Moorhead Center Avenue Planning & Preliminary Engineering Study

Project limits: The Red River to 8th Street

Prepared for:
City of Moorhead, Minnesota

Prepared by:
Stantec Consulting Ltd.

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Sign-off Sheet

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1.0 CHAPTER 1: PROJECT INTRODUCTION AND PUBLIC INVOLVEMENT

1.1 PROJECT BACKGROUND AND LOCATION

The City of Moorhead has programmed a mill and overlay of the Center Avenue corridor from the Red River to 8th Street in 2019. The City previously completed a study of the project corridor cooperatively with Metro COG and MnDOT in 2013. The 2013 Corridor Study included multiple corridors including TH 10 from the Red River to TH 336, TH 75 from 20th Avenue South to TH 10 and Center Avenue from the Red River to 8th Street. This planning and preliminary study, hereinafter the "project", will focus on re-evaluating the segment of Center Avenue from the Red River to 8th Street (see Figure 1).

Center Avenue is an important corridor servicing the downtown Moorhead, Minnesota area. It is classified as an urban minor arterial and provides direct access to the Moorhead Center Mall and Moorhead City Hall. It also serves as an important connection over the Red River connecting downtown Moorhead with downtown Fargo, ND. Currently, the corridor is a four-lane roadway with no turn lanes between the Red River and 6th Street. The roadway widens to a five-lane roadway with a continuous two-way left-turn lane from 6th Street to 8th Street.

May 19, 2017
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PROJECT LOCATION MAP

CITY OF MOORHEAD, MN
CENTER AVE - RED RIVER TO 8TH STREET

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1.2 PROJECT OBJECTIVES AND MAJOR TASKS

The objective of this project is to develop and evaluate alternatives that consider both corridor and intersection traffic volumes, their resultant levels of service, intersection traffic control, bicycles, pedestrians, transit, parking, ITS, utilities, lighting, access management, public input, and the overall aesthetics of the corridor. Ultimately, the City of Moorhead wants to ensure that the preferred project alternative that is selected for construction as part of their programmed 2019 project meets the needs of the corridor today and in the future, including the potential for new and redevelopment of Downtown Moorhead.

As part of the existing and forecast conditions analysis and resultant identification of issues for the planning and preliminary engineering study the following tasks were completed:

- Public and Stakeholder Involvement
    - Steering Committee Meeting 1 and 2, Focus Group Meeting 1, and Landowner Meetings
    - Public Input Meeting 1
    - Project Website Updates
- Existing and Forecast Year Conditions Assessment
    - Data Collection and Mapping
    - Existing Conditions Analysis
    - Forecast Year 2040 Analysis
    - Identification of Corridor Issues and Needs
    - Conditions and Issues Technical Memorandum

As part of the alternative development and analysis and resultant selection of a preferred alternative for the planning and preliminary engineering study the following tasks will completed and reported in a future alternatives technical memorandum:

- Public and Stakeholder Involvement
    - Steering Committee Meetings 3, 4 and 5; and Focus Group Meetings 2 and 3
    - Public Input Meeting 2
    - Commission and Council Presentations
    - Project Website Updates
- Alternative Development
    - Preliminary Alternative Development
    - Alternative Refinement
    - Alternative Cost Estimate
- Alternative Analysis and Preferred Alternative Selection
    - Alternative Traffic Operations Analysis
    - Alternative Impact Analysis
    - Alternative Analysis Matrix
    - Preferred Alternative Section and Landscape Concept

- Alternative Technical Memorandum

1.3 STAKEHOLDER INVOLVEMENT PROCESS

This study has a strong focus on public input and involved multiple steering committee, focus group, landowner, and public input meetings. Besides attending meetings, interested individuals could follow and engage in the project by viewing the project website for updates (www.cityofmoorhead.com/departments/engineering/current-projects/center-aveproject).

Steering Committee Meetings

A total of five steering committee meetings are to be held throughout the project. Members include technical staff from Moorhead Engineering, Moorhead Planning, Moorhead Transit, Moorhead Economic Development Authority, Moorhead Public Works, Metro COG, and the City of Fargo Engineering. The group will help guide the study process, provide valuable insight into the corridor, and ultimately aid in the selection of the preferred alternative. See Table 1 for a list of member names and affiliates.

Table 1: Steering Committee Members

Steering Committee Member	Steering Committee Representation
Bob Zimmerman	Moorhead Engineering
Tom Trowbridge	Moorhead Engineering
Jon Atkins	Moorhead Engineering
Kristie Leshovsky	Moorhead Planning
Kim Citrowske	Moorhead Planning
Lori Van Beek	Moorhead Transit
Cindy Graffeo	Moorhead Economic Development Authority
Steve Moore	Moorhead Public Works
Dan Farnsworth	Metro COG
Jeremy Gorden	City of Fargo Engineering

Two steering committee meetings were held during the existing and forecast conditions analysis and identification of issues. Steering Committee Meeting #1 was held on April 27, 2017. The purpose of the first steering committee meeting included an introduction to the project,

collecting existing conditions data along the corridor and identifying the corridor vision with steering committee members. Steering Committee Meeting #2 was held on June 1, 2017. The purpose of the second steering committee meeting included a review of the existing and forecast conditions analysis, a review of the identified project issues, a review of data to be presented at the first public input meeting and preliminary discussion regarding alternatives to be considered to mitigate the issues identified. A copy of the steering committee meeting minutes can be made available upon request.

Focus Group and Landowner Meetings

A total of 3 focus group meetings are to be held throughout the project. The City of Moorhead identified individuals for the Focus Group who had specific interests in the corridor. The purpose of the focus group is to share their goals and vision for future development of the corridor, and provided comments on the proposed alternatives before completion. See Table 2 for a list of member names and affiliates.

Table 2: Focus Group Members

Focus Group Member	Focus Group Member Affiliation
Anne Blackhurst	Downtown Moorhead Steering Committee
Bill Craft	Downtown Moorhead Steering Committee
Bob Buth	Downtown Moorhead Steering Committee
Dave Anderson	Downtown Moorhead Steering Committee
Dave Hunstad	Moorhead Business Association (MBA), Downtown Moorhead Steering Committee
Jenni Walthall	Downtown Moorhead Steering Committee
Peggy Kennedy	Downtown Moorhead Steering Committee
Tim Beaton	Downtown Moorhead Steering Committee
Tracey Moorhead	Downtown Moorhead Steering Committee
Chris Volkers	Downtown Moorhead Steering Committee
Kris Knutson	Moorhead Public Service - Water
Travis Schmidt	Moorhead Public Service - Electric
Christine Holland	River Keepers
Michael Burns	Michael Burns Architects
Bob Zimmerman	Moorhead Engineering
Tom Trowbridge	Moorhead Engineering
Kristie Leshovsky	Moorhead Planning
Kim Citrowske	Moorhead Planning
Randy Farwell	702 Communication, MBA
Mike Edenborg	Central Minnesota Credit Union, MBA
Kaleen Krueger	Moorhead State University Moorhead Student Representative
Nathalie Rinehardt	Concordia College Student Representative

One focus group meeting was held during the existing and forecast conditions analysis and identification of issues. Focus Group Meeting #1 was held on April 27, 2017. The purpose of the first focus group meeting included an introduction to the project, collecting existing conditions data along the corridor and identifying the corridor vision with focus group members. A copy of the focus group meeting minutes can be made available upon request.

Approximately one hundred letters were sent out to landowners immediately adjacent to the Center Avenue and 4th Street corridors within the project limits. Adjacent landowners were encouraged to set up a pre-scheduled time with the project manager to discuss the project and give input regarding the future of the Center Ave Corridor as well as discussing any opportunities or concerns that they had in regard to their property. In addition, the project team informed land owners of the project schedule and upcoming public input opportunities. On May 17, 2017 seven landowner meetings took place throughout the entire day. No additional land owner meetings are scheduled as part of the project. However, all adjacent property owners will receive a direct invite to both project public input meetings. A copy of the landowner meeting comments can be made available upon request.

2.0 CHAPTER 2: EXISTING & FORECAST YEAR 2040 CONDITIONS & ANALYSIS

Prior to the development of alternatives analysis of the existing and forecasted conditions was completed. This included data collection, site visits, reviewing related planning documents, and requesting information from steering committee and focus group members. The results of these efforts are discussed below.

2.1 LAND USE AND ADJACENT PROPERTIES

The land use immediately adjacent to Center Avenue is primarily surface parking lots used to serve a mixture of commercial and office land uses. The Red River and its trail system define the western most limits of the project. The north side of the corridor is largely inhabited by the Moorhead Center Mall, which occupies almost three city blocks. Two BNSF rail lines run parallel to Center Avenue behind the adjacent buildings on the south side.

2.2 CENTER AVENUE BRIDGE

The Center Avenue bridge spans The Red River connecting the cities of Fargo and Moorhead. The existing bridge has a narrow pedestrian walkway on the north side with a railing facing the river and a barrier wall separating the walkway from the roadway. The bridge is comprised of 4-lanes of traffic which are further discussed in the roadway geometry, section, and right of way portion of this report.

The Center Avenue bridge was built in 1937. A previously completed bridge rehabilitation project extended its serviceable life until approximately the year 2035 or 2040. In the year 2037 the bridge will be 100 years old and possibly require replacement. Although nothing structural will be examined as part of this project, it will be noted as a potential replacement project within the next 25-30 years. If on street bicycle lanes were added, the railings and barriers on the south side of the bridge would be required to be heighted for bicyclists.

2.3 CRASH ANALYSIS

A 10-year crash analysis was performed for the corridor. Table 3 shows the crash history and Table 4 shows the results of the crash calculations over the last 10 years over the corridor. Corridor crashes all occurred on Center Avenue only, whereas intersection crashes can also occur on the approaches from the side street. Table 5 and 6 shows the corresponding crash history and crash calculations of the intersections.

Table 3: Corridor Crash History - Red River to 8th Street

Calculated Rates		Statewide Avg. Rates		Critical Rates	
Crash	**Severity**	**Crash**	**Severity**	**Crash**	**Severity**
9.05	**13.06**	4.15	5.67	5.80	7.59

Table 4: Corridor Crash Calculator – Red River to 8th Street

K	A	B	C	PD	Total
0	0	8	27	62	97

Looking at the Center Avenue corridor in its entirety the calculated crash and severity rates are both well above their respective critical rates for similar corridors statewide. MnDOT's 2013 corridor and intersection crash calculator results were used to determine the critical rates for similar corridors for both 4-lane and 5-lane urban roadways. Critical crash rates are a statistical comparison based on similar intersections in the state. Locations with crash and/or severity rates above the critical rates are considered to be in need of safety improvements because there is statistically significant evidence that the intersection's crash/severity rates are considered outside the expected, normal range. This is likely due to the multiple driveways allowing midblock turning with the absence of protected turn lanes. Converting from a 4-lane to a 3-lane or 5-lane design with a two-way left-turn lane (TWLTL) would better protect drivers attempting to make midblock turns. The number of lanes needed, 3 or 5, will be determined by future capacity needs.

Of the four intersections studied, only 8th Street (TH 10) presented any concerns in the analysis. At 8th Street the calculated crash rate is equal to the critical rate, and the severity rate exceeds the critical rate. Of the recorded crashes twenty-one (41.2%) of them were Right Angle. All approaches currently have protective and permissive phasing for left-turning vehicles. In 2016, MnDOT completed a project at the Center Avenue and 8th Street intersection which included adding flashing yellow arrows for the permissive phasing. Since this project was completed after the 10-years of crash data collected, it is expected that this improvement may reduce crashes at this intersection. The intersection should be re-evaluated with a future crash analysis in 3 to 5 years once new data is available with the project improvements completed in 2016.

Table 5: Corridor/Intersection Crash History - Red River to 8th Street

Corridor/Intersection	K	A	B	C	PD	Total
8th Street	0	0	5	12	34	51
7th Street	0	0	0	3	5	8
6th Street	0	0	1	3	4	8
5th Street	0	0	1	3	4	8
4th Street	0	0	2	6	7	15

* Definition of crash types: K- Fatality, A – Debilitating Injury, B – Non-Debilitating Injury, C – Possible Injury, PD – Property Damage

Table 6: Intersection Crash Calculator – Red River to 8th Street

Corridor/Intersection	Calculated Rates		Statewide Avg. Rates		Critical Rates	
	Crash	Severity	Crash	Severity	Crash	Severity
8th Street	**0.87**	**1.25**	0.60	0.85	0.87	1.16
7th Street	0.24	0.33	0.60	0.85	0.97	1.27
6th Street	0.26	0.42	0.28	0.47	0.55	0.80
5th Street	0.26	0.42	0.60	0.85	0.98	1.29
4th Street	0.48	0.81	0.60	0.85	0.98	1.29

2.4 ACCESS INVENTORY

A completed access inventory showed a total of 11 access points along the corridor. Four of the accesses are stop light controlled at the intersections of 4th Street, 5th Street, 7th Street, and 8th Street. Another access leads to a dead end on 6th Street and the remaining six access points serve the Moorhead Center Mall, Scheels, United Sugars, American Federal Bank, Wells Fargo, and a shared access for Moorhead Billiards and American Square. See Figure 2 for the access inventory map.

This calculates to 11 access per 0.3 mile for a resultant per mile ratio of 37 access points. The City of Moorhead access guidelines for a minor arterial recommend conditional accesses be limited to one access per one-eighth mile or 8 access points per mile. This indicates Center Avenue has over four times as many access points as city code recommends.

Besides having many access points along the corridor another safety concern is the sight distance of these accesses. The most predominant sight distance issues occur at the accesses into the Moorhead Center Mall between 4th Street and 5th Street and the access into United Sugars on the north side of the 6th Street intersection. This is largely due to the close proximity of buildings and trees. During landowner meetings neither representative was in favor of closing their access; however, they did acknowledge it can be difficult to see unless you pull forward far enough. The representative of United Sugars indicated he may be willing to move their existing access further east to help reduce visibility issues.

All intersections within the project are perpendicular to the roadway except 4th Street. Due to the angle of the intersection sight distance issues have been observed. North of Center Ave 4th Street connects into 3rd Street and terminates. Through site visits and meeting discussions it was noted many vehicles are simply using 4th Street as an access into the Moorhead Center Mall and not as a connection to 3rd Street.

May 19, 2017
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ACCESS INVENTORY

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2.5 PARKING

Multiple surface parking lots and one parking ramp exist immediately adjacent to the project corridor. On-street parking is currently not allowed along Center Avenue within the project corridor limits. During discussions with landowners, they felt that on-street parking is not needed to serve the needs of the businesses that are currently present along the corridor. Focus group members expressed their desire to add on-street parking along the project corridor to better serve their vision of the revitalization of downtown Moorhead.

On Wednesday, May 10th, 2017 a parking utilization inventory was completed between the hours of 2 pm and 3:30 pm. Steering Committee members identified 10 parking lots to be inventoried by Stantec. Utilization of these lots varied from 0% to 89% during the timeframe studied. The most utilized parking lot observed is outside Moorhead City Hall and is primarily used by city staff. However, this parking lot is part of a larger lot used by Moorhead Center Mall visitors.

Steering Committee members identified lots 3, 4, 5A, 5B, and 5C as being lots primarily used by the Moorhead Center Mall. Parking lots 2, 6, 7, 8, 9, and 10 were identified as being miscellaneous adjacent lots servicing other area businesses. Parking lot 1 was not figured into either of these categories as the City has a future plan to utilize this parking lot as a trail head to the Red River. Table 7 lists the resulting percentages of the parking lot inventory and Figure 3 shows a map of the inventoried parking lots and their respective utilization percentages.

Table 7: Parking Lot Inventory Results

Parking Lot Description	Total Number of Spaces	Number of Spaces Occupied	Percent Utilization
Moorhead Center Mall Parking Lots	925	305	33%
Remaining Adjacent Parking Lots	381	177	46%
Total Inventoried Parking Lots*	1,334	482	36%

*Includes parking lot number 1

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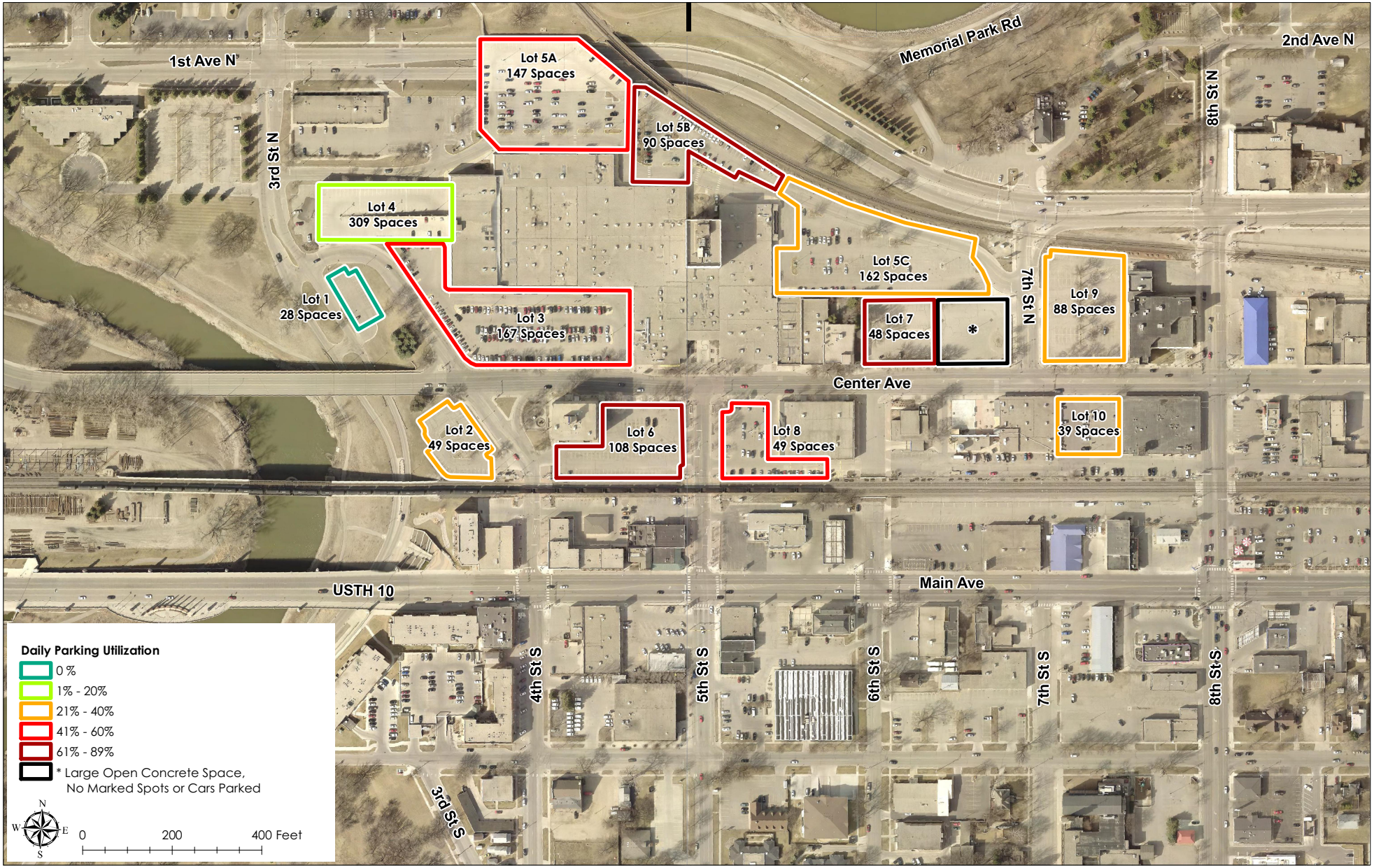

PARKING UTILIZATION

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2.6 BICYCLE AND PEDESTRIAN FACILITIES

Center Avenue has sidewalks adjacent to both sides of the road with no other bicycle facilities or shared use paths present. Pedestrians can cross the Red River on a narrow barrier-separated walkway along the north side of the Center Avenue bridge.

Issues surrounding the current bicycle and pedestrian facilities along the corridor include:

- Maintaining ADA standards along the entire length of the corridor
- Lack of east-west trail connectivity
- Many private commercial access points
- No buffer between the street and sidewalk
- Objects such as light poles, trees, fire hydrants, and miscellaneous utilities located within the sidewalk creating obstacles and ADA concerns
- Lack of corridor aesthetics which promotes increased pedestrian usage

Objects impeding the useable sidewalk width is the most predominant on the north side of Center Avenue between 6th Street and 8th Street, more specifically between 7th Street and 8th Street contains the most conflicts. Existing light poles border the sidewalk directly behind the curb and gutter, and trees growing within grates line the center of the sidewalk. Besides these obstacles, a fire hydrant and electrical box along the section adds to the complications.

Metro COG completed a bicycle gap exercise in the 2016 FM Metropolitan Bicycle and Pedestrian Plan. As part of this exercise attendees were asked to note which gaps in the current bicycle network are of the most importance to them for improvement. The location of NP Avenue/Center Avenue between University Drive and Highway 75 was ranked second overall.

See Figure 4 for existing and desired bicycle facilities along the corridor based on the 2017 FM Metropolitan Bicycle and Pedestrian Plan.

None of the representatives who participated in landowner meetings felt strongly against including bicycle lanes along the corridor. A few representatives noted that they do not see a need for additional bicycle facilities in our climate since they are predominately used six months out of the year. Metro COG's 2016 Bicycle and Pedestrian Plan shows approximately 6 pedestrians per hour and 8 bicyclists per hour using the Center Avenue bridge. These counts were taken on a weekday in September between the hours of 3pm and 7pm. Engineering staff also personally witnessed numerous bicyclists sharing the roadway on Center Avenue with other vehicles while performing site visits.

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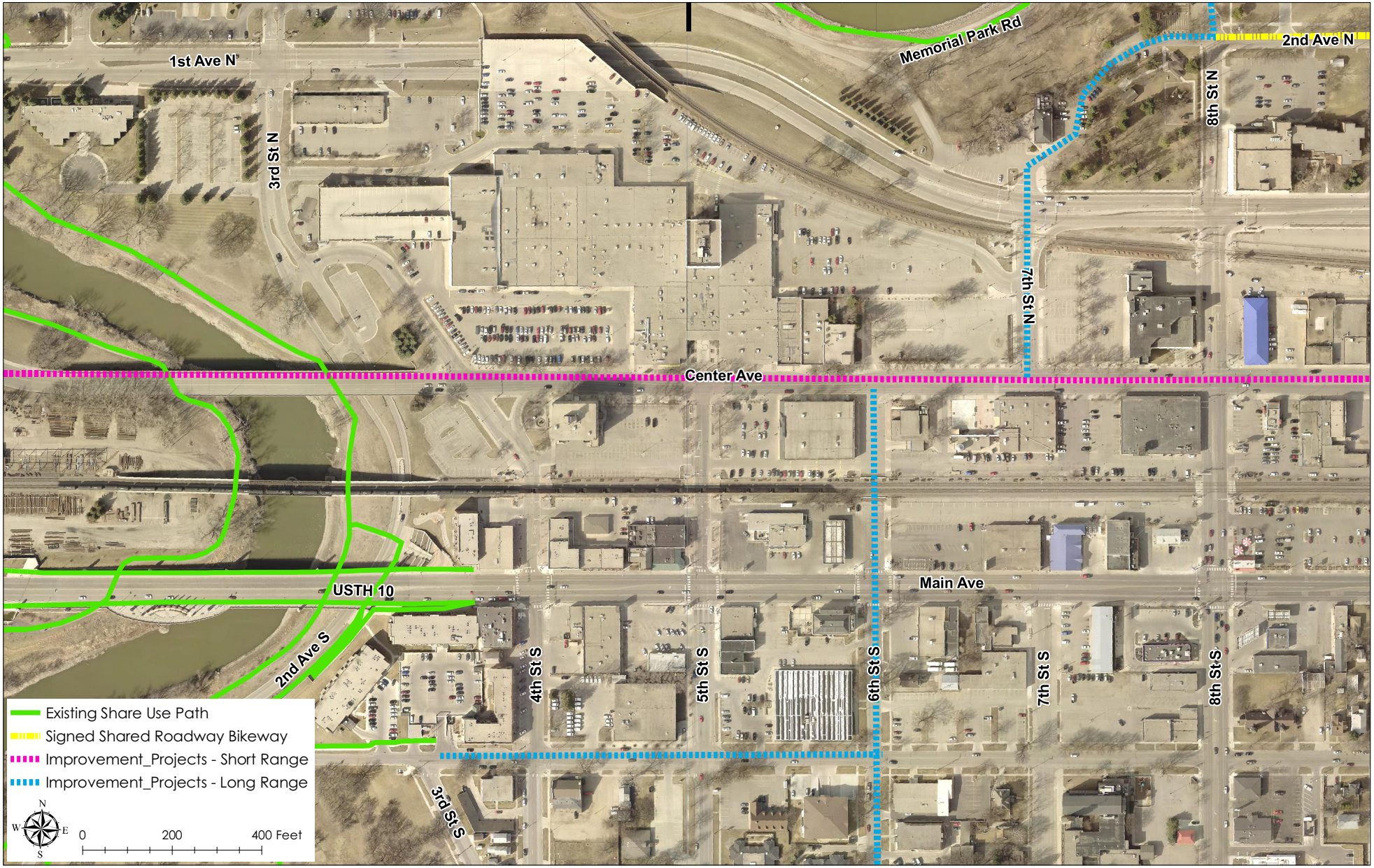

EXISTING AND PLANNED BICYCLE FACILITIES

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2.7 TRANSIT FACILITIES AND ROUTES

Metro Area Transit (MAT) bus routes provide fixed-route transit service within the Fargo-Moorhead area. Mat bus route 4 and Link FM both provide services along Center Ave and are available Monday through Saturday. Unlike traditional Matbus routes, Link FM's main purpose is to connect the downtowns of Fargo and Moorhead and will only stop at designated bus stop routes as needed to pick up passengers. Three bus shelters and one park and ride facility surround the project corridor at varying locations. The Mat Bus representative noted the two shelters adjacent to Center Ave are located very close to the road. Ideally these shelters would be placed further back to reduce road spray. See Figure 5 for existing transit routes and amenities.

Table 8 shows the boarding numbers for the month of April. The months of January and March tend to have the highest ridership rates due to the colder weather. Ridership decreases during the summer as more people walk and school is not in session.

Table 8: MAT Bus April Boarding Numbers (Passengers per Month)

Location	Passengers Per Month
Center Ave & 5th St N	159
7th Street & Moorhead Center Mall (East Side)	216
Center Ave & Moorhead Center Mall (South Side)	319

Note: Only passengers boarding the bus are counted, deboarding passengers are not counted.

A bus pull out exists between 5th Street and 6th Street on the north side of Center Ave. The MAT bus representative is in favor of removing this pull out as it makes it difficult for the busses to get back into traffic. She noted that if a 3-lane section is chosen, buses will hold up traffic for a short time during loading/unloading.

May 19, 2017
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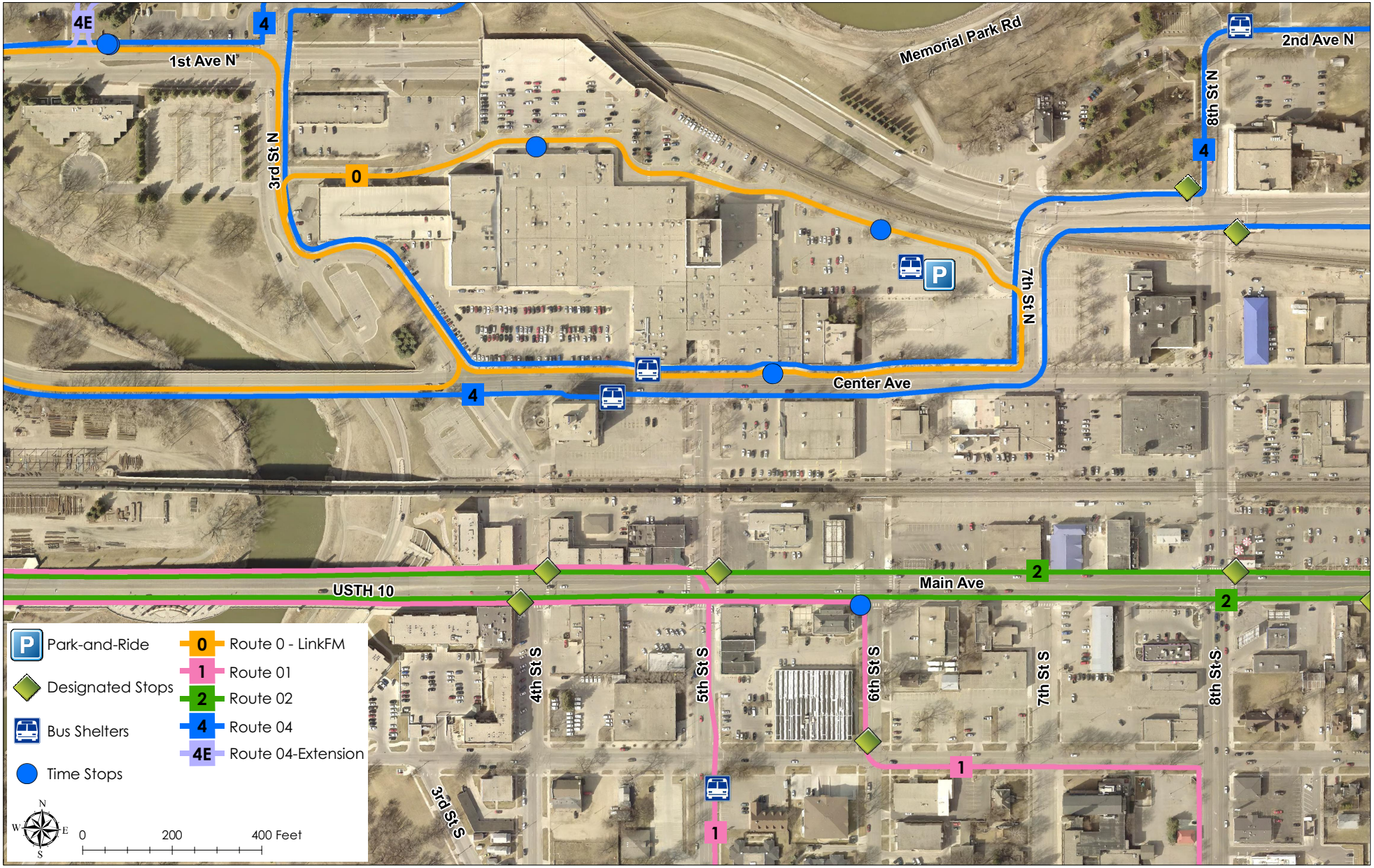

EXISTING TRANSIT FACILITIES

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2.8 ROADWAY GEOMETRY, SECTION, AND RIGHT OF WAY

Center Avenue is primarily made up of two existing typical section configurations. These configurations include a 4-lane section from the Center Avenue bridge to 6th Street, and a 5-lane section with a shared center turn lane from 6th Street to 8th Street. The actual dimensions of the existing sections vary greatly throughout the corridor. See Figure 6 for existing typical sections.

At 6th Street where the pavement section transitions from a 4-lane to a 5-lane section the alignment of the corridor shifts to the north. During landowner meetings, many people noted this as an area of concern. Drivers heading west bound in the left lane do not anticipate the roadway shift and simply continue driving into the right lane cutting off anyone in the right lane.

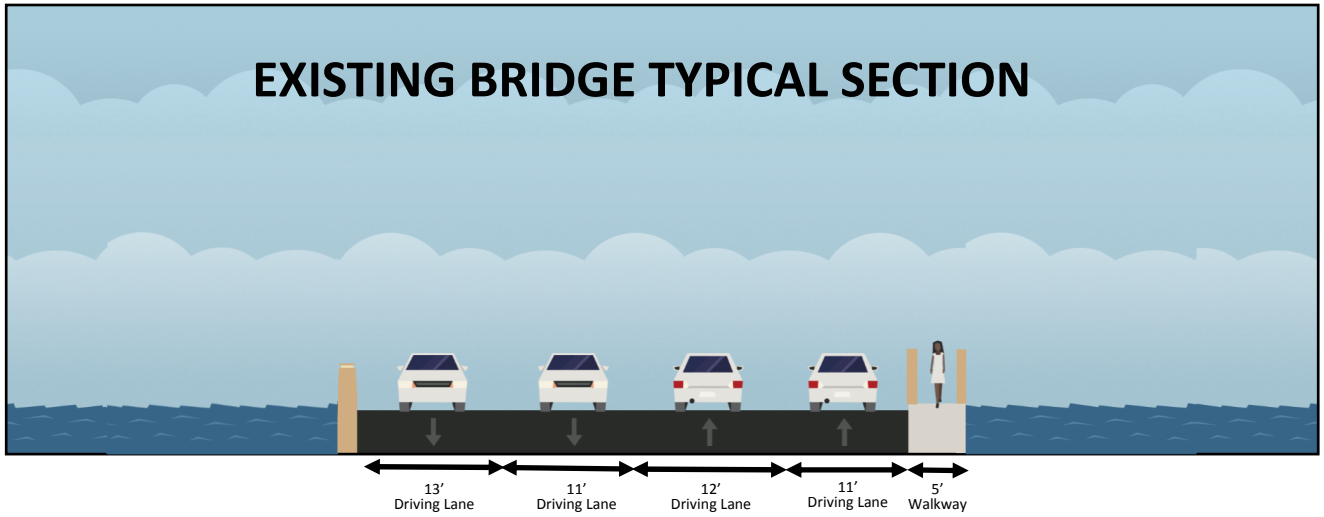
As built plans show the pavement section along Center Avenue from 4th Street to 8th Street is 2" of hot bituminous pavement over 8" of concrete pavement. The city will do pavement cores prior to the design phase of the 2019 construction project. The City of Moorhead utilizes the Pavement Condition Index (PCI) to indicate the general condition of the pavement. PCI numbers range from 0-100 with 100 being the best and 0 being the worst. In 2016 PCI ratings were recorded using ICON technology. Table 9 summarizes these existing PCI ratings for Center Avenue.

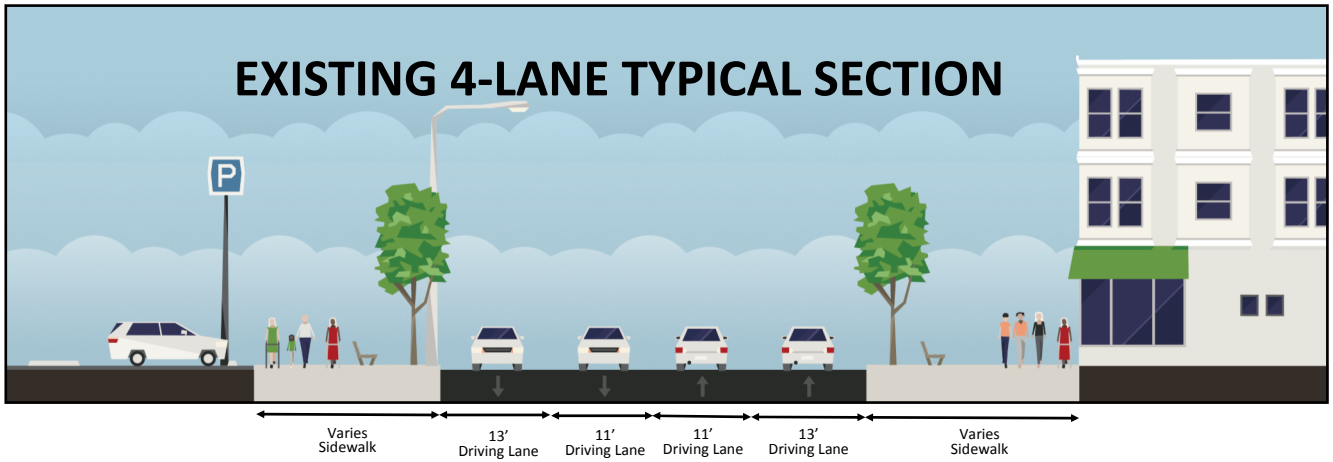
Table 9: Pavement Condition Index (PCI) Ratings – Center Avenue*

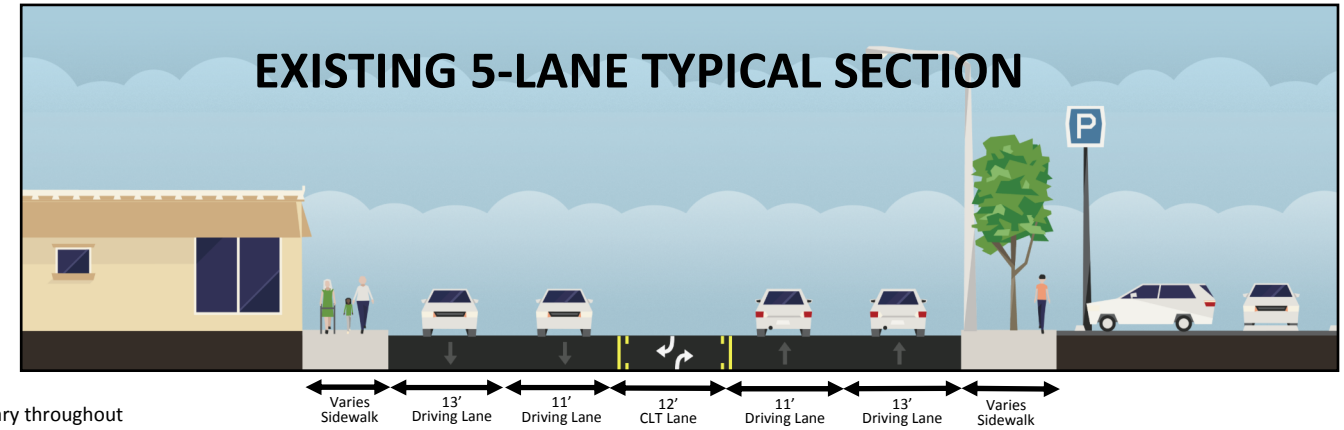
Location	PCI Value	Pavement Condition	Recommended Solutions
4th Street to 5th Street	29	Poor	Mill & Overlay, Rehabilitation/Reconstruction
5th Street to 6th Street	31	Poor	Mill & Overlay, Rehabilitation/Reconstruction
6th Street to 7th Street	46	Fair	Mill & Overlay, Local Repairs
7th Street to 8th Street	70	Good	Mill & Overlay, Crack Sealing, Seal Coating

* Due to the existing pavement section consisting of hot bituminous pavement over concrete pavement PCI ratings reflect the condition of the bituminous pavement on top and not necessarily the entire pavement structure.

Right of way along the project varies from 80 feet to approximately 90 feet along the entire corridor. In most cases the right of way abuts existing buildings, parking lots, and fences.







Notes:

Lane widths for all typical sections vary throughout the project.

Exterior driving lane width includes curb reaction distance.

2.9 LIGHTING, UTILITIES, AND INTELLIGENT TRANSPORTATION SYSTEMS

Existing utilities along Center Avenue include lighting, water, sanitary sewer, storm sewer, traffic light interconnect, and miscellaneous private utilities servicing area businesses. A survey will be completed this summer (2017) at which time a one call will placed to identify all utilities. Moorhead Public Service (MPS) and the City of Moorhead are responsible for the lighting, MPS is responsible for the water lines and the City of Moorhead is responsible for the sanitary sewer, storm sewer, and traffic light interconnect.

Lighting along Center Avenue consists of a mixture of smaller decorative street lights and larger commercial lights. Most of the lighting is either Sterner or LED with one Mongoose located east of 5th Street. Electrical lines along the corridor consist primarily of street light connections with one feeder line crossing Center Avenue at 4th Street. If 4th Street was realigned MPS noted this would impact existing electrical utilities. Aside from general maintenance no further electrical projects are anticipated. Steering committee members indicated the desire to add street lights with speakers along the corridor which could play local artists music.

The existing water line in the area is made up of PVC, Cast Iron, and Asbestos Cement Pipe. A 10" line runs on the north side of Center Avenue from 4th Street to 8th Street. At 4th Street the water line makes a T with a perpendicular line on the east side of 4th Street. It was noted if 4th Street was realigned it would impact these existing water lines. A 12" water line circles the Moorhead Center Mall on the west, north, and east sides eventually connecting with the 10" line at 7th Street. MPS has identified a water replacement project along Center Avenue from 4th Street to 8th Street in 2018 ahead of the programmed 2019 pavement rehabilitation. This project would most likely utilize trenchless methods to install the watermain at that time. Trenchless methods do require numerous holes to be dug for services and lateral mains to be reconnected. If a reconstruction was determined to be necessary, MPS would conduct watermain replacement coincident with that project.

The sanitary sewer line also runs along the north side of the roadway and is made up of vitrified clay pipe ranging in size from 9" to 15". The sanitary sewer was recently televised showing the sewer mains ranked in a 1 or 2 condition. Condition 1 correlates to good condition with no further action required. Condition 2 means problems exist, but they are not sufficient enough to require rehabilitation, therefore the city will continue to monitor. The sanitary sewer manholes are primarily made of brick and need rehabilitation at the street level. The results of the city's inspection of these manholes are summarized below in Table 10.

Table 10: Sanitary Sewer Manhole Recommendations

Manhole ID	Location	Recommendation
1N.4	Center Ave & 4th St	Replace four concrete rings with new plastic style rings
1N.5	Center Ave & 4th St	Good condition – no action at this time
1N.12	Center Ave & 5th St	Replace 2 courses of brick with new plastic style rings Replace casting and cover Center over manhole properly
1N.13	Center Ave & 5th St	Replace 2 courses of brick with new plastic style rings Replace casting and cover
1N.18	Center Ave & 6th St	Replace 2 courses of brick with new plastic style rings Replace casting and cover
1N.28	Center Ave & 7th St	Replace 2 courses of brick with new plastic style rings Replace casting and cover

The storm sewer main line runs parallel to Center Ave along the south side of the road. Due to the nature of collecting rainfall runoff form a variety of points the system is made up of different pipe sizes spread throughout the corridor. These lines all travel to the main which discharges in to the Red River on the west side of the project. The pipes are primarily made of PVC and reinforced concrete.

Intelligent Transportation Systems (ITS) help enable traffic and mobility management while allowing various road users to be better informed of roadway conditions. Currently, Center Ave utilizes traditional pedestrian push buttons at all the signalized intersections except 4th Street. A project adding APS push buttons to 4th Street began last year in 2016 and is in the process of being completed. In the future, the city would like to add fiber optic interconnect to all traffic signals, PS2 signal cabinets, a PTZ camera on 4th Street and Center Ave, and APS pedestrian push buttons to every remaining signal without them.

2.10 EXISTING AND FORECASTED TRAFFIC VOLUMES AND CORRIDOR CAPACITY NEEDS

The latest AADT counts of 7000-6100 for Center Avenue were taken by Metro COG in 2015. These counts indicate that the corridor is currently operating significantly under capacity. Capacities of different roadway design can be seen below in Table 11.

Table 11: Design Capacities for Various Raodway Facility Types

Facility Type	Daily Capacity Ranges (AADT)*	Approaching Capacity (85% of AADT)
Two-lane undivided urban	8,000-10,000	8,500
Three-lane urban	14,000-16,000	13,600
Four-lane undivided urban	18,000-21,000	17,850
Five-lane urban	28,000-31,000	26,350

*Derived from the Highway Capacity Manual 2010

The counts were taken at two locations in the corridor: between 4th and 5th Streets, and between 6th and 7th Streets. Forecast volumes for 2040 were derived using the most recent AADT counts and applying a growth factor of 1.5 as prescribed by the MnDOT State Traffic Projection Factors. Given the downward trend in AADT for the corridor in counts over the last decade, traffic volumes are not likely to reach this level. However, this will show a conservative analysis of the corridor. The forecast volume/capacity ratio for the different designs can be seen in Table 12 below.

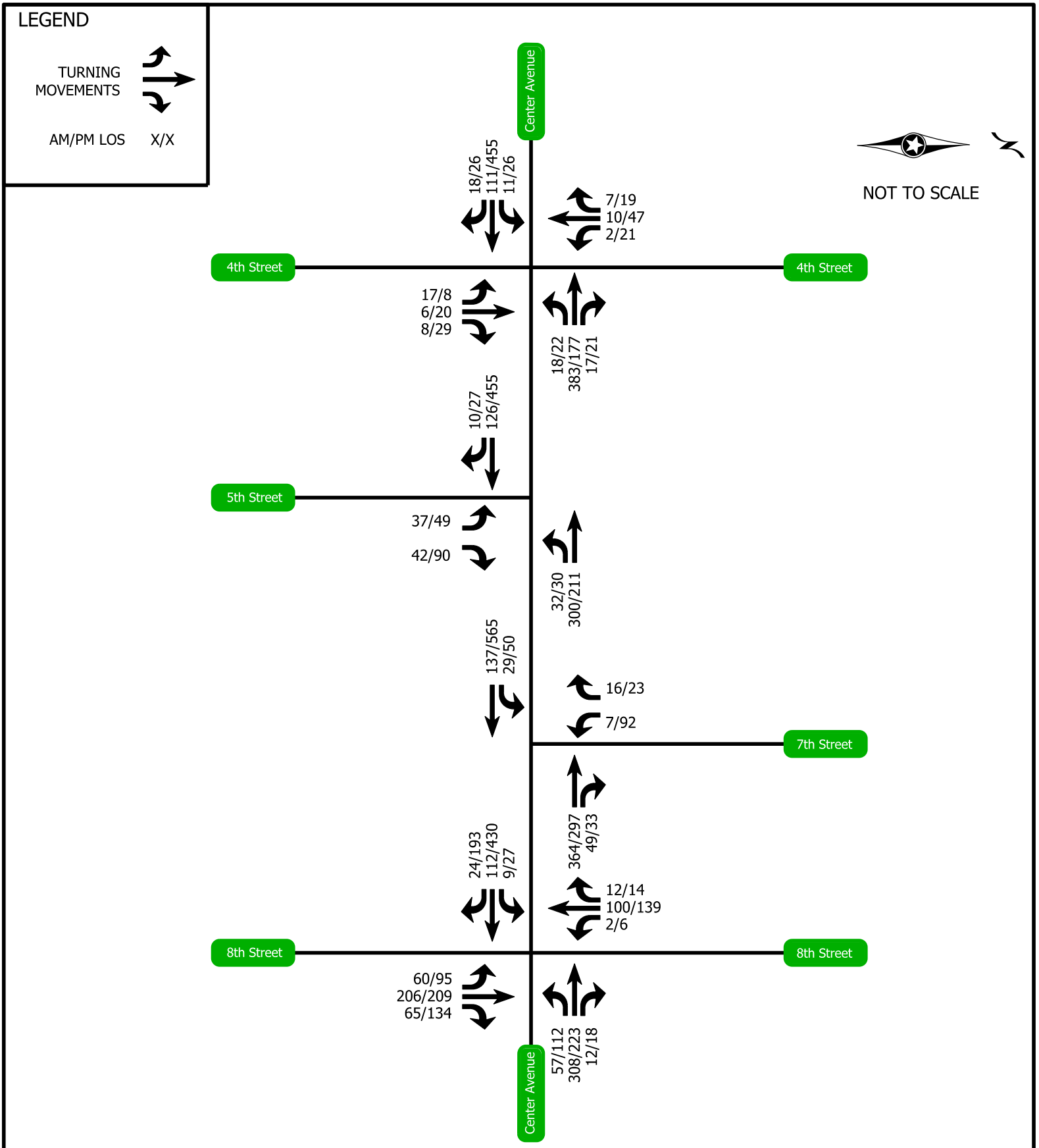
Table 12: Center Avenue Volume to Capacity Ratio for Various Raodway Facility Types

Facility Type	2040 Forecast		
	Volume	Capacity	V/C Ratio
Two-lane undivided urban	11,600	10,000	**1.16**
Three-lane urban	11,600	16,000	0.73
Four-lane undivided urban	11,600	21,000	0.55
Five-lane urban	11,600	31,000	0.37

As shown in Table 12, a three-lane design or higher will be capable of handling the forecasted volumes using conservative estimates.

2.11 PEAK HOUR TURNING MOVEMENTS AND RESULTANT LEVELS OF SERVICE (LOS)

An analysis of the existing conditions was performed using Synchro/SimTraffic. The turning movement counts can be seen in Figure 7. The existing conditions analysis revealed that each of the key intersections currently operates at an acceptable LOS C or better. There are no operational concerns with any individual movements at any intersections. The results of the analysis can be seen in Table 13. Turning movement data can be found in the appendix.



EXISTING PEAK HOUR TURN MOVEMENTS

FIGURE 7

CENTER AVENUE: 4TH TO 8TH STREET
- CITY OF MOORHEAD

Stantec

DATE: 5/24/2016

PROJECT NO: 193803603

Table 13: Existing LOS and Queue Lengths

Intersection	Direction	Movement	AM					PM				
			95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS	95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS
4th Street	EB	Left	90'	32.7	C	B (19.1)	C (22.0)	171'	25.0	C	C (21.2)	B (17.8)
		Thru	90'	20.6	C			171'	21.6	C		
		Right	42'	3.0	A			150'	10.2	B		
	WB	Left	131'	27.4	C	C (25.1)		68'	34.8	C	B (18.0)	
		Thru	143'	25.4	C			88'	17.5	B		
		Right	143'	16.8	B			88'	9.4	A		
	NB	Left	4'	8.4	A	A (3.8)		17'	6.9	A	A (4.7)	
		Thru	18'	4.7	A			34'	4.8	A		
		Right	35'	1.5	A			53'	1.6	A		
	SB	Left	15'	5.7	A	A (4.6)		8'	5.6	A	A (3.7)	
		Thru	11'	5.2	A			26'	5.0	A		
		Right	5'	2.2	A			16'	2.0	A		
5th Street	EB	Thru	82'	13.5	B	B (12.8)	B (15.3)	170'	18.4	B	C (18.3)	B (16.4)
		Right	70'	5.7	A			170'	15.4	B		
	WB	Left	129'	23.6	C	B (18.8)		106'	32.2	C	C (18.4)	
		Thru	149'	18.4	B			118'	16.9	B		
	NB	Left	48'	4.0	A	A (2.6)		73'	5.9	A	A (4.3)	
		Right	48'	1.5	A			73'	3.5	A		
7th Street	EB	Left	62'	20.8	C	B (17.6)	B (19.8)	71'	19.2	B	C (20.5)	B (19.2)
		Thru	86'	16.9	B			215'	20.6	C		
	WB	Thru	148'	23.5	C	C (21.8)		138'	22.7	C	C (21.5)	
		Right	148'	11.3	B			131'	11.9	B		
	SB	Left	13'	2.3	A	A (2.3)		65'	6.8	A	A (5.7)	
		Right	26'	2.3	A			30'	1.9	A		
8th Street	EB	Left	27'	24.4	C	C (21.0)	B (13.7)	50'	19.5	B	C (27.8)	C (20.1)
		Thru	81'	22.4	C			255'	29.7	C		
		Right	81'	13.2	B			255'	24.7	C		
	WB	Left	69'	19.9	B	B (20.0)		113'	22.9	C	C (20.2)	
		Thru	131'	20.5	C			119'	19.6	B		
		Right	105'	9.0	A			99'	11.0	B		
	NB	Left	60'	8.8	A	A (5.8)		82'	14.5	B	B (10.5)	
		Thru	89'	6.0	A			112'	12.0	B		
		Right	57'	2.2	A			94'	5.1	A		
	SB	Left	10'	10.1	B	A (7.2)		22'	16.4	B	B (14.0)	
		Thru	64'	7.6	A			102'	14.8	B		
		Right	27'	1.9	A			41'	2.5	A		

2.12 SIGNAL WARRANT ANALYSIS AT 7TH STREET

Signal warrant analysis was performed for the Center Avenue and 7th Street intersection. A traffic signal currently controls the intersection. The analysis focused on 2040 forecasted traffic volumes. A growth factor of 1.5 was applied to turning movement counts taken in 2015. The analysis focused on Warrants 1-3, as the remaining Warrants were either not applicable or unlikely to be met. The following is the results of the analysis:

- **Warrant 1 – Eight Hour Vehicular Volume**
  - Condition A – 0 of 8 hours met
  - Condition B – 2 of 8 hours met
  - Condition A+B – 0 of 8 hours met
- **Warrant 2 – Four Hour Vehicular Volume**
  - 1 of 4 hours met
- **Warrant 3 – Peak Hour Vehicular Volume**
  - 0 of 1 hours met

When removing a traffic signal, often the signal warrant criteria are reduced to 60% to justify the cost of the removal. However, this is not mandated to justify the signal removal. As shown in the analysis, the intersection does not meet warrants for existing 2015 traffic volumes and does not meet warrants for projected year 2040 traffic volumes. In addition, the traffic signal cannot be coordinated with the adjacent traffic signals along the Center Avenue corridor because it is the only traffic signal that does not have railroad pre-emption. Therefore, it causes the east-west traffic movements along the corridor to operate uncoordinated and reduces the efficiency of traffic flow along the corridor. The full warrant analysis results can be found in the appendix.

None of the representatives who participated in the landowner meetings were strongly opposed to removing the signal at 7th Street. The owner of the Moorhead Center Mall simply said he likes signalized intersections but wouldn't be extremely concerned if it was removed. The representative of United Sugars was highly favorable of the removal of this signal as it poses safety concern for his employees. The safety concerns he mentioned are as follows:

- Due to long wait times at the 7th Street signal vehicles:
  - Cut through the United Sugars parking lot
  - Make a turning movement on a red once they are tired of waiting
- Due to the low signal usage on 7th Street drivers have become conditioned to not stop at the intersection

2.13 RELATED PLANNING DOCUMENTS

2040 Long Range Transportation Plan (completed in 2014)

The 2040 Long Range Transportation Plan (LRTP) is prepared by FM Metro COG and updated every 5 years. This is a federally required plan that guides how the region grows and invests

transportation dollars over the next 25 years. This plan prioritizes projects and forecasts when within the 25-year plan horizon (2015-2040) the project would be completed. Existing conditions, growth, public involvement, goals, needs, and funding for the entire Fargo-Moorhead metropolitan planning area are discussed in this document.

The following goals were identified in the LRTP and were considered while preparing the study.

- Goal 1: Maintain the Existing Transportation System
- Goal 2: Improve the Efficiency, Performance and Connectivity of a Balanced Transportation System
- Goal 3: Maximize the Cost Effectiveness of Transportation
- Goal 4: Promote Consistency between Land Use and Transportation Plans to Enhance Mobility and Accessibility
- Goal 5: Provide Safe and Secure Transportation
- Goal 6: Support Economic Vitality
- Goal 7: Protect the Environment and Conserve Resources

2016 Fargo-Moorhead Metropolitan Bicycle and Pedestrian Plan

FM Metro COG is responsible for maintaining a comprehensive, coordinated, and continuous transportation planning process for all modes of transportation in the region. This update of the Bicycle and Pedestrian Plan is a sub-element of Metro COG's Long Range Transportation Plan which is updated every five years. As such, the Bicycle and Pedestrian Plan is also updated every five years. The plan looks at all types of bicycle and pedestrian facilities that have a transportation element. The purpose of the Plan is to identify current issues and needs as they relate to bicycling and pedestrian movements in the area; develop goals, objectives, and recommendations to enhance bicycle and pedestrian accommodations and safety for all types of users regardless of age, gender, race, social status, or mobility needs.

An integral part of this planning & preliminary engineering study is to determine the needs and feasibility of on-street bicycle facilities. Metro COG's Bicycle and Pedestrian Plan was an important document in identifying existing facilities and gaging public support. The study identified the need for east west trail connectivity between Fargo and Moorhead on Center Ave as a short range improvement. Long range improvements showed connectivity to the south on 6th Street and to the north on 7th Street. These improvement recommendations were carried forth in this document.

2013 MnDOT TH 10 (Red River to TH 336), TH 75 (20th Avenue South to TH 10), and Moorhead-Center Ave (Red River to 8th Street) Corridor Studies

The City of Moorhead, the City of Dilworth, MnDOT, and FM Metro COG partnered to study the roadways of MnDOT TH 10, TH 75, and Center Avenue. The key outcomes of the study were to identify and define the future multimodal improvement needs for the corridors, coordinate with the Fargo Main Avenue Corridor Study, and coordinate the conversion of NP Avenue and 1st Avenue North in Fargo from one-way to two traffic. As part of the study technical analysis, public input, and final documentation of the findings were completed.

Since this study directly investigated Center Ave in 2013 it was primarily used for comparison purposes. The study was consulted to verify existing conditions and act as a baseline if any conditions had changed. The preferred alternative chosen in this study was to restripe Center Ave to a 3-lane section from 4th Street to 6th Street, retain the 5-lane section from 7th Street to 8th Street, realign 4th Street, and add on street bicycle lanes. This alternative was selected to be fully analyzed in this project as well to ensure the final recommendation accounts for the future vision of downtown Moorhead as a whole.

2014 Moorhead River Corridor Master Plan

The City of Moorhead and FM MetroCOG created a master plan which considers how the Moorhead community embraces the River Corridor both now and in the future. It presents a long-term vision for the corridor side by side with implementation actions that can be undertaken in the near term, within current budgets, land ownership, and flood protection infrastructure. The study is a guide to future public access, recreation development, and vegetation restoration for the nine-mile Red River Corridor between approximately 60th Avenue South and County Road 22/Wall Street.

This plan identified six key principles in the development of a successful river front corridor. These principles included having an attractive river corridor, connectivity between Fargo and Moorhead, recreation opportunities, vegetation and habitat renewal, and interpretive opportunities to educate the community of the historical and ecological significance of the Red River. Besides purely focusing on the paved roadway of Center Ave this project looks at an overall vision of revitalizing downtown Moorhead. The Red River, being a significant feature of downtown Moorhead, plays a large role in this vison. This project incorporates the same six principles into creating an appealing downtown Moorhead corridor.

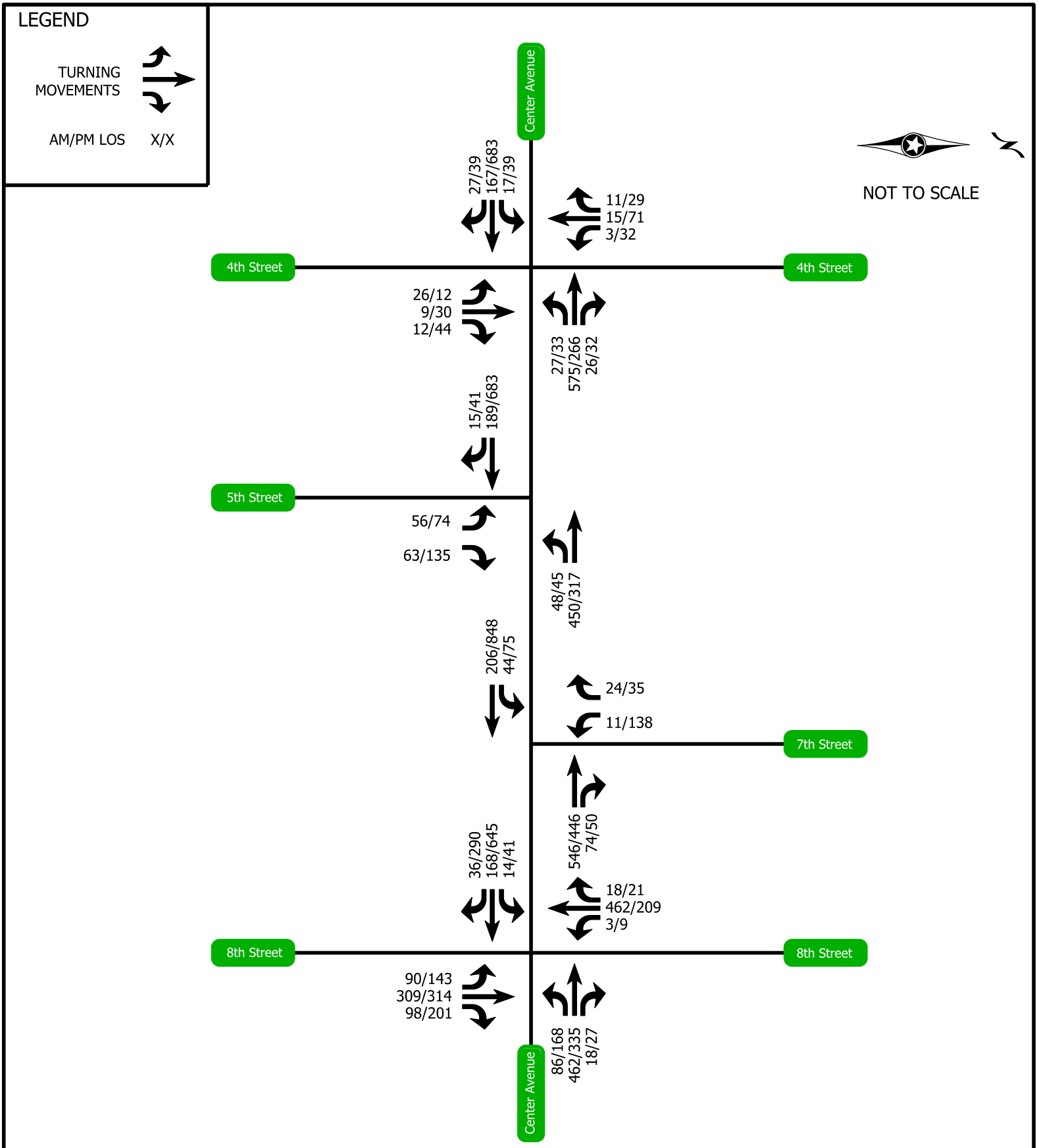
2016-2020 Fargo-Moorhead Metropolitan Area Transit Development Plan

MAT Bus and FM Metro COG created a report documenting the existing routes and facilities MAT Bus offers throughout the community and looked at possible future improvements to the transit system. The data and information made available in this report was used as a tool to assist in the evaluation of transit routes and facilities along Center Ave.

2.14 YEAR 2040 NO-BUILD TRAFFIC ANALYSIS

An analysis of the 2040 forecasted no build conditions was performed using Synchro/SimTraffic. As with the forecasted AADT, turn movements were increased by a 1.5 growth factor. Forecasted turning movement counts can be seen in Figure 8. The results of the no-build scenario which keeps the existing roadway geometry and traffic controls in place can be seen in Table 14. Since the signal warrant analysis shows that the 7th Street signal is not expected to be justified by projected traffic volumes, analysis was also conducted on the corridor with side-stop control replacing the 7th Street traffic signal. The results of this analysis can be seen in Table 15.

Overall all the intersections and approaches operate at an acceptable LOS C or better under the two year 2040 no-build scenarios. However, a few of the individual turning movements operate at a LOS D when no improvements are made to the corridor. These movements will be specifically reviewed and analyzed for improvements during the alternative development phase of the project.



FORECASTED 2040 PEAK HOUR TURN MOVEMENTS

FIGURE 7

CENTER AVENUE: 4TH TO 8TH STREET - CITY OF MOORHEAD

Stantec

DATE: 5/24/2016

PROJECT NO: 193803603

Table 14: Forcasted 2040 No Build LOS and Queue Lengths

Intersection	Direction	Movement	AM					PM				
			95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS	95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS
4th Street	EB	Left	113'	38.6	D	B (15.7)	B (11.5)	195'	19.5	B	B (14.7)	B (13.3)
		Thru	113'	15.8	B			195'	14.8	B		
		Right	58'	3.3	A			166'	7.5	A		
	WB	Left	134'	14.5	B	B (10.6)		92'	38.8	D	B (13.5)	
		Thru	134'	10.5	B			92'	11.7	B		
		Right	133'	7.7	A			89'	8.9	A		
	NB	Left	11'	3.9	A	A (6.6)		28'	11.5	A	A (8.3)	
		Thru	28'	8.3	A			52'	9.2	A		
		Right	45'	1.7	A			61'	1.8	A		
	SB	Left	24'	10.2	B	B (13.7)		17'	15.2	B	A (6.7)	
		Thru	18'	10.3	B			39'	10.6	B		
		Right	9'	2.2	A			27'	2.3	A		
5th Street	EB	Thru	113'	24.0	C	C (23.2)	B (13.7)	157'	11.0	B	B (10.8)	B (11.5)
		Right	103'	11.8	B			153'	7.9	A		
	WB	Left	159'	16.7	B	B (12.0)		138'	27.0	C	B (13.7)	
		Thru	176'	11.6	B			145'	12.2	B		
	NB	Left	59'	5.5	A	A (3.9)		105'	11.7	B	A (8.7)	
		Right	59'	2.4	A			105'	6.9	A		
7th Street	EB	Left	71'	13.7	B	B (12.5)	B (17.0)	71'	10.9	B	A (8.8)	B (10.4)
		Thru	107'	12.3	B			166'	8.6	A		
	WB	Thru	192'	20.4	C	B (19.6)		142'	13.9	B	B (13.3)	
		Right	191'	14.1	B			142'	8.4	A		
	SB	Left	26'	9.1	A	A (4.9)		94'	11.1	B	A (9.6)	
		Right	38'	3.2	A			45'	3.3	A		
8th Street	EB	Left	42'	22.0	C	C (20.7)	B (13.9)	121'	20.7	C	C (31.0)	C (22.4)
		Thru	111'	21.9	C			348'	31.3	C		
		Right	111'	13.7	B			348'	31.8	C		
	WB	Left	79'	18.2	B	B (17.6)		133'	24.7	C	B (19.0)	
		Thru	152'	17.8	B			138'	17.0	B		
		Right	122'	8.0	A			117'	9.0	A		
	NB	Left	73'	10.0	A	A (7.8)		120'	18.4	B	B (14.2)	
		Thru	108'	8.3	A			158'	15.4	B		
		Right	81'	4.0	A			156'	9.1	A		
	SB	Left	13'	13.8	B	A (9.5)		30'	16.2	B	B (17.5)	
		Thru	83'	10.3	B			134'	18.8	B		
		Right	41'	3.8	A			72'	5.6	A		

Table 15: Forcasted 2040 No Build LOS and Queue Lengths – 7th Street Signal Removed

Intersection	Direction	Movement	AM					PM				
			95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS	95 % Queue	Delay/ Vehicle	MVMT LOS	APPR LOS	LOS
4th Street	EB	Left	110'	34.4	C	B (14.4)	B (10.6)	251'	26.7	C	C (22.1)	B (18.9)
		Thru	110'	14.9	B			251'	22.3	C		
		Right	60'	3.2	A			236'	14.0	B		
	WB	Left	126'	10.4	B	A (9.7)		102'	36.9	D	B (18.0)	
		Thru	126'	9.8	A			109'	17.0	B		
		Right	124'	7.0	A			109'	9.9	A		
	NB	Left	7'	12.9	B	A (6.9)		36'	13.8	B	B (10.6)	
		Thru	28'	10.3	B			70'	12.2	B		
		Right	49'	1.5	A			60'	2.1	A		
	SB	Left	24'	10.8	B	A (7.8)		15'	14.8	B	A (7.4)	
		Thru	18'	7.5	A			37'	11.0	B		
		Right	2'	2.1	A			27'	2.3	A		
5th Street	EB	Thru	117'	25.3	C	C (24.4)	B (16.6)	163'	9.9	A	A (9.7)	C (23.5)
		Right	102'	10.3	B			155'	5.5	A		
	WB	Left	155'	21.3	C	B (16.3)		147'	47.0	D	C (20.6)	
		Thru	169'	15.8	B			153'	17.6	B		
	NB	Left	61'	5.8	A	A (4.0)		131'	14.4	B	B (10.8)	
		Right	61'	2.5	A			131'	9.1	A		
7th Street	EB	Left	54'	7.1	A	A (2.6)	A (2.3)	68'	6.2	A	A (2.7)	A (4.1)
		Thru	6'	1.7	A			73'	2.4	A		
	WB	Thru	12'	2.0	A	A (2.0)		6'	1.5	A	A (1.5)	
		Right	12'	2.0	A			6'	1.2	A		
	SB	Left	38'	11.4	B	A (5.2)		110'	23.6	C	B (19.5)	
		Right	49'	3.3	A			51'	3.4	A		
8th Street	EB	Left	35'	21.2	C	B (18.2)	B (13.5)	121'	18.7	B	C (24.0)	C (20.4)
		Thru	102'	19.7	B			307'	24.4	C		
		Right	102'	9.0	A			307'	23.9	C		
	WB	Left	82'	18.5	B	B (17.5)		128'	25.2	C	B (18.7)	
		Thru	158'	17.5	B			144'	16.3	B		
		Right	143'	10.2	B			122'	9.3	A		
	NB	Left	73'	10.5	B	A (8.1)		126'	21.7	C	B (16.2)	
		Thru	116'	8.8	A			180'	17.4	B		
		Right	86'	3.8	A			165'	10.2	B		
	SB	Left	14'	7.1	A	A (9.2)		36'	20.2	C	C (20.6)	
		Thru	85'	9.8	A			151'	22.1	C		
		Right	41'	3.9	A			76'	6.9	A		

3.0 CHAPTER 3: SUMMARY OF KEY ISSUES & CORRIDOR VISIONS

3.1 ISSUES IDENTIFICATION

Through the process of reviewing existing conditions, performing site visits, and participating in discussions with project stakeholders a summary of key issues has been developed. Center Avenue is a corridor with the potential to become more than a roadway to downtown Moorhead. Once these issues are identified feasible alternatives can be evaluated to determine the best solution for the City of Moorhead.

- Existing and future ADT volumes do not warrant a 4-lane section especially given the number access points along the corridor.
- Lack of designated east-west bicycle facilities connecting the downtowns of Fargo and Moorhead.
- No on-street parking which gives the corridor a downtown curb drive up feel.
- Many parking lots adjacent to the corridor which are underutilized.
- Along the entire corridor high crash rates exist for midblock turning and the 8th Street intersection.
- Close proximity of buildings and trees creates site distance issues for some accesses along the corridor.
- High volume of access points along the corridor.
- At 6th Street the roadway alignment shifts at the transition from a 5-lane to a 4-lane section. This causes safety concerns as drivers do not always continue in the correct lane.
- Existing utilities along the corridor are aging and need to be evaluated for possible repairs. However, this is not of great concern as water is already planned to be replaced using trenchless methods and the sanitary sewer manholes can be repaired at the street level.
- 7th Street traffic light is not tied into the same railroad preemptive system as the other lights along the corridor. This causes significant delays at the intersection and does not meet traffic signal warrants.
- 4th Street intersection is skewed creating visibility issues.
- Lack of convenient useable space to host events, festivals, and parades.

3.2 CORRIDOR VISION

At the end of the first steering committee and focus group meetings the question was asked, "What is your future vision for the corridor?" Members agreed, they would like to see Center Ave as the Center of downtown Moorhead, a place everyone wants to be. There is a desire to build the corridor in a manner that promotes this revitalization theme. Ideas included street lights with built in speakers where local music is played, pedestrian bump outs, a splash pad, an ice rink,

and student apartments above retail space. If 4th Street was realigned additional greenspace next to the river could be created. Considering flooding and geotechnical issues this space could be developed as a multi-use floodable amphitheater much like Phoenix Park in Eau Clair, WI. In general, members would like to see the river corridor used more to bring people of all ages together for festival events such as farmer's markets and art fairs.

Members had a vision of creating a corridor that could be shut down for parades and special events. Ideally the parade route would stay the same all the time and have a standard bus and traffic rerouting plan. This idea was compared to 6th Street in Austin, Texas where the street is closed to traffic on weekend evenings and is a fully functional street during the weekdays. Transforming Center Avenue into more than just an 8am to 5pm roadway would help reenergize and bring customers to downtown Moorhead. One member referred to it as being Moorhead's "Center Stage". As part of this vision the south plaza of the Moorhead Center Mall would be updated and more inviting to community residents. A large Christmas Tree could be placed during the winter months promoting downtown Moorhead as the place to be during all seasons.

On street parking versus bicycle lanes was discussed in the steering committee, focus group, and landowner meetings. The downtown Moorhead group felt overwhelmingly that on street parking was necessary for the downtown look and feel. Landowners felt with the large amounts of underutilized parking lots, on street parking was not the best fit right now but could be incorporated later as redevelopment is more imminent. Overall, the future vision of Center Ave is a place people call their neighborhood. A community gathering place where individuals live, work, play and learn.

Appendix A

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.1	0.0	1.7	0.0	0.1
Total Del/Veh (s)	19.1	25.1	3.8	4.6	22.0

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	12.8	18.8	2.6	15.3

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	17.6	21.8	2.3	19.8

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.7	0.2	0.5
Total Del/Veh (s)	21.0	20.0	5.8	7.2	13.7

Total Network Performance

Denied Del/Veh (s)	0.5
Total Del/Veh (s)	38.3

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	116	72	132	150	7	26	46	22	26	6
Average Queue (ft)	45	13	80	77	0	3	8	3	1	0
95th Queue (ft)	90	42	131	143	4	18	35	15	11	5
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)						1	0			0
Queuing Penalty (veh)						0	0			0

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	101	96	144	163	56
Average Queue (ft)	36	25	64	72	18
95th Queue (ft)	82	70	129	149	48
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	82	105	107	168	164	33	38
Average Queue (ft)	25	37	38	92	83	2	6
95th Queue (ft)	62	86	82	146	148	13	26
Link Distance (ft)		672	672	321	321	276	276
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150						
Storage Blk Time (%)		0					
Queuing Penalty (veh)		0					

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	39	88	94	80	157	138	82	107	74	18	78	39
Average Queue (ft)	6	34	41	32	81	55	24	43	24	1	29	6
95th Queue (ft)	27	71	81	69	131	105	60	89	57	10	64	27
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)					0		0	2			1	
Queuing Penalty (veh)					0		0	1			0	

Network Summary

Network wide Queuing Penalty: 2

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.2	0.0	2.0	0.0	0.3
Total Del/Veh (s)	21.2	18.0	4.7	3.7	17.8

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	18.3	18.4	4.3	16.4

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.1	0.1
Total Del/Veh (s)	20.5	21.5	5.7	19.2

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.2	0.8	0.2	0.5
Total Del/Veh (s)	27.8	20.2	10.5	14.0	20.1

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	44.5

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	190	161	82	105	22	41	46	17	35	22
Average Queue (ft)	109	79	35	41	4	10	18	1	7	1
95th Queue (ft)	171	150	68	88	17	34	53	8	26	16
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)						3	0		0	0
Queuing Penalty (veh)						1	0		0	0

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	192	200	124	133	92
Average Queue (ft)	83	89	59	59	33
95th Queue (ft)	164	170	106	118	73
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	84	199	238	165	155	77	38
Average Queue (ft)	31	96	129	84	73	25	8
95th Queue (ft)	71	175	215	138	131	65	30
Link Distance (ft)		672	672	321	321	276	276
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150						
Storage Blk Time (%)		1					
Queuing Penalty (veh)		1					

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	61	243	291	138	147	141	106	132	114	34	116	66
Average Queue (ft)	18	130	162	61	65	47	41	59	50	4	52	11
95th Queue (ft)	50	212	255	113	119	99	82	112	94	22	102	41
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)			0									
Queuing Penalty (veh)			0									
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)		6		0	0		2	5			5	
Queuing Penalty (veh)		2		0	0		2	5			0	

Network Summary

Network wide Queuing Penalty: 12

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.1	0.1	2.1	0.0	0.1
Total Del/Veh (s)	15.7	10.6	6.6	7.9	11.5

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	23.2	12.0	3.9	13.7

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1
Total Del/Veh (s)	12.5	19.6	4.9	17.0

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.7	0.1	0.5
Total Del/Veh (s)	20.7	17.6	7.8	9.5	13.9

Total Network Performance

Denied Del/Veh (s)	0.5
Total Del/Veh (s)	31.9

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	146	105	169	188	25	46	46	34	27	14
Average Queue (ft)	57	19	65	45	1	6	12	7	4	1
95th Queue (ft)	113	58	134	133	11	28	45	24	18	9
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)						3	0			0
Queuing Penalty (veh)						0	0			0

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	131	115	215	228	82
Average Queue (ft)	68	54	74	80	25
95th Queue (ft)	113	103	159	176	59
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	92	115	130	218	219	51	47
Average Queue (ft)	32	50	60	114	113	5	12
95th Queue (ft)	71	94	107	192	191	26	38
Link Distance (ft)		672	672	321	321	276	276
Upstream Blk Time (%)					0		
Queuing Penalty (veh)					0		
Storage Bay Dist (ft)	150						
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	48	106	133	92	162	137	81	129	111	24	90	53
Average Queue (ft)	15	48	63	41	100	74	35	61	42	2	43	14
95th Queue (ft)	42	91	111	79	152	122	73	108	81	13	83	41
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)					1		0	5			2	
Queuing Penalty (veh)					1		0	4			0	

Network Summary

Network wide Queuing Penalty: 6

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.2	0.0	2.0	0.0	0.3
Total Del/Veh (s)	14.7	13.5	8.3	6.7	13.3

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	10.8	13.7	8.7	11.5

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.2	0.1
Total Del/Veh (s)	8.8	13.3	9.6	10.4

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	1.1	0.9	0.3	0.6
Total Del/Veh (s)	31.0	19.0	14.2	17.5	22.4

Total Network Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	37.2

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	223	198	120	112	40	62	46	25	46	50
Average Queue (ft)	122	90	44	36	9	23	27	4	13	4
95th Queue (ft)	195	166	92	89	28	52	61	17	39	27
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)						12	0		1	0
Queuing Penalty (veh)						7	0		0	0

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	202	195	168	170	138
Average Queue (ft)	69	71	81	85	57
95th Queue (ft)	157	153	138	145	105
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	92	193	220	168	165	129	62
Average Queue (ft)	36	59	86	83	81	45	15
95th Queue (ft)	71	128	166	139	142	94	45
Link Distance (ft)		672	672	321	321	276	276
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150						
Storage Blk Time (%)		0					
Queuing Penalty (veh)		0					

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	213	330	336	160	151	138	114	187	186	35	153	110
Average Queue (ft)	38	208	242	80	82	65	70	89	88	8	78	26
95th Queue (ft)	121	318	348	133	138	117	120	158	156	30	134	72
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)		0	2									
Queuing Penalty (veh)		2	9									
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)		20		0	0		7	12		0	12	
Queuing Penalty (veh)		8		1	1		11	17		0	1	

Network Summary

Network wide Queuing Penalty: 59

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.1	0.0	2.1	0.0	0.1
Total Del/Veh (s)	14.4	9.7	6.9	7.8	10.6

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	24.4	16.3	4.0	16.6

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	2.6	2.0	5.2	2.3

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.7	0.2	0.5
Total Del/Veh (s)	18.2	17.5	8.1	9.2	13.5

Total Network Performance

Denied Del/Veh (s)	0.5
Total Del/Veh (s)	25.5

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	147	105	162	174	14	41	45	34	32	3
Average Queue (ft)	53	18	61	41	1	7	15	8	3	0
95th Queue (ft)	110	60	126	124	7	28	49	24	18	2
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)						3	0		0	
Queuing Penalty (veh)						0	0		0	

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	137	126	168	173	70
Average Queue (ft)	70	51	100	110	29
95th Queue (ft)	117	102	155	169	61
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	80	6	12	17	25	57	58
Average Queue (ft)	18	0	0	1	1	9	20
95th Queue (ft)	54	4	6	10	12	38	49
Link Distance (ft)		672	672	321	321	276	276
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150						
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	46	102	112	90	174	166	102	154	124	24	107	49
Average Queue (ft)	10	46	58	44	104	82	35	63	43	2	44	13
95th Queue (ft)	35	84	102	82	158	143	73	116	86	14	85	41
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)					1		1	5			2	
Queuing Penalty (veh)					1		1	5			0	

Network Summary

Network wide Queuing Penalty: 7

3: 4th St & Center Ave Performance by approach

Approach	EB	WB	SE	NW	All
Denied Del/Veh (s)	0.2	0.0	2.0	0.0	0.3
Total Del/Veh (s)	22.1	18.0	10.6	7.4	18.9

6: 5th St & Center Ave Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	9.7	20.6	10.8	13.4

8: Center Ave & 7th St Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.2	0.1
Total Del/Veh (s)	2.7	1.5	19.5	4.1

10: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	1.1	0.9	0.2	0.5
Total Del/Veh (s)	24.0	18.7	16.2	20.6	20.4

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	35.7

Intersection: 3: 4th St & Center Ave

Movement	EB	EB	WB	WB	SE	SE	SE	NW	NW	NW
Directions Served	LT	TR	LT	TR	L	T	R	L	T	R
Maximum Queue (ft)	290	249	122	134	51	108	46	21	45	56
Average Queue (ft)	165	138	51	51	11	29	26	3	13	4
95th Queue (ft)	251	236	102	109	36	70	60	15	37	27
Link Distance (ft)	719	719	438	438		267			173	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)					90		30	90		50
Storage Blk Time (%)					0	17	0		1	0
Queuing Penalty (veh)					0	10	0		0	0

Intersection: 6: 5th St & Center Ave

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	238	229	177	192	186
Average Queue (ft)	55	54	90	89	65
95th Queue (ft)	163	155	147	153	131
Link Distance (ft)	438	438	672	672	311
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8: Center Ave & 7th St

Movement	EB	EB	EB	WB	SB	SB
Directions Served	L	T	T	T	L	R
Maximum Queue (ft)	91	97	131	9	138	58
Average Queue (ft)	29	5	11	0	62	22
95th Queue (ft)	68	55	73	6	110	51
Link Distance (ft)		672	672	321	276	276
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150					
Storage Blk Time (%)		0				
Queuing Penalty (veh)		0				

Intersection: 10: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	188	315	342	158	174	141	114	222	180	62	172	119
Average Queue (ft)	35	155	179	74	81	62	72	103	91	8	86	28
95th Queue (ft)	121	279	307	128	144	122	126	180	165	36	151	76
Link Distance (ft)		321	321		802	802		416	416		318	318
Upstream Blk Time (%)		0	2									
Queuing Penalty (veh)		2	8									
Storage Bay Dist (ft)	150			150			75			70		
Storage Blk Time (%)		11		0	0		10	16		0	16	
Queuing Penalty (veh)		4		1	1		15	22		0	1	

Network Summary

Network wide Queuing Penalty: 67

Traffic Signal Warrant Analysis

Count Date: 2040 Forecasted Volumes Project No.: 193803458

Major Street Approaches:		Minor Street Approaches:	
Eastbound: Center Avenue		Northbound: 7th Street	
Number of Lanes:	2	Number of Lanes:	2
Approach Speed:	30	Approach Speed:	30
Total App. Vehicles:	5,629	Total App. Vehicles:	0
Rt Turn Percentage:	0%	Rt Turn Percentage:	0%
Westbound: Center Avenue		Southbound: 7th Street	
Number of Lanes:	2	Number of Lanes:	2
Approach Speed:	30	Approach Speed:	30
Total App. Vehicles:	4,930	Total App. Vehicles:	780
Rt Turn Percentage:	0%	Rt Turn Percentage:	0%

Analysis of Warrant 1: 8-Hour Volumes

Hour Begin	Major (Total)	Minor Street Volume	Minor Street Direction	Minor Street Rank	Condition A Meets Criteria?	Condition B Meets Criteria?	Condition A+B Meets Criteria?
12 AM	0	0	NB	13			
1 AM	0	0	NB	13			
2 AM	0	0	NB	13			
3 AM	0	0	NB	13			
4 AM	0	0	NB	13			
5 AM	0	0	NB	13			
6 AM	0	0	NB	13			
7 AM	708	3	SB	12	Major St		
8 AM	634	26	SB	11	Major St		
9 AM	554	27	SB	10			
10 AM	641	38	SB	9	Major St		
11 AM	813	64	SB	8	Major St		
12 PM	965	108	SB	2	Major St	- - -BOTH- - -	B ONLY
1 PM	931	83	SB	5	Major St	Major St	B ONLY
2 PM	985	73	SB	6	Major St	Major St	
3 PM	944	86	SB	3	Major St	Major St	B ONLY
4 PM	1324	123	SB	1	Major St	- - -BOTH- - -	B ONLY
5 PM	1270	84	SB	4	Major St	Major St	B ONLY
6 PM	790	65	SB	7	Major St		
7 PM	0	0	NB	13			
8 PM	0	0	NB	13			
9 PM	0	0	NB	13			
10 PM	0	0	NB	13			
11 PM	0	0	NB	13			

Condition A is the Minimum Vehicular Volume Warrant.
Condition B is the Interruption of Continuous Traffic Warrant.
Condition A+B is the combination of Conditions A and B at 80%.

Traffic Signal Warrant Analysis

Traffic Signal Warrant Summary: 2040 Forecasted Volumes Project No.: 193803458

Warrant 1 - Eight Hour Vehicular Volume

Condition A: **Not satisfied.** Required values reached for 0 hours. Eight hours required.
Criteria - Major Street 600 Minor Street 200

Condition B: **Not satisfied.** Required values reached for 2 hours. Eight hours required.
Criteria - Major Street 900 Minor Street 100

Condition A+B: **Not satisfied.** Required values reached for 0 hours. Requires volumes to meet 80 percent of requirement of A and of B for eight hours, not necessary the same eight hours.
Criteria - Major Street 480 720 Minor Street 160 80

Warrant 2 - Four Hour Vehicular Volume

Not satisfied. Required values reached for 1 hour. Four hours required.
See chart for criteria.

Warrant 3 - Peak Hour Vehicular Volume

Condition A: **Not examined.**
Criteria - Total Approach Volume: 650
- Minor Street High Side Volume: 150
- Minor Street High Side Delay: 5 vehicle-hours

Condition B: **Not satisfied.** Required values reached for 0 hours. One hour required.
See chart for criteria.

Warrant 4 - Pedestrian Volume

Not satisfied.
Criteria - Pedestrian volume crossing the major street is at least 100 per hour for any 4 hours or at least 190 during any one hour.

Warrant 5 - School Crossing

Not examined.
Criteria - At least 20 students crossing during the highest crossing hour.
- Consider implementing other measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.
- Do not apply at locations where distance to nearest signal is less than 300 feet.

Warrant 6 - Coordinated Signal System

Not examined
Criteria - Adjacent traffic control signals do not provide the necessary degree of platooning.
- Proposed and adjacent traffic control signals will collectively provide a progressive operation.
- Warrant should not be used where resultant spacing of traffic control signals would be less than 1,000 feet.

Traffic Signal Warrant Analysis

Traffic Signal Warrant Summary: 2040 Forecasted Volumes Project No.: 193803458

Warrant 7 - Crash Experience

Not examined.

Criteria - 5 or more correctable crashes, and

- Vehicular volumes meeting 80 percent of Warrant 1 condition A or B, or.
- Pedestrian volumes meeting 80 percent of Warrant 4 conditions.

Warrant 8 - Roadway Network

Not examined.

Criteria - Total existing entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday.

- 5-year projected traffic volumes that meet one or more of Warrants 1, 2, and 3 during an average weekday.
- Common intersection of two or more major routes.

Traffic Signal Warrant Analysis

Traffic Signal Warrant Graphs: 2040 Forecasted Volumes Project No.: 193803458

Figure 4C-1
Warrant 2 - Four-Hour Vehicular Volume

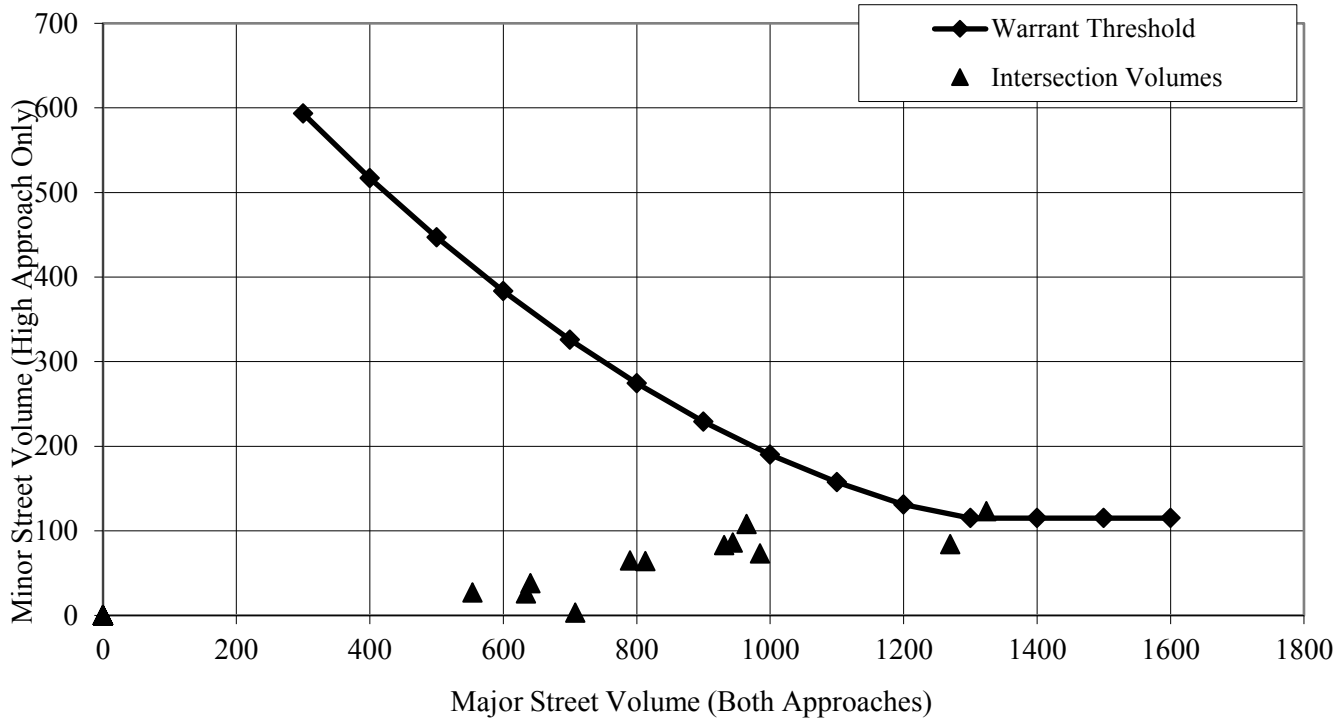


Figure 4C-3
Warrant 3 - Peak-Hour Vehicular Volume