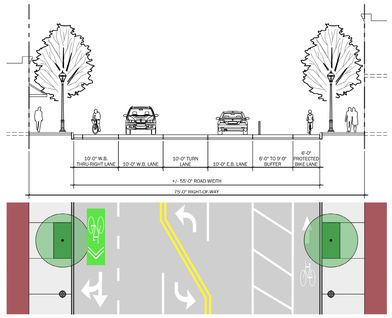
The center turn lane will provide access for emergency vehicles to go around traffic.

A reduction in the on-street parking can be absorbed by the abundance of off-street parking in the area. The left turn lane will also make access to driveways and off-street parking more accessible.

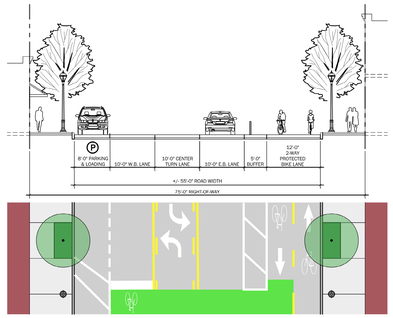
It is the CDOT’s recommendation to utilize one of the conceptual options developed by the City’s Transportation Planning Division for the reconfiguration, see attached. We would recommend one modification to the concept to replace some of the on-street parking with a CARTA bus stop and delivery loading zones. The adjacent businesses could provide input on the loading zone areas.

Conceptual Plans

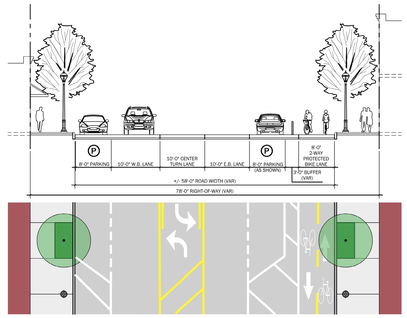




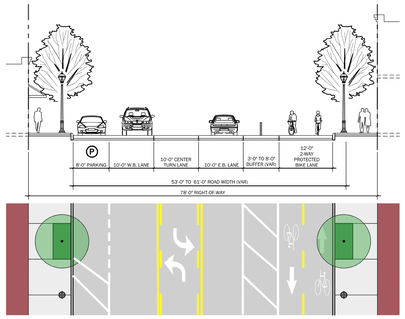
A1 **OPTION A:** N. MARKET ST TO WOODLAND AVE
Frazier Ave // 3-Lanes with Sharrow and Protected Bike Lane
SCALE: 1/8" = 1'-0"



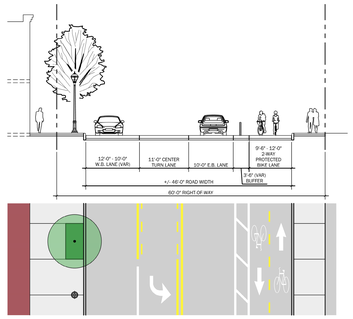
A2 **OPTION A:** WOODLAND AVE TO FOREST AVE
Frazier Ave // 3-Lanes with Parking and 2-Way Protected Bike Lane
SCALE: 1/8" = 1'-0"



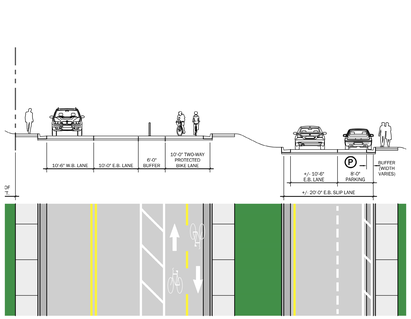
A3 **OPTION A:** FOREST AVE TO DELMONT ST
Frazier Ave // 3-Lanes with Parking and 2-Way Protected Bike Lane
SCALE: 1/8" = 1'-0"



A4 **OPTION A:** DELMONT ST TO TREMONT ST
Frazier Ave // 3-Lanes with 2-Way Protected Bike Lane
SCALE: 1/8" = 1'-0"



A5 **OPTION A:** TREMONT ST TO TAMPA ST
Frazier Ave // 3-Lanes with 2-Way Protected Bike Lane
SCALE: 1/8" = 1'-0"



A6 **OPTION A:** TAMPA ST TO VETERANS BRIDGE
Frazier Ave // 3-Lanes with 2-Way Protected Bike Lane
SCALE: 1/8" = 1'-0"

FRAZIER AVENUE SAFETY ENHANCEMENTS

OPTION A : Overall Scoping

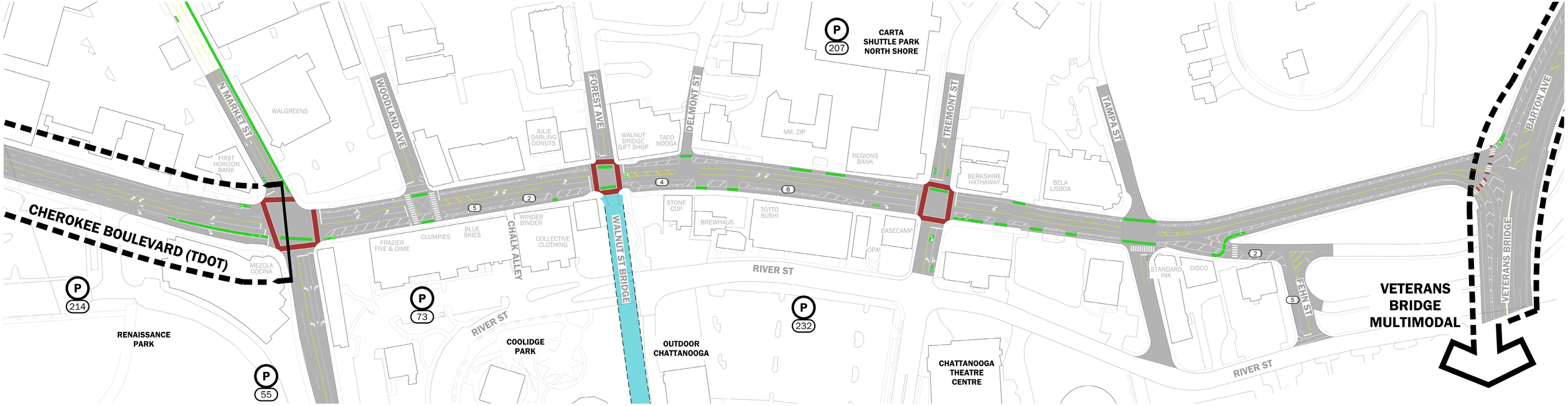
initial concepts:
for internal review only

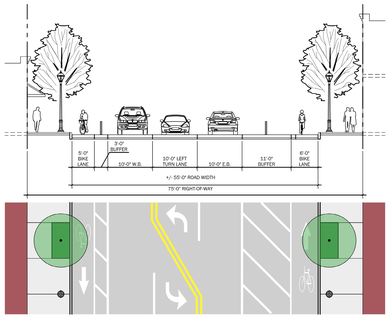
PARKING COMPARISON	
EXISTING	27 on-street spaces
OPTION A - PROPOSED	18 on-street spaces

prepared by: CITY OF CHATTANOOGA

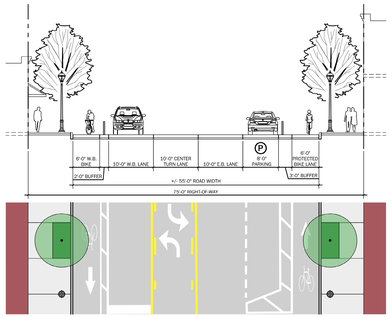
partners: Chattanooga Department of Planning / Division of Transportation Planning
Department of Public Works / Division of Transportation
Department of Technology Services / Intelligent Cities Division

date: January 22, 2024

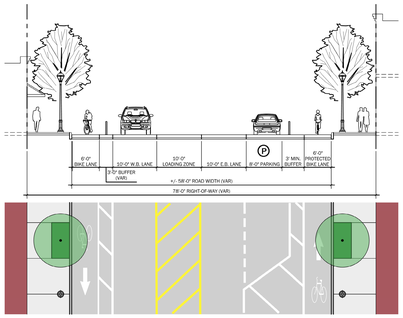




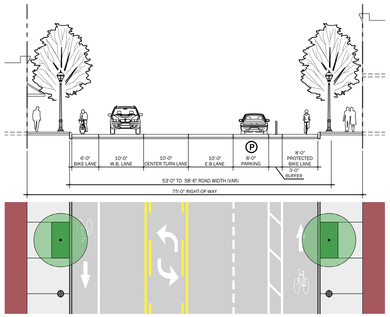
B1 **OPTION B:** N. MARKET ST TO WOODLAND AVE
Frazier Ave // 3-Lanes with Protected Bike Lanes
SCALE: 1/8" = 1'-0"



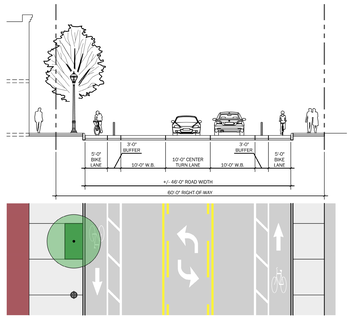
B2 **OPTION B:** WOODLAND AVE TO FOREST AVE
Frazier Ave // 3-Lanes with Parking and Protected Bike Lanes
SCALE: 1/8" = 1'-0"



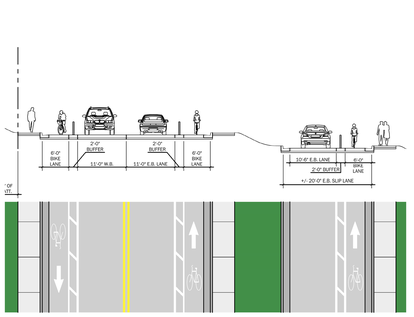
B3 **OPTION B:** FOREST AVE TO DELMONT ST
Frazier Ave // 2-Lanes with Parking and Protected Bike Lanes
SCALE: 1/8" = 1'-0"



B4 **OPTION B:** DELMONT ST TO TREMONT ST
Frazier Ave // 3-Lanes with Bike Lane and Protected Bike Lane
SCALE: 1/8" = 1'-0"



B5 **OPTION B:** TREMONT ST TO TAMPA ST
Frazier Ave // 3-Lanes with Protected Bike Lanes
SCALE: 1/8" = 1'-0"



B6 **OPTION B:** TAMPA ST TO VETERANS BRIDGE
Frazier Ave // 3-Lanes with Protected Bike Lanes
SCALE: 1/8" = 1'-0"

FRAZIER AVENUE SAFETY ENHANCEMENTS

OPTION B : Overall Scoping

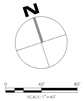
initial concepts:
for internal review only

PARKING COMPARISON	
EXISTING	27 on-street spaces
OPTION B - PROPOSED	17 on-street spaces

prepared by: CITY OF CHATTANOOGA

partners: Chattanooga Department of Planning / Division of Transportation Planning
Department of Public Works / Division of Transportation
Department of Technology Services / Intelligent Cities Division

date: January 22, 2024



Collision Diagram

COLLISION DIAGRAM

Location Frazier Ave

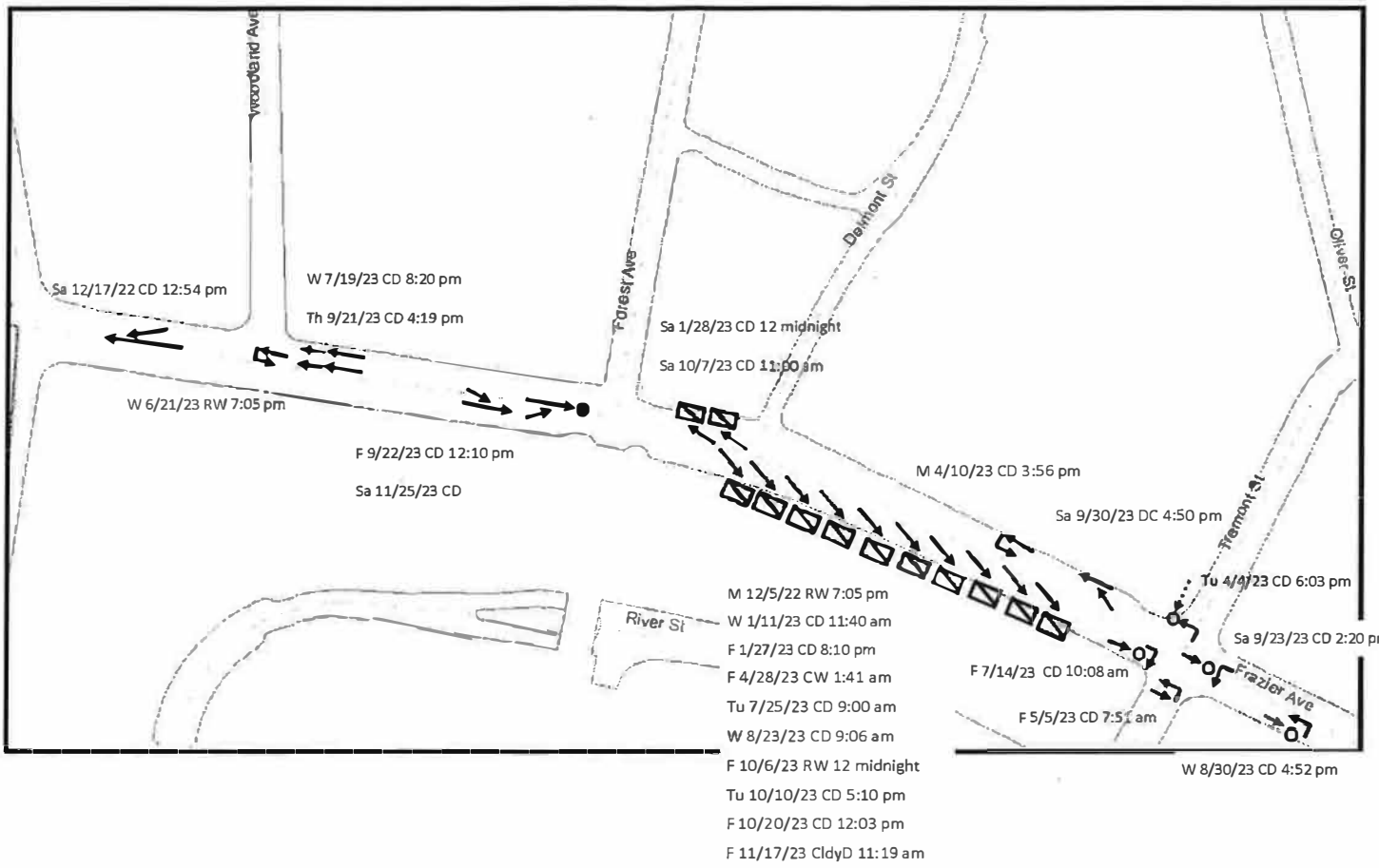
City Chattanooga

Data obtained from TITAN

Number of Crashes 25

Period of 1 year: 11/28/2022 to 2023

Compiled by Ben Taylor - 11/28/23



Moving Motor Vehicle

Pedestrian

Parked Vehicle

Fixed Object

Fatal Crash

Personal Injury

Property Damage

CRASH SUMMARY

Type	Fatal	Injury	Property Damage	Total
Right Angle		1		1
Rear End			2	2
Side-Swipe	1		15	16
Left Turns		3	3	6
Fixed Object				0
Others				0
TOTAL	1	4	20	25

Summary of CDOT Time Delay Study Data

CDOT Time Delay Study

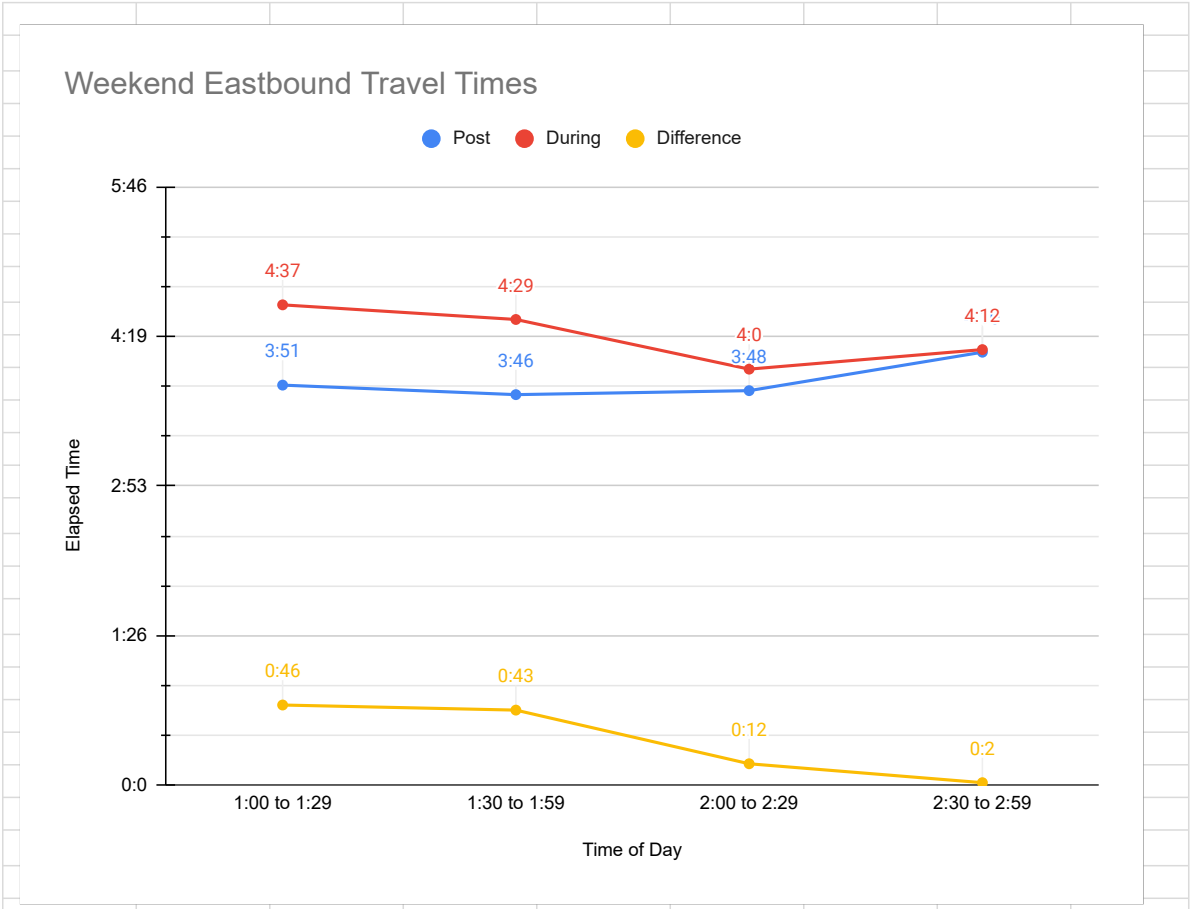
Time Reported in:
Hours : Minutes : Seconds

DURING	WEEKEND EASTBOUND							
12/9-1/10	11:30 to 11:59	12:00 to 12:29	12:30 to 12:59	1:00 to 1:29	1:30 to 1:59	2:00 to 2:29	2:30 to 2:59	3:00 to 3:29
During Exercise With Traffic Control Devices in-place	0:04:02	0:03:55	0:04:05	0:04:37	0:04:29	0:04:00	0:04:12	0:04:28
POST	**WEEKEND EASTBOUND**							
1/11-1/24	11:30 to 11:59	12:00 to 12:29	12:30 to 12:59	1:00 to 1:29	1:30 to 1:59	2:00 to 2:29	2:30 to 2:59	3:00 to 3:29
After Traffic Control Devices Removed				0:03:51	0:03:46	0:03:48	0:04:10	
Difference				0:00:46	0:00:43	0:00:12	0:00:02	

DURING	WEEKEND WESTBOUND							
12/9-1/10	11:30 to 11:59	12:00 to 12:29	12:30 to 12:59	1:00 to 1:29	1:30 to 1:59	2:00 to 2:29	2:30 to 2:59	3:00 to 3:29
During Exercise With Traffic Control Devices in-place	0:03:40	0:04:21	0:04:17	0:05:03	0:04:31	0:03:51	0:03:40	0:04:25
POST	**WEEKEND WESTBOUND**							
1/11-1/24	11:30 to 11:59	12:00 to 12:29	12:30 to 12:59	1:00 to 1:29	1:30 to 1:59	2:00 to 2:29	2:30 to 2:59	3:00 to 3:29
After Traffic Control Devices Removed				0:02:56	0:04:56	0:04:03	0:04:26	
Difference				0:02:07	-0:00:25	-0:00:12	-0:00:46	

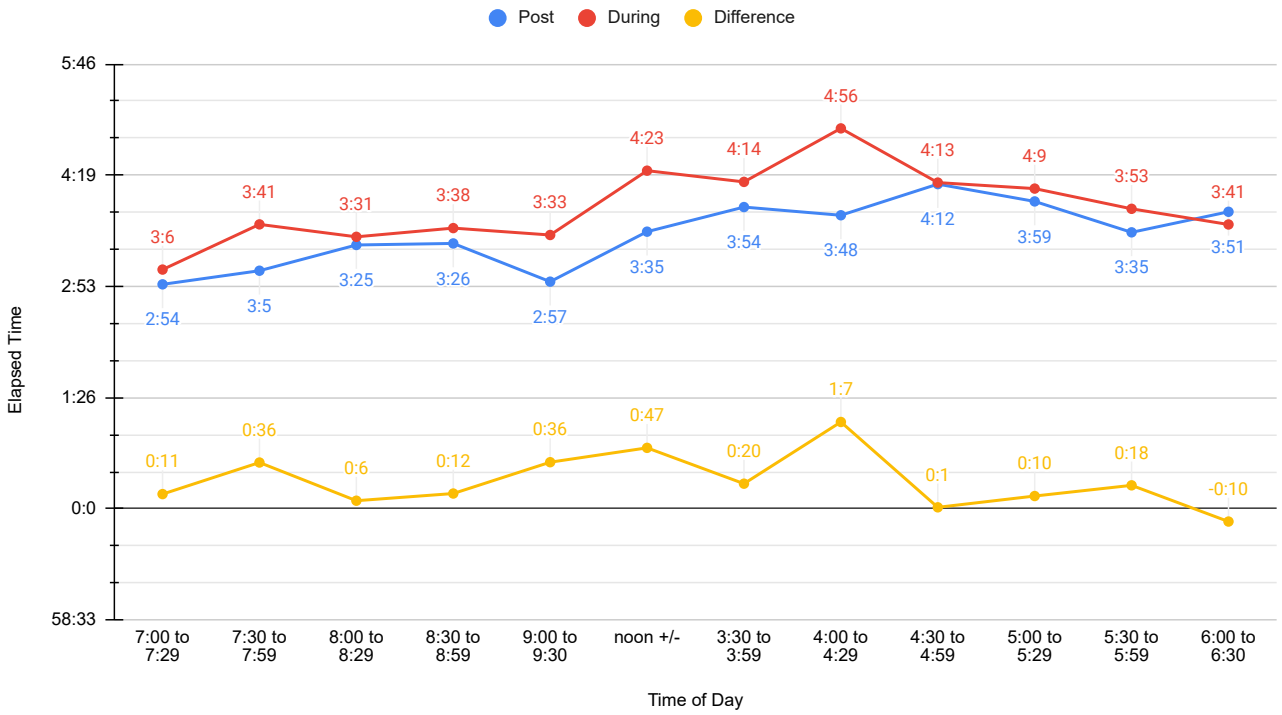
DURING	WEEKDAY EASTBOUND											
12/9-1/10	7:00 to 7:29	7:30 to 7:59	8:00 to 8:29	8:30 to 8:59	9:00 to 9:30	noon +/-	3:30 to 3:59	4:00 to 4:29	4:30 to 4:59	5:00 to 5:29	5:30 to 5:59	6:00 to 6:30
During Exercise With Traffic Control Devices in-place	0:03:06	0:03:41	0:03:31	0:03:38	0:03:33	0:04:23	0:04:14	0:04:56	0:04:13	0:04:09	0:03:53	0:03:41
POST	**WEEKDAY EASTBOUND**											
1/11-1/24	7:00 to 7:29	7:30 to 7:59	8:00 to 8:29	8:30 to 8:59	9:00 to 9:30	noon +/-	3:30 to 3:59	4:00 to 4:29	4:30 to 4:59	5:00 to 5:29	5:30 to 5:59	6:00 to 6:30
After Traffic Control Devices Removed	0:02:54	0:03:05	0:03:25	0:03:26	0:02:57	0:03:35	0:03:54	0:03:48	0:04:12	0:03:59	0:03:35	0:03:51
Difference	0:00:11	0:00:36	0:00:06	0:00:12	0:00:36	0:00:47	0:00:20	0:01:07	0:00:01	0:00:10	0:00:18	-0:00:10

DURING	WEEKDAY WESTBOUND											
12/9-1/10	7:00 to 7:29	7:30 to 7:59	8:00 to 8:29	8:30 to 8:59	9:00 to 9:30	noon +/-	3:30 to 3:59	4:00 to 4:29	4:30 to 4:59	5:00 to 5:29	5:30 to 5:59	6:00 to 6:30
During Exercise With Traffic Control Devices in-place	0:03:37	0:03:00	0:03:33	0:03:28	0:03:15	0:05:10	0:05:30	0:05:25	0:05:26	0:06:04	0:05:31	0:04:11
POST	**WEEKDAY WESTBOUND**											
1/11-1/24	7:00 to 7:29	7:30 to 7:59	8:00 to 8:29	8:30 to 8:59	9:00 to 9:30	noon +/-	3:30 to 3:59	4:00 to 4:29	4:30 to 4:59	5:00 to 5:29	5:30 to 5:59	6:00 to 6:30
After Traffic Control Devices Removed	0:03:03	0:02:21	0:03:15	0:03:33	0:03:00	0:04:17	0:03:36	0:04:05	0:04:14	0:04:41	0:04:34	0:03:23
Difference	0:00:34	0:00:39	0:00:19	-0:00:05	0:00:15	0:00:53	0:01:54	0:01:21	0:01:12	0:01:23	0:00:57	0:00:48

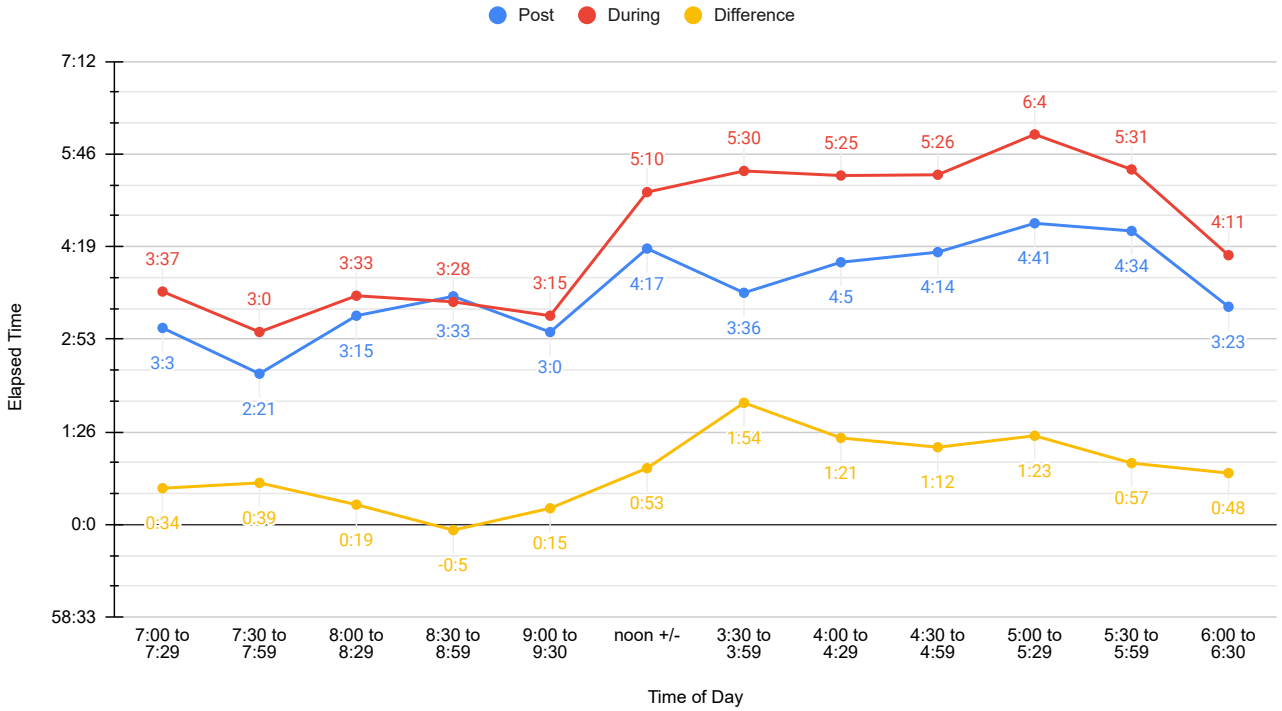

Weekend Eastbound Travel Times
Post
During
Difference
5:46
4:19
2:53
1:26
0:0
Elapsed Time
4:37
4:29
4:0
4:12
3:51
3:46
3:48
0:46
0:43
0:12
0:2
1:00 to 1:29
1:30 to 1:59
2:00 to 2:29
2:30 to 2:59
Time of Day


Weekend Westbound Travel Times
Post
During
Difference
5:46
4:19
2:53
1:26
0:0
58:33
Elapsed Time
4:56
5:3
4:26
4:3
4:31
2:56
3:51
3:40
2:7
-0:25
-0:12
-0:46
1:00 to 1:29
1:30 to 1:59
2:00 to 2:29
2:30 to 2:59
Time of Day

Weekday Eastbound Travel Times



Weekday Westbound Travel Times



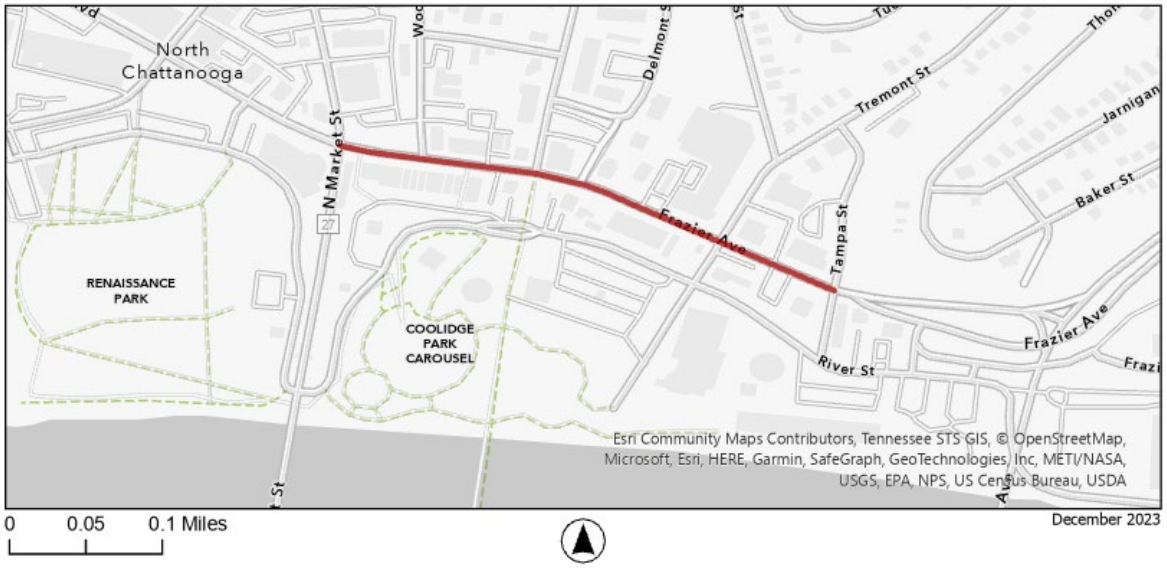
RPA Report

Scenario Impacts for Frazier Avenue

Based upon the 2050 Travel Demand Model for the Chattanooga-Hamilton County/North Georgia Transportation Planning Organization

Frazier Avenue - 0.3 miles (from Market St to Tampa St)

Scenario	Speed Limit (MPH)	AB Lanes	BA Lanes	Center Turn Lane	AM Peak Flow	PM Peak Flow	Off Peak Flow	Auto Daily Flow	Truck Daily Flow	Total Daily Flow	Daily Capacity	LOS (lowest Level of Service)	Free Flow Time (seconds)	Congested Time (seconds)	Free Flow Speed (MPH)	Congested Speed (MPH)	Vehicle Miles Traveled (VMT)	Vehicle Hours Delay (VHD)
2019 - No Change	30	2	2	no	2,686	3,158	6,517	12,361	840	13,201	28,431 - 30,635	0.202 (A)	28.8	31.2	36.8	33.5	3,197	8.2
2019 - Lower speed to 25mph	25	2	2	no	2,623	3,152	6,235	12,010	830	12,840	28,211 - 30,164	0.204 (A)	31.8	34.2	33.3	30.7	3,103	7.6
2019 - Lower speed to 25mp and reduce capacity to 3 lanes	25	1	1	yes	2,387	2,823	5,590	10,800	789	11,589	8,494 - 15,004	0.461 (B)	33.0	48.0	31.8	23.8	2,842	41.2
2019 - Lower speed to 20mph	20	2	2	no	2,563	3,083	6,377	12,024	842	12,866	28,136 - 29,862	0.200 (A)	28.8	37.8	29.9	27.8	3,130	7.4
2050 - No Change	30	2	2	no	2,922	3,473	7,482	13,878	863	14,740	28,431 - 30,635	0.222 (A)	31.8	31.2	36.8	33.3	3,665	9.9
2050 - Lower speed to 25mph	25	2	2	no	2,874	3,275	7,079	13,229	882	14,111	28,211 - 30,164	0.212 (A)	33.0	34.2	33.3	30.5	3,489	9.0
2050 - Lower speed to 25mp and reduce capacity to 3 lanes	25	1	1	yes	2,739	2,956	5,909	11,605	886	12,490	8,494 - 15,004	0.483 (B)	35.4	50.4	31.8	22.7	3,183	51.0
2050 - Lower speed to 20mph	20	2	2	no	2,868	3,258	7,241	13,367	919	14,286	28,136 - 29,862	0.212 (A)	35.4	37.8	29.9	27.6	3,553	9.1
TDOT AADT (2019)										16,991								
TDOT AADT (2022)										15,788								



AM peak - 6:00 am - 9:00 am

PM peak - 3:00 pm - 6:00 pm

Off Peak - 9:00 am - 3:00 pm and 6:00 pm to 6:00 am

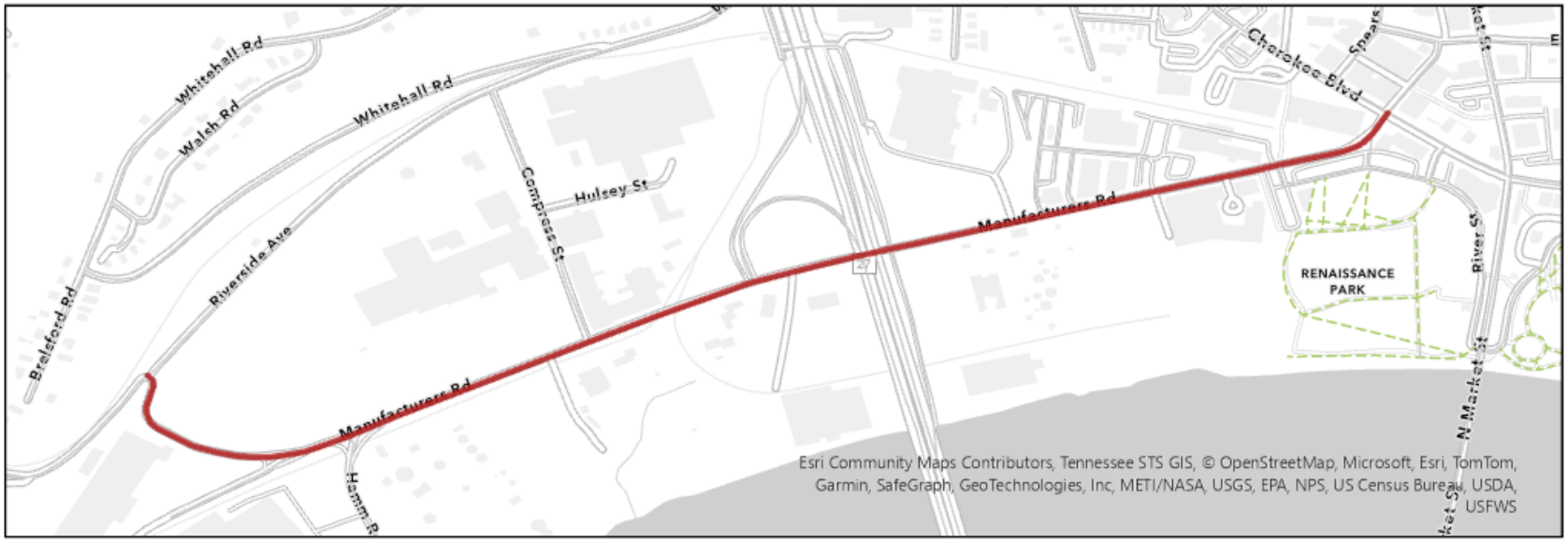
Based upon the 2050 Travel Demand Model for the
Chattanooga-Hamilton County/North Georgia Transportation Planning Organization

RPA

Impacts for Frazier Ave Scenarios on Manufacturers Road

Manufacturers Rd - 1.1 miles (Riverside Ave to Frazier Ave)

Scenario	AM Peak Flow	PM Peak Flow	Off Peak Flow	Auto Daily Flow	Truck Daily Flow	Total Daily Flow	Daily Capacity	LOS (lowest Level of Service)	Free Flow Time (seconds)	Congested Time (seconds)	Free Flow Speed (MPH)	Congested Speed (MPH)	Vehicle Miles Traveled (VMT)	Vehicle Hours Delay (VHD)
2019 - No Change	2,833	3,068	6,092	11,994	1,324	13,318	7,954 - 15,339	0.453 (A)	105.0	181.2	36.8	33.5	8,206	198.1
2019 - Lower speed to 25mph	2,803	3,166	5,943	11,912	1,357	13,269	7,954 - 15,339	0.453 (A)	105.0	181.2	33.3	30.7	8,261	196.2
2019 - Lower speed to 25mp and reduce capacity to 3 lanes	2,854	3,116	6,010	11,981	1,326	13,307	7,954 - 15,339	0.457 (A)	105.0	181.2	31.8	23.8	8,227	196.7
2019 - Lower speed to 20mph	2,800	3,100	5,965	11,865	1,362	13,227	7,954 - 15,339	0.468 (A)	105.0	181.8	37.0	25.9	8,184	198.9
2050 - No Change	3,016	3,262	6,649	12,927	1,594	14,521	7,954 - 15,339	0.498 (A)	105.0	196.2	36.8	33.3	9,495	269.1
2050 - Lower speed to 25mph	3,040	3,277	6,562	12,879	1,578	14,457	7,954 - 15,339	0.502 (B)	105.0	195.0	33.3	30.5	9,413	264.9
2050 - Lower speed to 25mp and reduce capacity to 3 lanes	3,008	3,217	6,433	12,658	1,597	14,255	7,954 - 15,339	0.481 (A)	105.0	192.0	31.8	22.7	9,352	249.5
2050 - Lower speed to 20mph	3,025	3,228	6,550	12,803	1,606	14,409	7,954 - 15,339	0.486 (B)	105.0	194.4	37.0	24.0	9,307	258.5
TDOT AADT (2019)						13,329								
TDOT AADT (2022)						13,417								



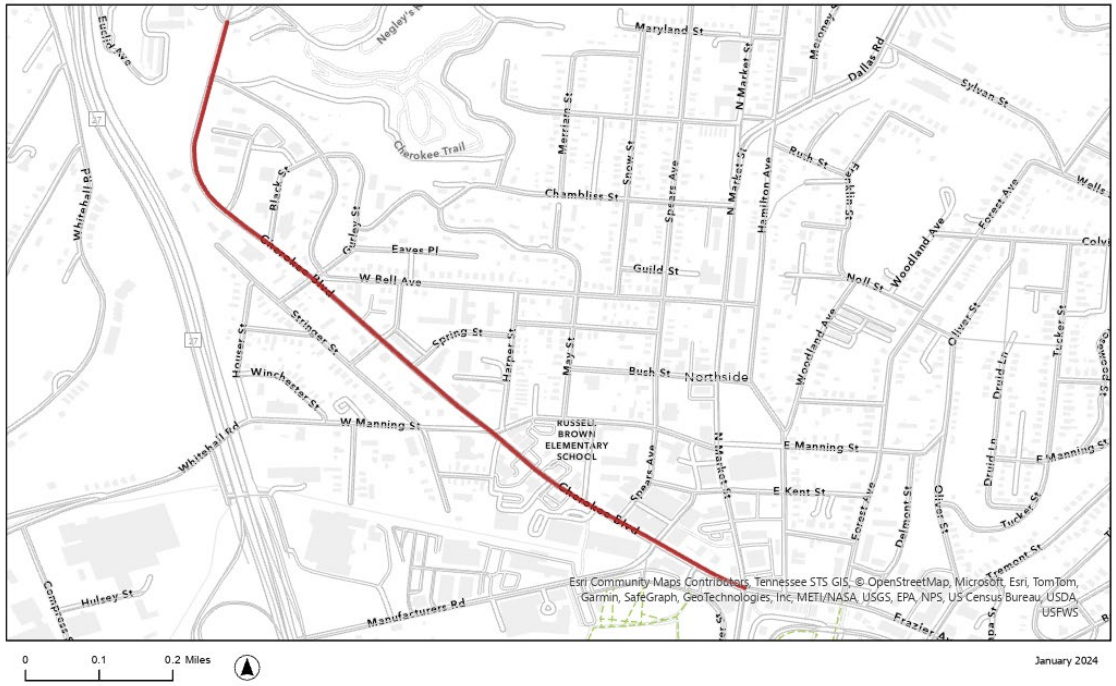
0 0.1 0.2 Miles

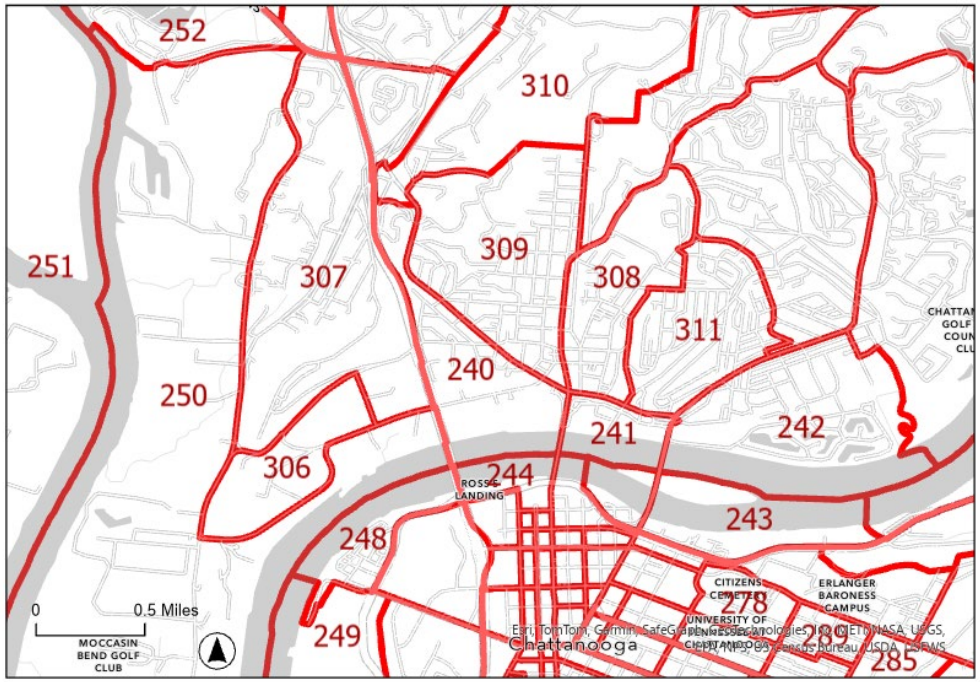
January 2024

RPA

Impacts for Frazier Ave Scenarios on Cherokee Blvd

Cherokee Blvd - 1.05 miles (from Frazier Ave/Market St to Tunnel)														
Scenario	AM Peak Flow	PM Peak Flow	Off Peak Flow	Auto Daily Flow	Truck Daily Flow	Total Daily Flow	Daily Capacity	LOS (lowest Level of Service)	Free Flow Time (seconds)	Congested Time (seconds)	Free Flow Speed (MPH)	Congested Speed (MPH)	Vehicle Miles Traveled (VMT)	Vehicle Hours Delay (VHD)
2019 - No Change	3,597	4,298	8,675	16,571	945	17,516	15,477 - 32,744	0.573 (C)	87.0	132.6	43.2	33.67	11,020	156.4
2019 - Lower speed to 25mph	3,536	4,208	8,409	16,153	929	17,082	15,477 - 32,744	0.560 (C)	87.0	132.6	43.2	33.69	10,923	156.2
2019 - Lower speed to 25mp and reduce capacity to 3 lanes	3,508	4,164	8,298	15,971	891	16,862	15,477 - 32,744	0.558 (C)	87.0	133.2	43.2	33.70	10,900	159.3
2019 - Lower speed to 20mph	3,563	4,301	8,657	16,520	926	17,446	15,477 - 32,744	0.572 (C)	87.0	133.2	43.2	33.65	11,094	159.3
2050 - No Change	4,327	5,041	10,387	19,755	989	20,744	15,477 - 32,744	0.688 (C)	87.0	143.4	43.2	32.62	13,175	222.1
2050 - Lower speed to 25mph	4,287	4,953	10,121	19,362	987	20,349	15,477 - 32,744	0.671 (C)	87.0	142.8	43.2	32.70	13,093	217.3
2050 - Lower speed to 25mp and reduce capacity to 3 lanes	4,310	4,766	9,774	18,850	1,004	19,854	15,477 - 32,744	0.670 (C)	87.0	142.8	43.2	32.76	12,893	219.4
2050 - Lower speed to 20mph	4,275	4,901	10,367	19,542	1,017	20,560	15,477 - 32,744	0.676 (C)	87.0	142.8	43.2	32.70	13,129	218.9
TDOT AADT (2019)						15,287								
TDOT AADT (2022)						13,950								





Traffic Analysis Zones

Demographics and Projections in the TDM

Data from the TDM for the 9 TAZ's that make up the NorthShore area is shown in the table below. Upon review of buiding permit data and proposed future projects, there are some areas that the 2050 projected households and populations prepared in 2020 are lower than the current trends (approximately 33% less.) Additional housing units are mainly along Manufactures Rd and in TAZ 240 and 250. The currently proposed units and projects make up an additional 1600 households and will gerenate an estimated additional 11,500 trips.[1] Present day level of service for both Frazier Ave and Manufacturers Rd is level A (approximately 0.2). Capacity for Frazier Ave stands at approximately 60,000 (with no speed limit reduction or number of lane changes) and Manufacturers Rd has a capacity of roughly half that at 30,000.

TAZ	Population 2019	Students 2019	Employment 2019	Projected Population 2050	Projected Students 2050	Projected Employment 2050	Subdivision lots 2019-2023	Households 2019	New Residential Building Permits 2019-2023	Housing units in Proposed Projects	2019 Households plus planned and permited housing unit	Projected Households 2050	Number of planned / proposed units beyond 2050 Household Projections
240	1,001	-	1,581	1,475	-	1,780	-	563	278	371	1,212	808	404
241	203	-	551	206	-	572	-	93	-	-	93	96	-
242	1,007	530	195	1,015	721	254	6	459	7	-	466	470	-
250	776	24	1,434	947	24	2,078	-	338	-	1,072	1,410	365	1,045
306	5	-	663	5	-	824	-	3	-	-	3	3	-
307	900	-	474	1,624	-	834	72	533	63	108	704	884	-
308	915	429	739	956	-	867	6	414	32	45	491	441	50
309	960	-	2,039	1,040	-	2,345	37	464	107	68	639	507	132
311	1,614	-	106	1,744	-	170	3	737	53	15	805	813	-
TOTAL Northshore Area							124	3,604	540	1,679	5,823	4,387	1,631

- Source is TDM

[1]Trip estimation is based on an 80/20 split of single unit detached / condo or townhouse and was calculated using the Trip and Parking Generation Rates for 2 Different Housing Types: Effects of 3 Compact Development :

ITE Trip Generation Manual (weekday)

	Vehicle trips (per unit)
Single-Family Detached (210)	9.52
Condominium/Townhouse (230)	5.81
Apartment (220)	6.65

RPA

UTC Report

Frazier Avenue Data

We used Turning Movement data for understanding the effect of barriers on the number of vehicles that traveled through the Frazier. Tables below show data from four Mondays, Tuesdays, and Wednesdays (two from before, one during, and one after barriers were kept during the week).
These tables are specifically showing the number of vehicles that entered Frazier eastbound.

	Monday			
	Before		During	After
	27-Nov	4-Dec	8-Jan	22-Jan
Number of turning movements from Market Street to Frazier	5703	5809	5078	5535

	Tuesday			
	Before		During	After
	28-Nov	5-Dec	9-Jan	23-Jan
Number of turning movements from Market Street to Frazier	6119	5953	4994	5718

	Wednesday			
	Before		During	After
	29-Nov	6-Dec	10-Jan	24-Jan
Number of turning movements from Market Street to Frazier	6153	6121	5558	5675

In summary, number of vehicles went down by 10%, when compared Monday Jan. 8th with before and after. This number got increased to almost 16% for Tuesday and reduced to 2% on Wednesday. Numbers suggest barriers were removed on Wednesday morning.

The next set of tables below are showing the number of vehicles entering the Forest intersection from all approaches.

	Monday			
	Before		During	After
	27-Nov	4-Dec	8-Jan	22-Jan
Total number of vehicles in eastbound	7012	7110	6211	6591
Total number of turning movements at the Forest intersection	14954	15021	13552	14111

	Tuesday			
	Before		During	After
	28-Nov	5-Dec	9-Jan	23-Jan
Total number of vehicles in eastbound	7145	7271	5993	6917
Total number of turning movements at the Forest intersection	15105	15423	12749	14673

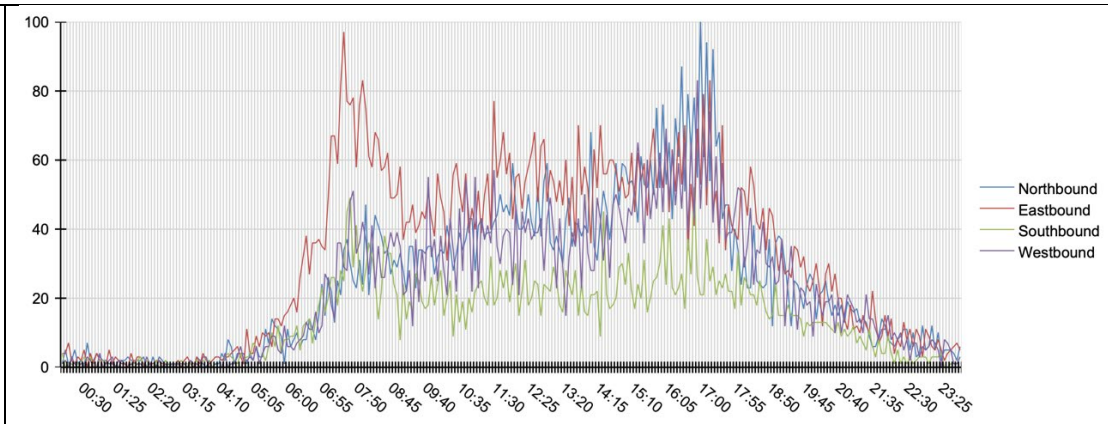
	Wednesday			
	Before		During	After
	29-Nov	6-Dec	10-Jan	24-Jan
Total number of vehicles in eastbound	7315	7367	6617	6515
Total number of turning movements at the Forest intersection	15428	15514	14224	14013

We see the same trend that on Tuesday that we had a big reduction in number of vehicles (almost 15%) compared to 8% and 5% on Monday and Wednesday, respectively.

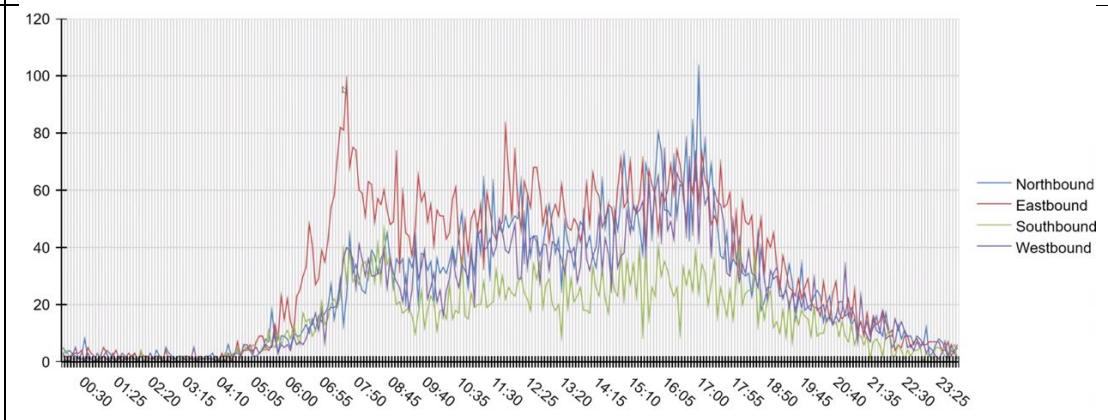
Tables in the next two pages are showing the turning movement for every hour during the 4 Mondays listed before. As one can see, the magnitude of the peak during the morning rush is reduced during the Jan. 8th, but its width is increased. This potentially shows that traffic congestion started earlier and lasted longer.

Market St

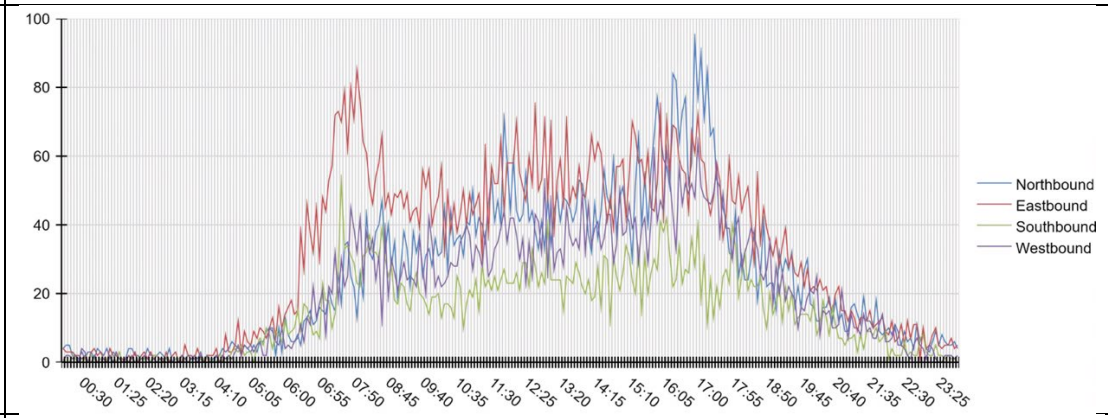
11/27/23



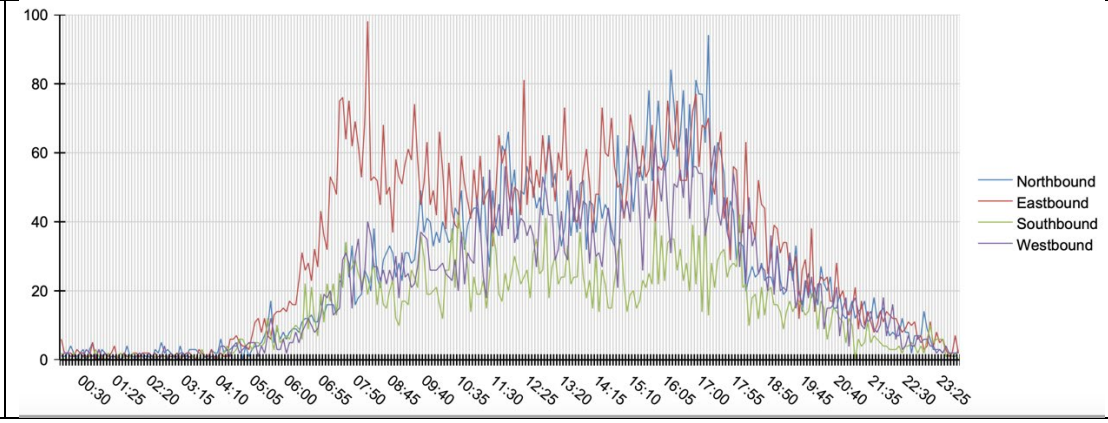
12/4/23

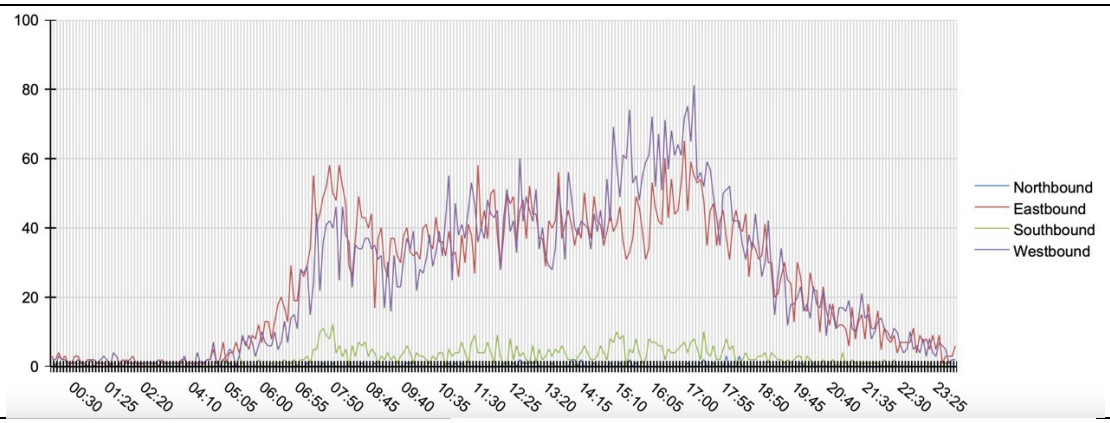
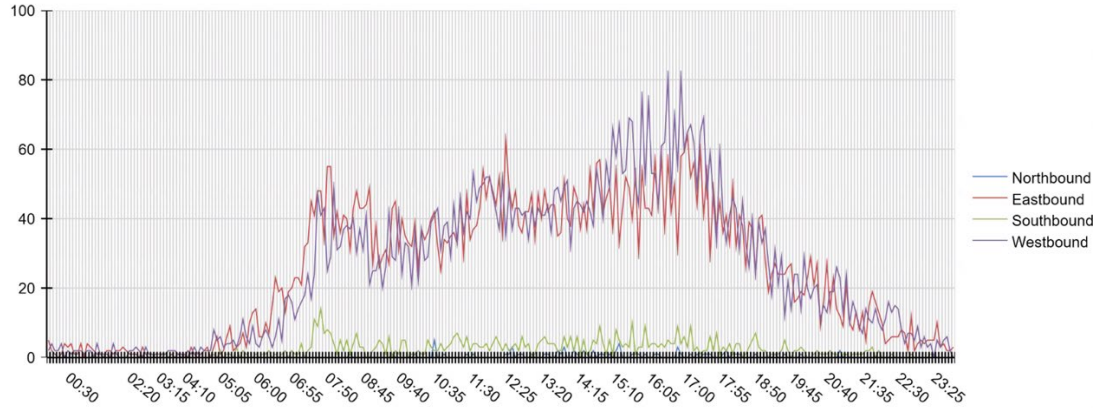
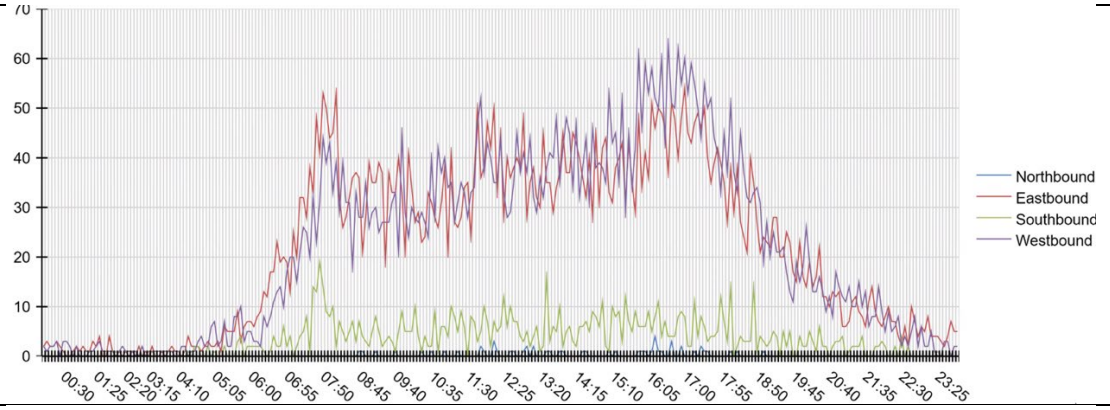


1/8/24



1/22/24



Forest Ave	
11/27/23	
12/4/23	
1/8/24	
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