25th Street

Corridor Study

City of Fargo Project #5681

Fargo, North Dakota

January 2009

FINAL REPORT

HWS

Solutions Through Service

25TH STREET CORRIDOR STUDY

17th AVENUE SOUTH TO 32ND AVENUE SOUTH

FARGO, NORTH DAKOTA

Final Report

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Submitted To:

The City of Fargo

Submitted By:

HWS CONSULTING GROUP

OMAHA, NEBRASKA

In Association with:

HOUSTON ENGINEERING

FARGO, NORTH DAKOTA

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Executive Summary

Background

This report summarizes the results of a corridor study for 25th Street between 17th Avenue South and 32nd Avenue South in Fargo, North Dakota. This corridor is a major north-south arterial within the city. The corridor is currently experiencing congestion and queuing problems which are anticipated to get worse as traffic increases along the corridor. Existing and future year scenarios were examined to determine where congestion and queuing problems are anticipated to occur. To address these problems, lane geometry alternatives were developed and evaluated for the corridor.

Currently, there are eight signalized intersections within the study area along 25th Street:

- 17th Avenue South
- 20th Avenue South
- I-94 North Ramp Terminal
- I-94 South Ramp Terminal
- 23rd Avenue South
- 26th Avenue South
- 30th Avenue South
- 32nd Avenue South

Identification of alternatives and issues for the project was facilitated through a series of meetings with the project Study Review Committee (SRC). The SRC consisted of representatives from the City of Fargo Traffic Engineering and Planning Departments, Fargo-Moorhead Council of Governments (FM COG), and the North Dakota Department of Transportation (NDDOT) Fargo District. Through discussion with the SRC the following issues were identified and studied:

1. 17th Avenue South: This intersection currently experiences congestion and queuing problems during the PM peak hour. The two movements that experience the greatest delay are the eastbound right and northbound left. These movements have heavy traffic volumes because of the traffic traveling to and from the West Acres area, which is west of Interstate 29 (I-29).
2. Congestion between the South Ramp Terminal and 23rd Street: The close spacing of these two intersections, along with the configuration of the on/off ramps, contributes to queuing problems and congestion during the PM peak hour. Queue lengths for several movements at the South Ramp Terminal extend through adjacent intersections. In addition, several of the storage bay lengths for auxiliary turn lanes are not long enough to support existing queue lengths. At these locations, the queues back up into the through stream of traffic.
3. Eastbound I-94 On-ramp: One of the circumstances that contribute to queuing and congestion between the South Ramp Terminal and 23rd Street is the current lane configuration at the Interstate 94 (I-94) South Ramp Terminal. Currently, all traffic that wants to travel east on I-94 must use the loop ramp in the southwest quadrant of the interchange. This is not much of a problem for southbound traffic on 25th Street; however, northbound traffic must make a left

turn at the south ramp terminal to access the loop ramp. As a result of the heavy southbound through volume, this northbound left-turn movement has difficulty finding acceptable gaps, which causes back up. This problem is compounded by a short northbound left-turn bay. As a result, queue spillback occurs which can block the inside through lane for northbound traffic on 25th Street. Adding a new on-ramp in the southeast quadrant of the interchange would eliminate the northbound left-turn movement. This should alleviate some of the congestion and reduce queuing problems around the I-94 South Ramp Terminal.

4. Future Growth: Traffic volumes along the corridor are expected to increase as the City of Fargo grows. The anticipated growth is expected to exacerbate some of the previously described problems

To address the issues described previously, City representatives wanted to study various lane configuration improvements along the study corridor that would reduce congestion and maintain or improve safety for all forms of transportation. The approach for this report was to study and document traffic operations along the corridor using existing lane geometries. This was carried out using existing year traffic volumes, as well as traffic volumes anticipated for the future year planning horizon. Through this process, the study team was able to identify existing and anticipated operational deficiencies or safety concerns along the corridor. Once these issues were identified, various lane geometry alternatives were developed and analyzed to mitigate these deficiencies. The identification and evaluation of alternatives is further described in the following sections.

Existing Conditions

As mentioned previously, the study corridor currently experiences some undesirable operations. To better understand and benchmark these operations, a capacity analysis was performed. The analysis evaluated the existing year AM and PM peak hour traffic operations using the existing lane configuration in order to identify capacity deficiencies.

A LOS analysis was performed using Synchro, Version 7, to benchmark the study intersection traffic operations. The existing lane configurations and timings were used. For this report, acceptable levels of service were considered LOS C or better for intersections and LOS D or better for individual movements. The signal phasing and timing plans for the analyses are displayed in Appendix A.

The following deficiencies were noted:

- AM Peak Hour
  - 20th Avenue South – westbound left: LOS E
  - I-94 South Ramp Terminal – eastbound through/left: LOS E
- PM Peak Hour
  - 17th Avenue South – overall intersection: LOS D; eastbound right: LOS F
  - 20th Avenue South – overall intersection: LOS D; westbound left: LOS E
  - 23rd Avenue South – eastbound left: LOS E

A queue length analysis was also performed for the analysis scenarios. The 95th percentile queue length from Synchro 7 was used to determine the anticipated queue lengths. The 95th percentile queue lengths

were rounded up to the nearest 25 feet. In several locations, the vehicle queue exceeds the available storage bay length. For example, during existing conditions at the I-94 South Ramp Terminal, the northbound left-turn queue length of 150 feet exceeds the 100 feet of storage provided. The queuing analyses results can be found in Appendix A.

Future Conditions – No Build

Once traffic operations were established for the existing year, the study team analyzed and documented the traffic operations for the future year planning horizon. The future year planning horizon was considered to be year 2030 for this report. The following sections describe the results of the analysis.

A capacity analysis along the 25th Street corridor was performed using the same methodology described for the existing year analysis. The existing lane configuration and year 2030 peak hour traffic volumes were used to determine the study intersection traffic operations. The cycle lengths remained unchanged but the splits were optimized.

The following deficiencies were noted:

- AM Peak Hour
  - 20th Avenue South – westbound left: LOS F
  - I-94 North Ramp Terminal – overall intersection: LOS D; westbound right: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS D; eastbound through/left: LOS E; southbound left: LOS E
- PM Peak Hour
  - 17th Avenue South – overall intersection: LOS F; eastbound right: LOS F; northbound left: LOS F; southbound through: LOS F
  - 20th Avenue South – overall intersection: LOS F; westbound left: LOS E; northbound left: LOS E; southbound through/right: LOS F
  - I-94 North Ramp Terminal – overall intersection: LOS E; westbound left: LOS F; southbound through: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; northbound left: LOS F; northbound through/right: LOS E; southbound left: LOS F; southbound through: LOS E
  - 23rd Avenue South – overall intersection: LOS D; eastbound left: LOS E; northbound left: LOS E; southbound through/right: LOS E

A queue length analysis was performed for the Year 2030 analysis scenarios using the same methodology described for the existing year analysis. The results of the analysis indicate that many of the auxiliary turning movements between 17th Avenue South and 23rd Avenue South are anticipated to exceed the available storage length.

Through discussions with the City staff, an operational concern was identified in the area of the I-94 ramp terminals and 23rd Avenue South. It was determined that a traffic simulation for this area using SimTraffic, Version 7, should be performed to provide a better depiction of the traffic operations.

Simulation takes into account how the intersections interact together, giving consideration to storage lengths and the distances between the intersections. The simulation results can be found in Appendix A.

During the simulation, the following deficiencies were identified:

- AM Peak Hour
  - I-94 North Ramp Terminal – westbound left: LOS F; westbound right: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; eastbound right: LOS F; westbound right: LOS E; northbound left: LOS F; northbound through/right: LOS E; southbound left: LOS F
  - 23rd Avenue South – overall intersection: LOS F; eastbound left: LOS E; northbound left: LOS F; northbound through/right: LOS F
- PM Peak Hour
  - I-94 North Ramp Terminal – overall intersection: LOS F; westbound left: LOS F; westbound right: LOS F; southbound through: LOS E
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; eastbound right: LOS F; northbound left: LOS F; northbound through/right: LOS F; southbound left: LOS F
  - 23rd Avenue South – overall intersection: LOS F; eastbound left: LOS F; eastbound through/right: LOS F; westbound left/through/right: LOS F; northbound left: LOS E

The results of the capacity analyses indicate traffic operations will deteriorate significantly at several intersections if changes are not made to the current roadway configuration. These operations occur at or north of 23rd Avenue South. Intersections south of 23rd Avenue South are anticipated to operate at an acceptable LOS in year 2030. As result, alternative roadway geometry was not investigated and the subsequent analyses were not performed for intersections south of 23rd Avenue South.

A safety analysis was also performed using three years of crash data provided by the North Dakota Department of Transportation (NDDOT). The results of the analysis indicated that several crash trends exist along the corridor. One of these trends was at the I-94 South Ramp Terminal. At this intersection, northbound lefts trying to access the eastbound loop on-ramp are being struck by southbound through traffic.

Alternative Development and Analysis

Once the operations and safety were analyzed and documented for the existing lane geometry, the study team, with the help of the SRC, was able to develop several different lane geometry alternatives. These alternatives were developed to address the operational and safety issues described previously. These improvements included:

- Widening 25th Street to six lanes
- Side street lane improvements
- Northbound 25th Street to eastbound I-94 on-ramp

These improvements were combined in different variations to develop two alternatives with various sub-options.

Once the preliminary alternatives were developed, the study team performed a cursory analysis for each alternative to determine whether or not traffic operations or safety could be improved. The analyses examined specific issues such as:

- 13th Avenue South: Lane Extension
- 17th Avenue South: Protected vs. Permitted-Protected Northbound Left Turns
- Benefits of the Proposed On-Ramp at I-94 South Ramp Terminal

These alternatives and the results of the analyses were presented to the public on June 4, 2008.

At the conclusion of first public meeting, the study team met with the SRC to discuss public comment. Based on the discussions regarding public input, cost estimates, and anticipated impacts, the SRC was able to identify features to be included in the preferred alternative.

Once project concept plans for the preferred alternative was complete, the second public meeting was conducted. The second public meeting was held on October 8, 2008. A presentation was given at the meeting to highlight the purpose of the project and the features, impacts and benefits of the preferred alternative.

Recommendation

Over the course of the study, many different aspects of the corridor were studied. Each of these aspects helped the study team and SRC identify improvements for the corridor that will improve safety and mobility for all forms of transportation. Through this process, the study team was able to identify a set of improvements for the study corridor of 25th Street. This set of improvements was the make up for the recommended alternative. The following components were incorporated into the recommended alternative:

- raised medians
- new on-ramp for northbound 25th Street to eastbound I-94
  - a northbound left-turn bay at the I-94 South Ramp Terminal will be maintained during construction of the new on-ramp
- I-94 South Ramp Terminal shifted south
- Southbound lane extension to 13th Avenue South
- Maintain bike path widths of 10 feet throughout the project
  - One exception to the width may be necessary to minimize potential impacts. The bike path in front of Camelot Cleaners may need to be decreased from 10 feet wide to 8 feet wide

The study team developed order-of-magnitude cost estimates for the recommended alternative. The cost estimates included the cost of the widening for 25th Street and the cost of the proposed eastbound I-94 on-ramp. The engineer's opinion of probable cost was estimated to be $9,436,000.

A capacity analysis was performed using Synchro software and recommended lane geometry. The results indicate that proposed geometries for the recommended alternative are anticipated to improve levels of service along 25th Street between 23rd Avenue South and 17th Avenue South from the levels of service exhibited for year 2030 conditions with the existing lane configuration. **Table E-1** displays a comparison between year 2030 Synchro levels of service with and without recommended lane geometries. Intersections that experience LOS F also have the delay in seconds displayed.

Table E-1. Synchro Intersection Level of Service Comparison

Intersection	AM Peak Period		PM Peak Period	
	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)
13th Avenue South	NA*	D	NA*	D
17th Avenue South	C	C	F (117)	D
20th Avenue South	C	NA*	F (184)	NA*
I-94 N. Ramp	C	B	D	B
I-94 S. Ramp	D	C	E	C
23rd Avenue South	C	C	C	B

*-Scenario was not analyzed

A simulation analysis was performed using recommended lane geometry and the results of the analyses indicate that proposed geometries for the recommended alternative are anticipated to improve levels of service along 25th Street between 23rd Avenue South and 17th Avenue South from the levels of service exhibited for year 2030 conditions with the existing lane configuration. **Table E-2** displays a comparison of year 2030 levels of service with and without recommended lane geometries. Intersections the experience LOS F also have the delay in seconds displayed.

Table E-2. SimTraffic Intersection Level of Service Comparison

Intersection	AM Peak Period		PM Peak Period	
	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)
13th Avenue South	NA*	F (105)	NA*	F (219)
17th Avenue South	NA*	D	NA*	F (227)
I-94 N. Ramp	C	B	F (109)	B
I-94 S. Ramp	F (198)	C	F (302)	C
23rd Avenue South	F (106)	C	F (279)	C

*-Scenario was not analyzed

While the recommended alternative offers capacity improvements over year 2030 existing operations, the recommended alternative can provide additional safety benefits. A crash analysis along the corridor revealed the majority of crashes at the I-94 South Ramp Terminal occur when northbound-left turning vehicles cross the southbound through traffic to access I-94 eastbound loop on-ramp. These crashes can be eliminated if the proposed on-ramp is implemented.

Impacts

As part of the study, a solicitation of views was initiated with agencies to solicit input on the potential impacts. This information was summarized to review the potential environment, land use and construction impacts. Most of the impacts are anticipated to be negligible, except those listed below.

- North Dakota Park and Recreation said that there were two bird species in the area that may be affected. These birds are located to the east of University Drive, near the Red River.
- Xcel Energy has a duct running along the east side of 25th Street starting north of 18th Street South. North of the interchange, the duct crosses the street and runs north on the west side of 25th Street.
- Sprint has a fiber optic line along 25th Street It runs on the east side to 18th Street South, crosses to the southwest corner of the I-94 South Ramp Terminal, and continues north under I-94. The proposed improvements may affect the fiber line in several locations, especially if the I-94 South Ramp Terminal is shifted to the south.
- Moorhead Public Service has a power line pole southeast of the I-94 North Ramp Terminal which may be affected by the widening of 25th Street.

Based on these anticipated conflicts, the study team contacted the energy and communication companies to estimate the cost of relocation. The cost estimates were updated to include according to estimates provided by each respective company.

One of the main issues associated with the widening of 25th Street was the available bridge clearance between I-94 and the 25th Street Bridge. If the road is widened, the clearance for traffic traveling under the 25th Street Bridge on I-94 will be less than the NDDOT minimum clearance of 16.5 feet. One measure that may help in achieving the minimum clearance would be to implement shallower I-beams when constructing the widened section of 25th Street. The shallower I-beams will cost more than traditional 63" beams but may be required to achieve the minimum clearance. The added cost of the beams was factored into the cost estimate for the preferred alternative.

Drainage concerns were also identified by the SRC representative from NDDOT. These included potential conflicts with existing drainage structures and proposed drainage improvements near the interchange. Currently, NDDOT has plans to add a number of drainage structures on the west and east sides of 25th Street.

On the west side of 25th Street, several proposed drainage structures may conflict with the proposed I-94 South Ramp Terminal shifted to the south. The proposed roadway improvements will require some of these drainage structures be relocated or extended. It may also require some grading to ensure positive drainage.

On the east side of 25th Street, the conflict of the proposed on-ramp with an existing lift station in the southeast quadrant of the interchange was a concern. The study team examined the proximity of the ramp and the grades in the area with respect to the lift station to determine the impacts. In order to avoid impacts to the lift station, the study team shifted the ramp north and placed retaining walls between the Interstate and ramp, as well as around the lift station.

Another issue that was identified early in the process was the need for a pedestrian signal at the proposed trail crossing created when the proposed eastbound on-ramp is constructed. The SRC and the study team identified the High-Intensity Activated Crosswalk (HAWK) signal as the desired traffic control at this location. The HAWK signal is not currently recommended for use in the MUTCD; however it has been identified as one of the updates that will be incorporated into the next edition of the MUTCD (2009 Edition). The use of the HAWK signal has been shown to substantially improve motorist stopping behavior when compared to traditional pedestrian-activated signals. For this reason, the HAWK signal was displayed at both public meetings and presented as the preferred traffic signal for the proposed eastbound on-ramp pedestrian crossing.

The recommended improvements should be considered preliminary. Modifications to this plan may be necessary after a ground survey is available and new traffic counts are available.

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1.0 Introduction

1.1 Description

This report summarizes the results of a corridor study for 25th Street between 17th Avenue South and 32nd Avenue South in Fargo, North Dakota. This corridor is a major north-south arterial within the city. The corridor is currently experiencing congestion and queuing problems which are anticipated to get worse as traffic increases along the corridor. Existing and future year scenarios were examined to determine where congestion and queuing problems are anticipated to occur. To address these problems, lane geometry alternatives were developed and evaluated for the corridor.

1.2 Background

Currently, there are eight signalized intersections within the study area along 25th Street:

- 17th Avenue South
- 20th Avenue South
- I-94 North Ramp Terminal
- I-94 South Ramp Terminal
- 23rd Avenue South
- 26th Avenue South
- 30th Avenue South
- 32nd Avenue South

Figure 1 displays a map of the study area and the location of each signalized intersection. This map also displays some of the current issues along the study corridor. The following is a list of these issues and a brief description:

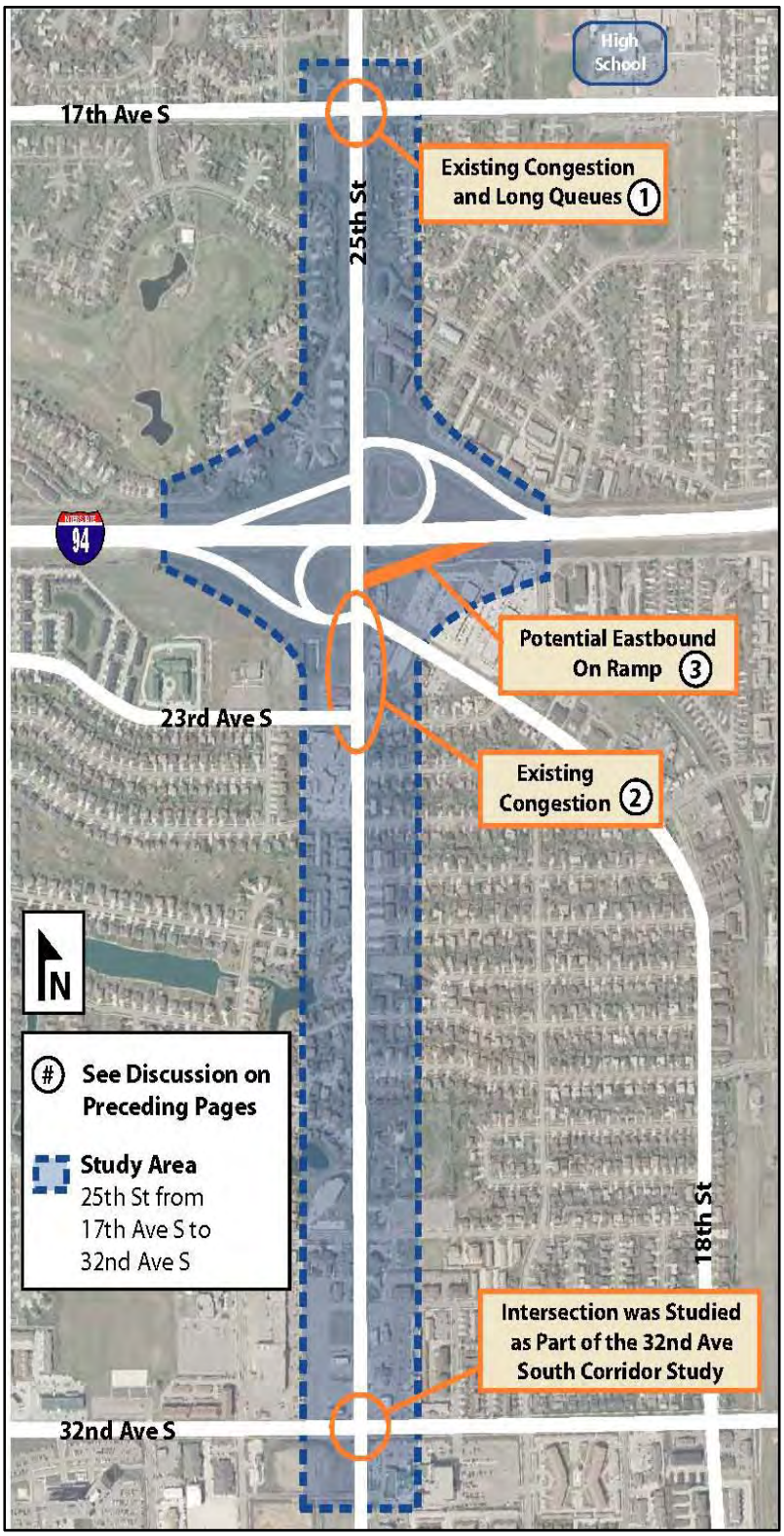
5. 17th Avenue South: This intersection currently experiences congestion and queuing problems during the PM peak hour. The two movements that experience the greatest delay are the eastbound right and northbound left. These movements have heavy traffic volumes because of the traffic traveling to and from the West Acres area which is west of Interstate 29 (I-29).
6. Congestion between the South Ramp Terminal and 23rd Street: The spacing between these two intersections along with the configuration of the on/off ramps contributes to queuing problems and congestion during the PM peak period. Queue lengths for several movements at the South Ramp Terminal extend through adjacent intersections. In addition, several of the storage bay lengths for auxiliary turn lanes are not long enough to support existing queue lengths. At these locations, the queues back up into the through stream of traffic.
7. Eastbound I-94 On-ramp: One of the circumstances that contribute to queuing and congestion between the South Ramp Terminal and 23rd Street is the current lane configuration at the Interstate 94 (I-94) South Ramp Terminal. Currently, all traffic that wants to travel east on I-94 must use the loop ramp in the southwest quadrant of the interchange. This is not much of a problem for southbound traffic on 25th Street; however, northbound traffic must make a left turn to access the loop ramp. Because of the heavy southbound through volume, this left-turn movement has difficulty finding acceptable gaps. This causes the northbound left-turning traffic to back up. This problem is compounded by a short northbound left-turn bay. As a result,

queue spillback occurs which can block the inside through lane for northbound traffic on 25th Street. Adding a new on-ramp in the southeast quadrant of the interchange would eliminate the northbound left-turn movement. This should alleviate some of the congestion and reduce queuing problems around the I-94 South Ramp Terminal.

8. Future Growth: Traffic volumes along the corridor are expected to increase as the City of Fargo grows. The anticipated growth is expected to exacerbate some of the problems described in issues 1-3.

For these reasons, City officials wanted to study and quantify the existing operating conditions as well as those anticipated for the future. With this information, problem areas could be identified and addressed where appropriate.

Figure 1. Study Area Map and Issues



1.3 Approach

Because of the issues described previously, City representatives wanted to study various lane configuration improvements along the study corridor that would reduce congestion and maintain or improve safety for all forms of transportation. The approach for this report was to study and document traffic operations along the corridor using existing lane geometries. This was carried out using existing year traffic volumes as well as traffic volumes anticipated for the future year planning horizon. Through this process, the study team was able to identify existing and anticipated operational deficiencies or safety concerns along the corridor. Once these issues were identified, various lane geometry alternatives were developed and analyzed to mitigate these deficiencies. The identification and evaluation of alternatives is further described in the following sections.

1.3.1 Alternative Identification

Identification of alternatives was facilitated through a series of meetings with the project Study Review Committee (SRC). The SRC consisted of representatives from the City of Fargo Traffic Engineering and Planning Departments, Fargo-Moorhead Council of Governments (FM COG), and the North Dakota Department of Transportation (NDDOT) Fargo District. The purpose of the SRC was to provide the study team with perspective on the issues related to the corridor as well as to identify feasible and reasonable geometric improvements that address corridor operational or safety problems. The following is a list of meeting dates with the SRC and a brief description of what was discussed at each meeting:

- May 30, 2007 – Kickoff meeting: review the draft public participation plan, draft goals and objectives, draft project management plan, and establish design criteria assumptions.
- October 31, 2007 – Discussed results of the analyses for existing and future year operations with existing lane configuration. Also discussed preliminary alternative development. At the conclusion of the meeting, two alternative lane geometries were identified for detailed analysis.
- January 14, 2008 – Preliminary geometric concepts, as well as capacity analyses, were discussed for each preliminary alternative. Updated geometries were identified along with additional analysis items.
- April 4, 2008 – Further refinements of concept geometries were identified, along with additional capacity analyses.
- May 8, 2008 – Discussed updated geometries and analyses identified at the previous meeting. Final adjustments were identified for the two alternative lane geometries and a date was identified for the first public meeting.
- July 30, 2008 – Discussed comments from the first public meeting, along with the results of the safety analysis. Also discussed impacts and cost estimates. Through these discussions, geometric features of the preferred alternative were selected.
- September 8, 2008 – Discussed the details of the preferred alternative and identified final updates. Bridge clearance and drainage issues were also discussed. Lastly, the group identified the date for the last public meeting.

The content and issues identified at each meeting are discussed in later chapters of this report.

1.3.2 Alternative Evaluation

Once alternatives were identified, the study team needed to determine how each alternative would fulfill the goals and objectives of the project. To do this, the study team and SRC used a set of qualitative and quantitative measures aimed at distinguishing the benefits and drawbacks of one alternative compared to the others. These measures included traffic operations, safety, project costs, socio-economic factors, and land-use factors. Using these measures, the study team, with the help of the steering committee, was able to refine the project alternatives.

The following chapters explain the process by which alternatives were identified and evaluated for this study, along with the rationale for eliminating or retaining the various features that make up each alternative.

2.0 Analysis of Existing Lane Geometry

Before alternatives were developed for this project, the study team set out to examine and document the existing conditions of the study area roadway network. This included traffic analyses of the current roadway geometry using existing year traffic volumes and future year traffic volumes. A safety analysis was also carried out using the latest three years of historical crash data. The following sections describe these analyses and their results.

2.1 Existing Conditions Analysis

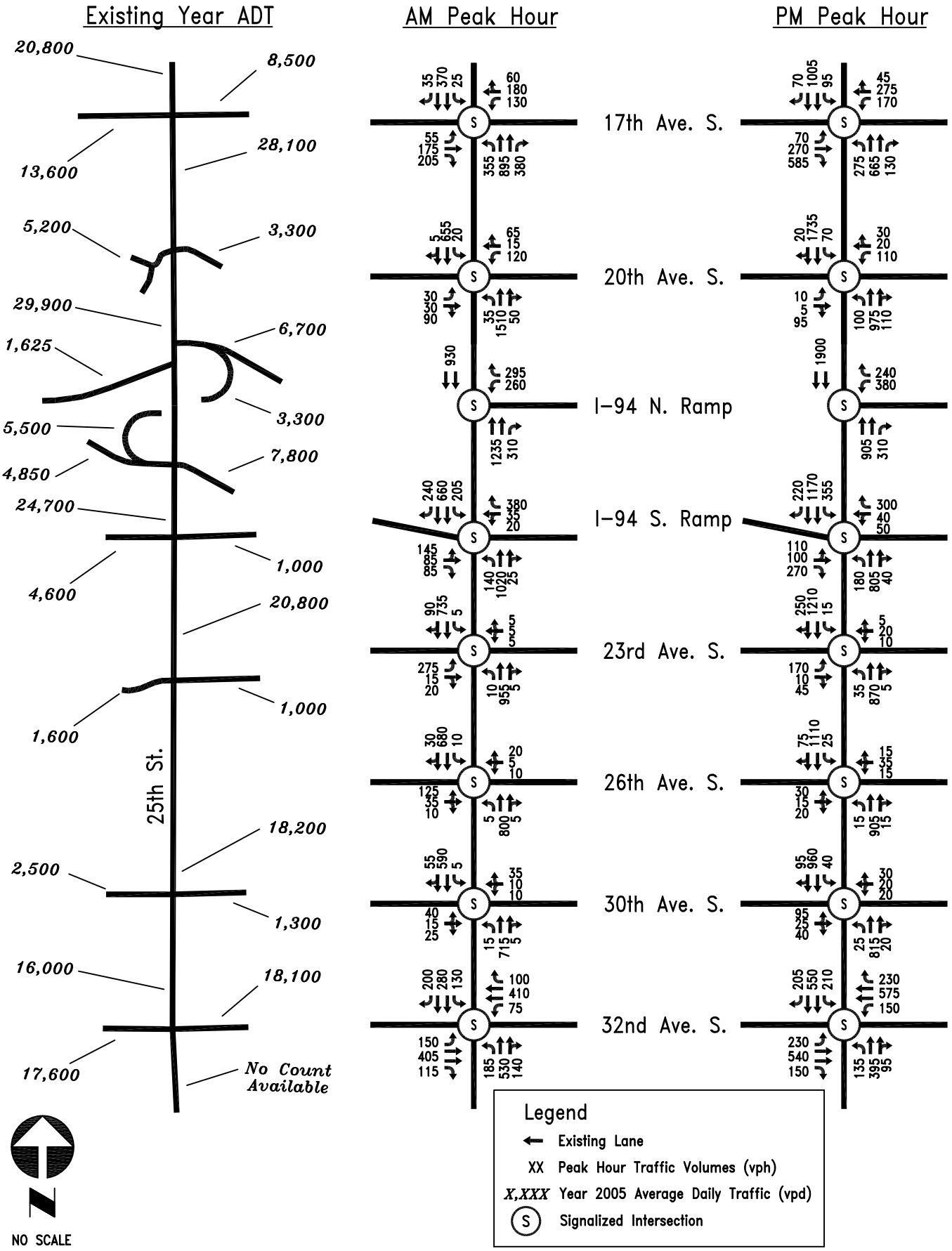
As mentioned previously, the study corridor currently experiences some undesirable operations. To better understand and benchmark these operations, a capacity analysis was performed. The analysis evaluated the existing year AM and PM peak hour traffic operations using the existing lane configuration in order to identify capacity deficiencies.

The following eight signalized intersections along 25th Street were identified for the traffic analysis:

1) 17th Avenue South
2) 20th Avenue South
3) I-94 North Ramp Terminal
4) I-94 South Ramp Terminal
5) 23rd Avenue South
6) 26th Avenue South
7) 30th Avenue South
8) 32nd Avenue South

2.1.1 Traffic Volumes

Intersection traffic count data was obtained from the City of Fargo Traffic Engineering Department. **Figure 2** illustrates the existing year average daily traffic (ADT) volumes along with AM and PM peak hour traffic volumes used for the analysis.



O:\Proj\55271212\dwg\17 Draft Report\Fig 02 Existing Year ADT and Peak Hour Traffic Volumes.dwg, Model, 11/14/2008 4:25:23 PM, ayates

25th Street Corridor Study
City of Fargo, North Dakota

Existing Year ADT
and Peak Hour Traffic Volumes

Figure 2

2.1.2 Capacity Analysis

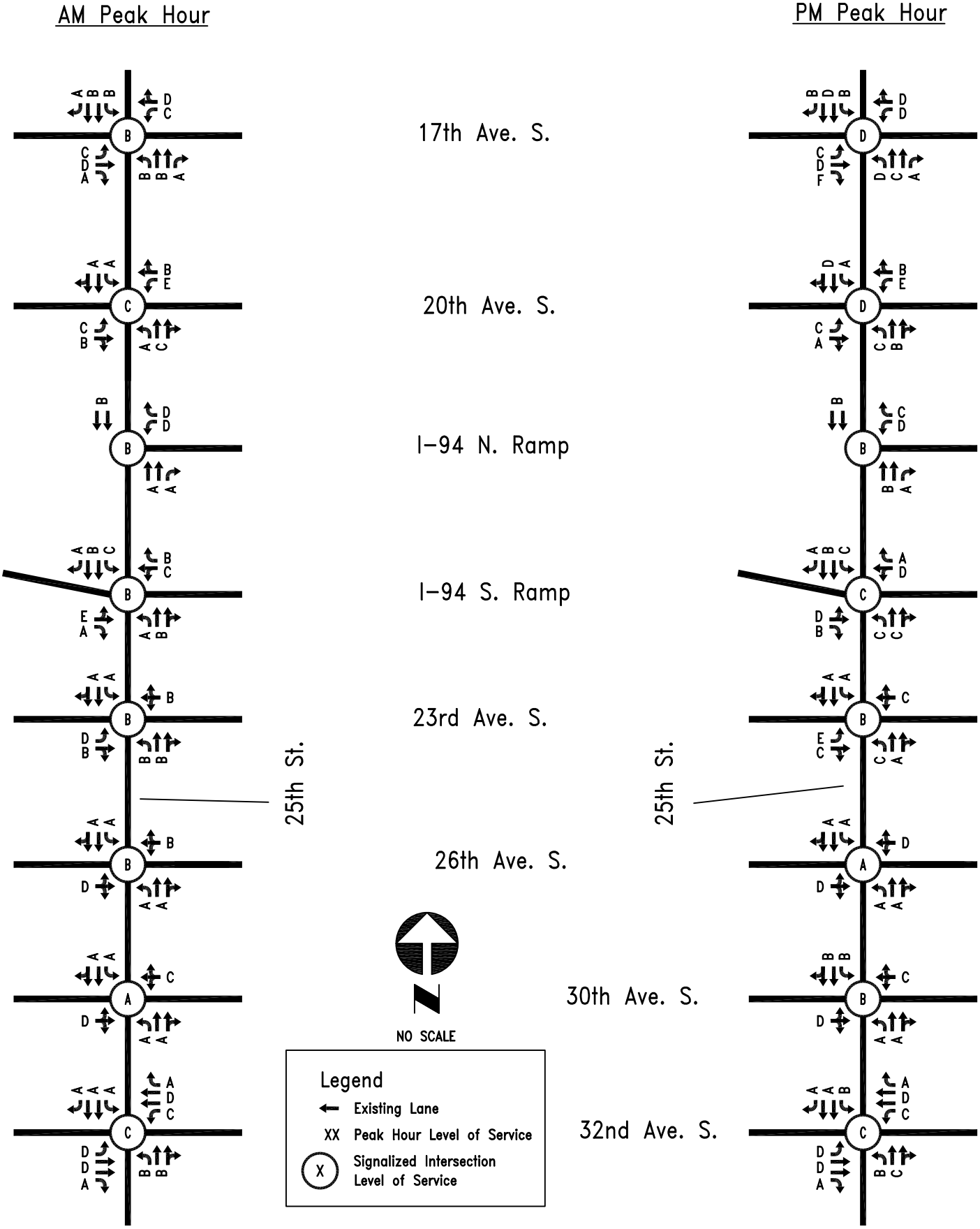
A level of service (LOS) analysis was performed using Synchro, Version 7, to benchmark the study intersection traffic operations. The existing lane configurations and timings were used. For this report, acceptable levels of service were considered LOS C or better for intersections and LOS D or better for individual movements. The signal phasing and timing plans for the analyses are displayed in Appendix A.

Figure 3 displays the results of the LOS analysis. The following deficiencies were noted:

- AM Peak Hour
  - 20th Avenue South – westbound left: LOS E
  - I-94 South Ramp Terminal – eastbound through/left: LOS E
- PM Peak Hour
  - 17th Avenue South – overall intersection: LOS D; eastbound right: LOS F
  - 20th Avenue South – overall intersection: LOS D; westbound left: LOS E
  - 23rd Avenue South – eastbound left: LOS E

A queue length analysis was also performed for the analysis scenarios. The 95th percentile queue length from Synchro 7 was used to determine the anticipated queue lengths. The 95th percentile queue lengths were rounded up to the nearest 25 feet. The AM and PM peak periods were both analyzed and are displayed in **Figure 4**.

Additionally, **Figure 4** indicates when the analysis queue lengths exceed the storage provided. For example, during existing conditions at the I-94 South Ramp, the northbound left-turn queue length of 150 feet exceeds the 100 feet of storage provided. The queuing analyses results can be found in Appendix A.

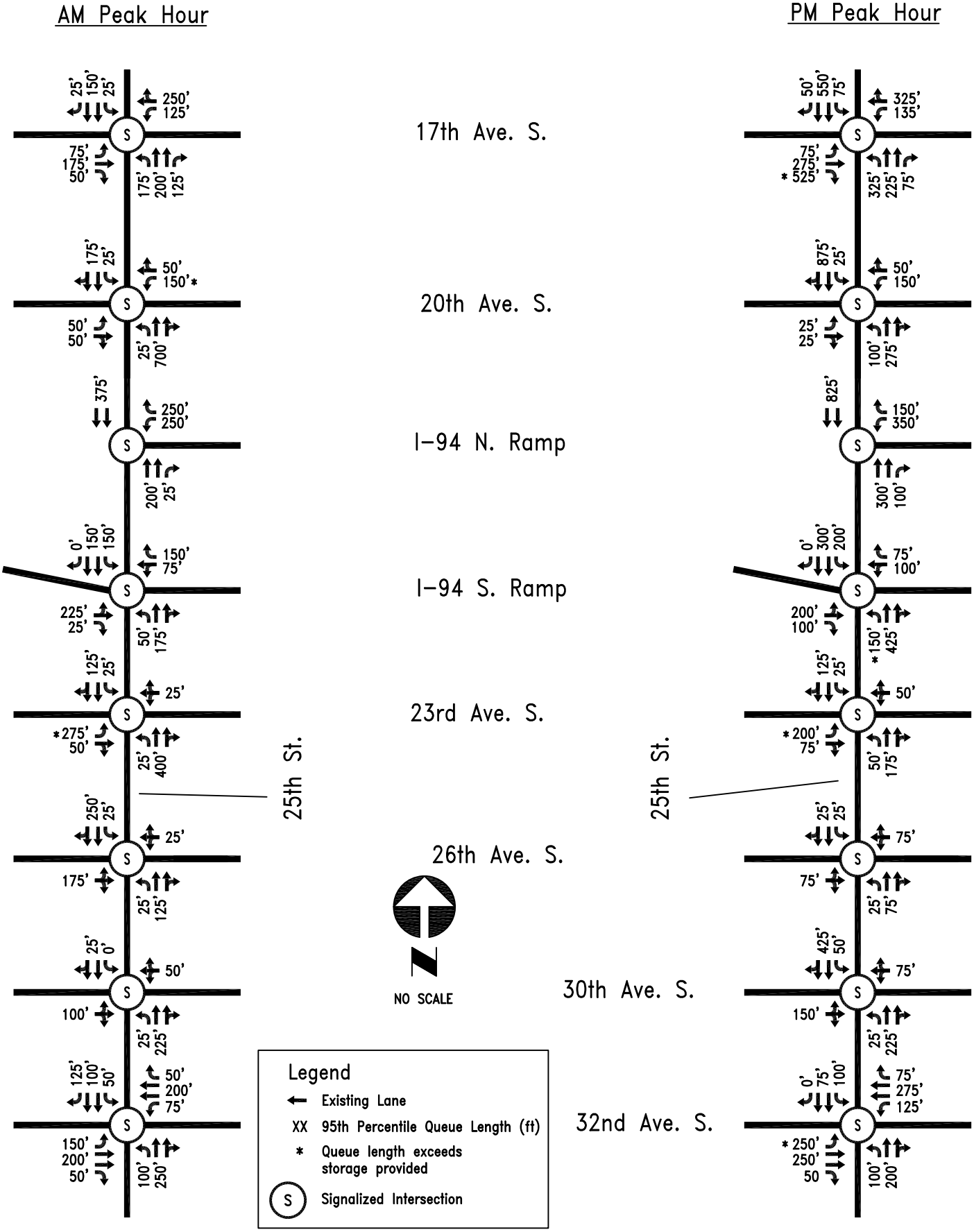


25th Street Corridor Study
City of Fargo, North Dakota

Existing Year Peak Hour
Level of Service Using Synchro 7

Figure 3

O:\Proj\55271212\dwg\17 Draft Report\Fig 03 Existing Year Peak Hour Level of Service Using Synchro 7.dwg, Model, 11/18/2008 8:38:37 AM, ayates



25th Street Corridor Study
City of Fargo, North Dakota

Existing Year 95th Percentile Queue Lengths Using Synchro 7

Figure 4

O:\Proj\55271212\dwg\17 Draft Report\Fig 04 Existing Year 95th Percentile Queue Lengths Using Synchro 7.dwg, Model, 11/14/2008 4:27:10 PM, ayates

2.2 Future Conditions Analysis

Once traffic operations were established for the existing year, the study team analyzed and documented the traffic operations for the future year planning horizon. The future year planning horizon was considered to be year 2030 for this report. The following sections describe the results of the analysis.

2.2.1 Traffic Volumes

The Advanced Traffic Analysis Center (ATAC) at North Dakota State University (NDSU) and FM COG provided year 2030 ADT volume projections. **Figure 5** displays year 2030 average daily traffic projections. These ADT volumes, along with existing traffic characteristics and engineering judgment, were used to develop year 2030 peak hour traffic volumes at each of the study intersections. These turning movements were used for all future year analyses in this report. **Figure 5** displays year 2030 AM and PM peak hour turning movement volumes.

2.2.2 Capacity Analysis

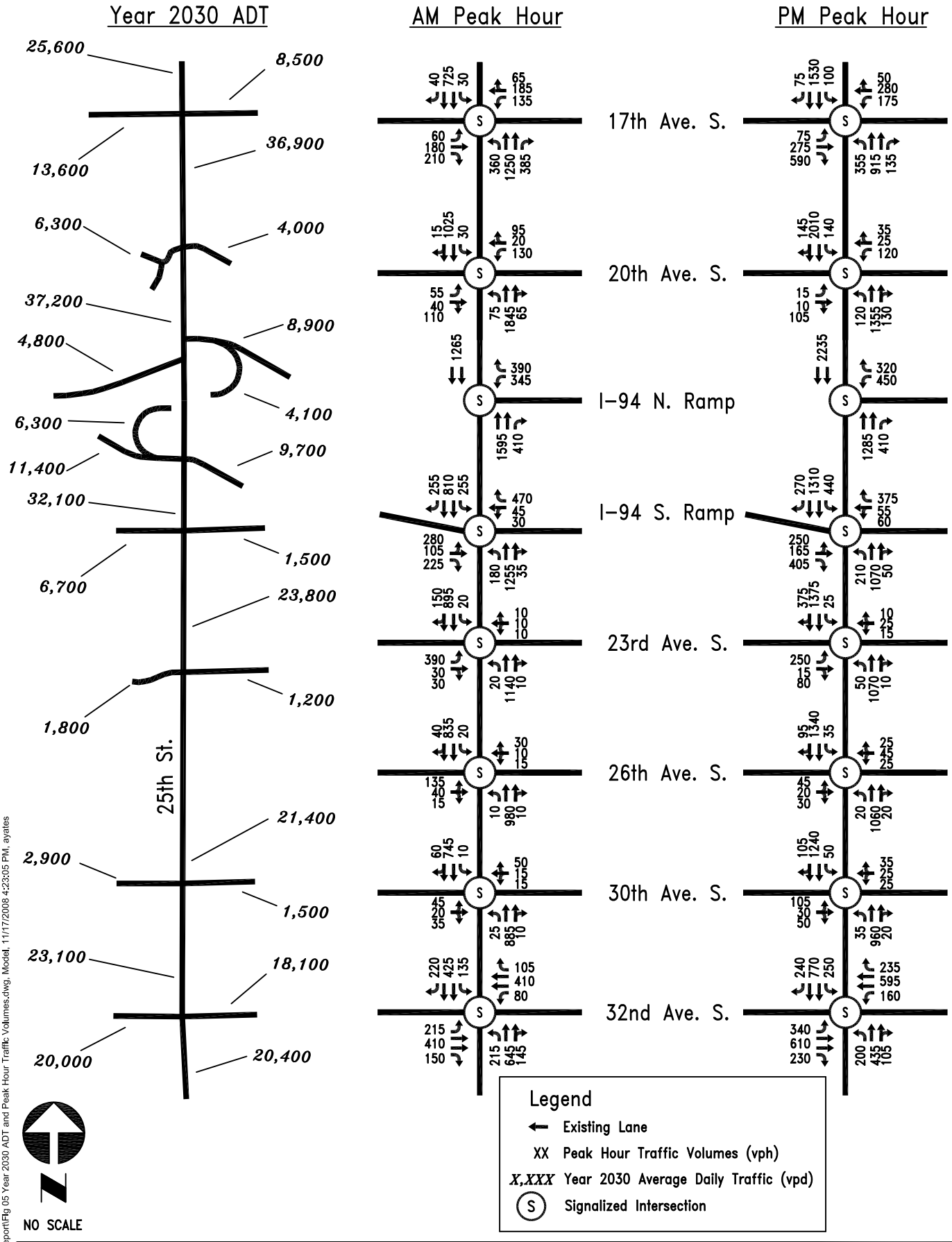
The capacity analysis along the 25th Street corridor was performed using Synchro, Version 7. The existing lane configuration and year 2030 peak hour traffic volumes were used to determine the study intersection traffic operations. The cycle lengths remained unchanged but the splits were optimized.

Figure 6 displays the results of the LOS analysis. The following deficiencies were noted:

- AM Peak Hour
  - 20th Avenue South – westbound left: LOS F
  - I-94 North Ramp Terminal – overall intersection: LOS D; westbound right: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS D; eastbound through/left: LOS E; southbound left: LOS E

- PM Peak Hour
  - 17th Avenue South – overall intersection: LOS F; eastbound right: LOS F; northbound left: LOS F; southbound through: LOS F
  - 20th Avenue South – overall intersection: LOS F; westbound left: LOS E; northbound left: LOS E; southbound through/right: LOS F
  - I-94 North Ramp Terminal – overall intersection: LOS E; westbound left: LOS F; southbound through: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; northbound left: LOS F; northbound through/right: LOS E; southbound left: LOS F; southbound through: LOS E
  - 23rd Avenue South – overall intersection: LOS D; eastbound left: LOS E; northbound left: LOS E; southbound through/right: LOS E

A queue length analysis was performed for the Year 2030 analysis scenarios using the same methodology described for the existing year analysis. **Figure 7** displays these queue lengths. The queuing analyses can be found in Appendix A.

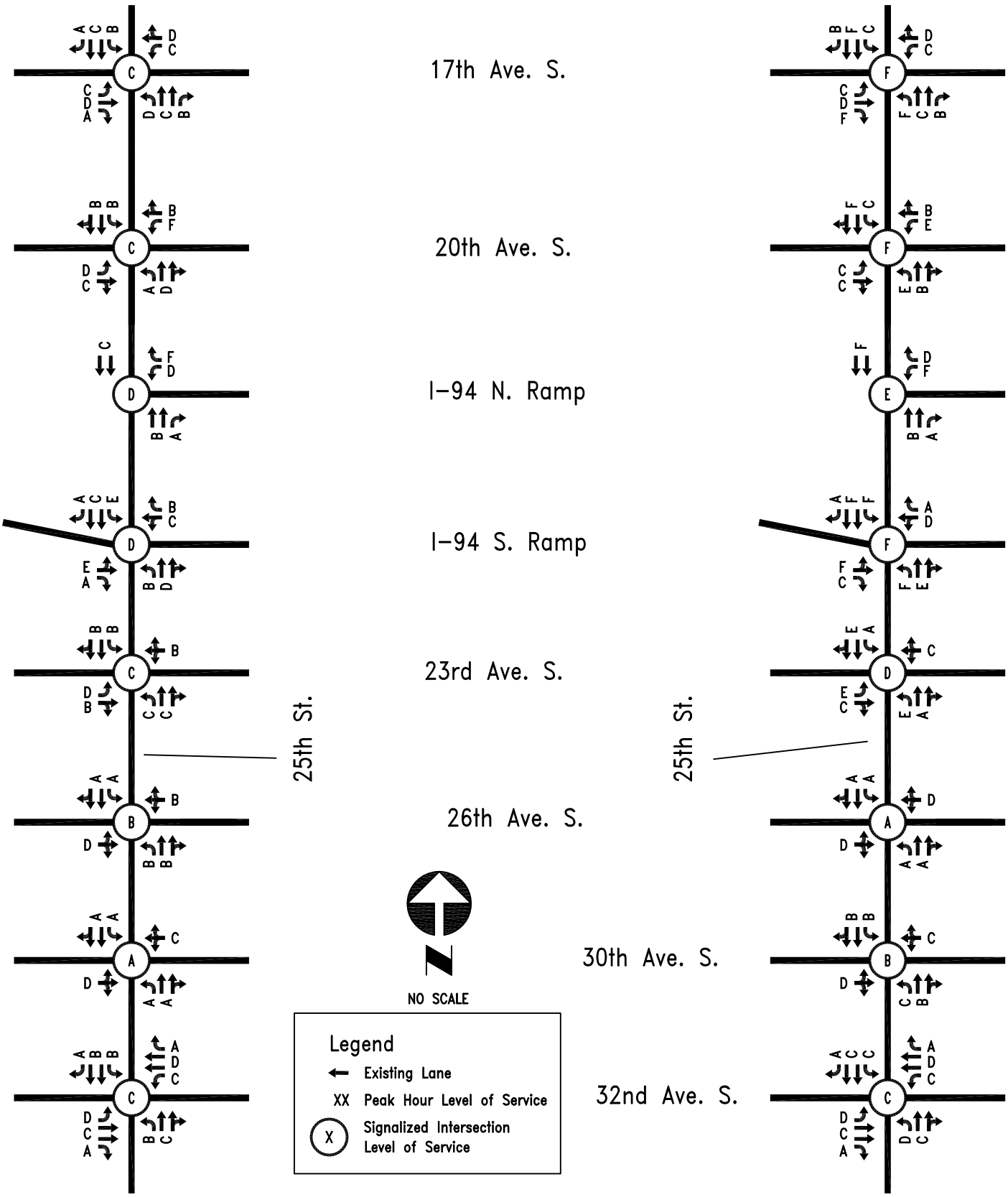


25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 ADT
and Peak Hour Traffic Volumes

Figure 5

O:\Proj\55271212\dwg\17 Draft Report\Fig 05 Year 2030 ADT and Peak Hour Traffic Volumes.dwg, Model, 11/17/2008 4:23:05 PM, ayates

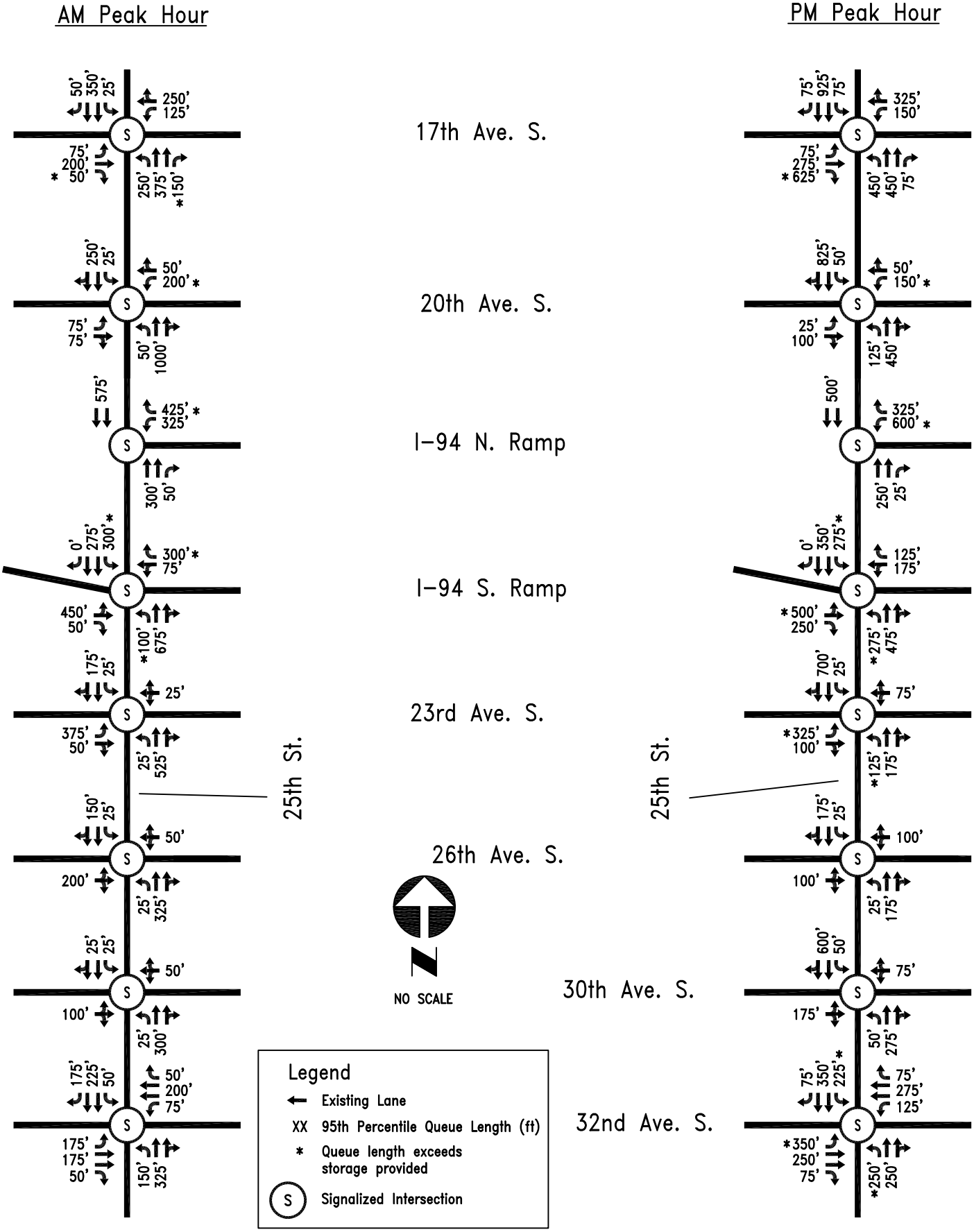


25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Peak Hour
Level of Service Using Synchro 7

Figure 6

O:\Proj\55271212\dwg\17 Draft Report\Fig 06 Year 2030 Peak Hour Level of Service Using Synchro 7.dwg, Model, 11/18/2008 8:48:03 AM, ayates



25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 95th Percentile
Queue Lengths Using Synchro 7

Figure 7

O:\Proj\55271212\dwg\17 Draft Report\Fig 07 Year 2030 95th Percentile Queue Lengths Using Synchro 7.dwg, Model, 11/14/2008 4:28:54 PM, ayates

2.2.3 Simulation Analysis

Through discussions with the City staff, an operational concern was identified in the area of the I-94 ramp terminals and 23rd Avenue South. There are short auxiliary turn lanes at the 23rd Avenue South intersection, which is approximately 650 feet south of the I-94 South Ramp Terminal. It was determined that a traffic simulation for this area using SimTraffic, Version 7, should be performed to provide a better depiction of the traffic operations. Simulation takes into account how the intersections interact together, giving consideration to storage lengths and the distances between the intersections. **Figure 8** displays the simulation LOS results, as well as the anticipated simulation queue lengths. The simulation results can be found in Appendix A.

During the simulation, the following deficiencies were identified:

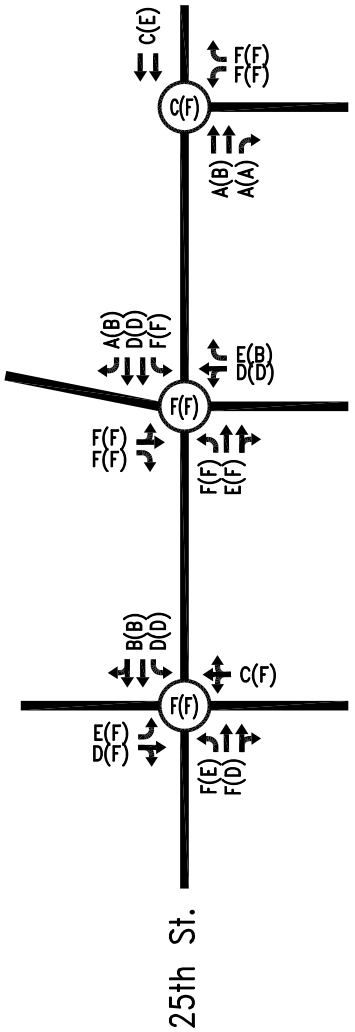
- AM Peak Hour
  - I-94 North Ramp Terminal – westbound left: LOS F; westbound right: LOS F
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; eastbound right: LOS F; westbound right: LOS E; northbound left: LOS F; northbound through/right: LOS E; southbound left: LOS F
  - 23rd Avenue South – overall intersection: LOS F; eastbound left: LOS E; northbound left: LOS F; northbound through/right: LOS F

- PM Peak Hour
  - I-94 North Ramp Terminal – overall intersection: LOS F; westbound left: LOS F; westbound right: LOS F; southbound through: LOS E
  - I-94 South Ramp Terminal – overall intersection: LOS F; eastbound through/left: LOS F; eastbound right: LOS F; northbound left: LOS F; northbound through/right: LOS F; southbound left: LOS F
  - 23rd Avenue South – overall intersection: LOS F; eastbound left: LOS F; eastbound through/right: LOS F; westbound left/through/right: LOS F; northbound left: LOS E

The results of the capacity analyses indicate traffic operations will deteriorate significantly at several intersections if changes are not made to the current roadway configuration. These operations occur at or north of 23rd Avenue South. Intersections south of 23rd Avenue South are anticipated to operate at an acceptable LOS in year 2030. As result, alternative roadway geometry was not investigated and the subsequent analysis was not performed for intersections south of 23rd Avenue South.

It should be noted, for the year 2030 scenarios, the system is reaching over-capacity conditions. The analysis tools may be overestimating delay and may not be “realistic”. However, the results provide relative measures for comparison purposes.

Level of Service

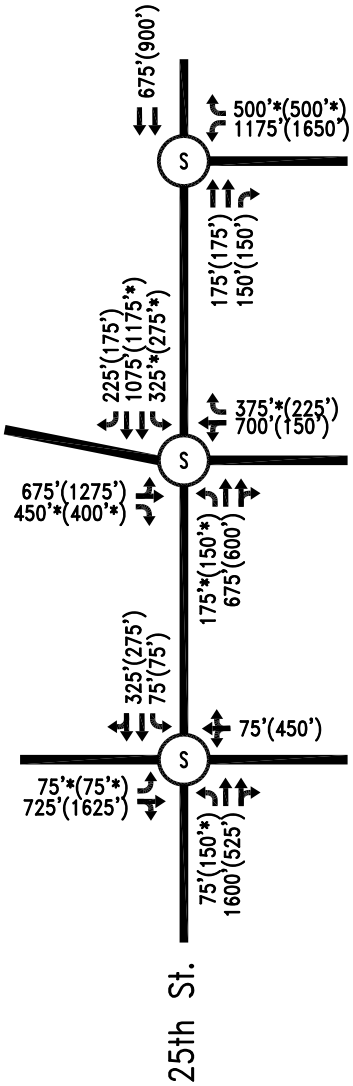


I-94 N. Ramp

I-94 S. Ramp

23rd Ave. S.

Queue Length



Legend	
←	Existing Lane
XX	AM Peak Hour Level of Service
(XX)	PM Peak Hour Level of Service
X(X)	Signalized Intersection Level of Service

Legend	
XXX'	AM 95th% Queue Length (ft)
(XXX')	PM 95th% Queue Length (ft)
S	Signalized Intersection
*	Queue length exceeds storage provided

N

NO SCALE

25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Peak Hour Level of Service and Queue Lengths Using SimTraffic 7

Figure 8

O:\Proj\55271212\dwg\17 Draft Report\Fig 08 Year 2030 Peak Hour Level of Service and Queue Lengths Using SimTraffic 7.dwg, Model, 11/14/2008 4:29:32 PM, ayates

2.3 Safety Analysis

The purpose of the safety analysis was to examine crash history, identify high crash locations (greater than five crashes per year), identify potential countermeasures for the types of crashes, and recommend safety enhancements at those locations.

Crash statistics for the study area were provided by NDDOT. These statistics document crash history from December, 2004 to December, 2007. These crashes were separated into three categories by severity: *Property Damage Only* (PDO) (reportable crashes with at least $1,000 damage); *Injury*; and *Fatality.*

2.3.1 Identification of High Crash Locations

Roadway sections and intersections with greater than five crashes per year were considered high-crash locations. Quantifying what is considered a high crash rate can be determined by the surrounding environment and available crash statistics. For this study, a detailed statistical analysis was not performed because of the time and effort involved. As an alternative, a 'rule-of-thumb' threshold was utilized to define high-crash locations. The *Manual on Uniform Traffic Control Devices* (MUTCD) uses five or more crashes as one of the threshold criteria for the Crash Experience traffic signal warrant (Warrant 7). For this reason, high-crash locations were defined as intersections with greater than five crashes per year

Using the NDDOT crash history, the top three high-crash roadway sections and intersections were identified and are discussed in the following sections. For the purposes of this analysis, intersection crashes were considered to occur less than or equal to 50 feet from an intersection. Conversely, roadway section crashes were considered as those crashes that occur greater than 50 feet from an intersection.

2.3.1.1 Roadway Sections

The NDDOT crash history catalogued crashes on 14 roadway sections on the study stretch of 25th Street. Of those, only one roadway section averaged greater than five crashes per year: 20th Avenue South to the I-94 North Ramp Terminal, with an average of 5.67 crashes per year. Additionally, the *Manual of Transportation Engineering Studies,* Institute of Transportation Engineers (ITE), 2000, includes a methodology for calculating crash rates. The ITE crash rates were calculating using year 2006 ADT data from the FM COG. **Table 1** displays the roadway section crash summary, with the high-crash location highlighted in red. The ITE crash rates are included for informational purposes.

Table 1. Roadway section Crash Summary - December 2004 to December 2007

Section	Severity			Total	Crash Rate*	Average per year
	PDO	Injury	Fatality			
17th Ave S to 20th Ave S	9	4	0	13	192	4.33
20th Ave S to I-94 North Terminal	13	4	0	17	346	**5.67**
I-94 N. Terminal to S.Terminal	8	3	0	11	184	3.67
I-94 South Terminal to 23rd Ave S	3	2	0	5	154	1.67
23rd Ave S to 24th Ave S	1	0	0	1	73	0.33
24th Ave S to 25th Ave S	1	0	0	1	73	0.33
25th Ave S to 25 1/2 Ave S	1	0	0	1	65	0.33
25 1/2 Ave S to 26th Ave S	0	0	0	0	0	0.00
26th Ave S to 26 1/2 Ave S	0	0	0	0	0	0.00
26 1/2 Ave S to 27th Ave S	0	0	0	0	0	0.00
27th Ave S to Fremont Dr	0	0	0	0	0	0.00
Fremont Dr to 30th Ave S	0	2	0	2	91	0.67
30th Ave S to 30 1/2 Ave S	4	0	0	4	285	1.33
30 1/2 Ave S to 32nd Ave S	7	2	0	9	367	3.00

* ITE Crash Rate for Section (RSEC), expressed as "Crashes per 100 million vehicle-miles"

$$RSEC = \frac{100{,}000{,}000A}{365T \times V \times L}$$

A= Number of Reported Crashes
T= Time frame of the analysis, years
V= Average Daily Traffic Volume
L= Length of the section, miles

2.3.1.2 Intersections

There are 15 intersections in the study area. The three highest average crash rates occurred at the following intersections:

- I-94 South Ramp Terminal, with an average of 13.33 crashes per year
- 32nd Avenue South, with an average of 11.00 crashes per year
- 17th Avenue South, with an average 9.00 crashes per year.

Table 2 displays the intersection crash summary, with the high-crash locations highlighted in red. The ITE crash rates are included for informational purposes.

Table 2. Intersection Crash Summary - December 2004 to December 2007

Intersection	Severity			Total	Crash Rate*	Average per year
	PDO	Injury	Fatality			
17th Avenue South	17	10	0	27	0.69	**9.00**
20th Avenue South	7	7	0	14	0.38	4.67
I-94 North Terminal	9	8	0	17	0.49	5.67
I-94 South Terminal	26	14	0	40	1.13	**13.33**
23rd Avenue South	10	1	0	11	0.40	3.67
24th Avenue South	1	0	0	1	0.04	0.33
25th Avenue South	4	0	0	4	0.16	1.33
25 1/2 Avenue South	0	0	0	0	0.00	0.00
26th Avenue South	1	0	0	1	0.04	0.33
26 1/2 Avenue South	2	0	0	2	0.09	0.67
27th Avenue South	0	1	0	1	0.05	0.33
Fremont Drive	0	0	0	0	0.00	0.00
30th Avenue South	4	1	0	5	0.25	1.67
30 1/2 Avenue South	1	1	0	2	0.11	0.67
32nd Avenue South	22	11	0	33	0.93	**11.00**

* ITE Crash Rate for a Spot (RSP), expressed as "Crashes per million entering vehicles"

$$RSP = \frac{1{,}000{,}000A}{365T * V}$$

A= Total Crashes for the intersection
T= Time frame for the analysis, years
V= Average Daily Traffic Volume

2.3.2 Identification of Countermeasures

The intersections and roadway sections identified previously were examined to determine whether the crashes that occurred exhibited any patterns. The collision diagrams from NDDOT were used for this determination. For each location, feasible countermeasures were identified using the ITE *Manual*. HWS also wanted to determine how the countermeasures would reduce crashes. ITE does not include crash reduction factors for countermeasures; however crash reduction factors (CRF) are documented in *Desktop Reference for Crash Reduction Factors,* Federal Highway Administration (FHWA), 2007. The factors were used to determine how countermeasures may reduce crashes.

2.3.2.1 20th Avenue South to I-94 North Terminal

On this roadway section, the prevalent crashes were southbound rear-end crashes. Southbound vehicles encountered vehicles stopped in queue at the I-94 North Ramp Terminal. The ITE recommended countermeasures, along with the FHWA CRF are as follows.

- Providing progression with improved signal timings – 17% CRF for PDO rear-end crashes
- Increasing the yellow change interval – 15% CRF for all crash types and severities
- Adding an additional primary signal head – 28% CRF for rear-end crashes of all severities

- Increasing the number of lanes – 53% CRF for read-end crashes of all severities

2.3.2.2 25th Street & 17th Avenue South

This intersection experienced many different crash types, but most were northbound left turns. There was a definite pattern to those crashes, according to the accident reports. Descriptions from these reports indicate that the northbound left-turning drivers expected the southbound through drivers to stop on the yellow light, which did not happen. Consequently, the northbound left-turning vehicles were struck by the southbound through vehicles. The countermeasures and CRF for left-turn crashes are as follows.

- Improving the change intervals – 63% CRF for PDO left-turn crashes, 55% CRF for injury left turn crashes
- Increasing the yellow time – 15% CRF for all crash types and severities
- Installing dual-left turn lanes – 71% CRF for PDO left-turn crashes, 47% CRF for injury left turn crashes
    - Increasing the number of lanes – 71% CRF for left turn crash types of all severities

2.3.2.3 25th Street & I-94 South Ramp Terminal

At this intersection, the predominant crash type was left-turn crashes. These crashes occurred when the northbound left-turning vehicles turned to access the I-94 eastbound loop on-ramp and were struck by the southbound through traffic. Since left-turn crashes were the most numerous crash type, the same countermeasures identified for 17th Avenue South apply to this intersection at the I-94 South Ramp Terminal. The countermeasures and CRF are as follows.

- Improving the change intervals – 63% CRF for PDO left-turn crashes, 55% CRF for injury left turn crashes
- Increasing the yellow time – 15% CRF for all crash types and severities
- Installing dual-left turn lanes – 71% CRF for PDO left-turn crashes, 47% CRF for injury left turn crashes
- Increasing the number of lanes – 71% CRF for left turn crash types of all severities

2.3.2.4 25th Street & 32nd Avenue South

This intersection experienced many different crash types. There was no single contributing factor or pattern to these crashes. Since left-turn crashes were the most numerous crash type, the same countermeasures identified for 17th Avenue South and the I-94 South Ramp Terminal apply to this intersection at 32nd Avenue South. The countermeasures and CRF are as follows.

- Improving the change intervals – 63% CRF for PDO left-turn crashes, 55% CRF for injury left turn crashes
- Increasing the yellow time – 15% CRF for all crash types and severities
- Installing dual-left turn lanes – 71% CRF for PDO left-turn crashes, 47% CRF for injury left turn crashes
- Increasing the number of lanes – 71% CRF for left turn crash types of all severities

Many of the potential countermeasures are related to geometric improvements. The study team used this information when developing various lane alternatives. The following chapters describe the process by which alternatives were developed and refined, as well as how each alternative should improve safety.

3.0 Preliminary Alternatives

Once the operations and safety were analyzed and documented for the existing lane geometry, the study team, with the help of the SRC, was able to develop several different lane geometry alternatives. These alternatives were developed to address the operational and safety issues discussed in Section 2 of this report. Once the preliminary alternatives were developed, the study team performed a cursory analysis for each alternative to determine if traffic operations or safety could be improved. The following sections describe the alternatives that were developed, along with the analysis results.

3.1 Alternative Development

The preliminary alternatives were developed for 25th Street between 17th Avenue South and the I-94 South Ramp Terminal. This section of roadway is anticipated to experience poor levels of service in year 2030, with existing lane geometry. The study team identified three distinct improvements that could be implemented to improve levels of service. These improvements included:

- Widening 25th Street to six lanes
- Side street lane improvements
- Northbound 25th Street to eastbound I-94 on-ramp

These improvements were combined in different variations to develop two alternatives with various sub-options. Arbitrarily, alternative options that only widened 25th Street were referred to as "Alternative 1" while the combinations that widened 25th Street and included the eastbound on-ramp to I-94 were referred to as "Alternative 2". This nomenclature will be used for the remainder of this document. The following paragraphs describe the alternatives and sub-options that were developed.

It should be noted, preliminary alternatives were not developed or studied for 25th Street south of 23rd Avenue South. The results of the existing conditions capacity analysis indicated 25th Street between 23rd Avenue South and 32nd Avenue South should have sufficient capacity to achieve minimum desired levels of service in year 2030.

1a. Alternative 1a widens 25th Street to six lanes between 17th Avenue South and the I-94 North Ramp Terminal. In the southbound direction, the widening begins north of 17th Avenue South and terminates as a lane drop on to the I-94 eastbound loop ramp. In the northbound direction, the widening begins at the I-94 North Ramp Terminal as a free westbound right-turn into the outside lane. The new outside lane extends north through the 17th Avenue South intersection. In addition to this widening, auxiliary left-turn bays are added to the I-94 South Ramp Terminal/18th Street South.

1b. The widening configuration of Alternative 1b is the same as 1a, except in the northbound direction, the widening begins south of the I-94 South Ramp Terminal, instead of beginning at the I-94 North Ramp Terminal. This alternative also includes auxiliary left turn bays for the eastbound and westbound approaches of the I-94 South Ramp Terminal/18th Street South intersection.

1c. Proposed geometry for Alternative 1c is very different from either 1a or 1b. Widening of 25th Street in the southbound direction begins at 17th Avenue South as a free eastbound right-turn into the outside lane. The new outside southbound lane will terminate as a lane drop onto the I-94 Eastbound Loop Ramp. In the northbound direction, the widening of 25th Street begins as a westbound free right-turn at 18th Street South. The widening would terminate at 17th Avenue South as a dual northbound left-turn. In addition to this widening, auxiliary left turn bays are added for the eastbound and westbound approaches of the I-94 South Ramp Terminal/18th Street South intersection.

2a. Widening of 25th Street for Alternative 2a is very similar to that of Alternative 1a; the termini of the widening are the same. The difference between these two alternatives is the addition of an eastbound on-ramp to I-94. As a result, the geometry at the I-94 South Ramp Terminal will change. Northbound left turns along with westbound through movements are eliminated and will now use the new on-ramp. The westbound right is a free right onto the outside northbound through lane. This through lane is short and terminates as a drop lane onto the eastbound on-ramp to I-94. In addition to these changes, an auxiliary left turn bay is proposed for the eastbound approach of the I-94 South Ramp Terminal.

2b. Widening of 25th Street in the southbound direction begins north of 17th Avenue South and terminates as a lane drop on to the I-94 eastbound loop ramp. In the northbound direction, the widening begins at the I-94 North Ramp Terminal and extends through the 17th Avenue South intersection. Several other lane changes are also included in this option. One of these changes includes the addition of a northbound left-turn bay to create a dual left-turn movement at 17th Avenue South. An eastbound on-ramp to I-94 is also included with this option. South of this proposed on-ramp, 25th Street is widened to the outside in the northbound direction. This begins south of the I-94 South Ramp Terminal and terminates as a lane drop onto the proposed on-ramp. Lastly, an auxiliary left turn bay is proposed for the eastbound approach of the I-94 South Ramp Terminal.

A cursory-level analysis was performed for each alternative and sub-options to compare the benefits of each combination. Year 2030 PM peak period traffic volumes were used with Synchro software to determine the resulting LOS for each alternative. The results of the analysis for each variation are displayed in **Figure 9**.

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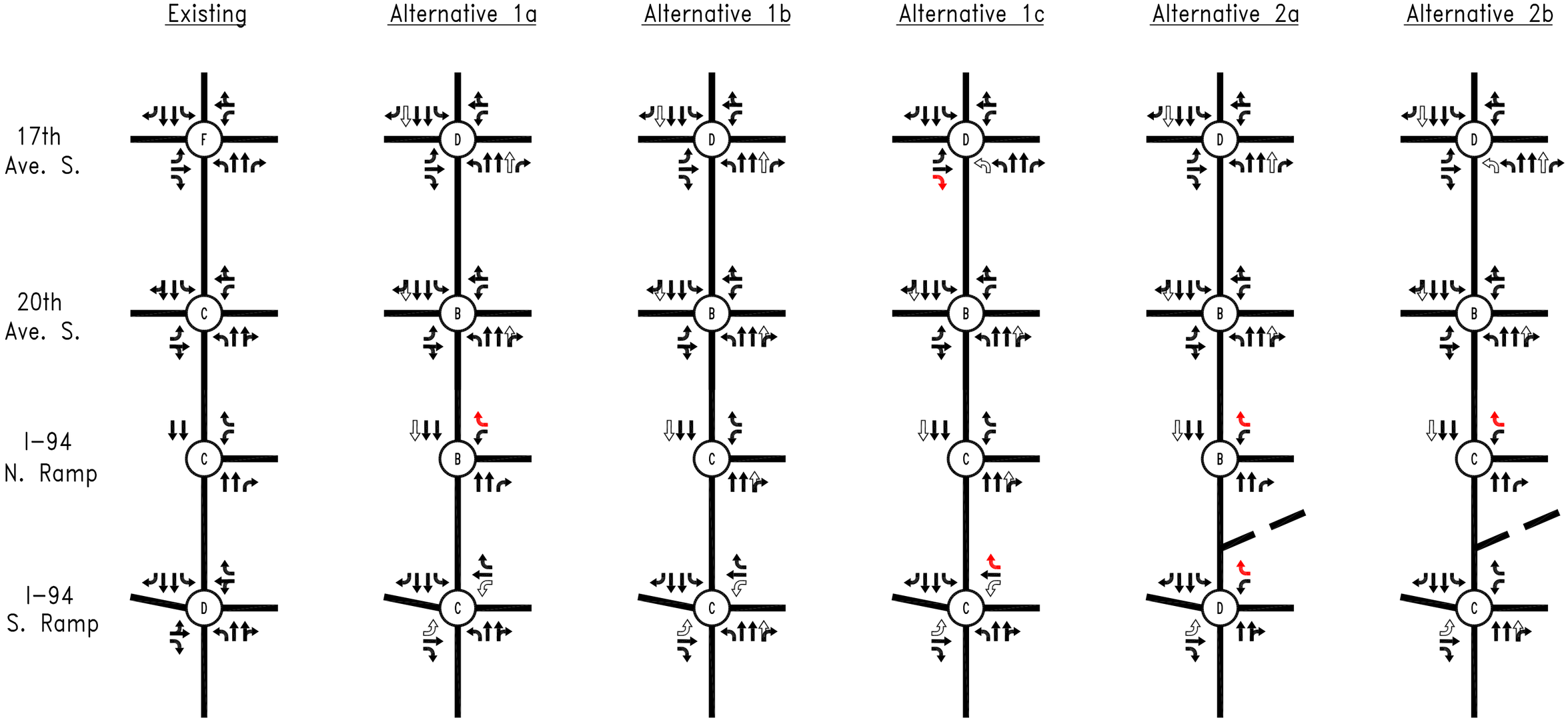

25th Street Corridor Study
City of Fargo, North Dakota

Preliminary Alternative Comparison

Figure 9

4.0 Alternative Refinement Process

The results of the analysis for the preliminary alternatives were discussed with the SRC on October 31, 2007. The purpose of that meeting was to identify the most desirable geometric features from each alternative. These features would then be used to develop refined alternatives that would be studied in greater detail.

At the conclusion of that meeting, two alternatives were identified for further study. One alternative would maintain the existing interchange configuration ("Alternative 1"), and one would incorporate an eastbound on-ramp to I-94 in the southeast quadrant of the interchange ("Alterative 2"). Both alternatives examined 25th Street as a 6-lane section from 17th Avenue South to 23rd Avenue South.

While the main components that make up each alternative were straightforward, there were many different design details that went into the development of the refined alternatives. These details were utilized to develop project concept plans. These plans were used throughout the study process to show where right-of-way impacts may occur. In many cases, the design details that went into the project concept plans determined the extent of impacts for each alternative. As a result, the study team developed project concept plans for the two refined alternatives through an iterative process. The study team consulted the SRC after each iteration to further refine the project concept plans. At the conclusion of this process, project concept plans for the two alternatives were presented at a public meeting. The following sections describe the process and analyses that were performed for each iteration.

It should be noted that dual northbound left-turn bays at the intersection of 17th Avenue South and 25th Street were eliminated from consideration for the remainder of the study process for several reasons:

- Through discussions with City staff, the study team was informed that 17th Avenue South currently experiences heavy traffic volumes despite the fact that it is a two-lane residential street. The heavy volumes are comprised of local neighborhood traffic and traffic traveling to the West Acres area. Many of the local residents feel that the traffic volumes along 17th Avenue South are already too high. Adding a dual northbound left would only promote the use of 17th Avenue South and exacerbate the problem.
- The outside lane of the dual left-turn bay may be under-utilized. In order for the dual left-turn bays to work properly, 17th Avenue South would need to be updated to receive two lanes of turning traffic. Currently, there is only one receiving lane and there are no plans to widen 17th Avenue South west of 25th Street to two lanes. To make the dual left function properly, a second receiving lane would need to be constructed. This receiving lane would probably drop at East Gateway Circle. As a result, drivers in the outside left-turn bay would either need to turn onto East Gateway Circle or merge left to travel west. This would lead to underutilization of the outside lane and therefore would not provide the capacity benefit for which it would be intended.

4.1 Preliminary Concept Plan Development and Traffic Analysis

The study team's first attempt to develop project concept plans for each alternative was guided by a set of minimum design criteria established by the SRC at the October 31st meeting. These criteria can be found in Appendix B. The following sections describe the geometric design details for each alternative and the resulting LOS.

4.1.1 Alternative 1

As mentioned previously, the proposed geometry for 25th Street was identified as six lanes wide from 23rd Avenue South to 17th Avenue South. The following sections discuss geometric features and corresponding levels of service for Alternative 1. The project concept plans and LOS figures for the first iteration of Alternative 1 can be found in Appendix B.

4.1.1.1 Proposed Geometry

The intersection of 25th Street with 23rd Avenue South includes improvements only to the north leg. The third lane added to the southbound approach drops at this intersection as a right-turn lane. The southbound approach has three lanes while the northbound departure consists of two lanes directly north of 23rd Avenue South which then tapers out to three lanes.

The existing right-of-way between 23rd Avenue South and 18th Street South is approximately 100 feet. Because of this, minimum design standards are implemented to avoid impacting additional right-of-way. In addition, the roadway is shifted to the west to fit into the existing right-of-way. This section contains a 15-foot painted median, 11-foot lanes, two-foot curb and gutter widths, and an eight-foot bike trail with a two-foot separation from the roadway.

The intersection of 25th Street with 18th Street South is designed with improvements on all legs. The south leg has a left-turn lane, two through lanes and a shared right-turn/through lane. The north leg has the same configuration; however it tapers out to desirable lane widths. The west leg is expanded to have a right-turn lane, in addition to a through lane and a left-turn lane. The east leg is improved to cross 25th Street with more tangent than what currently exists but the lane configuration was not changed. A retaining wall is necessary on the north side of this leg to tie in before the parking lot.

On 25th Street between 18th Street South and the Interstate 94 North Ramp Terminal, right-of-way allows the section to taper out to more desirable design criteria. This section contains a 17-foot paved median, 12-foot lanes, 2 ½-foot curb and gutter widths, and a ten-foot bike trail.

The North Ramp Terminal returns will only be reconstructed where necessary to tie into 25th Street.

On 25th Street between the I-94 North Ramp Terminal and 20th Avenue South, right-of-way allows the section to have more desirable design criteria. This south portion of this section contains a 17-foot paved median, 12-foot lanes, 2 ½-foot curb and gutter widths, and a ten-foot bike trail. As the section approaches 20th Avenue South, it narrows to line up with 25th Street north of 20th Avenue South.

On 25th Street between 20th Avenue South and 17th Avenue South, the roadway section contains a 15-foot painted median, 12-foot lanes, and 2 ½-foot curb and gutter widths. With this section, the existing bike trail was utilized and there are negligible impacts to the right-of-way.

On 25th Street north of 17th Avenue South, the improvements include the addition of a southbound right-turn lane. This ties back into the existing roadway approximately 1000 feet north of the intersection of 25th Street and 17th Avenue South.

4.1.1.2 Capacity Analysis

A LOS analysis was performed for Alternative 1 using Synchro, Version 7, to determine the traffic operations at study intersections. The proposed lane configurations and optimized timings were used. For this report, acceptable levels of service were considered LOS C or better for intersections and LOS D or better for individual movements. The following sections discuss the results of the analyses for each future year peak period scenario. The signal phasing and timing plans for the analyses are displayed in Appendix B.

Year 2030 AM

For the future AM peak period, all intersections operate at LOS C or better with Alternative 1 proposed lane geometry. There are, however, some individual movements at the intersection of 20th Avenue South that operate at LOS E (westbound left and southbound left). All other intersection movements operate at LOS D or better. The year 2030 AM peak hour levels of service for Alternative 1 can be found in Appendix B.

Year 2030 PM

The results of the analysis indicate that levels of service improve at each study intersection from the existing lane configuration; however, some undesirable levels of service still remain with proposed Alternative 1 lane geometry. The intersection of 17th Avenue South is anticipated to experience LOS D. In addition, there are individual movements at the intersections of 17th Avenue South, 20th Avenue South, the I-94 South Ramp Terminal, and 23rd Avenue South are anticipated to experience LOS E or worse. These levels of service for Alternative 1 can be found in Appendix B.

4.1.2 Alternative 2

For this alternative, the proposed geometry would be the relatively the same as Alternative 1 (six lanes wide from 23rd Avenue South to 17th Avenue South) except that it will incorporate an eastbound on-ramp in the southeast quadrant of the interchange. The following sections discuss geometric features and corresponding levels of service for Alternative 2. The project concept plans for the first iteration of Alternative 2 can be found in Appendix B.

4.1.2.1 Proposed Geometry

The proposed improvements at the intersection of 25th Street and 23rd Avenue South are the same as Alternative 1 (described in Section 4.1.1.1).

On 25th Street between 23rd Avenue South and 18th Avenue South, Alternative 2 is nearly identical to Alternative 1. The geometrics between Alternative 2 and Alternative 1 at this location begin to vary as 25th Street approaches 18th Avenue South, where a shared right-turn/through lane is added.

The intersection of 25th Street with 18th Street South is designed with improvements on all legs. The south leg has four approach lanes, three through lanes and one shared right-turn/through lane. Northbound left turns are no longer necessary from the south leg because of the proposed I-94 eastbound on-ramp. These movements are restricted with a channelizing island located on the west leg of the intersection. The north leg has a left-turn lane, two through lanes and a shared right-turn/through lane. Also, the north leg is tapered out to desirable lane widths north of the intersection. The only change to the west leg from Alternative 1 is the relocation of the island to restrict northbound left turn movements. The east leg is improved to cross 25th Street with more tangent than what currently exists. It is modified to have a right-turn lane and a left-turn lane. The through movement is no longer necessary or possible from the west leg. A retaining wall is necessary on the north side of this leg to tie in before the parking lot.

On 25th Street between 18th Street South and the I-94 North Ramp Terminal, the section was designed with a 17-foot paved median, 12-foot lanes, 2 ½-foot curb and gutter widths, and a ten-foot bike trail. There is an additional northbound lane that allows right-turn access to the eastbound I-94 on-ramp.

The North Ramp Terminal returns will only be reconstructed where necessary to tie into 25th Street.

On 25th Street between the North Ramp Terminal and 20th Avenue South, Alternative 2 is identical to Alternative 1 (described in Section 4.1.1.1).

On 25th Street between 20th Avenue South and 17th Avenue South, Alternative 2 is identical to Alternative 1 (described in Section 4.1.1.1).

On 25th Street between 17th Avenue South and 13th Avenue South, the improvements include the addition of a southbound right-turn lane at the intersection of 17th Avenue South as well as the addition of a southbound through lane that extends from 13th Avenue South to 17th Avenue South. With this configuration, the exclusive southbound right-turn lane at 25th Street and 13th Avenue South becomes a shared right-turn/through lane.

4.1.2.2 Capacity Analysis

A LOS analysis was performed for Alternative 2 using proposed geometry and the same methodologies used for the Alternative 1 analysis. The following sections discuss the results of the analyses for each future year peak period scenario. The signal phasing and timing plans for the analyses are displayed in Appendix B.

Year 2030 AM

For the future AM peak period, all intersections operate at LOS C or better with Alternative 2 proposed lane geometry. There is, however, one individual movement at the intersection of 20th Avenue South that operates at LOS E (westbound left). All other intersection movements are anticipated to operate at LOS D or better. The year 2030 AM peak hour levels of service for Alternative 2, are displayed in Appendix B.

Year 2030 PM

The results of the analysis indicate that levels of service for Alternative 2 proposed geometry will not differ significantly from that of Alternative 1 for the PM peak period. The LOS at the I-94 South Ramp Terminal is anticipated to only improve slightly from Alternative 1. The year 2030 PM peak hour levels of service for Alternative 2 are displayed in Appendix B.

4.2 Updated Concept Plan and Traffic Analysis

The preliminary concept plans and traffic analyses described in the preceding section were discussed with the SRC on January 14, 2008. Through these discussions, a variety of geometric updates to the preliminary concept plans were identified. The following sections discuss those updates.

4.2.1 Geometric Updates

4.2.1.1 Alternative 1

The following is a list of geometric changes/updates for Alternative 1:

1. Realign 25th Street to avoid jogs in the roadway. The City can purchase ROW on the east side between 23rd Avenue and 18th Street South, if necessary.
2. HWS should narrow the raised median width. The raised medians noses shall be 6’ (face-of-curb to face-of-curb).
3. The northbound taper between the I-94 North Ramp Terminal and 20th Avenue South should start just north of the North Ramp Terminal to make the transition smoother.

4. The painted medians may be 12'.
5. North of 20th Avenue South, the widening of the road comes close to the existing bike trail of the west side of 25th Street. Due to vertical difference between the road and bike trail, the bike trail may need to be rebuilt.
6. HWS should develop figures that show intersections east and west of 25th Street on 17th Avenue South.
7. The southbound right-turn lane added on the north leg of the intersection of 25th Street and 17th Avenue South can be eliminated. The decision to eliminate the southbound right-turn bay was based partly on a low number of southbound right turns at the intersection. In addition, the southbound through queue will block any auxiliary southbound right-turn bay.
8. Alternative 1 will show a combination of painted and raised medians.

The updated project concept plans for this iteration of Alternative 1 are located in Appendix C.

4.2.1.2 Alternative 2

The following is a list of geometric changes/updates for Alternative 2:

1. Realign 25th Street to avoid jogs in the roadway. The City can purchase ROW on the east side between 23rd Avenue and 18th Street South, if necessary.
2. HWS should narrow the raised median width. The raised medians noses shall be 6' (face-of-curb to face-of-curb).
3. On 18th Street South, the right turn lane on the east leg should be shifted over to the painted-out area. This will provide more tangent and minimize impacts.
4. HWS will remove the short shared northbound through /right-turn lane at 18th Street South. This will change the northbound lane configuration from four through lanes with a shared right to three through lanes with a shared right. This change was made because it may confuse drivers and would add negligible capacity benefits to the intersection.
5. The taper for right-turn lane onto the proposed I-94 eastbound on-ramp should begin just north of 18th Street South.
6. Look at shifting the proposed I-94 eastbound on-ramp to the north to better fit in taper. This may require a retaining wall. Use state contours to determine the appropriateness.
7. Add bike trail tie-in near proposed I-94 on-ramp.
8. Alternative 2 will show all raised medians.

The updated project concept plans for this iteration of Alternative 2 are located in Appendix C.

4.2.2 Capacity Analysis Updates

The following sections discuss the issues related to capacity analysis identified on the January 14, 2007, conference call with the SRC. The updated capacity analysis is also discussed.

4.2.2.1 Updates

Prior to discussions with the SRC, the study team performed some preliminary SimTraffic simulation analyses to further aid the discussion regarding traffic

operations for the two alternative lane geometries. The results of the simulation analysis seemed to indicate that Alternative 2 would operate better than Alternative 1; however, several issues and questions arose from the results of the capacity analysis. The following is a list of questions and comments that were identified by the committee:

1. The committee requested that the simulations be re-run with the updated geometry identified earlier in the call.
2. The updated simulation analysis should include 17th Avenue South.
3. At 17th Avenue South, a significant amount of walk and flashing don't walk time is required for pedestrians to cross the proposed 25th Street configuration. Since pedestrians are not anticipated to use the walk phase for every cycle, HWS can run the simulations without an eastbound/westbound walk phase at 17th Avenue South.
4. The preliminary simulation analyses at 17th Avenue South indicated that levels of service are anticipated to be poor. One of the factors that contributed to the poor levels of service was the heavy volume of northbound left-turns at the intersection. Another factor that may also have contributed to the poor levels of service was that the northbound left was operating with a "protected only" phase. This was implemented because the northbound left must cross three southbound through lanes. As a result, HWS looked at simulating the intersection with "permitted-protected" phasing for the northbound left, even though it is not a desirable signal operation.
5. The proposed geometry for each alternative introduces a lane drop for the northbound and southbound right-turn lanes at 17th Avenue South and 23rd Avenue South, respectively. These lane drops cause drivers to distribute themselves unevenly across the available lanes on upstream approaches. This means that approach lanes upstream of the drop lanes may not function as a full through lane. To take this into consideration, the equivalent number of through lanes for an approach can be estimated by adjusting the lane utilization factor. The *Highway Capacity Manual* states, "The lane utilization adjustment factor, f_{LU}, accounts for the unequal distribution of traffic among the lanes in a lane group with more than one lane…This adjustment is normally applied and can be used to account for the variation of traffic flow on the individual lanes in a lane group due to upstream or downstream roadway characteristics such as changes in the number of lanes available or flow characteristics such as the prepositioning of traffic within a lane group for heavy turning movements." For these reasons, the lane utilization factor was calculated for approaches upstream of the drop lanes. These factors were then utilized for all of the capacity analysis scenarios. The calculations for the lane utilization factors are provided in Appendix C.
6. One improvement identified for Alternative 2 was to add another southbound through lane to the north leg of 17th Avenue South. This lane would then extend back to 13th Avenue South. The SRC asked that this lane and its effect at 13th Avenue South be added to the capacity analyses to aid in making a decision on whether the improvement provides additional benefits to the corridor. As a result, traffic operations at 13th Avenue South were studied using year 2030 traffic volumes. Year 2030 peak hour traffic volumes for this intersection were developed using existing traffic count information and future year traffic projections documented in the "*Thirteenth Avenue South Corridor Study and*

Access Control Plan – Final Report", November 2000, prepared by HWS Consulting Group. Peak hour volumes at 13th Avenue South are provided in Appendix C.

The study team utilized these comments to update the concept plans for each alternative. The updated project concept plans are displayed in Appendix C.

4.2.2.2 Updated Capacity Analysis

Alternative 1

A LOS analysis was performed for Alternative 1 using Synchro, Version 7, to determine the study intersection traffic operations. The proposed lane configurations and optimized timings were used. The following sections discuss the results of the analyses for each future year peak period scenario. The traffic signal phasing and timing plans for the analyses are provided in Appendix C.

Year 2030 AM

For the future year AM peak period, all intersections operate at LOS C or better with Alternative 1 proposed lane geometry. However, there are some individual movements at the intersection of 13th Avenue South that operate at LOS D or worse (southbound left, and eastbound left). The year 2030 AM peak hour levels of service for Alternative 1 are displayed in Appendix C.

Year 2030 PM

The results of the analysis indicate that levels of service improve at each study intersection from the existing lane configuration; however, some undesirable levels of service still remain with proposed Alternative 1 lane geometry. The intersections of 13th Avenue South and 17th Avenue South are anticipated to experience LOS D. In addition, some of the individual movements at the intersections of 13th Avenue South, 17th Avenue South, and 23rd Avenue South are anticipated to experience LOS E or worse. These levels of service for Alternative 1 can be found in Appendix C.

Alternative 2

A LOS analysis was performed for Alternative 2 using proposed geometry and the same methodologies used for the Alternative 1 analysis. The following sections discuss the results of the analyses for each future year peak period scenario. The traffic signal phasing and timing plans for the analyses are provided in Appendix C.

Year 2030 AM

For the future AM peak period, all intersections operate at LOS C or better with Alternative 2 proposed lane geometry. However, there are some individual movements at the intersection of 13th Avenue South that operate at LOS E or worse (westbound left, and southbound left). All other intersection movements operate at LOS D or better. The year 2030 AM peak hour levels of service for Alternative 2 are displayed in Appendix C.

Year 2030 PM

The results of the analysis indicate that levels of service for Alternative 2 proposed geometry will not differ significantly from that of Alternative 1 for the PM peak period. The LOS at the I-94 South Ramp Terminal is anticipated to only improve slightly from Alternative 1. The year 2030 PM peak hour levels of service for Alternative 2 are displayed in Appendix C.

4.2.2.3 SimTraffic Simulation Analysis of 25th Street

A simulation analysis was performed for Alternatives 1 and 2 using SimTraffic, Version 7. The analysis was performed because simulations take into account how intersections interact together, giving consideration to storage lengths and the distances between the intersections. The proposed lane configurations and optimized timings were used for this analysis. For each scenario, ten simulations were performed. The reported results are an average of the ten runs. The following sections discuss the results of the analyses for each future year peak period scenario. The traffic signal phasing and timing plans for the analyses are provided in Appendix C.

Alternative 1

Year 2030 AM

The results of the analysis indicate that several intersections are anticipated to operate at LOS D or worse (13th Avenue South, 17th Avenue South, and I-94 South Ramp Terminal). In addition, many of the individual movements at study intersections operate at LOS E or worse. These operations are not considered acceptable; however, they are a significant improvement when compared with the levels of service experienced along the corridor using existing lane geometry (see Section 2.2.3). The year 2030 AM peak hour levels of service for Alternative 1 are displayed in Appendix C. Appendix C also lists the LOS results for all analysis scenarios in tabular format.

Year 2030 PM

Similar to the AM analysis scenario, the results of the PM peak hour analysis for Alternative 1 indicated that several study intersections will operate poorly under year 2030 traffic conditions (13th Avenue South, 17th Avenue South, and I-

94 South Ramp Terminal). Also, many of the movements operate at LOS E or worse. However, there is significant improvement when these levels of service are compared with the levels for the year 2030 existing lane configuration scenario (see Section 2.2.3). These levels of service for Alternative 1 are displayed in Appendix C. Appendix C also lists the LOS results for all analysis scenarios in tabular format.

Alternative 2

Year 2030 AM

The results of the analysis indicate that several intersections are anticipated to operate at LOS D or worse (13th Avenue South, 17th Avenue South, and I-94 South Ramp Terminal). In addition, many of the individual movements at study intersections operate at LOS E or worse. These results were compared with the Alternative 1 levels of service and indicated that the new on-ramp configuration may improve operations at the I-94 South Ramp terminal. However, there are intersections at which delay increases (17th Avenue South, and 23rd Avenue South), albeit slightly. The year 2030 AM peak hour levels of service for Alternative 2 are displayed in Appendix C. The LOS results for all analysis scenarios are listed in tabular format in Appendix C.

Year 2030 PM

The results of the PM peak hour analysis for Alternative 2 indicated that two study intersections will operate poorly under year 2030 traffic conditions (13th Avenue South, and 17th Avenue South). Many of the movements operate at LOS E or worse. When compared with Alternative 1 levels of service, the results indicate that the Alternative 2 proposed lane geometry may improve levels of service at the I-94 South Ramp Terminal; however, other intersections experience increases in delay (17th Avenue South and 23rd Avenue South). These levels of service for Alternative 2 are displayed in Appendix C. Appendix C also lists the LOS results for all analysis scenarios in tabular format.

4.2.2.4 CORSIM Simulation Analysis of I-94

Another issue that was discussed during the January 14th conference call was the effect the proposed I-94 eastbound on-ramp (in Alternative 2) will have on interstate operations. In order to determine the effect of the ramp, a simulation analysis would need to be performed. The SRC identified several issues that needed to be examined for the simulation analysis.

- One of the issues discussed was the distance on I-94 between the proposed ramp tie-in point and the existing off-ramp at the University Drive interchange. The SRC asked that the HWS team study the addition of an auxiliary lane to the interstate between the proposed tie-in point and the

University Drive interchange. The need for an auxiliary lane would depend on the traffic volumes and operations.

- Another item that came up through discussion of the proposed corridor geometries was the use of "through with shared right turn lanes" at interchange ramps. The SRC thought that the HWS team may want to look at adding exclusive right-turn lanes to 25th Street at interchange ramps since NDDOT may require it. However, the SRC representative from NDDOT indicated that exclusive right-turn lanes are typically desirable at ramps, but in this case were not necessary. For this reason, exclusive right turn lanes at interchange ramps were not examined further.

Once the analysis issues along the interstate were established, the study team conducted a simulation analysis for the interstate using TSIS/CORSIM simulation software. This was performed to determine the tie-in's effect on Interstate 94 operations. The tie-in point will be approximately 3100 feet upstream of the eastbound off-ramp at the University Drive interchange. The results of the analysis indicated the proposed eastbound I-94 on-ramp should not interfere with I-94 operations between 25th Street and University Drive. The results of these analyses can be found in Appendix D, "*Simulation Analysis Report for the 25th Street Corridor Study, Interstate 94 between Interstate 29 and University Drive South"*, April 2008, prepared by HWS Consulting Group.

4.3 Second Update to Concept Plans and Traffic Analyses

The study team presented the results of the updated concept plans and capacity analyses described in Section 4.2 at a SRC meeting held on April 4, 2008. The purpose of the meeting was to discuss the results of the analysis and to determine if the concept plans or capacity analyses could be further refined. The following sections discuss the updates that were identified, according to alternative.

4.3.1 Alternative 1

For Alternative 1, several issues were discussed regarding the intersection of 25th Street and 17th Avenue South.

- Two changes were identified:
  - The study team was instructed to update the capacity analyses to show permitted/protected operations for the northbound left turns.
  - Another suggested improvement was to develop a frontage road for houses whose driveways have direct access to 17th Avenue South, east of 25th Street. The SRC indicated that this may be possible due to the relocation of the pump lift station from the northeast corner of the intersection to the northwest corner.

The updated results of the Synchro and SimTraffic analyses for Alternative 1 indicated permitted-protected operations do not significantly improve traffic operations at this intersection. The change in traffic signal operations only adds a "sneaker capacity" of one or

two cars per cycle. The results of these analyses can be found in Appendix E. Also, updated project concept plans displaying frontage road options for 17th Avenue South are displayed in Appendix E.

4.3.2 Alternative 2

Several changes were identified for Alternative 2 at the April 4th SRC meeting. The following is a summary of the changes/updates that were identified.

- 25th Street, south of 18th Street/South Ramp Terminal
  - The SRC instructed HWS to change the raised median south of the intersection to a painted median, as it blocks 24th Avenue South. Also, it was suggested that the west leg of 23rd Avenue South should be widened since it is somewhat narrow today. As part of this, HWS was instructed to create a larger radius for the southwest corner of the intersection.
  - Regarding the cross section of 25th Street south of 18th Street/South Ramp Terminal, HWS sought agreement on 11-foot lanes, 17-foot medians, and 2.5-foot curb and gutter. City of Fargo and NDDOT representatives of the SRC agreed that these dimensions should be used to update the section of 25th Street south of 18th Street.
- 25th Street & I-94 Interchange
  - HWS expressed concerns that the proposed tangent for 18th Street on the east side of 25th Street may impact an existing petroleum line. The City offered to provide HWS with GIS utilities information. With this information, HWS was able to determine that a conflict would exist and that the tangent would have to remain as shown.
  - HWS was instructed to remove the right-turn lane into the gas station on the southeast corner of the I-94 South Ramp Terminal. Removal of the turning lane could allow for a shorter perpendicular segment of 18th Street.
  - The group discussed the possibility of southbound dual left turns at the I-94 South Ramp Terminal to accommodate the heavy left-turn movement. However, the group decided against dual left turns at that location for two reasons: first, there would need to be a receiving lane of significant length; second, the bridge would need to be widened to accommodate an additional lane.
  - HWS suggested the possibility of auxiliary lanes on the bridge exclusively for the loop on-ramps. The SRC agreed, and asked the HWS team to re-examine the alternatives with these lanes. The committee also gave instructions that the northbound auxiliary lane should not extend south beyond the proposed on-ramp.
  - Regarding pedestrians at the I-94 North Ramp Terminal, study team representatives said that either the pedestrian underpass needs to be forced (possibly by fencing the at-grade crossing) or removed. The SRC thought that people might not want to pay to remove the underpass, as it is already there. The group decided that a pedestrian refuge island should be added to the I-94 North Ramp Terminal, since pedestrians may still choose to use the at-grade crossing.

As per these discussion items, the project concept plans along, with the capacity analyses, were updated for Alternative 2. It should be noted that the results of the updated capacity analyses for Alternative 2 were not significantly different than the results discussed in Sections 4.2.2.2 and 4.2.2.3. The results of these analyses can be found in Appendix E. Also, updated project concept plans are displayed in Appendix E.

4.4 Final Updates to Concept Plans and Traffic Analyses

The final updates to Alternative 1 and Alternative 2 were identified on a conference call with the SRC on May 8, 2008. The purpose of the meeting was to finalize proposed geometry for each alternative along with any final capacity analysis updates before the first public meeting. The details of the first public meeting were also discussed on the conference call. The following sections discuss the updates that were identified, according to alternative.

4.4.1 Alternative 1

Several changes were identified for Alternative 1 at the May 8th SRC meeting. The following is a summary of the changes/updates that were identified.

- I-94 & 25th Street Interchange
  - South Ramp Terminal
    - The SRC representative from NDDOT mentioned there are vertical sight distance restrictions at the South Ramp Terminal/18th Street. As a result, HWS was instructed to mitigate those restrictions using available contour information.
    - City staff suggested that the whole intersection be shifted south. Shifting the intersection would provide better sight distance and lane alignment. Consideration should be given to minimizing impacts to the gas station located on the southeast corner of the intersection.
- 25th Street & 17th Avenue South
  - A frontage road was identified at the April meeting and added to the east leg for residents with direct access to 17th Avenue South (see Section 4.3.1). The frontage road proposed by HWS would be two-way, tying into 17th Avenue South at Prairie Lane. City of Fargo representatives expressed concern that queues from the signal at 25th Street & 17th Avenue South would block access to an access point at Prairie Lane. They instructed HWS to change the frontage road to one-way westbound, with access at either end. The proposed frontage road could tie into 25th Street at the west terminus, and tie into 17th Avenue South (via the easternmost house with direct access) at the eastern terminus. HWS was also instructed to develop a typical section (before and after) drawing to display at the public meeting.
  - The City of Fargo representatives instructed HWS to extend the two-way left-turn lane (TWLTL) on the east leg to 23rd Street. HWS should show how the new section ties into the existing section east of 23rd Street on 17th Avenue South.

4.4.2 Alternative 2

Several changes were identified for Alternative 2 at the May 8th SRC meeting. The following is a summary of the changes/updates that were identified.

- 25th Street & 23rd Avenue South

- Regarding the west leg, 23rd Avenue South was widened and the radius of the southwest corner was adjusted. HWS expressed concerns that these changes could not be totally accurate since the aerial photographs show the intersection under construction. Because of this, the true curb location could not be identified. City staff would provide HWS with the design file of the intersection for updates.

- I-94 & 25th Street Interchange
  - Proposed On-Ramp
    - The group reviewed the appearance and operation of a High Intensity Activated Crosswalk (HAWK) signal at the at-grade crossing of the proposed on ramp and the trail. City of Fargo representatives pointed out that the use of a HAWK signal at this location would be the first in Fargo and likely the first in North Dakota. This may pose a problem, due to driver familiarity. HWS will showcase the appearance and operation of a HAWK signal at the public meeting on a display board.

At the conclusion of the May 8th conference call, final updates were incorporated into project concept plans and final capacity analyses were completed. The final project concept plans and capacity analyses for Alternatives 1 and 2 were submitted to the SRC on June 18, 2008 in a technical memorandum. The final concept plans and analysis results for each alternative (described in that memorandum) were presented at the first public meeting. The following sections describe the final geometry and capacity analysis results for Alternatives 1 and 2. Please note, input from the first public meeting is described in a later section of this report.

5.0 Refined Alternatives

Two alternatives were developed at the SRC Meeting on October 31st, 2007. Following that meeting, several variations of the alternatives have been studied and documented. The variations to the alternatives resulted through discussions with the SRC members on the following dates:

- January 14th – Conference Call
- April 4th – Meeting in Fargo
- May 8th – Conference Call

Each time, proposed geometry and capacity analyses results were discussed and updated in anticipation of the first public meeting. This chapter of the report discusses the updates identified on the May 8th, 2008 conference call. Each alternative was analyzed using year 2030 AM and PM peak hour traffic volumes and proposed lane configurations.

The following sections discuss the proposed geometrics for each alternative along with the resulting levels of service. The LOS analyses took into consideration the proposed geometry for each alternative including the lane drops for the northbound and southbound right-turn lanes at 17th Avenue South and 23rd Avenue South, respectively. The lane utilization factors for upstream approaches of the drop lanes were recalculated. These factors were then utilized for year 2030 capacity analysis scenarios. The calculations for the lane utilization factors are provided in Appendix C

It should be noted, the operations at the intersection of 25th Street and 13th Avenue South was studied for this report. Originally, this intersection was not considered part of the study corridor; however, one of the alternatives will have an effect on the operations at 13th Avenue South and 25th Street. In order to better understand the benefits of each alternative, traffic operations at 13th Avenue South were studied using year 2030 traffic volumes. Year 2030 peak hour traffic volumes for this intersection were developed using existing traffic count information and future year traffic projections documented in the "*Thirteenth Avenue South Corridor Study and Access Control Plan – Final Report*", November 2000, prepared by HWS Consulting Group. Peak hour volumes at 13th Avenue South are provided in Appendix C.

5.1. Alternative 1

For this alternative, the proposed geometry for 25th Street would be six lanes wide from 23rd Avenue South to 17th Avenue South. The following sections discuss geometric features and corresponding levels of service for Alternative 1.

5.1.1 Proposed Geometric Features

Alternative 1 improves 25th Street from its existing five lanes to six lanes with a median or turn lane from 23rd Avenue South to north of 17th Avenue South. Alternative 1 uses a combination of painted and raised medians. The north and south ends of the project have a painted median; this is where right-of-way is limited or where the project ties back into existing. A raised median

is used in the middle of the project area. Additionally, auxiliary right-turn lanes are added to provide exclusive right-turns onto the I-94 loop on-ramps. The I-94 South Ramp Terminal is shifted approximately 50 feet to the south allowing for improved sight distance on the eastbound off-ramp and 18th Street South. Small alignment transitions (up to approximately 2 ½ feet) are made through some of the intersections because of the changes to the typical sections and to minimize right-of-way impacts. The widths of the intersections provide adequate distance for these shifts and skip markings would be placed to guide drivers through these intersections. If transitions through intersections are deemed undesirable, it will be necessary to jog the alignment in between the intersections. Roads running perpendicular to 25th Street will be impacted minimally in Alternative 1; returns will be constructed where necessary to tie into 25th Street. Lane drop/add tapers are typically 10:1.

Figures 10-15 display the proposed lane geometry for Alternative 1. **Figures 16-19** display the typical sections that were used along the study section of 25th Street as well as 17th Avenue South.

23rd Avenue South Intersection

The intersection of 25th Street with 23rd Avenue South includes improvements only to the north leg. The third lane added to the southbound approach drops as a right-turn lane at this intersection. The southbound approach has three lanes while the northbound departure consists of two lanes directly north of 23rd Avenue South which immediately begins to taper out to three lanes. This is shown in **Figure 10**.

23rd Avenue South to 18th Street South

On 25th Street between 23rd Avenue South and 18th Street South, desirable design standards were mixed with a painted median. The section includes 12-foot lanes with 2 ½-foot curb and gutter. The painted median is 12 feet in width. The section also includes a new bike trail constructed on the east side of the road. It is two feet offset from the back of curb and ten feet in width. The west side does not have a sidewalk or bike trail. Construction encroaches approximately five feet onto property on the east side only. This is shown in **Figure 10**.

18th Street South Intersection

The intersection of 25th Street with 18th Street South/I-94 South Ramp Terminal contains improvements on all legs. The intersection is shifted approximately 50 feet to the south, which allows for better sight distance and improved geometry at 18th Street South. The north and south legs each have a left-turn lane, two through lanes and a shared right-turn/through lane. The west leg is expanded to have a right-turn lane in addition to a through lane and a left-turn lane. The loop ramp will be rebuilt to accommodate the shifted intersection. The east leg was modified to line up with the loop ramp; this has improved the length of tangent tying into 25th Street. The gas lines that run along 18th Street South have limited the amount of improvements available for this leg. This intersection is shown in **Figures 10 and 11**.

18th Street South to the I-94 North Ramp Terminal

On 25th Street between 18th Street South and the I-94 North Ramp Terminal, the section widens to allow a raised median. This transition taper length is 267 feet. This follows guidance from the MUTCD. For roadways with speeds less than 45 mph, the MUTCD suggests tapering over a length determined using the equation $L = WS^2/60$ (where L = length of taper and S = Design Speed). This section contains: a 17-foot paved median; 12-foot lanes; 2 ½-foot curb and gutter widths; and a ten-foot bike trail on the east side. The section also includes auxiliary right-turn lanes through the bridge to provide exclusive access to the loop-on ramps. The pedestrian refuge island on the north loop on-ramp is updated to fit the proposed improvements. This provides a safer crossing for pedestrians who do not use the underpass. Construction encroachment onto property ranges from three to twenty feet on the east side. This is shown in **Figures 10 – 12**.

I-94 North Ramp Terminal to 20th Avenue South

On 25th Street between the I-94 North Ramp Terminal and 20th Avenue South, the section includes a raised median on the south end to line up the intersection and transitions to a painted median. This transition taper length is 267 feet. This follows the same guidance as the transition from the previous section. This south portion of this section contains: a 17-foot paved median; 12-foot lanes; 2 ½-foot curb and gutter widths; and a ten-foot bike trail on the east side. The section transitions to include: 12-foot lanes; 2 ½-foot curb and gutter; 12-foot painted median and a ten-foot bike trail on the east side offset two feet from the back of curb. Right-of-way impacts are negligible. This is shown in **Figure 12**.

20th Avenue South to 17th Avenue South

On 25th Street between 20th Avenue South and 17th Avenue South, the roadway section contains: 12-foot lanes; 2 ½-foot curb and gutter; a 12-foot painted median; and a ten-foot bike trail reconstructed on the west side of the road offset 20' from back of curb. The bike trail is offset 20 feet to allow for the grade difference noted by the City. The existing trail on the east side is not impacted. Impacts to private right-of-way are negligible. This is shown in **Figures 12 and 13**. **Figures 14 and 15** show the intersection of 17th Avenue South as well as the drives and intersections east and west of 25th Street. A frontage road is provided to consolidate access to 17th Avenue South.

North of 17th Avenue South

On 25th Street north of 17th Avenue South, the improvements include converting the existing exclusive southbound right turn-lane into a shared right-turn/through lane. This lane extends approximately 500 feet north of the intersection of 25th Street with 17th Avenue South. Right-of-way impacts are minimal. This is shown in **Figure 13**.

17th Avenue South / Frontage Road

A frontage road has been designed to consolidate access from six properties onto 17th Avenue South east of 25th Street. Improvements include shifting 17th Avenue South to the south approximately 12 feet to allow for the frontage road along the north. Improvements

extend to the 23rd Street South on the east and to west of 25th Street in order to tie back into the existing road. Two alternatives for the frontage road were developed. **Figure 14** provides an alternative of a one-way frontage road that begins on 17th Avenue South and ends on 25th Street. **Figure 15** provides an alternative of a one-way frontage road that begins on 17th Avenue South and ends on South Flickertail Drive. **Figure 19** shows a typical section showing existing and proposed sections along 17th Avenue South and the proposed frontage road.

5.1.2 Capacity Analysis

A LOS analysis was performed for Alternative 1 using Synchro, Version 7, to determine the study intersection traffic operations. The proposed lane configurations and optimized timings were used. For this report, acceptable levels of service were considered LOS C or better for intersections and LOS D or better for individual movements. The following sections discuss the results of the analyses for each future year peak period scenario. The traffic signal phasing and timing plans for the analyses are provided in Appendix F.

Year 2030 AM

For the future year AM peak period, all intersections operate at LOS C or better with Alternative 1 proposed lane geometry. However, some of the individual movements at the intersections of 13th Avenue South and the I-94 South Ramp Terminal are anticipated to experience LOS E. **Figure 20** displays the year 2030 AM peak hour levels of service for Alternative 1.

Year 2030 PM

The results of the analysis indicate that levels of service improve at each study intersection from the existing lane configuration; however, some undesirable levels of service still remain with proposed Alternative 1 lane geometry. The intersection of 13th Avenue South is anticipated to experience LOS E; the intersection of 17th Avenue South is anticipated to experience LOS D. In addition, many individual movements at some of the intersections in the study area are anticipated to experience LOS E or worse. **Figure 20** displays these levels of service for Alternative 1.

5.1.3 Simulation Analysis

A simulation analysis was performed for Alternative 1 using SimTraffic, Version 7. The analysis was performed because simulations take into account how intersections interact together, giving consideration to storage lengths and the distances between the intersections. The proposed lane configurations and optimized timings were used for this analysis. For each scenario, ten simulations were performed. The reported results are an average of the ten runs. The following sections discuss the results of the analyses for each future year peak period scenario. The SimTraffic analysis output is provided in Appendix F.

Year 2030 AM

The results of the analysis indicate that several intersections are anticipated to operate at LOS D or worse (13th Avenue South, 17th Avenue South, and the I-94 South Ramp Terminal). In addition, many of the individual movements at study intersections operate at LOS E or worse. These operations are not considered acceptable; however, they are a significant improvement when compared with the levels of service experienced along the corridor using existing lane geometry (see Section 2.2.3). **Figure 21** displays the year 2030 AM peak hour levels of service for Alternative 1. The LOS results for all analysis scenarios are listed in tabular format in Appendix F.

Year 2030 PM

Similar to the AM analysis scenario, the results of the PM peak hour analysis for Alternative 1 indicated that the intersections of 13th Avenue South and 17th Avenue South will operate poorly under year 2030 traffic conditions; the I-94 South Ramp Terminal is anticipated to operate at LOS D. Also, many of the movements at these intersections operate at LOS E or worse. However, there is significant improvement when these levels of service are compared with the levels for the year 2030 existing lane configuration scenario. **Figure 21** displays these levels of service for Alternative 1. The LOS results for all analysis scenarios are listed in tabular format in Appendix F.

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25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 1 Proposed Geometry

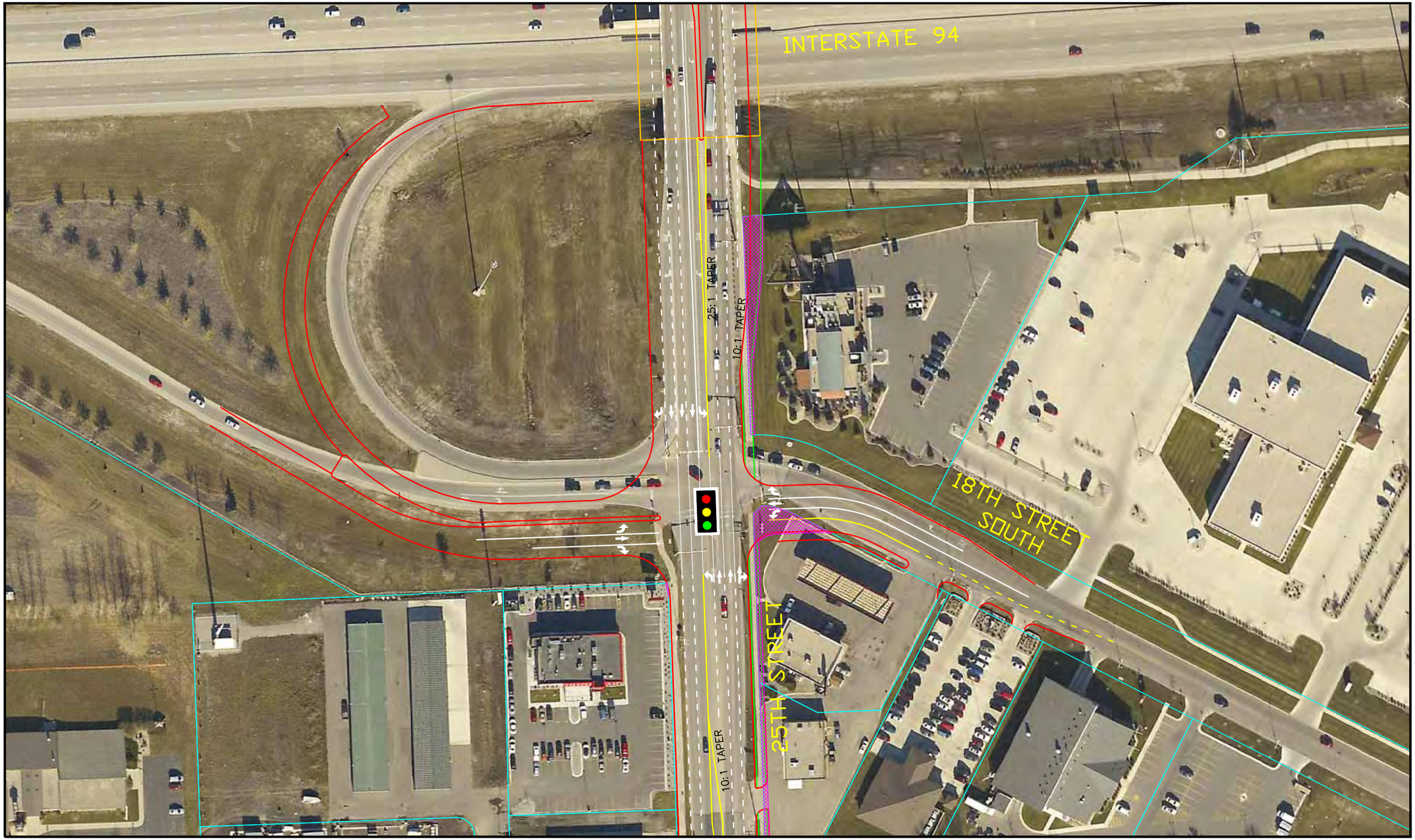
Six-Lane with Painted Medians

N

SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 10



25th Street Corridor Study
City of Fargo, North Dakota
HWS

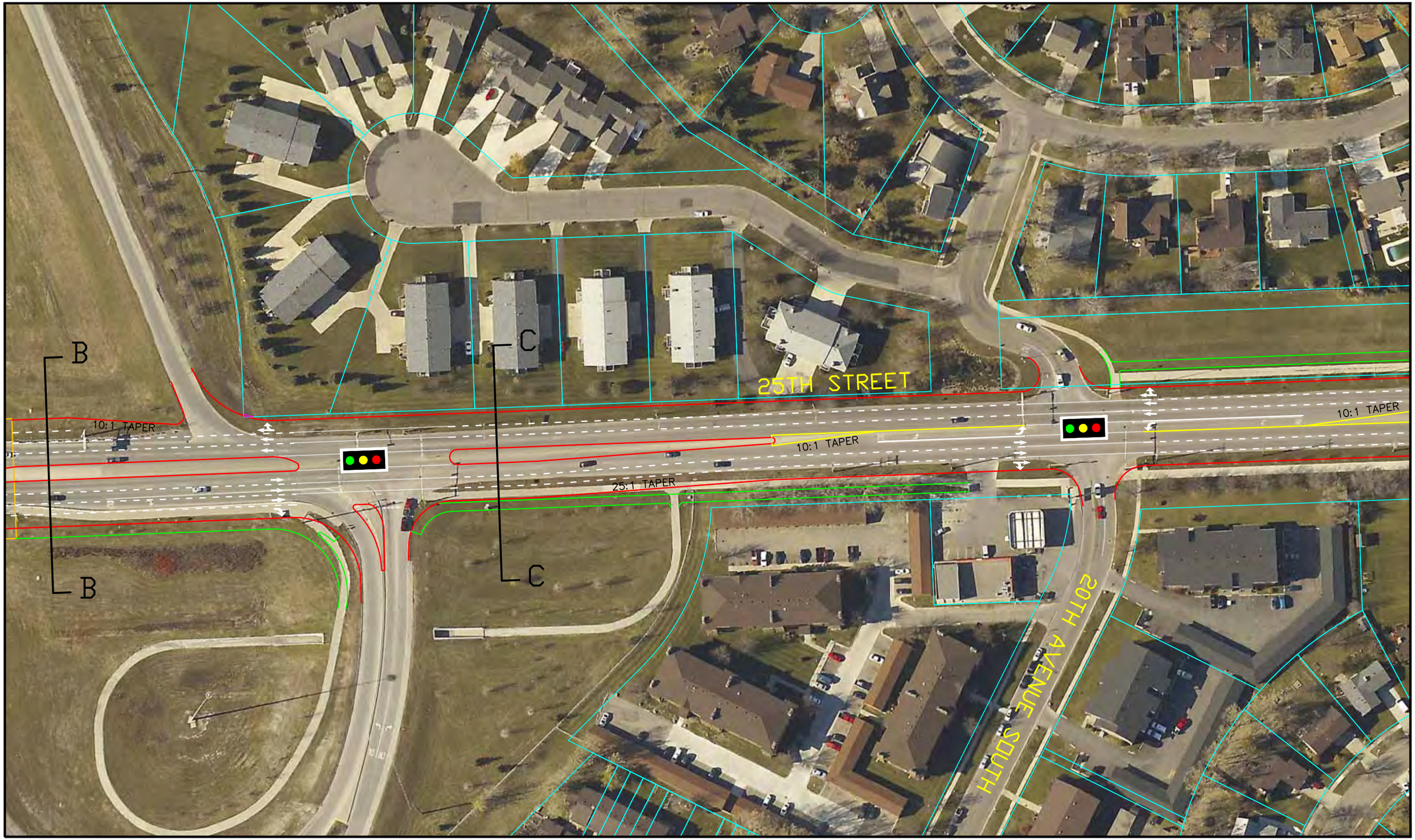
Alternative 1 Proposed Geometry

Six-Lane with Painted Medians - Shifted South Terminal Concept

N
SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 11



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 1 Proposed Geometry

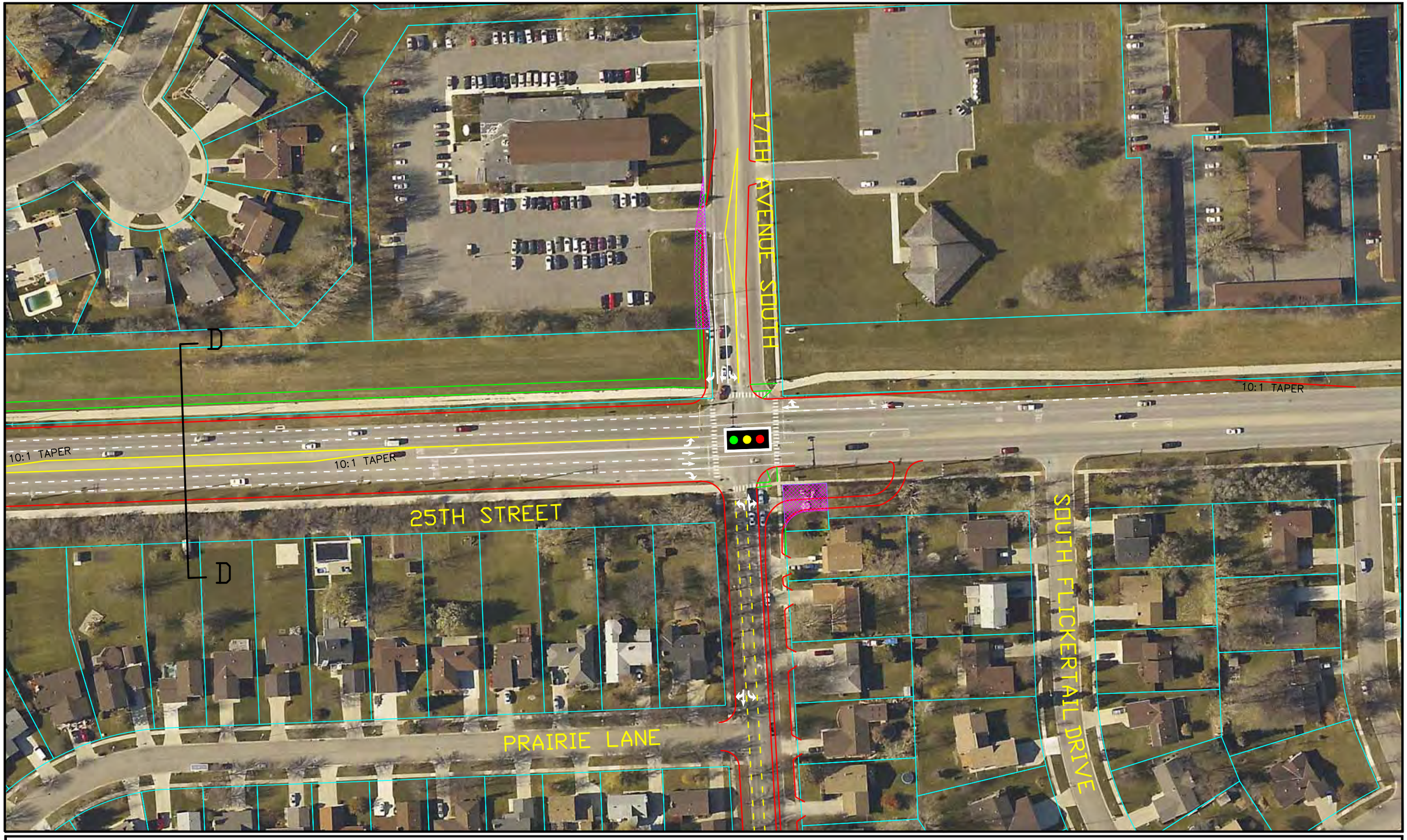
Six-Lane with Painted Medians

N

SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 12



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 1 Proposed Geometry

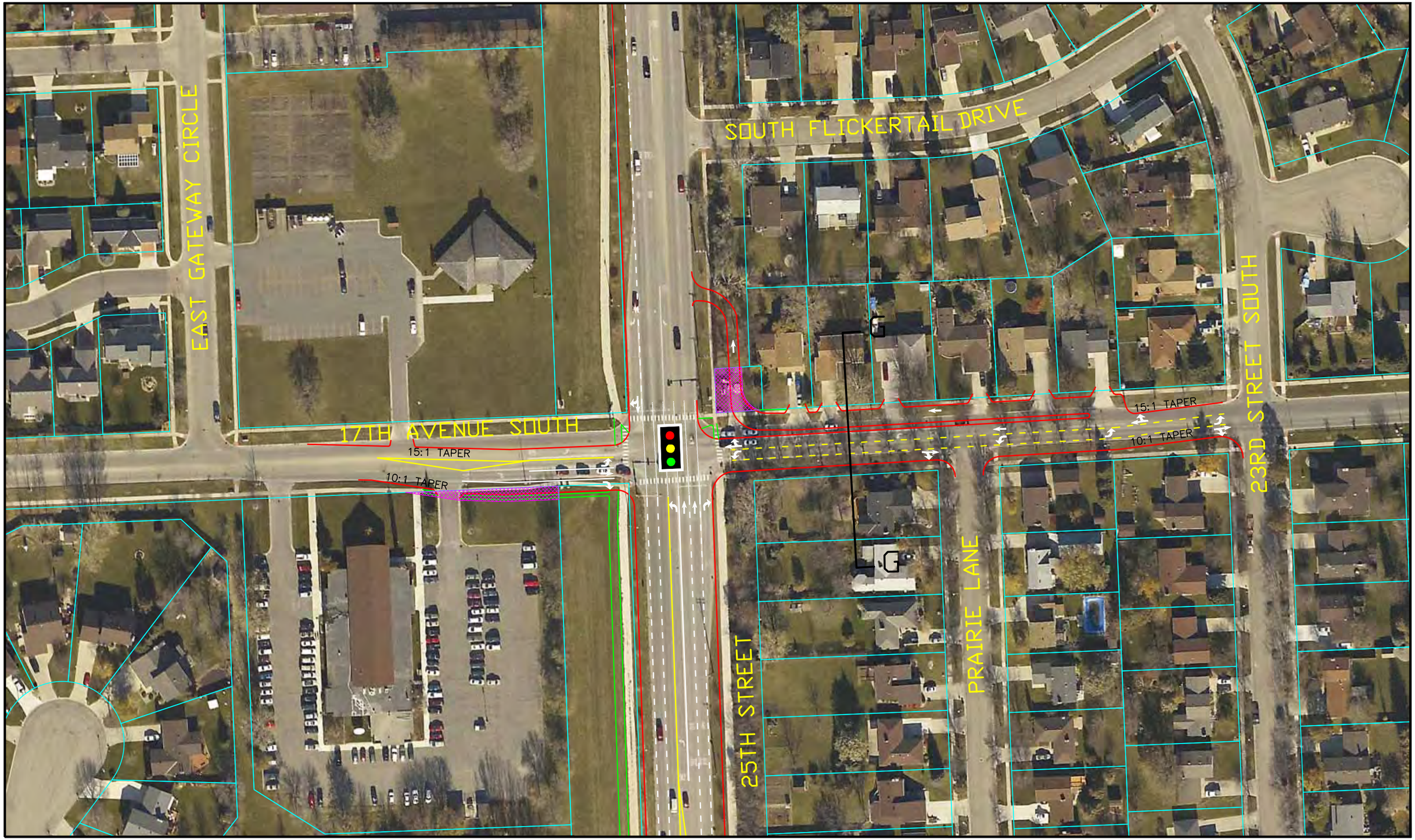
Six-Lane with Painted Medians

N

SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 13



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 1 Proposed Geometry

Six-Lane with Painted Medians - Frontage Road Concept 1

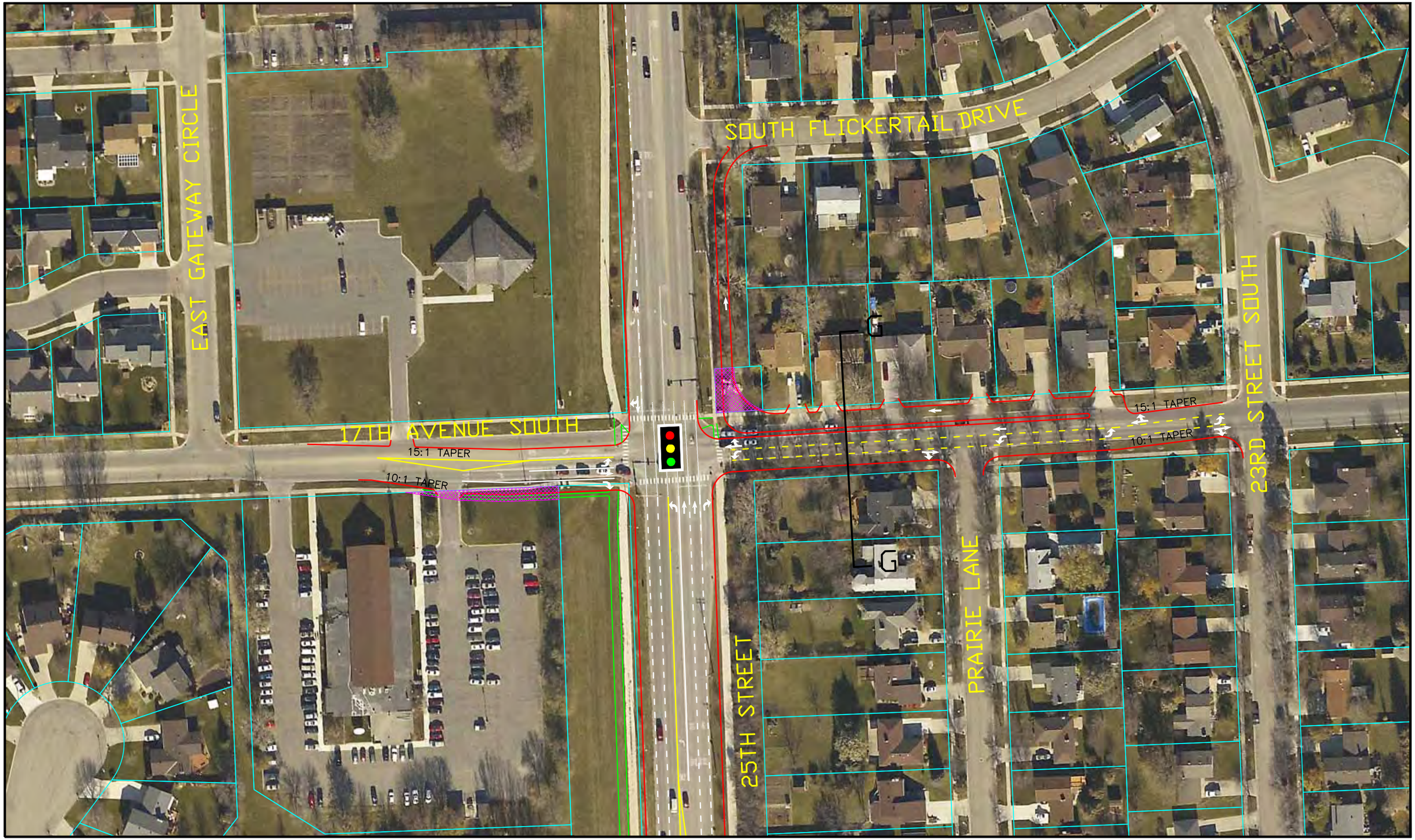
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 14



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 1 Proposed Geometry

Six-Lane with Painted Medians -Frontage Road Concept 2

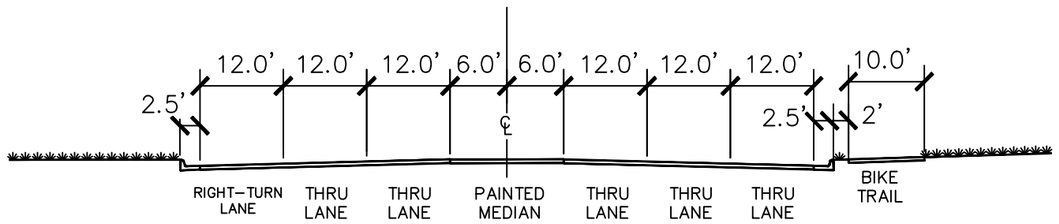
N

SCALE 1"=100'

LEGEND:

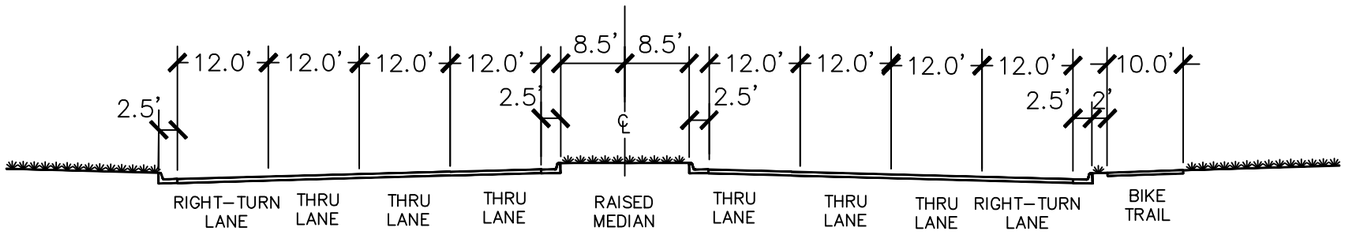
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 15



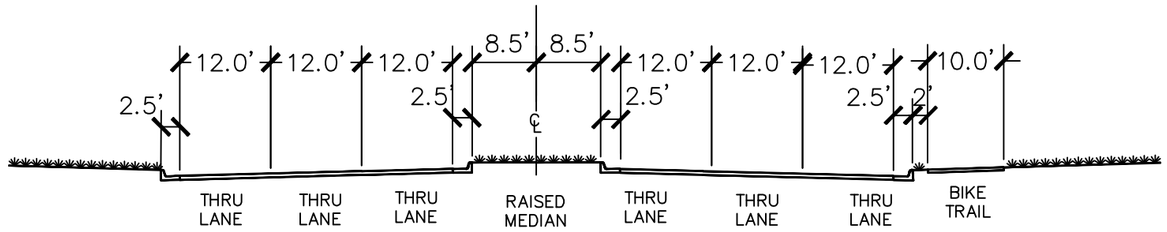
SECTION A–A

SIX-LANE URBAN SECTION



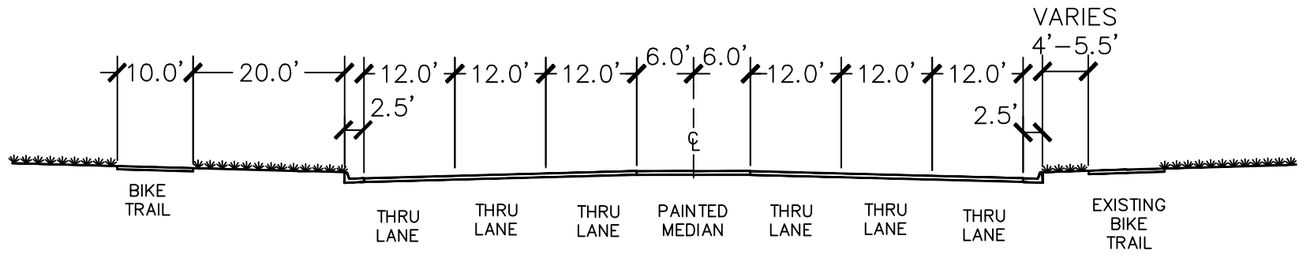
SECTION B–B

SIX-LANE URBAN SECTION WITH AUXILIARY LANES



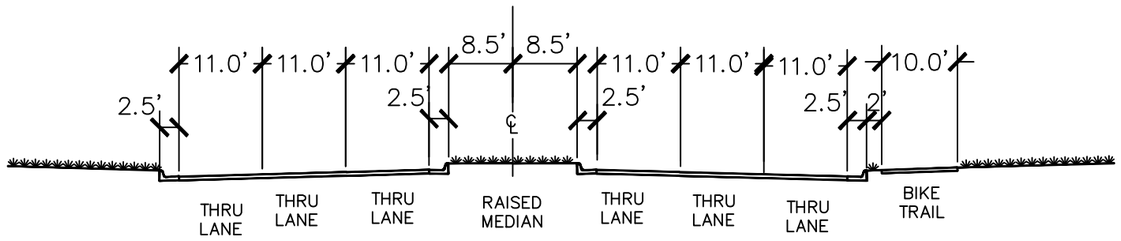
SECTION C–C

SIX-LANE URBAN SECTION



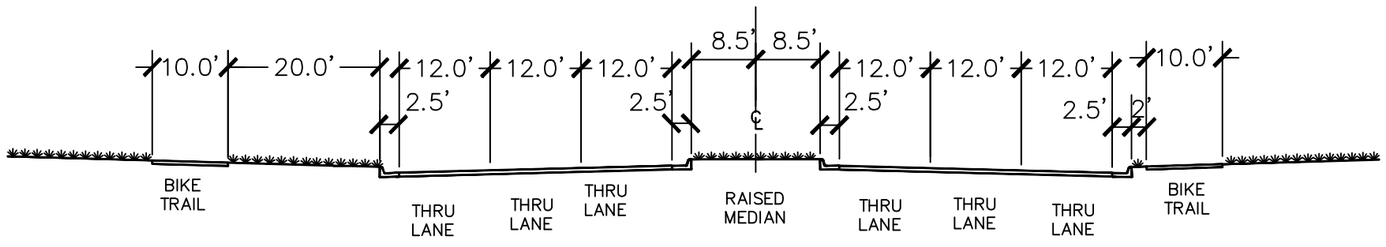
SECTION D–D

SIX-LANE URBAN SECTION



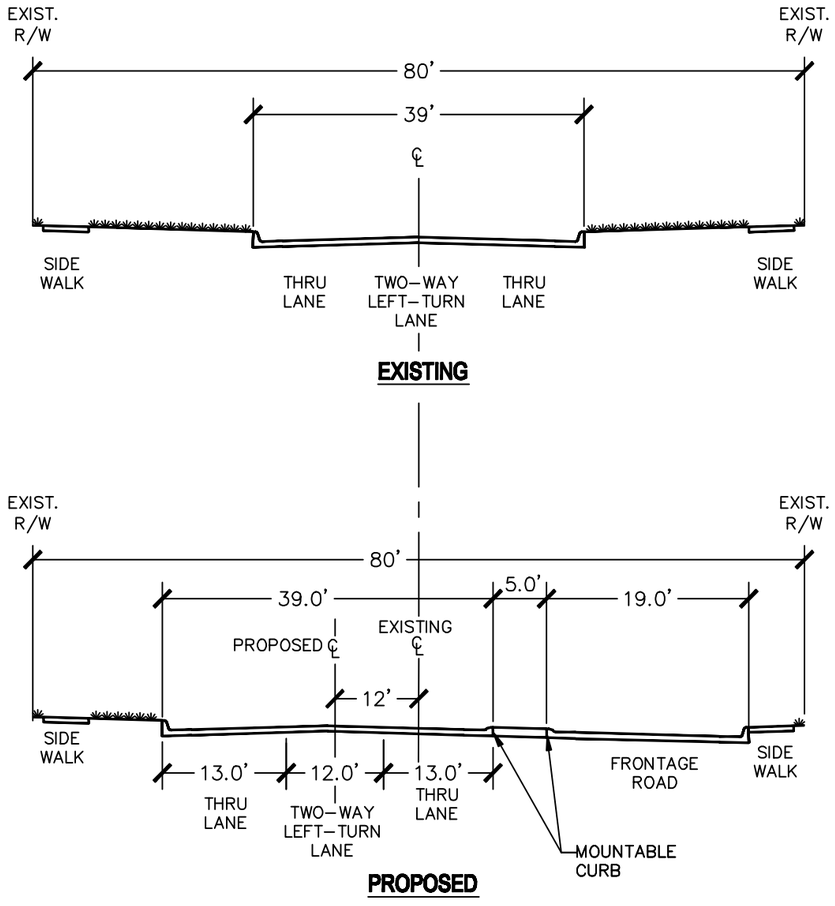
SECTION E–E

SIX-LANE URBAN SECTION



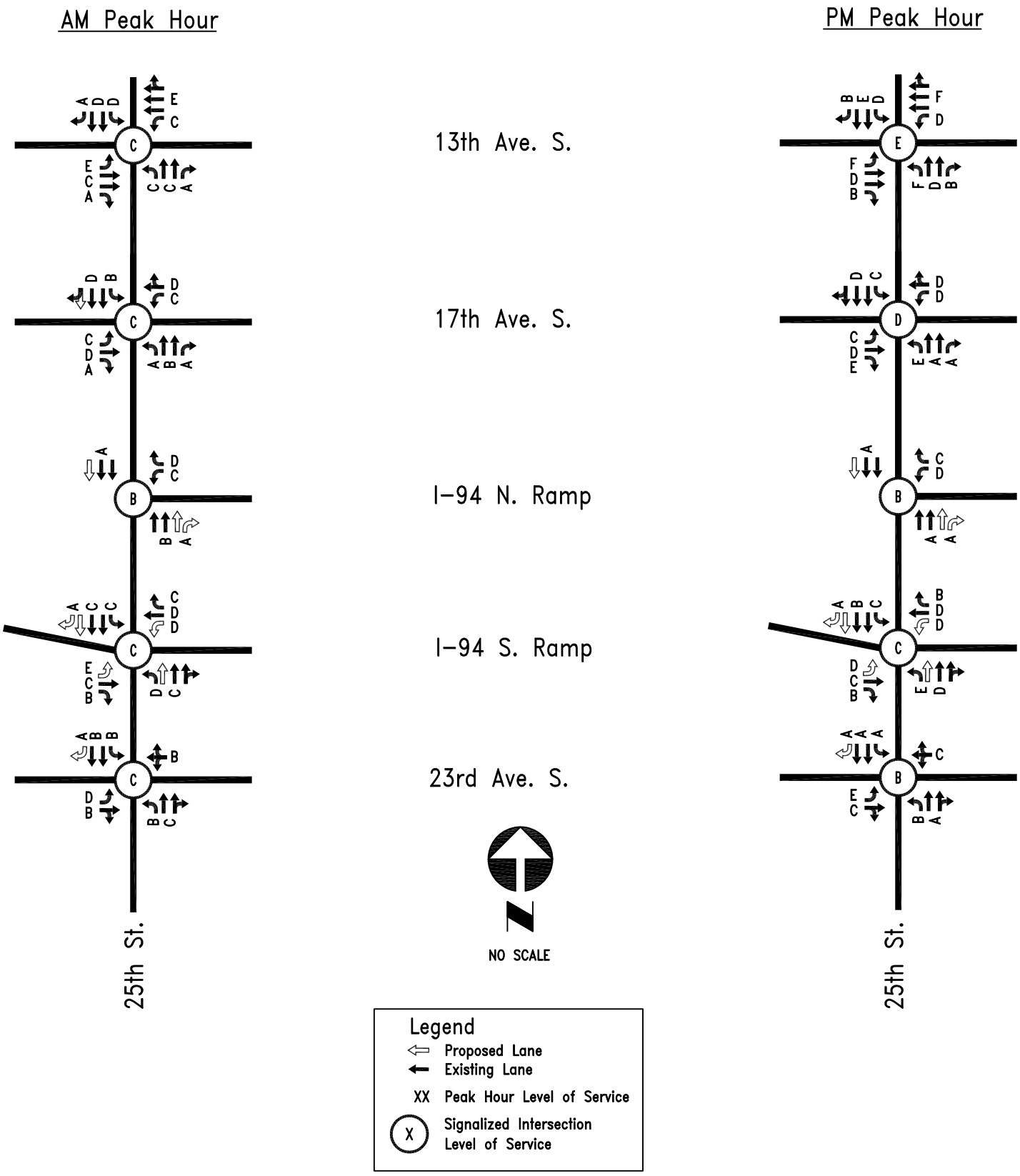
SECTION F–F

SIX-LANE URBAN SECTION



SECTION G–G

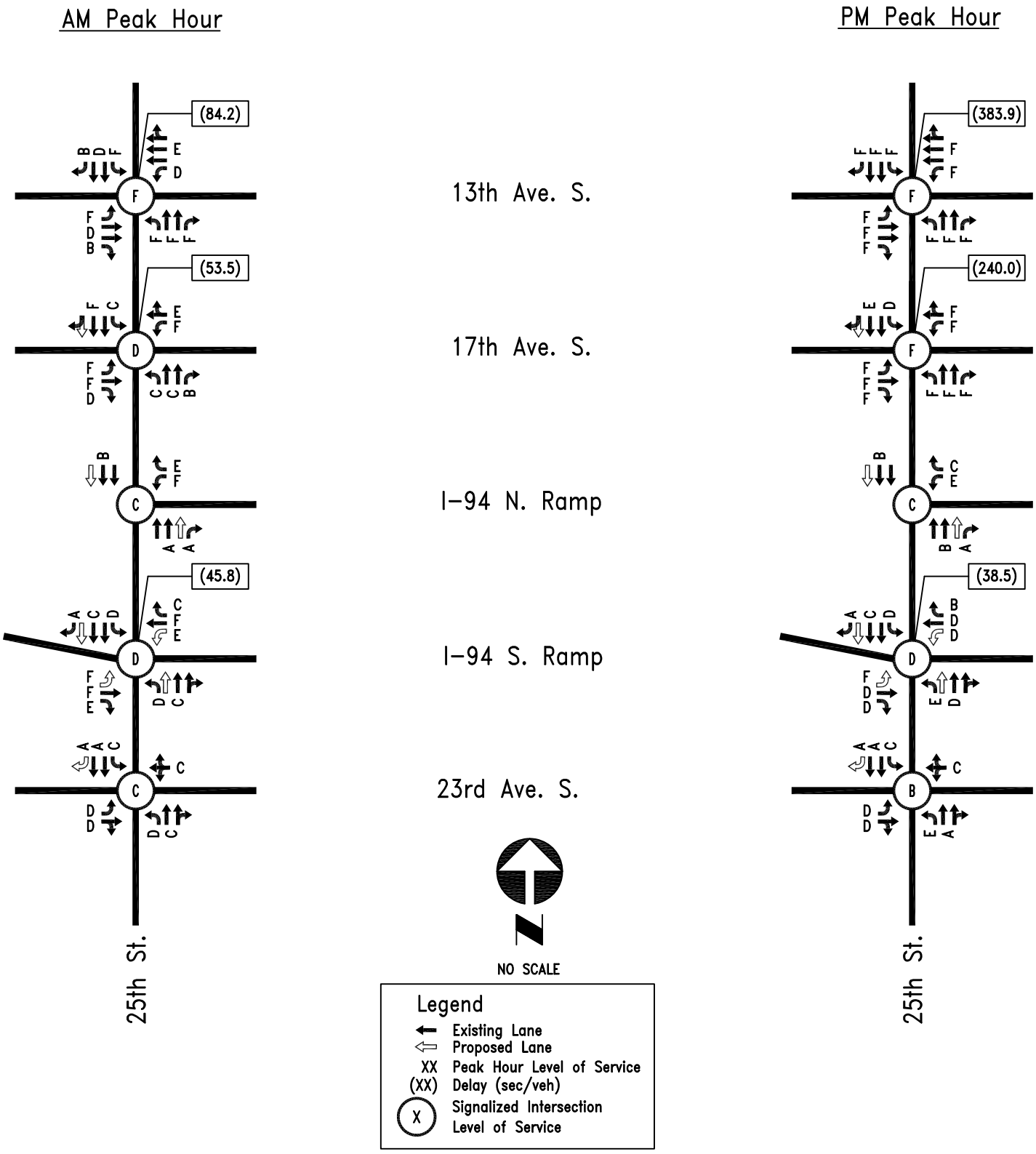
17TH AVENUE SOUTH AND FRONTAGE ROAD



25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Alternative 1
Synchro Levels of Service

Figure 20



25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Alternative 1
SimTraffic Levels of Service

Figure 21

5.2 Alternative 2

For this alternative, the proposed geometry is similar to Alternative 1 (six lanes wide from 23rd Avenue South to 17th Avenue South) except that it will incorporate an eastbound on-ramp in the southeast quadrant of the interchange. In addition, a southbound outside through lane is added between 13th Avenue South and 17th Avenue South. The following sections discuss geometric features and corresponding levels of service for Alternative 2.

5.2.1 Proposed Geometric Features

Alternative 2 improves 25th Street from its existing five lanes to six lanes with a median or turn lane from 23rd Avenue South to north of 13th Avenue South. Alternative 2 uses all raised medians. It also expands the project limits just enough to allow for transitioning back to existing so that the raised medians extend the entire length of the project. Alternative 2 also provides an eastbound I-94 on-ramp for northbound traffic. Additionally, auxiliary right-turn lanes are added to provide exclusive right-turns onto the Interstate 94 loop on-ramps. Small alignment transitions (up to approximately 1 foot) are made through some of the intersection because of the widened typical section and to minimize right-of-way impacts The widths of the intersections provide adequate distance for these shifts and skip markings would be placed to guide drivers through these intersections. If transitions through intersections are deemed undesirable, it will be necessary to jog the alignment in between the intersections. The roads running perpendicular to 25th Street will be impacted minimally; returns will be constructed where necessary to tie into 25th Street. Lane drop/add tapers are typically 10:1.

Figures 22-28 display the proposed lane geometry for Alternative 2. In addition, **Figures 16-18** display the typical sections that were used along the study section of 25th Street as well as 17th Avenue South.

23rd Avenue South Intersection

The intersection of 25th Street with 23rd Avenue South includes improvements to the north and south legs. The north leg has four southbound lanes, which include a left-turn lane, two through lanes and a right-turn lane. The median is raised. There are two northbound lanes; just north of the intersection, the road begins to taper out for a third northbound lane. The south leg is improved to line up with the north leg and extends south to transition into the existing five-lane road. This transition follows the same guidance from the MUTCD as the transitions in Alternative 1. The median to the south is striped to allow left turns off 25th Street. The west leg and return have been widened to reflect improvements that have taken place since the aerial was taken. This intersection is shown in **Figure 22**.

23rd Avenue South to 18th Street South

On 25th Street between 23rd Avenue South and 18th Street South, the section includes: 11-foot lanes; 2 ½-foot curb and gutter; a 17-foot raised median; and a ten-foot bike trail on the east side offset two feet from the back of curb. There is no bike trail or sidewalk on the west side. There are no impacts to the right-of-way on the west side; however right-of-way

impacts are somewhat extensive on the east side (up to approximately 13 feet). The lanes widths were reduced in order to lessen impacts. This segment is shown in **Figure 22**.

18th Street South (I-94 South Ramp Terminal) Intersection

The intersection of 25th Street with 18th Street South/I-94 South Ramp Terminal contains improvements on all legs. The south leg has three approach lanes: two through lanes and one shared right-turn/through lane. Northbound left turns are no longer necessary from the south leg because of the proposed I-94 eastbound on-ramp. These movements will be restricted with a channelizing island located on the west leg of the intersection. The north leg has a left-turn lane, two through lanes and a shared right-turn/through lane. The west leg has one right-turn lane, one through lane and one left-turn lane. The island has been designed to restrict northbound left turn movements and westbound through movements. As a result, the westbound approach is now left-turn and right-turn only. Because of the gas lines that run along the north side of 18th Street South, the east leg has minimal improvements. The lanes are shifted as much as possible to remain lined up with the west leg, improve the tangent, and avoid impacts to the gas lines. In addition, the right-turn lane into the gas station south of 18th Street South has been eliminated. This intersection is shown in **Figure 22**.

18th Street South to Proposed Interstate 94 On-Ramp

On 25th Street between 18th Street South and the proposed Interstate on-ramp, the section remains the same as the previous stretch with the addition of a right-turn lane which provides access to the proposed on-ramp. This lane drops at the ramp. The section also includes auxiliary right-turn lanes through the bridge to provide exclusive access to the loop on-ramps. Construction encroaches onto property on the east side up to 50 feet, but averages 18 feet during the transition into the right-turn lane for the proposed on-ramp. This is shown in **Figures 22 – 24**.

Proposed Interstate 94 On-Ramp to the I-94 North Ramp Terminal

On 25th Street between the proposed Interstate on-ramp and the existing north ramps, the section includes: 12-foot lanes, 2 ½-foot curb and gutters; a 17-foot raised median and a ten-foot bike trail on the east side. There are no impacts to right-of-way. The pedestrian refuge island on the north loop on-ramp is updated to fit the proposed improvements. This provides a safer crossing for pedestrians who do not use the underpass. This is shown in **Figures 23 and 24**.

Interstate 94 North Ramps to 20th Avenue South

On 25th Street between the Interstate 94 north ramps and 20th Avenue South, the section includes: 12-foot lanes, 2 ½-foot curb and gutters; a 17-foot raised median and a ten-foot bike trail on the east side. Impacts to right-of-way are negligible. This is shown in **Figure 24**.

20th Avenue South to 17th Avenue South

On 25th Street between 20th Avenue South and 17th Avenue South, the section includes: 12-foot lanes; 2 ½-foot curb and gutters; a 17' raised median and ten-foot bike trails located on both sides of the section. The existing bike trail on the east side is impacted by the proposed improvements and is therefore reconstructed two feet offset from the back of curb. The bike trail on the west side is reconstructed 20 feet offset from the back of curb. This allows for the grade difference noted by the City. Impacts to private right-of-way are negligible. This is shown in **Figure 25**. **Figure 26** shows the intersection of 17th Avenue South as well as the drives and intersections east and west of 25th Street.

17th Avenue South to 13th Avenue South

On 25th Street between 17th Avenue South and 13th Avenue South, the improvements include the addition of a southbound lane that extends between 13th Avenue South and 17th Avenue South. With this configuration, the exclusive southbound right-turn lane at 25th Street and 13th Avenue South would become a shared right-turn/through lane. The section also transitions from a raised median to the existing roadway which includes a painted median. This transition follows the same guidance from the MUTCD as the transitions in Alternative 1. Impacts to right-of-way are minor with potentially the exception of the building southwest of the intersection of 25th Street and 13th Avenue South. Survey is necessary to determine the extent of these impacts. This is shown in **Figures 27 and 28**.

5.2.2 Capacity Analysis

A LOS analysis was performed for Alternative 2 using proposed geometry and the same methodologies used for the Alternative 1 analysis. The following sections discuss the results of the analyses for each future year peak period scenario. The traffic signal phasing and timing plans for the analyses are provided in Appendix F.

Year 2030 AM

For the future AM peak period, most intersections operate at LOS C or better with Alternative 2 proposed lane geometry. The intersection of 13th Avenue South is anticipated to experience LOS D. However, there are some individual movements at 13th Avenue South and the I-94 South Ramp Terminal that operate at LOS E or worse. All other intersection movements operate at LOS D or better. **Figure 29** displays the year 2030 AM peak hour levels of service for Alternative 2.

Year 2030 PM

The results of the analysis indicate that levels of service for Alternative 2 proposed geometry is improved over Alternative 1: 13th Avenue South is anticipated to improve from LOS E to LOS D. There are some individual movements throughout the study area that operate at LOS E, however. **Figure 29** displays the year 2030 PM peak hour levels of service for Alternative 2.

5.2.3 Simulation Analysis

A simulation analysis was performed for Alternative 2 using SimTraffic, Version 7, similar to Alternative 1. The following sections discuss the results of the analyses for each future year peak period scenario. The SimTraffic analysis output is provided in Appendix F.

Year 2030 AM

The results of the analysis indicate that two intersections are anticipated to operate at LOS D or worse (13th Avenue South, and 17th Avenue South). In addition, many of the individual movements at study intersections operate at LOS E or worse. These results, when compared with the Alternative 1 levels of service, indicated that the new on-ramp configuration may improve operations at the I-94 South Ramp Terminal and adjacent intersections. **Figure 30** displays the year 2030 AM peak hour levels of service for Alternative 2. The LOS results for all analysis scenarios are listed in tabular format in Appendix F.

Year 2030 PM

The results of the PM peak hour analysis for Alternative 2 indicated that two study intersections, 13th Avenue South and 17th Avenue South, are anticipated to operate poorly under year 2030 traffic conditions. Both the North and South Ramp Terminals exhibited an improvement compared to Alternative 1, improving an LOS letter grade each. Many of the movements in the study area are anticipated to operate at LOS E or worse. **Figure 30** displays these levels of service for Alternative 2. The LOS results for all analysis scenarios are listed in tabular format in Appendix F.

25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

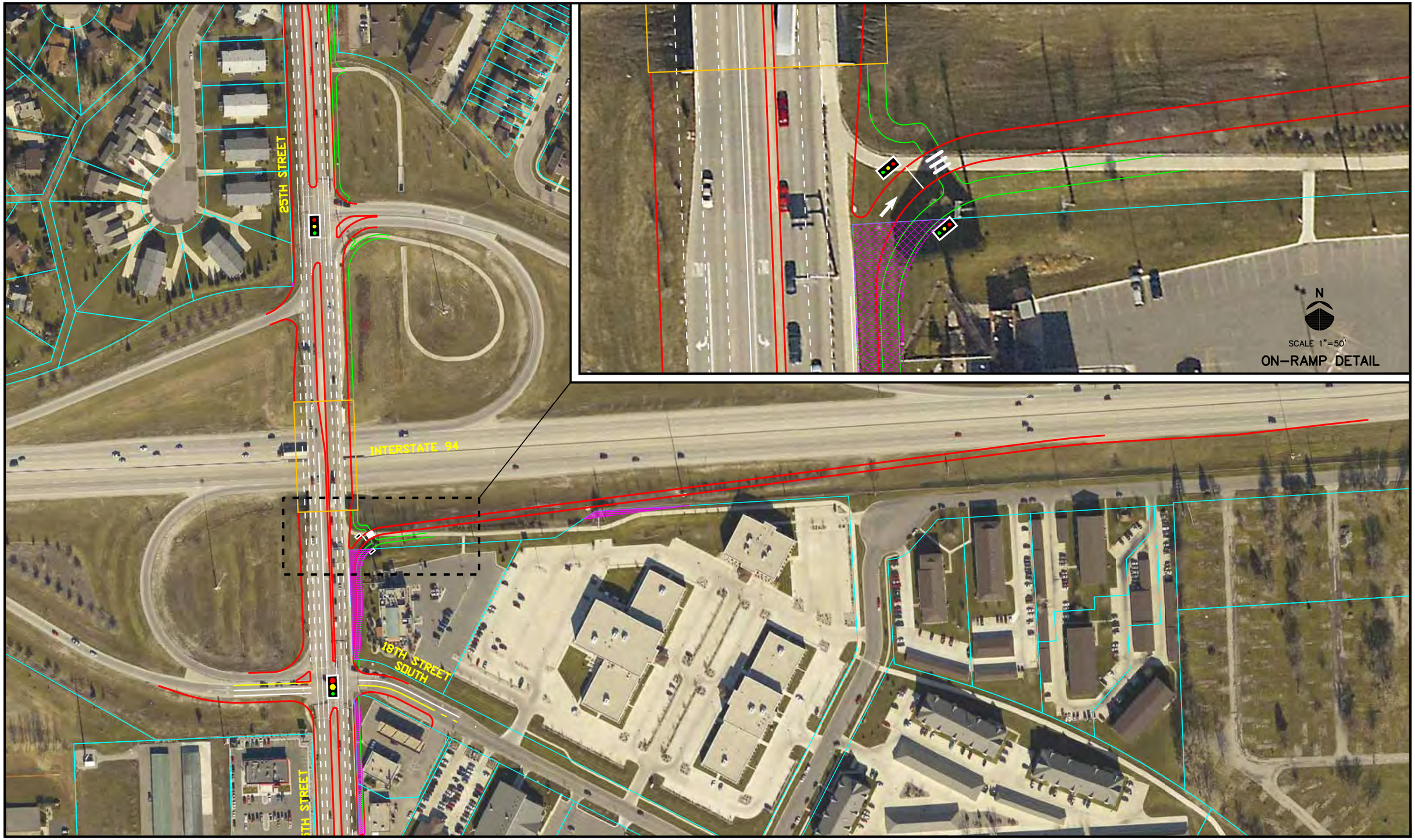
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 22



25th Street Corridor Study
City of Fargo, North Dakota
HWS

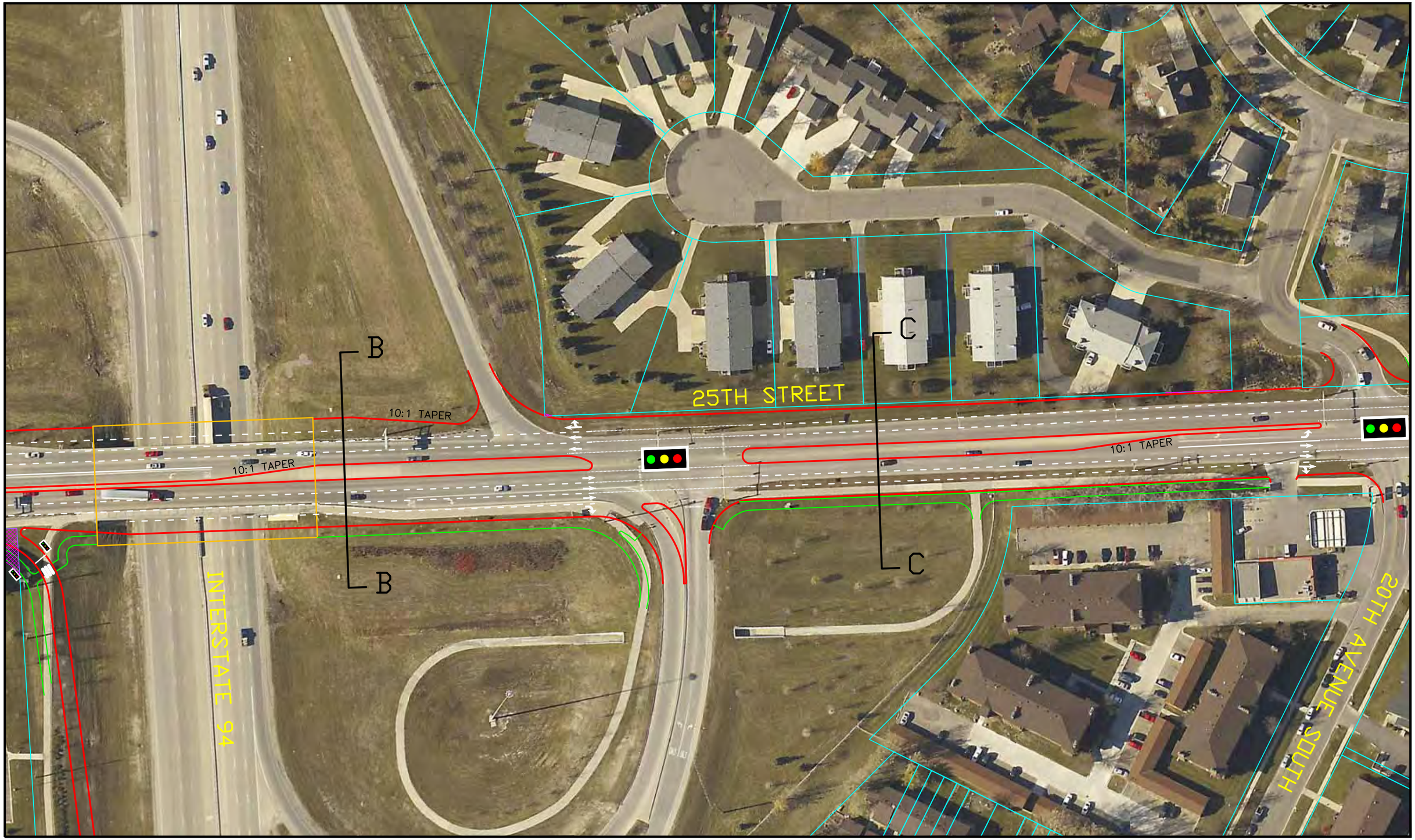
Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

N
SCALE 1"=200'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 23



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 24

25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

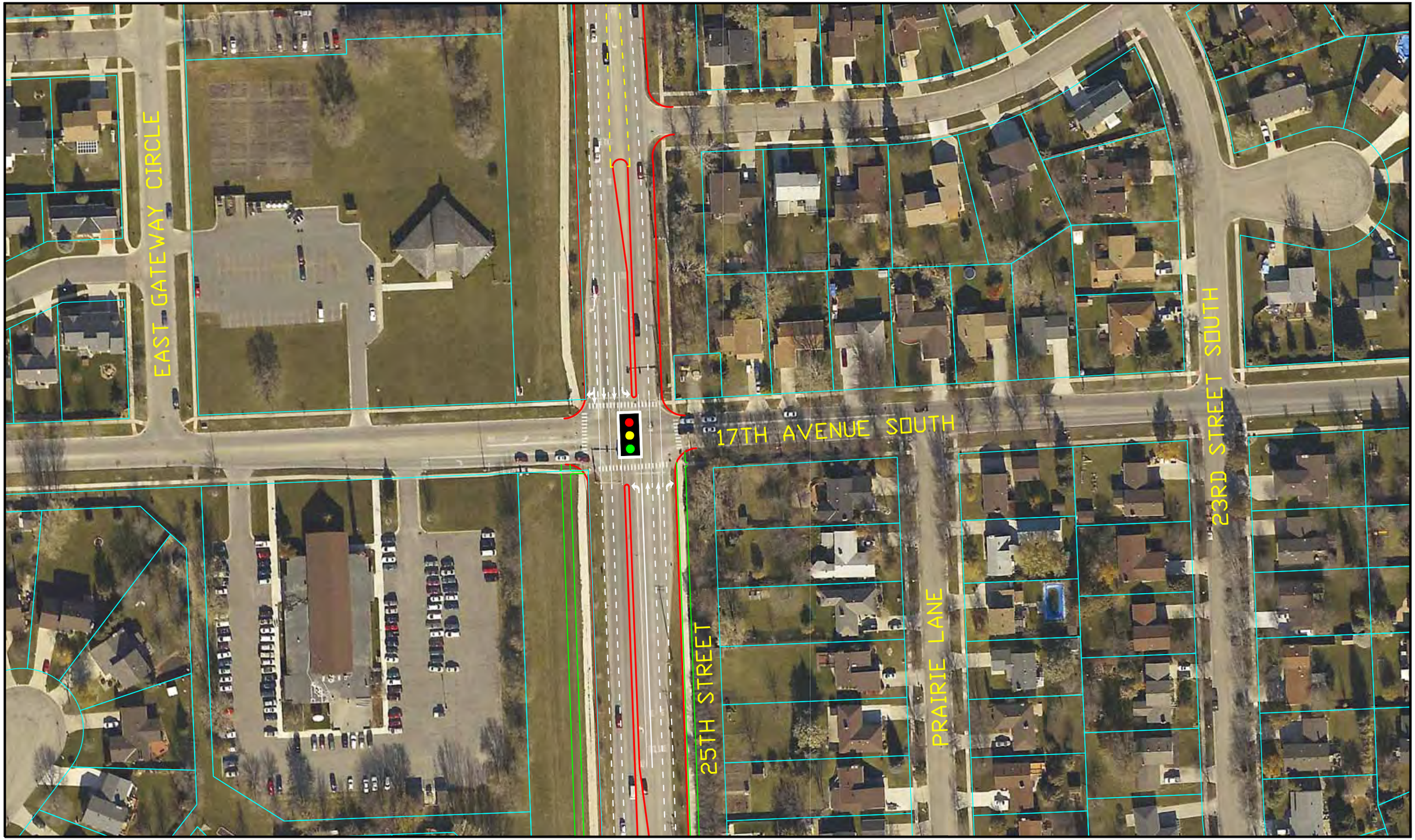
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 25



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 2 Proposed Geometry

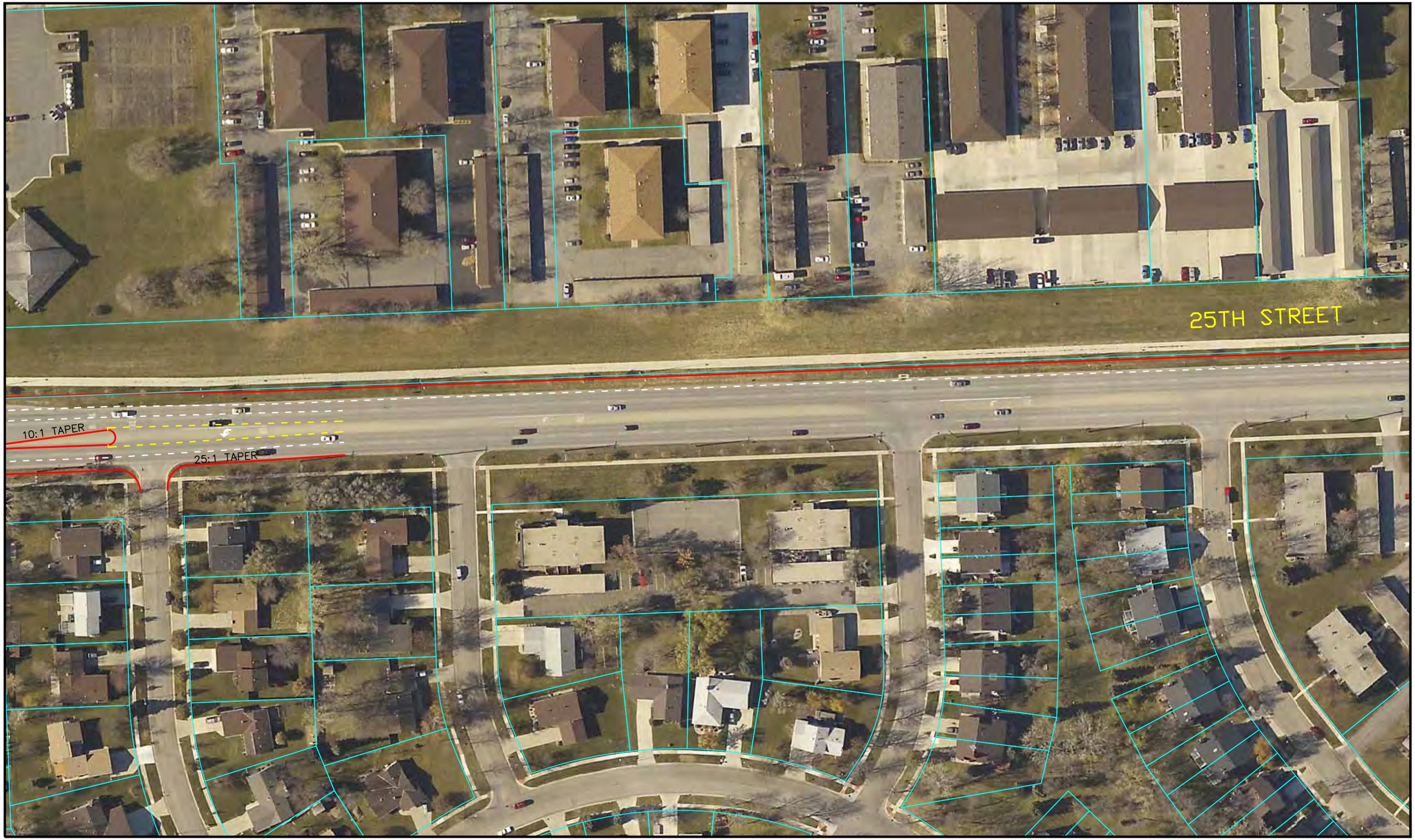
Six-Lane with Raised Medians

N

SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 26



25th Street Corridor Study
City of Fargo, North Dakota
HWS

Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

N
SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 27

25th Street Corridor Study
City of Fargo, North Dakota

HWS

Alternative 2 Proposed Geometry

Six-Lane with Raised Medians

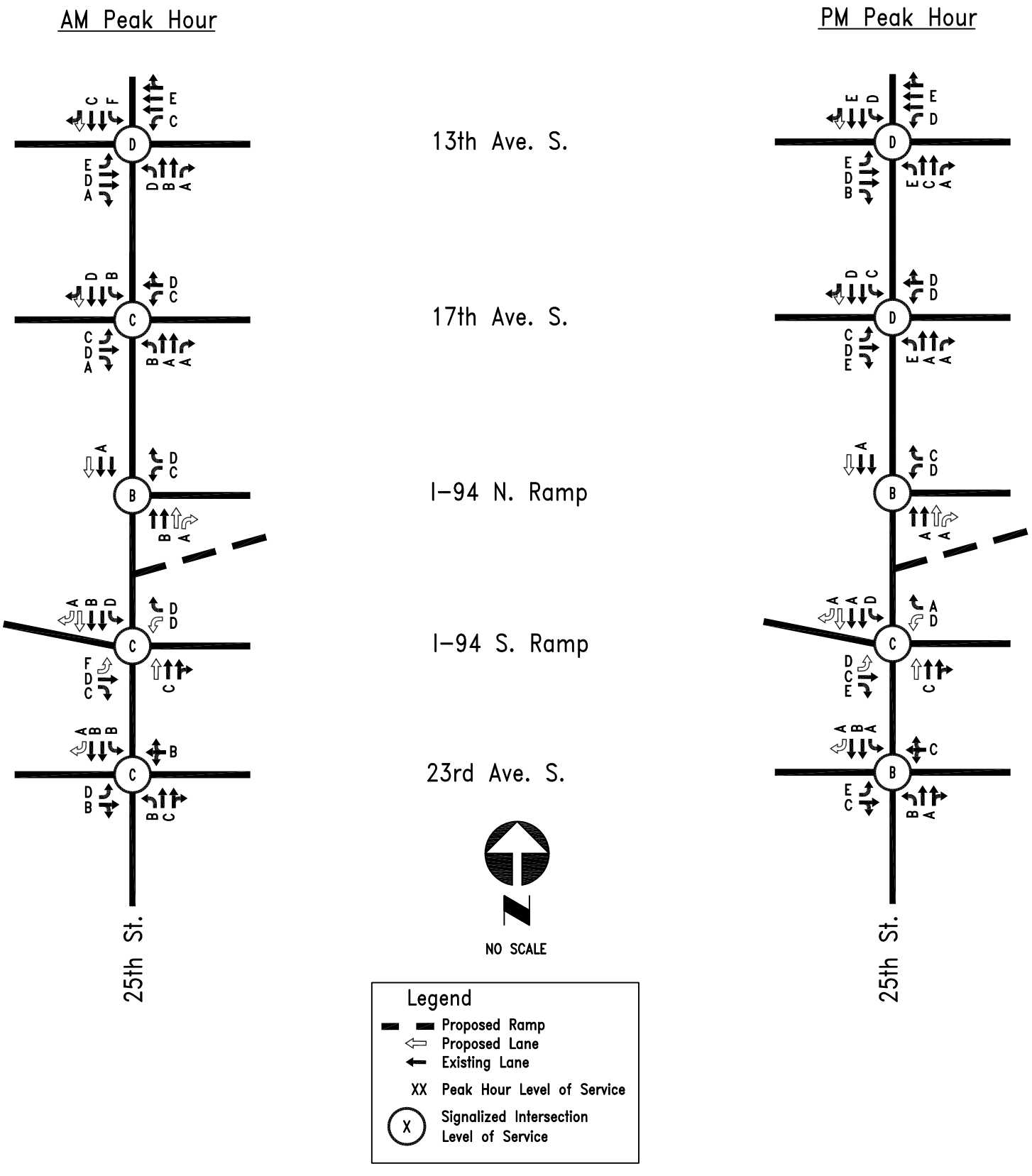
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- BRIDGE
- PROPOSED RIGHT-OF-WAY ACQUISITION

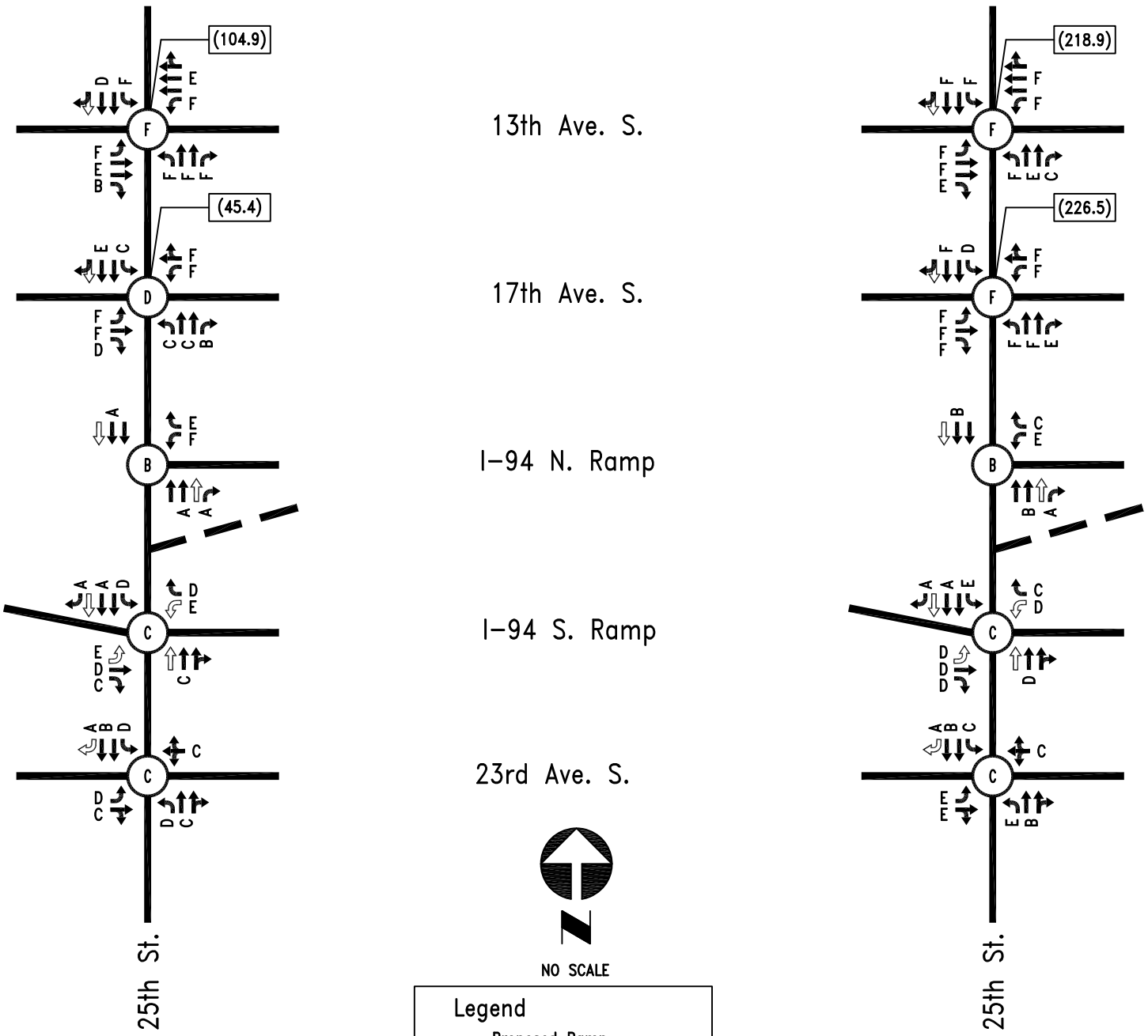
FIGURE 28



25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Alternative 2
Synchro Levels of Service

Figure 29



25th Street Corridor Study
City of Fargo, North Dakota

Year 2030 Alternative 2
SimTraffic Levels of Service

Figure 30

5.3 Alternative Comparison

The results of the alternatives analyses discussed in the preceding sections indicate that proposed geometries for Alternatives 1 and 2 are anticipated to improve levels of service along 25th Street, between 23rd Avenue South and 17th Avenue South, from the levels of service exhibited for year 2030 conditions with the existing lane configuration. However, when the two alternatives are compared with each other, it was not immediately clear which performs better. The following sections have been developed to gain a better understanding of the different benefits associated with each alternative and their features. A detailed discussion of these aspects follows.

5.3.1 13th Avenue South: Lane Extension

Each Alternative features the addition of a southbound through with shared right turn lane at the intersection of 17th Avenue South and 25th Street. For Alternative 1, this lane extends north, as shown in **Figures 13-15.** For Alternative 2, the lane extends farther north, back to 13th Avenue South, shown in **Figures 25-28**. Since the extended lane may affect traffic operations at 13th Avenue South, this intersection was studied in greater detail.

A simulation analysis was conducted to determine the lane's effect on the LOS at 13th Avenue South. Upon examination of the individual movements affected by the extension of this lane, it appears that such an extension would provide some benefit to the intersection, with a drastic reduction in overall delay during the PM peak period. **Table 3** displays the simulation LOS at 13th Avenue South for Alternative 1 and Alternative 2 during the AM and PM peak periods.

Table 3. SimTraffic Level of Service and Delay for 13th Ave. S.

13th Avenue South & 25th Street														
Peak Period	Year 2030	Eastbound			Westbound			Northbound			Southbound			Overall LOS (sec)
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
AM	Existing/ Alternative 1	F(191.3)	D(46.5)	B(15.5)	D(52.7)	E(58.3)	E(62.9)	F(148.4)	F(115.2)	F(105.2)	F(145.3)	D(38.3)	B(10.4)	**F(84.2)**
	Alternative 2	F(252.2)	E(58.2)	B(16.7)	F(104.5)	E(65.1)	E(78.8)	F(163.7)	F(129)	F(119.4)	F(498.8)	D(37.7)	C(31.3)	**F(104.9)**
PM	Existing/ Alternative 1	F(671.6)	F(297.8)	F(247.2)	F(220.7)	F(213)	F(252)	F(756.4)	F(231.1)	F(171.6)	F(561.8)	F(552.3)	F(524.9)	**F(383.9)**
	Alternative 2	F(333.7)	F(125.8)	E(80)	F(95.4)	F(136)	F(165.1)	F(281.3)	E(67.4)	C(25.2)	F(490.7)	F(386.1)	F(420)	**F(218.9)**

5.3.2 17th Avenue South: Protected vs. Permitted-Protected Northbound Left Turns

For both Alternatives, a variation of signal phasing was investigated at 17th Avenue South. The northbound left turn movement was modeled as both "Protected only" as well as "Permitted/Protected" to determine if there was a capacity benefit to either phasing option. Alternative 1 was the only alternative analyzed, since the configuration of the intersection remains the same in both alternatives. The analyses indicate that phasing the signal as permitted/protected significantly improves the operation of the southbound approach, as more green time is available to those movements. The northbound movements suffer increased delay compared to the protected only operation because there is less exclusive green time for the northbound movements. There is an overall intersection delay savings of approximately 30 seconds per vehicle with the permitted/protected operation. **Table 4** shows the SimTraffic LOS comparison between phasing options.

Table 4. SimTraffic LOS and Delay for 17th Avenue South - Protected vs. Permitted-Protected NBL

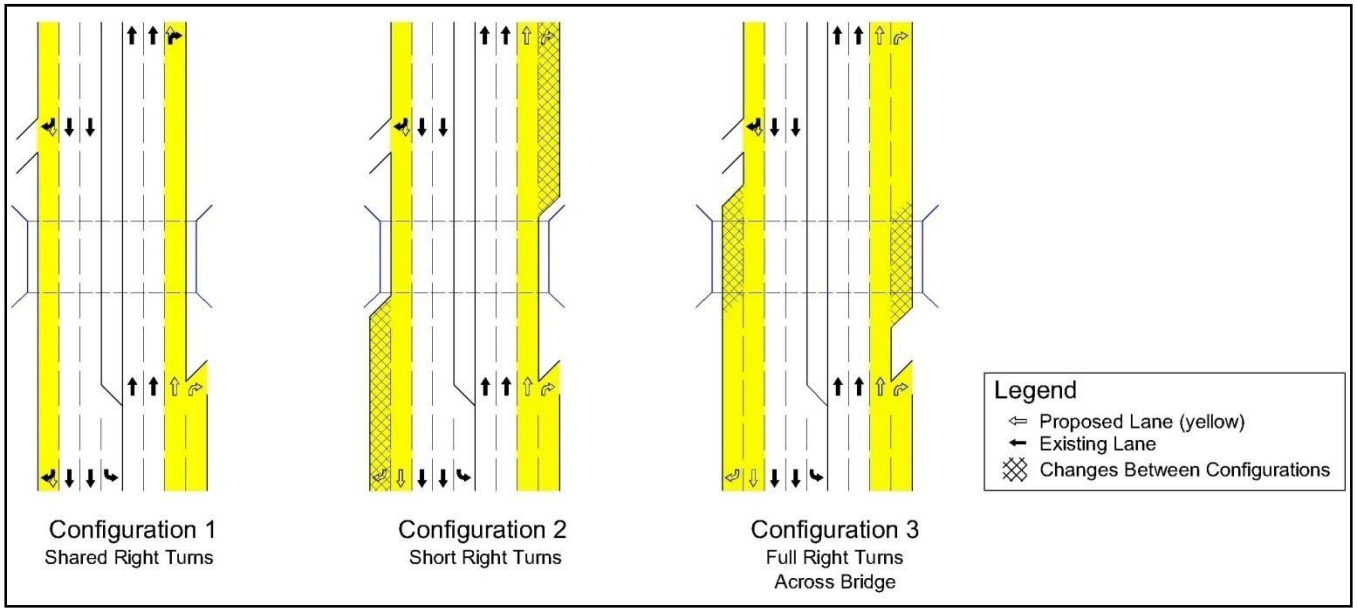
17th Avenue South & 25th Street													
2030 PM Peak Hour	Eastbound			Westbound			Northbound			Southbound			Overall LOS (sec)
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
Alternative 1 - NBL Prot	*F(469.1)*	*F(458.6)*	*F(443.2)*	*F(101.3)*	*D(52.8)*	*D(43.6)*	*F(389.5)*	*F(115.4)*	*F(90.3)*	*F(225)*	*F(248.9)*	*F(271.7)*	***F(243.5)***
Alternative 1 - NBL Pm-Pt	F(508.6)	F(491.7)	F(478.4)	F(92.7)	D(47.8)	D(37.3)	F(494.7)	F(186.8)	F(160.3)	F(91.2)	F(92.2)	F(110.7)	**F(211.8)**

5.3.3 Sensitivity Analysis for Auxiliary Right Turn Lanes across I-94 Bridge

At the April 4th, 2008, SRC meeting, City of Fargo representatives requested the addition of auxiliary right turn lanes across the I-94 bridge to remove right turning vehicles from the through traffic stream. To quantify the capacity benefits of extending the auxiliary right turn lanes, a sensitivity analysis was performed. The sensitivity analysis compared various right turn lane configurations under different future growth conditions to determine whether any configuration performs better. Alternative 2 was chosen for further analysis because it provides a more conservative analysis, in that the full auxiliary right-turn lanes would be shorter in Alternative 2, compared to Alternative 1. The three right turn lane configurations analyzed are as follows. **Figure 31** illustrates the three configurations.

- Configuration 1 features shared through/right turn lanes at both terminals
- Configuration 2 features short auxiliary right turn lanes at both terminals that extend back to the I-94 bridge
- Configuration 3 features full auxiliary right turn lanes that extend across the I-94 bridge
  - The northeast loop ramp lane extends back to the proposed eastbound on-ramp
  - The southwest loop ramp lane extends back to the westbound on-ramp

Figure 31. Lane Configurations for Auxiliary Right Turn Lane Sensitivity Analysis



Each lane configuration scenario was simulated using year 2030 traffic volumes and optimized traffic signal timings. In addition, each lane configuration scenario was simulated using an

arbitrary growth factor of 1.2. This growth factor represents a 20% increase in established year 2030 traffic volumes. The application of the growth factor was utilized to offset any potential under-predications of the future traffic volumes. The growth factor was also intended to identify if one of the configurations might perform better under higher traffic volume conditions. Timings were not optimized for scenarios with the growth factor in order to accurately compare results. Each of the configurations was simulated with the year 2030 PM traffic volumes and optimized traffic signal timings. For each configuration, ten simulations were performed. The reported results are an average of the ten runs.

The results of the analysis for the un-grown traffic volumes (growth factor = 1.0) do not indicate that one configuration significantly out-performed the others at either terminal. For the analysis configurations with the growth factor applied (growth factor = 1.2), the I-94 North Ramp Terminal is anticipated to benefit significantly with Configurations 2 and 3, with approximately a 40 second delay savings. There are, however, only slight delay savings at the I-94 South Ramp Terminal. For the northbound right at the I-94 North Ramp Terminal and southbound right at the I-94 South Ramp Terminal, there are significant delay savings with Configuration 2 when compared with Configuration 1. **Table 5** and **Table 6** display the SimTraffic LOS results at the I-94 North Ramp Terminal and the I-94 South Ramp Terminal, respectively. Each table compares the growth factor analysis scenarios for each lane configuration. The results of SimTraffic LOS and queue analyses for the Sensitivity Analysis are provided in Appendix F.

Table 5. SimTraffic LOS and Delay for I-94 North Ramp Terminal - Sensitivity Analysis Results

I-94 North Ramp Terminal & 25th Street							
Growth Factor	2030 Alt 2 PM	Westbound		Northbound		Southbound	Overall LOS (sec)
		Left	Right	Through	Right	Through	
1.0	*Configuration 1*	*F(185.9)*	*F(136.4)*	*B(14.6)*	*B(20)*	*D(35.3)*	***D(48.3)***
	Configuration 2	*F(93.3)*	*E(61.7)*	*A(6.4)*	*A(3.2)*	*D(50.1)*	***D(38.8)***
	Configuration 3	*F(94.2)*	*E(65.4)*	*A(6.4)*	*A(2.9)*	*D(49)*	***D(38.6)***
1.2	Configuration 1	F(490.9)	F(418.3)	B(18.7)	C(25.2)	E(60.2)	**F(107)**
	Configuration 2	F(213)	F(181.8)	A(8.1)	A(3.3)	E(74.9)	**E(71.2)**
	Configuration 3	F(204)	F(175.9)	A(8.2)	A(2.9)	E(73.7)	**E(69.5)**

Table 6. SimTraffic LOS and Delay for I-94 South Ramp Terminal - Sensitivity Analysis Results

I-94 South Ramp Terminal & 25th Street												
Growth Factor	2030 Alt 2 PM	Eastbound			Westbound		Northbound		Southbound			Overall LOS (sec)
		Left	Through	Right	Left	Right	Through	Right	Left	Through	Right	
1.0	*Configuration 1*	*E(57.2)*	*D(47.1)*	*D(48.8)*	*D(52.8)*	*B(18.3)*	*D(51.9)*	*D(53.9)*	*E(69.9)*	*B(11.8)*	*A(7.7)*	***D(36.8)***
	Configuration 2	*E(60.3)*	*D(47.9)*	*D(46.7)*	*E(55.7)*	*B(20)*	*D(50.9)*	*E(68.4)*	*D(37.5)*	*B(13.5)*	*A(2)*	***D(36.8)***
	Configuration 3	*E(58.4)*	*D(45.9)*	*D(43.3)*	*E(55.5)*	*B(19.3)*	*D(53.8)*	*E(75.6)*	*E(68.3)*	*B(13.4)*	*A(1.9)*	***D(37.1)***
1.2	Configuration 1	F(156.1)	F(138.2)	F(146.9)	E(63.7)	C(26.2)	E(73.7)	E(75.8)	E(71.2)	B(13.1)	A(8.6)	**E(63)**
	Configuration 2	F(135.8)	F(112.2)	F(119.6)	E(62.2)	C(27.5)	E(75.7)	F(107.5)	E(70)	B(14.1)	A(1.9)	**E(59.1)**
	Configuration 3	F(135.1)	F(113.5)	F(119.2)	E(59.4)	C(27)	E(72.4)	F(107.4)	E(69.5)	B(14.5)	A(1.9)	**E(58)**

5.3.4 Benefits of the Proposed On-Ramp at I-94 South Ramp Terminal (Alternative 2)

The results of the analysis show marked improvement in operations at the I-94 South Ramp Terminal during both the AM and PM peak hours with the proposed I-94 eastbound on-ramp. Some individual movements, however, experience an increase in delay. This is due to the

reassignment of traffic volumes caused by the elimination of the westbound through and northbound left-turn movements. The traffic volumes of those movements were rerouted to the westbound right turn and northbound through movements, respectively. While both Alternatives offer improvement over year 2030 existing operations, Alternative 2 can provide additional safety benefits. A crash analysis along the corridor has revealed the majority of crashes at the South Terminal occur when northbound-left turning vehicles cross the southbound through traffic to access the I-94 eastbound loop on-ramp. These crashes can be eliminated if the on-ramp proposed in Alternative 2 is implemented. **Table 7** displays the SimTraffic LOS results for each alternative at the I-94 South Terminal.

Table 7. SimTraffic LOS and Delay for I-94 South Ramp Terminal

I-94 South Ramp Terminal / 18th Street South & 25th Street														
Peak Period	Year - Lane Configuration	Eastbound			Westbound			Northbound			Southbound			Overall
		Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	LOS (sec)
AM	2030 - Existing	F(1101.6)	F(1144)	F(959.1)	E(59.6)	D(39.4)	E(55.7)	F(86.6)	E(61.2)	E(66.1)	F(236.4)	D(42)	A(7.6)	**F(198.2)**
	2030 - Alternative 1	F(162.4)	F(104.9)	E(78.3)	E(55.6)	F(107)	C(30.2)	D(40.7)	C(28)	C(29.4)	D(42.3)	C(33.3)	A(7.9)	**D(45.8)**
	2030 - Alternative 2	E(67.1)	D(48)	C(26.5)	E(64.9)		D(44.2)		C(27.1)	D(36.5)	D(45.7)	A(8.1)	A(1.5)	**C(29)**
PM	2030 - Existing	F(1443.3)	F(1350.2)	F(1343.7)	D(42.1)	D(38.6)	B(19.6)	F(169.1)	F(100.5)	F(85)	F(306.8)	D(52.9)	B(10.2)	**F(302.2)**
	2030 - Alternative 1	F(99.2)	D(54.2)	D(36.1)	D(50)	D(44.8)	B(18.4)	E(62.8)	D(42.8)	D(43.6)	D(53.9)	C(24.4)	A(5.1)	**D(38.5)**
	2030 - Alternative 2	D(54.5)	D(42.1)	D(38.6)	D(51.3)		C(23.4)		D(43.9)	E(66.5)	E(55.4)	A(9.7)	A(1.6)	**C(31.4)**

6.0 Preferred Alternative

Once the benefits and performance of Alternative 1 and Alternative 2 were studied and documented, the study team needed to identify a preferred alternative and, eventually, a recommended alternative. The following sections discuss the process by which the preferred alternative was identified.

6.1 Public Meeting 1

Once the project concept plans and traffic analyses for the two alternatives were complete, the first public meeting was conducted. The first public meeting was held on June 4, 2008, at the Lewis and Clark Elementary School, from 5:00 PM – 7:00 PM. A presentation was given at the meeting to highlight the purpose of the project and the features (impacts and benefits) of each Alternative. At the conclusion of the meeting, the public was given two weeks in which to submit comments on the project. Comments were received using comment sheets or through direct contact with HWS. Approximately 45 people attended the meeting. A summary of the comments along with the actual comments sheets received are displayed in Appendix G.

6.2 Updated Concept Plans

Once the comment period was over, the study team and SRC met to discuss the public comments and the development of a preferred alternative. The meeting was a conference call on July 30, 2008. The following sections describe some of the issues and items that were discussed.

6.2.1 Right-of-way

The following ROW issues were discussed for Alternative 2.

- SRC representatives wanted clarification on the impacts of the raised medians to the Camelot Cleaners dry cleaning on the southeast corner of 25th Street & 18th Street South. HWS said that in Alternative 1, there is approximately 20 feet from the front door of the cleaners to the street, compared with approximately 12 feet in Alternative 2.
  - Regarding the cleaners, City Staff suggested that the ROW impacts may be severe, even to the point of a full buyout. The study team said that this will not be known until actual survey of the area and final design details are available.
- City Staff inquired about the proximity of the new sidewalk to the gas station on the southeast corner of 25th Street & 18th Street South. The drawings show the sidewalk coming extremely close to the corner of the gas station building. Again, HWS said that without a survey, it is difficult to determine the impacts. The impacts could be better or worse than what is shown, depending on the projection of the aerial photo.
  - The study team suggested pulling the bike path in, from 10-feet wide to 8-feet wide in that area to minimize potential impact. City staff agreed that an 8-foot wide path would reduce the ROW impacts and should be shown in the Alternative 2 concept layout.
- City staff said they liked how the I-94 South Ramp Terminal was shifted to the south in Alternative 1 and would like to see the same shifting in Alternative 2.
- City staff pointed out that a retaining wall may be needed west of Doolittle's, on the northeast corner of 25th Street & 18th Street South. He believed the necessary information

might be in a previous study of the area by Parsons. HWS updated the drawings and cost estimates where appropriate.

- Another concern expressed by City staff regarding ROW for the preferred alternative was the proximity of the proposed road to property lines northwest of the I-94 North Ramp Terminal. There would be vertical alignment issues with the three southernmost multiplex housing units at that location. HWS investigated a retaining wall and updated the drawings and cost estimates where appropriate.
- HWS asked if ROW impacts should be shown north of 20th Avenue South on the east side of 25th Street. City Staff said even though it would most likely be free ROW (through the Parks Department), that the impact should still be shown.
- HWS pointed out a ROW-impacted building on the southwest corner of 25th Street and 13th Avenue South. City staff said the impacted building belongs to Qwest Communications.

6.2.2 Preliminary Cost Estimates

HWS reviewed the order-of-magnitude cost estimates for both Alternatives. Alternative 1 would cost approximately $6.5 million, and Alternative 2 would cost approximately $7.5 million.

- City staff expressed concern that the costs for ROW acquisitions are too low. They recommended using the prices of $10/square foot for commercial property and $3/square foot for residential property.
  - HWS said that the total ROW acquisitions for the Alternatives were 10,800 square feet for Alternative 1 and 15,200 square feet for Alternative 2. The difference equates to about $50,000 in acquisition costs.
  - HWS asked whether to include an estimate for a full buyout of the cleaners. City staff said to make a note of it, but not to include it in any cost estimates.
- The SRC said the cost for the concrete looked low, based on the rising price of raw materials. The NDDOT representative recommended using $42.40/square yard, instead of the $35/square yard that was used in the estimate.
- HWS asked if the City of Fargo wished to remove and replace concrete or salvage any pavement. The City of Fargo representatives said to salvage pavement north of the I-94 bridge and remove/replace south of the bridge. They also pointed out that there was asphalt pavement south of the dry cleaners.

6.2.3 Other Impacts

As part of the study, a solicitation of views was initiated with agencies to solicit input on the potential impacts. This information was summarized to review the potential environment, land use, and construction impacts. Most of the impacts are anticipated to be negligible, except those listed below. A complete listing of the solicitation of views can be found in Appendix H.

- North Dakota Park and Recreation said that there were two bird species in the area that may be affected. These birds are located to the east of University Drive, near the river.
- Xcel Energy has a duct running along the east side of 25th Street starting north of 18th Street South. North of the interchange, the duct crosses the street and runs north on the west side of 25th Street.
- Sprint has a fiber optic line along 25th Street It runs on the east side to 18th Street South, crosses to the southwest corner of the I-94 South Ramp Terminal, and continues north

under I-94. The proposed improvements may affect the fiber line in several locations, especially if the I-94 South Ramp Terminal is shifted to the south.
- Moorhead Public Service has a power line pole southeast of the I-94 North Ramp Terminal which may be affected by the widening of 25th Street.

Based on these anticipated conflicts, the study team contacted the energy and communication companies to estimate the cost of relocation. The cost estimates were updated to include according to estimates provided by each respective company.

6.3 Preferred Alternative

Based on the discussions during the July conference call regarding public input, cost estimates, and anticipated impacts, the SRC was able to identify features to be included in the preferred alternative.

6.3.1 Draft Concept for Preferred Alternative

The following components from the discussion were incorporated into the preferred alternative:

- raised medians
- new on-ramp for northbound 25th Street to eastbound I-94
- I-94 South Ramp Terminal shifted south
- 17th Avenue South frontage road Concept 1
  - HWS said that homeowners have expressed concerns regarding the loss of trees on the south side of 17th Avenue South, and that the Concept 2 frontage road that ties into Flickertail Drive might impact even more trees on the east side of 25th Street.
- Southbound lane extension to 13th Avenue South
  - HWS asked if consideration should be given to a third northbound lane based on public comments. City staff directed HWS to only incorporate the third southbound lane.

City staff also inquired about the possibility of having a northbound left-turn lane at the I-94 South Ramp Terminal until the new ramp is completed. HWS suggested eliminating the channelizing island for the left-turn lane, and re-installing the island once the ramp is constructed. As a result, an "interim configuration" was developed configuration and is displayed in Figure 33.

6.3.2 Updated Concept for Preferred Alternative

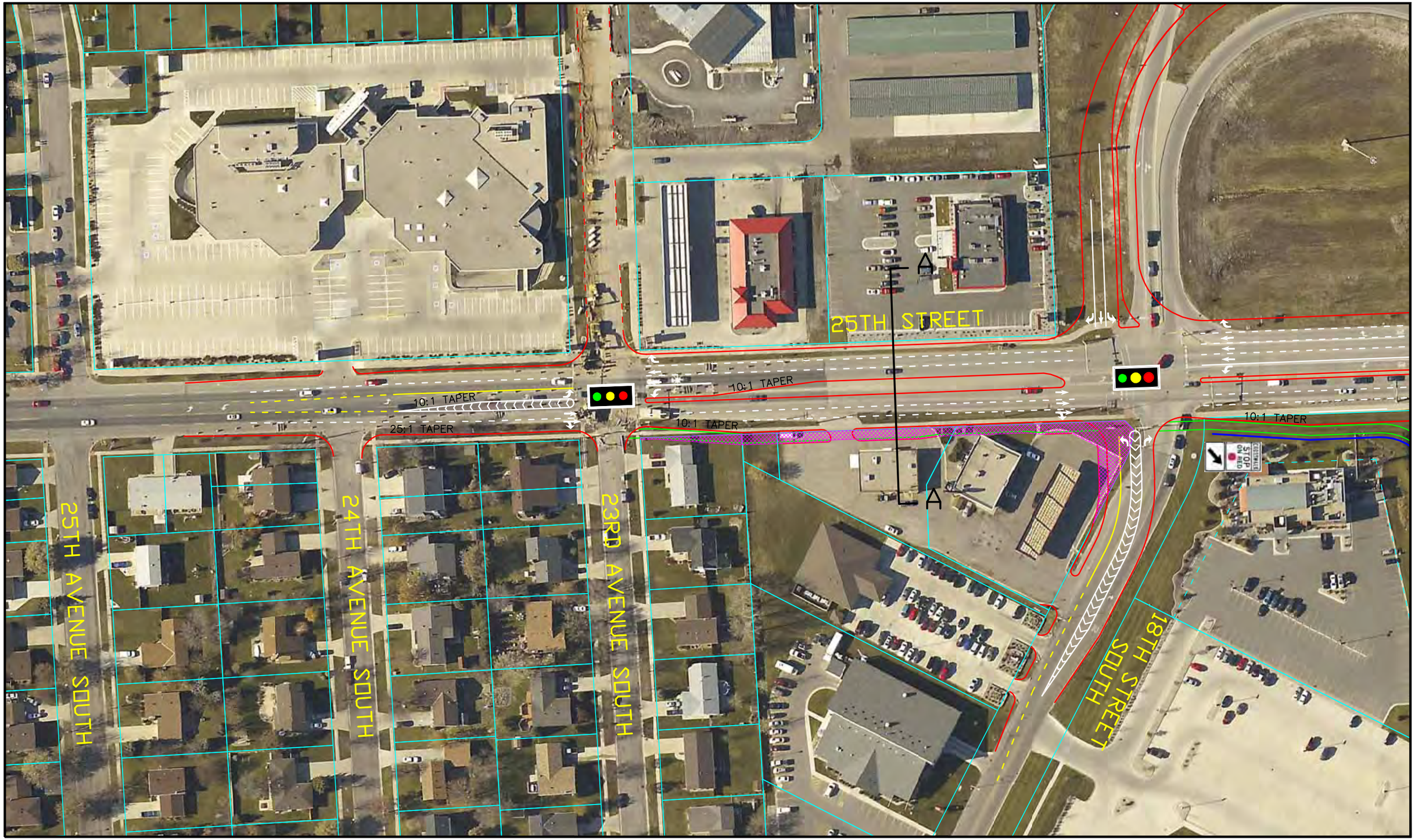
At the conclusion of the July 30 conference call, a draft concept for the preferred alternative was developed. This draft concept was presented to the SRC at a meeting on September 8, 2008. At that meeting, additional changes where identified. The additional changes are as follows:

- Six feet of right-of-way (ROW) was added along the east side of 25th Street, near the gas station on the southeast corner of 25th Street & 18th Street South.
  - The underground tanks at the gas station are on the southeast side of the gas station and are not anticipated to be affected by any improvements to 25th Street.
- The bike path in front of the cleaners was decreased from 10 feet wide to 8 feet wide to minimize potential impacts.
- The I-94 South Ramp terminal was shifted south to allow for more tangent and a better alignment of the east and west legs of the intersection.

- The NDDOT representative said that there is a drainage project coming up in the immediate vicinity of the shifted intersection. It appears that the shifting of the I-94 South Ramp Terminal may affect a proposed lift station. He said he would provide drawings of the project to both HWS and the City of Fargo. HWS will check for conflicts.

- The westbound through lane at the I-94 South Ramp terminal will be updated to be shown as striped out.
- A retaining wall is needed west of Doolittle's, most likely with a handrail on the top for the bike path. This retaining wall was not included in the cost estimate but is not anticipated to significantly affect the cost. The figures and cost estimate were updated appropriately.
- The group discussed the proposed retaining wall on the west side of the I-94 North Ramp Terminal (by the multiplexes). Houston Engineering said the vertical drop is not as steep as originally thought and a retaining wall may not be necessary. There is a drainage ditch in that location, so instead of a retaining wall, the drainage could be piped and covered to improve elevation difference.
- 17th Avenue South will be shown on the existing centerline for the preferred alternative. HWS will show the frontage road as an option to the Preferred Alternative.

At the conclusion of the September meeting, HWS develop project concept plans for the preferred alternative. **Figures 32-39** display the proposed lane geometry for the preferred alternative. In addition, **Figures 40-42** display the typical sections that were used along the study section of 25th Street as well as 17th Avenue South. These concept plans were presented at the second public meeting which will be discussed later in this report.



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Proposed Geometry

Final Concept

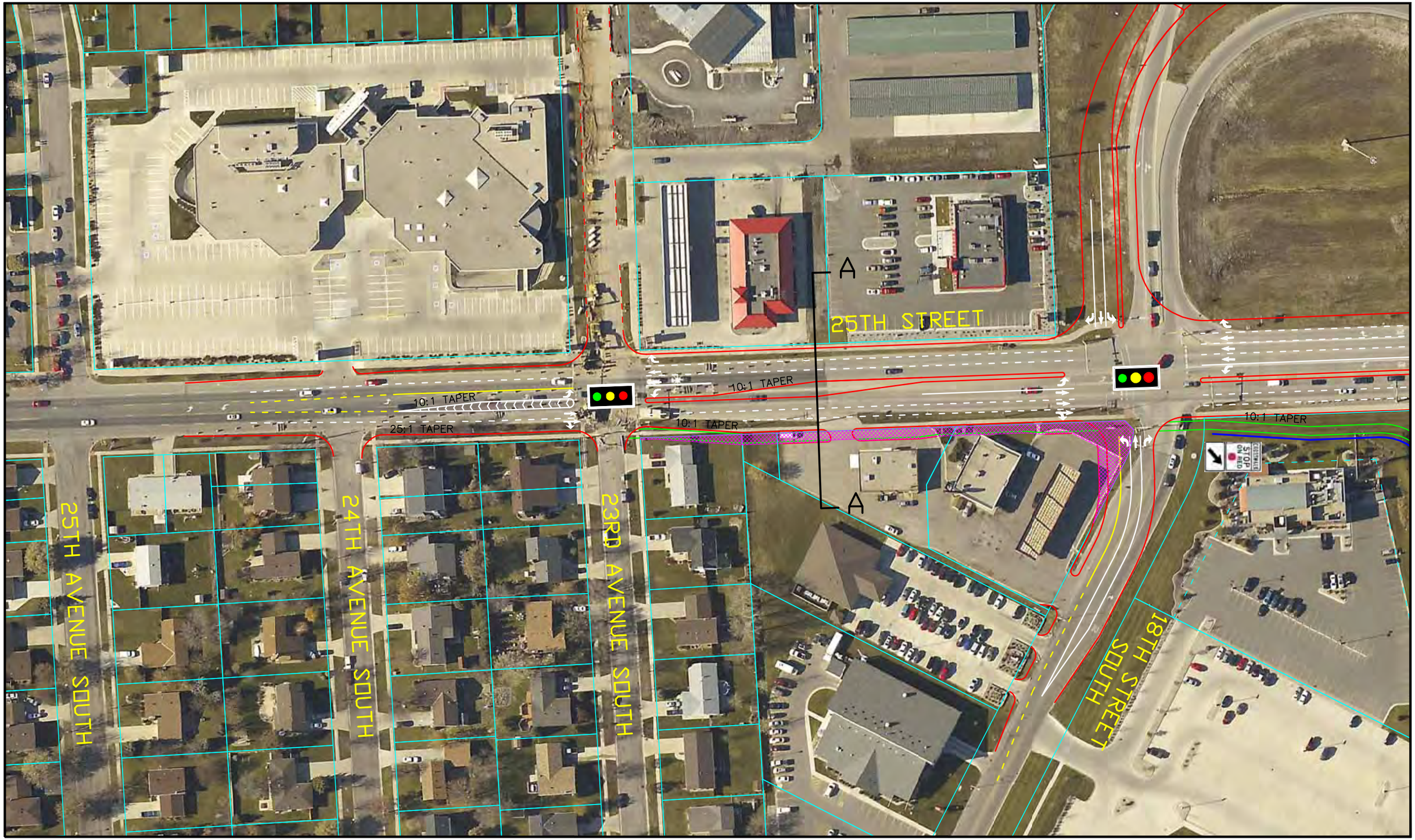
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 32



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Proposed Geometry

Final Concept - Prior to Entrance Ramp Construction

N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 33

25TH STREET

INTERSTATE 94

18TH STREET SOUTH

N

SCALE 1"=50'

ON-RAMP DETAIL

Proposed Geometry

Final Concept

25th Street Corridor Study
City of Fargo, North Dakota

HWS

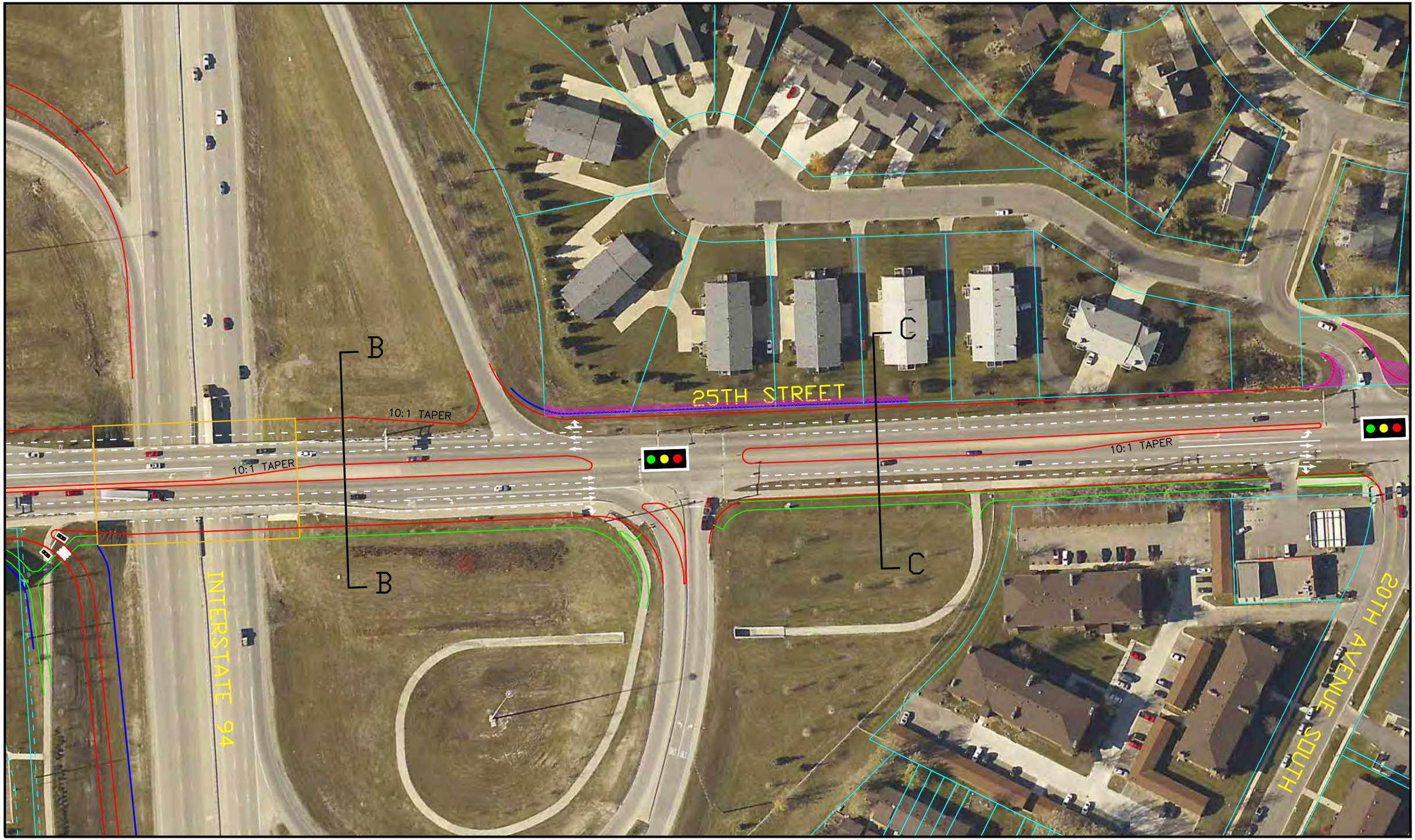
N

SCALE 1"=200'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 34



25th Street Corridor Study
City of Fargo, North Dakota

HWS

Proposed Geometry
Final Concept

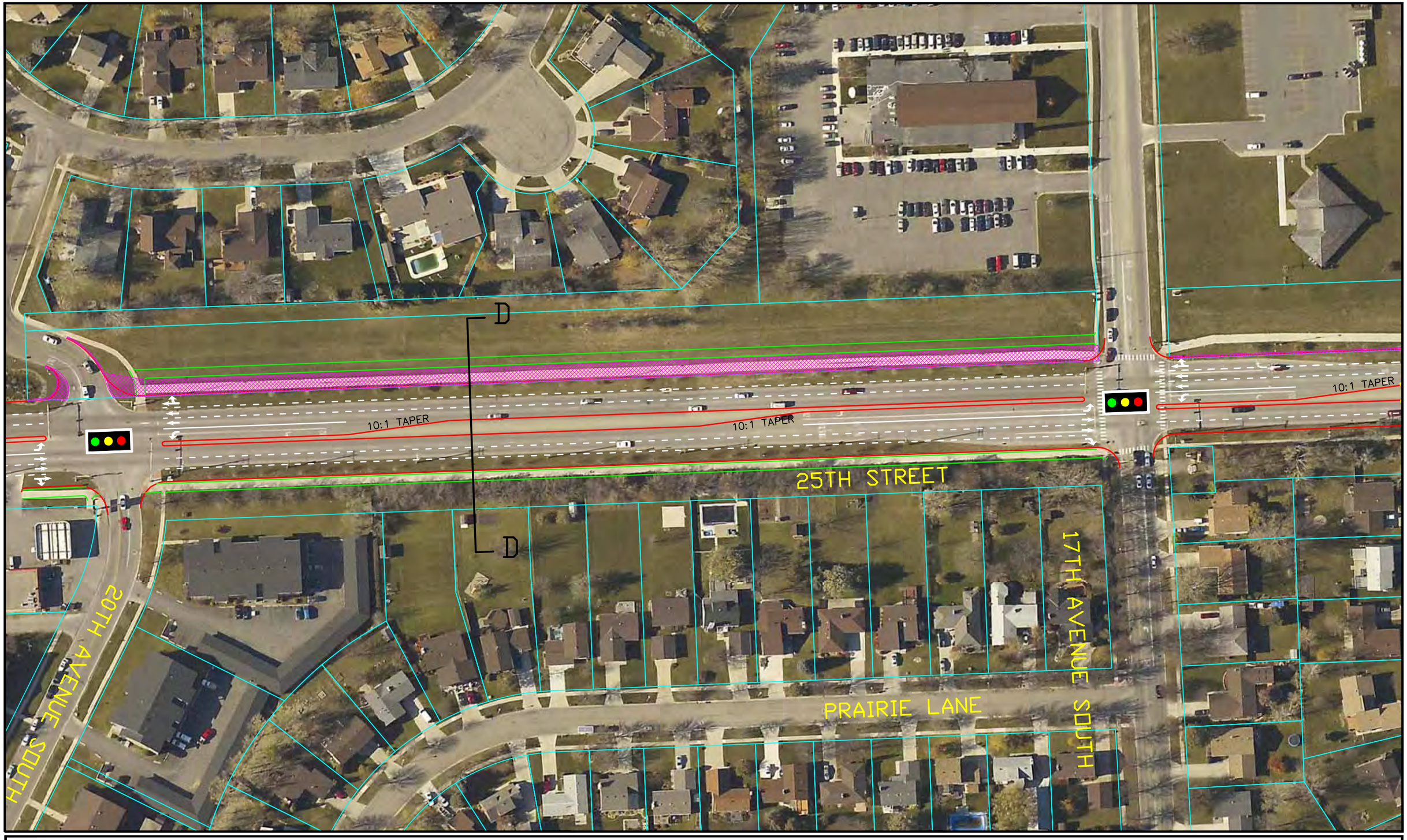
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 35



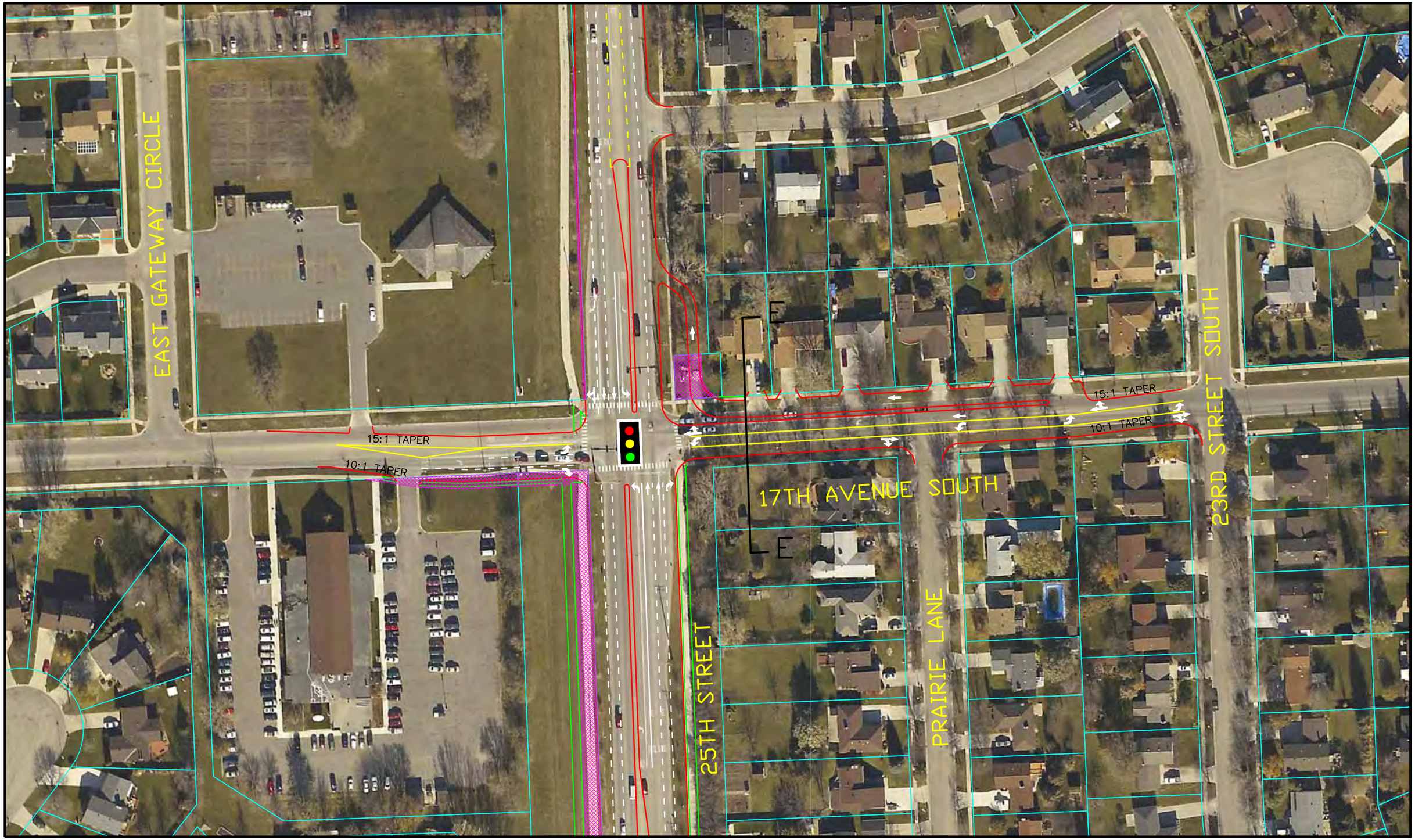
25th Street Corridor Study
City of Fargo, North Dakota
HWS

Proposed Geometry
Final Concept

N
SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 36



25th Street Corridor Study
City of Fargo, North Dakota

HWS

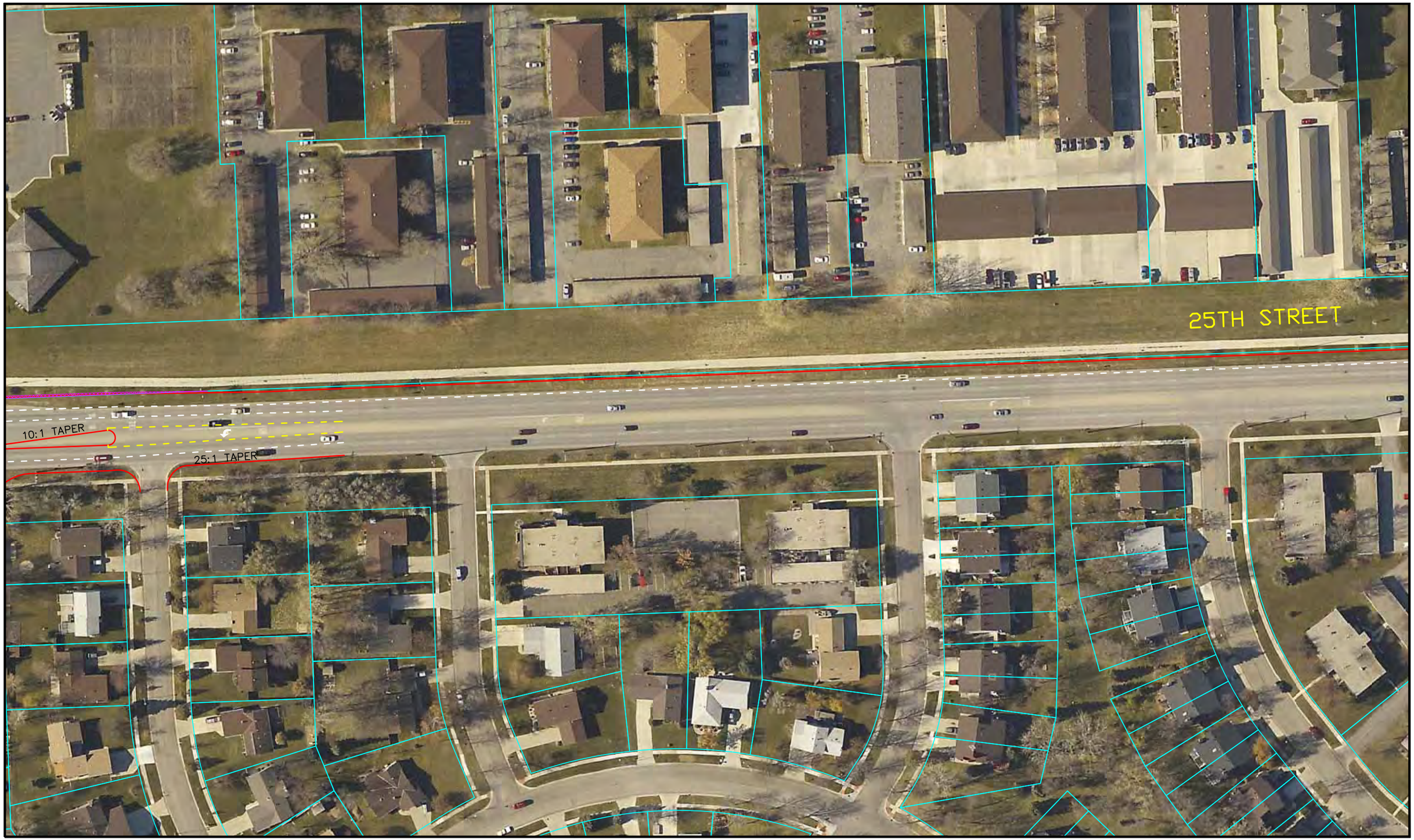
Proposed Geometry
Frontage Road Alternative

N

SCALE 1"=100'

LEGEND:
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 37



25th Street Corridor Study
City of Fargo, North Dakota

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Proposed Geometry

Final Concept

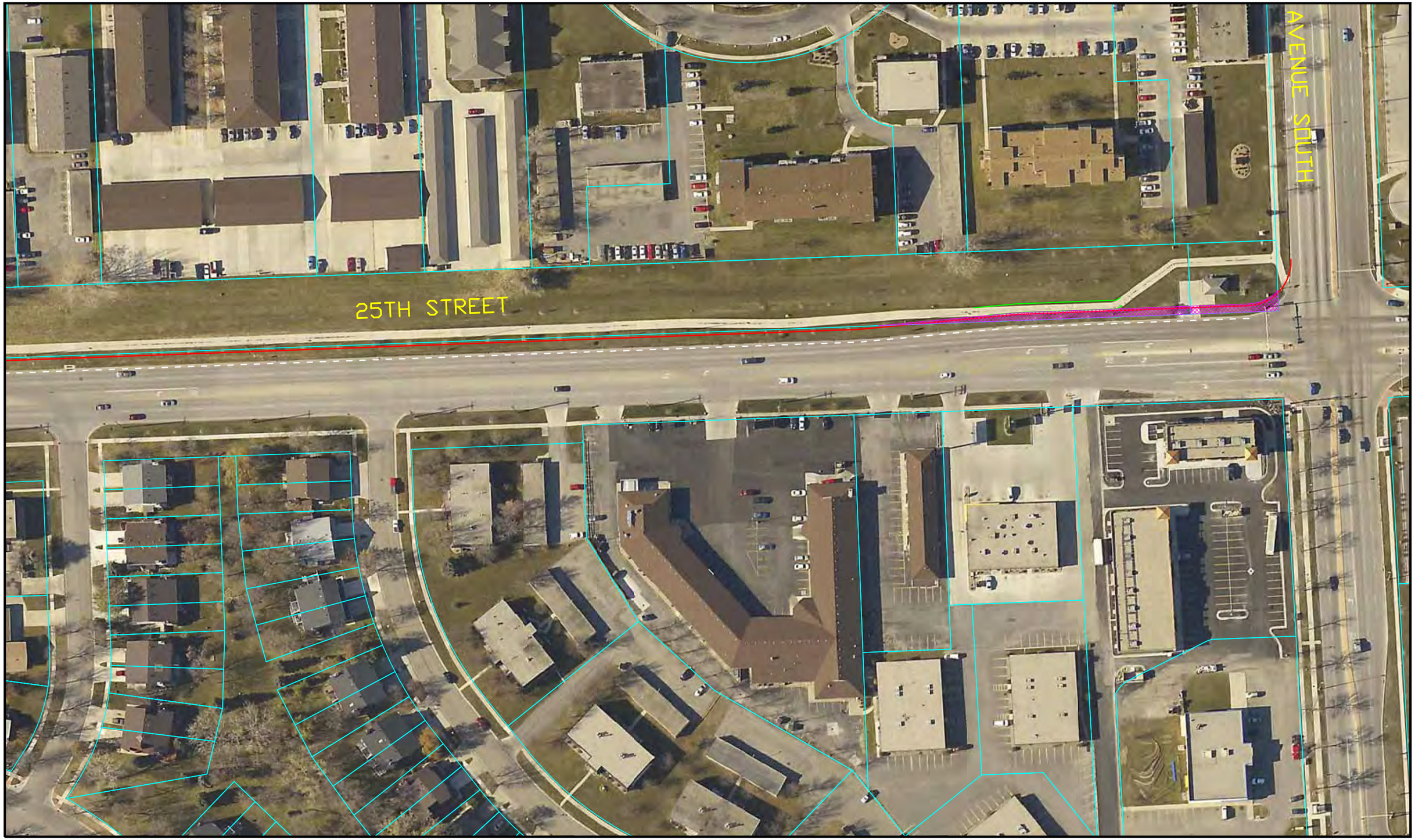
N

SCALE 1"=100'

LEGEND:

- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 38



25th Street Corridor Study
City of Fargo, North Dakota

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Proposed Geometry

Final Concept

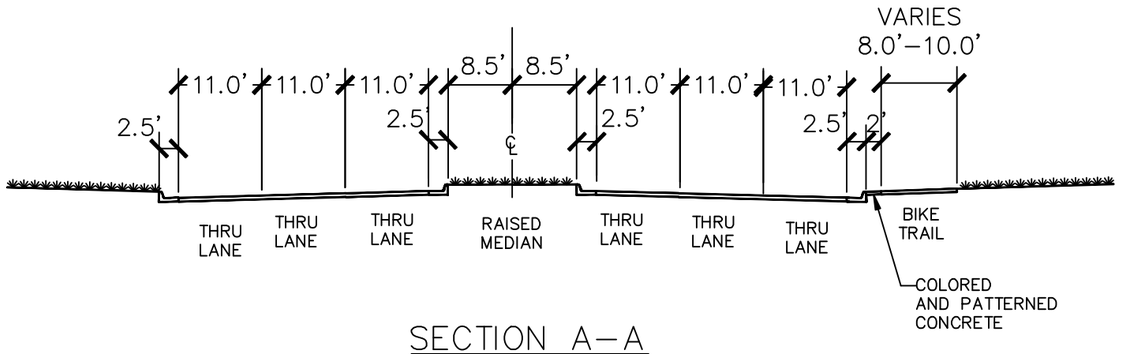
N

SCALE 1"=100'

LEGEND:

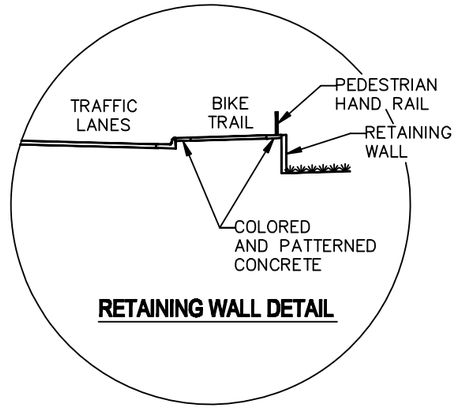
- BACK OF CURB/EDGE OF PAVEMENT
- EDGE OF BIKE TRAIL
- RETAINING WALL
- BRIDGE
- EXISTING RIGHT-OF-WAY
- EXISTING EASEMENT
- PROPOSED RIGHT-OF-WAY ACQUISITION

FIGURE 39

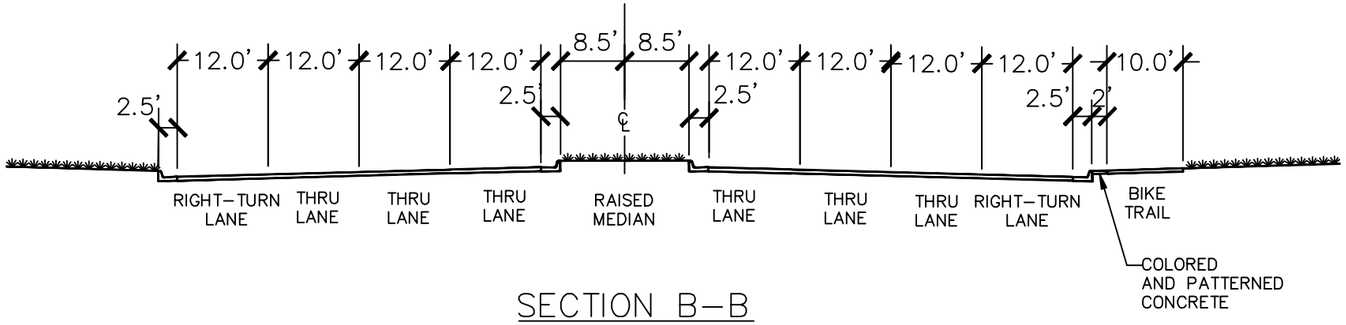


SECTION A–A

SIX-LANE URBAN SECTION

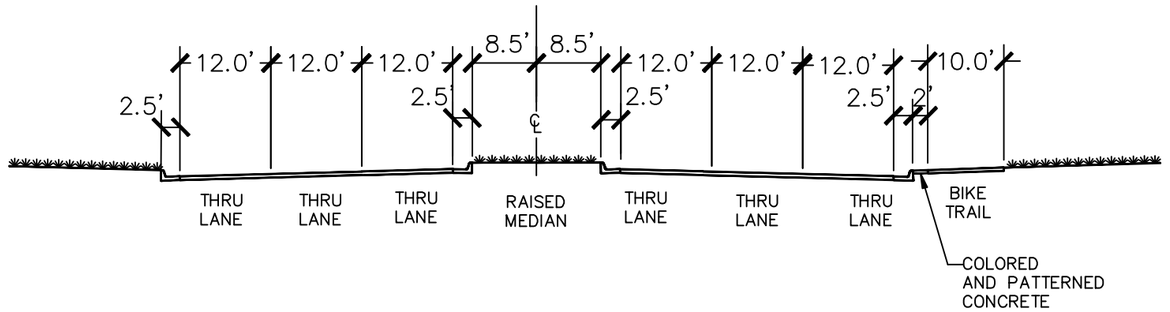


RETAINING WALL DETAIL



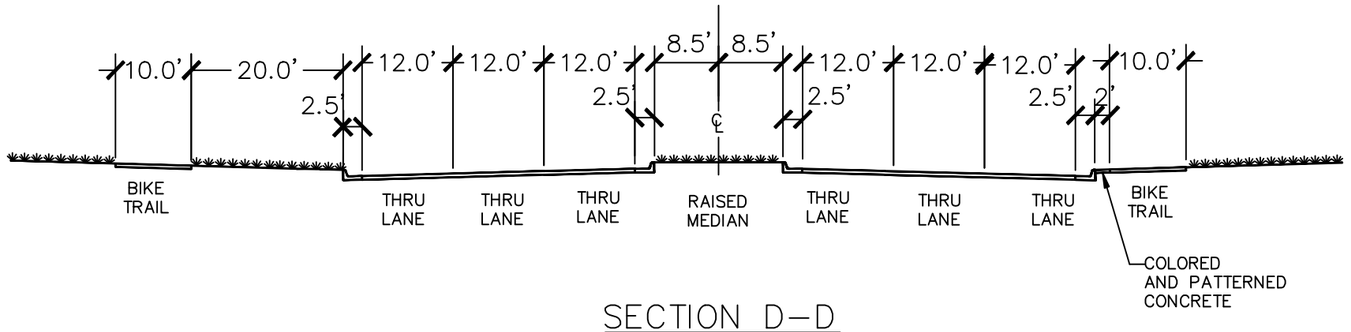
SECTION B–B

SIX-LANE URBAN SECTION WITH AUXILIARY LANES



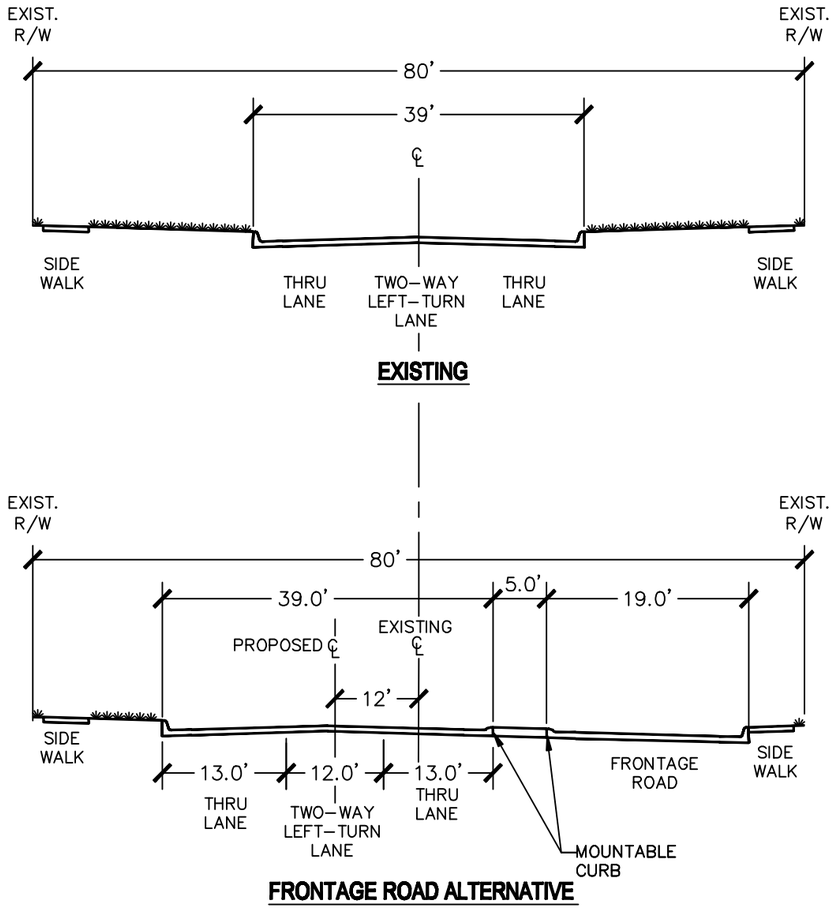
SECTION C–C

SIX-LANE URBAN SECTION



SECTION D–D

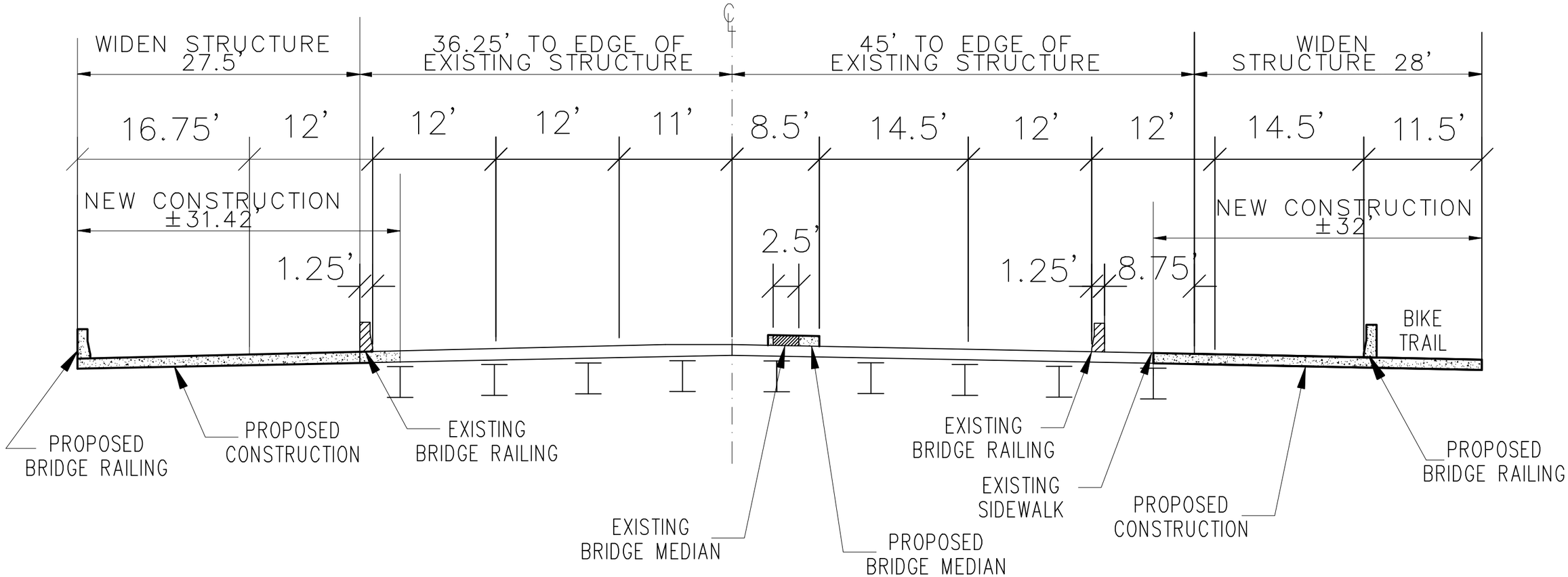
SIX-LANE URBAN SECTION



FRONTAGE ROAD ALTERNATIVE

SECTION E–E

17TH AVENUE SOUTH AND FRONTAGE ROAD



*Facing North

25th Street Corridor Study
City of Fargo, North Dakota

HWS

I-94 Bridge Typical Section

FIGURE 43

6.3.3. Other Issues

Through the development of the preferred alternative, several design issues were identified and studied further. The following sections discuss the issues and their resolution.

6.3.3.1 I-94 Bridge Clearance

One of the main issues associated with the widening of 25th Street was the available bridge clearance between I-94 and the 25th Street Bridge. The proposed typical section over the bridge will widen 25th Street approximately 28 feet on either side of the existing structure (see **Figure 42**). If the road is widened, the clearance for traffic traveling under the 25th Street Bridge on I-94 will be less than the NDDOT minimum clearance of 16.5 feet. Houston Engineering examined various ways to achieve the minimum clearance. Some of these included adjustments to the median or lane configuration over the bridge. Reduction in the width of the bike path over the bridge was also considered; however City staff said it should not be reduced from 10 feet wide. The one measure that may help in achieving the minimum clearance would be to implement shallower I-beams when constructing the widened section of 25th Street. The shallower I-beams will cost more than traditional 63" beams but will be required to achieve the minimum clearance. The added cost of the beams was factored into the cost estimate for the preferred alternative. The specific details of the clearance issue are located in Appendix I.

6.3.3.2 Drainage Issues

Drainage concerns were identified by the SRC representative from NDDOT. These included potential conflicts with existing drainage structures and proposed drainage improvements near the interchange. Currently NDDOT has plans to add a number of drainage structures on the west and east sides of 25th Street.

On the west side of 25th Street, several proposed structures may conflict with the proposed I-94 South Ramp Terminal shifted to the south. The proposed roadway improvements will require some of these structures be relocated or extended. It may also require some grading to ensure positive drainage.

On the east side of 25th Street, the conflict of the proposed on-ramp with an existing lift station in the southeast quadrant of the interchange was a concern. The study team examined the proximity of the ramp and the grades in the area with respect to the lift station to determine the impacts. In order to avoid impacts to the lift station, the study team shifted the ramp north and placed retaining walls between the Interstate and ramp as well as around the lift station.

6.3.3.3 HAWK Signal

Early in the process, the study team identified the need for a pedestrian signal at the proposed trail crossing created when the proposed eastbound on-ramp is constructed (see **Figure 23** and **Figure 34**). The SRC and the study team identified the High-Intensity Activated Crosswalk (HAWK) signal as the desired traffic control

at this location. The HAWK signal is not currently recommended for use in the MUTCD; however it has been identified as one of the updates that will be incorporated into the next edition of the MUTCD. The use of the HAWK signal has been shown to substantially improve motorist stopping behavior when compared to traditional pedestrian-activated signals. For this reason, the HAWK signal was displayed at both public meetings and presented as the preferred traffic signal for the proposed eastbound on-ramp pedestrian crossing.

6.3.4 Cost Estimates

Once the geometric features of the preferred alternative were established, the study team developed order-of-magnitude cost estimates. The cost estimates were separated by the different features. **Table 8** displays the cost of the widening for 25th Street only. **Table 9** displays the cost associated with the 17th Avenue South Frontage Road option. **Table 10** displays the cost of the proposed eastbound I-94 on-ramp. The engineer's opinion of probable cost was estimated to be $9,851,000

Table 8. Finalist Alternative Cost Estimate for Widening of 25th Street

	Unit Cost $	Quantity		Total Cost $
Contract Bond	$15,000	LS		$15,000
Mobilization	$100,000	LS		$100,000
Remove curb and gutter	$5	13171	LF	$65,855
Install curb and gutter	$20	20057	LF	$401,140
Removal of concrete Pavement	$4	28000	SY	$97,998
Common excavation	$2	8900	CY	$17,800
Borrow	$5	12900	CY	$64,500
Base Course	$24	9986	TN	$239,669
Pavement	$43	40969	SY	$1,761,667
Median	$35	4285	SY	$149,975
Traffic Control	$45,000	LS		$45,000
Sidewalk Removal	$3	5113	SY	$12,782
Install Sidewalk	$25	5243	SY	$131,081
Seeding	$500	4.5	AC	$2,250
Other Drainage	$150,000	LS		$150,000
Add lane(s) to bridge	$115	12880	SF	$1,481,200
Erosion Control	$25,000	LS		$25,000
Right of way (comm.)	$10	7402	SF	$74,020
Right of way (res.)	$3	3910	SF	$11,730
Right of way (transfer)	$0	26216	SF	$0
Retaining Wall	$30	1992	SF	$59,760
Traffic Signals	$750,000	LS		$750,000
Utilities Relocation (est)	$132,000	LS		$132,000
Signing and marking	$36,000	LS		$36,000
Total				$5,824,000
18% Preliminary & Construction Engineering				$1,048,300
20% Contingency				$1,164,800
GRAND TOTAL				**$8,037,000**

Table 9. Finalist Alternative Cost Estimate for 17th Ave. S. Frontage Road Option

	Unit Cost $	Quantity		Total Cost $
Contract Bond	$0	LS		$0
Mobilization	$0	LS		$0
Remove curb and gutter	$5	1840	LF	$9,200
Install curb and gutter	$20	3035	LF	$60,700
Removal of concrete Pavement	$4	1418	SY	$4,965
Common excavation	$2	0	CY	$0
Borrow	$5	0	CY	$0
Base Course	$24	580	TN	$13,913
Pavement	$43	2378	SY	$102,264
Median	$35	216	SY	$7,572
Traffic Control	$0	LS		$0
Sidewalk Removal	$3	171	SY	$429
Install Sidewalk	$25	120	SY	$2,997
Seeding	$500	0.5	AC	$250
Other Drainage	$50,000	LS		$50,000
Add lane(s) to bridge	$110	0	SF	$0
Erosion Control	$5,000	LS		$5,000
Right of way (comm.)	$10	2937	SF	$29,370
Right of way (res.)	$3	0	SF	$0
Right of way (transfer)	$0	1680	SF	$0
Retaining Wall	$30	0	SF	$0
Traffic Signals	$0	LS		$0
Utilities Relocation (est)	$10,000	LS		$10,000
Signing and marking	$4,000	LS		$4,000
Total				$301,000
18% Preliminary & Construction Engineering				$54,200
20% Contingency				$60,200
GRAND TOTAL				**$415,000**

Table 10. Finalist Alternative Cost Estimate for Eastbound I-94 On-ramp

	Unit Cost $	Quantity		Total Cost $
Contract Bond	$15,000	LS		$15,000
Mobilization	$100,000	LS		$100,000
Remove curb and gutter	$5	353	LF	$1,765
Install curb and gutter	$20	856	LF	$17,120
Removal of concrete Pavement	$4	753	SY	$2,637
Common excavation	$2	8900	CY	$17,800
Borrow	$5	11900	CY	$59,500
Base Course	$24	1115	TN	$26,764
Pavement	$43	4575	SY	$196,730
Median	$35	353	SY	$12,355
Traffic Control	$5,000	LS		$5,000
Sidewalk Removal	$3	0	SY	$0
Install Sidewalk	$25	0	SY	$0
Seeding	$500	1	AC	$500
Other Drainage	$100,000	LS		$100,000
Add lane(s) to bridge	$110	0	SF	$0
Erosion Control	$10,000	LS		$10,000
Right of way (comm.)	$10	191	SF	$1,910
Right of way (res.)	$3	0	SF	$0
Right of way (transfer)	$0	951	SF	$0
Retaining Wall	$30	9420	SF	$282,600
Traffic Signals	$150,000	LS		$150,000
Utilities Relocation (est)	$10,000	LS		$10,000
Signing and marking	$4,000	LS		$4,000
Total				$1,014,000
18% Preliminary & Construction Engineering				$182,500
20% Contingency				$202,800
GRAND TOTAL				**$1,399,000**

7.0 Recommended Alternative

Once the preferred alternative was developed, the study team gathered final comments and developed a recommendation regarding the 25th Street corridor. The following sections discuss the second public meeting and the recommended alternative.

7.1 Public Meeting 2

Once the project concept plans for the preferred alternative was complete, the second public meeting was conducted. The second public meeting was held on October 8, 2008, at the Lewis and Clark Elementary School, from 5:00 PM – 7:00 PM. A presentation was given at the meeting to highlight the purpose of the project and the features (impacts and benefits) of the preferred alternative. At the conclusion of the meeting, the public was given two weeks to in which to submit comments on the project. Comments were received using comment sheets or through direct contact with HWS. Approximately 40 people attended the meeting. A summary of the comments, along with the actual comments sheets received, are displayed in Appendix J.

7.2 Recommendation

Over the course of the study, many different aspects of the corridor were studied. Each of these aspects helped the study team and SRC identify improvements for the corridor that will improve safety and mobility for all forms of transportation. Through this process, the study team was able to identify a set of improvements for the study corridor of 25th Street. This set of improvements was the make up for the recommended alternative. The following sections describe the geometric, operational, and safety features associated with the recommended alterative.

It should be noted, analyses performed for the recommended alternative only evaluated intersections along 25th Street between 23rd Avenue South and 13th Avenue South. Intersections south of 23rd Avenue South were not analyzed because current geometry south of the intersection provides sufficient capacity for future traffic volumes. This is supported by analyses documented in Section 2.2 of this report.

7.2.1 Proposed Geometry

The following components were incorporated into the recommended alternative:

- raised medians
- new on-ramp for northbound 25th Street to eastbound I-94
  - a northbound left-turn bay at the I-94 South Ramp Terminal will be maintained if the new on-ramp construction is delayed
- I-94 South Ramp Terminal shifted south
- Southbound lane extension to 13th Avenue South
- Maintain bike path widths of 10 feet throughout the project
  - One exception to the width may be necessary to minimize potential impacts. The bike path in front of Camelot Cleaners may need to be decreased from 10 feet wide to 8 feet wide

The recommended lane geometry is very similar to the preferred alternative discussed in Section 6. The only difference between the recommended alternative and the preferred is that the frontage road option for 17th Avenue South will not be recommended. **Figures 32-36, 38-39** display the proposed lane geometry for the recommended alternative. In addition, **Figures 40, 41, and 43** display the typical sections that were used along the study section of 25th Street as well as 17th Avenue South.

The study team developed order-of-magnitude cost estimates for the recommended alternative. The cost estimates included the cost of the widening for 25th Street and the cost of the proposed eastbound I-94 on-ramp. The engineer's opinion of probable cost was estimated to be $9,436,000. The breakdown of these costs is displayed in **Tables 8, and 10**.

7.2.2 Capacity Analyses

A LOS analysis was not performed for the recommended alternative; however, the capacity analyses results for Alternative 2 (described in Section 5.2) were considered interchangeable with those that are anticipated for the recommended alternative. This conclusion was reached because the lane geometries are similar enough that changes to the results of the capacity analysis would not be significant. The results of the analyses indicate that proposed geometries for the recommended alternative are anticipated to improve levels of service along 25th Street between 23rd Avenue South and 17th Avenue South from the levels of service exhibited for year 2030 conditions with the existing lane configuration. **Table 11** displays a comparison between year 2030 levels of service with and without recommended lane geometries. Intersections that experience LOS F also have the delay in seconds displayed.

Table 11. Synchro intersection Level of Service Comparison

Intersection	AM Peak Period		PM Peak Period	
	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)
13th Avenue South	NA	D	NA	D
17th Avenue South	C	C	F (117)	D
20th Avenue South	C	NA	F (184)	NA
I-94 N. Ramp	C	B	D	B
I-94 S. Ramp	D	C	E	C
23rd Avenue South	C	C	C	B

The following sections discuss the anticipated levels of service for each future year peak period scenario.

Year 2030 AM

For the future AM peak period, most intersections operate at LOS C or better. The intersection of 13th Avenue South is anticipated to experience LOS D. However, there are some individual movements at 13th Avenue South and the I-94 South Ramp Terminal that

operate at LOS E or worse. All other intersection movements operate at LOS D or better. **Figure 29** displays the anticipated year 2030 AM peak hour levels of service.

Year 2030 PM

The results of the analysis indicate that levels of service is improved over Alternative 1: 13th Avenue South is anticipated to improve from LOS E to LOS D. There are some individual movements throughout the study area at that operate at LOS E, however. **Figure 29** displays the year 2030 PM peak hour levels of service for Alternative 2.

7.2.3 Simulation Analyses

Similar to the capacity analysis, a LOS analysis was not performed for the recommended alternative. The simulation analyses results for Alternative 2 (described in Section 5.2) were considered interchangeable with those that are anticipated for the recommended alternative. This conclusion was reached because the lane geometries are similar enough that changes to the results of the simulation analysis would not be significant. The results of the analyses indicate that proposed geometries for the recommended alternative are anticipated to improve levels of service along 25th Street between 23rd Avenue South and 17th Avenue South from the levels of service exhibited for year 2030 conditions with the existing lane configuration. **Table 12** displays a comparison of year 2030 levels of service with and without recommended lane geometries. Intersections the experience LOS F also have the delay in seconds displayed.

Table 12. SimTraffic Intersection Level of Service Comparison

Intersection	AM Peak Period		PM Peak Period	
	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)	Existing Lane Configuration Level of Service (sec.)	Recommended Lane Configuration Level of Service (sec.)
13th Avenue South	NA	F (105)	NA	F (219)
17th Avenue South	NA	D	NA	F (227)
I-94 N. Ramp	C	B	F (109)	B
I-94 S. Ramp	F (198)	C	F (302)	C
23rd Avenue South	F (106)	C	F (279)	C

The following sections discuss the anticipated levels of service for each future year peak period scenario.

Year 2030 AM

The results of the analysis indicate that two intersections are anticipated to operate at LOS D or worse (13th Avenue South and 17th Avenue South). In addition, many of the individual movements at study intersections operate at LOS E or worse. **Figure 30** displays the anticipated year 2030 AM peak hour levels of service.

Year 2030 PM

The results of the PM peak hour analysis indicated that two study intersections, 13th Avenue South and 17th Avenue South, are anticipated to operate poorly under year 2030 traffic conditions. Both the North and South Ramp Terminals exhibited an improvement compared to the existing lane geometry. Many of the movements in the study area are anticipated to operate at LOS E or worse. **Figure 30** displays these levels of service.

7.2.4Safety Analysis

The purpose of the safety analysis was to examine crash history, identify high crash locations (greater than five crashes per year), identify potential countermeasures for the types of crashes, and recommend safety enhancements at those locations.

Crash statistics for the study area were provided by NDDOT. These statistics document crash history from December, 2004, to December, 2007. These crashes were separated into three categories by severity: *Property Damage Only* (PDO) (reportable crashes with at least $1,000 damage); *Injury*; and *Fatality.*

The results of the analysis identified one roadway section and three intersections as high crash locations. For each location, feasible countermeasures were identified using the ITE *Manual*. In addition, crash reduction factors (CRF) were identified for each countermeasure using the *Desktop Reference for Crash Reduction Factors,* FHWA, 2007. Many of the potential countermeasures are related to geometric improvements.

While the recommended alternative offers capacity improvements over year 2030 existing operations, the recommended alternative can provide additional safety benefits. A crash analysis along the corridor revealed the majority of crashes at the I-94 South Ramp Terminal occur when northbound-left turning vehicles cross the southbound through traffic to access I-94 eastbound loop on-ramp. These crashes can be eliminated if the proposed on-ramp is implemented.

7.2.5 Impacts

As part of the study, a solicitation of views was initiated with agencies to solicit input on the potential impacts. This information was summarized to review the potential environment, land use and construction impacts. Most of the impacts are anticipated to be negligible, except those listed below. A complete listing of the solicitation of view can be found in Appendix H.

- North Dakota Park and Recreation said that there were two bird species in the area that may be affected. These birds are located to the east of University Drive, near the river.
- Xcel Energy has a duct running along the east side of 25th Street starting north of 18th Street South. North of the interchange, the duct crosses the street and runs north on the west side of 25th Street.
- Sprint has a fiber optic line along 25th Street It runs on the east side to 18th Street South, crosses to the southwest corner of the I-94 South Ramp Terminal, and continues north under I-94. The proposed improvements may affect the fiber line in several locations, especially if the I-94 South Ramp Terminal is shifted to the south.

- Moorhead Public Service has a power line pole southeast of the I-94 North Ramp Terminal which may be affected by the widening of 25th Street.

Based on these anticipated conflicts, the study team contacted the energy and communication companies to estimate the cost of relocation. The cost estimates were updated to include according to estimates provided by each respective company.

In addition to these impacts, the SRC was able to identify several potential conflicts through the review process. The following sections briefly describe these issues. Each is more fully explained in Section 6.3.3.

7.2.5.1 Bridge Clearance

One of the main issues associated with the widening of 25th Street was the available bridge clearance between I-94 and the 25th Street Bridge. If the road is widened, the clearance for traffic traveling under the 25th Street Bridge on I-94 will be less than the NDDOT minimum clearance of 16.5 feet. One measure that may help in achieving the minimum clearance would be to implement shallower I-beams when constructing the widened section of 25th Street. The shallower I-beams will cost more than traditional 63" beams but may be required to achieve the minimum clearance. The added cost of the beams was factored into the cost estimate for the preferred alternative.

7.2.5.2 Drainage

Drainage concerns were identified by the SRC representative from NDDOT. These included potential conflicts with existing drainage structures and proposed drainage improvements near the interchange. Currently, NDDOT has plans to add a number of drainage structures on the west and east sides of 25th Street.

On the west side of 25th Street, several proposed structures may conflict with the proposed I-94 South Ramp Terminal shifted to the south. The proposed roadway improvements will require some of these structures be relocated or extended. It may also require some grading to ensure positive drainage.

On the east side of 25th Street, the conflict of the proposed on-ramp with an existing lift station in the southeast quadrant of the interchange was a concern. The study team examined the proximity of the ramp and the grades in the area with respect to the lift station to determine the impacts. In order to avoid impacts to the lift station, the study team shifted the ramp north and placed retaining walls between the Interstate and ramp as well as around the lift station.

7.2.5.3 HAWK Signal

Early in the process, the study team identified the need for a pedestrian signal at the proposed trail crossing created when the proposed eastbound on-ramp is constructed (see **Figure 23** and **Figure 34**). The SRC and the study team identified the High-Intensity Activated Crosswalk (HAWK) signal as the desired traffic control

at this location. The HAWK signal is not currently recommended for use in the MUTCD; however it has been identified as one of the updates that will be incorporated into the next edition of the MUTCD. The use of the HAWK signal has been shown to substantially improve motorist stopping behavior when compared to traditional pedestrian-activated signals. For this reason, the HAWK signal was displayed at both public meetings and presented as the preferred traffic signal for the proposed eastbound on-ramp pedestrian crossing.

The recommended improvements should be considered preliminary. Modifications to this plan may be necessary after a ground survey is available and new traffic counts are available.

8.0 Appendix

Appendix A. Existing Conditions Analysis Results

Appendix B. Preliminary Concepts

Appendix C. Updated Concept

Appendix D. Simulation Analysis Report for the 25th Street Corridor Study: CORSIM Analysis

Appendix E. Second Update to Concepts

Appendix F. Refined Alternatives

Appendix G. Public Meeting 1 Comments

Appendix H. Solicitation of Views: Scanned Responses

Appendix I. Memorandum from Houston Engineering on Bridge Clearance Issues

Appendix J. Public Meeting 2 Comments

HWS Consulting Group
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