

DRAFT TECHNICAL MEMORANDUM

DATE: October 22, 2010

TO: Jeremy Gorden (City of Fargo)

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FROM: Austin Yates (Benesch)

RE: NP Avenue and 1st Avenue North Corridor Development Plan –
Alternatives Development and Analysis

Chapter 2: Alternatives Development and Analysis

2.1 Introduction

This technical memorandum summarizes the alternatives development and analysis performed for the NP Avenue and 1st Avenue North corridor between 2nd Street North and University Drive in Fargo, North Dakota.

The mission statement for the project is to recommend a plan that accommodates all travelers: pedestrians, bicyclists, transit users, and drivers. The plan's design and safety features will improve the physical health of individuals, the environmental quality of the community and further increase opportunities for development. In keeping with the mission statement, the following alternatives were developed:

- Doing nothing: leaving both 1st Avenue North and NP Avenue as one-way, three-lane roadways (the No Build alternative, previously analyzed; see **Section 1.2.2** of **Chapter 1**, the *Corridor Needs and Issues* technical memorandum)
- Converting 1st Avenue North and NP Avenue to two-way roadways with two lanes in the direction of the existing one-way operation and a single lane going the opposite direction. This configuration, known as a 2+1, would be two lanes westbound and one lane eastbound on 1st Avenue North and two lanes eastbound and one lane westbound on NP Avenue.
- Converting 1st Avenue North and NP Avenue to two-way roadways with a single lane in each direction and a center two-way left-turn lane (the Two-way, Two-lane alternative)
- Keeping 1st Avenue North and NP Avenue as one-way roadways but reducing the number of lanes on each street from three lanes to two lanes (the One-way, Two-lane alternative)

2.2 Projected Future Traffic Volumes

The Advanced Traffic Analysis Center (ATAC) at North Dakota State University (NDSU), in cooperation with the Fargo-Moorhead Metropolitan Council of Governments (Metro COG) provided the future year (year 2035) projected average daily traffic (ADT) volumes for the 1st Avenue North, NP Avenue, and Main Avenue corridors for the alternatives. The AM and PM peak hour turning movements were derived utilizing the existing turning

movements and the projected ADT volumes (see **Section 1.2.2.1** in the *Corridor Needs and Issues* technical memorandum for further discussion).

2.3 Traffic Analysis

Each of the alternatives was evaluated based on the projected year 2035 traffic volumes during the AM and PM peak commuter periods.

Table 1 (previously displayed in **Chapter 1**) displays the 20 intersections in downtown Fargo that were identified for traffic analysis.

Table 1. Study Intersections (previously displayed in Chapter 1)

1 st Avenue North & 2 nd Street North	NP Avenue & 2 nd Street North	Main Avenue & 2 nd Street
1 st Avenue North & 4 th Street North	NP Avenue & 4 th Street North	Main Avenue & 4 th Street
1 st Avenue North & 5 th Street North	NP Avenue & 5 th Street North	Main Avenue & Broadway
1 st Avenue North & Broadway North	NP Avenue & Broadway North	Main Avenue & 8 th Street North
1 st Avenue North & Roberts Street North	NP Avenue & Roberts Street North	Main Avenue & University Drive
1 st Avenue North & 10 th Street North	NP Avenue & 8 th Street North	* - unsignalized
1 st Avenue North & University Drive	NP Avenue & 10 th Street North	
	NP Avenue & University Drive*	

The traffic operations of each intersection during the peak periods were evaluated by computing the respective service capacities, amount of vehicle delay, level of service (LOS) and vehicle queuing requirements for each vehicular movement at the study intersections. The traffic operations for the study intersections were determined using methodologies described in the *2000 Highway Capacity Manual (HCM)*.

Level of service is a qualitative system of ranking intersection performance using average stop delay per vehicle as the evaluation criteria (expressed as seconds of delay per vehicle, or sec/veh). The HCM LOS rankings are displayed in **Table 2**. For this report, acceptable levels of service were considered LOS C or better for intersections and LOS D or better for individual movements. The HCM reports along with the signal phasing and timing plans are displayed in the **Appendix**. Level of service calculations were performed using Synchro Studio 7 software.

Table 2. HCM Level of Service (previously displayed in Chapter 1)

LOS	Average Delay [s/veh]	
	Signalized	Unsignalized
A	≤10	≤10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

2.3.1 Alternative 1 – 2+1 Lane Configuration

In the 2+1 configuration, 1st Avenue North will have two lanes in the westbound direction with a single lane in the eastbound direction. This option provides two lanes of capacity in the same direction of the existing one-way pairs. Similarly, NP Avenue will be converted to provide two-lanes in the eastbound direction and a single lane in the westbound direction. Separate, striped bicycle lanes are proposed for both 1st Avenue North and NP Avenue on the right side of the street, in the direction of the two lanes on either street; parallel parking will be available on each side of 1st Avenue North and NP Avenue. **Exhibit 1, Exhibit 2, and Exhibit 3** display the proposed 2+1 configuration and the subsequent changes to 1st Avenue North and NP Avenue.

The projected year 2035 traffic volumes are displayed in **Figure 12**. The results of the capacity analysis of the 2+1 alternative are shown in **Figure 13** and **Figure 14**. Based on the results of the capacity analysis, the following intersections experienced a significant change in level of service and delay:

- 1st Avenue North & 2nd Street North** – As previously discussed in **Chapter 1, Corridor Needs and Issues**, the year 2035 southbound-to-eastbound left-turn movement is projected to be significant. Approximately 240 and 670 vehicles per hour (vph) during the AM and PM peak commuter periods, respectively, are anticipated for the base future year No Build. The heavy left-turning volume yields unacceptable levels of service for the AM and PM analysis scenarios. An additional southbound left-turn lane should be considered in the future to help improve the overall level of service of the intersection. For these reasons, the 2+1 scenarios were analyzed with a dual southbound left turn at 1st Avenue North & 2nd Street North.
- NP Avenue & 8th Street North/Roberts Street North** – The proposed 2+1 alternative provides two-way traffic on NP Avenue. With the addition the westbound traffic to the intersections of NP Avenue with 8th Street North and Roberts Street North, the eastbound and westbound vehicles backup into the adjacent intersection because the two intersections are located approximately 170 feet apart. To improve the traffic flow along NP Avenue, the Roberts Street intersection (and traffic signal) would be removed from NP Avenue, creating a two-way street around the west and north sides of Ole Tangen Triangle Park. Public vehicular access to the area between the park and the downtown Fargo Fire Station would be restricted but would be available only for emergency vehicles.
- NP Avenue & University Drive**– The westbound approach for NP Avenue at University Drive North is anticipated to operate with unacceptable levels of service and to experience significant vehicle queues because the approach is two-way stop control. This intersection is unable to be signalized due to the proximity to the intersection at Main Avenue & University Drive. While it is not uncommon for side streets to experience poor levels of service during the peak commuter periods, drivers have

the availability of using 1st Avenue North via 10th Street North or Main Avenue via 8th Street North in order to bypass the stop control at NP Avenue & University Drive.

2.3.1.1 Advantages of the 2+1

Two-way traffic eliminates the indirect travel necessitated by one-way streets (e.g., having to travel around three sides of a block to get to a destination). The 2+1 provides similar capacity as the existing one-way operation: three lanes eastbound (two lanes on NP Avenue, one on 1st Avenue North) and three lanes westbound (two lanes on 1st Avenue North and one lane on NP Avenue). By using the same three-lane footprint as the existing configuration, impacts to parking will be minimal. Two-way traffic generally causes a decrease in motor vehicle speeds creating a safer environment for pedestrians, cyclists, and other non-motorized modes of transportation.

2.3.1.2 Disadvantages of the 2+1

The abrupt change in traffic operations would require advance education for roadway users. The availability of new routes may cause confusion at first, but roadway users will quickly adjust. Two-way traffic will cause decreased motor vehicle speeds but the resulting increase in overall delay on the corridor will be comparable to the existing configuration. Freight loading areas will not be as profuse as the *de facto* loading zones in the existing configuration, but providing marked and signed loading zones will make up for the shortage.

2.3.2 Alternative 2 – Two Way with Center Turn Lane

In Alternative 2, 1st Avenue North and NP Avenue are proposed to be two-way corridors with a single lane in each direction and a center turn lane. A proposed bike lane is proposed on the right side of both NP Avenue and 1st Avenue North. Parallel parking is proposed to be provided on both sides of 1st Avenue North and NP Avenue. **Exhibit 4, Exhibit 5, and Exhibit 6** display the proposed two-way, two-lane configuration and the subsequent changes to 1st Avenue North and NP Avenue.

The projected year 2035 traffic volumes are displayed in Figure 15. The results of the capacity analysis of the 2+1 alternative are shown in **Figure 16** and **Figure 17**. Based on the results of the capacity the analysis, the following intersections experienced a significant change in level of service and delay:

- **1st Avenue North & 2nd Street North** – As previously discussed in **Chapter 1** and **Section 2.3.1**, the year 2035 southbound-to-eastbound left-turn movement is projected to be significant. An additional southbound left-turn lane should be considered in the future to help improve the overall level of service of the intersection. For these reasons, the Two-way, Two-lane scenarios were analyzed with a dual southbound left turn at 1st Avenue North & 2nd Street North.
- **NP Avenue & 8th Street North/Roberts Street North** – Similar to the 2+1, the proposed Two-way, Two-lane alternative provides two-way traffic on NP Avenue and will experience the same problems with the intersections of NP Avenue with Roberts Street and 8th Street North. These two intersections were modified similar to the 2+1.
- **NP Avenue & University Drive**– Like the 2+1, the westbound approach for NP Avenue at University Drive North is anticipated to operate with unacceptable levels of service and to experience significant vehicle queues because the approach is two-way stop control. Fortunately, drivers have the availability of rerouting their trips to 1st Avenue North or Main Avenue to avoid undue delay at NP Avenue & University Drive.

2.3.2.1 Advantages of the Two-way, Two-lane

Two-way traffic eliminates the indirect travel necessitated by one-way streets (e.g., having to travel around three sides of a block to get to a destination). While this alternative provides less capacity than the existing configuration, the center two-way left-turn lane provides increased access to business and parking lots on both NP Avenue and 1st Avenue North. Impacts to parking will be minimal due to the use of a three-lane footprint, like the existing configuration. Two-way traffic generally causes a decrease in motor vehicle speeds creating a safer environment for pedestrians, cyclists, and other non-motorized modes of transportation.

2.3.2.2 Disadvantages of the Two-way, Two-lane

Similar to the 2+1, the abrupt change in traffic operations would require advance education for roadway users. Two-way traffic will cause decreased motor vehicle speeds but the overall delay on the corridor will be greatly increased compared to the existing configuration. Freight loading areas will not be as profuse as the *de facto* loading zones in the existing configuration, but marked and signed loading zones will make up for the shortage. While the impacts to parking will be minimal, the disadvantage to having only one lane in each direction means that vehicles stopping to maneuver in and out of parking stalls will have a greater impact on traffic operations than would the 2+1.

2.3.3 Alternative 3 – One-way, Two-lane

The eastbound and westbound one-way streets for 1st Avenue North and NP Avenue will remain but will be reduced from three lanes to two lanes. The parking will be changed from parallel parking to diagonal parking on the left side of the street and a proposed bike lane on the right side of both NP Avenue and 1st Avenue North. **Exhibit 7, Exhibit 8, and Exhibit 9** display the proposed One-way, Two-lane configuration and the subsequent changes to 1st Avenue North and NP Avenue.

The projected year 2035 traffic volumes are displayed in **Figure 18**. The results of the capacity analysis of the 2+1 alternative are shown in **Figure 19** and **Figure 20**. Based on the results of the capacity the analysis, the following intersections experienced a significant change in level of service and delay:

- **1st Avenue North & 2nd Street North** – As previously discussed, the year 2035 southbound-to-eastbound left-turn movement is projected to be significant. An additional southbound left-turn lane should be considered in the future to help improve the overall level of service of the intersection. For these reasons, the One-way, Two-lane scenarios were analyzed with a dual southbound left turn at 1st Avenue North & 2nd Street North.

2.3.3.1 Advantages of the One-way, Two-lane

Overall, the analysis results indicate similar operations to the future No Build conditions, with slight increases in delay and degradations in level of service. There would need to be little or no roadway user education with Alternative 3 due to the similarity to the existing configuration.

2.3.3.2 Disadvantages of the One-way, Two-lane

Parking can only be on one side of the street; there cannot be parking on both sides of a one-way, two-lane street because of the possibly of vehicles maneuvering in and out of parking stalls completely obscuring the flow of traffic. Parking on a single side of block is not advantageous to the business community. Vehicular speeds on a one-way facility are typically greater a two-way facility, meaning crashes can be more severe on a one-way street.

2.4 Alternative Analysis Summary and Recommendations

There is no doubt that one-way roadways move traffic efficiently. The elimination of conflicting turning movements enables unparalleled progression of traffic due to the coordinability of the traffic signals. However, delay for motorized vehicles should not be the only measure of a “good” alternative. Each of the proposed alternatives has advantages and disadvantages. To best fulfill the mission statement, though, the existing streets should be converted to two-way operations.

Two of the alternatives propose two-way operation but Alternative 2, Two-way, Two-lanes, clearly does not handle traffic as well as Alternative 1, the 2+1. The alternative that has greatest positive result to the Fargo downtown development area is the 2+1 alternative.

It is the recommendation of the study team that Alternative 1, the 2+1 configuration, be carried forward for more detailed analysis.