Memorandum

SRF No. 11648

To: Michael Maddox
Fargo-Moorhead Metro COG

From: Leif Garnass, PE, PTOE, Principal
Brent Clark, PE, Senior Engineer

Date: April 3, 2020

Subject: US 10/75 Corridor Study – Year 2045 Conditions Technical Memorandum

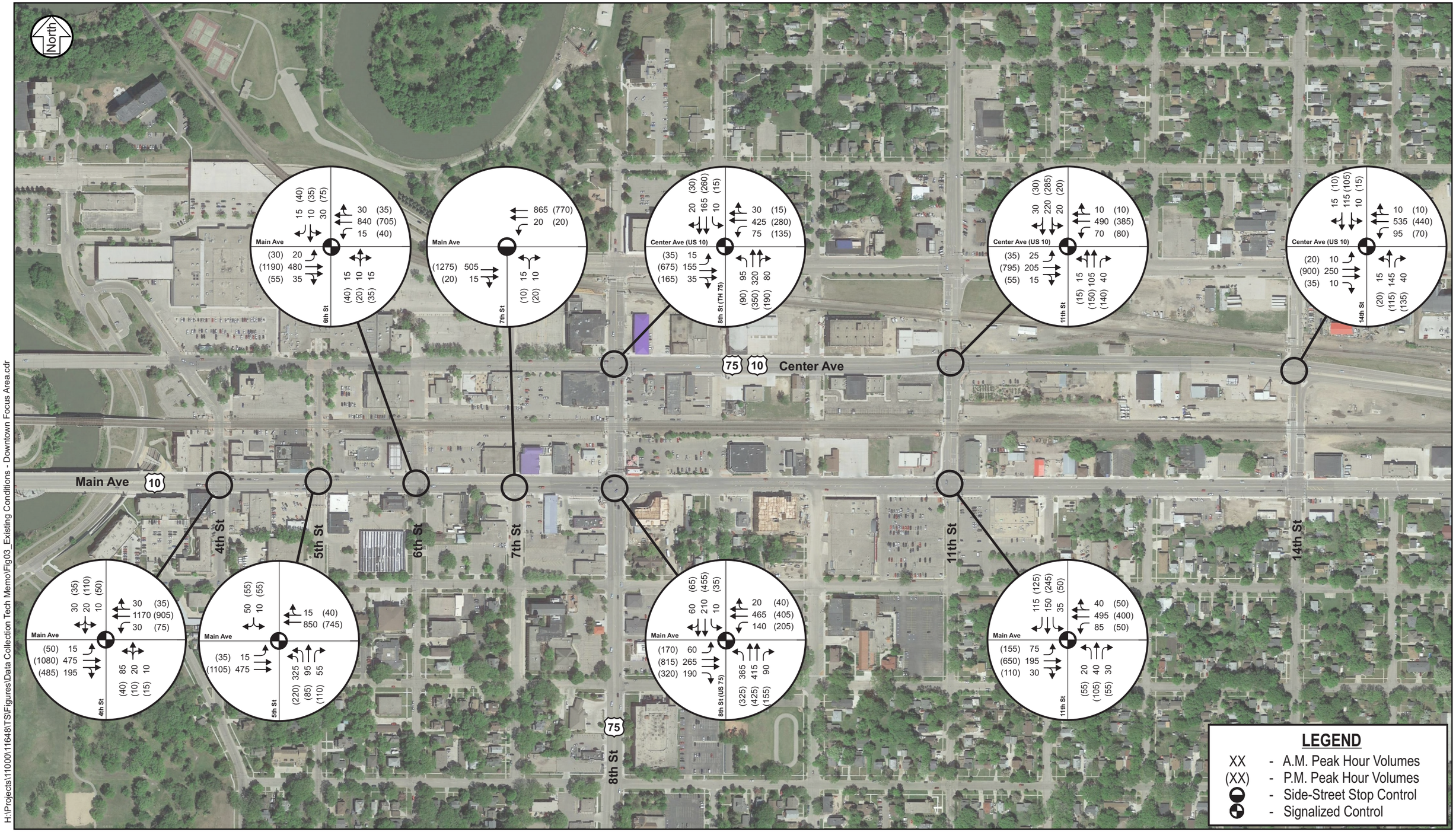
Introduction

This memorandum summarizes the year 2045 no build conditions, the alternatives developed and considered to inform the corridor visions and provides recommendations for the build conditions for the US 10/75 Corridor Study. Findings and recommendations presented in this memorandum are divided by the three study focus areas: 1) Downtown; 2) US 10 East; and 3) US 75 South. This was used to inform discussions with the Study Review Committee (SRC) regarding corridor concepts.

Year 2045 No Build Conditions

MnDOT is planning to reconstruct the US 10/75 corridors in years 2025-2026. The no build assumes that the existing intersection geometrics, roadway cross-sections, and traffic controls will all remain consistent with current conditions, but the existing signal timing was assumed to be optimized at intersections currently signalized. Also, the jurisdictional transfer of US 10 from Center Avenue to Main Avenue between 8th Street and 11th Street, which is planned to occur prior to year 2045 conditions, was assumed in the no build conditions analysis. Year 2045 peak hour traffic volumes for the Downtown, US 10 East and US 75 South Focus Areas are illustrated in Figure 1, Figure 2, and Figure 3, respectively. The methodology for developing traffic volumes is documented in the *Traffic Forecasts Technical Memorandum*, dated May 2019.

A traffic operations analysis was conducted for the a.m. and p.m. peak hours at the study intersections to determine how future year 2045 traffic is expected to operate in the study area. PTV VISSIM (Version 11.00-02) was once again used to evaluate the intersections since it is an effective tool to analyze how pedestrian activity and train operations influence traffic operations. Results of the year 2045 no build analysis shown in Table 1 indicate that all study intersections are expected to operate at an acceptable overall LOS D or better during the a.m. and p.m. peak hour.



H:\Projects\11000\11648\TS\Figures\Data Collection Tech Memo\Fig03_Existing Conditions - Downtown Focus Area.cdr

SRF Consulting Group, Inc.

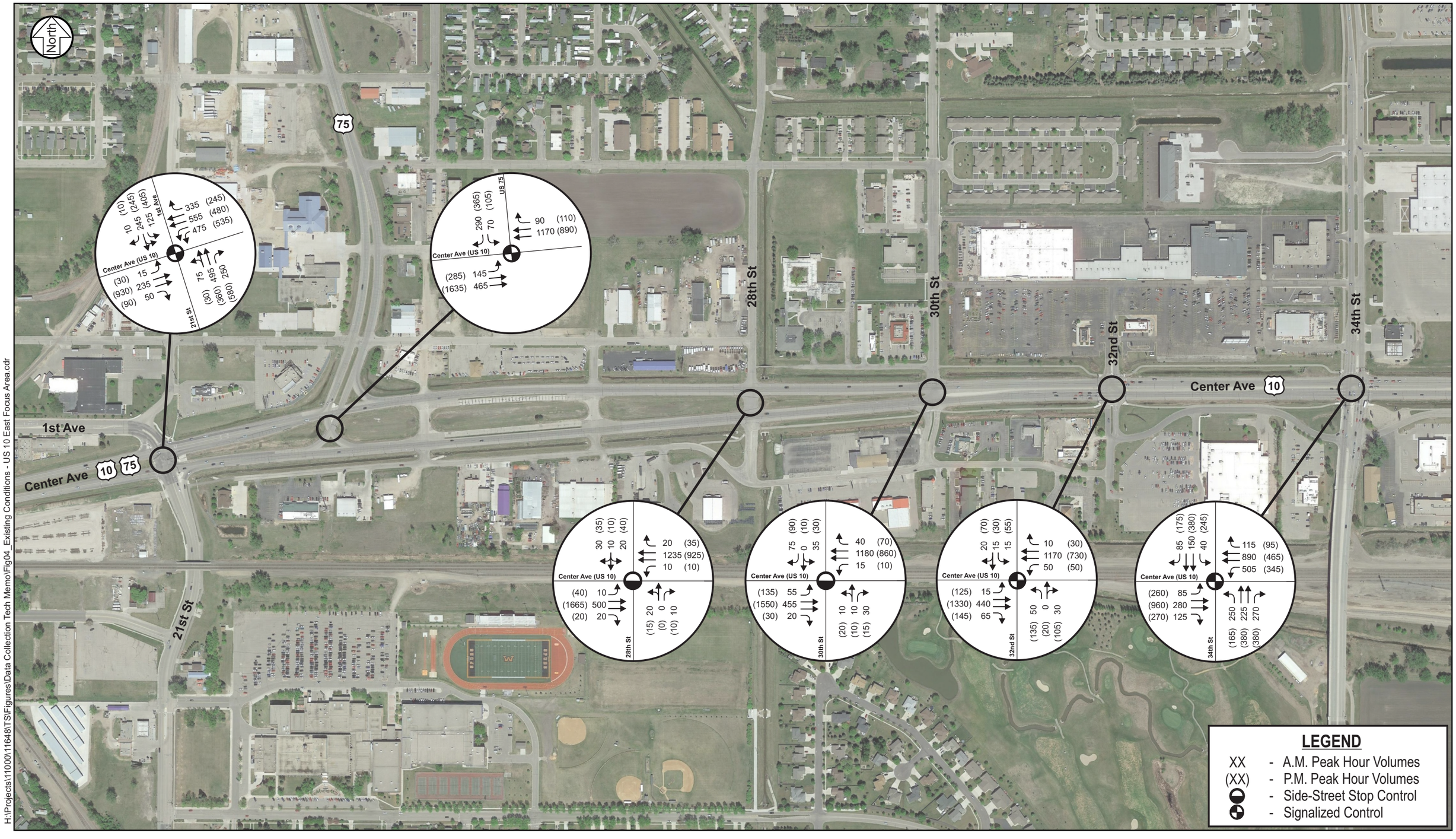
Year 2045 No Build Conditions - Downtown Focus Area

US 10 / US 75 Corridor Study

Fargo-Moorhead Metropolitan Council

01911648
March 2019

Figure 1



H:\Projects\11000\11648\TS\Figures\Data Collection Tech Memo\Fig04_Existing Conditions - US 10 East Focus Area.cdr

SRF Consulting Group, Inc.

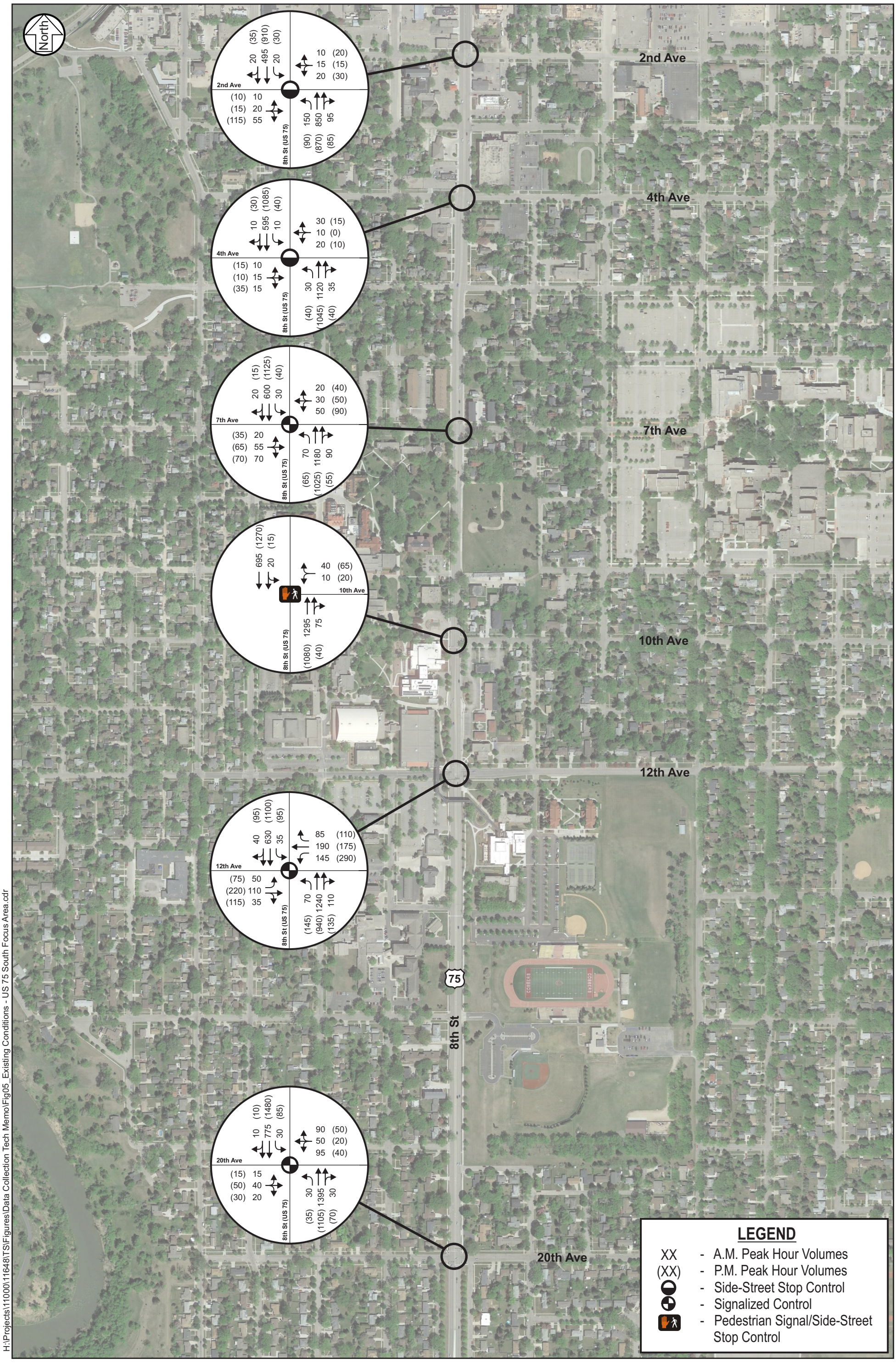
Year 2045 No Build Conditions - US 10 East Focus Area

US 10 / US 75 Corridor Study

Fargo-Moorhead Metropolitan Council

01911648
March 2019

Figure 2



H:\Projects\11000\11648\TS\Figures\Data Collection Tech Memo\Fig05_Existing Conditions - US 75 South Focus Area.cdr

SRF Consulting Group, Inc.

01911648
March 2019

Year 2045 No Build Conditions - US 75 South Focus Area

US 10 / US 75 Corridor Study

Fargo-Moorhead Metropolitan Council

Figure 3

Table 1. Year 2045 No Build Intersection Capacity Analysis

Intersection	Level of Service (LOS)	
	A.M. Peak Hour	P.M. Peak Hour
Downtown		
Main Avenue (US 10)/4th Street	A	C
Main Avenue (US 10)/5th Street	B	B
Main Avenue (US 10)/6th Street	A	A
Main Avenue (US 10)/7th Street (1)	A/C	A/D
Main Avenue (US 10)/8th Street (US 75)	C	D
Main Avenue/11th Street	B	C
Center Avenue (US 10/US 75)/8th Street	C	C
Center Avenue (US 10/US 75)/11th Street	C	C
Center Avenue (US 10/US 75)/14th Street	C	B
US 10 East		
Center Avenue (US 10/US 75)/21st Street/1st Avenue	C	D
Center Avenue (US 10)/US 75	A	B
Center Avenue (US 10)/28th Street (1)	A/C	A/E
Center Avenue (US 10)/30th Street (1)	A/C	A/F
Center Avenue (US 10)/32nd Street	A	B
Center Avenue (US 10)/34th Street	B	C
US 75 South		
8th Street (US 75)/2nd Avenue (1)	A/F	C/F
8th Street (US 75)/4th Avenue (1)	A/D	B/F
8th Street (US 75)/7th Avenue	B	B
8th Street (US 75)/10th Avenue (1)(2)	A/C	A/C
8th Street (US 75)/12th Avenue	C	D
8th Street (US 75)/20th Avenue	A	B

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS.
(2) A pedestrian signal is located at this intersection and was modeled to incorporate delay with this signal.

While the overall intersections are expected to operate acceptably, the following operational and queuing issues should be noted:

Main Avenue (US 10)/4th Street

- Eastbound queues are expected to extend approximately 700 feet during the p.m. peak hour.

Center Avenue (US 10/75)/11th Street

- The southbound approach is expected to operate in the LOS E/F range with maximum queues extending more than 400 feet during the p.m. peak hour. Deficiencies are due to a combination of train events and poor lane utilization for vehicles positioning themselves for the Main Avenue/11th Street intersection.

Center Avenue (US 10/75)/21st Street /1st Avenue

- The northbound right-turn movement is expected to operate in the LOS D/E range with maximum queues extending 600 feet or greater during the p.m. peak hour.

Center Avenue (US 10)/28th Street

- The northbound movement is expected to operate at a LOS E during the p.m. peak hour.

Center Avenue (US 10)/30th Street

- Side-street movements are anticipated to operate at a LOS F during p.m. peak hour with delays of two (2) minutes or greater.

8th Street (US 75) at 2nd Avenue and 4th Avenue

- Side-street movements are anticipated to operate at the LOS E/F border during a.m. and p.m. peak hours.

8th Street (US 75)/12th Avenue

- Maximum mainline queues are anticipated to extend 600 feet or greater during the p.m. peak. The eastbound thru/right-turn lane and westbound left-turn lane maximum queues are expected to extend approximately 450 feet.

Detailed measures of effectiveness (MOEs) are included in Appendix A.

Alternatives Considered

The alternatives developed for each focus area ranged from grade-separation of users (i.e., roadways, railroads, and pedestrian/bicycle accommodations) to adding and/or removing lanes of traffic to restricting access at low-volume intersections and mid-block driveways. Converting one-way streets to two-way traffic were considered along with changes to how intersections are controlled (i.e., roundabouts vs. traffic signals). Incorporating technology to reduce impacts caused be train activities was considered. Lastly, alternatives were developed to focus on improving the experience for pedestrians and bicyclists.

Alternatives were developed for the three focus areas (Downtown, US 10 East, and US 75 South Focus Areas) and were reviewed based on a variety of objectives, including potential safety impacts, traffic operational impacts, social/economic impacts and walkability/bikeability impacts. A description, as well as a summary of the potential benefits and challenges for each alternative are summarized in this section. Detailed MOEs for the proposed alternatives (where applicable) are included in Appendix B.

Downtown Focus Area

The City of Moorhead is currently conducting a study to identify if/where a railroad grade-separation should be constructed in downtown Moorhead. Previous studies, including the 2013 Corridor Study and the 2014 Moorhead Downtown Grade Separation Study, identified 11th Street to be the optimal location for a grade-separated railroad crossings between 1st Avenue and Center Avenue (BNSF Prosper Subdivision) and between Center Avenue and Main Avenue (BNSF KO Subdivision).

The 2013 Corridor Study and subsequent 2014 Moorhead Downtown Grade Separation Study also recommended a jurisdictional transfer of US 10/75 from the existing jurisdiction along 8th Street (between Main Avenue and Center Avenue) and along Center Avenue (between 8th Street and 11th Street) to a future jurisdiction along Main Avenue (between 8th Street and 11th Street) and along 11th Street (between Main Avenue and Center Avenue). This transfer is expected to occur regardless of if/when 11th Street has grade-separated railroad crossings.

The ongoing grade-separation study is conducting detailed traffic analysis work for the downtown area to determine where the grade-separation is recommended and what additional improvements/mitigation will be included. While the US 10/75 Corridor study assumes that the grade-separation will occur along 11th Street based on study previous recommendations, the grade-separation study is evaluating other locations as well, including 8th Street and 14th Street. The grade-separation study will also recommend intersection and roadway cross-section improvements along 11th Street and to the key intersections between 8th Street (US 75) and 14th Street along Main Avenue.

The following summarizes the benefits and challenges of each of the alternatives considered for the Downtown Focus Area:

Alternative 1: 11th Street Grade-Separation

Previous studies have identified 11th Street to be the likely location for grade-separated railroad crossings between 1st Avenue and Center Avenue (BNSF Prosper Subdivision) and between Center Avenue and Main Avenue (BNSF KO Subdivision). This will include roadway capacity improvements as well as a shared-use path along 11th Street between 1st Avenue and Main Avenue.

The ongoing Downtown Grade-Separation Study is conducting a detailed analysis of the benefits and challenges of providing a grade-separated crossing at 11th Street and will review additional locations before determining if the 11th Street is the preferred corridor. For the purposes of the US 10/75 Corridor Study, a high-level review of the benefits and challenges are summarized below.

Description:

- Construct a grade-separated crossing along 11th Street between 1st Avenue and Main Avenue.

Benefits	Challenges
• Reliable transportation system for all modes of transportation (vehicles, trucks, pedestrians, bicyclists, trains, transit, and emergency vehicles) • Reduces traffic on other corridors such as Center Avenue west of 11th Street and along 8th Street • Reduces the time that it will take for the roadway system to recover after a train event • Provides pedestrian/bicycle connections • Reduces conflicts with the at-grade railroad crossing thereby improving safety	• Construction costs and impacts

Detailed analysis results can be requested through the Downtown Grade-Separation Study team.

Alternative 2: Three-Lane Cross-Sections along Center Avenue and 8th Street following Jurisdictional Transfer and Grade-Separation

With the future jurisdictional transfer, and if a grade-separated crossing along 11th Street between 1st Avenue and Main Avenue (Alternative 1) is constructed, traffic volumes will be reduced along 8th Street between Center Avenue and Main Avenue and along Center Avenue between 8th Street and 11th Street. This provides the opportunity to reduce the cross-section and remove a thru lane in both directions.

Alternative 2A: Three-Lane Cross-Section along Center Avenue between 8th Street and 11th Street

Center Avenue is expected to operate acceptably (see Appendix B) with a three-lane cross-section and is discussed below.

Description:

- Restripe or modify the curb location to provide a three-lane section along Center Avenue between 8th Street and 11th Street.
- To transition from the five-lane to the three-lane and vice versa, it was assumed that two eastbound thru lanes would begin approximately 200 to 300 feet west of 11th Street and the northernmost westbound thru lane east of 11th Street would trap into a right-turn lane at the 11th Street intersection. If this alternative is selected, additional consideration is needed during design to determine the optimal configuration to transition between the three-lane and five-lane sections.
- If this alternative is selected, Center Avenue would be re-striped to be consistent with the changes to Center Avenue west of 8th Street that were completed by the City in 2019.

Benefits	Challenges
• Opportunity to provide on-street parking, shared on-street bike lanes, and/or wider sidewalks • Removes the multiple-lane threat for pedestrians • Reduces the crossing distance for pedestrians and opportunities to provide pedestrian crossing enhancements at non-signalized intersections • Intersections are expected to operate at an overall acceptable level of service • Three-lane provides vehicular safety benefits compared to the five-lane facility • Three-lane likely to reduce travel speeds through this segment (depending on lane widths) • Consistent with the three-lane section on Center Avenue west of 8th Street	• While the intersections are expected to operate acceptably, the corridor will be more congested during peak hours compared to existing cross-section • Center Avenue is a likely future transit route; additional consideration should be given to where transit stops should be located

Alternative 2B: Three-Lane Cross-Section along 8th Street between Center Avenue and Main Avenue

An initial test determined that the existing roadway geometry along 8th Street between Center Avenue and Main Avenue is needed for both capacity and vehicle storage during train events (see Appendix B). The southbound queue at the Main Avenue/8th Street intersection will queue into the Center Avenue/8th Street intersection, impacting operations.

Description:

- Restripe or modify the curb location to provide a three-lane section along 8th Street between Center Avenue and Main Avenue.
- If this alternative is selected, additional consideration is needed during design to determine the optimal configuration to transition between the three-lane and five-lane sections, potentially including a southbound left-turn lane, one thru lane, and one shared thru/right-turn lane.

Benefits	Challenges
• Opportunity to provide on-street parking, shared on-street bike lanes, and/or wider sidewalks • Removes the multiple-lane threat for pedestrians • Reduces the crossing distance for pedestrians and opportunities to provide pedestrian crossing enhancements at non-signalized intersections • Three-lane provides vehicular safety benefits compared to the five-lane facility • Three-lane likely to reduce travel speeds through this segment (depending on lane widths)	• The corridor will be more congested during peak hours compared to existing cross-section and queues are expected between the Center Avenue and Main Avenue intersections • During the p.m. peak, failing operations are expected

Alternative 2B is not recommended by the SRC due to the congestion expected with the close intersection spacing and their interaction with the at-grade railroad crossings. Further, 8th Street serves as a main connection between I-94 and 1st Avenue. 1st Avenue is the City's preferred traffic corridor through downtown.

Alternative 3: Add Trail Connection between 11th Street and 21st Street/1st Avenue

The segment of Center Avenue (US 10/75) between 11th Street and 21st Street/1st Avenue is an existing gap in the pedestrian/bicycle network. It should be noted that in the US 10 East Focus Area, alternatives to provide a pedestrian connection between 21st Street/1st Avenue and 28th Street area are discussed (see Alternative 2 in the US 10 East Focus Area). Two alternatives were considered:

Alternative 3A: Add Trail on the North or South Side of 1st Avenue Between 11th Street and 21st Street/1st Avenue

Adding a trail along 1st Avenue was deemed feasible by the previous 1st Avenue Corridor Study. Installing an 8-foot (minimum) wide shared-use path would result in removal of the existing sidewalk, stamped and colored boulevard ADA ramps, and relocation of streetlights. It would also be prudent to replace the curb and gutter to better control of grades and flexibility in the design.

Description:

- Construct a shared use path along 1st Avenue between 11th Street and 21st Street/1st Avenue.

Benefits	Challenges
• Addresses the existing gap in the pedestrian/ bicycle network • Similar distance for pedestrians/bicyclists to travel between 11th Street and 21st Street/1st Avenue if a trail were to be provided along Center Avenue (US 10/75)	• No pedestrian/bicycle facilities would be provided along Center Avenue (US 10) between 11th Street and 21st Street/1st Avenue • Wayfinding signage may be needed to direct pedestrians/bicyclists to 1st Avenue

Alternative 3B: Add Trail on the North or South Side of Center Avenue (US 10/75) between 11th Street and 21st Street/1st Avenue

Description:

- Construct a shared-use path trail along the north or south side of Center Avenue (US 10/75) between 11th Street and 21st Street/1st Avenue.

Benefits	Challenges
• Addresses the existing gap in the pedestrian/ bicycle network • Similar distance for pedestrians/bicyclists to travel between 11th Street and 21st Street/1st Avenue if a trail were to be provided along 1st Avenue	• There are slope issues at the railroad bridge piers that make it challenging to construct a trail along Center Avenue (US 10/75); based on a review it is not considered feasible to construct a trial until the railroad bridge is reconstructed

Alternative 3B is not feasible and therefore is not recommended to be carried forward or considered further at this time. However, adding trail along Center Avenue (US 10) is a long-term vision for this corridor and should be considered when the railroad bridge is reconstructed and there is opportunity to relocate the bridge piers to accommodate a trail.

Alternative 4: One-Way to Two-Way Conversion along 5th Street Between Main Avenue (US 10) and 2nd Avenue

The Main Avenue (US 10)/5th Street intersection is expected to operate acceptably under year 2045 conditions. 5th Street is currently one-way northbound. At the Main Avenue (US 10) intersection the northbound approach has two left-turn lanes, a thru lane and a right-turn lane. To the north of the intersection, 5th Street is a two-way roadway with one northbound and southbound thru lane.

Description:

- Modify the south leg from a one-way northbound to two-way operations.
- Convert the westernmost northbound left-turn lane to a southbound thru lane.
- Modifications to the existing parking lot in the commercial area in the southwest quadrant of the intersection may be required (currently striped with angle parking, one-way internal operations).
- Opportunity to close access(es) along Main Avenue if two-way operations provided.
- There will likely be a southbound thru lane alignment shift of approximately eight feet.

Benefits	Challenges
• Intersection is expected to operate acceptably • Converting 5th Street from one-way to two-way operations makes it easier to navigate downtown and to access business to/from 2nd Avenue • Potential to close access along Main Avenue, improving compliance with access spacing guidelines • Consistent with two-way operations at 4th Street	• Does not improve pedestrian crossing • Converting the south leg from a one-way to two-way operations increases the intersection conflicts potentially increasing risk for crashes • The southbound thru lane will be challenging to align through the intersection • Parking lot in the southwest quadrant would likely require restriping and modification

Alternative 5: Modify Main Avenue (US 10) between River and 8th Street (US 75)

Main Avenue (US 10) between the River and 8th Street is current a four-lane undivided roadway with left-turn lanes at each of the public streets. To the east of 8th Street (US 75), Main Avenue transitions to a five-lane undivided roadway with center two-way left-turns. The Fargo Main Avenue Reconstruction project started construction in Spring 2019. The project is converting Main Avenue between 8th Street and 2nd Street to a three-lane roadway with on-street parking. While the Fargo Main Avenue traffic study did not estimate significant travel pattern/volume changes to the Main Avenue segment in Moorhead, if traffic volumes decrease as a result of the Fargo Main Avenue project a different cross-section should be considered along Main Avenue between the River and 11th Street.

The methodology for developing traffic volumes for this study is documented in the *Traffic Forecasts Technical Memorandum*, dated May 2019. The future expected traffic diversion will need to be determined during project development when new data can be collected following completion of the Main Avenue reconstruction project and other ongoing projects impacting traffic in downtown Moorhead. Without any assumed diversion the daily volume ranges from 18,500 (existing) to 24,900 (2045), which both are within the expected range of a three-lane roadway capacity (17,000 to 25,000

daily vehicles). The capacity depends on roadway characteristics, access spacing, and traffic patterns. From a peak hour perspective, overall poor operations (LOS E or worse) are expected during the afternoon peak at the signalized intersections of 4th Street, 5th Street, and 8th Street with the three-lane concept. However, MnDOT's Performance-Based Practice Design notes a "design vehicular LOS of D or lower is suggested for urban streets as an appropriate balance between design-year peak-hour operation and off-peak safety." Thus, the SRC supports the trade-off between the less than ideal peak hour operations under worst-case volume conditions to promote walkability and bikeablility. Details are included in Appendix B.

In year 2022 (one-year after the completion of the Fargo Main Avenue Reconstruction project), traffic volumes in downtown Moorhead should be re-assessed to determine if traffic pattern changes have occurred that would suggest a different cross-section would work. Further, reevaluation of traffic at this time would allow for a new "base" set of data to be evaluated once traffic stabilizes following the completion of several ongoing constructions projects that impact traffic volumes in downtown.

Alternative 5A: Maintain 5-Lane Roadway on Main Avenue (US 10) between the River and 8th Street

Description:

- Reconstruct as a five-lane with a center two-way left-turns.

Benefits	Challenges
• Intersections and corridor are expected to operate acceptably • Two-way left-turn striping is consistent with the access density and the striping west of 11th Street	• Does not promote walkability/bikeability

Alternative 5B: Modify the Main Avenue (US 10) Cross-Section to a 3-Lane Roadway

Description:

- Reconstruct Main Avenue (US 10) as a 3-lane roadway between the River and 8th Street to provide one thru lane in each direction, center two-way left-turns, and on-street parking.
- Widen sidewalks with reconstruction.

Benefits	Challenges
• Promotes walkability/bikeability	• Poor traffic operations are expected with current projections • Need to re-evaluate traffic once ongoing construction projects are complete and traffic stabilizes through downtown Moorhead

Alternative 6: Additional Improvements for Consideration

The following additional enhancements such as signage, pedestrian improvements, and streetscaping elements have also been discussed as potential improvement options for the downtown area.

Alternative 6A: Add Dynamic Signage to Notify Vehicles of Approaching Trains

During the public and stakeholder engagement process, feedback was provided that the Downtown Focus Area is congested during train events. Providing additional signage notifying motorists when trains are approaching will help motorists to make decisions on travel routes to avoid getting stuck at an at-grade crossing when a train is traveling through downtown and the gate arms are down.

Description:

- Add dynamic message signage to notify motorists of when trains are coming.

Benefits	Challenges
• Notifies motorists of oncoming trains • Reduces the likelihood of vehicles not getting stuck at a railroad crossing • Reduces driver frustration	• Ability and technique to coordinate with the railroad detection system

Alternative 6B: Add Pedestrian Crossing Enhancements at Main Avenue (US 10)/7th Street

The 7th Street intersection along Main Avenue (US 10) is the only unsignalized intersection along the corridor between the River and 8th Street (US 75). It is a T-intersection (no north leg) and provides the opportunity to add a pedestrian refuge island on the west leg. However, there are few pedestrians that would likely want to cross at this intersection based on the current land uses and there are nearby alternative pedestrian crossing options at the signals at 6th Street and 8th Street. It should be noted that according to Minnesota's Crosswalk Law, vehicles must stop for crossing pedestrians at all intersections regardless if the intersection is marked or unmarked.

Description:

- Construct a pedestrian refuge island on the west leg (with a 5-lane roadway) or provide a curb bump-out on the north side of Maine Avenue (with a 3-lane roadway).
- Consider marking the crosswalk and adding "Stop for Pedestrian" signage or a Rectangular Rapid Flashing Beacon (RRFB).

Benefits	Challenges
• Pedestrians tend to select routes that are the shortest distance between two points – if a pedestrian's origin/destination is along 7th Street north or south of Main Avenue (US 10), pedestrians are likely to want to cross at 7th Street	• Few pedestrians currently want to cross at this intersection – the lack of pedestrian enhancements encourages pedestrians to cross at signalized intersections to the east and west

Alternative 6C: Increase the Sidewalk Width along 8th Street Between 1st and Center Avenues

Public feedback from the public engagement process identified that this study should prioritize pedestrians and bicyclists. One of the improvements identified by the SRC was to explore the possibility of increasing the sidewalk width along 8th Street between 1st Avenue and Center Avenue. The current sidewalk width narrows just north of the Center Avenue intersection due to the NAPA driveway area. One of the alternatives being explored for the US 75 South Focus Area is adding a share-use trail on the east side of 8th Street (US 75) between Main Avenue (US 10/75) and 12th Avenue (see Alternative 3 in the US 75 South Focus Area), which extending the pedestrian/bicycle connection to the north to 1st Avenue becomes a critical connection.

Description:

- Widen the sidewalk on the east side of 8th Street between 1st Avenue and Center Avenue to a minimum of 8 feet.

Benefits	Challenges
• Improves the pedestrian/bicycle facility and connectivity to the Downtown Focus Area and the regional system	• Coordinate with the NAPA store parcel – modifications to the parcel would be needed and likely the block long driveway would need to be removed or modified • The current sidewalk configuration is not ADA compliant

Alternative 6D: Utilize Dead-End Space for Parking, Streetscaping, Park Space, etc.

There are currently dead-end locations along the corridor where the railroad intersects the roadway and there are no at-grade railroad crossings (i.e., 6th Street between Center Avenue and Main Avenue and 9th Street and 10th Street between 1st Avenue and Center Avenue). In discussions with City staff, there may opportunity to better utilize this space such as for designated on-street parking, streetscaping elements, park space, etc. The City is currently conducting a Downtown Master Planning Study that will take a closer look at improvements such as these. Therefore, while this study will not recommend what (if any) specific use the dead-end spaces will serve, this study will recommend that the dead-end spaces should be studied further in the Downtown Master Planning Study.

Description:

- The Downtown Master Planning Study project team should work with the public and local business community to identify the best use for the dead-end space

Benefits	Challenges
• Better utilization of the space	• Coordinating with the community and competing interests

Alternative 6E: Add Streetscaping Elements and Reduce Roadway Width along Center Avenue (US 10/75) between 14th Street and 21st Street/1St Avenue to Reduce Travel Speeds

Public feedback from the public engagement process suggested that this study should explore opportunities to reduce the travel speeds along Center Avenue (US 10/75) between 14th Street and 21st Street/1st Avenue. Reducing travel speeds and adding streetscaping elements along corridor will create a more cohesive design connecting the Downtown and US 10 East Focus Areas.

Description:

- Add streetscaping elements such as trees, park area, and/or trail (see Alternative 3B).
- Reduce roadway lane widths.

Benefits	Challenges
• Potential to reduce travel speeds along Center Avenue (US 10/75) • Potential to create active green space	• Reduces vehicular speeds along Center Avenue (US 10/75)

Alternative 7: Restrict or Close Driveway Accesses in Downtown

The access density along Main Avenue and Center Avenue in the Downtown Focus Area exceeds the current access spacing requirements. Consolidating, restricting or eliminating access would improve safety and mobility along the corridors.

Description:

- Specific access locations TBD.

Benefits	Challenges
• Improves compliance with access spacing guidelines • Provides safety improvements • Maintains accessibility for vehicles entering/ exiting each parcel	• Coordinating with property owners on locations where access is proposed to be consolidated, restricted, or eliminated

US 10 East Focus Area

During the public and stakeholder engagement process, comments were received to explore opportunities to modify the roadway cross-section and streetscaping elements to create a cohesive roadway that connects the Downtown and US 10 East Focus Areas. This included alternatives that would reduce travel speeds along Center Avenue (US 10/75) to be consistent with the existing speed limit in the Downtown Focus Area (30 mph), as well as alternatives that evaluated an urban section with curb and gutter along Center Avenue (US 10). In addition, feedback was given to review alternatives to add pedestrian/bicycle facilities along Center Avenue (US 10) between 21st Street/1st Avenue and 28th Street to connect into the existing facilities. The following summarizes the benefits and challenges of each of the alternatives considered for the US 10 East Focus Area:

Alternative 1: Center Avenue between the 21st Street/1st Avenue and 32nd Street

The center median of Center Avenue (US 10) east of the US 75 East Junction intersection was designed to be used as a truck weigh station but the weigh station closed, and its remnants are now used as a truck inspection site. This alternative explores the opportunity to reclaim that area and to design the US 10 corridor between the 21st Street/1st Avenue and 32nd Street intersections with a complete streets approach. Further, under year 2045 conditions, the side-street approaches at the 24th Street, 26th Street, 28th Street, and 30th Street are expected to have high average delays during the peak hours with the current two-stage crossing configuration. Two alternatives were considered, both assume the alignment of Center Avenue was shifted south to better tie-in the alignments east and west of the wide median:

Alternative 1A: Remove the Grass Ditch Median along Center Avenue between the 21st Street/1st Avenue and 32nd Street Intersections with Access Restrictions (28th Street is Full Access)

Description:

- Remove the grass ditch median and replace it with a narrow concrete median with curb and gutter.
- Modifications to the 21st Street/1st Avenue intersection are discussed in Alternative 3 and modifications to the US 75 East Junction intersection are discussed in Alternative 4.
- The following access modifications were assumed under this alternative:
  - 24th Street – close access due to its proximity to the US 75 East Junction intersection
  - 26th Street – restrict access to right-in/right-out to provide safety and operational benefits
  - 28th Street – provide full access and signalize once traffic volumes warrant installation
  - 30th Street – restrict access to three-quarter access to provide safety and operational benefits
  - 32nd Street – maintain as a full access signalized intersection
- *Optional* - Provide a frontage road connection between 28th Street and 30th Street on the north side of Center Avenue to improve connectivity since northbound and southbound left-turn and thru movements are restricted at the 30th Street intersection under this alternative.

Benefits	Challenges
• Roadway modifications and access restrictions are expected to provide safety and operational benefits • Addresses safety/operational issues observed at the 30th Street intersection • Improves compliance with access spacing guidelines • A new pedestrian crossing can be provided at the 28th Street signalized intersection • Roadway design expected to reduce travel speeds promoting an urban, multi-modal environment • 28th Street provides the best north/south regional connectivity since it connects to 80th Avenue to the north • 28th Street is located midway between US 75 East Junction and 32nd Street providing good traffic signal spacing • 28th Street is located closer to 24th Street and 26th Street compared to 30th Street making it closer for vehicles to re-route to • Vehicles can make a U-Turn along Center Avenue for locations where access is proposed to be restricted • Urbanizing the corridor to lower speeds provides the opportunity for transit buses to stop in-lane with the potential to add a high-frequency transit route between Moorhead and Dilworth	• Construction costs • Coordination with businesses on proposed access closure/restriction locations • Traffic volumes on 30th Street are greater than traffic volumes on 28th Street • Vehicles re-routing from 24th Street, 26th Street, and 30th Street (proposed access closures or restrictions) would need to make a U-Turn or use the frontage road system to access the signal at 28th Street thereby increasing vehicle miles traveled • Closure of 24th Street access has transit impacts – need to coordinate with MATBUS to determine how transit would be re-routed or if an eastbound right-in is needed

Alternative 1B: Remove the Grass Ditch Median Along Center Avenue between the 21st Street/1st Avenue and 32nd Street Intersections with Access Restrictions (30th Street is Full Access)

Description:

- Remove the grass ditch median and replace it with a narrow concrete median with curb and gutter.
- Modifications to the 21st Street/1st Avenue intersection are discussed in Alternative 3 and modifications to the US 75 East Junction intersection are discussed in Alternative 4.
- The following access modifications were assumed under this alternative:
  - 24th Street – close access due to its proximity to the US 75 East Junction intersection
  - 26th Street – restrict access to right-in/right-out to provide safety and operational benefits
  - 28th Street – restrict access to three-quarter access to provide safety and operational benefits
  - 30th Street – provide a full access and signalize once traffic volumes warrant installation
  - 32nd Street – restrict access to three-quarter access to improve traffic signal spacing

- *Optional* - Provide a frontage road connection between 28th Street and 30th Street on the north side of Center Avenue to improve connectivity since southbound/northbound left-turn and thru movements are restricted at the 28th Street intersection under this alternative.

Benefits	Challenges
• Roadway modifications and access restrictions are expected to provide safety and operational benefits • Addresses safety/operational issues observed at the 30th Street intersection • Improves compliance with access spacing guidelines • A new pedestrian crossing can be provided at the 30th Street intersection • Roadway design expected to reduce travel speeds promoting an urban, multi-modal environment • 30th Street is located midway between US 75 East Junction and 34th Street providing good traffic signal spacing • Vehicles can make a U-Turn along Center Avenue for locations where access is proposed to be restricted • Traffic volumes on 30th Street are greater than traffic volumes on 28th Street • Urbanizing the corridor to lower speeds provides the opportunity for transit buses to stop in-lane with the potential to add a high-frequency transit route between Moorhead and Dilworth	• Construction costs • Coordination with businesses on proposed access closure/restriction locations • Pedestrian crossings on Center Avenue would be removed at 32nd Street • Removes an existing signal at 32nd Street – coordination with the Easten Shopping Center would be needed and potential modifications to their parking lot to encourage vehicles to exit onto 30th Street or 34th where signals would be provided • Removes existing signal at 32nd Street where transit buses use the intersection • 30th Street does not provide the same regional connectivity as 28th Street provides since 30th Street dead-ends approximately one-half mile to the north of Center Avenue • Vehicles re-routing from 24th Street, 26th Street, and 28th Street (proposed access closure or restrictions) would need to make a U-Turn or use the frontage road system to access the signal at 30th Street thereby increasing vehicle miles traveled • Closure of 24th Street access has transit impacts – need to coordinate with MATBUS to determine how transit would be re-routed or if an eastbound right-in is needed

Alternative 2: Add Trail on Center Avenue between 21st Street/1st Avenue and 28th Street

The segment of Center Avenue between 21st Street/1st Avenue and 28th Street is an existing gap in the pedestrian/bicycle network. It should be noted that in the Downtown Focus Area, alternatives to provide a pedestrian connection between 11th Street and 21st Street/1st Avenue were discussed (see Alternative 3 in the Downtown Focus Area). Based on that review, a trail along 1st Avenue (Alternative 3A) was identified to be the recommended alternative. Combining Alternative 3A in the Downtown Focus Area with Alternative 2 in the US 10 East Focus Area, pedestrian/bicycle connections would address the existing gap. Based on discussions with the SRC, this study reviewed options to provide trail on both the north and south sides of Center Avenue between 21st Street/ 1st Avenue and 28th Street.

Description:

- Construct a shared-use path along both the north and the south sides of Center Avenue between 21st Street/1st Avenue and 28th Street.
- This alternative assumes that Alternative 1A or 1B for the US 10 East Focus Area is selected, providing additional right-of-way space to the north and assumes that the US 75 East Junction intersection can be redesigned to accommodate pedestrians on the north leg (further discussed in Alternative 4).

Benefits	Challenges
• Addresses the existing gap in the pedestrian/ bicycle network • Provides accommodations on both the north and south sides of Center Avenue	• Requires the greatest amount of space for trail facilities; however, no right-of-way acquisition is anticipated to be needed

Alternative 3: Center Avenue (US 10/75)/21st Street/1st Avenue Intersection

Under year 2045 conditions, this intersection is expected to operate near capacity with the existing intersection configuration. Feedback provided from the SRC as well as from public and stakeholder engagement efforts suggested that this study should explore opportunities to modify the intersection configuration to remove split signal timing phasing for the northbound/southbound approaches, improve pedestrian crossing safety, provide pedestrian/bicycle facilities to the east and west along the corridor, remove/reduce the existing median, and to create an urban section/intersection to reduce travel speeds through the intersection and further to the east. It is important to note that the design of this intersection is impacted by other alternatives being considered:

- In the Downtown Focus Area, alternatives to provide a pedestrian connection between 11th Street and 21st Street/1st Avenue were discussed (see Alternative 3 in the Downtown Focus Area). Based on the review, a trail along 1st Avenue (Alternative 3A) was recommended.
- For purposes of evaluating this intersection, new trail was assumed to be constructed on the north and south sides of Center Avenue that would connect into the existing trail at 28th Street (Alternative 2).
- Due to close intersection spacing with the Center Avenue (US 10)/US 75 East Junction intersection, the proposed improvements at this intersection need to work in coordination with the improvements at the US 75 East Junction intersection (Alternative 4).

Three alternatives were considered:

Alternative 3A: Modify Intersection Configuration but keep Split Phasing

Description:

- Remove the grass ditch median and construct a narrow pavement median. Reduce the lane widths and provide curb and gutter sections along Center Avenue (US 10/75) to the east and west of the intersection (See Alternative 1).
- Modify the signal phasing to provide a northbound right-turn and westbound left-turn overlap.
- Remove the northbound channelized right-turn or consider installing flashing yellow right-turn arrows to accommodate the northbound right-turn and westbound left-turn overlap signal phase.
- Reduce the intersection skew.
- Provide a pedestrian refuge island on the west leg (if no underpass is built).
- Intersection would be modified, but the lane geometry and split signal timing phasing would remain the same as existing conditions.

Benefits	Challenges
• Overall operations during the peak hours are expected to improve • Reduces delay/queues for the northbound right-turn movement during the p.m. peak hour • Intersection design expected to reduce travel speeds promoting an urban, multi-modal environment • Skewed intersection reduced thereby improving safety • Pedestrian crossing distance reduced on the west leg (if no underpass is built) • Maintains ability for eastbound transit buses on 1st Avenue to easily access the left-turn movement at the intersection	• Reduces travel speeds impacting mobility • Likely would need to eliminate the pedestrian crossing on the east leg unless modifications can be made to provide a two-stage crossing • Split signal phasing during the non-peak periods reduces intersection efficiency • The intersection to the north may need to be closed or restricted

Alternative 3B: Modify Intersection Configuration with Protected/Permitted Left-turn Phasing

Description:

- Remove the grass ditch median and construct a narrow pavement median. Reduce the lane widths and provide curb and gutter sections along Center Avenue (US 10/75) to the east and west of the intersection (See Alternative 1).
- Remove the northbound channelized right-turn or consider installing flashing yellow right-turn arrows to accommodate the northbound right-turn and westbound left-turn overlap signal phase.
- Modify the signal phasing to provide a northbound right-turn and westbound left-turn overlap.
- Reduce the intersection skew.

- Provide a pedestrian refuge island on the west leg (if no underpass is built).
- To ensure that northbound and southbound left-turns do not overlap, the pedestrian crossing on the east approach would need to be set back approximately 70 feet from the intersection creating a potential pedestrian crossing safety concern for northbound and westbound right-turns.
- Intersection would be modified, and split signal phasing would be removed, but the lane geometry would remain the same as existing conditions.

Benefits	Challenges
• Removing the split phasing increases the intersection efficiency during non-peak hours • Intersection design expected to reduce travel speeds promoting an urban, multi-modal environment • Skewed intersection reduced thereby improving safety • Pedestrian crossing distance reduced on the west leg	• Reduces travel speeds impacting mobility • Vehicle compliance concerns for the westbound approach as vehicles may not stop at the designated stop bar location • Pedestrian crossing safety concerns on the north leg due to potential conflicts with westbound right-turning vehicles • Likely would need to eliminate the pedestrian crossing on the east leg • The intersection to the north may need to be closed or restricted

This alternative is only recommended if a grade-separation for pedestrians is built. To remove overlapping turns the stop bar back on the east leg would need to be set back a distance to which negatively impacts the pedestrian crossing.

Alternative 3C: Construct a Multi-Lane Roundabout

Description:

- Construct a multi-lane roundabout.

Benefits	Challenges
• Reduces delay during non-peak hours • Reduces travel speeds through the intersection	• Failing operations (LOS F (>2 min.)) during peak hours • Potential operational issues during events at the High School • Poor pedestrian accommodations • Increases in the frequency of crashes expected • The intersection to the north may need to be closed or restricted

Alternative 3C is not feasible based on expected future intersection capacity needs; therefore, this alternative was not recommended to be carried forward or considered further.

Alternative 4: Center Avenue (US 10)/US 75 East Junction

Under year 2045 conditions, this intersection is expected to operate acceptably with the existing intersection configuration. Feedback provided from the SRC as well as from public and stakeholder engagement suggested that this study should explore opportunities to simplify the traffic control, improve pedestrian crossing safety, and to reduce travel speeds through the intersection. It should be noted the design of this intersection is impacted by other alternatives being considered:

- A new trail was assumed to be constructed on the north and south sides of Center Avenue that would connect into the existing trail at 28th Street (Alternative 2).
- Due to its close intersection spacing with the Center Avenue (US 10/75)/21st Street/1st Avenue intersection, the proposed improvements at this intersection need to work in coordination with the improvements at the 21st Street/1st Avenue intersection (Alternative 3).

Three alternatives were considered:

Alternative 4A: Modify Intersection Configuration with Typical Signal Phasing

Description:

- Remove the grass ditch median and construct a narrow pavement median. Reduce the lane widths and provide curb and gutter sections to the east and west.
- Construct dual eastbound left-turn lanes with protected only signal phasing.
- Provide pedestrian crossings on all legs and a pedestrian refuge island on the east leg along Center Avenue.
- Replace the current traffic signal phasing with a typical signal phasing configuration.

Benefits	Challenges
• Simplifies intersection • Acceptable overall operations during the peak hours • Intersection design expected to reduce travel speeds promoting an urban, multi-modal environment • Pedestrian crossing will likely be feasible on all legs	• Reduces travel speeds impacting mobility • Eastbound traffic must stop, which it currently is a free movement • Overall operations expected to have higher delay than a Continuous Green-T intersection

Alternative 4B: Construct an Urban Continuous Green-T Intersection

Description:

- Remove the grass ditch median and construct a narrow pavement median. Reduce the lane widths and provide curb and gutter sections to the east and west.
- Construct a single eastbound left-turn lane with flashing-yellow-arrow phasing.

- Provide an acceleration lane for southbound left-turning traffic onto eastbound Center Avenue, which is the typical configuration for a Continuous Green-T intersection.
- No pedestrian crossings are permitted across Center Avenue with this intersection configuration since the eastbound traffic does not have to stop.
- Provide a pedestrian crossing on the north leg.

Benefits	Challenges
• Simplifies intersection from current configuration • Acceptable overall operations during the peak hours • Provides the lowest overall delay/queues compared to the other alternatives • Eastbound traffic does not stop	• Higher speeds through the intersection since the eastbound traffic does not stop • Eliminates potential for a pedestrian crossing on the east and west legs

Alternative 4C: Construct a Multi-Lane Roundabout

Description:

- Construct a multi-lane roundabout.

Benefits	Challenges
• Acceptable overall operations during the peak hours • Reduces delay during non-peak hours • Reduces travel speeds through the intersection	• Potential operational issues during events at the High School Increases in the frequency of crashes expected • Large roundabout footprint needed to accommodate high volume of heavy vehicles

Recommendations and additional details for the Center Avenue (US 10)/US 75 East Junction are documented in the *Intersection Control Evaluation (ICE)*, report dated April 2020. This includes discussion an option to consider for the commercial vehicle inspection site being impacted.

Alternative 5: Center Avenue (US 10)/34th Street Intersection

The Center Avenue (US 10)/34th Street intersection was identified to have an existing crash rate above the critical crash rate. Based on a review of the crash trends, the driveways to the north and the South Frontage Road to the south of the intersection are likely significant contributors to the high frequency of crashes due to the proximity of these accesses/intersections to the Center Avenue (US 10) intersection. Two alternatives were considered:

Alternative 5A: Relocate/Restrict Access to the North and Restrict South Frontage Road to Right-In/Right-Out

Description:

- Restrict the south driveway into the Tesoro gas station to right-in/right-out; relocate the north driveway into the Tesoro gas station and the main Tractor Supply Co. driveway to the north to be directly across from one another while maintaining full access.
- Restrict the South Frontage road access to right-in/right-out.
- Extend the westbound left-turn lane storage to a minimum of 500 feet.
- Eastbound/westbound left-turns are recommended to be protected only during the a.m. and p.m. peak hours.

Benefits	Challenges
• Maintains full access to the Tractor Supply Co. • Provides one full access and one right-in/right-out access to Tesoro (currently two full accesses) • Reduces conflicts at the intersections/driveways located closest to the Center Avenue (US 10) intersection • Westbound left-turn lane storage can accommodate the expected queues during the peak hours • The protected left-turn phasing is expected to improve safety at the intersection	• Coordination is needed with the businesses with relocation and/or restriction of accesses • Restricting the South Frontage Road to right-in/right-out will likely re-route vehicles to the existing traffic signal at the 32nd Street intersection or to 34th Street to make a U-Turn • Transit route #6 currently makes a southbound left-turn at the South Frontage Road and would need to use an alternative route

Alternative 5B: Relocate/Restrict Access to the North and Restrict South Frontage Road 3/4 Access

Description:

- Restrict the south driveway into the Tesoro gas station to right-in/right-out; relocate the north driveway into the Tesoro gas station and the main Tractor Supply Co. driveway to the north to be directly across from one another while maintaining full access.
- Restrict the South Frontage road access to a three-quarter access intersection.
- Extend the westbound left-turn lane storage to a minimum of 500 feet.
- Eastbound/westbound left-turns are recommended to be protected only during the a.m. and p.m. peak hours.

Benefits	Challenges
• Maintains full access to the Tractor Supply Co. • Provides one full access and one right-in/right-out access to Tesoro (currently two full accesses) • Reduces conflicts at the intersections/driveways located closest to the Center Avenue (US 10) intersection • Westbound left-turn lane storage can	• Coordination is needed with the businesses with relocation and/or restriction of accesses • Restricting the South Frontage Road to right-in/right-out will likely re-route vehicles to the existing traffic signal at the 32nd Street intersection or to 34th Street to make a U-Turn • Conflict between northbound left-turns at the

accommodate the expected queues during the peak hours
- The protected left-turn phasing is expected to improve safety at the intersection
- Maintains current transit route #6 which makes a southbound left-turn at the South Frontage Road

Center Avenue (US 10) and South Frontage Road still exists
- Operational concerns for if/when the queues from the southbound left-turn onto the South Frontage Road impact the Center Avenue (US 10 intersection)
- Operational concerns for if/when the queues from the northbound left-turn onto Center Avenue (US 10) impact the South Frontage Road

Alternative 5B was not recommended by the SRC based on safety and operational concerns with the three-quarter access onto the South Frontage Road and therefore, was not recommended to be carried forward or considered further.

Alternative 6: Center Avenue (US 10/75) Grade Separated Pedestrian/Bicyclist Crossing Between 21st Street/1st Avenue and US 75 East Junction

Consideration was given to the need for a pedestrian/bicycle grade-separated crossing (i.e., bridge or underpass) across Center Avenue (US 10) between the 21st Street/1st Avenue and the US 75 East Junction intersections. In the Downtown Focus Area, alternatives to provide a pedestrian connection between 11th Street and 21st Street/1st Avenue were discussed (see Alternative 3 in the Downtown Focus Area). Based on the review, a trail along 1st Avenue (see Alternative 3A) was identified to be the recommended alternative. Further, Alternative 2 in the US 10 East Focus Area reviewed alternatives to provide a trail on the north and south side of Center Avenue between 21st Street/1st Avenue and 28th Street. The pedestrian/bicycle grade-separated crossing alternative would connect the trail at 1st Avenue with the trail on the south side of Center Avenue.

Pedestrian crossings may need to be removed on the east approach of the 21st Street/1st Avenue intersection (Alternative 3A and 3B) and potentially both the east and west approaches of the US 75 East Junction intersections (Alternative 4B). This grade-separated crossing would improve connectivity and provide a safe and conflict-free crossing for pedestrians and bicyclists. Two alternatives were considered:

Alternative 6A: Construct a Pedestrian/Bicycle Bridge

Description:

- Construct a pedestrian/bicycle bridge across Center Avenue.
- If this alternative is selected for further consideration, additional study will be needed to determine how the structured ramps to the grade-separated crossing would be designed and how the structure would connect to the existing/proposed trail system, etc.

Benefits	Challenges
• No conflicts for pedestrians and bicycles crossing	• Construction costs • Sightline concerns for where the bridge piers would be located to make sure that adequate sight distance is provided for vehicles and to not introduce safety issues • Bridges tend to have longer structured approaches requiring pedestrians/bicyclists to walk/bike further out of their way to cross, potentially reducing the likelihood that they will use the crossing vs. crossing at-grade • Bridge may block visibility of businesses

Alternative 6B: Construct a Pedestrian/Bicycle Underpass

Description:

- Construct a pedestrian/bicycle underpass across Center Avenue.
- If this alternative is selected for further consideration, additional study will be needed to determine the design of the tunnel and how they connect to the existing/proposed trail system, etc.

Benefits	Challenges
• No conflicts for pedestrians and bicycles crossing • No sightline issues	• Construction costs • Need to confirm that there are no water table issues with constructing an underpass • Public generally has safety and lighting concerns with underpasses

US 75 South Focus Area

During the public and stakeholder engagement process, comments were received to explore opportunities to provide pedestrian/bicycle facilities along 8th Street (US 75). It was also noted that the 8th Street (US 75)/12th Avenue intersection has high pedestrian crossing volumes (verified with the data collection efforts), which can make it challenging for vehicles to make left- or right-turns. Further, safety and operational issues were identified at the 8th Street (US 75)/2nd Avenue intersection under existing and year 2045 conditions. The following summarizes the benefits and challenges of each of the alternatives considered for the US 75 South Focus Area:

Alternative 1: 8th Street (US 75) Between Main Avenue (US 10) and 4th Avenue Segment Test

Under year 2045 conditions, the side-street approaches along 8th Street (US 75) intersections at the 2nd Avenue, 3rd Avenue, and 4th Avenue intersections are expected to have operational issues (average delays of more than three minutes during the p.m. peak hour). In addition, the 2nd Avenue intersection was identified to have an existing crash rate above the critical crash rate.

Description:

- Construct a raised median along the center of 8th Street (US 75) to restrict the 2nd Avenue intersection to only allow the northbound left-turn movement.
- Install a traffic signal at the 4th Avenue intersection. A cursory review of year 2045 traffic volumes indicates that with the access restrictions at 2nd Avenue and 3rd Avenue that the traffic signal is expected to be warranted.
- The center raised median provides the opportunity for a two-stage pedestrian crossing with a pedestrian refuge island at 2nd Avenue and 3rd Avenue across 8th Street (US 75).
- Consider marking the crosswalk and adding "Stop for Pedestrian" signage or a Rectangular Rapid Flashing Beacon (RRFB) at the 2nd Avenue and 3rd Avenue intersections.

Benefits	Challenges
• Access restrictions expected to improve safety and traffic operations • Opportunities to enhance the pedestrian crossings at unsignalized intersections (2nd Avenue and 3rd Avenue) • New signalized intersection at 4th Avenue will provide an additional signalized crossing along the corridor; the signal can also help transition the lane alignment shifts • Access restrictions have no impacts to transit	• Coordinate with business along this segment of 8th Street (US 75) to discuss proposed access restrictions and any impacts to delivery truck circulation

Alternative 2: 8th Street (US 75) Lane Alignment Shifts at 4th Avenue and 5th Avenue

There are existing lane alignment shift issues along 8th Street (US 75) at 4th Avenue and 5th Avenue which cause driver confusion. During winter months, when the pavement markings are difficult to see with the snow/ice on the pavement, vehicles paths do not follow the through lane markings.

Description:

- Modify the roadway configuration to reduce or eliminate the existing skew for northbound and southbound vehicles traveling through the 4th Avenue and 5th Avenue intersections.
- To reduce the skew, the existing on-street parking along 8th Street (US 75) was removed.

Benefits	Challenges
• Reducing the existing lane alignment shifts which will reduce driver confusion traveling along the corridor	• Would likely require removing the on-street parking • Due to the required right-of-way acquisition, utility impact, and mature tree impacts it will be challenging to remove the alignment shift completely

Alternative 3: Add Trail on 8th Street (US 75) Between Main Avenue (US 10) and 12th Avenue

During the public engagement process, feedback was provided indicating the importance of providing a shared-use trail along 8th Street (US 75) between Main Avenue (US 10) and 12th Avenue. Currently, there is sidewalk on both the east and the west sides of 8th Street (US 75) in this segment, but there are no shared-used trails or existing on-street bike lanes to accommodate bicyclists. It should be noted that there is an existing trail on the east side of 8th Street (US 75) south of 12th Avenue.

The 12th Avenue Corridor Study recommended a shared-use trail on the south side of 12th Avenue between 5th Street and 20th Street, connecting into the existing trail at 20th Street. If trail cannot be accommodated along 8th Street (US 75) between Main Avenue (US 10) and 12th Avenue, then a trail should be considered along adjacent or nearby north/south corridors that connect to/from 12th Avenue. Two alternatives were considered:

Alternative 3A: Construct Trail on the East Side of 8th Street (US 75) between Main Avenue (US 10) and 12th Avenue

Description:

- Construct a trail on the east side of 8th Street (US 75) between Main Avenue (US 10) and 12th Avenue.
- Construction of trail requires removal of existing mature trees within the right-of-way, relocation of existing utilities, and has right-of-way impacts.

Benefits	Challenges
• Addresses the gap for bicyclists	• In several areas there would not be space to provide a boulevard between the road and the shared-use trail • In several areas the purchase of permanent easements of right-of-way would be needed and would result in re-grading almost all residential front yards • Requires removal of mature trees • Requires relocation of existing utilities

Alternative 3A is not feasible based impacts to right-of-way, mature trees, and utilities; therefore, it was not recommended to be carried forward or considered further.

Alternative 3B: Identify an Alternative Corridor for a North/South Pedestrian/Bicycle Connection

Description:

- 4th Street/5th Street or 11th Street are alternative corridors for consideration. Further discussion is needed with City staff to determine an appropriate location.
- Wayfinding signage would be provided along 12th Avenue to direct pedestrians/bicyclists to the alternative route.

Benefits	Challenges
• Feasibility of constructing a shared-use trail or on-street bike lanes on an alternative corridor is more likely	• Wayfinding/signage would need to be provided along 12th Avenue to direct pedestrians/ bicyclists

Alternative 4: 8th Street (US 75)/12th Avenue Intersection

As previously noted, this intersection is also being evaluated as part of the 12th Avenue Corridor Study. Under year 2045 conditions, this intersection is expected to operate acceptably, but is nearing capacity. Queues along 8th Street (US 75) are anticipated to extend 600 feet or greater during the p.m. peak and the eastbound thru/right-turn lane and westbound left-turn lane queues are expected to extend approximately 450 feet. Due to the existing pedestrian skyway bridge and the lack of available right-of-way space, adding additional turn lanes was considered not feasible. Further, due to the high pedestrian crossing volumes at this intersection when school is in session at Concordia College, there are high number of vehicle-pedestrian conflicts for vehicles wanting to make a left- or right-turn conflicting with pedestrians in the crosswalk thereby reducing the intersection efficiency. Under year 2045 no build conditions, the existing signal timing was modified to provide additional green time for the eastbound and westbound approaches to give vehicles more green time after the walk phase has ended. This helped to reduce the eastbound and westbound queues by reducing the number of cycle failures. Two alternatives were considered:

Alternative 4A: Install LPI and Blank Out Signage

Description:

- Install Leading Pedestrian Interval (LPI) to allow pedestrians to start crossing before vehicles are given a green light to proceed through the intersection. Note that with LPI, protected left-turns need to be lagging. LPI can be installed at intersection with flashing yellow arrows (FYA).
- Install "No Right Turn on Red" blank out signs at the intersection. During the peak periods during the school year, it is recommended that vehicles continue to be directed to not make a right-turn on red for pedestrian safety considerations. However, when school is not in session or outside of peak hours when pedestrian crossing volume is lower, vehicles would be permitted to make right-turns on red. This could potentially reduce driver frustration through this intersection.

Benefits	Challenges

• LPI is a Federal Highway Administration (FHA) proven safety countermeasure that:
  ○ Increases the visibility of crossing pedestrians
  ○ Reduces the conflicts between pedestrians and vehicles
  ○ Increases the likelihood of a vehicle yielding to pedestrians
  ○ Provides enhanced safety for pedestrians who may be slower to start into the intersection
• LPI is expected to have minimal impact to the overall traffic operations at the intersection
• Installing no right-turn on red blank out signs is expected to reduce driver frustration and intersection operations during non-peaks
	• This would be the first intersection in the City with LPI and blank out signage – coordination and troubleshooting may be needed to determine the optimal signal timing and the hours of day/time of season for the blank out signage

Alternative 4B: Modify Eastbound Lane Geometry, Install LPI and Blank Out Signage

Description:

- Modify the eastbound approach from a left-turn lane and shared thru/right-turn lane configuration to a shared left-turn/thru lane and right-turn lane configuration. Requires modifications to the curb to better align the eastbound/westbound through lanes and removes the eastbound left-turn protected signal phase.
- Install LPI at the intersection.
- Install "No Right Turn on Red" blank out signs at the intersection.

Benefits	Challenges
• Lane geometry provides a small benefit on intersection operations and reduces the eastbound queue approximately 75 feet • LPI is a Federal Highway Administration (FHA)	• Potential safety concerns with the inside left-lane offsets with the eastbound left-turn/thru lane and right-turn lane configuration • Cost to modify the curb line

proven safety countermeasure that:
  - Increases the visibility of crossing pedestrians
  - Reduces the conflicts between pedestrians and vehicles
  - Increases the likelihood of a vehicle yielding to pedestrians
  - Provides enhanced safety for pedestrians who may be slower to start into the intersection
- LPI is expected to have minimal impact to the overall traffic operations at the intersection
- Installing no right-turn on red blank out signs is expected to reduce driver frustration and intersection operations during non-peaks

- Protected eastbound left-turn phasing would be removed
- This would be the first intersection in the City with LPI and blank out signage – coordination and troubleshooting may be needed to determine the optimal signal timing and the hours of day/time of season for the blank out signage

Alternative 5: 8th Street (US 75)/20th Avenue Intersection

Under year 2045 conditions, the 8th Street (US 75)/20th Avenue intersection is expected to operate acceptably during the peak hours. No intersection crash issues were identified under existing conditions. The 20th Avenue corridor is a planned future bikeway; however, currently the bike facility type is unknown. There are existing frontage roads parallel to the east and to the west of 8th Street (US 75) between 20th Avenue and 24th Avenue. Access to the frontage road is located close to the 20th Avenue intersection, approximately 50 feet east and west of the intersection. Two alternatives were considered:

Alternative 5A: Existing Signal with Closing Both the East and West Frontage Roads at 20th Avenue

Description:

- Close access for both frontage roads to the east and west of 8th Street (US 75) along 20th Avenue.
- Residents and visitors of the properties along the frontage roads would still be able to access the properties via 22nd Avenue.

Benefits	Challenges
• Closing the frontage road intersections at 20th Avenue is expected to reduce conflicts near the 8th Street (US 75) intersection and improve intersection safety for vehicles and pedestrian/bicyclists • Residents and visitors of the properties along the frontage road can still access via 22nd Avenue	• Coordination is needed with the property owners along the frontage road to get feedback on the proposed access closures

Alternative 5B: Construct a Multi-Lane Roundabout

Description:

- Construct a multi-lane roundabout.

- Frontage roads would likely need to be closed to accommodate roundabout footprint.

Benefits	Challenges
• Acceptable overall operations during the peak hours • Reduces delay during non-peak hours • Reduces travel speeds through the intersection • Closing the frontage road intersections at 20th Avenue is expected to reduce conflicts near the 8th Street (US 75) intersection and improve intersection safety for vehicles and pedestrian/bicyclists • Residents and visitors of the properties along the frontage road can still access via 22nd Avenue	• Construction costs • Would likely require right-of-way acquision • Poor pedestrian/bicycle crossing accommodations compared to a signal • Increases in the frequency of crashes expected • Large roundabout footprint needed to accommodate high volume of heavy vehicles • Coordination is needed with the property owners along the frontage road to get feedback on the proposed access closures

Recommendations and additional details for the 8th Street (US 75)/21st Avenue intersection are documented in the *Intersection Control Evaluation (ICE)*, report dated April 2020.

Appendix A
Year 2045 No Build MOEs

2045 AM No Build
US 10/US 75 VISSIM Analysis
MOE Results

Main Ave/4th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	82	14	105	27	C	25.1	C	7.9	A
	Thru	19	14	105	25.3	C				
	Right	8	16	110	9.2	A				
Southbound	Left	7	3	52	41.7	D	29.3	C		
	Thru	18	3	51	36.7	D				
	Right	28	3	54	21.4	C				
Eastbound	Left	12	0	15	11.5	B	7.8	A		
	Thru	465	18	171	7.7	A				
	Right	185	20	176	7.6	A				
Westbound	Left	26	0	19	9.0	A	5.5	A		
	Thru	1,169	21	230	5.5	A				
	Right	30	22	232	5.1	A				

Main Ave/5th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	332	35	187	28	C	26.8	C	14.7	B
	Thru	93	14	112	34.7	C				
	Right	52	1	40	5.8	A				
Southbound	Left	8	2	58	34.7	C	22.3	C		
	Right	51	2	59	20.4	C				
Eastbound	Left	13	1	15	23.8	C	6.0	A		
	Thru	467	8	114	5.5	A				
Westbound	Thru	849	35	251	12.2	B	12.3	B		
	Right	13	37	259	17.4	B				

Main Ave/6th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	14	4	44	31	C	22.1	C	4.8	A
	Thru	8	3	43	26.1	C				
	Right	11	4	45	7.8	A				
Southbound	Left	26	5	54	31.7	C	24.9	C		
	Thru	7	5	50	29.7	C				
	Right	13	1	34	8.8	A				
Eastbound	Left	20	0	22	8.4	A	5.3	A		
	Thru	471	10	160	5.0	A				
	Right	36	11	166	6.9	A				
Westbound	Left	14	0	9	3.3	A	2.8	A		
	Thru	840	6	141	2.8	A				
	Right	26	7	143	2.7	A				

Main Ave/7th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	12	2	39	26	D	19.9	C	0.6	A
	Right	8	1	39	10.0	B				
Eastbound	Thru	497	0	1	0.4	A	0.4	A		
	Right	13	0	1	0.9	A				
Westbound	Left	19	0	17	2.8	A	0.4	A		
	Thru	866	0	0	0.3	A				

Main Ave/8th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	352	47	264	23	C	21.9	C	23.4	C
	Thru	411	33	196	24.8	C				
	Right	84	0	28	1.6	A				
Southbound	Left	8	1	20	35.0	D	41.3	D		
	Thru	201	25	191	44.6	D				
	Right	57	27	195	30.4	C				
Eastbound	Left	62	7	66	26.7	C	19.1	B		
	Thru	258	24	124	25.9	C				
	Right	183	6	108	7.0	A				
Westbound	Left	139	13	126	20.8	C	21.3	C		
	Thru	474	34	220	21.5	C				
	Right	21	35	223	18.7	B				

2045 AM No Build
US 10/US 75 VISSIM Analysis
MOE Results

Main Ave/11th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	21	2	34	16	B	14.0	B	16.3	B
	Thru	43	4	52	19.8	B				
	Right	30	0	30	4.2	A				
Southbound	Left	35	18	247	35.2	**D**	27.1	C		
	Thru	145	17	239	31.7	C				
	Right	118	4	109	19.0	B				
Eastbound	Left	74	4	66	15.0	B	13.2	B		
	Thru	187	9	91	13.0	B				
	Right	26	9	93	9.5	A				
Westbound	Left	78	4	61	11.8	B	12.8	B		
	Thru	496	23	160	13.2	B				
	Right	42	25	162	9.9	A				

Center Ave/8th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	99	5	117	21	C	25.4	C	20.2	C
	Thru	320	26	223	27.5	C				
	Right	78	25	222	22.5	C				
Southbound	Left	6	0	15	25.3	C	32.9	C		
	Thru	163	10	110	34.1	C				
	Right	22	11	110	26.8	C				
Eastbound	Left	12	1	35	23.9	C	13.3	B		
	Thru	158	11	121	13.1	B				
	Right	32	12	123	10.5	B				
Westbound	Left	75	5	77	16.7	B	13.3	B		
	Thru	416	17	172	12.5	B				
	Right	27	19	178	15.4	B				

Center Ave/11th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	12	8	75	41	**D**	32.3	C	25.1	C
	Thru	107	8	74	36.1	**D**				
	Right	41	1	40	19.7	B				
Southbound	Left	20	65	318	44.6	**D**	57.9	**E**		
	Thru	220	63	315	59.9	**E**				
	Right	26	67	323	51.0	**D**				
Eastbound	Left	27	2	47	21.5	C	13.5	B		
	Thru	204	11	111	12.2	B				
	Right	13	12	115	17.3	B				
Westbound	Left	66	3	64	13.7	B	12.3	B		
	Thru	482	18	183	12.1	B				
	Right	8	24	202	13.9	B				

Center Ave/14th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	15	37	225	56	**E**	43.8	**D**	21.5	C
	Thru	142	38	230	51.8	**D**				
	Right	39	0	14	10.2	B				
Southbound	Left	7	19	148	42.3	**D**	50.3	**D**		
	Thru	115	21	157	51.7	**D**				
	Right	16	19	155	43.4	**D**				
Eastbound	Left	8	1	16	23.6	C	12.7	B		
	Thru	245	12	123	12.3	B				
	Right	7	0	18	12.9	B				
Westbound	Left	93	5	77	13.0	B	11.9	B		
	Thru	528	19	186	11.4	B				
	Right	8	34	232	32.1	C				

2045 AM No Build
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/1st Ave/21st St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	73	71	255	39	D	26.5	C	26.3	C
	Thru	479	71	255	36.2	D				
	Right	246	1	49	3.8	A				
Southbound	Left	120	49	181	40.3	D	39.2	D		
	Thru	240	49	181	39.5	D				
	Right	7	20	154	7.0	A				
Eastbound	Left	15	5	42	55.8	E	26.7	C		
	Thru	225	26	160	28.6	C				
	Right	49	2	56	8.7	A				
Westbound	Left	467	80	231	51.3	D	22.8	C		
	Thru	548	18	135	10.5	B				
	Right	434	11	139	7.7	A				

Center Ave/TH 75 — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Southbound	Left	68	23	124	45.8	D	18.4	B	8.8	A
	Right	285	40	155	11.9	B				
Eastbound	Left	138	24	137	38.8	D	9.3	A		
	Thru	453	0	0	0.4	A				
Westbound	Thru	1,166	17	201	6.1	A	5.8	A		
	Right	86	0	10	1.1	A				

Center Ave/28th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	18	0	5	21	C	17.0	C	1.2	A
	Thru	0	-	-	0.0	A				
	Right	8	0	4	8.8	A				
Southbound	Left	23	4	56	25.4	D	17.8	C		
	Thru	7	4	57	27.6	D				
	Right	29	2	65	9.4	A				
Eastbound	Left	7	1	27	14.5	B	0.4	A		
	Thru	488	0	0	0.2	A				
	Right	18	0	0	1.1	A				
Westbound	Left	6	0	23	4.2	A	0.5	A		
	Thru	1,241	0	0	0.5	A				
	Right	24	0	0	0.9	A				

Center Ave/30th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	7	3	35	41	E	23.3	C	2.2	A
	Thru	6	3	35	73.5	F				
	Right	27	1	36	7.5	A				
Southbound	Left	31	3	41	40.6	E	18.2	C		
	Thru	0	-	-	0.0	A				
	Right	77	5	76	9.2	A				
Eastbound	Left	51	2	55	9.6	A	1.1	A		
	Thru	447	0	0	0.1	A				
	Right	19	0	0	0.9	A				
Westbound	Left	10	0	14	3.4	A	0.6	A		
	Thru	1,189	0	0	0.6	A				
	Right	39	0	0	1.1	A				

Center Ave/32nd St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	48	11	70	43	D	29.8	C	6.1	A
	Thru	0	-	-	0.0	A				
	Right	27	1	31	5.9	A				
Southbound	Left	16	4	41	44.3	D	31.1	C		
	Thru	13	4	49	43.0	D				
	Right	21	5	55	13.6	B				
Eastbound	Left	12	0	11	8.2	A	5.0	A		
	Thru	432	7	111	5.3	A				
	Right	60	0	37	2.5	A				
Westbound	Left	48	0	22	5.9	A	4.1	A		
	Thru	1,174	10	168	4.1	A				
	Right	6	0	2	1.9	A				

2045 AM No Build
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/34th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	254	45	250	31	C	22.4	C	19.1	B
	Thru	219	22	116	28.7	C				
	Right	258	9	109	8.6	A				
Southbound	Left	39	4	47	23.2	C	27.0	C		
	Thru	155	23	98	38.4	D				
	Right	80	2	54	6.7	A				
Eastbound	Left	80	4	62	15.8	B	15.5	B		
	Thru	273	19	120	19.7	B				
	Right	117	2	68	5.3	A				
Westbound	Left	494	51	329	20.3	C	17.2	B		
	Thru	897	47	268	17.0	B				
	Right	111	2	54	4.6	A				

8th St/2nd St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	143	2	67	6	A	2.7	A	5.6	A
	Thru	836	29	148	2.2	A				
	Right	94	1	23	2.4	A				
Southbound	Left	21	1	42	11.0	B	0.7	A		
	Thru	480	0	14	0.2	A				
	Right	22	0	14	0.8	A				
Eastbound	Left	8	16	103	58.6	F	40.6	E		
	Thru	22	16	102	65.5	F				
	Right	58	20	116	28.7	D				
Westbound	Left	21	11	66	77.2	F	65.1	F		
	Thru	14	11	65	60.5	F				
	Right	7	13	74	37.9	E				

8th St/4th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	25	0	25	7	A	2.7	A	3.9	A
	Thru	1,100	0	0	2.6	A				
	Right	32	0	0	2.9	A				
Southbound	Left	8	0	15	11.1	B	2.0	A		
	Thru	586	0	8	1.9	A				
	Right	8	0	8	1.7	A				
Eastbound	Left	8	3	46	42.8	E	31.5	D		
	Thru	13	3	47	41.9	E				
	Right	13	3	47	14.0	B				
Westbound	Left	18	6	60	44.1	E	32.0	D		
	Thru	7	6	61	42.4	E				
	Right	27	6	61	21.3	C				

8th St/7th Ave — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	67	2	61	14	B	11.3	B	12.9	B
	Thru	1,159	46	439	11.1	B				
	Right	91	47	445	11.6	B				
Southbound	Left	25	1	21	14.1	B	9.8	A		
	Thru	589	16	166	9.7	A				
	Right	18	17	169	8.4	A				
Eastbound	Left	21	19	122	37.0	D	26.0	C		
	Thru	59	19	120	31.8	C				
	Right	63	23	129	16.8	B				
Westbound	Left	49	18	111	42.0	D	35.9	D		
	Thru	28	18	110	34.7	C				
	Right	18	20	114	20.9	C				

8th St/10th Ave — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Thru	1,275	22	344	4.4	A	4.4	A	4.5	A
	Right	71	0	5	4.3	A				
Southbound	Left	20	10	167	17.5	C	4.0	A		
	Thru	680	7	150	3.6	A				
Westbound	Left	9	5	60	32.2	D	15.7	C		
	Right	45	3	48	12.4	B				

2045 AM No Build
US 10/US 75 VISSIM Analysis
MOE Results

8th St/12th Ave **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	69	4	58	24	C	23.2	C	23.3	C
	Thru	1,222	117	558	23.0	C				
	Right	109	117	559	24.3	C				
Southbound	Left	34	2	38	22.5	C	18.0	B		
	Thru	604	40	251	17.5	B				
	Right	42	40	254	21.1	C				
Eastbound	Left	45	5	55	23.0	C	32.9	C		
	Thru	112	30	156	36.2	**D**				
	Right	35	30	156	35.4	**D**				
Westbound	Left	139	19	133	26.6	C	28.2	C		
	Thru	194	31	165	28.7	C				
	Right	81	13	96	29.5	C				

8th St/20th Ave **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	27	0	14	7	A	3.2	A	8.1	A
	Thru	1,379	9	184	3.1	A				
	Right	28	9	185	3.4	A				
Southbound	Left	28	1	20	16.3	B	6.4	A		
	Thru	749	12	172	6.1	A				
	Right	6	13	175	5.7	A				
Eastbound	Left	12	12	83	42.1	**D**	32.0	C		
	Thru	42	12	83	37.7	**D**				
	Right	20	14	88	14.0	B				
Westbound	Left	93	48	223	42.9	**D**	37.6	**D**		
	Thru	45	48	222	39.5	**D**				
	Right	89	51	226	31.0	C				

Note: Results are the average of ten (10) simulation runs

2045 No Build PM
US 10/US 75 VISSIM Analysis
MOE Results

Main Ave/4th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	39	10	76	42	D	36.3	D	26.2	C
	Thru	7	10	78	34.7	C				
	Right	14	12	81	20.2	C				
Southbound	Left	49	35	235	43.5	D	45.0	D		
	Thru	105	35	238	47.3	D				
	Right	35	37	240	39.9	D				
Eastbound	Left	46	2	42	22.6	C	34.4	C		
	Thru	1,062	244	749	32.1	C				
	Right	482	249	755	40.7	D				
Westbound	Left	73	6	64	26.8	C	9.1	A		
	Thru	897	25	236	7.8	A				
	Right	33	26	235	6.7	A				

Main Ave/5th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	226	27	134	31	C	27.8	C	15.1	B
	Thru	84	17	124	41.8	D				
	Right	105	4	62	9.3	A				
Southbound	Left	57	26	182	67.8	E	54.8	D		
	Right	59	27	185	42.2	D				
Eastbound	Left	33	2	33	20.8	C	9.4	A		
	Thru	1,092	34	309	9.1	A				
Westbound	Thru	724	27	212	10.5	B	10.7	B		
	Right	41	28	215	13.1	B				

Main Ave/6th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	39	9	77	26	C	20.3	C	9.0	A
	Thru	20	9	77	25.0	C				
	Right	35	10	80	11.6	B				
Southbound	Left	76	19	115	32.7	C	26.0	C		
	Thru	34	19	115	31.6	C				
	Right	41	2	47	8.9	A				
Eastbound	Left	28	1	24	8.5	A	8.2	A		
	Thru	1,170	38	322	8.2	A				
	Right	50	39	327	8.4	A				
Westbound	Left	35	1	32	11.4	B	5.4	A		
	Thru	688	11	162	5.1	A				
	Right	33	12	170	5.0	A				

Main Ave/7th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	8	4	47	61	F	32.5	D	3.3	A
	Right	19	4	47	20.4	C				
Eastbound	Thru	1,253	14	199	4.1	A	4.1	A		
	Right	19	16	218	2.7	A				
Westbound	Left	23	2	34	18.7	C	0.9	A		
	Thru	749	0	0	0.3	A				

Main Ave/8th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	303	85	318	43	D	34.5	C	35.8	D
	Thru	405	54	244	39.3	D				
	Right	159	4	84	5.4	A				
Southbound	Left	33	5	66	39.0	D	45.3	D		
	Thru	450	76	370	46.4	D				
	Right	61	78	373	40.3	D				
Eastbound	Left	170	47	257	47.2	D	32.9	C		
	Thru	797	116	371	36.8	D				
	Right	304	23	218	14.6	B				
Westbound	Left	196	45	225	46.1	D	35.2	D		
	Thru	412	40	199	30.5	C				
	Right	41	42	201	30.8	C				

2045 No Build PM
US 10/US 75 VISSIM Analysis
MOE Results

Main Ave/11th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	54	5	64	19	B	19.8	B	21.3	C
	Thru	101	14	101	28.3	C				
	Right	57	1	39	5.8	A				
Southbound	Left	46	40	362	39.0	**D**	28.9	C		
	Thru	236	40	361	32.5	C				
	Right	128	5	103	18.8	B				
Eastbound	Left	151	21	196	28.0	C	20.7	C		
	Thru	636	58	349	19.4	B				
	Right	104	59	352	17.8	B				
Westbound	Left	49	2	43	16.1	B	16.7	B		
	Thru	395	26	156	17.1	B				
	Right	48	27	158	13.8	B				

Center Ave/8th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	93	12	169	28	C	32.2	C	29.9	C
	Thru	338	57	318	35.5	**D**				
	Right	186	56	319	28.1	C				
Southbound	Left	13	1	22	46.8	**D**	61.0	**E**		
	Thru	259	40	248	62.8	**E**				
	Right	29	41	252	51.3	**D**				
Eastbound	Left	33	3	40	23.1	C	20.7	C		
	Thru	673	61	308	20.2	C				
	Right	156	63	310	22.5	C				
Westbound	Left	131	28	177	43.1	**D**	23.0	C		
	Thru	270	14	131	13.5	B				
	Right	13	15	138	16.4	B				

Center Ave/11th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	13	14	104	40	**D**	31.7	C	28.8	C
	Thru	150	14	104	40.8	**D**				
	Right	137	6	116	21.0	C				
Southbound	Left	20	117	416	56.5	**E**	78.1	**E**		
	Thru	282	117	413	79.8	**E**				
	Right	26	118	416	76.1	**E**				
Eastbound	Left	31	3	38	22.3	C	17.1	B		
	Thru	784	48	294	16.5	B				
	Right	53	49	297	22.4	C				
Westbound	Left	77	4	71	18.7	B	14.0	B		
	Thru	380	16	170	13.1	B				
	Right	7	22	189	15.7	B				

Center Ave/14th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	22	36	214	49	**D**	35.6	**D**	18.9	B
	Thru	116	38	221	55.7	**E**				
	Right	128	3	83	15.0	B				
Southbound	Left	14	19	148	50.1	**D**	51.3	**D**		
	Thru	101	18	137	52.8	**D**				
	Right	8	14	134	34.7	C				
Eastbound	Left	22	2	25	34.3	C	13.4	B		
	Thru	881	37	304	13.0	B				
	Right	34	1	41	9.7	A				
Westbound	Left	64	3	59	14.1	B	12.5	B		
	Thru	430	17	173	12.1	B				
	Right	7	29	220	20.8	C				

2045 No Build PM
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/1st Ave/21st St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	25	139	362	49	D	58.2	E	42.1	D
	Thru	345	140	362	46.4	D				
	Right	562	278	636	65.9	E				
Southbound	Left	406	122	353	47.1	D	48.6	D		
	Thru	236	122	353	51.8	D				
	Right	7	94	323	30.6	C				
Eastbound	Left	25	7	56	54.7	D	37.4	D		
	Thru	888	126	474	39.5	D				
	Right	87	3	66	10.8	B				
Westbound	Left	527	86	267	48.8	D	30.3	C		
	Thru	472	33	177	21.7	C				
	Right	246	6	98	7.3	A				

Center Ave/TH 75 — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Southbound	Left	102	34	152	52.4	D	20.0	B	11.9	B
	Right	360	54	183	10.8	B				
Eastbound	Left	284	57	219	50.5	D	8.2	A		
	Thru	1,572	0	0	0.6	A				
Westbound	Thru	883	33	234	16.3	B	15.2	B		
	Right	106	0	33	6.0	A				

Center Ave/28th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	14	0	4	64	F	46.6	E	2.3	A
	Thru	0	-	-	0.0	A				
	Right	7	0	5	11.4	B				
Southbound	Left	43	5	66	38.8	E	27.1	D		
	Thru	9	5	65	52.3	F				
	Right	39	2	69	8.4	A				
Eastbound	Left	38	3	57	11.4	B	1.3	A		
	Thru	1,609	0	0	1.1	A				
	Right	22	0	0	1.8	A				
Westbound	Left	7	7	88	33.6	D	0.6	A		
	Thru	908	0	0	0.3	A				
	Right	33	0	0	1.0	A				

Center Ave/30th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	11	96	158	665	F	361.4	F	8.8	A
	Thru	4	97	159	623.2	F				
	Right	13	0	30	23.9	C				
Southbound	Left	21	76	164	284.4	F	99.1	F		
	Thru	6	86	172	354.3	F				
	Right	87	17	117	36.7	E				
Eastbound	Left	134	4	70	7.1	A	1.1	A		
	Thru	1,497	0	0	0.6	A				
	Right	28	0	0	1.1	A				
Westbound	Left	8	0	17	15.3	C	0.8	A		
	Thru	847	0	0	0.6	A				
	Right	66	0	0	1.3	A				

Center Ave/32nd St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	134	27	156	36	D	27.8	C	18.8	B
	Thru	19	9	99	39.5	D				
	Right	103	11	103	15.1	B				
Southbound	Left	60	10	76	33.8	C	26.9	C		
	Thru	27	10	91	41.4	D				
	Right	66	12	96	14.8	B				
Eastbound	Left	123	6	97	13.3	B	18.7	B		
	Thru	1,262	95	490	20.6	C				
	Right	136	2	57	5.6	A				
Westbound	Left	49	2	47	18.8	B	14.7	B		
	Thru	725	33	206	14.9	B				
	Right	29	0	27	3.6	A				

2045 No Build PM
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/34th St — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	162	28	168	33	C	29.7	C	23.0	C
	Thru	377	60	227	44.0	D				
	Right	373	28	189	14.0	B				
Southbound	Left	251	61	251	44.1	D	34.7	C		
	Thru	382	53	192	40.8	D				
	Right	172	5	77	7.4	A				
Eastbound	Left	239	12	119	13.7	B	14.3	B		
	Thru	903	48	341	16.7	B				
	Right	264	5	109	6.5	A				
Westbound	Left	343	46	262	27.8	C	19.4	B		
	Thru	477	24	153	16.2	B				
	Right	95	2	53	4.9	A				

8th St/2nd St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	86	4	67	13	B	6.1	A	18.6	C
	Thru	843	25	176	5.5	A				
	Right	75	24	170	5.2	A				
Southbound	Left	28	2	47	11.5	B	0.9	A		
	Thru	884	1	44	0.5	A				
	Right	34	0	44	1.1	A				
Eastbound	Left	7	112	273	155.8	F	116.7	F		
	Thru	13	115	278	180.9	F				
	Right	116	120	290	107.2	F				
Westbound	Left	24	130	235	328.8	F	303.1	F		
	Thru	11	131	236	303.4	F				
	Right	21	133	239	273.5	F				

8th St/4th St — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	38	2	38	19	C	8.0	A	12.0	B
	Thru	1,017	0	3	7.6	A				
	Right	40	0	2	6.6	A				
Southbound	Left	39	1	37	13.9	B	8.6	A		
	Thru	1,058	0	21	8.4	A				
	Right	26	0	21	9.5	A				
Eastbound	Left	12	49	130	235.7	F	143.5	F		
	Thru	7	42	120	146.4	F				
	Right	32	46	123	108.2	F				
Westbound	Left	7	7	40	133.2	F	88.5	F		
	Thru	0	-	-	0.0	A				
	Right	11	7	39	60.1	F				

8th St/7th Ave — **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	58	3	67	20	C	11.7	B	17.5	B
	Thru	997	40	416	11.2	B				
	Right	56	42	422	11.2	B				
Southbound	Left	38	2	37	30.3	C	19.8	B		
	Thru	1,099	131	438	19.4	B				
	Right	13	137	447	21.0	C				
Eastbound	Left	34	20	133	30.6	C	23.9	C		
	Thru	64	20	133	28.1	C				
	Right	63	24	142	16.1	B				
Westbound	Left	91	33	173	37.4	D	33.4	C		
	Thru	47	33	174	35.0	D				
	Right	39	35	176	22.1	C				

8th St/10th Ave — **2-Way Stop**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Thru	1,049	13	244	3.2	A	3.2	A	5.6	A
	Right	39	0	3	3.4	A				
Southbound	Left	12	21	266	11.5	B	6.6	A		
	Thru	1,232	22	259	6.5	A				
Westbound	Left	21	12	90	42.6	E	21.8	C		
	Right	66	8	77	15.2	C				

2045 No Build PM
US 10/US 75 VISSIM Analysis
MOE Results

8th St/12th Ave **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	145	36	176	51	**D**	42.6	**D**	44.7	**D**
	Thru	915	168	645	41.1	**D**				
	Right	135	168	645	43.9	**D**				
Southbound	Left	94	18	110	52.8	**D**	45.3	**D**		
	Thru	1,054	207	641	44.6	**D**				
	Right	94	208	642	45.4	**D**				
Eastbound	Left	67	9	71	36.2	**D**	51.4	**D**		
	Thru	217	121	448	54.2	**D**				
	Right	112	122	448	55.2	**E**				
Westbound	Left	288	107	467	53.2	**D**	43.1	**D**		
	Thru	175	26	157	31.5	C				
	Right	106	20	117	34.8	C				

8th St/20th Ave **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	33	1	28	19	B	9.4	A	12.4	B
	Thru	1,108	32	375	9.1	A				
	Right	70	33	381	9.5	A				
Southbound	Left	77	2	48	18.5	B	12.8	B		
	Thru	1,430	178	643	12.5	B				
	Right	6	197	668	10.3	B				
Eastbound	Left	12	13	98	33.3	C	29.3	C		
	Thru	48	13	99	35.0	C				
	Right	26	15	102	16.9	B				
Westbound	Left	35	15	111	40.6	**D**	28.7	C		
	Thru	18	16	112	36.2	**D**				
	Right	46	17	115	16.7	B				

Note: Results are the average of ten (10) simulation runs

Appendix B
Year 2045 Build MOEs

Downtown Focus Area

- Consideration of 3-lane roadway on 8th between Center and Main:
  - A.M. Peak hour operations are anticipated to be acceptable
  - During the P.M. Peak hour, EB movements will break down at the Main Avenue/4th Avenue intersection, not allowing vehicles through the network which causes model failure
  - During the P.M. Peak Hour, the Southbound queue at the Main Avenue/8th Street intersection will queue into the Center Avenue/8th Street intersection, impacting operations

Table 1. 2045 – 3-Lane Alternative Operations

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Main Avenue (US 10)/4th Street	A	9 sec.	**F**	**102 sec.**
Main Avenue (US 10)/5th Street	C	23 sec.	**E**	**69 sec.**
Main Avenue (US 10)/6th Street	A	8 sec.	C	24 sec.
Main Avenue (US 10)/7th Street (1)	A/D	32 sec.	**C/F**	**201 sec.**
Main Avenue (US 10)/8th Street (US 75)	C	30 sec.	**F**	**81 sec.**
Center Avenue (US 10/US 75)/8th Street	B	19 sec.	**F**	**165 sec.**

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

Downtown Focus Area

- Consideration of 3-lane roadway on Main between River and 8th:
  - A.M. Peak hour operations are anticipated to be acceptable
    - Main Avenue/5th Street intersection will be the most challenging with NBL queues extending beyond 2nd Avenue
  - During the P.M. Peak hour, EB movements will break down at the Main Avenue/4th Avenue intersection, not allowing vehicles through the network which causes model failure

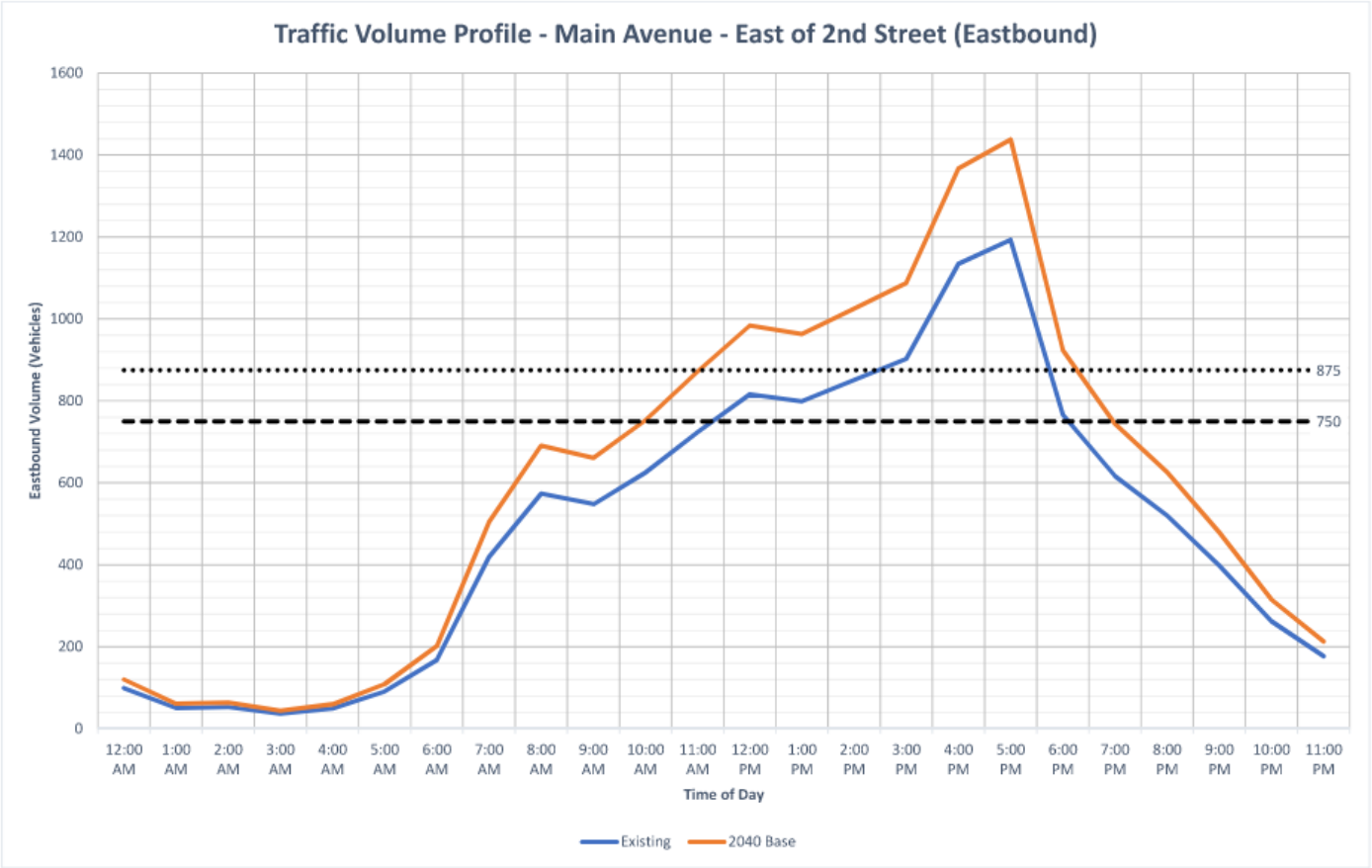
Table 1. 2045 – 3-Lane Alternative Operations

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Main Avenue (US 10)/4th Street	A	9 sec.	**F**	**102 sec.**
Main Avenue (US 10)/5th Street	C	23 sec.	**E**	**69 sec.**
Main Avenue (US 10)/6th Street	A	8 sec.	C	24 sec.
Main Avenue (US 10)/7th Street (1)	A/D	32 sec.	**C/F**	**201 sec.**
Main Avenue (US 10)/8th Street (US 75)	C	30 sec.	**F**	**81 sec.**
Center Avenue (US 10/US 75)/8th Street	B	19 sec.	**F**	**165 sec.**

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

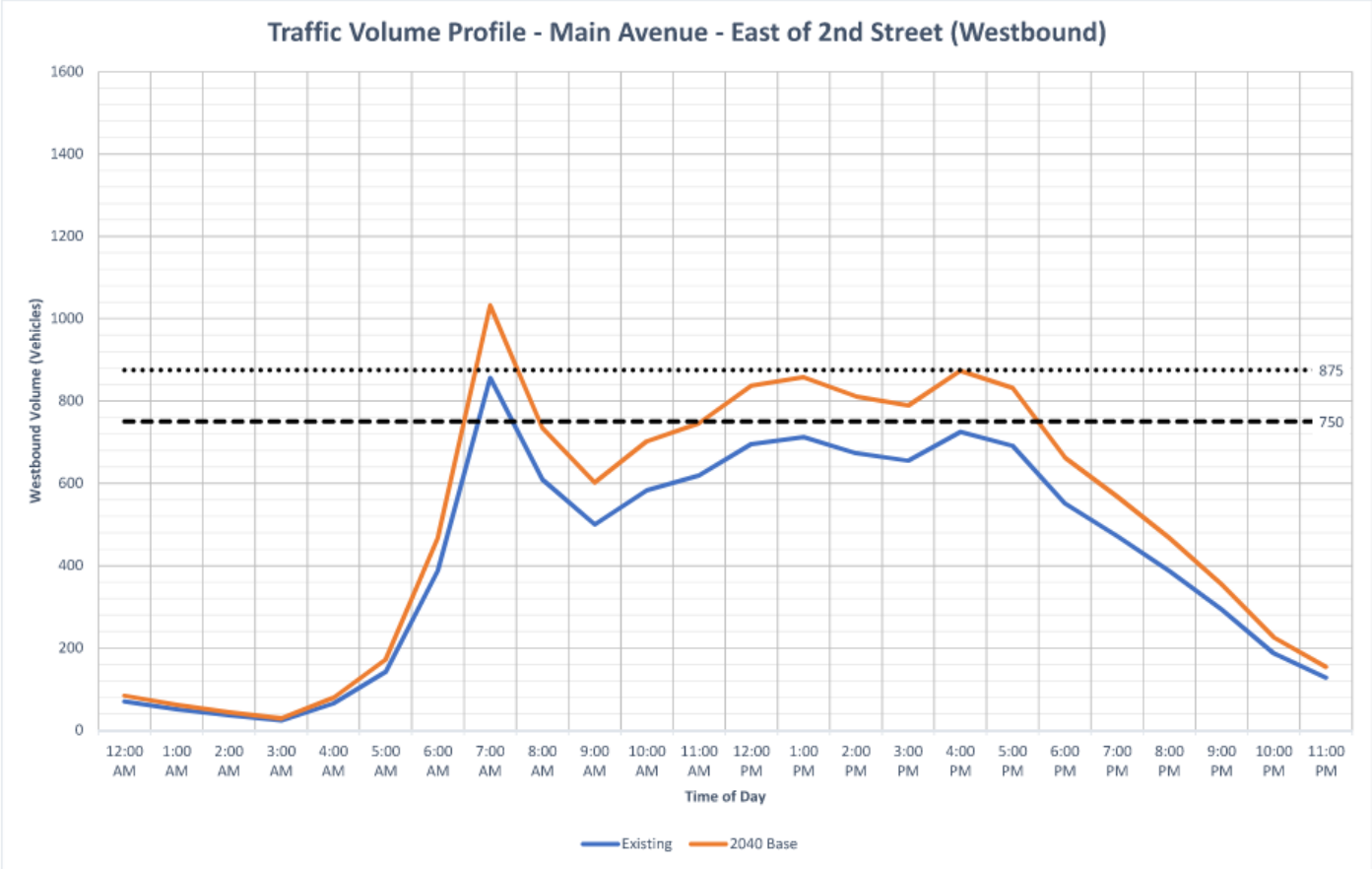
Downtown Focus Area

- Consideration of 3-lane roadway on Main between River and 8th:
  - Congestion expected eastbound for ~7 hours



Downtown Focus Area

- Consideration of 3-lane roadway on Main between River and 8th:
  - Congestion expected westbound for ~1 hour
  - Nearing capacity westbound for ~5 hours



70: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.3	0.0
Total Del/Veh (s)	9.9	12.4	13.5	14.9	12.8

80: 11th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.5	0.1
Total Del/Veh (s)	8.7	9.2	25.4	30.5	15.9

Total Zone Performance

Denied Del/Veh (s)	0.4
Total Del/Veh (s)	1142.9

Intersection: 70: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	44	130	49	174	266	109	121	165	181	29	106	69
Average Queue (ft)	9	53	15	45	127	15	44	57	77	8	44	26
95th Queue (ft)	33	104	41	127	236	62	97	124	157	26	84	57
Link Distance (ft)		449			1193			345	345		613	613
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	100		150	100		75	100			100		
Storage Blk Time (%)		2			12	0	1	1			0	
Queuing Penalty (veh)		1			12	0	1	1			0	

Intersection: 80: 11th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	63	126	30	107	258	23	46	76	90	61	109	223
Average Queue (ft)	15	50	6	25	94	2	14	33	45	17	20	108
95th Queue (ft)	47	109	25	72	206	15	40	65	77	48	61	185
Link Distance (ft)		1193			1229	1229		359	359		1064	1064
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	125		125	175			100			100		
Storage Blk Time (%)		0			1					0	0	
Queuing Penalty (veh)		0			1					0	0	

Zone Summary

Zone wide Queuing Penalty: 16

70: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.3	0.0
Total Del/Veh (s)	20.2	19.1	27.1	27.0	22.8

80: 11th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.4	0.1
Total Del/Veh (s)	14.4	12.3	20.9	31.3	17.8

Total Zone Performance

Denied Del/Veh (s)	0.4
Total Del/Veh (s)	1575.9

Intersection: 70: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	174	458	225	173	280	104	124	223	265	46	176	144
Average Queue (ft)	34	279	97	82	101	8	57	97	134	9	86	47
95th Queue (ft)	124	459	242	155	221	50	119	185	234	32	148	110
Link Distance (ft)		449			1193			345	345		613	613
Upstream Blk Time (%)		1										
Queuing Penalty (veh)		9										
Storage Bay Dist (ft)	100		150	100		75	100			100		
Storage Blk Time (%)		32		6	11		1	9			7	
Queuing Penalty (veh)		62		17	16		3	8			1	

Intersection: 80: 11th St & Center Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (ft)	109	381	175	140	268	48	59	113	169	53	111	268
Average Queue (ft)	19	126	103	41	106	3	11	51	82	15	27	131
95th Queue (ft)	64	268	185	97	222	21	39	92	139	43	80	218
Link Distance (ft)		1193			1229	1229		359	359		1064	1064
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	125		125	175			100			100		
Storage Blk Time (%)		5	5		2			1			0	
Queuing Penalty (veh)		26	20		1			0			0	

Zone Summary

Zone wide Queuing Penalty: 163

50: 8th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	15.0	19.4	15.0	26.7	17.0

70: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.3	0.0
Total Del/Veh (s)	9.3	14.0	14.1	15.2	13.4

Total Zone Performance

Denied Del/Veh (s)	0.3
Total Del/Veh (s)	145.6

Intersection: 50: 8th St & Main Ave

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	R	L	TR
Maximum Queue (ft)	71	140	117	110	172	193	208	298	265	222	31	250
Average Queue (ft)	20	72	49	51	82	91	107	143	113	13	4	102
95th Queue (ft)	48	128	99	91	141	171	177	239	213	97	21	187
Link Distance (ft)		678	678			1201	1201	2347	2347			344
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150			175	250					175	150	
Storage Blk Time (%)		0		0					2			2
Queuing Penalty (veh)		0		0					5			0

Intersection: 70: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB		
Directions Served	L	T	R	L	TR	L	TR	L	T	R		
Maximum Queue (ft)	35	134	41	150	316	117	233	31	132	36		
Average Queue (ft)	6	46	9	29	141	44	80	5	54	10		
95th Queue (ft)	26	99	29	92	263	104	176	22	98	33		
Link Distance (ft)		448			1211		344		624	624		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	100		150	100		100		100				
Storage Blk Time (%)		1			10	0	4		1			
Queuing Penalty (veh)		0			5	1	4		0			

Zone Summary

Zone wide Queuing Penalty: 15

50: 8th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.0	0.2	0.1
Total Del/Veh (s)	37.1	40.7	43.2	91.0	45.6

70: 8th St & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.5	0.1
Total Del/Veh (s)	22.8	26.1	31.3	84.2	31.7

Total Zone Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	688.8

Intersection: 50: 8th St & Main Ave

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	T	R	L	TR
Maximum Queue (ft)	225	522	536	215	349	480	237	562	511	225	174	365
Average Queue (ft)	115	287	301	159	225	134	112	317	165	53	60	320
95th Queue (ft)	255	458	490	275	349	321	192	549	347	193	169	421
Link Distance (ft)		678	678			1201	1201	2347	2347			344
Upstream Blk Time (%)		0	0									27
Queuing Penalty (veh)		1	1									108
Storage Bay Dist (ft)	150			175	250					175	150	
Storage Blk Time (%)	0	38	28	0	18	0			7	0	0	64
Queuing Penalty (veh)	0	42	90	0	37	0			22	0	0	22

Intersection: 70: 8th St & Center Ave

Movement	EB	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	TR	L	TR	L	T	R
Maximum Queue (ft)	174	441	225	170	259	124	339	149	435	44
Average Queue (ft)	24	265	115	70	110	63	174	14	155	12
95th Queue (ft)	104	424	263	141	217	131	316	67	352	37
Link Distance (ft)		448			1211		344		624	624
Upstream Blk Time (%)		0					1		0	
Queuing Penalty (veh)		3					3		0	
Storage Bay Dist (ft)	100		150	100		100		100		
Storage Blk Time (%)		28	3	13	9	1	24		37	
Queuing Penalty (veh)		52	20	38	7	3	21		5	

Zone Summary

Zone wide Queuing Penalty: 474

20: 5th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	3.0	0.0	0.7
Total Del/Veh (s)	5.3	7.5	27.4	21.7	12.5

Intersection: 20: 5th St & Main Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	T	T	TR	L	T	R	LT	R
Maximum Queue (ft)	35	99	116	182	191	272	183	115	75	63
Average Queue (ft)	7	34	44	74	88	160	61	26	26	29
95th Queue (ft)	27	78	97	145	160	243	133	67	62	57
Link Distance (ft)		283	283	298	298		700		358	358
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	90					250		100		
Storage Blk Time (%)		0				1	3			
Queuing Penalty (veh)		0				2	12			

20: 5th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	3.0	0.1	0.5
Total Del/Veh (s)	5.5	7.7	23.2	30.1	10.7

Intersection: 20: 5th St & Main Ave

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	T	T	TR	L	T	R	LT	R
Maximum Queue (ft)	52	205	182	127	164	218	106	101	173	69
Average Queue (ft)	16	56	63	61	77	111	53	45	72	28
95th Queue (ft)	43	146	147	118	140	182	92	86	137	59
Link Distance (ft)		283	283	298	298		700		358	358
Upstream Blk Time (%)		0								
Queuing Penalty (veh)		0								
Storage Bay Dist (ft)	90					200		200		
Storage Blk Time (%)	0	2				0				
Queuing Penalty (veh)	0	1				1				

10: 4th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.4	0.0	0.2	0.1	0.5
Total Del/Veh (s)	4.3	9.2	35.6	31.6	9.6

20: 5th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	3.0	3.6	0.9
Total Del/Veh (s)	7.0	13.4	42.6	23.7	19.6

30: 6th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	3.6	6.2	28.8	33.4	6.5

50: 8th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.6	19.7	41.5	32.6	29.2

Total Zone Performance

Denied Del/Veh (s)	1.8
Total Del/Veh (s)	317.9

Intersection: 10: 4th St & Main Ave

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	L	T	R	L	TR	LTR	LTR
Maximum Queue (ft)	39	165	106	150	318	138	95
Average Queue (ft)	10	57	24	22	194	63	38
95th Queue (ft)	34	124	66	90	360	118	77
Link Distance (ft)		1242			300	736	942
Upstream Blk Time (%)					2		
Queuing Penalty (veh)					24		
Storage Bay Dist (ft)	210		200	130			
Storage Blk Time (%)		0	0		11		
Queuing Penalty (veh)		0	0		3		

Intersection: 20: 5th St & Main Ave

Movement	EB	EB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	TR	L	T	R	L	R
Maximum Queue (ft)	61	216	306	343	409	70	83	56
Average Queue (ft)	11	82	196	213	79	24	19	32
95th Queue (ft)	43	164	350	338	240	56	61	59
Link Distance (ft)		300	296		712		931	
Upstream Blk Time (%)			2					
Queuing Penalty (veh)			15					
Storage Bay Dist (ft)	90			300		115		25
Storage Blk Time (%)		4	23	6	0	0	9	19
Queuing Penalty (veh)		1	0	8	0	0	4	1

Intersection: 30: 6th St & Main Ave

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	46	140	67	252	49	81
Average Queue (ft)	14	45	9	110	22	35
95th Queue (ft)	41	113	44	241	50	72
Link Distance (ft)		296		312	719	913
Upstream Blk Time (%)				0		
Queuing Penalty (veh)				1		
Storage Bay Dist (ft)	175		150			
Storage Blk Time (%)		0		4		
Queuing Penalty (veh)		0		1		

Intersection: 50: 8th St & Main Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	106	213	143	258	373	45	400	790	432	65	205	75
Average Queue (ft)	26	95	48	83	173	10	265	300	46	6	98	40
95th Queue (ft)	70	175	94	165	315	35	435	842	383	36	188	89
Link Distance (ft)		309			1201	1201		2360	2360		345	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	150		175	300			300			150		50
Storage Blk Time (%)		1			2		25	0			35	1
Queuing Penalty (veh)		3			3		71	0			18	1

Zone Summary

Zone wide Queuing Penalty: 156

10: 4th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	511.9	0.0	0.1	0.2	297.8
Total Del/Veh (s)	181.5	7.2	62.0	58.1	101.7

20: 5th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	7.2	120.0	7.7
Total Del/Veh (s)	37.5	5.9	70.7	804.6	69.4

30: 6th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.3	0.0	0.2	0.2	0.2
Total Del/Veh (s)	31.9	4.3	45.5	45.8	23.8

40: 7th St & Main 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)	21.3	1.9	201.4	17.0

50: 8th St & Main Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	38.2	0.0	1.6	8.1
Total Del/Veh (s)	30.8	121.5	86.3	136.4	81.1

Total Zone Performance

Denied Del/Veh (s)	318.4
Total Del/Veh (s)	1517.8

Intersection: 10: 4th St & Main Ave

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	L	T	R	L	TR	LTR	LTR
Maximum Queue (ft)	259	2299	275	190	307	126	259
Average Queue (ft)	75	2120	266	48	132	47	147
95th Queue (ft)	246	2759	337	117	270	100	234
Link Distance (ft)		2244			300	736	931
Upstream Blk Time (%)		56			0		
Queuing Penalty (veh)		0			3		
Storage Bay Dist (ft)	210		250	130			
Storage Blk Time (%)		54	0	0	5		
Queuing Penalty (veh)		287	6	0	4		

Intersection: 20: 5th St & Main Ave

Movement	EB	EB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	R	L	R
Maximum Queue (ft)	164	318	228	325	409	160	805	50
Average Queue (ft)	44	302	94	166	148	99	505	23
95th Queue (ft)	151	339	177	303	431	183	1048	63
Link Distance (ft)		300	297		713		919	
Upstream Blk Time (%)		14	0		3		27	
Queuing Penalty (veh)		162	0		0		0	
Storage Bay Dist (ft)	90			300		115		25
Storage Blk Time (%)		61		1	2	31	92	10
Queuing Penalty (veh)		21		1	8	94	50	5

Intersection: 30: 6th St & Main Ave

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	250	319	59	199	150	199
Average Queue (ft)	52	310	17	70	74	108
95th Queue (ft)	202	318	49	151	129	180
Link Distance (ft)		297		311	719	888
Upstream Blk Time (%)		24				
Queuing Penalty (veh)		302				
Storage Bay Dist (ft)	175		150			
Storage Blk Time (%)		55		1		
Queuing Penalty (veh)		15		0		

Intersection: 40: 7th St & Main Ave

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (ft)	326	53	142
Average Queue (ft)	307	12	59
95th Queue (ft)	370	39	134
Link Distance (ft)	311		833
Upstream Blk Time (%)	13		
Queuing Penalty (veh)	173		
Storage Bay Dist (ft)		85	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 50: 8th St & Main Ave

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	225	327	215	375	1034	837	385	1120	959	174	361	75
Average Queue (ft)	96	314	173	301	558	207	315	627	282	48	342	32
95th Queue (ft)	237	328	288	471	1258	873	470	1625	1098	169	399	86
Link Distance (ft)		311			1201	1201		2360	2360		345	
Upstream Blk Time (%)		25			5	1		0			47	
Queuing Penalty (veh)		324			17	3		0			184	
Storage Bay Dist (ft)	150		175	300			300			150		50
Storage Blk Time (%)	0	48	0	54	1		42	2		0	85	1
Queuing Penalty (veh)	0	206	1	227	2		117	8		0	67	2

Zone Summary

Zone wide Queuing Penalty: 2288

100: 21st St/1st Ave & Center Ave Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	1.2	0.3	0.4
Total Del/Veh (s)	60.1	34.0	40.7	43.1	44.1

Intersection: 100: 21st St/1st Ave & Center Ave

Movement	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	R	L	L	T	T	R	LT	T	R
Maximum Queue (ft)	229	538	540	297	279	306	166	168	115	440	612	300
Average Queue (ft)	32	315	312	65	169	183	67	78	25	158	221	235
95th Queue (ft)	123	480	488	243	253	268	133	142	71	309	492	348
Link Distance (ft)		2577	2577				682	682		1608	1608	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	275			275	350	350			300			200
Storage Blk Time (%)		20	18			0					0	24
Queuing Penalty (veh)		5	16			0					3	43

Intersection: 100: 21st St/1st Ave & Center Ave

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	299	341	72
Average Queue (ft)	184	207	5
95th Queue (ft)	275	312	34
Link Distance (ft)	784	784	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			50
Storage Blk Time (%)		61	0
Queuing Penalty (veh)		4	0

2045 AM Build - Alternative 3B - Modify with Protected/Permitted Left-Turn Phasing
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/1st Ave/21st St **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	72	15	125	41	**D**	27.5	C	27.2	C
	Thru	476	55	238	32.4	C				
	Right	246	15	148	13.9	B				
Southbound	Left	120	20	91	38.2	**D**	35.8	**D**		
	Thru	239	53	230	35.0	**D**				
	Right	8	50	231	23.3	C				
Eastbound	Left	15	4	34	47.6	**D**	23.6	C		
	Thru	226	19	116	25.4	C				
	Right	49	3	93	7.9	A				
Westbound	Left	464	61	216	41.0	**D**	25.5	C		
	Thru	545	27	173	16.4	B				
	Right	428	44	297	20.4	C				

2045 PM Build - Alternative 3B - Modify with Protected/Permitted Left-Turn Phasing
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/1st Ave/21st St **Signal**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Northbound	Left	25	6	57	46	D	28.5	C	33.3	C
	Thru	343	50	256	37.0	D				
	Right	573	79	347	22.6	C				
Southbound	Left	398	98	293	62.0	E	51.1	D		
	Thru	235	53	230	33.5	C				
	Right	8	51	232	25.2	C				
Eastbound	Left	24	6	54	49.3	D	37.1	D		
	Thru	904	127	456	39.3	D				
	Right	87	5	107	11.0	B				
Westbound	Left	519	60	214	37.0	D	24.5	C		
	Thru	470	21	135	14.9	B				
	Right	246	18	160	16.3	B				

HCS7 Roundabouts Report

General Information

Analyst	Brent Clark
Agency or Co.	SRF Consulting
Date Performed	1/22/2020
Analysis Year	2045
Time Analyzed	2045 AM - Alternative 3C
Project Description	US 10/21st St/1st Ave

Site Information

Intersection	US 10/21st St/1st Ave
E/W Street Name	US 10
N/S Street Name	21st St/1st Ave
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	US 10

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	13	236	47	0	472	553	431	0	74	492	249	0	121	243	7
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	15	264	53	0	528	619	483	0	83	551	279	0	135	272	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	156.04	175.96		766.10	863.90		429.11	483.89		195.05	219.95	
Entry Volume veh/h	151.50	170.83		743.79	838.74		416.61	469.80		189.37	213.54	
Circulating Flow (v_c), pc/h	935			649			414			1230		
Exiting Flow (v_{ex}), pc/h	678			710			1049			853		
Capacity (c_{pce}), pc/h	571.15	641.41		743.06	817.92		922.39	998.76		435.40	499.15	
Capacity (c), veh/h	554.52	622.73		721.42	794.10		895.53	969.67		422.72	484.62	
v/c Ratio (x)	0.27	0.27		1.03	1.06		0.47	0.48		0.45	0.44	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	10.3	9.3		65.6	70.3		9.8	9.6		17.5	15.4	
Lane LOS	B	A		F	F		A	A		C	C	
95% Queue, veh	1.1	1.1		18.2	20.7		2.5	2.7		2.3	2.2	
Approach Delay, s/veh	9.8			68.1			9.7			16.4		
Approach LOS	A			F			A			C		
Intersection Delay, s/veh | LOS	39.5						E					

HCS7 Roundabouts Report

General Information		Site Information	
Analyst	Brent Clark	Intersection	US 10/21st St/1st Ave
Agency or Co.	SRF Consulting	E/W Street Name	US 10
Date Performed	1/22/2020	N/S Street Name	21st St/1st Ave
Analysis Year	2045	Analysis Time Period (hrs)	0.25
Time Analyzed	2045 PM - Alternative 3C	Peak Hour Factor	0.92
Project Description	US 10 /21st St/1st Ave	Jurisdiction	US 10

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0
Lane Assignment	LT		TR		LT		TR		LT		TR		LT		TR	
Volume (V), veh/h	0	27	930	88	0	532	478	243	0	27	357	580	0	404	243	7
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	30	1041	99	0	596	535	272	0	30	400	649	0	452	272	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2				2			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276		4.6453	4.3276	
Follow-Up Headway (s)	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352		2.6667	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	549.90	620.10		659.41	743.59		430.00	649.00		452.00	280.00	
Entry Volume veh/h	533.88	602.04		640.20	721.93		417.48	630.10		438.83	271.84	
Circulating Flow (v_c), pc/h	1320			460			1523			1161		
Exiting Flow (v_{ex}), pc/h	2142			573			702			967		
Capacity (c_{pce}), pc/h	400.80	462.39		884.17	960.46		332.52	389.11		463.93	529.31	
Capacity (c), veh/h	389.13	448.93		858.42	932.49		322.84	377.78		450.42	513.89	
v/c Ratio (x)	1.37	1.34		0.75	0.77		1.29	1.67		0.97	0.53	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	210.7	193.3		19.1	19.6		186.2	337.2		66.6	17.2	
Lane LOS	F	F		C	C		F	F		F	C	
95% Queue, veh	25.8	27.4		7.0	7.9		19.8	37.8		12.1	3.1	
Approach Delay, s/veh	201.5			19.4			277.1			47.7		
Approach LOS	F			C			F			E		
Intersection Delay, s/veh | LOS	136.1						F					

110: Center Ave/Center Ave (TH 10) Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.3	0.0
Total Del/Veh (s)	17.5	18.1	16.2	17.6

Intersection: 110: Center Ave/Center Ave (TH 10)

Movement	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	R	L	R
Maximum Queue (ft)	147	95	106	298	313	49	57	124
Average Queue (ft)	95	44	58	201	214	10	35	87
95th Queue (ft)	167	109	120	313	322	104	70	137
Link Distance (ft)		691	691	341	341		744	744
Upstream Blk Time (%)				0	1	0		
Queuing Penalty (veh)				3	4	0		
Storage Bay Dist (ft)	450					300		
Storage Blk Time (%)					2			
Queuing Penalty (veh)					2			

110: Center Ave/Center Ave (TH 10) Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.3	0.0
Total Del/Veh (s)	17.2	16.5	21.8	17.7

Intersection: 110: Center Ave/Center Ave (TH 10)

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	L	R
Maximum Queue (ft)	277	151	182	315	263	158	208
Average Queue (ft)	176	61	71	174	147	73	98
95th Queue (ft)	264	127	147	282	243	135	175
Link Distance (ft)		700	700	334	334	752	752
Upstream Blk Time (%)				0			
Queuing Penalty (veh)				0			
Storage Bay Dist (ft)	475						
Storage Blk Time (%)					0		
Queuing Penalty (veh)					0		

2045 AM Build - Alternative 4C - Multi-Lane Roundabout
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/TH 75 **Roundabout**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Southbound	Left	67	17	152	7.5	A	10.7	B	5.7	A
	Right	286	17	152	11.5	B				
Eastbound	Left	138	0	24	2.6	A	2.0	A		
	Thru	453	0	24	1.8	A				
Westbound	Thru	1,153	5	178	6.1	A	6.1	A		
	Right	84	4	178	5.9	A				

2045 Build PM - Alternative 4C - Multi-Lane Roundabout
US 10/US 75 VISSIM Analysis
MOE Results

Center Ave/TH 75 **Roundabout**

Approach	Movement	Volume (vph)	Average Queue (ft)	Maximum Queue (ft)	Movement Delay (sec/veh)	Movement LOS	Approach Delay (sec/veh)	Approach LOS	Overall Delay (sec/veh)	Overall LOS
Southbound	Left	102	13	147	5.3	A	7.2	A	7.1	A
	Right	358	13	147	7.8	A				
Eastbound	Left	284	7	223	7.4	A	6.4	A		
	Thru	1,588	7	223	6.2	A				
Westbound	Thru	881	5	151	8.5	A	8.4	A		
	Right	104	5	150	7.2	A				

HCS7 Roundabouts Report

General Information

Analyst	Brent Clark
Agency or Co.	SRF Consulting
Date Performed	1/22/2020
Analysis Year	2045
Time Analyzed	2045 AM - Alternative 5B
Project Description	8th St/20th Ave

Site Information

Intersection	8th St (US 75)/20th Ave
E/W Street Name	20th Ave
N/S Street Name	8th St (US 75)
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	8th St (US 75)

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
Lane Assignment			LTR				LTR		LT		TR		LT		TR	
Volume (V), veh/h	0	13	40	20	0	94	47	88	0	27	1395	27	0	27	775	7
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	15	45	22	0	105	53	99	0	30	1562	30	0	30	868	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)		2.5352			2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		82.00			257.00		762.34	859.66		425.82	480.18	
Entry Volume veh/h		79.61			249.51		740.14	834.62		413.42	466.19	
Circulating Flow (v_c), pc/h	1003			1607			90			188		
Exiting Flow (v_{ex}), pc/h	105			91			1676			995		
Capacity (c_{pce}), pc/h		605.39			362.30		1308.34	1308.34		1196.72	1196.72	
Capacity (c), veh/h		587.75			351.75		1270.24	1270.24		1161.86	1161.86	
v/c Ratio (x)		0.14			0.71		0.58	0.66		0.36	0.40	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		7.8			35.2		9.6	11.4		6.6	7.2	
Lane LOS		A			E		A	B		A	A	
95% Queue, veh		0.5			5.2		4.0	5.2		1.6	2.0	
Approach Delay, s/veh	7.8			35.2			10.6			6.9		
Approach LOS	A			E			B			A		
Intersection Delay, s/veh | LOS	11.5						B					

HCS7 Roundabouts Report

General Information

Analyst	Brent Clark
Agency or Co.	SRF Consulting
Date Performed	1/22/2020
Analysis Year	2045
Time Analyzed	2045 PM - Alternative 5B
Project Description	8th St/20th Ave

Site Information

Intersection	8th St (US 75)/20th Ave
E/W Street Name	20th Ave
N/S Street Name	8th St (US 75)
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.92
Jurisdiction	8th St (US 75)

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
Lane Assignment			LTR				LTR		LT		TR		LT		TR	
Volume (V), veh/h	0	27	47	27	0	40	20	47	0	34	1105	67	0	81	1476	7
Percent Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	30	53	30	0	45	22	53	0	38	1237	75	0	91	1652	8
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)		2.5352			2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		113.00			120.00		634.50	715.50		822.97	928.03	
Entry Volume veh/h		109.71			116.50		616.02	694.66		799.00	901.00	
Circulating Flow (v_c), pc/h	1788			1305			174			105		
Exiting Flow (v_{ex}), pc/h	219			68			1320			1727		
Capacity (c_{pce}), pc/h		310.63			468.33		1212.06	1212.06		1290.61	1290.61	
Capacity (c), veh/h		301.59			454.69		1176.76	1176.76		1253.01	1253.01	
v/c Ratio (x)		0.36			0.26		0.52	0.59		0.64	0.72	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		20.4			11.9		9.0	10.3		11.0	13.4	
Lane LOS		C			B		A	B		B	B	
95% Queue, veh		1.6			1.0		3.2	4.1		4.9	6.7	
Approach Delay, s/veh	20.4			11.9			9.7			12.3		
Approach LOS	C			B			A			B		
Intersection Delay, s/veh | LOS	11.5						B					