



ENGINEERING DEPARTMENT

DATE: January 21, 2020
FROM: Gabe Schell, PE | City Engineer
ITEM: SI 531 Traffic Operations Analysis

REQUEST

Present traffic operations analysis along East Divide Avenue and South Washington Street within the proposed SI 531 work area.

Please place this item on the January 28, 2020 City Commission meeting agenda.

BACKGROUND INFORMATION

Divide Avenue from 19th Street to Volk Drive and South Washington Street from Bismarck Expressway to the south Bismarck drainage ditch are included in Street Improvement District 531. The annual street rehabilitation projects provide an opportunity to implement improvements to the roadway network configuration at minimal project costs. This process has been used on previous projects to implement cross walks, turn lanes, parking areas, etc. The Board directed staff on January 14, 2020 to reach out to additional public and provide additional analysis and report back at the next Commission meeting.

Washington Street

The existing conditions were reviewed to establish a baseline to compare and determine any future impacts associated with the proposed lane conversion to a 3 lane roadway. The evaluation of existing conditions includes existing traffic volumes, a crash analysis, and intersection capacity analysis.

Existing Conditions

Washington Street is a four-lane undivided principal arterial roadway with a 35 mile per hour (mph) posted speed limit south of Bismarck Expressway. Parking is prohibited along the corridor within the SI 531 proposed work area. The intersections of Riverwood Drive/Denver Avenue, Reno Avenue and Wachter Avenue are all signalized intersections. All other public streets are stop controlled on the minor street.

Traffic Volumes

24-hour traffic volumes for the following study intersections was collected on of September 27, 2018.

- Reno Avenue and Washington Street
- Wachter Avenue and Washington Street

Traffic volumes on the corridor range from nearly 13,000 average annual daily traffic (AADT) south of Riverwood Drive/Denver Avenue to approximately 10,000 AADT south of Wachter Avenue. As a comparison, traffic volumes on other 3-lane roadways such as Washington Street near E Avenue C are approximately 15,000 AADT and on N 19th Street near Century Avenue are 13,000. The ADDT on Reno Avenue is approximately 1,500 on each approach and on Wachter Avenue is approximately 1,500 on the west approach and 4,000 on the east approach.

Crash Analysis

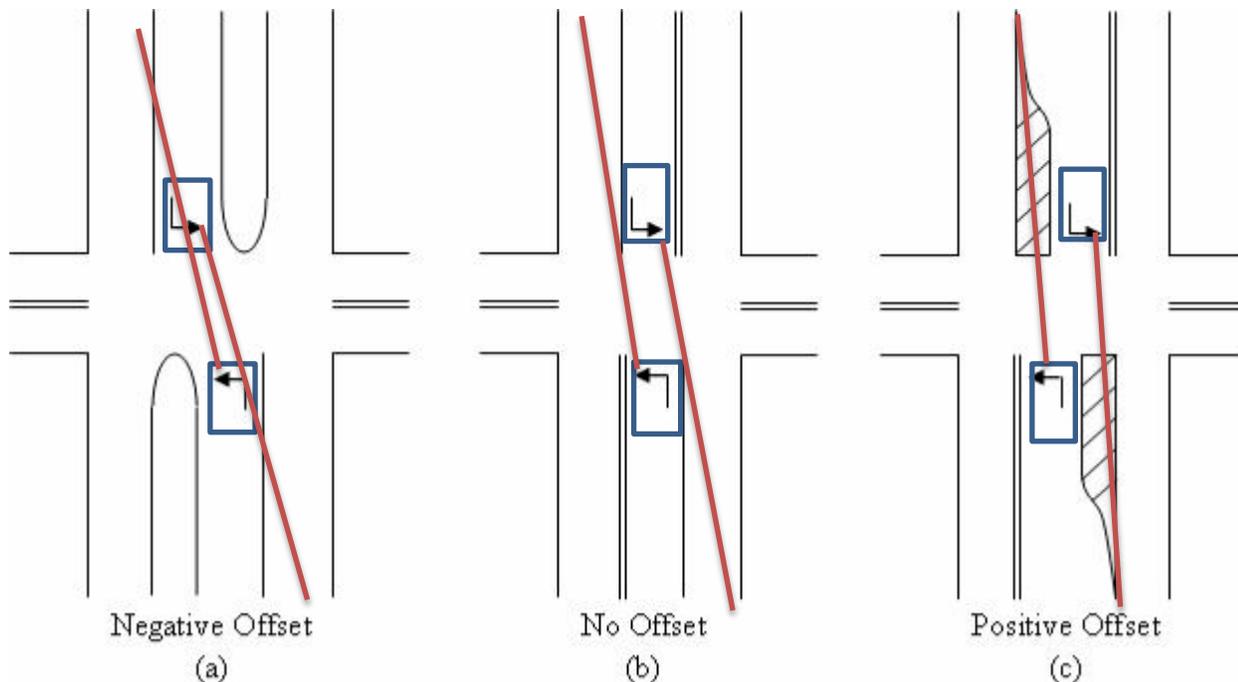
Crash data was reviewed from January 1, 2017 through December 31, 2019, which represents the most recent three-year period available. Based on this data, there were a total of 55 crashes between Easy Street and the drainage ditch. 22 of the 55 crashes were not intersection related. 37 of the 55 crashes involved at least one vehicle turning left, turning right, slowing or stopped on Washington Street. This is partially attributed to the unpredictable nature of the inside through lane that also functions as a left turn lane. Vehicles making a left turn off of Washington Street come to a complete stop or significantly slow down waiting for an adequate gap in the opposing traffic to complete the turn. Meanwhile vehicles following are trapped behind the slower moving or stopped lead vehicle and react accordingly by safely slowing themselves, maneuvering around the stopped vehicle or unfortunately crashing into the lead vehicle. Reported crashes occurring over the analysis period are summarized type in Table 1. Studies have shown that a conversion from a four-lane roadway to a three-lane roadway with center left turn lane can reduce crashes by 47%. While a conversion to a three-lane roadway would still result in crashes, it is anticipated to greatly reduce the angle crashes, head on and sideswipe type of crashes with the angle and head on generally having a higher severity of injury potential.

Table 1 Crash Data

Crash Type	Rear End	Side Swipe	Angle	Head On	Non-Collision w/ veh	Total
	29	6	12	1	7	55
Crash Severity	Property Damage Only	Non-Incapacity Injury	Possible Injury	Total		
	45	5	5	55		

Though outside of the 3-year analysis period, there was a fatality on this corridor that occurred on Sunday, July 24, 2016 at the intersection of Reno Avenue and Washington Street. The crash involved a northbound left turning vehicle and a southbound motorcycle. Circumstances of the

crash indicate that the southbound motorcyclist's view was obstructed due to a southbound left turning vehicle in the inside lane waiting to make a left turn. The northbound left turning vehicle experienced a similar situation with their view of opposing traffic being obstructed by the southbound left turning vehicle. On four-lane roadways the left turning traffic does not directly oppose each other, obstructing each other's view of oncoming opposing traffic or sight distance. This is referred to a "negative offset". When left turning vehicles directly oppose each other there is minimal obstruction or "zero offset" this is a typical situation on multi-lane roadways that have exclusive left turn lanes. The figure below illustrates the three types of offsets.



Capacity Analysis

A capacity analysis was conducted to determine how traffic is currently operating at the study intersections. All intersections were analyzed using Synchro/SimTraffic and the Highway Capacity Manual (HCM).

Synchro is a macroscopic analysis and optimization software application. Synchro supports the Highway Capacity Manual's (HCM) 6th Edition, 2010 and 2000 for signalized intersections, unsignalized intersections and roundabouts.. Synchro's signal optimization routine allows the user to weight specific phases, thus providing users more options when developing signal timing plans.

SimTraffic is a micro-simulation software application. With SimTraffic, individual vehicles are modeled and displayed traversing a street network. SimTraffic models signalized and unsignalized intersections, as well as freeway sections with cars, trucks, pedestrians, and buses.

Capacity analysis results identify a Level of Service (LOS) which indicates how well an intersection is operating. Intersections are ranked from LOS A through LOS F. The LOS results are based on average delay per vehicle results from SimTraffic, which correspond to the delay

threshold values shown in Table 2. LOS A indicates the best traffic operation and LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A through D is generally considered acceptable by drivers in the Bismarck area.

Table 2. Level of Service Criteria for Signalized Intersections

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10
B	> 10 - 20
C	> 20 - 35
D	> 35 - 55
E	> 55 - 80
F	> 80

Results of the existing capacity analysis shown in Table 3 indicate that the studied intersections operate at a LOS C or better for all approaches and for the intersection overall during the weekday a.m. and p.m. peak hours with the existing traffic control and geometric layout. No other significant side-street delays or queuing issues were observed in the traffic simulation at the study intersections. Delay is expressed in seconds per vehicle.

Table 3. Existing 4-Lane Peak Hour Capacity Analysis

Intersection	Weekday AM Peak Hour		Weekday PM Peak Hour			
	Intersection LOS/Delay	Approach LOS/Delay	Intersection LOS/Delay	Approach LOS/Delay		
Reno Ave and Washington St	A/6.8	NB	A/6.3	A/5.6	NB	A/3.1
		SB	A/4.3		SB	A/3.7
		EB	B/12.8		EB	C/20.6
		WB	B/11.6		WB	B/19.4
Wachter Ave and Washington St	A/7.7	NB	A/6.1	A/7.6	NB	A/3.4
		SB	A/4.6		SB	A/4.7
		EB	B/14.7		EB	C/22.2
		WB	B/13.5		WB	C/22.5

Proposed 3-Lane

Results of the proposed 3-lane capacity analysis shown in Table 4 indicate that the studied intersections operate at a LOS C or better for all approaches and for the intersection overall during the weekday a.m. and p.m. peak hours and the proposed 3-lane roadway configuration. The overall intersection delay times would be longer through the corridor but still within acceptable values. No other significant side-street delays or queuing issues were observed in the traffic simulation at the study intersections.

Table 4. Proposed 3-Lane Peak Hour Capacity Analysis

Intersection	Weekday AM Peak Hour			Weekday PM Peak Hour		
	Intersection LOS	Movement	Delay	Intersection LOS	Movement	Delay
Reno Ave and Washington St	B/11.7	NB	B/12.7	A/6.9	NB	A/4.4
		SB	A/5.0		SB	A/5.4
		EB	B/19.6		EB	C/20.8
		WB	B/17.5		WB	B/19.6
Wachter Ave and Washington St	B/12.6	NB	B/14.9	A/9.1	NB	A/4.4
		SB	A/6.1		SB	A/6.5
		EB	B/14.7		EB	C/23.2
		WB	B/13.5		WB	C/23.5

Speed

In the fall of 2019 speed studies were conducted along South Washington in both directions between Reno Avenue and Denver Avenue and between Reno Avenue and Wachter Avenue. The results of those studies are provided in Table 5. The results are expressed in 85th percentile speeds.

Table 5. Fall of 2019 Travel Speed Data Summary – S Washington Street

Location	Northbound (mph)	Southbound (mph)
Denver Ave to Reno Avenue	38	36
Reno Avenue to Wachter Avenue	39	39

As part of the SimTraffic simulation, travel speeds are predicted in the model. A comparison of travels speeds through the corridor of the data collected and simulation indicated travel speeds through the corridor will be slower.

Summary and Conclusion – S Washington Street

Converting South Washington Street from a 4-lane roadway to 3-lane roadway will not have significant negative impacts to traffic operations. The proposed 3-lane roadway changes would improve safety through the corridor by improving sight distances at the signalized intersections through creating a “zero offset” left turn lanes for left turning traffic and the reduction of travel speeds. Since there is no existing parking on Washington Street, there would be no impacts to parking. I have discussed this concept with the Bismarck Police Department Traffic Commander for his input. We are in agreement that a 3-lane roadway on S Washington Street would improve safety to the general public and may lower excessive speeding.

No lane configuration changes are recommended north of Riverwood Drive/Denver Avenue as there is not the same opportunity to create a safer and yet still efficient traffic improvement in that area.

Divide Avenue

The existing conditions were reviewed to establish a baseline to compare and determine any future impacts associated with the proposed lane conversion. The evaluation of existing conditions includes existing traffic volumes and a crash analysis.

Existing Conditions

The existing lane configuration of Divide Avenue from 19th Street to Northview Lane is a 48-foot roadway two-lane roadway with a bike lane for eastbound and westbound bicycle traffic. Parking is permitted along the south side of Divide Avenue near 20th Street and along the north side of Divide Avenue from 300' east of 19th Street to Northview Lane. Divide Avenue is a 48-foot roadway from 26th Street to Volk Drive and is a 3-lane roadway section with parking permitted only on the south side adjacent to Sleepy Hollow Park. Outside of and adjacent to the project area, Divide Avenue is a 3-lane section with parking prohibited west of 19th Street to State Street and east of Volk Drive to Bismarck Expressway. Private access onto Divide Avenue decreases significantly as you travel east through the corridor. Also, the traffic volumes utilizing these private access points are high due to the adjacent land use, multi-unit housing.

Traffic Volumes

24 hour vehicular turning movement counts were used for the following study intersections from of September 25, 2018.

- Divide Avenue At 26th Street

To the west of 26th Street the traffic volumes nearly double (13331 ADT) in comparison to east of 26th Street (7713 ADT).

Crash Analysis

Crash data was utilized from January 1, 2017 through December 31, 2019, which represents the most recent three-year period available. Reported crashes occurring at segments over the analysis period are summarized by type in Table 6.

Table 6 Crash Segment Study – E Divide Ave

Segments	Rear End	Side Swipe	Angle
19th Street to 23 rd Street	38	10	20
23 rd Street to 26 th Street	6	0	1
26 th Street to Volk Drive	7	1	2

In reviewing the crash data, the majority of the rear end and sideswipe crashes are occurring between 19th Street and 23rd Street. Currently traffic desiring to make a left turn off of Divide Avenue into the numerous multi-family complexes, stop in the through lane waiting for an adequate gap in opposing traffic to complete the turn. Meanwhile vehicles following will be trapped behind the stopped left turning vehicle or maneuver around the stopped vehicle. It was noticed in this area that the adjacent land use leads to higher volumes of non-intersection turning traffic utilizing private access points than to the east of 23rd Street. To the east of 23rd Street the land use has a lower density and the number of private access points is very limited resulting in a lower number on non-intersection turning movements.

This increase in non-intersection turning volumes using the access points resulting from the multi-family land use can be an indicator higher numbers non-intersection turning movements. Drivers may not anticipate traffic stopping if not near an intersection. The high volume of through traffic movements limiting gaps can increase the potential for rear end crashes or side swipes crashes.

Summary and Conclusion – E Divide Ave

Implementing a TWLTL roadway configuration would likely reduce the number of crashes on this segment of E Divide Avenue from 19th Street to Volk Drive. The implementation of a center left turn lane would improve safety of the roadway by removing left turning traffic from the through traffic lane. To implement a TWLTL roadway configuration while maintaining the existing bike lanes, existing parking on Divide Avenue would need to be removed along the north side of E Divide Avenue from Northview Lane to 300' east of 19th Street and on the south side between 20th Street and 200' east of 20th Street.

The draft Metropolitan Planning Organization's Metropolitan Transportation Plan "Arrive2045" will host a public meeting on January 23, 2020 at 5:30 PM at the City/County Building where these specific projects as well as concepts for other transportation projects will be communicated to the public. If it is the Board's direction to engage in additional public input regarding proposed changes to S Washington Street and E Divide Avenue, I can present my thoughts at the Commission meeting as to how that input and decision making could be integrated into the bid documents for SI 531.

RECOMMENDED CITY COMMISSION ACTION

Receive additional traffic operations analysis and provide direction to staff.

STAFF CONTACT INFORMATION

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