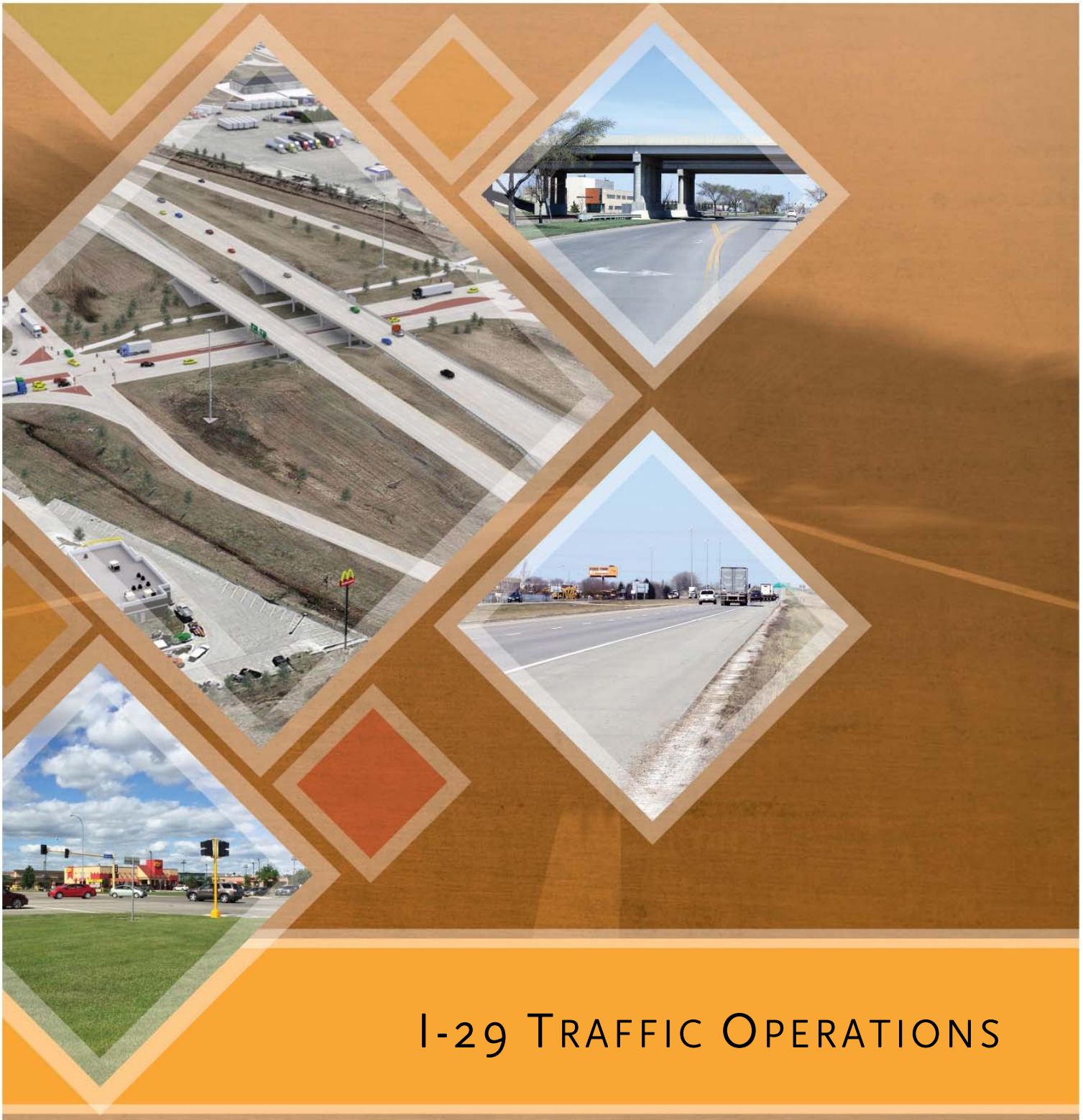


I-29 Traffic Operations

ALLIANT ENGINEERING

KLJ

JUNE 2017

TABLE OF CONTENTS

LIST OF FIGURES

1. Summary of Analysis

2. Existing Conditions Analysis

3. Future Conditions Analysis

4. Alerus Center Event Conditions Analysis

5. Environmental Constraints Analysis

6. Macro Level Alternatives Analysis

7. Micro Level Alternatives Analysis

8. Implementation Plan

LIST OF TABLES

1. Summary of Analysis

2. Existing Conditions Analysis

3. Future Conditions Analysis

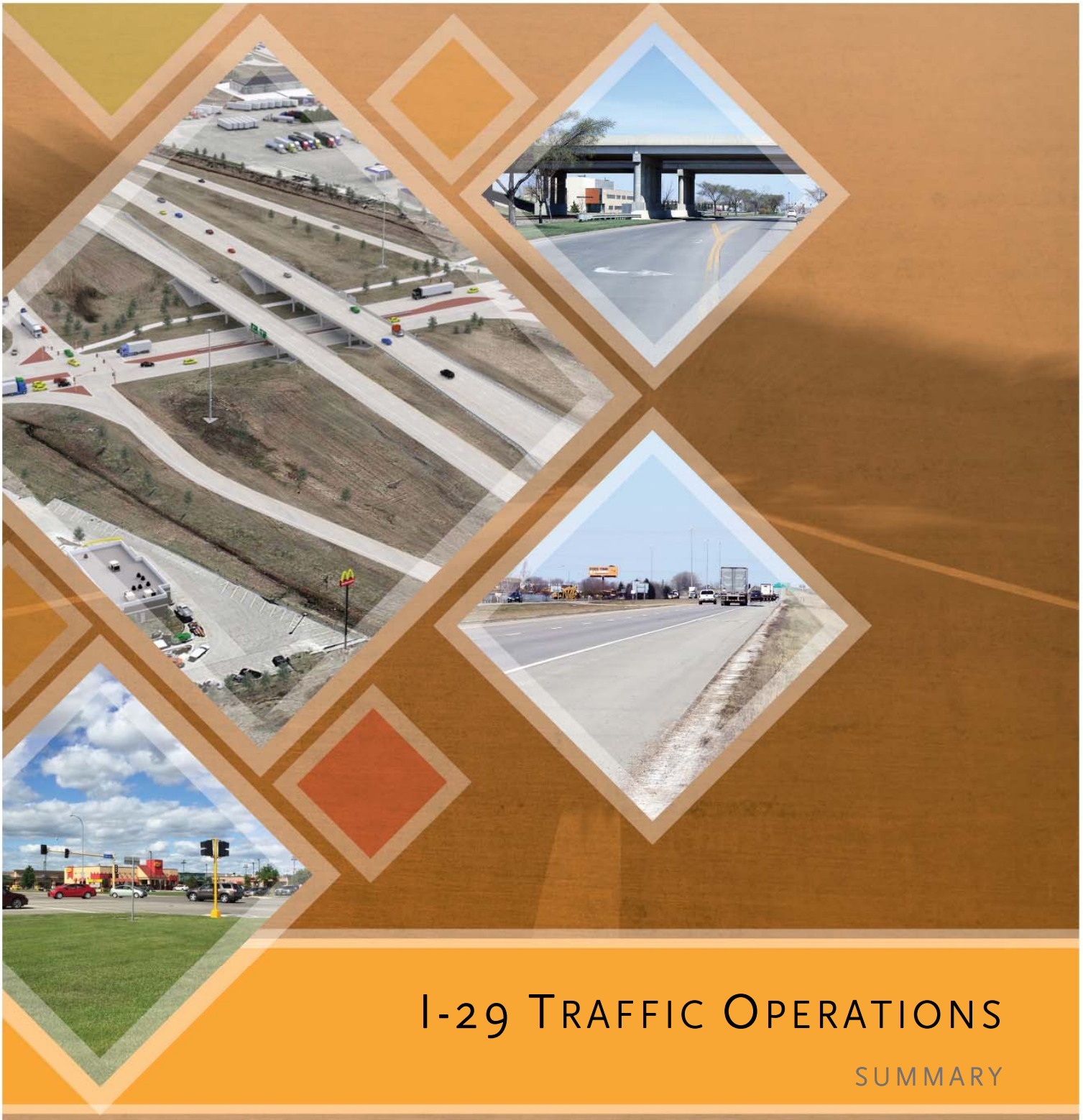
4. Alerus Center Event Conditions Analysis

5. Environmental Constraints Analysis

6. Macro Level Alternatives Analysis

7. Micro Level Alternatives Analysis

8. Implementation Plan



I-29 Traffic Operations

SUMMARY

ALLIANT ENGINEERING

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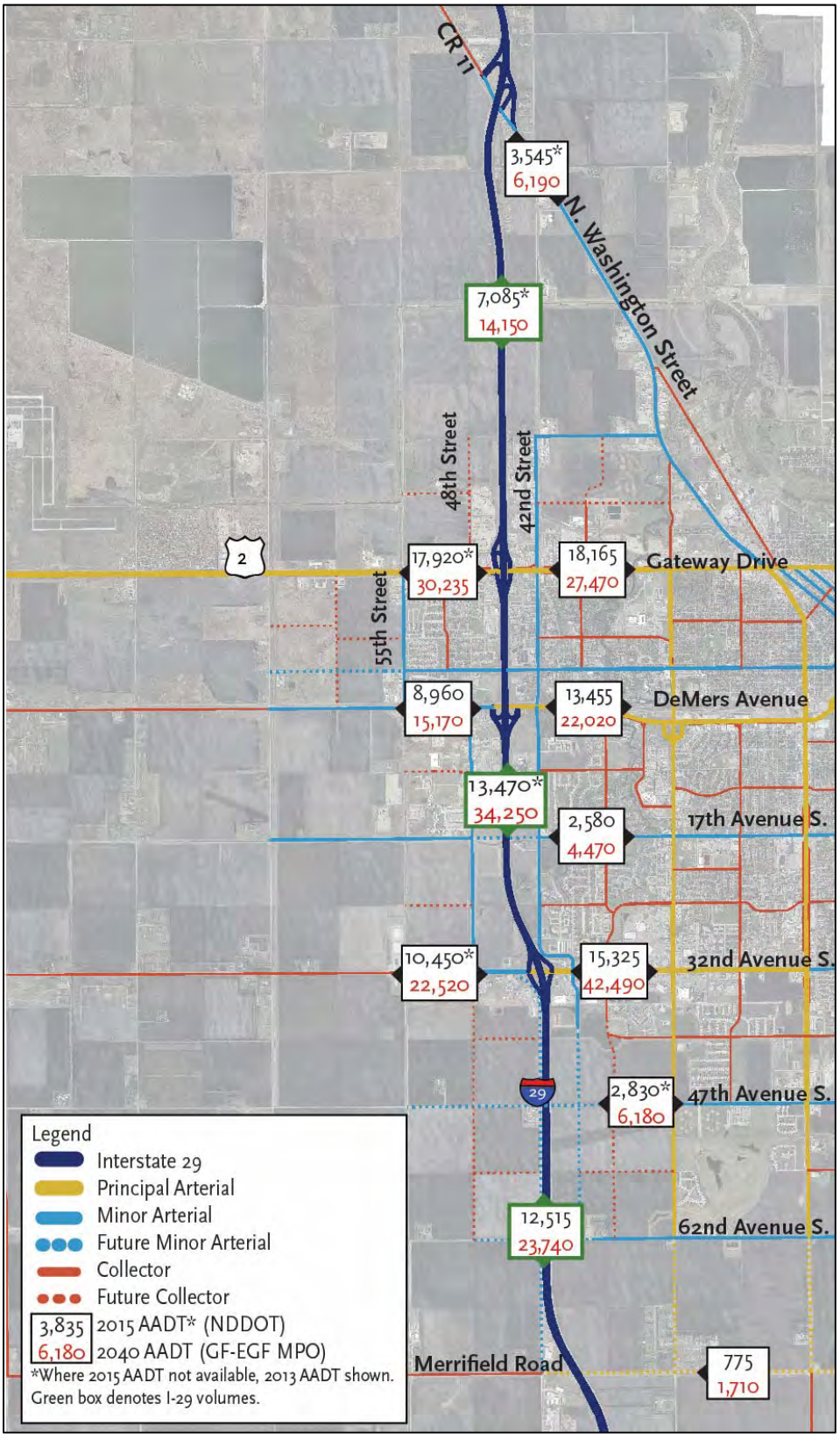
JUNE 2017

1. EXECUTIVE SUMMARY

Interstate 29 (I-29) is one of the most widely traveled corridors in the area and is critical to the region's economic vitality. This corridor serves many purposes: moving freight, providing regional access to the University of North Dakota (UND) campus, special event travel (Alerus Center), out-of-town shoppers and daily commuters. While intended to provide regional accessibility and mobility, this corridor is utilized for local accessibility and mobility as well.

I-29 runs through the City of Grand Forks on a north-south alignment near the city's western border. Three interchanges and one overpass are located along I-29 in Grand Forks at Gateway Drive/ US Highway 2, University Avenue (overpass), DeMers Avenue/ North Dakota Highway 297 and 32nd Avenue South/ US Highway 81B. Just north of Grand Forks, an interchange is located at North Washington Street/ Grand Forks County Road 11/ US Highway 81. Just south of Grand Forks, an overpass is located at Merrifield Road/ Grand Forks County Road 6. These interchanges, overpasses and the areas of I-29 in between comprise the 10-mile study area, as shown in Figure 1-1.

Figure 1-1: Study Area



Study Approach

The study approach for this project was based on three phases, which began with issues identification, moved to developing an improvement plan and ended with plan approval. Each phase contained intermediate memos, review from the Steering Committee and public input opportunities. The phases are summarized below, with the intermediate memos and public input summary in the appendices.

Figure 1-2: Study Process

PUBLIC INPUT

Each phase included stakeholder and public engagement with Steering Committee meetings, public input meetings and updates to the MPO's Technical Advisory Committee. A summary of the engagement efforts can be found in Appendix F.

STEERING COMMITTEE

The Steering Committee was a diverse group of stakeholders with varying interests along the corridor. Members of the Steering Committee included:

- FHWA North Dakota
- NDDOT Grand Forks District
- NDDOT Local Government
- NDDOT Traffic Operations
- Grand Forks – East Grand Forks Metropolitan Planning Organization
- Grand Forks County Engineering
- Grand Forks County Planning and Zoning
- City of Grand Forks Engineering
- City of Grand Forks Planning and Community Development

MPO TECHNICAL ADVISORY COMMITTEE

The Grand Forks – East Grand Forks Metropolitan Planning Organization has a standing committee, the Technical Advisory Committee (TAC) that advises their governing body, the Policy Board on technical matters. Members on the TAC represent Grand Forks, East Grand Forks, Cities Area Transit, Airport Authority, Grand Forks County, Polk County, NDDOT and MnDOT.

ISSUES IDENTIFICATION

The purpose of this phase was to establish the current and future needs and opportunities for the corridor.

INTERMEDIATE MEMOS

The issues identification phase was comprised of four intermediate memos which established the existing and future conditions of the study area, operations during special events and the environmental constraints.

- The Existing Conditions analysis identified existing conditions along the study corridor, including land use, traffic operations, safety, multimodal facilities, infrastructure conditions, lighting and access management.
- The Future Conditions analysis identified future conditions along the study corridor through refined traffic forecasts based on a variety of scenarios. It developed 2025 and 2040 traffic projections and operations.
- Alerus Center Events analysis evaluated the impacts a major event at the Alerus Center, located west of I-29 between Gateway Drive/US 2 and DeMers Avenue/ND 297, has on current and future operations of the interstate.
- The Environmental Constraints analysis identified the affected environment and established the purpose and need for the project, which was used later to evaluate alternatives.

MPO TECHNICAL ADVISORY COMMITTEE UPDATES

Throughout this stage there were two updates to the TAC, which included a brief summary of the analysis completed for the existing conditions analysis, future conditions analysis, environmental constraints and the events conditions analysis.

STEERING COMMITTEE MEETINGS

There were two Steering Committee meetings during this phase; the first reviewed the existing conditions and the second reviewed the future conditions, environmental constraints and the events analysis. Each of the Steering Committee Meetings included a technical presentation and discussion where the Steering Committee was given the opportunity to identify additional issues and provide feedback. Comments received from these meetings have been incorporated into the report.

Figure 1-4: Pop-Up Meeting at Simonson Station Store

PUBLIC ENGAGEMENT

Public Input Meeting #1

The first public input series was held on April 14th, 2016, with the intent to gather feedback on existing and future issues within the I-29 corridor study area. The series consisted of three meetings held throughout the day at various locations along the study corridor, including

- Columbia Mall on South Columbia Road from 12:30 to 2:30 P.M.
- Simonson Station Store on 4720 Gateway Drive from 2:45 to 4:45 P.M.
- Alerus Center at 1200 South 42nd Street from 5 to 7 P.M.

Figure 1-4: Public Input Meeting Advertisement on DMS along I-29

The Columbia Mall and Simonson Station Store meetings were informal discussions including a display board and members of the study team on-hand to answer questions. The Alerus Center meeting was an open house format with a formal presentation.

A variety of techniques were used to inform the public about their opportunity to comment on the project.

- A press release and box ad were published 10 days before the meeting.
- Information was posted on www.drivei29.com.
- Fliers were distributed to the Steering Committee, the Grand Forks Region Economic Development Council, Grand Forks City Commission and the Grand Forks County Commission.
- Advertisement on the Dynamic Message Signs north and south of Grand Forks on I-29.

Fifteen people attended one of the three meetings held throughout the day. Including four at the Columbia Mall, three at the Simonson Station Store and eight at the Alerus Center.

IMPROVEMENT PLAN DEVELOPMENT

The improvement plan phase evaluated high level infrastructure scenarios, specific improvement opportunities and a plan for implementation.

INTERMEDIATE MEMOS

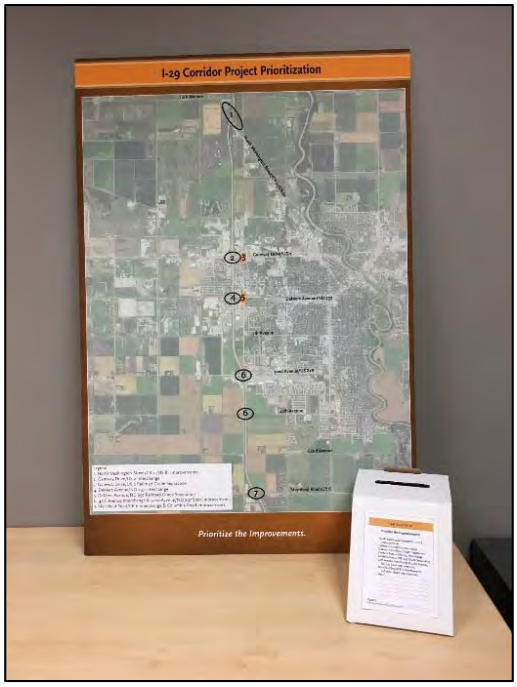
The improvement plan development phase was comprised of three intermediate memos:

- The Macro-Level Alternatives analysis used the project purpose and need statement, cost-benefit analysis and cost-effectiveness analysis to evaluate a variety of grade separations, interchanges and red river crossings that altered regional traffic patterns to reduce network wide delay and miles travelled and should be included in future infrastructure scenarios.
- The Micro-Level Alternatives analysis evaluated each of the existing interchanges and future interchange opportunity locations to identify necessary improvements such as loops, lane configurations, traffic control, turn lanes and other improvements.
- The Implementation Plan created a project development and programming framework for infrastructure needs throughout the study area.

MPO TECHNICAL ADVISORY COMMITTEE UPDATES

Throughout this stage there were two updates to the TAC. The first occurred after the Macro Level Analysis was completed, which presented the infrastructure scenarios to be carried forward for further analysis. The second occurred after the Micro Level Analysis which presented alternatives based on the analysis and Value Planning workshop.

Figure 1-5: Voting Ballot Boxes



STEERING COMMITTEE MEETINGS

There were four Steering Committee meetings during this phase; two occurred during the development of the Macro-Level Alternatives memo, one during the Micro-Level alternatives and one during the Implementation Plan. Comments received from these meetings have been incorporated into the final report.

PUBLIC ENGAGEMENT

The second public input meeting was held on February 16th, 2017, with the intent to gather feedback on the alternatives and the implementation plan. The meeting was held at the Alerus Center at 1200 South 42nd Street from 5:30 to 7:30 P.M. This meeting included an open house and formal presentation. After the presentation, attendees were given ballots to indicate their preference on the alternatives presented and implementation strategies.

A variety of techniques were used to inform the public about their opportunity to comment on the project.

- A press release and box ad were published 10 days before the meeting.
- Information was posted on the project website.
- Fliers were distributed to the Steering Committee, the Grand Forks Region Economic Development Council, Grand Forks City Commission and the Grand Forks County Commission.

Eleven people attended the meeting.

PLAN APPROVAL

The plan approval phase was comprised of project wrap-up activities, including developing the final report and appendices, presenting to guiding committees and agencies, including City, County and State stakeholders and the last public input meeting.

KEY APPENDICES

A variety of supporting information has been included in the appendices to the final report, including the following key items:

- **Evaluation of FHWA Policy Points for 47th Avenue** which evaluates the 47th Avenue interchange using FHWA's Eight Policy Points to substantiate the need for an interchange at the 47th Avenue location.
- **Evaluation of FHWA Policy Points for Merrifield Road/CR 6** which evaluates the Merrifield road/CR 6 interchange using FHWA's Eight Policy Points to substantiate the need for an interchange at the Merrifield Road/CR 6 location.
- **Public Involvement Summary** includes the meeting materials used to advertise the public input meetings, the materials presented and all comments received.

PRESENTATIONS

NDDOT Management Presentation

The draft report was presented to NDDOT Management. Multiple questions were asked and answered related to interstate origins and destination, mainline I-29 operations with next interstate access and support infrastructure needs.

City Committee of the Whole

The final report was presented to the Grand Forks City Council of the Whole on June 12th, 2017. This presentation was information only and designed to garner questions to incorporate into the final draft.

Grand Forks County Board of Commissioners

The final report was presented to the Grand Forks County Board of Commissioners on June 7th, 2017. This presentation was information only and designed to garner comments to incorporate into the final draft.

MPO Technical Advisory Committee

The final report was presented to the TAC for comment and approval on June 14th, 2017. They recommended approval.

MPO Policy Board

The final report was presented to the Policy Board for comment and approval on June 21st, 2017. The Policy Board approved the study.

Public Engagement

The final public input meeting was held June 15th, 2017, with the intent to gather feedback on the final plan. The meeting was held at the Alerus Center at 1200 South 42nd Street from 5:30 to 7:30 P.M. This meeting included an open house and formal presentation.

A variety of techniques were used to inform the public about their opportunity to comment on the project.

- A press release and box ad were published 10 days before the meeting.
- Information was posted on the project website.

No members of the public attended.

SUMMARY OF KEY ISSUES, IMPROVEMENT AND IMPLEMENTATION PLANS

This section presents the key issues identified from the analysis completed in each phase of the report, as detailed above. Each location includes key existing and future issues and opportunities, the prioritized improvements and the implementation plan. The improvements were prioritized based on technical scoring, Steering Committee weighting and ranking and public input. The technical scoring is based on the following criteria:

- Local operations – average delay for the combined intersection operations in seconds per vehicle, estimated using traffic simulation software.
- Mainline operations – average density for the 500-foot upstream section of off-ramps and 500-foot downstream section of on-ramps, estimated using traffic simulation software.
- Environmental impacts – permanent ecological, socioeconomic, business, cultural and recreational impacts.
- Safety – estimated crash potential for rear-end, sideswipe and crossing conflict, estimated using Vissim outputs in FHWA's Supplementary Safety Assessment Model.
- Cost – estimated project cost and construction impacts.

The highest ranked alternatives included in this document are not the final decision. Further analysis and public input will be needed during the environmental documentation phase of project development before implementation can occur.

Costs reported throughout the document are reported in 2015 dollars and include construction, right-of-way and a 30 percent contingency.

NORTH WASHINGTON STREET/CR 11/US 81

The North Washington Street/CR11/US 81 interchange experiences the least traffic in the study area, carrying fewer than 4,000 vehicles per day. By 2040, this number increases to more than 8,000 vehicles per day. Most traffic through this interchange functional area is coming-from or going-to the city. With interstate access for several large industrial properties this interchange experiences around 33 percent heavy truck traffic. These volumes are unlikely to require major capacity enhancements.

The presence of the Glasston Subdivision on the southwest side of North Washington Street/CR 11/US 81 and skew of the I-29 creates complicated intersection configurations, specifically tight turning radii, leading to truck off-tracking. Additionally, there are no turn lanes along North Washington Street/CR 11/US 81.

In 1.25 miles, there are eight access points. The high posted speeds (55 miles per hour or more), proximity to the interchange functional area and the industrial uses generating relatively high truck traffic makes access management an important element of improving current and future safety.

IMPROVEMENT PLAN

Highest Ranked Alternative

The prioritized improvement plan for the North Washington Street/CR 11/US 81 includes the following:

- Left-turn and right-turn lanes at the ramp intersections.
- Access consolidation at the Sproule Farms and Simplot Grower Solutions.
- Consolidating and realigning the northbound on- and off-ramps and the southbound on-ramp at the interchange.
- Access consolidation at 42nd Street and 54th Avenue. This improvement is optional and should only be pursued if deemed necessary in the future.

The combined set of improvements would prevent future operational and safety issues from developing by reducing crash potential at unsignalized intersections with additional turn lanes and reducing access risk by consolidating accesses. With no current or future operational or safety deficiencies identified, many of the alternatives presented here are low impact and low priority.

Figure 1-6: Access Consolidation at 42nd Street and 54th Avenue

Other Improvements

The other improvement studied was to realign the northbound on-ramp with the private driveway on the west side of North Washington Street/CR 11/US 81. This realignment would help prevent off-tracking of southeast to northbound trucks and limit driver expectancy issues.

IMPLEMENTATION PLAN

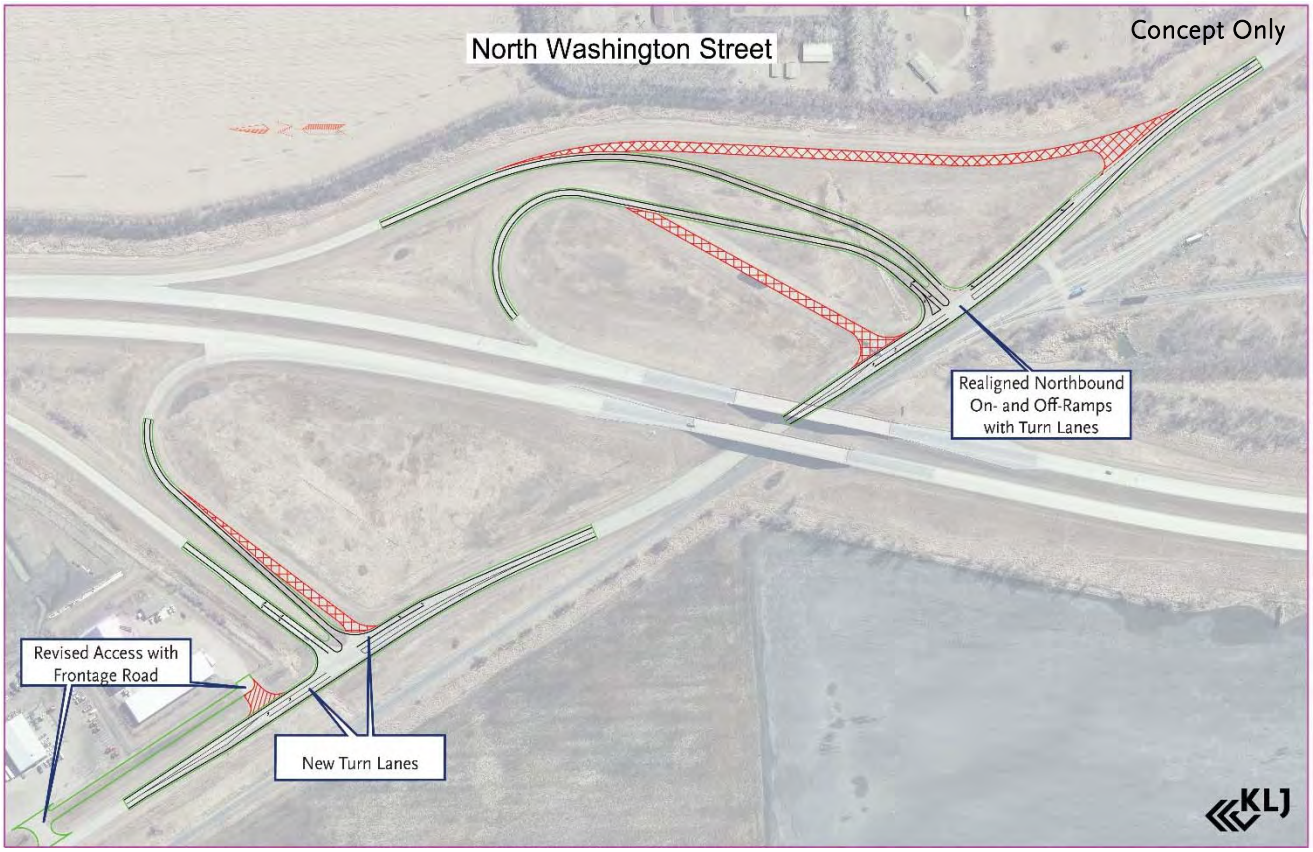
With no identified capacity or safety needs, the improvements prioritized for the North Washington Street/CR 11/US 81 are not urgent. There is the potential to reevaluate potential access management changes and ramp modifications during the scoping process for the 2030 I-29 CPR & Grind project. If improvements are not made during the 2030 project, needs should be reevaluated in the long term.

Cost

The estimated cost in 2017 dollars is $5.98 million ($12.5 million in 2035 dollars). This includes:

- $55,000 for access consolidation at the Sproule Farms and Simplot Grower Solutions
- $375,000 for the optional access consolidation at 42nd Street and 54th Avenue
- $300,000 for turn lanes
- $5.25 million for the East Ramp realignment

Figure 1-7: North Washington Street/CR 6/US 81 Improvement Plan



GATEWAY DRIVE/US 2

Gateway Drive/US 2 is a major local, state and national corridor: it connects the west coast as far east as Michigan; designated on the National Network by the Federal Highway Administration; and helps carry more than half of North Dakota's Freight. With two truck stops, access to an industrial corridor, a National Highway System route, Strategic Highway Network and "Super-Haul Expanded Envelope Corridor", Gateway Drive/US 2 produces heavy truck traffic, greater than 12 percent, which is

10 percentage points higher than typical urban corridors. This corridor is the most widely traveled corridor in the study area, carrying more than 16,000 vehicles under current conditions. While not yet deficient, current peak hour operations create a crash trend, likely associated with congestion and queueing onto across closely spaced adjacent intersections.

Dense access spacing introduces conflicts into the traffic flow as vehicles enter and exit the mainline. In less than a half mile, there are five access points, including four signalized intersections. The one unsignalized intersection, 43rd Street, sees angle crashes caused by drivers on the minor approach trying to find an acceptable gap. Long queues and heavy traffic may reduce acceptable gaps and obstruct vision of conflicting traffic.

Access spacing, combined with heavy traffic, including heavy truck traffic creates poor traffic flow and operations. By 2040, traffic operations at many of the study intersections in the interchange functional area fall to poor or deficient levels and queues reach the interstate.

This interchange functional area also sees challenges due to the at-grade railroad crossing of the Glasston Subdivision east of 42nd Street. While the Glasston Subdivision only sees an average of six trains per day currently, local and regional developments and the potential rerouting of the Mill Spur are expected to increase that number up to twelve trains per day. On average, each train causes more than five minutes of delay, which creates major delays and increased crash potential on the interstate by introducing stopped vehicles onto the highway. As a result of the Glasston Subdivision Railroad Crossings Mitigation Study, a grade separation was recommended.

IMPROVEMENT PLAN

Interchange Improvements

Highest Ranked Alternative

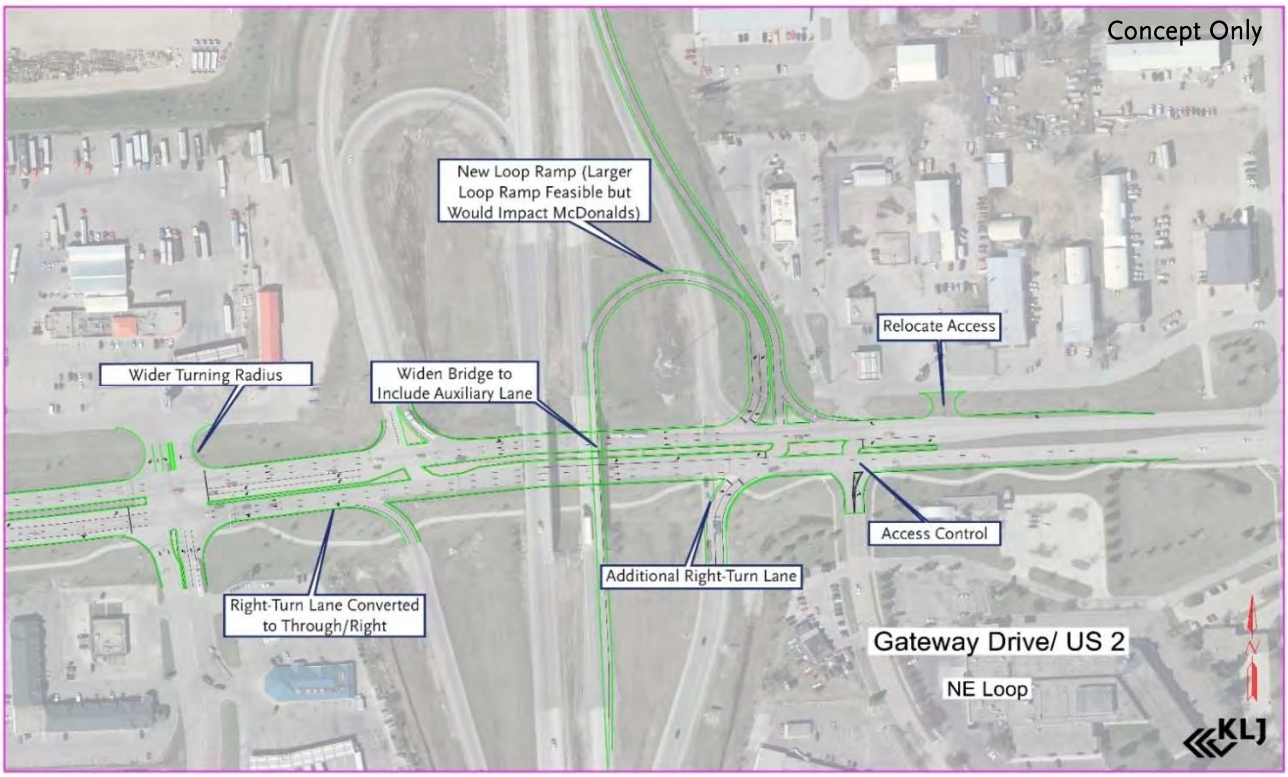
Analysis completed for this study confirmed the analysis and recommendations of the US 2 Corridor Study which prioritized the Northeast Loop Alternative. The Northeast Loop alternative would

- Widen the east I-29 bridge to include a new auxiliary lane for the northeast loop.
- Provide an additional northbound right-turn lane at the I-29 East Ramp for improved operations.
- Convert the eastbound right-turn lane at 47th Street to a shared through/right-turn lane to improve flow onto the I-29 southbound on-ramp.
- Relocate the north approach of 43rd Street 175 feet east and convert to right-in/right-out. Restrict left-out of the south access of 43rd Street.
- Retaining wall to separate the I-29 northbound on-ramp from the existing McDonald's parking lot. A larger northeast loop ramp has also been considered to mitigate queueing onto the interstate, which would require buying out McDonalds but would mitigate the need for a retaining wall.
- Wider turning radius for westbound right-turns at 47th Street to better accommodate truck traffic entering the Simonson Travel Center and help eliminate trucks broaching the curb or hitting the traffic signal pole.
- Incorporate queue flushing on the off-ramps and new loop ramp that includes queue detection which overrides the traffic control signal to give green time to the off-ramp to prevent queues from extending back or onto I-29.
- Pedestrian crossing improvements at the ramp intersections that would include pedestrian actuation and prevent right-turns on red when a pedestrian is present.

This alternative improves local and mainline operations to LOS "B" through 2040 and is expected to reduce crash potential by 48.6 percent.

The interchange improvement is independent of the grade separation improvement.

Figure 1-8: Gateway Drive/US 2 Improvement Plan



Other Improvements

Two other alternatives analyzed provide acceptable local and mainline operations and reduce crash potential, but come at a much higher cost for implementation. They will be carried forward into environmental documentation and can be found in Chapter 7:

- The Diverging Diamond Interchange improves operations but results in access impacts west of I-29 with the needs of a backage road.
- Modified Single Point Urban Interchange improves operations but results in business impacts to the McDonalds in the northeast quadrant of the interchange.

There were other alternatives analyzed in the US 2 Corridor Study but were not carried forward for analysis in this study because they did not meet the project purpose and need.

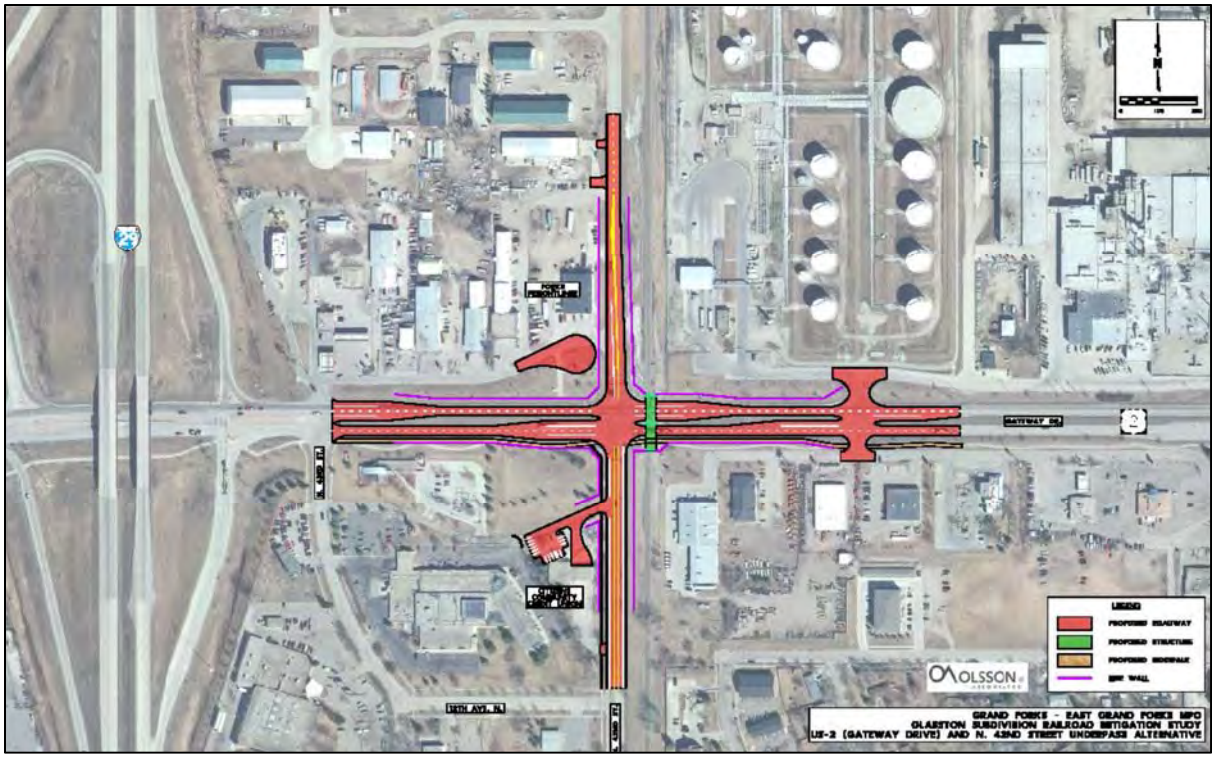
- Single Point Urban Interchange
- Roundabouts with Northeast Loop

Grade Separation Improvements

Highest Ranked Alternative

The Glasston Subdivision Railroad Crossings Mitigation Study prioritized an underpass alternative if the Mill Spur line is to be closed. That study only evaluated one configuration, but more may be required as part of any environmental documentation and is outside the scope of this study. Based on the planning level designs, it would require closing the frontage road access to 42nd Street, north of Gateway Drive/US 2. The compatibility between the access management plan included in the interchange improvement plan and this grade separation alternative would need to be evaluated during project development.

Figure 1-9: Glasston Subdivision Railroad Grade Separation Alternative



The grade separation improvement is independent of the interchange improvement.

Other Improvements

The Glasston Subdivision Railroad Crossings Mitigation Study did not provide any additional grade separation build alternatives. It is likely that additional alternatives design efforts will be completed before project development will occur.

IMPLEMENTATION PLAN

Interchange Improvements

The interchange improvements are needed before 2040, when traffic operations degrade to LOS "F". This means that efforts to implement the most significant needs of the improvement plan (Northeast Loop, access management) do not need to begin until approximately 2031 (beginning of the mid-term phase), when preliminary engineering and advanced project development will begin and the project should be programmed into the TIP.

The Northeast Loop Alternative has an estimated cost of $6.6 million in 2017 dollars ($14.5 million in 2035 dollars).

Interim Improvements

The queue flushing improvements ($20,000 in 2017 dollars per ramp) and pedestrian crossing enhancements ($30,000 in 2017 dollars per ramp) are relatively low cost and should be implemented as soon as feasible, possibly in the next TIP.

Grade Separation Improvements

While train events that occur during peak hour traffic result in queueing onto the interstate during current events, the grade separation is not warranted without the closure of the Mill Spur, according to Benefit-Cost analysis completed in the Glasston Subdivision Railroad Crossings Mitigation Study, and future train growth associated with local and regional developments. In the short term, this project should be evaluated against with the 2045 LRTP update to determine its regional significance and priority. Based on this evaluation, additional planning, scoping and project development activities should occur as reasonable.

Interim Improvements

In the interim, advanced notification of train events can be used on the existing DMS to encourage drivers to choose a more appropriate route. This will help reduce potential for queueing to and onto the interstate.

DEMERS AVENUE/ND 297

DeMers Avenue/ND 297 serves major traffic generators like the University of North Dakota campus, Alerus Center and the industrial park. Traffic to these and other major generators are often blocked or impacted by frequent train events at the 42nd Street at-grade railroad crossing north of DeMers Avenue/ND 297. Based on the 42nd Street Grade Separation Technical Needs Assessment, completed in 2014, train delays average more than five minutes and frequently approach 20 minutes. This produces 60 hours of total delay experienced each day, which is 50 percent greater than the highest threshold set by the Federal Highway Administration to justify a grade separation.

By 2025, recurring congestion, like peak hour traffic, and nonrecurring congestion, like train events on the Grand Forks Subdivision, will overburden this interchange functional area, which has just one through lane in each direction. By 2040, nearly every intersection in this functional area operates deficiently during the A.M. peak and travel time through the interchange functional area increases eight minutes, taking nearly four times longer to get through the interchange than during free flow conditions. Furthermore, train blockages at 42nd Street just north of DeMers Avenue/ND 297 create queueing that extends to the interchange and is forecasted to reroute several thousand vehicles onto the interstate by 2040.

In the last five years, there were more than 100 crashes in the DeMers Avenue/ND 297 functional area, with 65.4 percent occurring at the 42nd Street intersection. Of these crashes at 42nd Street, 28 (40 percent of all 42nd Street crashes) were left-turn crashes. With increasing recurring and nonrecurring congestion, driver frustration may be fueling riskier behavior, including running yellow and red lights. There was also a rear-end crash trend at the East Ramp, including five (35.7 percent of crashes at this intersection) northbound rear-end crashes. This could be associated with long queues at the yield controlled right-turn when motorists look upstream for gaps in traffic and not forward, and then collide with vehicles ahead.

IMPROVEMENT PLAN

Interchange Improvements

Highest Ranked Alternative

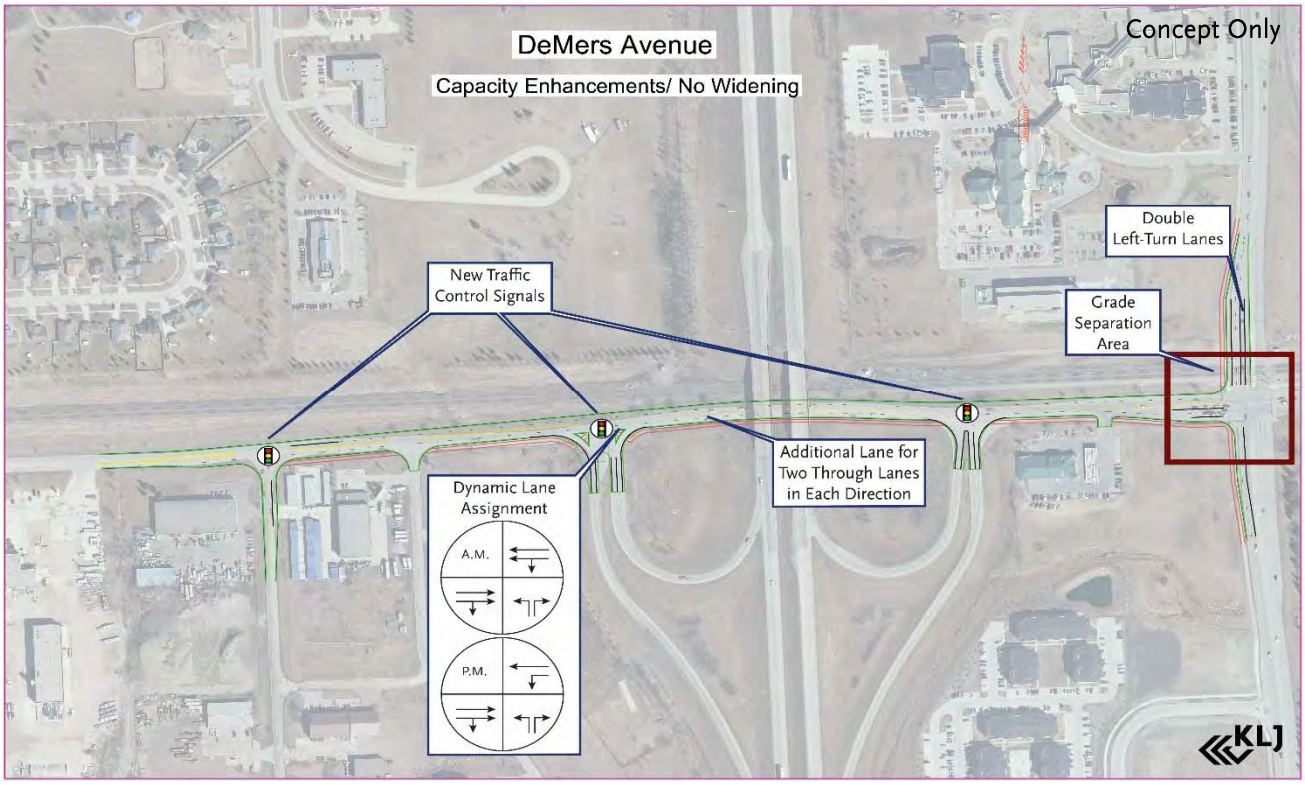
The Capacity Enhancements with No Bridge Widening alternative was the prioritized alternative for DeMers Avenue/ND 297. This alternative would:

- Add one lane of traffic, without impacting the existing bridge.
- Use dynamic lane assignment; during the A.M. peak period, the westbound lanes would operate as two through lanes with a shared left turn lane but during the P.M. peak period, the westbound lanes would operate as one through lane and one left turn lane.
- Incorporate traffic control signals at the 48th Street, West Ramp and East Ramp intersections.
- Install queue flushing included on the West Ramp and East Ramp intersections.

This alternative is the lowest cost alternative with acceptable levels of service under 2040 conditions at $7.40 million and would have a positive impact on operations, expected to be at LOS “C” during both A.M. and P.M. peak hours, and reduce crash potential by 5.4 percent. The improvements are expected to prevent queueing onto the interstate, mitigate crash trends and improve traffic flow and levels of service.

Concept Only

Figure 1-10: DeMers Avenue/ND 297 Improvement Plan



Other Improvements

Three other build alternatives were evaluated but did not provide similar benefits. The Capacity Enhancements with Bridge Widening is feasible and should be carried forward to the environmental document.

- Capacity Enhancements with Bridge Widening is the highest cost alternative. It did not drastically improve local and mainline operations or safety compared to the prioritized alternative that did not include widening. This alternative provides a 2.9 percent improvement in operations for the peak hours over the Capacity Enhancements with No Bridge Widening but with a cost 154.1 percent higher.

The Roundabouts with Ramp Metering, Multilane Roundabouts and Spot Improvements alternatives have deficient operations under higher growth scenarios so do not meet the Purpose and Need established for this project and should be discarded.

- Roundabouts with Ramp Metering, the Multilane Roundabouts and Spot Improvements alternatives provide acceptable local and mainline operations as the prioritized improvement under the 2040 Existing Interstate Access Scenario. However, under higher growth scenarios, like the 47th Avenue Interchange Scenario (increases traffic on DeMers Avenue/ND 297 by 7.0 percent) or the 47th Avenue and Merrifield Road/CR 6 interchange scenario (increases traffic on DeMers Avenue/ND 297 by 10.1 percent), operations began to deteriorate to unacceptable levels under higher growth scenarios.

Grade Separation Improvements

Highest Ranked Alternative

Interchange improvements cannot resolve the queueing and delay issues that occur during train events. However, the interchange improvements do not impact or preclude any of the grade separation alternatives analyzed in the 2014 environmental document. With no signed environmental document, no preferred alternative has been officially developed, but the need has been established and Alternative "B" was prioritized:

- Alternative "B": Lower 42nd Street Roadway Below Railroad and DeMers Avenue, Shift Alignment West of Existing
  - » $40.0 million in 2017 dollars.
  - » This would create an underpass and shift 42nd Street to form a jug handle.
  - » This alternative would limit access to right-in/right-out at the gas station in the southwest corner of the DeMers Avenue/ND 297 and 42nd Street.

Figure 1-11: Railroad Grade Separation Alternative B for 42nd Street

The build alternatives included in the environmental document would mitigate nonrecurring congestion associated with train events on the Grand Forks subdivision and improve multimodal crossing safety. They would provide more than $9.2 million worth of safety and delay benefits between 2017 and 2040.

Figure 1-12: Railroad Grade Separation Alternative C for 42nd Street

Alternately, building an interchange that could handle the storage of blocked vehicles during a train event would be cost prohibitive and unnecessary for most times of the day. Planning level cost estimates suggest $31 million would be needed to build up the interstate and related infrastructure to carry the rerouted traffic. A railroad grade separation would mitigate nonrecurring congestion associated with train events, and when combined with the interchange improvements, would ensure acceptable day-to-day local and mainline operations.

Other Improvements

The other build alternative that was included in the environmental document included Alternative "C", which would

- Lower the DeMers Avenue and 42nd Street intersection below the railroad on its existing alignment
- This alternative would construct an underpass on the existing alignment.
- This alternative would relocate the access to the gas station in the southwest corner of the DeMers Avenue/ND 297 and 42nd Street.

IMPLEMENTATION PLAN

With deficient operations expected by 2025, the interchange improvements and railroad grade separation at the DeMers Avenue/ND 297 interchange functional area were identified as high priority needs.

Interchange Improvements

Given the needs identified by 2025, preliminary engineering and advanced project development should occur in the short term (2017-2025). The Capacity Enhancements with No Bridge Widening Alternative has an estimated cost of $7.4 million in 2017 dollars ($9.0 million in 2021 dollars).

Interim Improvements

The queue flushing improvements ($20,000 in 2017 dollars per ramp) are relatively low cost and should be implemented as soon as feasible, possibly in the next TIP.

Grade Separation Improvements

A grade separation at the Grand Forks Subdivision at-grade crossing will require a finalized NEPA document. Environmental documentation, preliminary engineering and project programming should be completed in the short term, 2017-2025. In the mid-term, it is expected that advanced project development, including construction could occur. The grade separation has an estimated cost of $40 million in 2017 dollars ($61.6 million in 2028 dollars).

Interim Improvements

More immediately, advanced notification of train events can be used on the existing DMS to encourage drivers to choose a more appropriate route. This will help reduce potential for queueing to and onto the interstate until the grade separation can permanently resolve the problem.

32ND AVENUE/US 81B AND 47TH AVENUE S

KEY ISSUES

32nd Avenue/US 81B serves as a major existing commercial corridor in Grand Forks; 47th Avenue is a major east-west arterial supporting the growth occurring on the south side of Grand Forks. The areas surrounding the existing 32nd Avenue/US 81B interchange and heading south to 47th Avenue are forecasted to be the largest population and employment growth centers in the city through 2040. Specifically, 58 percent of new employment opportunities and 46 percent of new housing opportunities are expected to occur within one mile of either the 32nd Avenue/US 81B interchange or the proposed interchange location at 47th Avenue.

By 2040, volumes on 32nd Avenue/US 81B are expected to exceed 43,500 vehicles each day east of I-29. Furthermore, the commercial nature of the corridor results in a P.M. peak hour that is more than 60 percent higher than the A.M. peak hour. This peaking, combined with growth projections discussed above, results in deficient operations on 32nd Avenue/US 81B by 2025 including queueing onto the interstate during the P.M. peak hour. By 2040, deficiencies begin to occur during the A.M. peak as well. These deficiencies could not be mitigated with improvement scenarios that include widening 32nd Avenue/US 81B to eight lanes.

A major factor in the capacity issues is the bottleneck at 38th Street. 38th Street is a minor north-south arterial which serves destinations to the north like the Alerus Center, and dense existing and future commercial and residential developments to the south. Without a future 47th Avenue interchange ADT on 38th Street south of 32nd Avenue/US 81B will exceed 20,600 vehicles per day, while 38th Street north of 32nd Avenue/US 81B will approach 15,000 vehicles per day by 2040.

The expected future growth will have significant impacts to 32nd Avenue/US 81B; 47th Avenue has been identified as a parallel corridor to help relieve that demand.

Additional issues identified at this location include:

- Crash trends at this interchange location were primarily due to negative offset turn lanes, congestion, long queues and poor traffic flow. The negative offset turn lanes at the 32nd Avenue/US 81B and 38th Street intersection are anticipated to be improved as part of a requested safety project on the corridor.
- Access spacing between the 42nd Street west frontage road and the West Ramp becomes challenging as that intersection becomes important for the future growth area.
- While currently rated as “Good”, pavement from the East Ramp to Columbia Road is expected to be degraded and require reconstruction between 2030 and 2040.

A Road Safety Review and Highway Safety Improvement Program application was recently completed and submitted for the 32nd Avenue/Us 81B corridor extending from the East Ramp east beyond this study area. The recommendations, and ultimately the application, include removing the negative offset of eastbound and westbound left-turn lanes and implement flashing yellow arrow, queue flushing and other improvements.

IMPROVEMENT PLAN

47th Avenue

Highest Ranked Alternative

Analysis completed for this study found a 47th Avenue interchange to have a positive cost-benefit and a high cost-effectiveness. It was also the most effective solution for mitigating deficient operations on 32nd Avenue/US 81B, providing more efficient circulation to the large growth areas, both east and west of I-29 and south of 32nd Avenue/US 81B. The following set of improvements have been prioritized:

- Diamond interchange with south loops and mixing lanes on the current 47th Avenue alignment. This would include traffic control signals at the ramp and a shared-use path along 47th Aveue.
- Improved five-lane urban section that extends from the west adjacent intersection (48th Street) to Columbia Road. Traffic control signal would be installed at the east adjacent intersection (34th Street).

An interchange at 47th Avenue would have many benefits to the Grand Forks regional transportation network:

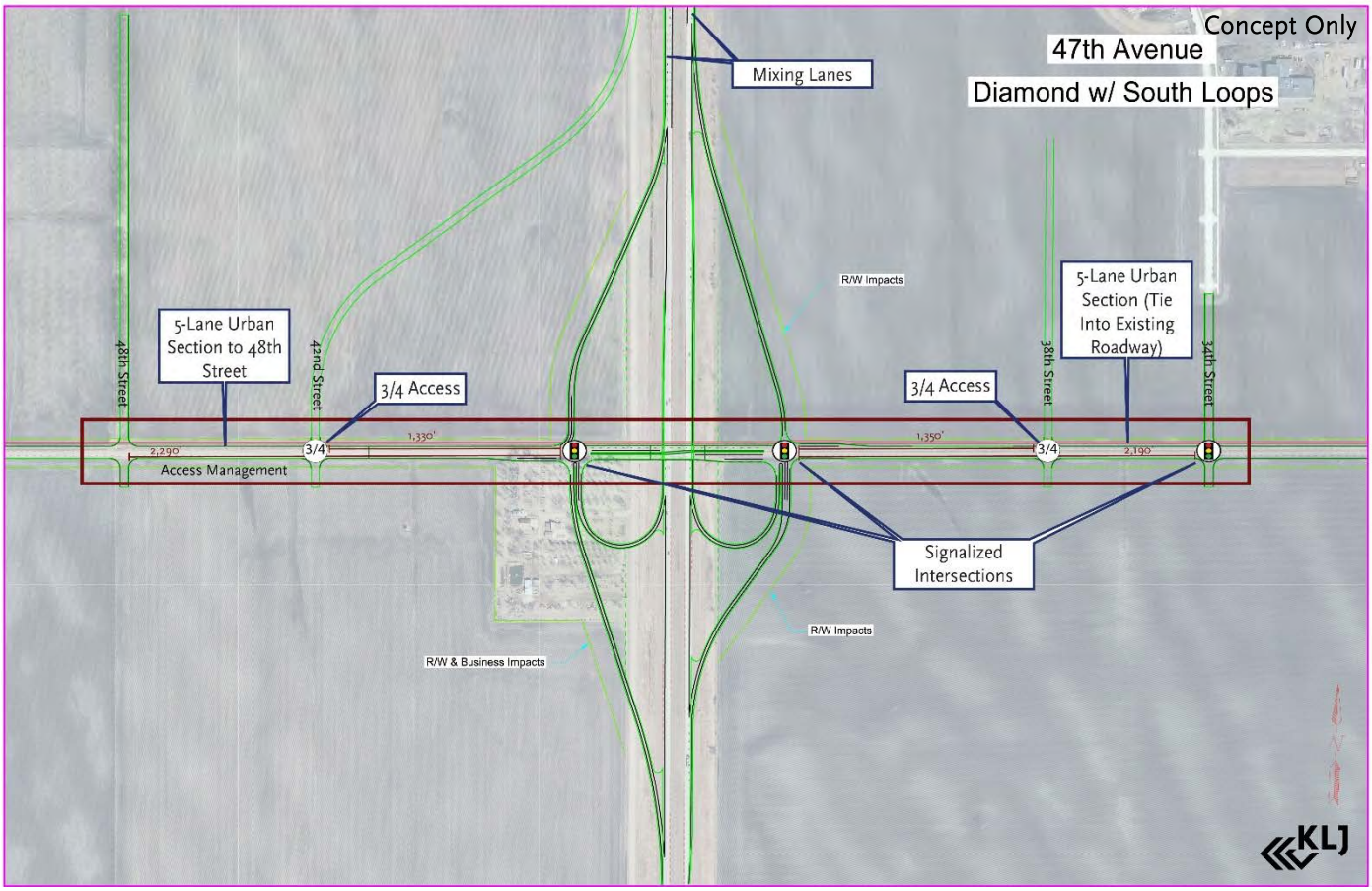
- Reduce 13,500 vehicle miles traveled each day.
- Reduce 1,100 vehicle hours traveled each day.
- Reduces need for significant investment on 32nd Avenue corridor for additional capacity by reducing traffic by 40.3 percent. This allows 32nd Avenue/US 81B to operate at LOS "D" with the Spot Improvements Alternative, which includes double left-turn lanes on the eastbound, westbound and southbound approaches and an extended right-turn lane on the eastbound approach at the 38th Street intersection and a double right-turn lane on the northbound off-ramp.
- While this interchange is expected to increase traffic on I-29 by 21.2 percent, there is adequate capacity on I-29 without degrading operations to a deficient level.
- Net decrease in crash potential on I-29 of 10.2 percent to 28.6 percent, depending on the configuration. Even with a 21.2 percent increase in traffic on I-29, the lack of queueing onto the interstate from 32nd Avenue/US 81B provides a net safety benefit.

Other Improvements

Three other alternatives were analyzed and will be carried forward into environmental analysis:

- Traditional Diamond Interchange is a standard diamond interchange with signals at the West Ramp, East Ramp and first adjacent intersection east of the interchange. This alternative provides challenges between the 32nd Avenue/US 81B southbound on-ramp and the 47th Avenue southbound off-ramp, which results in some lane densities that fall to LOS "D" during the 2040 P.M. peak. This alternative has the worst mainline operations of all alternatives studied. The deficiencies do not occur consistently across the full hour of analysis so do not change mainline levels of service but are concerning to providing high-speed and safe operations of I-29.
- Shifted Diamond with South Loops Interchange is a standard diamond interchange, including a southwest and southeast loop ramp shifted 0.25 miles south. This alternative provides acceptable operations, but during the 2040 P.M. peak hour, some lane densities fall to LOS "D" and has a higher estimated crash potential.
- Shifted Diamond with No Business Impacts is a diamond interchange with a southwest loop ramp for the on and off movements for the southbound movements. It is the lowest cost alternative and requires the least amount of ROW, but does result in densities at LOS "D" during the 2040 P.M. peak hour. Momentary queueing on the off-ramp reaches back to the interstate, but given its brevity it does not change the mainline level of service across the full hour of analysis, but are concerning to providing high-speed and safe operations of I-29. This alternative is the only one that does not require a buyout of the campground in the southwest quadrant of the interchange.

Figure 1-13: Diamond with South Loops and Mixing Lanes



32nd Avenue/US 81B

Highest Ranked Alternative

The Spot Improvements Alternative was the prioritized alternative for 32nd Avenue/US 81B. This alternative would:

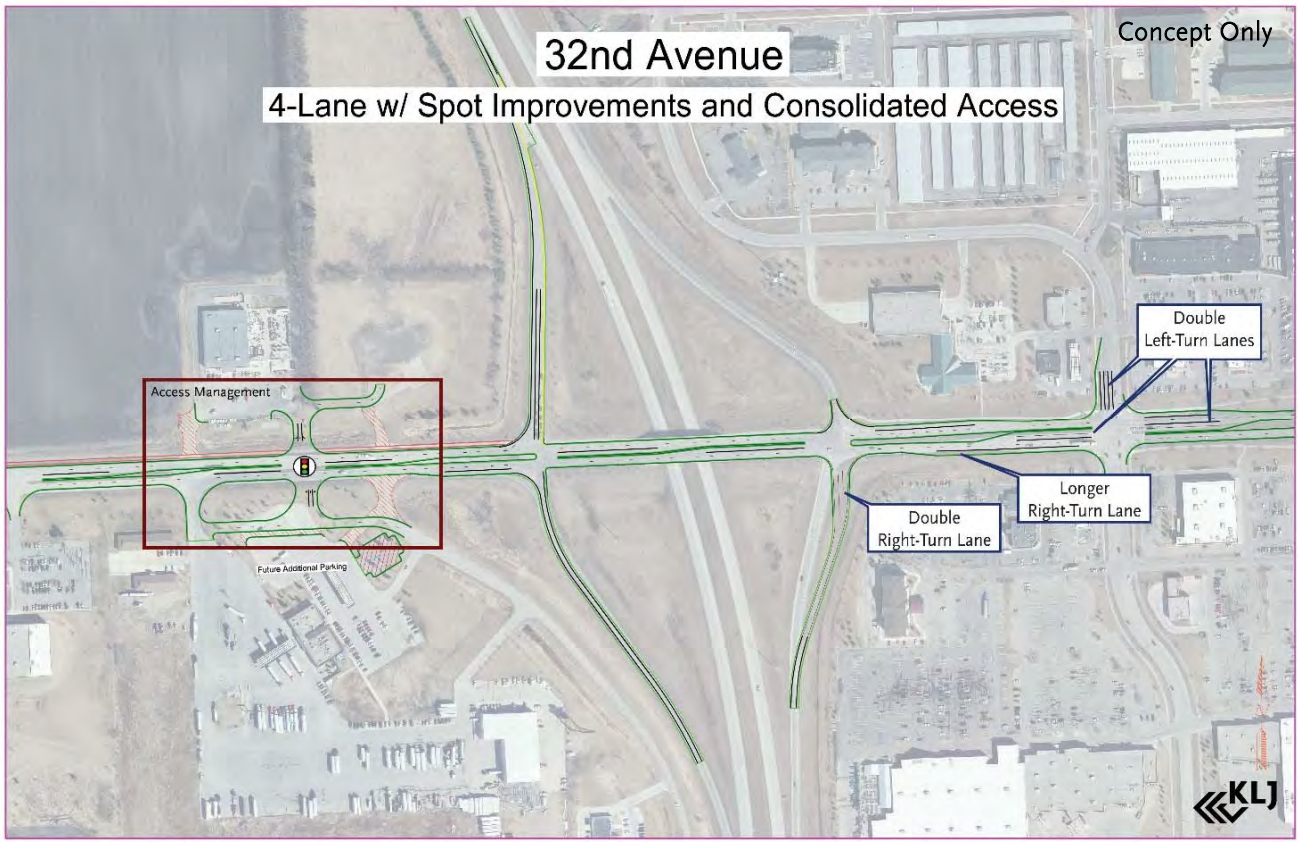
- At 38th Street, extend the eastbound right-turn lane (435 feet, full width) and install double left-turn lanes on the eastbound, westbound and southbound approaches.
- At the East Ramp, a double right-turn lane on the northbound off-ramp.
- Traffic control signal and access modification at the 42nd Street west frontage road intersection.
- Queue flushing on the off-ramps
- Pedestrian crossing enhancements at the ramp intersections include pedestrian actuation and prohibit right-turns.
- Reconstruct or major rehabilitation of pavement from the East Ramp to Columbia Road.

Combined with the construction of the 47th Avenue interchange, the spot improvements would result in all study intersections operating at LOS "D" or better during both peak hours through 2040. This alternative would minimize queueing onto the interstate and improve traffic flow, which should mitigate some of the most prevalent crash trends. The signal at the 42nd Street west frontage road and improvements to the existing signal timing should improve pedestrian crossing safety.

Recent platting on the NW quadrant of the interchange and concern over possible right-of-way acquisition to implement turn lanes potential make portions of the spot improvement plan at 32nd Avenue challenging. These improvements are vital toward the timing of when the 47th Avenue interchange is needed to mitigate congestion at 32nd Avenue. With these improvements, the operational efficiency of 32nd Avenue is prolonged to the year 2030 or beyond. Without these improvements, the need arises prior to 2025. While an interchange at 47th Avenue does mitigate the importance of these improvements, there are still very clear operational and safety advantages to these improvements.

These improvements would not be enough to keep operations at LOS "D" or better through 2040 without a 47th Avenue interchange. As growth accelerates west of I-29 and south of 32nd Avenue/US 81B the traffic patterns change resulting in more turning movements competing with through movements.

Figure 1-14: 32nd Avenue/US 81B Prioritized Improvements



INTERIM IMPROVEMENTS

The queue flushing improvements ($20,000 in 2017 dollars per ramp) and pedestrian crossing enhancements ($30,000 in 2017 dollars per ramp) are relatively low cost and should be implemented as soon as feasible, possibly in the next TIP.

Other Improvements

Other interchange alternatives were studied for this interchange, assuming a 47th Avenue interchange and no widening needed: Consolidated East Ramp, Northwest Loop Ramp, Southwest Loop Ramp and Diverging Diamond Interchange. The Consolidated East Ramp alternative was included in the current Long Range Transportation Plan to help mitigate the bottleneck at 38th Street, but was found to be unnecessary with the construction of a 47th Avenue interchange; congestion could be mitigated with small scale turn lane improvements. These alternatives do provide some benefits to local and mainline operations and safety, but come with much more significant costs, ranging from $13.6 million to $21.5 million.

Ultimately, the Steering Committee recommended to discard these alternatives based on the project purpose and need statement and the scoring criteria. Only the Spot Improvements and Do Nothing alternatives will move forward to the environmental document. This conforms to 23 CFR 450 Appendix A.

IMPLEMENTATION PLAN

The improvement plan for 32nd Avenue/US 81B assumes the construction of a 47th Avenue interchange. The low-cost improvements, queue flushing and pedestrian crossing enhancements, should be considered for inclusion in the next Transportation Improvement Plan and the HSIP improvement project. The HSIP project includes some of the turn lane improvements, but additional improvements are necessary prior to 2025. In the short term, 2017-2025, remaining spot improvements should be evaluated with the 2045 LRTP update and capacity needs should be monitored and analyzed against

the progress of the 47th Avenue interchange project. In the mid-term, advanced project development should proceed to perform reconstruction or major rehabilitation from the East Ramp intersection to Columbia Road. The spot improvements, including turn lanes, should be coordinated with these efforts, if not before.

With 32nd Avenue/US 81B likely to be over capacity as soon as 2025, a new interchange at 47th Avenue is a high priority for the Grand Forks transportation network. An Interstate Justification Report should be initiated and the NEPA document completed by 2025. By 2030, advanced project development should occur with project funding secured.

The Spot Improvement Alternative for 32nd Avenue/US 81B will likely keep operations acceptable through 2025 but will not keep operations acceptable to 2040. Growth anticipated by 2040 will overburden 32nd Avenue/US 81B, even as an eight-lane section. As previously noted, there have been identified right-of-way challenges with the Spot Improvement Plan. Without the Spot Improvement Plan, the 47th Avenue interchange will likely be needed prior to 2025.

MERRIFIELD ROAD/CR 6

KEY ISSUES

For several decades, efforts have been made to identify an alternative bypass/reliever route around the metro area, primarily for truck traffic and the Merrifield Road/CR 6 corridor has been the center of this plan. Currently, without a Red River crossing and bypass, trucks are routed through dense urban areas on Gateway Drive/US 2 or DeMers Avenue/ND 297. During beet harvest, high volumes of trucks use DeMers Avenue/ND 297, creating conflicts with local traffic, pedestrians, bicycles and school activity. This study excluded a Red River crossing from further analysis after it was screened out for not meeting the project purpose and need, which required benefits to traffic conditions within the I-29 study area, nor offering a cost-effective solution to build the interchange and river crossing. The analysis found an interchange at this location has many benefits to the overall transportation network, including reducing traffic on I-29 and the adjacent interchanges nearly five percent and reducing network vehicle miles traveled (VMT) by nearly 75 million miles from 2025 to 2040.

The Merrifield Road/CR 6 is the southern edge of flood protection for the City of Grand Forks and will likely be the furthest south any development stretches. This corridor will likely grow in importance as development occurs to move south. Even still, the corridor provides sufficient capacity for existing and future traffic projections without any deficient operations. However, with pavement conditions in "Poor" or "Satisfactory" some pavement management activities will be necessary, with one programmed to occur in 2018.

IMPROVEMENT PLAN

Highest Ranked Alternative

The prioritized interchange ramp design is a traditional diamond interchange with ramps that could, in the future, incorporate a northwest and southeast loop ramps for additional capacity. Turn lanes and bridge widening were incorporated. Constructing an interchange at this location would not require any additional traffic control at the ramp intersections, through 2040.

An interchange at this location would attract between 4,800 to 6,000 vehicles per day east of I-29, depending on whether the 47th Avenue interchange is built. There are few changes west of I-29. These are not new trips on the network, but those that have been rerouted from other county roadways. This increase in traffic could necessitate improved traffic control, either a traffic control signal or roundabout, and turn lanes at the Merrifield Road/CR 6 and Columbia Road intersection to mitigate deficient peak hour operations. Based on model results, vehicles are attracted to the Columbia Road and Washington Street corridors as parallel routes into the city.

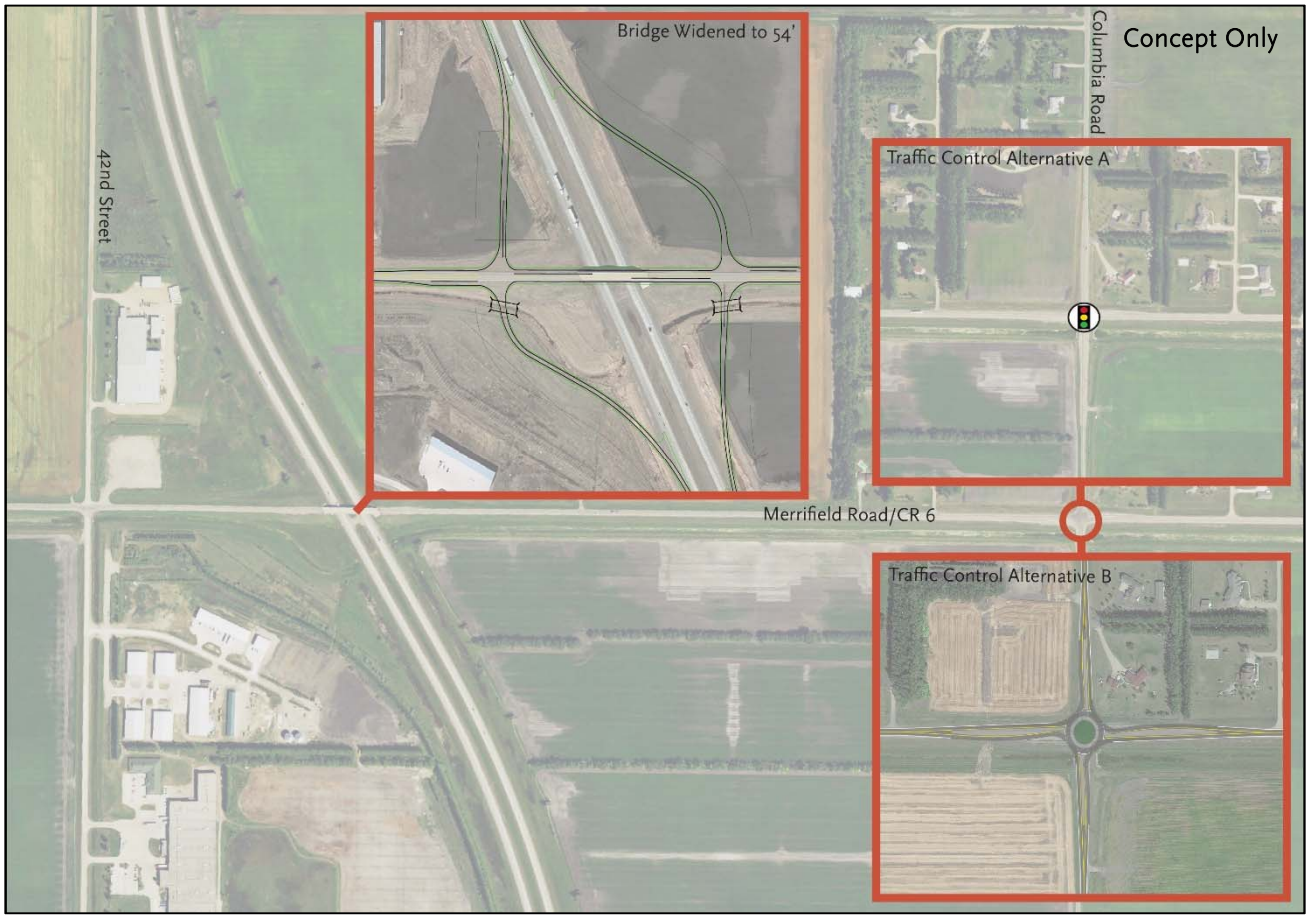
Converting the overpass to a full interchange, plus traffic control at the Merrifield Road/CR 6 and Columbia Road intersection has costs that range between $16.5 million to $18.1 million in 2017 dollars. This does not include the costs for the mill and overlay between 16th Street NE and Columbia Road.

An interchange at Merrifield Road/CR 6 would have many benefits to the Grand Forks regional transportation network and I-29 specifically:

- Reduce 18,000 vehicle miles traveled each day by 2040

- Reduce 647 vehicle hours traveled each day by 2040
- Reduce traffic on mainline I-29 by 4.1 percent by 2040
- Even though there are new merge and diverge conflict points, no safety impacts are expected because of the reduction of traffic on mainline I-29.

Figure 1-15: Prioritized Merrifield Road/CR 6 Improvements



Other Improvements

No other interchange configurations were evaluated in this study because of the previous efforts given to this interchange and the adequate capacity. However, stakeholders have identified other potential designs to be considered in a final environmental document:

- Increasing the space between the ramp intersections so turn lanes can be accommodated outside the bridge and mitigate the need for bridge widening.
- Roundabouts at the ramp intersections to remove the need for turn lanes and mitigate the need for bridge widening.
- Widen the bridge to accommodate the turn lanes and improve pedestrian/bicycle facilities and crossing width for oversized agricultural equipment.

IMPLEMENTATION PLAN

The Merrifield Road/CR 6 interchange has no immediate operational or safety needs but does provide network-wide VMT benefits. Planning and scoping activities will likely occur in the mid-term, between 2026 and 2030, with advanced project development to occur between 2030 and 2040. There are opportunities to coordinate the development of the interchange and related improvements with planned I-29 and Merrifield Road/CR 6 pavement management projects in 2030.

The interchange has an estimated cost of $16.5 million 2017 dollars ($36.1 million in 2035 dollars).

SUMMARY OF NEEDS

Figure 1-16 shows the prioritized improvements for the I-29 Traffic Operations study corridor, summarized below. The highest ranked alternatives included in this document are not the final decision. Further analysis and public input will be needed during the environmental documentation phase of project development before implementation can occur.

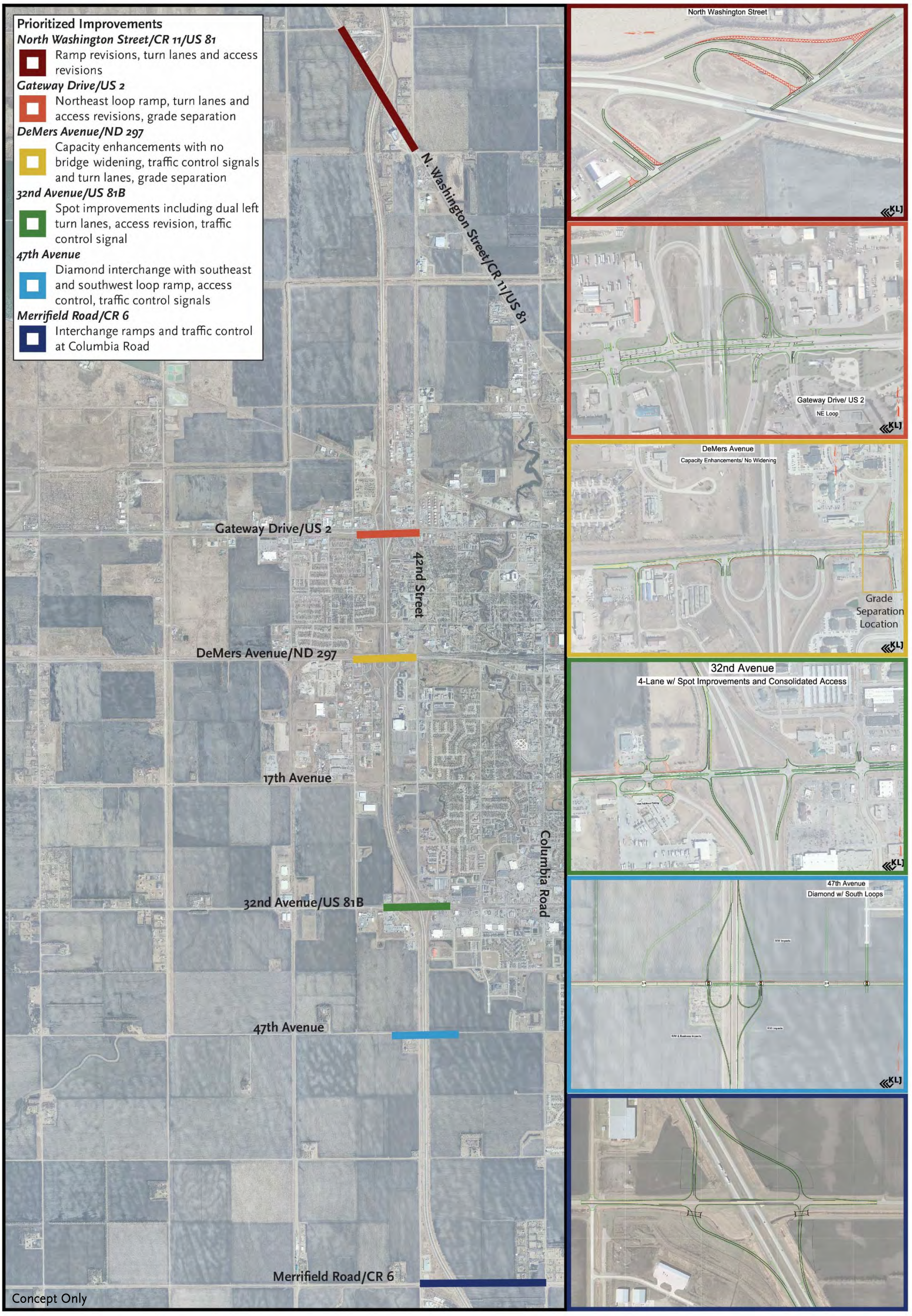
- **North Washington Street/CR 11/US 81.** Realign the northbound ramps, construct turn lanes and consolidate access.
- **Gateway Drive/US 2.** Install a northeast loop ramp for northbound to westbound movements and access and turn lane modifications. Construction of a grade separation would benefit the local and regional transportation network.
  - » Small scale improvements including queue flushing on the off-ramps, pedestrian crossing improvements and train event advanced notification using the dynamic message signs should be considered for programming before 2025.
- **DeMers Avenue/ND 297.** Add capacity to four-lanes through the interchange functional area and install traffic control signals at the 48th Street, West Ramp and East Ramp intersections. Construction of a grade separation would benefit the local and regional transportation network.
  - » Small scale improvements including queue flushing on the off-ramps and train event advanced notification using the dynamic message signs should be considered for programming before 2025.
- **32nd Avenue/US 81B.** Implement spot improvements including dual left-turn lanes on the southbound, eastbound and westbound approaches and a longer eastbound right-turn lane at the 38th Street intersection, dual right-turn lane at the northbound off-ramp and access management at the 42nd Street west frontage road intersection. The 42nd Street west frontage road intersection will need a traffic control signal between 2025 and 2040.
  - » Before 2025, the dual left-turn lanes and right-turn lane at 38th Street and dual right-turn lane at the northbound off-ramp will be necessary for operations.
  - » Small scale improvements including queue flushing on the off-ramps, pedestrian improvements at the ramp crossings should be considered for programming before 2025.
- **47th Avenue.** Construct a diamond interchange with southeast and southwest loop ramps, mixing lanes including a five-lane urban section from 48th Street west of I-29 to 34th Street east of I-29 and traffic control signals at the West Ramp, East Ramp and 34th Street intersections.
- **Merrifield Road/CR 6.** Construct interchange ramps and install traffic control at the Columbia Road intersection.

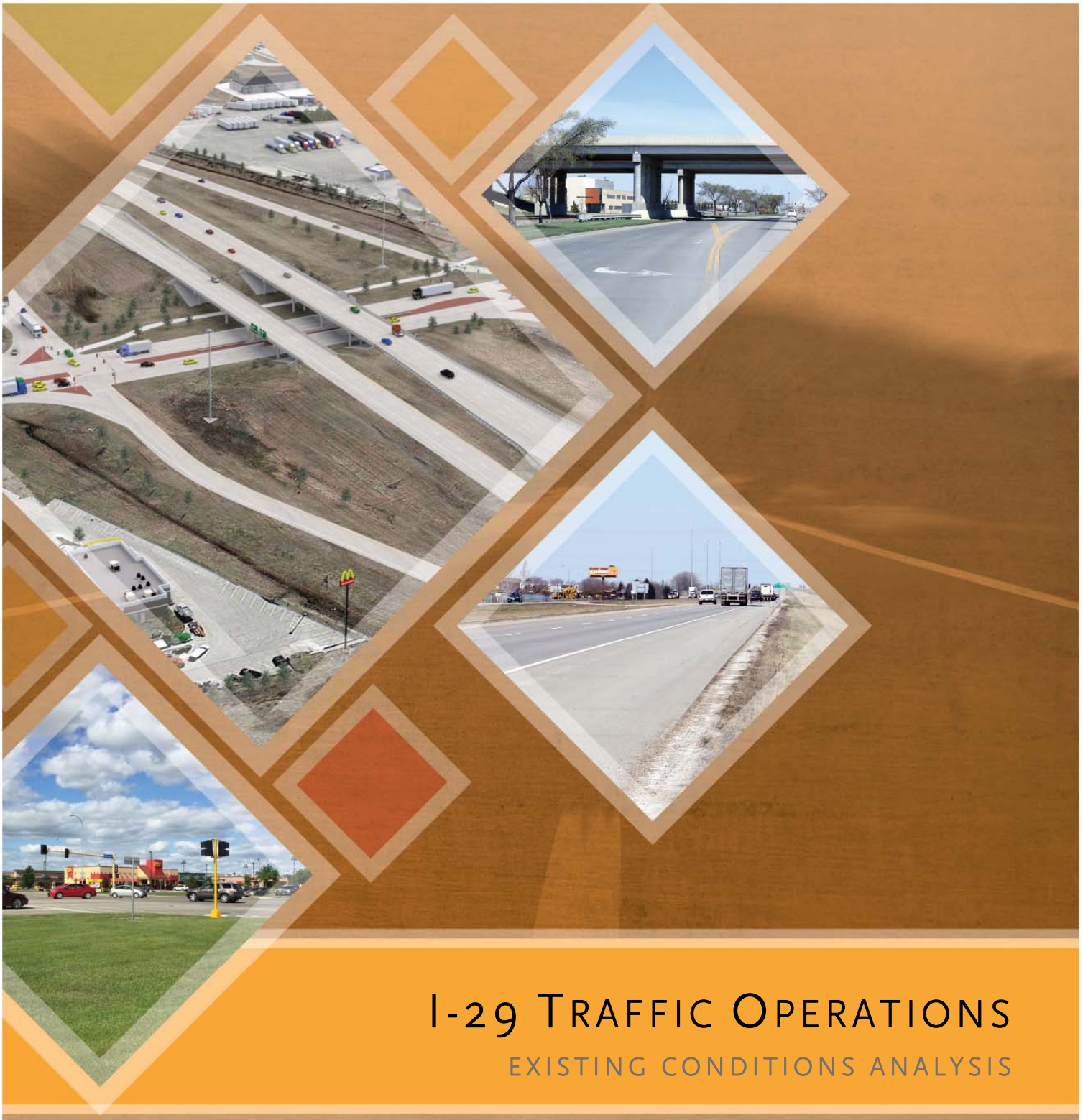
Table 1-1: Summary of Prioritized Improvements

Location	Key Issues	Highest Ranked Alternative*	Interim Solutions	Cost**	Year of Implementation
North Washington Street/CR11/US 81	▪ Challenging geometric conditions, with tight turning radii. ▪ Dense access spacing. ▪ No turn lanes.	▪ Access consolidation at the Sproule Farms and Simplot Grower Solutions. ▪ Left-turn and right-turn lanes at the ramp intersections. ▪ Consolidating and realigning the northbound on- and off-ramps and the southbound on-ramp at the interchange. ▪ Optional: Access consolidation at 42nd Street and 54th Avenue.	▪ None	▪ $5.98 Million » $430,000 for access consolidations » $300,000 for turn lanes » $5.25 million for East Ramp realignment	▪ 2030 CPR project could incorporate these improvements.
Gateway Drive/US 2	▪ Heavy truck traffic. ▪ Dense access and signal spacing leads to poor traffic flow. ▪ Deficient operations by 2040 with queueing onto the interstate. ▪ Impacted by train events that block Gateway Drive/US 2 resulting in queueing onto the interstate.	▪ Northeast Loop Alternative » Double right-turn lane at northbound off-ramp » Access restrictions at 43rd Street ▪ Railroad grade separation on Gateway Drive/US 2 east of 42nd Street	▪ Queue flushing on off-ramps ▪ Pedestrian crossing enhancements ▪ Advanced train event notification with existing DMS	▪ $6.62 Million for Northeast Loop Ramp Alternative ▪ $28.3 Million for Railroad Grade Separation	▪ Interim solutions as soon as feasible. ▪ Northeast Loop Alternative considered in Long-Term (2031-2040+). ▪ Railroad grade separation to undergo additional planning/scoping beginning in Mid-Term (2026-2030).
DeMers Avenue/ND 297	▪ Interchange impacted by train events that block 42nd Street. Under current conditions, traffic is rerouted onto interstate and queues extend to interstate. ▪ Limited capacity with three-lane section and no traffic control results in poor operations by 2025. ▪ Left-turn angle crash trends and rear-end crash trends that could be mitigated with improved traffic flow.	▪ Capacity Enhancements with No Bridge Widening Alternative » Additional through lane » Dynamic lane assignment at West Ramp Intersection » Traffic control signals ▪ Railroad grade separation at 42nd Street north of DeMers Avenue/ND 297	▪ Queue flushing on off-ramps ▪ Advanced train event notification with existing DMS	▪ $7.40 Million for Capacity Enhancements with No Bridge Widening Alternative ▪ $40.0 Million for Railroad Grade Separation	▪ Interim solutions as soon as feasible. ▪ Interchange improvements should undergo preliminary engineering, environmental documentation and advanced project development before 2025. ▪ Railroad grade separation should begin preliminary engineering and environmental documentation by 2025. Advanced project development expected by 2030.
32nd Avenue/US 81B & 47th Avenue	▪ Major growth areas around 32nd Avenue/US 81B and 47th Avenue result in the 32nd Avenue/US 81B corridor over capacity by 2025 without interim improvements. Queues extend onto the interstate. ▪ Access spacing between 42nd Street west frontage road and West Ramp intersection leads to challenging operations as growth to the south continues. ▪ Degraded pavement expected by 2030.	▪ Interchange at 47th Avenue » Prioritized the Diamond with South Loops and Mixing Lanes Alternative ▪ Spot Improvement Plan at 32nd Avenue/US 81B » Double left-turn lanes on 38th Street intersection on eastbound, westbound and southbound approaches » Longer eastbound right-turn lane at 38th Street intersection » Double right-turn lane on northbound off-ramp » Access management at 42nd Street	▪ 32nd Avenue/US 81B » Queue flushing on off-ramps » Pedestrian crossing enhancements	▪ $915,000 for Spot Improvement Plan at 32nd Avenue/US 81B ▪ $28.5 Million for 47th Avenue Interchange	▪ Interim solutions as soon as feasible. ▪ 32nd Avenue/US 81B interchange improvements necessary by 2025 and should undergo preliminary engineering in the Short-Term (2017-2025). ▪ Interstate Access Report initiated and environmental documentation completed in the short-term for 47th Avenue interchange. Advanced project development to occur in Mid-Term.
Merrifield Road/CR 6	▪ No specific issues on Merrifield Road/CR 6 ▪ Interchange at Merrifield Road/CR 6 would reduce traffic on I-29 by nearly five percent and reduce network vehicle miles traveled by nearly 75 million miles from 2025 to 2040.	▪ Construct Interchange Ramps » Widen bridge to incorporate left-turn lanes and improved operations for bicycles and pedestrians and oversized agricultural equipment. » Traffic control at the Columbia Road intersection.	▪ None	▪ $16.8 - $18.1 Million » $16.5 Million to construct interchange ramps with turn lanes and widening bridge » $300,000 to $1.6 Million for traffic control at Columbia Road intersection	▪ The Interstate Access Report should be updated and scoping should occur in the Mid-Term. Advanced project development to occur in the Long-Term.

*Additional alternatives included in body of report will need to be included in any relevant environmental document. Highest ranked based on technical analysis, Steering Committee weighting and public input.
**Construction and Right-of-Way Costs only. Reported in 2017 dollars.

Figure 1-16: Summary of Highest Ranked Alternatives





I-29 Traffic Operations

Existing Conditions Analysis

ALLIANT ENGINEERING

KLJ

2. EXISTING CONDITIONS ANALYSIS

Introduction

Interstate 29 (I-29) is one of the most widely traveled corridors in the area and is vital to the region's economic vitality. This corridor serves many purposes: moving freight, providing regional access to the University of North Dakota (UND) campus, special event travel (Alerus Center), out-of-town shoppers and daily commuters. While intended to provide regional accessibility and mobility, this corridor provides local accessibility and mobility as well.

I-29 runs through the City of Grand Forks on a north-south alignment near the city's western border. Three interchanges and one overpass are located along I-29 in Grand Forks at Gateway Drive/US Highway 2 (US 2), University Avenue (overpass), DeMers Avenue/North Dakota Highway 297 (ND 297) and 32nd Avenue/US Highway 81B (US 81B). Just north of Grand Forks, an interchange is located at North Washington Street/ Grand Forks County Road 11 (CR 11)/ US Highway 81 (US 81). Just south of Grand Forks, an overpass is located at Merrifield Road/ Grand Forks County Road 6 (CR 6). These interchanges, overpasses and the areas of I-29 in between comprise the 10-mile study area, as shown in Figure 2-2.

This chapter will identify existing conditions along the study corridor, including land use, traffic operations, safety, multimodal facilities, infrastructure conditions, lighting and access management. Future conditions analysis is included in Chapter 3.

Background Information

This section includes background information on existing conditions, past studies and possible deficiencies to be evaluated further as part of this project.

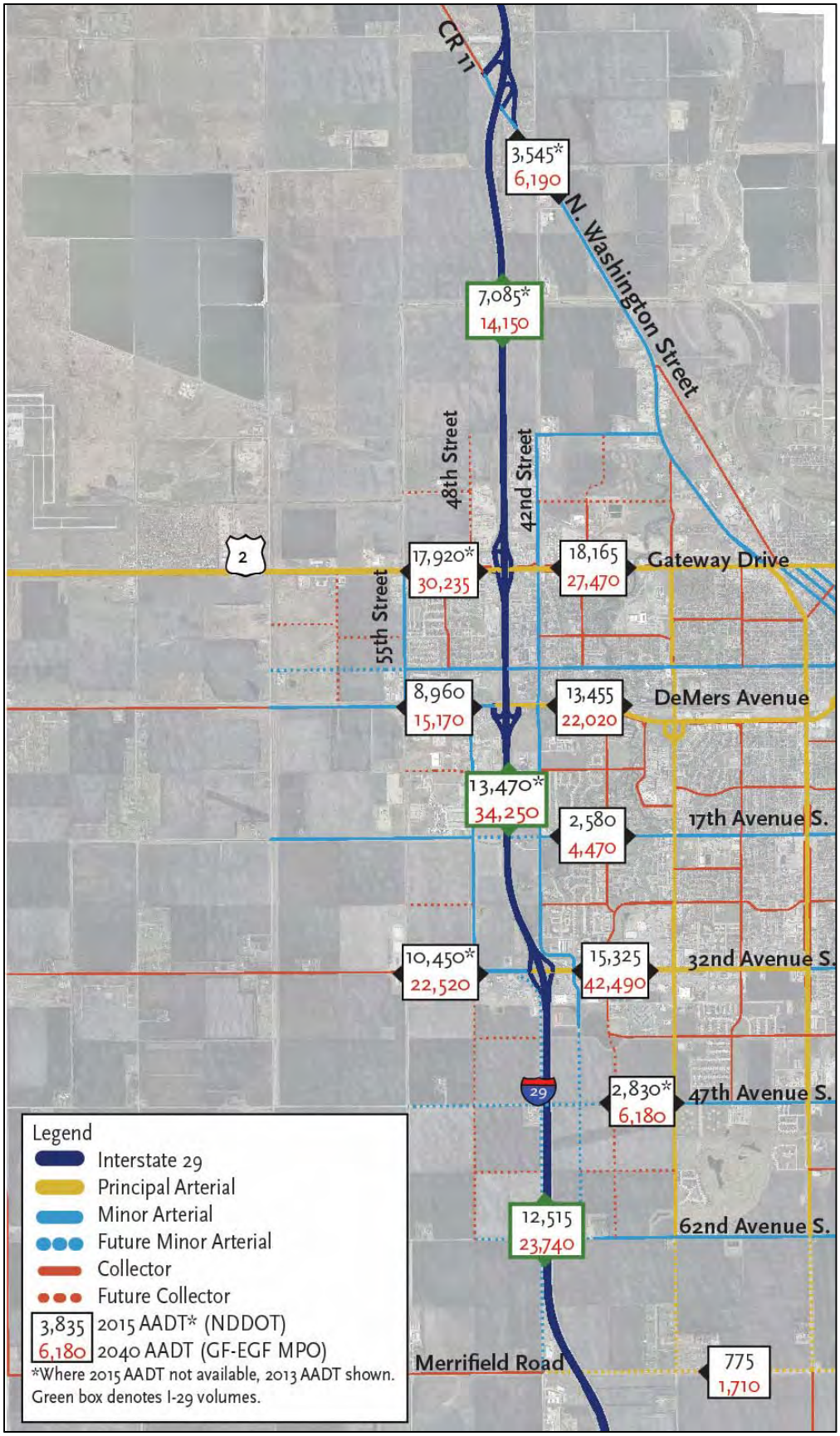
I-29 MAINLINE

Figure 2-1: Trucks on I-29 Mainline

The I-29 mainline is one of the most widely-travelled corridors in the area, carrying as many as 13,470 vehicles per day between 32nd Avenue/US 81B and DeMers Avenue/ND 297 and no fewer than 7,000 vehicles anywhere within the study area. Traffic on I-29 is comprised of 23 to 33 percent trucks, with origins or destinations throughout the nation and often internationally. I-29 is designated as a North American Free Trade Agreement (NAFTA) trade corridor, terminating to the south at Kansas City with connections to I-35, which then continues south to the Mexican border. To the north, I-29 connects to Manitoba Highway 75 at the Pembina border crossing, the fourth largest point of entry in terms of truck trade. By 2035, freight is forecasted to increase by more than 100 percent on I-29, according to the Pembina Port of Entry Study, completed in 2013. By 2040, the Grand Forks metro population is forecasted to increase by 25 percent. The combination of increased local and regional traffic will take a toll on I-29 with forecasts on the Interstate as great as 34,250 vehicles per day between 32nd Avenue/US 81B and DeMers Avenue/ND 297 and no fewer than 13,000 vehicles per day anywhere along the corridor.

Currently, the mainline is in good condition, with no major reconstruction or bridge replacements required through 2040. There are however, four programmed rehabilitation projects tentatively scheduled for 2026 in the Long Range Transportation Plan (LRTP) between 32nd Avenue/US 81B to North Washington Street/CR 11/US 81 expected to cost $14.3 million in year of expenditure dollars.

Figure 2-2: Study Area

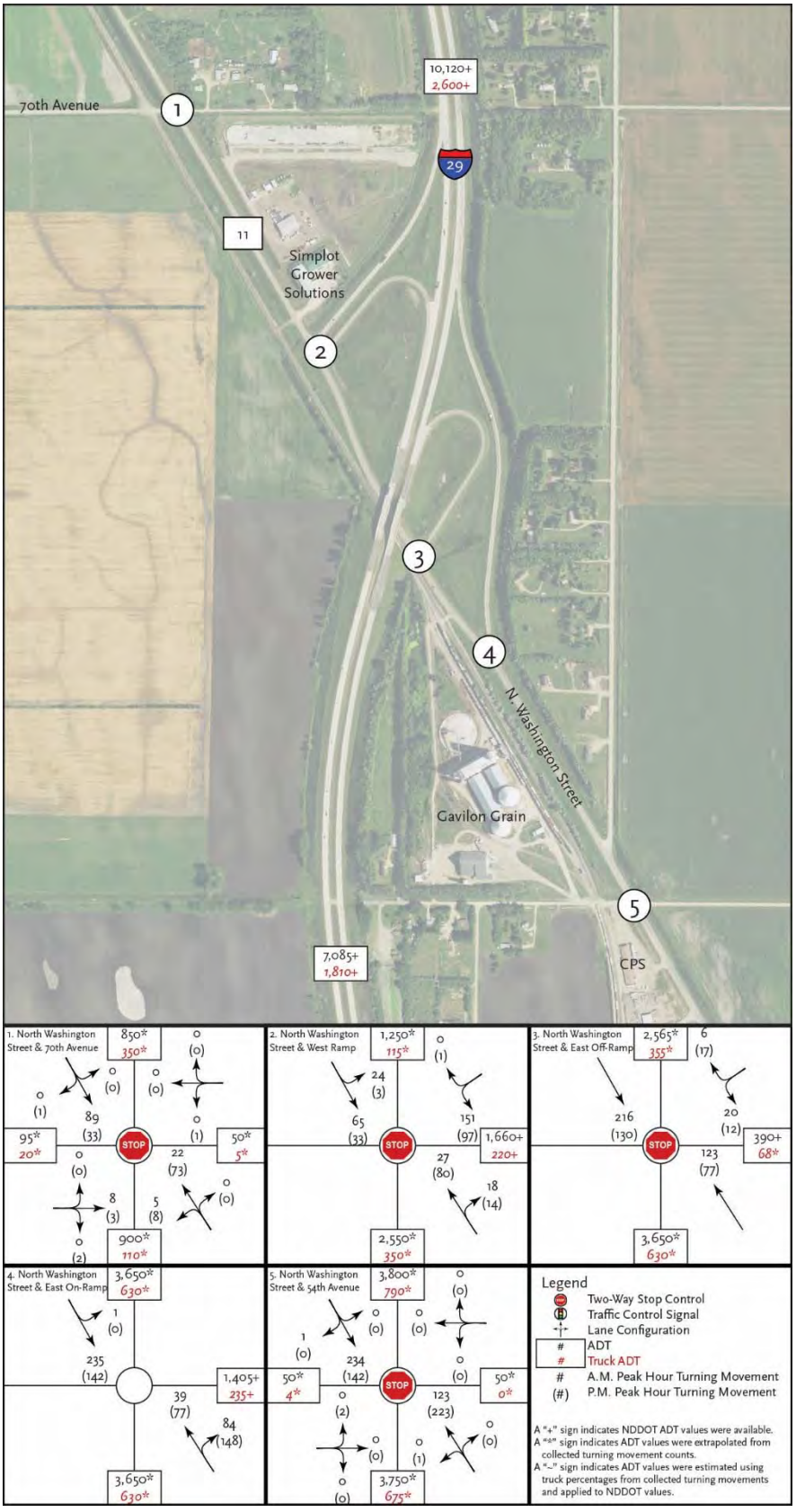


NORTH WASHINGTON STREET/ GRAND FORKS COUNTY ROAD 11/ US HIGHWAY 81

The North Washington Street/CR 11/US 81 interchange experiences the least traffic in the study area, carrying fewer than 4,000 cars on any approach. By 2040, this number increases to more than 8,000 vehicles as this corridor serves as an alternate entrance to the core of Grand Forks. Most traffic through this interchange functional area is coming-from or going-to the City. Thus, throughout the day most vehicles coming off southbound I-29 make left-turns onto North Washington Street/CR 11/US 81 and more than half the northbound vehicles on North Washington Street/CR 11/US 81 make right-turns onto northbound I-29. With interstate access for several large industrial properties, like Gavilon Grain and CF Industries, this interchange experiences around 33 percent heavy truck traffic.

Similar to the DeMers Avenue/ND 297 interchange, the North Washington Street/ CR 11/ US 81 interchange is a folded diamond due to the presence of the Glasston Subdivision railroad tracks to the southwest of the roadway. The Glasston Subdivision also creates a complicated intersection configuration at North Washington Street/CR 11/US 81 and 54th Avenue, with the offset at 42nd Street/CR 18. Also, like DeMers Avenue/ND 297, the bridge width for North Washington Street/CR 11/US 81 is constrained, restricting the ability to add new lanes without impacting bridge piers. However, unlike DeMers Avenue/ND 297, the North Washington Street/CR 11/US 81 interchange will not face congestion that will require major capacity enhancements.

Figure 2-3: North Washington Street/ CR 11/ US 81 Interchange Functional Area



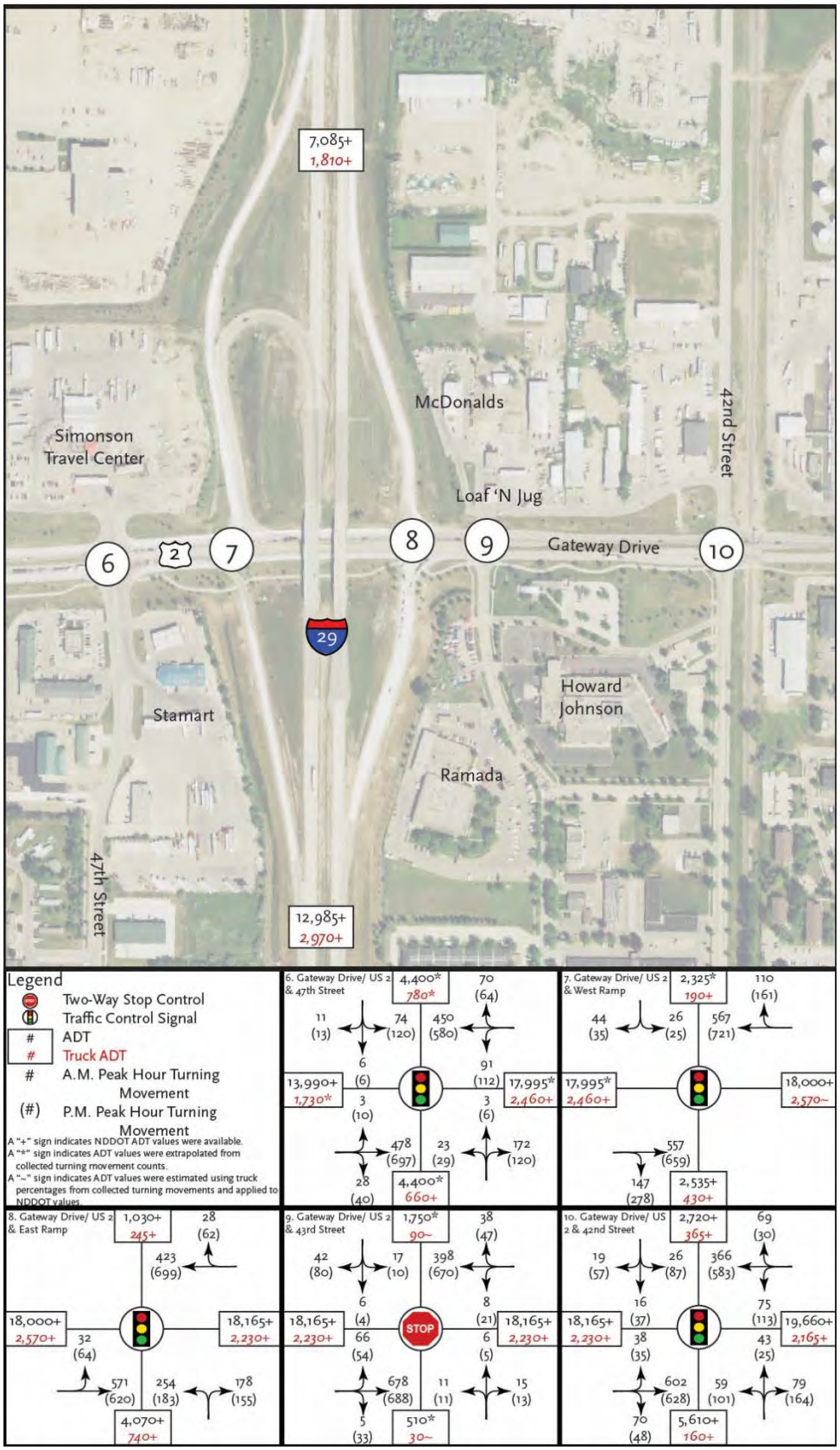
GATEWAY DRIVE/ US HIGHWAY 2

Gateway Drive/US 2 is a principal arterial providing regional mobility to tens of thousands of motorists, connecting the West Coast to as far east as Michigan. It is designated on the National Network by the FHWA, helping to carry more than half of North Dakota's freight (GF-EGF MPO's 2040 Long Range Transportation Plan). The Gateway Drive/US 2 interchange with I-29 is currently the most widely traveled corridor in the area, carrying more than 16,000 vehicles under current conditions between the two ramps, which increases to around 30,000 vehicles by 2040.

With two truck stops, access to an industrial corridor, a National Highway System route and "Super Haul-Expanded Envelope Corridor", Gateway Drive/US 2 produces heavy truck traffic, greater than 12 percent, through the interchange functional area, and more than 16 percent on the ramps. During the A.M. peak, more than 250 vehicles make northbound to westbound left-turns off the East Ramp; this is matched during the P.M. peak, where more than 250 vehicles make the eastbound to southbound right-turn onto the West Ramp.

The I-29 East Ramp intersection creates a major bottleneck on Gateway

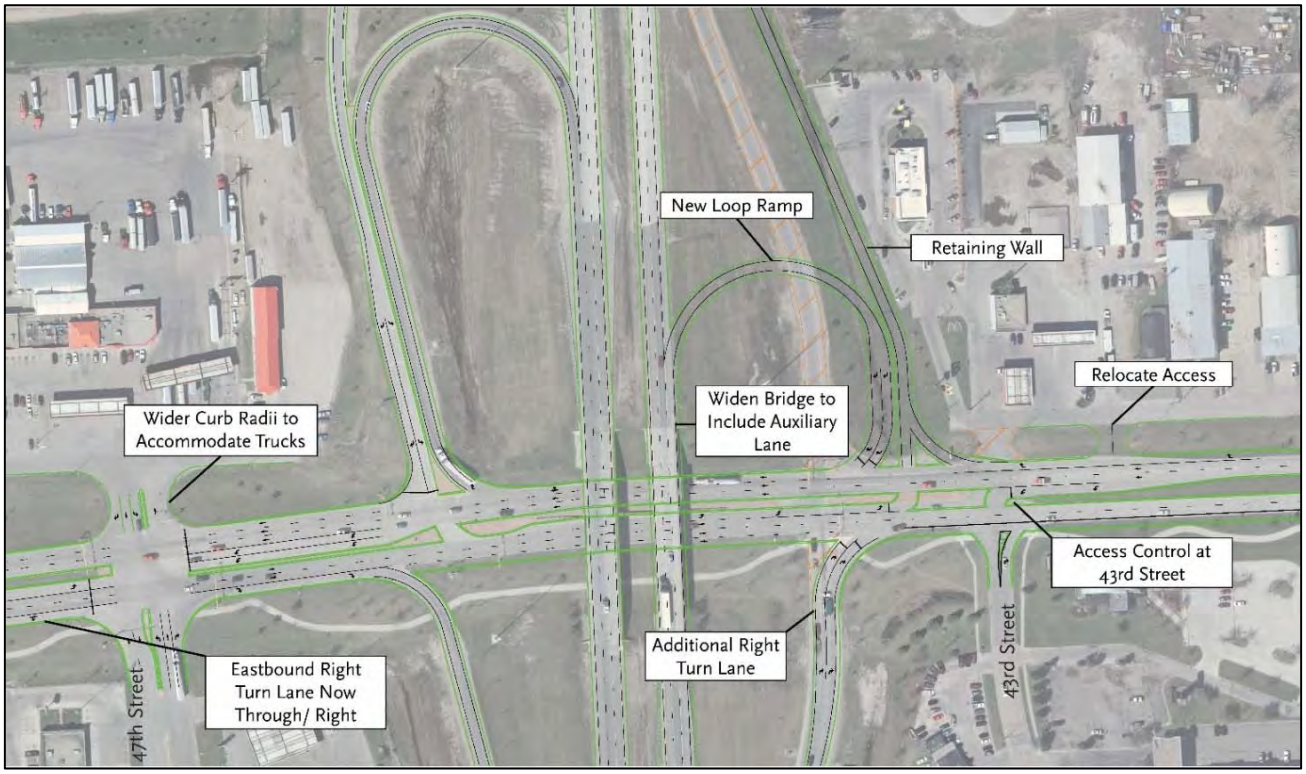
Figure 2-4: Gateway Drive/ US 2 Interchange Functional Area



Drive/US 2. Queueing from this intersection onto the interstate occurs occasionally under existing conditions and unavoidable by 2040. The I-29 East Ramp intersection also generates queues across adjacent intersections, creating congestion and delay. Queuing on Gateway Drive/US 2 is a major challenge in the interstate influence area due to proximity of four intersections within 0.4 miles. Congestion and queueing onto the interstate and across adjacent intersections contributes to an increased crash potential.

This interchange was studied in great detail as part of the US 2 Corridor Study. Working with a variety of key stakeholders, ranging from roadway agencies to property owners, a wide range of improvement strategies were evaluated. Ultimately, stakeholders, public and technical data recommended to build a loop ramp in the northeast quadrant along with a variety of turn lane additions and access restrictions at the East Ramp intersection and 43rd Street, respectively. This alternative mitigates potential for queueing onto the interstate and potential for queueing across adjacent Gateway Drive/ US 2 intersections, reducing conflict potential. Quantitatively stated, this alternative provides a 40 percent reduction in crash potential, 20 percent reduction in peak hour delay and a benefit cost ratio of 8.5. This alternative will be studied under revised traffic conditions and scenarios developed as part of this study. Revised alternatives may be necessary. Improvements at this interchange, estimated at $6.34 million have not been included in the cost constrained list of projects in the 2040 LRTP.

Figure 2-5: Prioritized Alternative for Gateway Drive/ US 2 Interchange Improvements from US 2 Corridor Study



DEMERS AVENUE/ NORTH DAKOTA HIGHWAY 297

DeMers Avenue/ND 297 serves as the primary access to Grand Forks for students accessing the University of North Dakota (UND) campus as well as the thousands of attendees on their way to events at the Alerus Center. In 2006, the Alerus Center Event Traffic Management Plan was completed; however, the assumptions and data in this report are dated and the focus on the report was on 42nd Street, not the interstate.

To the west of I-29, the DeMers Avenue/ND 297 interchange provides access to an industrial park and Amtrak station. At DeMers Avenue/ND 297 and 48th Street, the roadway providing access to significant job and freight generators like Henningsen Cold Storage, Dakota Aircraft and LM Wind Power, the A.M. peak produces heavy westbound to southbound left-turning movements; during the P.M. peak, the northbound to eastbound right-turning movement experiences more than 300 vehicles. To the east of I-29, the DeMers Avenue/ND 297 interchange provides access to the Alerus Center and UND campus, Altru, downtown and many other large traffic generators. During the A.M. peak, most vehicles from both northbound and southbound I-29 make right-turns to continue into the city, returning during the evening.

When trains are present across 42nd Street, north of DeMers Avenue/ND 297, a physical barrier is created limiting north-south travel. This produces delays to motorists diverting traffic to overburdened regional corridors, like I-29. This also introduces crash conflicts for pedestrians, bicyclists and motorists alike. According to data provided in the 42nd Street Grade Separation Technical Needs Assessment, completed in 2014, train delays average more than five minutes and frequently approach 20 minutes. This produces 60 hours of total delay experienced each day (total of all motorists crossing the trucks). This is 50 percent greater than the highest threshold set forth by the Federal Highway Administration (FHWA) to justify a grade separation. Currently, the City of Grand Forks is working on an environmental

Figure 2-6: DeMers Avenue/ ND 297 Interchange Functional Area

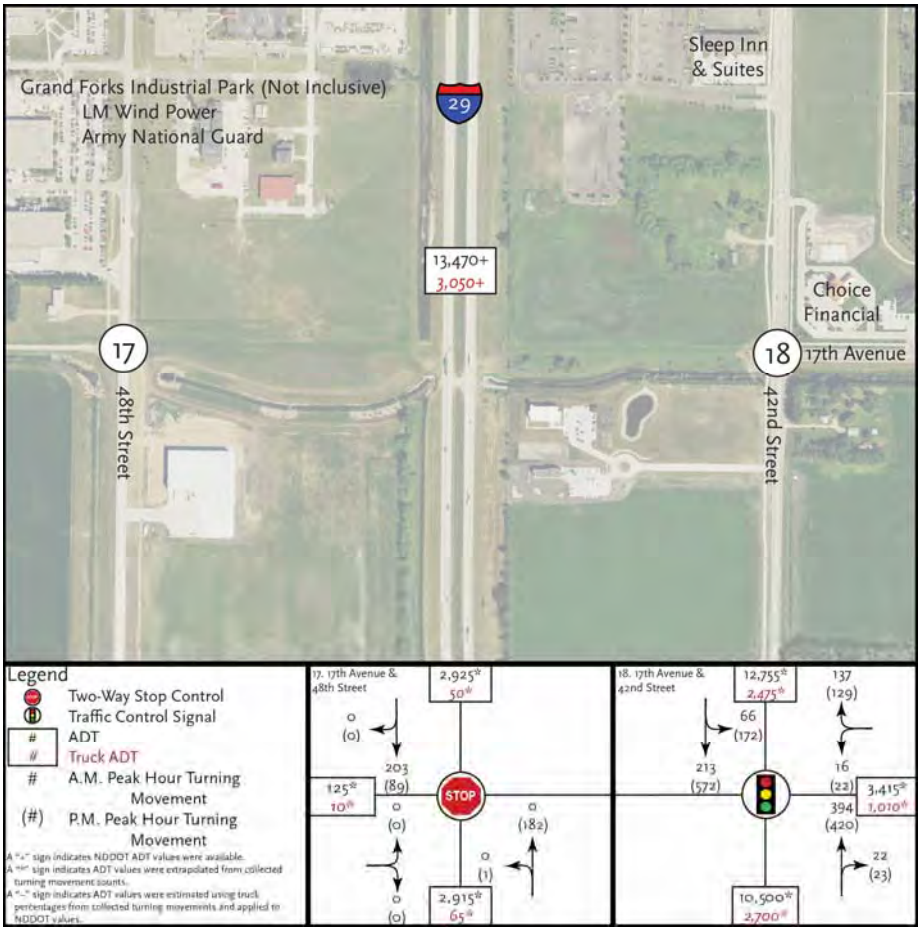
document for a grade separation at this location. This grade separation was estimated to cost $28.5 million dollars and has been listed as illustrative in the 2040 LRTP.

The 42nd Street and DeMers Avenue/ND 297 Technical Memorandum found that by 2040, it is expected that this intersection will operate at LOS "D" during the A.M. peak and LOS "F" during the P.M. peak with the grade separation and LOS "F" during both A.M. and P.M. peak if no grade separation is constructed. Train delays oversaturate the intersection of 42nd Street and DeMers Avenue/ND 927 leading to long queues. By 2040, queued vehicles will block access to I-29 and the Alerus Center. This study did not evaluate whether intersection specific capacity enhancements would provide efficient operations or whether additional capacity on DeMers Avenue/ND 297 and through its interchange was necessary.

The DeMers Avenue/ND 297 interchange is a folded diamond configuration due to conflicts with the BNSF mainline located 35 feet north. Currently, DeMers Avenue/ND 297 carries 13,000 vehicles to the east of I-29 and 9,000 to the west. Current traffic volumes are accommodated efficiently without any traffic control on DeMers Avenue/ND 297.

By 2040, volumes are forecasted to increase to 22,000 east of I-29 and 15,170 west of I-29. Traffic control will inevitably be required to accommodate continued traffic growth and has been included in the 2040 LRTP as an illustrative project with an estimated cost of $400,000. By 2040, increased volumes may even warrant additional capacity, although it has not been included in previous LRTPs. A major constricting factor at this interchange is the width of the bridge, which may not permit additional lanes. The lack of through lanes also creates storage problems during special events at the Alerus Center and train events at the BNSF at-grade crossing with 42nd Street.

Figure 2-7: 17th Avenue South



17TH AVENUE SOUTH

In the 2040 LRTP, a 17th Avenue South overpass of I-29 was recommended to connect 42nd Street and 48th Street. The concept would provide a more direct route into the industrial park west of I-29 and provide the only crossing of I-29 between DeMers Avenue/ ND 297 and 32nd Avenue/US 81B, currently a two-mile gap in system continuity. Previous LRTPs also studied a full interchange at this location.

In the 2035 LRTP, it was forecasted that the overpass could carry as many as 8,500 vehicles per day. However, the most recent Land Use Plan and LRTP forecast that future growth patterns will dramatically shift away from 17th Avenue South west of I-29 to the south end of Grand Forks. This revised growth pattern minimized the need for a 17th Avenue South overpass and moved it from a mid-term project in the 2035 LRTP to an illustrative project in the 2040 LRTP. This project has a cost more than $10 million.

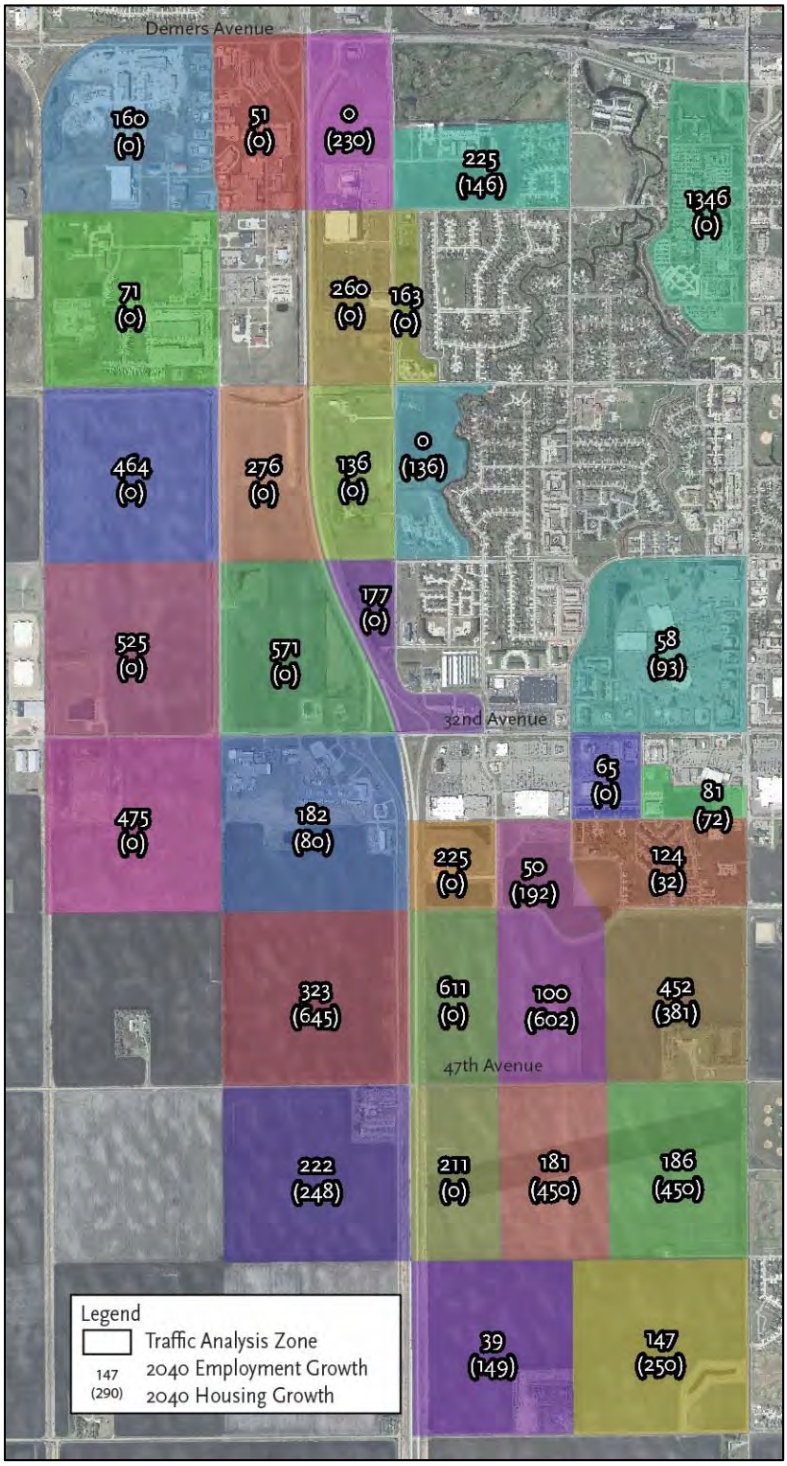
32ND AVENUE/US HIGHWAY 81B

Daily traffic volumes from 2013 along 32nd Avenue/US 81B range from approximately 10,500 vehicles per day west of I-29 to 16,000 east of I-29. The areas surrounding I-29 at 32nd Avenue/US 81B and heading south to 47th Avenue South are forecasted to be the largest population and employment growth centers in the city. Specifically, 58 percent of new employment opportunities and 46 percent of new housing opportunities are expected to occur within one mile of either the 32nd Avenue/US 81B interchange or the proposed overpass/interchange at 47th Avenue South. By 2040, this amount of growth will increase volumes across the 32nd Avenue/US 81B interchange to 23,000 vehicles per day west of I-29 and 44,700 east of I-29. This results in oversaturated interchange operations, producing long delays and queues.

The existing 32nd Avenue/US 81B interchange is a diamond configuration. The 32nd Avenue/US 81B bridge is a five-lane section with two through lanes in each direction with a back-to-back left-turn lanes. The current bridge configuration over I-29 does not allow significant geometric changes to provide capacity for future growth without implementing significant improvements, which would include widening the bridge.

Congestion along 32nd Avenue/US 81B impacts operations at the interchange. Of particular concern is the 32nd Avenue/US 81B and 38th Street intersection; this intersection accommodates all traffic destined for north 42nd Street to access major developments like the Alerus Center. This intersection also accommodates turning movements into the densely built commercial developments surrounding the intersection. By 2040, when volumes are forecasted to exceed 40,000 vehicles on 32nd Avenue/US 81B, queue spillback to the interchange from 38th Street will be commonplace, creating major delays and blockages.

Figure 2-8: Forecasted Employment and Housing Growth around 32nd Avenue/US 81B Interchange



The 2040 LRTP planned for widening 32nd Avenue/US 81B to six lanes, planned for construction between 2031 and 2040 with an estimated cost of $12.64 million. Due to the commercial nature of this area, traffic during the P.M. peak can be more than 60 percent higher than the A.M. peak. The 2040 LRTP also identified a project that would align 42nd Street with the northbound off-ramp to mitigate congestion at 38th Street. This project had an estimated cost of $8.86 million dollars and could not be cost constrained.

47TH AVENUE SOUTH

The past two LRTPs have reviewed potential interchange locations and identified 47th Avenue South as the logical location. According to the preliminary Interchange Access Modification Request (IAR) completed for the City of Grand Forks, a new interchange at 47th Avenue South is proposed to address future long-term development in southern Grand Forks. This proposed interchange is located approximately one mile south of the existing interchange at 32nd Avenue/US 81B and seven miles north of the next closest interchange to the south at North Dakota Highway 15. According to the preliminary IAR, a 47th Avenue South interchange could reduce traffic volumes at 32nd Avenue/US 81B by more than 40 percent, potentially delaying or reducing the extent of improvements at this location through 2040.

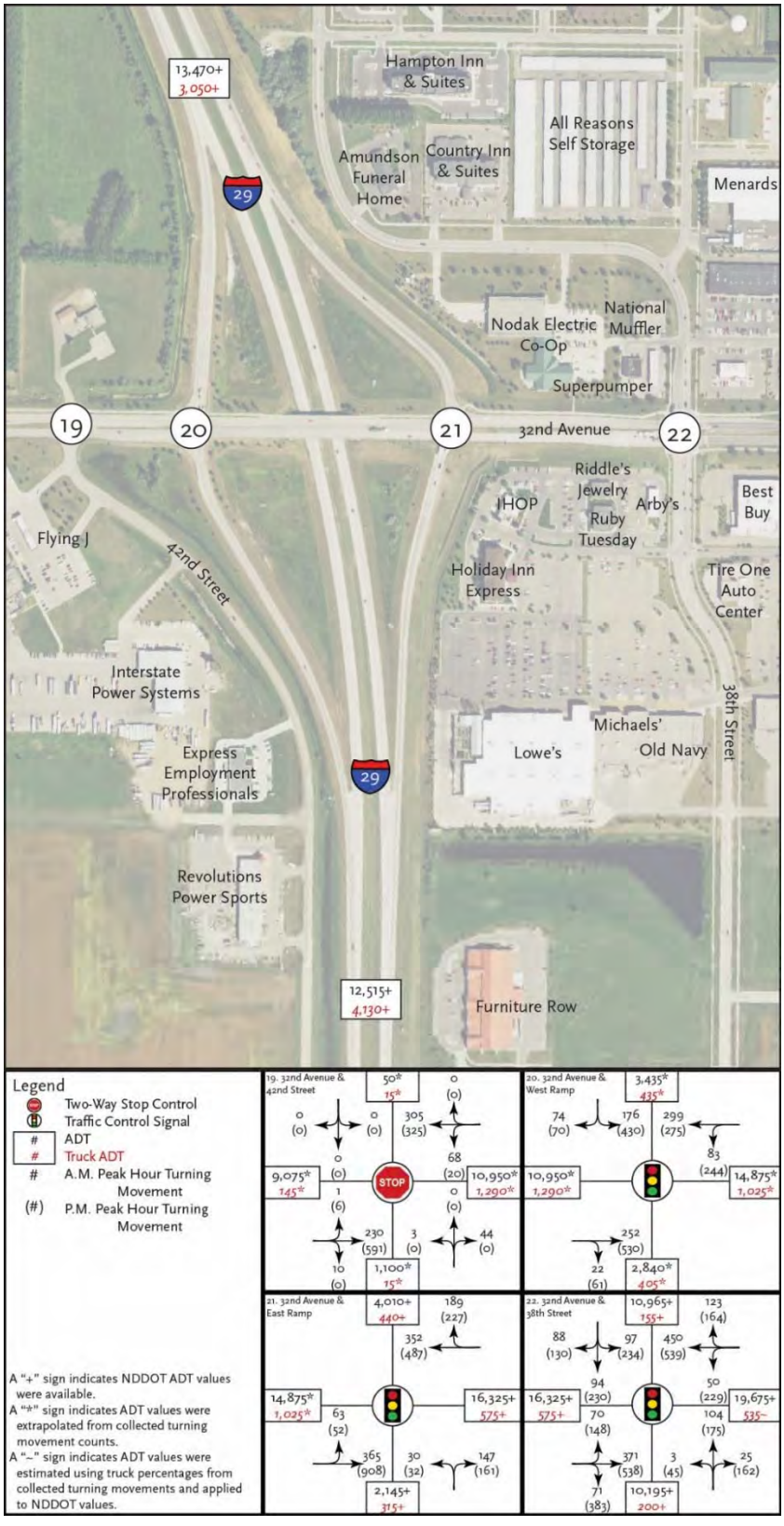
An interchange at this location was estimated to cost $20.8 million dollars in the 2040 LRTP. This project could not be cost constrained and was placed on the illustrative project list.

No previous LRTP has studied an overpass at this location to determine its impact on surrounding interchanges. This study will evaluate both an interchange and overpass solution at this location and their impacts to surrounding interchanges.

MERRIFIELD ROAD/ GRAND FORKS COUNTY ROAD 6

For several decades, continuous efforts have been made to identify an alternative

Figure 2-9: 32nd Avenue/US 81B Interchange Functional Area

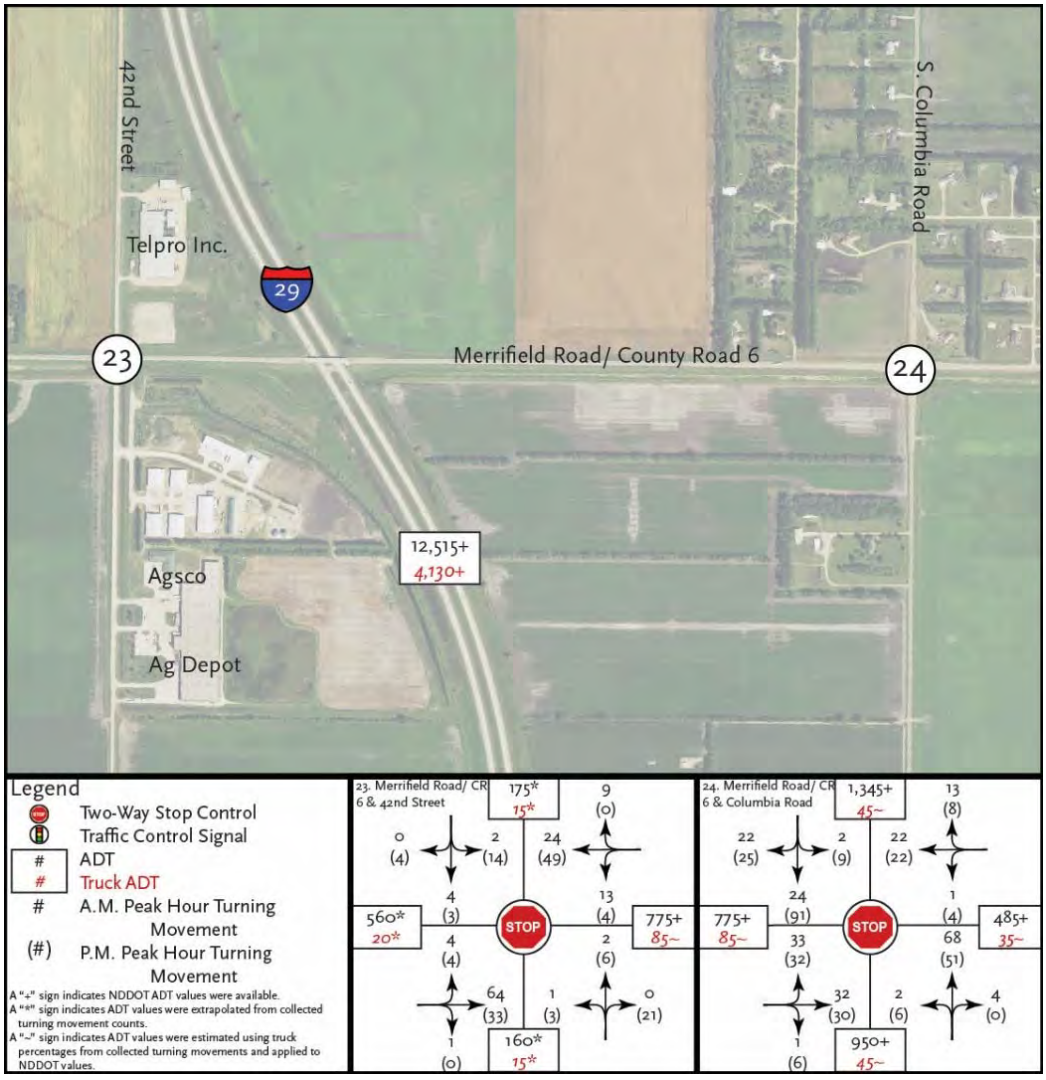


bypass/reliever route around the metro area, primarily for truck traffic. Currently, trucks are routed through dense urban areas on Gateway Drive/US 2 or DeMers Avenue/ND 297. One major area of concern is during beet harvest, when high volumes of trucks use DeMers Avenue/ND 297 through the heart of downtown Grand Forks and East Grand Forks. This route creates conflicts with local traffic, pedestrians, bicycles and school activity.

Since the mid 1990's, the bypass/ reliever route discussion has focused on the "Merrifield Corridor". To serve this purpose, major projects would be required including on- and off-ramps at the Merrifield Road/CR 6 overpass and a new bridge over the Red River connecting Merrifield Road/CR 6 to Polk County Highway 225. However, the cost of converting the overpass to an interchange ($9 million) and to implement a new river crossing ($21.4 million) were such that it could not be included in the cost constrained 2040 LRTP. These cost estimates do not include several million dollars' worth of additional roadway costs like paving and turn lanes for Merrifield Road/CR 6 to make this corridor a fully functioning bypass.

Currently, Merrifield Road/CR 6 is an overpass carrying around 1,000 vehicles per day over I-29. Constructing ramps at this location would not only provide for a potential bypass/reliever route, but also improved access and circulation for the rural communities in the area.

Figure 2-10: Merrifield Road/ CR 6



Data Collection

Data collection is the foundation of any corridor study. According to FHWA guidance, the closest major intersection in each direction should be included in interchange analyses. The Grand Forks-East Grand Forks Metropolitan Planning Organization (GF-EGF MPO) collected 12 hours of turning movement counts at the following intersections:

- **North Washington Street/CR 11/US 81:** 70th Avenue North, West Ramp, East Ramp and 54th Avenue North
- **Gateway Drive/US 2:** 47th Street, West Ramp, East Ramp, 43rd Street and 42nd Street
- **DeMers Avenue/ND 297:** 48th Street, 46th Street, West Ramp, East Ramp, Cenex Driveway and 42nd Street
- **17th Avenue South:** 48th Street and 42nd Street
- **32nd Avenue/US 81B:** 42nd Street, West Ramp, East Ramp and 38th Street
- **Merrifield Road/CR 6:** 42nd Street/ 12th Street and South Columbia Road

MAINLINE I-29

For mainline regional traffic data, cameras were set up at the north and south termini to count traffic as it enters the system. Twenty-four hours of data was collected and processed at each location to gain an understanding for daily passenger vehicle and truck volumes and distributions. Entering volumes were used for model calibration, which is discussed below.

NORTH OF 70TH AVENUE NORTH

Traffic entering and exiting the system was collected north of 70th Avenue North. The A.M. peak (7 A.M.) was only the sixth highest peak hour, with 6.6 percent of daily traffic. Characteristics of the A.M. peak include:

- 60.8 percent of all traffic is headed south.
- Truck traffic is 13.2 percent of all A.M. peak traffic at this location.
- 34.1 percent of truck traffic is headed south.

An afternoon peak emerged in the data collection at this location. This afternoon peak (2 P.M.) was the highest peak hour with 9.7 percent of daily traffic. Characteristics of the afternoon peak include:

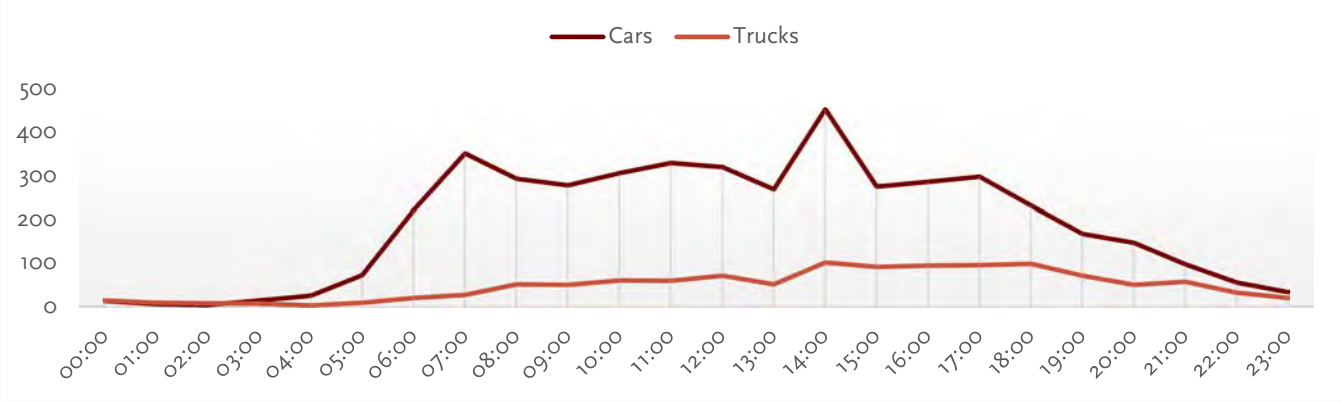
- 53.4 percent of all traffic is headed south.
- Truck traffic is 20.4 percent of all afternoon peak traffic at this location.
- 70.3 percent of truck traffic is headed south.

The P.M. peak hour (5 P.M.) was the second highest peak hour with 6.9 percent of daily traffic. Characteristics of the P.M. peak include:

Figure 2-11: Data Collection Locations

- 42.5 percent of all traffic is headed south.
- Truck traffic is 16.6 percent of all P.M. peak traffic at this location.
- 62.7 percent of truck traffic is headed south.

Figure 2-12: 24-Hour Distribution of Southbound Traffic North of 70th Avenue



SOUTH OF 32ND AVENUE/US 81B

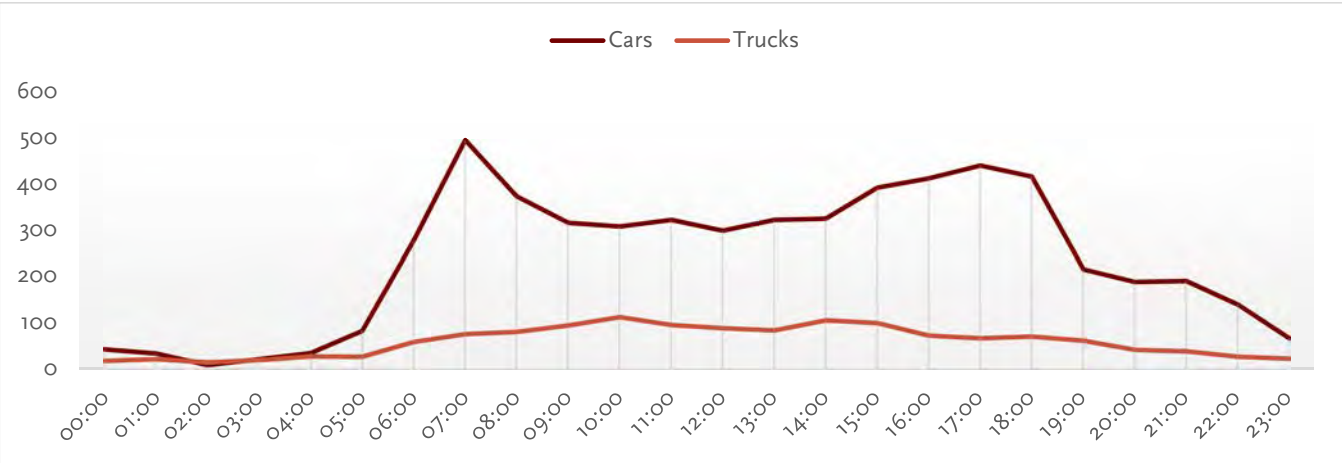
Traffic entering and exiting the system was collected south of 32nd Avenue/US 81B. The A.M. peak (7 A.M.) was the highest peak hour, with 8.3 percent of daily traffic. Characteristics of the A.M. peak include:

- 75.9 percent of all traffic is headed north.
- Truck traffic is 10.1 percent of all A.M. peak traffic at this location.
- 53.5 percent of truck traffic is headed north.

The P.M. peak hour (5 P.M.) was the second highest peak hour with 7.3 percent of daily traffic. Characteristics of the P.M. peak include:

- 56.4 percent of all traffic is headed north.
- Truck traffic is 10.6 percent of all P.M. peak traffic at this location.
- 37.6 percent of truck traffic is headed north.

Figure 2-13: 24-Hour Distribution of Northbound Traffic South of 32nd Avenue/US 81B

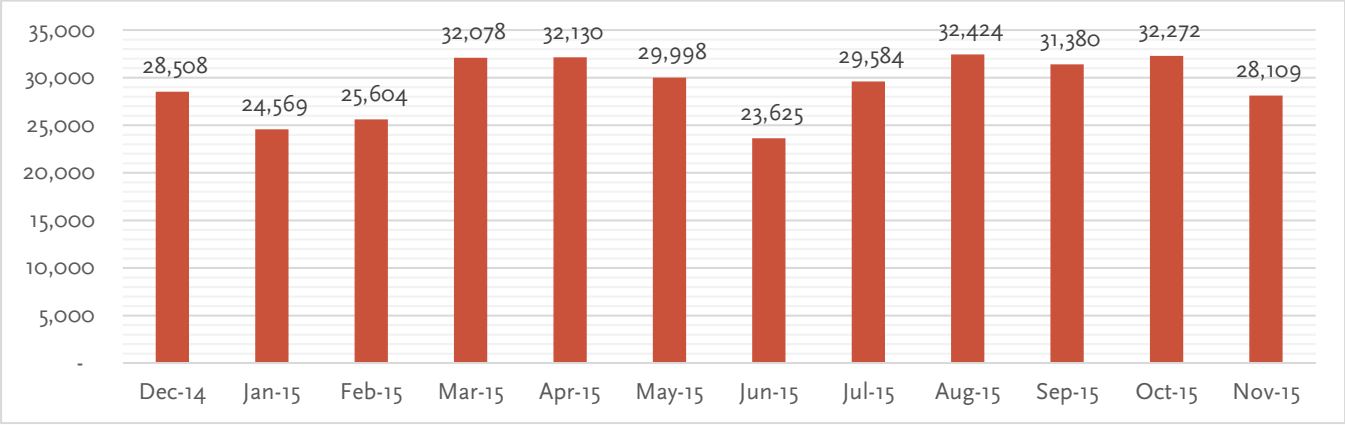


32ND AVENUE/US 81B

At 32nd Avenue/US 81B, the primary generators are commercial and often produce high volumes of traffic during the evening and weekend peak hours. Specifically, traffic is generated internally to Grand Forks and East Grand Forks, but also regionally as far north as Canada. ATAC has developed the Traffic Analysis Tool which uses video detection units to collect and analyze daily, weekly, monthly and annual traffic patterns at major intersections. The ATAC tool provides the best, most expansive data set for completing this analysis but has some flaws, most significantly, the lack of left-turn movements from the northbound approach and days missing from the dataset. However, this tool was able to provide average daily traffic data for 329 days from December 1, 2014 through November 30, 2015, which was used in this analysis. Days where traffic counts could not be validated were extracted. While data exists for other study corridors, like Gateway Drive/US 2, the traditional weekday A.M. and P.M. peaks drive traffic needs, so no further analysis was necessary for those corridors.

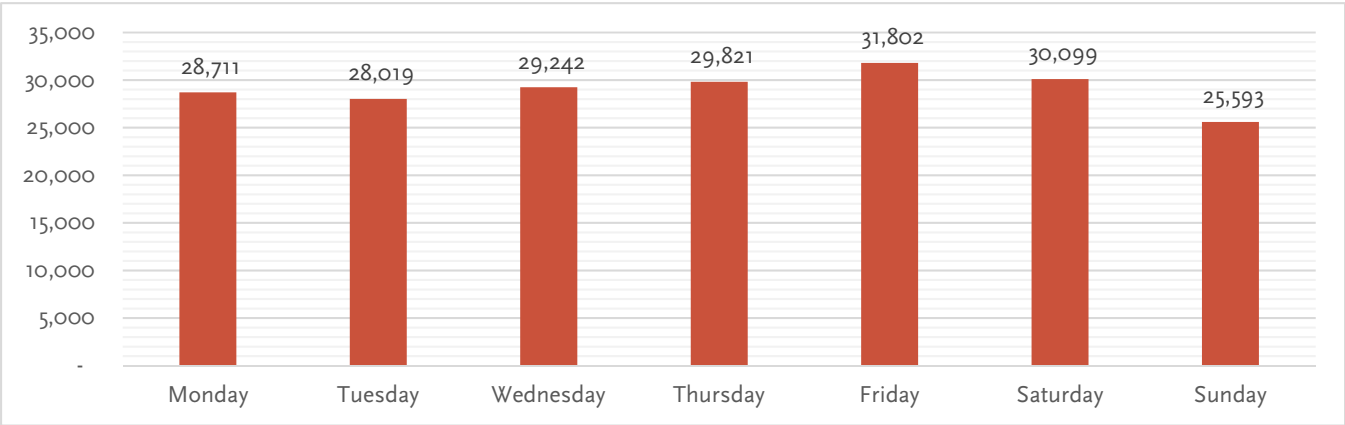
Given the strong commercial presence, monthly average daily traffic was analyzed. Average daily traffic was highest in April, August and October but surprisingly lower during the prime holiday shopping time during November and December. The lowest two months were January and June.

Figure 2-14: Average Daily Traffic Entering Volumes at the 32nd Avenue/US 81B and 38th Street by Month



Friday was the highest traffic day at the 32nd Avenue/US 81 B and 38th Street intersection. The ADT entering volumes were nine percent higher than mid-week entering volumes (Tuesday through Thursday, the days traditionally used for weekday data collection) and 5.4 percent higher than Saturday entering volumes.

Figure 2-15: Average Daily Traffic Entering Volumes at the 32nd Avenue/US 81B and 38th Street Intersection



Because Friday had the highest ADT entering volumes, the most recent six months of P.M. peak data was analyzed to ensure that the Friday P.M. peak would not drive traffic needs and thus operational analysis. Similar analysis was not completed for A.M. or mid-day peaks, as these periods were approximately 40 percent lower than the P.M. peaks.

The P.M. peaking characteristics varied based on month. For example, Fridays had the highest P.M. peak in June, but the weekdays had the highest P.M. peak in July, with Saturdays having the highest P.M. peak in August. The average of the P.M. peak across six months is only negligibly higher on Fridays, just 1.08 percent, or 31 cars than the weekday P.M. peak and just 0.02 percent or one car higher than the Saturday P.M. peak.

Table 2-1: Highest Average Daily Traffic Entering Volumes by Month at the 32nd Avenue/US 81 B and 38th Street intersection for Weekday, Friday and Saturday

P.M. Peak	June	July	August	September	October	November	6-Month Average	Difference
Weekday		✓					2,853	-1.08%
Friday	✓				✓	✓	2,884	-
Saturday			✓	✓			2,883	-0.02%

During detailed analysis, it was identified that Fridays typically have higher daily volumes because traffic begins increasing around noon and maintains higher volumes than a typical weekday into the evening. This does however distribute the P.M. peak hour across multiple hours, making it less concentrated.

With the variability across months and small differences across the average P.M. peaks, no additional analysis will be completed for Friday or Saturday P.M. peak hours.

CALIBRATION DATA

Calibration is a critical aspect of developing a reliable model. For example, FHWA found that calibration differences of 13 percent in the predicted speeds for existing conditions increased to differences of 69 percent in the forecasted speeds for future conditions. The following approaches will be used to calibrate the microsimulation traffic model discussed later in this report.

- A speed study was conducted during the P.M. peak on I-29 between 32nd Avenue/US 81B and DeMers Avenue/ND 297 to calibrate speeds on mainline I-29. For all northbound traffic, the 85th percentile speed was 72 miles per hour. The 85th percentile for northbound truck traffic was 70 miles per hour. For all southbound traffic, the 85th percentile speed was 75 miles per hour. The 85th percentile speed for southbound truck traffic was 71 miles per hour.
- A queue length study was conducted at the 32nd Avenue/US 81B interchange to calibrate intersection operations. This will be supplemented by a similar study completed at the Gateway Drive/US 2 interchange during the US 2 Corridor Study.
- The entire model was calibrated to collected traffic counts.

PEDESTRIAN AND BICYCLE TRAFFIC

Pedestrian and bicycle traffic was collected in conjunction with the turning movement counts conducted by the GF-EGF MPO. The collected data showed very little pedestrian and bicycle activity throughout the study area, with more than half of the intersections within the 32nd Avenue/US 81B, DeMers Avenue/ND 297 and Gateway Drive/US 2 interchange functional areas experiencing no bicycle and pedestrian activity.

Land Use

The 10-mile I-29 corridor serves a variety of different land uses. On either end of the corridor, the uses are primarily agricultural, with limited residential development. Around the 32nd Avenue/US 81B interchange is primarily commercial, with access to institutional uses (Alerus Center) and residential. The DeMers Avenue/ND 297 interchange serves primarily institutional uses like UND and the Alerus Center, the industrial park, limited commercial and access to residential uses. The Gateway Drive/US 2 interchange primarily serves commercial and industrial uses as well as UND.

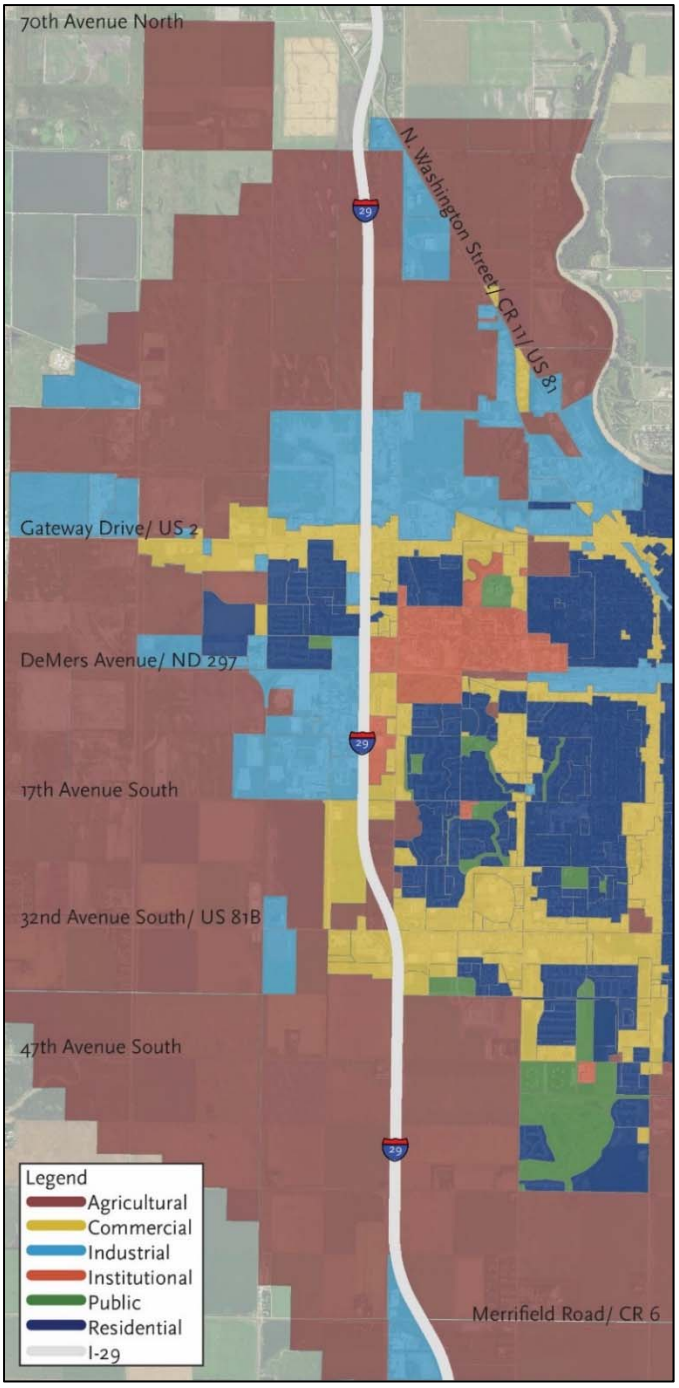
Each land use type results in different demands for the transportation network. For example, at the Gateway Drive/US 2 interchange, industrial properties require truck traffic to deliver inputs and ship outputs, leading to heavy truck traffic throughout the day, while the institutional uses east of I-29 along DeMers Avenue/ND 297 may see heavy peaking characteristics as people travel to school and work during the morning peak and back home during the evening peak. The industrial uses west of I-29 along DeMers Avenue/ND 297 likely produce heavy truck traffic.

Based on the demographic and socioeconomic information found in the latest Traffic Analysis Zones (TAZs), which are used to prepare the TDM for the 2040 LRTP, pockets of high population and employment exist. The only areas with population of 1,000 or more occur between 34th Street and 42nd Street and 32nd Avenue/US 81B to Gateway Drive/US 2. Much of the housing available in these areas are multi-family developments.

The TAZs that include Altru Health System, the Columbia Mall and the industrial complex, including LM Wind Power and Cirrus, along 17th Avenue South, west of I-29 each provide more than 1,000 jobs. In Altru Health Systems case, more than 5,000 jobs. All three locations can be accessed using either the DeMers Avenue/ND 297 interchange or the 32nd Avenue/US 81B interchange.

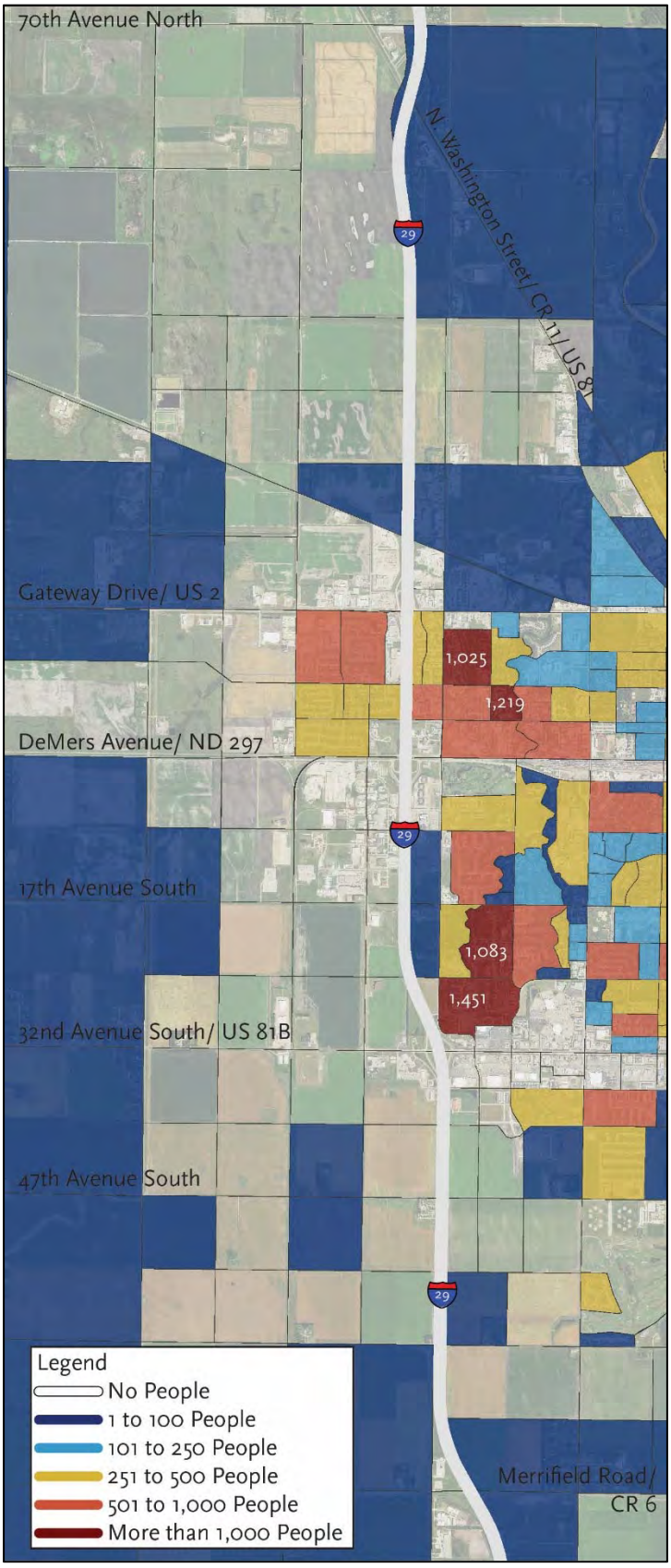
The industrial park creates unique challenges for the DeMers Avenue/ND 297 and 32nd Avenue/US 81 B interchanges. Oversized loads, especially from LM Wind Power, require interchange geometries that can accommodate this type of traffic.

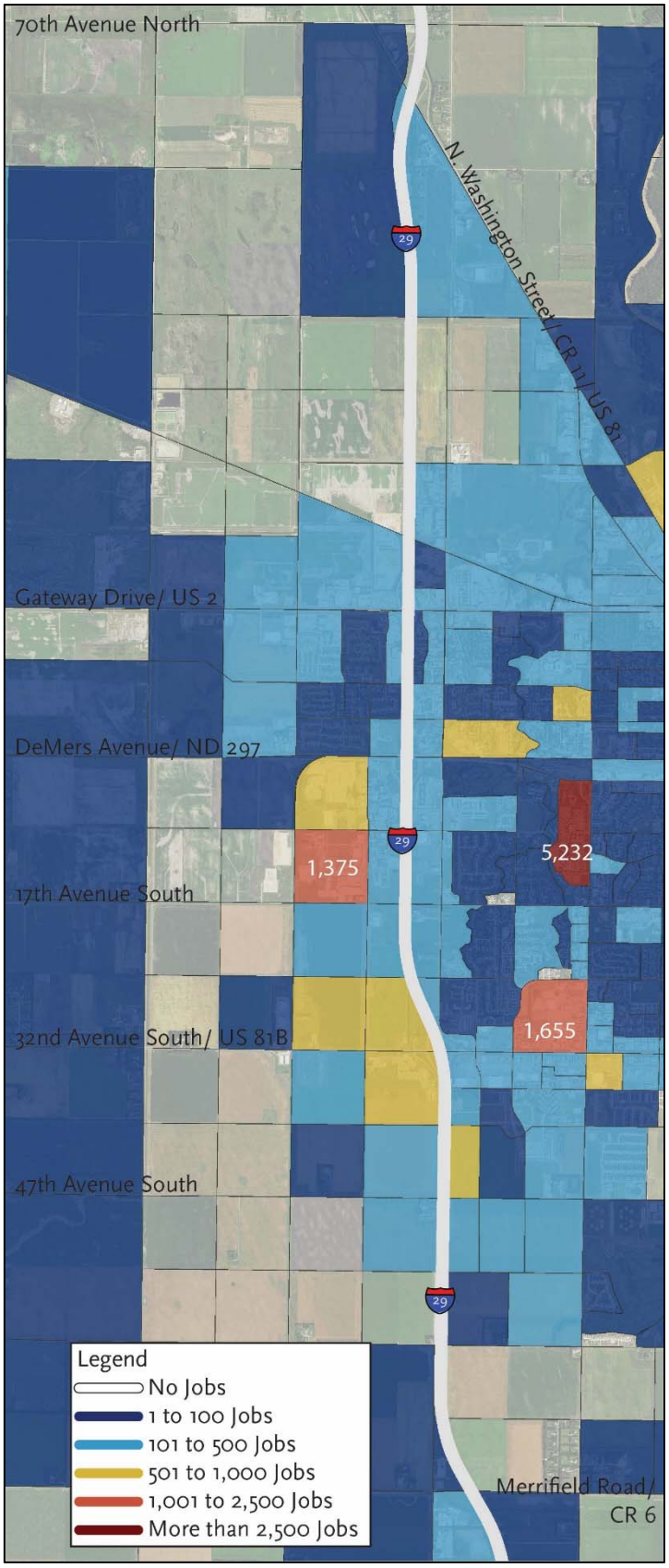
Figure 2-16: Existing Zoning



The GF-EGF MPO updated the Grand Forks Land Use Plan concurrently with this study. There were no significant changes to the future land use plan that would impact the results of this study.

Figure 2-17: 2010 Population (Left) and Employment (Right)





Traffic Operations

Two models were used to evaluate traffic operations in the study area. The first used Synchro software, which applies equations published in the Highway Capacity Manual (HCM). HCM is an industry and NDDOT standard. This model was used for the corridor periphery, which included the North Washington Street/CR 11/US 81 interchange and the Merrifield Road/CR 6 overpass. Where merging, diverging, weaving and queueing complications may exist, a more rigorous model was developed using Vissim software. Vissim simulates the movement of every vehicle through an intersection and then collects information for associated performance measures like delay, queue lengths, travel times and density. Because the Vissim models require substantially more effort to develop and calibrate, this model was used for urban I-29 and the interchange functional areas from the Gateway Drive/US 2 interchange to 47th Avenue South. This microsimulation model was calibrated to queue length data, traffic volume inputs and speed.

Capacity analysis was evaluated for intersections in the interchange functional area in terms of delay and level of service (LOS). LOS is a term used to describe the operational performance of transportation infrastructure elements; essentially, LOS is a grade value that corresponds to specific traffic characteristics within a given system. NDDOT updated the Traffic Operations Manual in June 2015. The organization now accepts LOS "C" for urban and suburban interstate segments. LOS "B" is the lowest acceptable for rural interstate segments. In urban and suburban areas, LOS "C" is the minimum acceptable threshold for interstate ramp intersections, while LOS "D" is the minimum acceptable threshold for principal and minor arterials, collectors and local roads. The GF-EGF MPO accepts LOS "D" as the minimum acceptable value, but strives for LOS "C". For the purposes of this study, LOS "D" is considered acceptable where other alternatives were not feasible or cost-effective.

Capacity analysis was also evaluated for mainline I-29 as it intersects with the on- and off-ramps at the various interchanges. Different interchange configurations result in different mainline operations; operations were studied at the 500-foot section upstream of off-ramps and the 500-foot section downstream of on-ramps. The HCM reports freeway operations as density (passenger cars per mile per lane).

Table 2-2: HCM Level of Service for Intersections and Freeway Facilities

Level of Service	Control Delay (sec/veh)		Density (pc/mi/ln*)
	Unsignalized	Signalized	
A	≤ 10	≤ 10	≤ 11
B	10 – 15	10 – 20	11 – 18
C	15 – 25	20 – 35	18 – 26
D	25 – 35	35 – 55	26 – 35
E	35 – 50	55 – 80	35 – 45
F	> 50	> 80	> 45

*Passenger cars per mile per lane

Because the City of Grand Forks routinely updates signal timing plans, signal timing within the models were optimized to get a realistic understanding of actual capacity problems, not signal timing deficiencies.

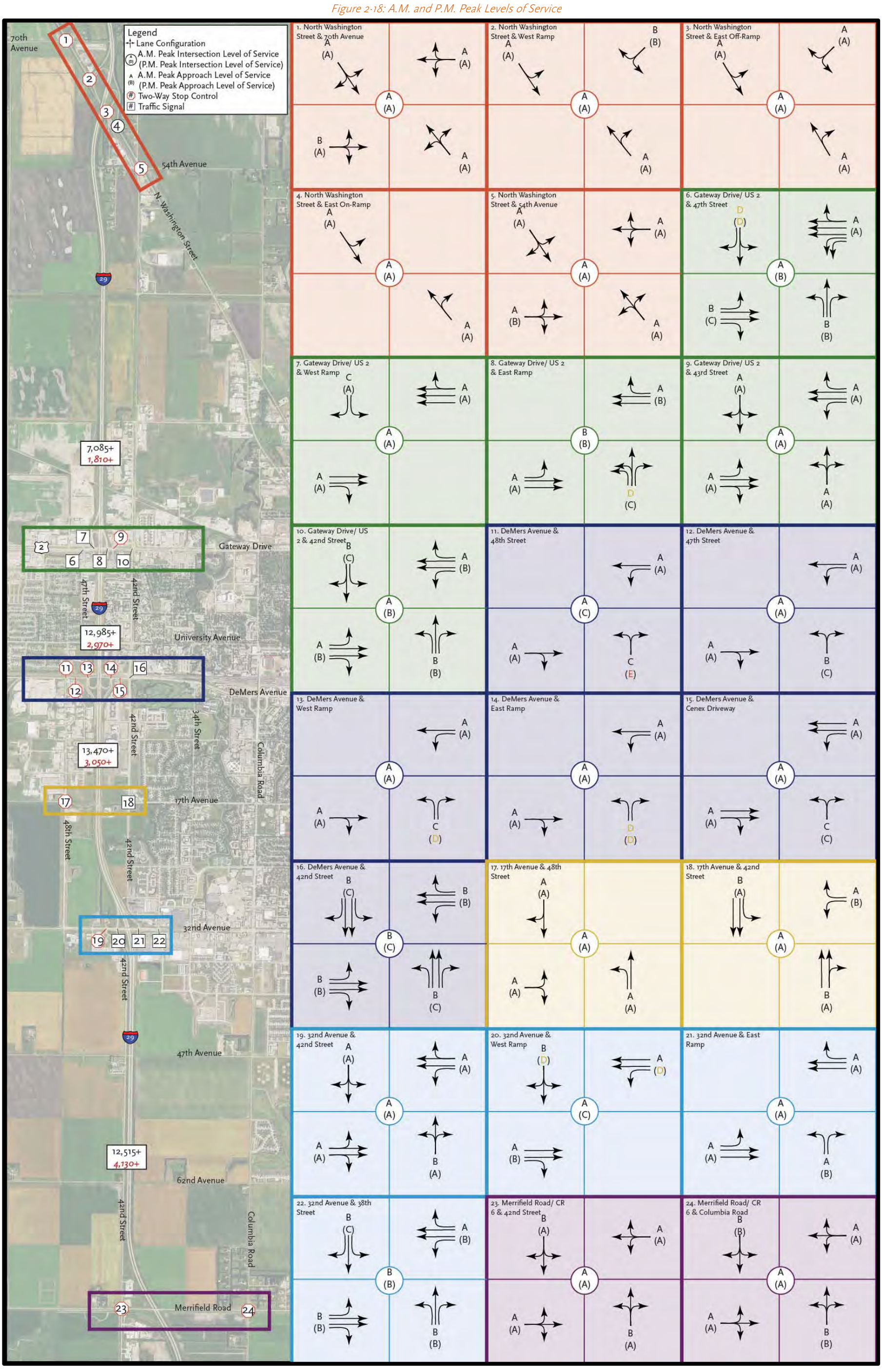
2015 A.M. AND P.M. PEAK

During the existing A.M. peak, all intersections are at LOS "C" or better.

- All intersections in the North Washington Street/CR 11/US 81 functional area are LOS "A" during both A.M. and P.M. peak hours. All approaches are LOS "B" or better during the A.M. and P.M. peak hours.
- All intersections in the Gateway Drive/US 2 interchange functional area are LOS "B" or better during both A.M. and P.M. peak hours. Some approaches, the southbound approach at 47th Street during the A.M. and P.M. peak and the northbound approach at the East Ramp during the A.M. peak, fall to LOS "D".
- During the A.M. peak hour, all intersections in the DeMers Avenue/ND 297 interchange functional area are LOS "B" or better. However, during the P.M. peak hour, the DeMers Avenue/ND 297 and 48th Street intersection and the DeMers Avenue/ND 297 and 42nd Street intersection falls to LOS "C". 48th Street is a stop controlled intersection that serves the industrial park. It experiences strong northbound to eastbound right-turning movements during the P.M. peak, while 42nd Street experiences 20 percent more traffic during the P.M. peak than the A.M. peak. All other intersections operate at LOS "A".

- The two study intersections at 17th Avenue South operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are at LOS "B" or better during both peak hours.
- At the 32nd Avenue/US 81B interchange functional area, all intersections are at LOS "B" or better during the A.M. peak and LOS "C" or better during the P.M. peak. At the West Ramp intersection, the southbound and westbound approaches operate at LOS "D" during the P.M. peak.
- The two study intersections at Merrifield Road/CR 6 operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are LOS "B" or better during both peak hours.

Figure 2-18: A.M. and P.M. Peak Levels of Service



INTERSTATE NETWORK PERFORMANCE

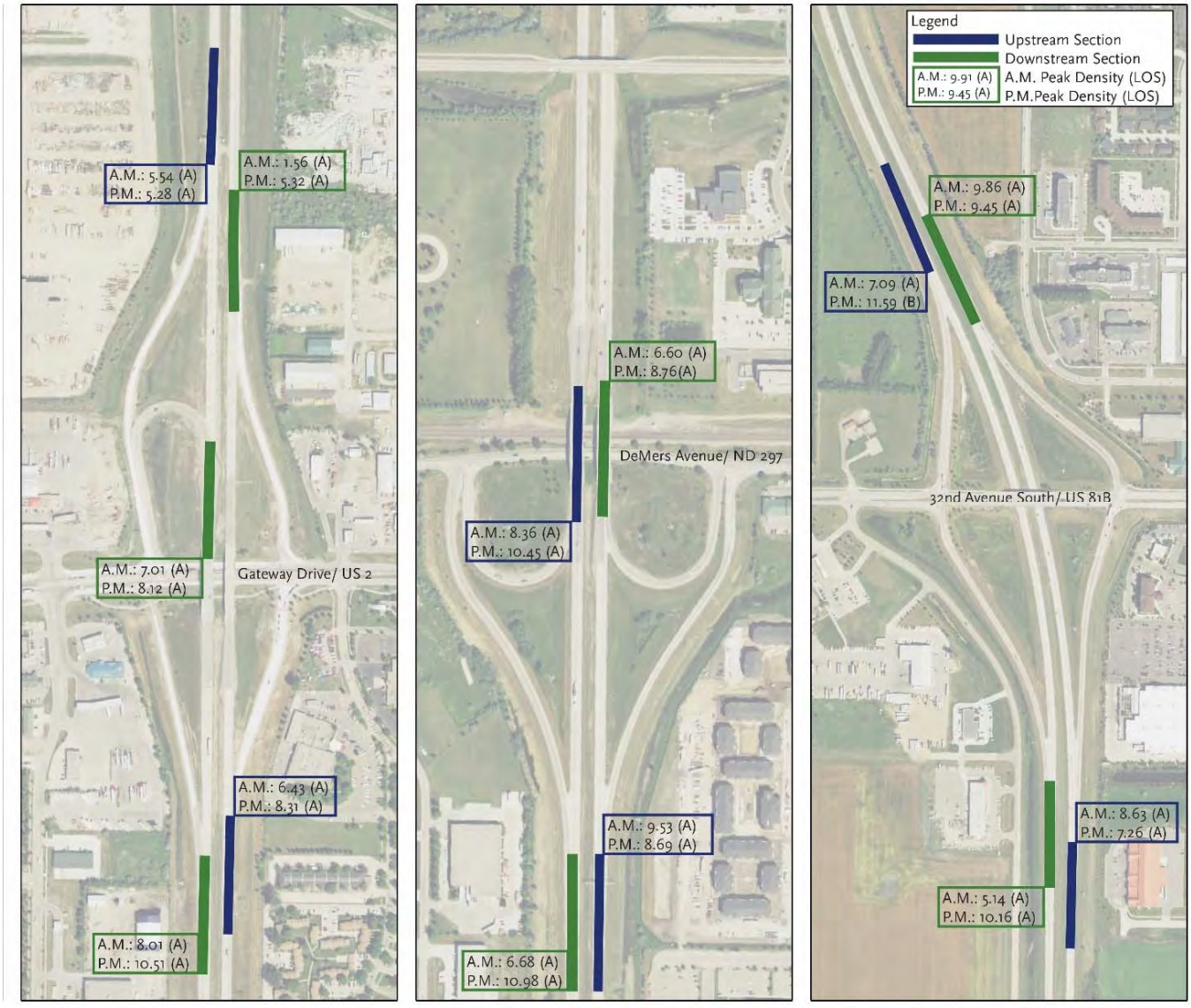
As noted above, interstate LOS is measured in density and anything below a density of 11 passenger cars per mile per lane is considered LOS "A".

Table 2-3: Network and Interstate Performance

	Interstate Performance		
	Average Link Density	Average Link Delay	Average Speed
A.M. Peak	6.17	0.03	70.18
P.M. Peak	7.95	0.03	69.73

The overall interstate network has an average link density of 6.17 during the A.M. peak and 7.96 during the P.M. peak. There is less than one second of link delay and the average speed during both peak hours is essentially free-flow speed. Link densities were evaluated more closely at the 500-foot upstream and downstream sections of the three urban interchanges. Only the southbound upstream section at 32nd Avenue/US 81B was LOS "B" during the P.M. peak. All other sections were LOS "A".

Figure 2-19: Urban Interchange Upstream and Downstream Densities

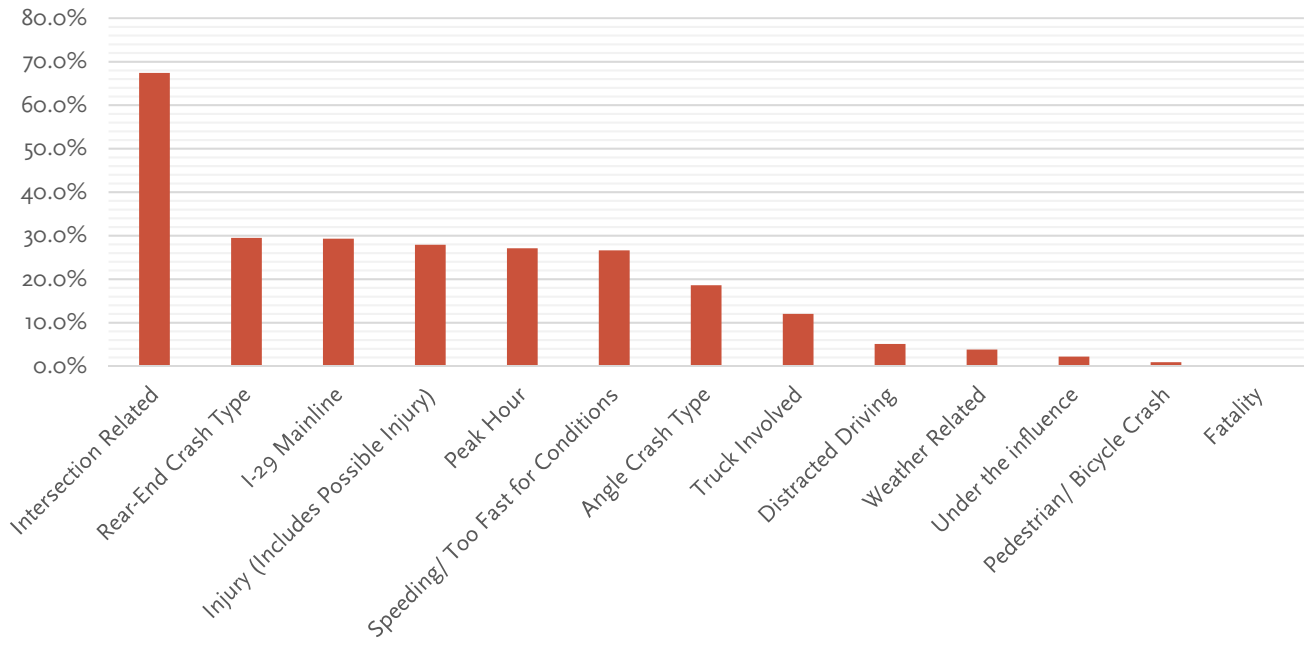


Safety

Safety is of utmost importance when evaluating a corridor; reviewing historic crash information is vital to identifying existing deficiencies. Five years of crash records (August 1, 2010 to July 31, 2015) were obtained from NDDOT that showed an average of 90 crashes per year in the study area (including mainline and interchanges). This includes one fatality in the five-year period and 25 crashes per year resulting in an injury, including the possible injury classification.

An evaluation of crash trends, shown in Figure 2-20, identifies intersection related crashes as the most prolific trend, with 67.4 percent occurring at or related to intersections. Rear-end crash types made up nearly 30 percent of all crash types, followed by angle crashes with 18.6 percent. More than 29 percent of all crashes occurred on the I-29 mainline. Trucks were involved in 12 percent of crashes, and pedestrians/ bicyclists in one percent. Major contributing factors to crash incidents include speeding, 26.6 percent, and distracted driving, 5.1 percent.

Figure 2-20: Crash Trends



The National Safety Council estimates the economic impact of crashes based on wage and productivity losses, medical and administrative expenses, motor vehicle damage and employer costs due to injuries. Using this data, the total costs associated with crashes in the study area were more than $1.34 million per year. These cost estimates are illustrative only and are not used by the MPO or NDDOT to monitor crashes.

LOCAL ROAD SAFETY PROGRAM

The Local Road Safety Program (LRSP) is part of North Dakota's Statewide Highway Safety Improvement Plan. The goal of this program is to "identify and implement specific safety strategies at specific locations and to link these projects directly with the contributing factors associated with the majority of serious crashes on the local roads". The LRSP for Grand Forks County was completed in June 2014 and identified the following locations and improvements:

- **Advanced Walk and Countdown Timers:** Gateway Drive/US 2 and East Ramp and West Ramp; 32nd Avenue/US 81B East Ramp and West Ramp.
- **Advanced Walk:** Gateway Drive/US 2 and 42nd Street; DeMers Avenue/ND 297 and 42nd Street; 17th Avenue South and 42nd Street; 32nd Avenue/US 81B and 38th Street.

- **Confirmation Lights:** Gateway Drive/US 2 and 47th Street, West Ramp, East Ramp and 42nd Street; 32nd Avenue/US 81 B and West Ramp, East Ramp and 38th Street; DeMers Avenue/ND 297 and 42nd Street; 17th Avenue South and 42nd Street.
- **Merrifield Road/ CR 6 and South Columbia Road:** Install Mainline Dynamic Warning Sign, upgrade STOP sign, upgrade JUNCTION AHEAD sign, upgrade STOP AHEAD sign, upgrade STOP AHEAD marking and upgrade stop bar. This was identified as a medium priority project.

The Gateway Drive/US 2 corridor currently has confirmation lights programmed in the STIP for implementation in 2019.

CRASH HOTSPOTS

To identify overrepresented crash locations within the study area, a two-phase approach was adopted. First, crash frequency was studied to identify locations with the highest number of crashes. This is the most straightforward approach to determining locations susceptible to crashes. This approach, however, ignores the rate at which crashes occur. Typically, intersections with a high number of crashes also carry high traffic volumes. Many times, a low volume location may have fewer overall crashes, but on a per car basis, have a much higher susceptibility to crashes. Therefore, it is beneficial to identify which locations in the study area experience a statistically high crash rate.

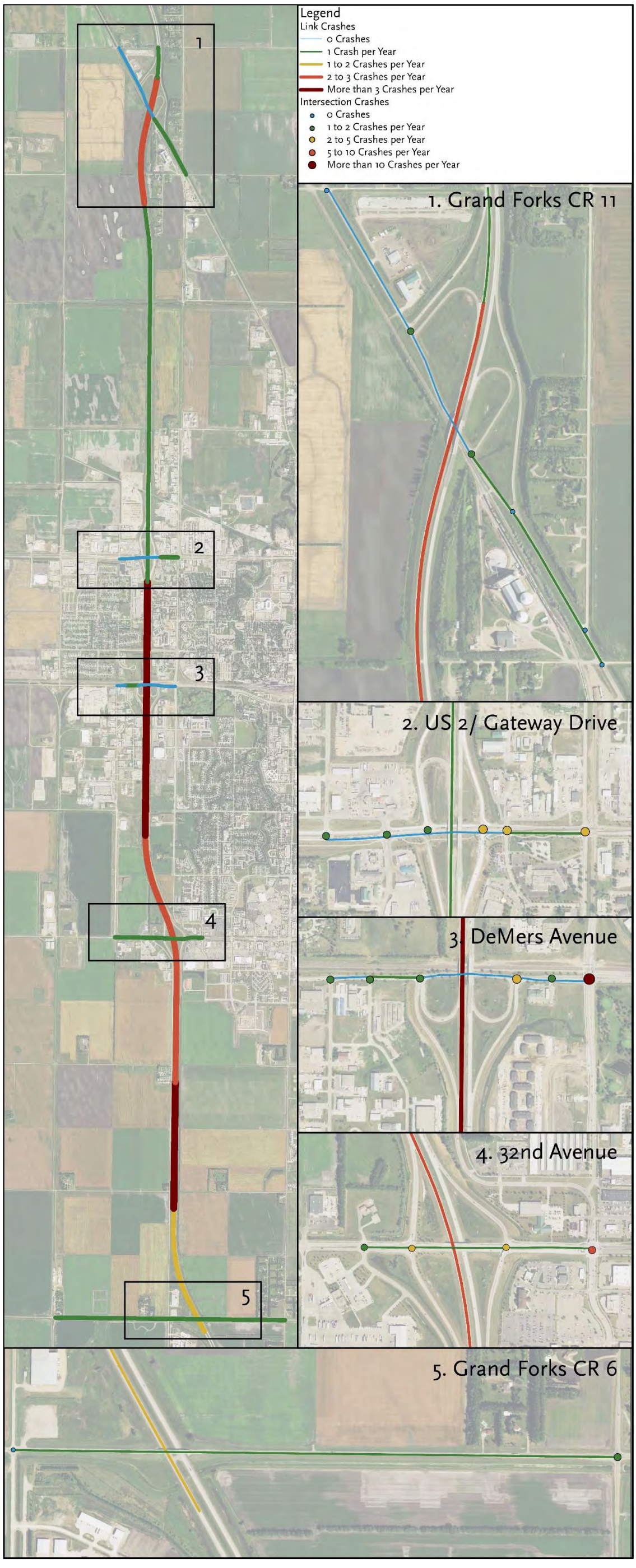
To identify statistically significant crash rates, the critical crash rate method was used. This method was developed by the Minnesota Department of Transportation (MnDOT) and is included in the NDDOT Design Manual. This method incorporates traffic volumes and crash rates for a particular location and compares this rate against crash rates for similar facilities. Facilities for this study include I-29 mainline crashes, all other link crashes and intersection crashes.

According to the critical crash analysis methodology, intersections and links with crash rates above the critical rate are considered overrepresented and in need of further review; there is a high probability that conditions at the site are contributing to the higher crash rate. Based on this analysis, the following links and intersections were found to be overrepresented:

- I-29 Mainline between mile marker 140 and 141, located between DeMers Avenue/ND 297 and Gateway Drive/US 2
- The DeMers Avenue/ND 297 and East Ramps intersection
- The DeMers Avenue/ND 297 and 42nd Street intersection
- The 32nd Avenue/US 81B and West Ramps intersection
- The 32nd Avenue/US 81B and 38th Street intersection

Two of these intersections were analyzed in the 2040 LRTP. Both were found to be under the critical crash rate calculated for the entire Grand Forks metro area. The analysis presented in the 2040 LRTP used a threshold of 10 crashes during a three-year period. The critical crash rate analysis presented in this report analyzed a different time period and used a crash threshold of one per year during a five-year period in an effort to filter out random events, thus resulting in different results than the LRTP. The purpose of this analysis was to identify all crash-prone locations within the study area. Detailed analysis at these locations can be found below.

Figure 2-21: Crashes in Study Area



TREND ANALYSIS

NORTH WASHINGTON STREET/CR 11/US 81 INTERCHANGE FUNCTIONAL AREA

There were seven total crashes in this interchange functional area. Three at the East Ramps, three at the West Ramps and one link crash between the East Ramp and 54th Avenue North on North Washington Street/CR 11/US 81. One resulted in an incapacitating injury, while the remaining six resulted in property damage only. Speed was the contributing factor in three of seven crashes (42.9 percent). There were no other trends.

GATEWAY DRIVE/US 2 INTERCHANGE FUNCTIONAL AREA

There were 96 total crashes in the Gateway Drive/US 2 interchange functional area; 94 of these were intersection related crashes.

Peak Hour Crashes

Of all crashes, 33.3 percent occurred during the A.M. and P.M. peak hours. One-third of these peak hour crashes were westbound rear-end crashes. Congestion and queueing onto the interstate and across adjacent intersections contributes to an increased rear-end crash potential.

Angle Crashes at 43rd Street

43rd Street is an unsignalized intersection located just 250 feet east of the Gateway Drive/US 2 and East Ramps intersection and 800 feet west of the Gateway Drive/US 2 and 42nd Street intersection. Two-thirds of crashes at this intersection were angle crashes caused by drivers on the minor approach trying to find an acceptable gap. Seven of the twelve angle crashes at this intersection were from the southbound approach. Long queues and heavy traffic may reduce acceptable gaps and obstruct vision of conflicting traffic. As drivers tire of waiting they make engage in riskier behavior trying to exit the development.

Figure 2-22: Westbound Queues at the Gateway Drive/ US 2 West Ramp

Crashes at the East Ramp Intersection

Northbound rear-end crashes contributed to seven of the 20 (35 percent) total crashes at this intersection. As vehicles look left for gaps in traffic to make a right-turn, they may fail to see vehicles ahead of them and cause rear-end crashes.

Rear-End Crashes at 47th Street

Of the 22 crashes at 47th Street, there were 10 rear-end crashes (six eastbound and five westbound). This intersection experiences heavy queueing, along with the West Ramp, that produces frequent stop-and-go traffic conditions, leading to increased crash potential.

DEMERS AVENUE/ND 297 INTERCHANGE FUNCTIONAL AREA

There were 107 crashes in the DeMers Avenue/ND 297 interchange functional area, with 70 occurring at 42nd Street.

Rear-End Crashes at the East Ramp

This intersection was identified as overrepresented, with 14 total crashes. Of these crashes, five were northbound rear-end crashes (35.7 percent). During both A.M. and P.M. peak, this approach operates at LOS "D". With stop-and-go traffic and long queues and delays, rear-end crash potential is raised. Often times, at locations with a yield controlled right-turn, motorists look upstream for gaps in traffic and not forward, and then collide with vehicles ahead.

Left-Turn Crashes at 42nd Street

There were 28 left-turn crashes at 42nd Street, the dominant crash type at this intersection. Twelve of these crashes occurred during peak hours. Special events at the Alerus Center and train events may result in long queues and delays. A report recently completed for this at-grade rail crossing found the average delay during train events to be just over five minutes, with the longest delays approaching 20 minutes. The FHWA found that the frequency of red light running increases as traffic volumes increase, especially during the peak hours when delays are longer. Increased motorist frustration may lead to risk taking behavior; drivers may tend to run yellow and occasionally the beginning of red lights to avoid long delays, like train events.

Figure 2-23: Queues after Train Event at 42nd Street and DeMers Avenue/ ND 297

17TH AVENUE SOUTH

There were seven total crashes at the 17th Avenue South and 42nd Street intersection. Four were angle crashes where a westbound vehicle making a right-turn failed to yield to northbound traffic. It is possible that because the second northbound through lane opens at this intersection, meaning northbound traffic can change lanes, it is difficult for westbound to northbound vehicles to judge approaching traffic.

There were no crashes at the 17th Avenue South and 48th Street intersection.

32ND AVENUE/US 81B INTERCHANGE FUNCTIONAL AREA

There were 98 total crashes at this interchange functional area, with 42 occurring at 38th Street, 24 at the East Ramps and 23 at the West Ramps. There were no day-of-week trends identified for crashes in this functional area; crashes were not disproportionate during the weekends. Crash analysis at this interchange was completed for the 47th Avenue Interchange Access Request (IAR). It identified the West Ramp, East Ramp and 38th Street intersections as overrepresented based on critical crash analysis. The analysis in this report found overrepresentation at the West Ramp and 38th Street intersection. The differences in the results is due to a larger study area and different time frame.

Angle Crashes at the West Ramp Intersection

Research has found that 60 percent of fatal crashes are angle crashes (right- and left-turn crashes). At the West Ramp intersection, angle crashes made up 47.8 percent of all crashes. Of these 11 crashes, eight occurred during the off-peak hours. Seven of the 11 crashes occurred because a driver ran a red light (four southbound and three westbound drivers).

A review of crash reports were unclear whether red light running was due to inability to stop or disregard for the traffic signal. Red light running due to the inability to stop can be mitigated with adjustments to clearance intervals. Increased enforcement may change the behavior and driver choice to disregard.

Rear-End Crashes at the East Ramp Intersection

Two-thirds (16 of 24) of all crashes at the East Ramp intersection were rear-end crashes. These rear-end crashes were split between peak and off-peak hours. However, half of all the rear-end crashes occurred on the northbound off-ramp, which may be caused by long queues on the ramp.

38th Street Intersection

There were 42 total crashes at 38th Street. Fourteen of these crashes, 33.3 percent, were left-turn crashes. Ten of these left-turn crashes were caused by eastbound to northbound or westbound to southbound vehicles during off-peak hours. These left-turn crashes may be attributed to negative offset turn lanes which can obstruct views of conflicting traffic.

Figure 2-24: Negative Offset Turn Lanes at 32nd Avenue South/ US 81B and 38th Street

Eleven of the 42 crashes were angle crashes (26.2 percent). Eight of the 11 crashes occurred during off-peak hours, six due to drivers running red lights. Drivers may be more likely to run red lights during times of long delays or shorter than anticipated clearance intervals.

Fifteen of the 42 crashes were rear-end crashes (35.7 percent). Of these rear-end crashes, 73.3 percent occurred during off-peak hours. Stop-and-go traffic caused by congestion may contribute to this crash trend.

MERRIFIELD ROAD/CR 6

There were three total crashes, two of which occurred at the intersection of Merrifield Road/CR 6 and Columbia Road. No trends were identified.

I-29 MAINLINE CRASHES

There were 132 total crashes along the ten-mile corridor of I-29. More than 60 percent of mainline crashes were single-vehicle incidents. More than 56 percent of mainline crashes were attributable to speed; 42.4 percent were attributable to weather or roadway conditions.

I-29 South of 32nd Avenue/US 81B

In the four-mile section south of Merrifield Road/CR 6 to 32nd Avenue/US 81B, there were 38 crashes. Of these crashes, 24 were southbound and 14 were northbound. Of the 24 southbound crashes, 11 were due to icy roadways or decreased visibility; two were merging crashes onto I-29 from the 32nd Avenue South/ US 81B interchange. Of the 14 northbound crashes, eight were due to icy roadways or weather.

I-29 between 32nd Avenue/US 81B and DeMers Avenue/ND 297

There were 41 crashes in the two-mile section between 32nd Avenue/US 81B and DeMers Avenue/ND 297; 19 were northbound crashes and 22 were southbound. Of the 19 northbound crashes, seven were weather or icy roadways related. Four of the 19 crashes were merging and diverging crashes.

Of the 22 southbound crashes, nine were weather or icy roadways related. Only one of these crashes was merging related.

I-29 between DeMers Avenue/ND 297 and Gateway Drive/US 2

This is a one-mile section of I-29, between DeMers Avenue/ND 297 and Gateway Drive/US 2 that was overrepresented in the critical crash analysis, with 28 crashes. In this section, there were 22 southbound crashes and six northbound crashes. Of the 22 southbound crashes, 12 were due to icy roadways or weather. Three occurred when a vehicle tried to merge onto I-29. Other causes include speeding (three) and improper driving (three).

Of the six northbound crashes, two were due to roadway conditions, one driving under the influence and the last three due to improper action (lane change, evasive, following, etc.).

I-29 North of Gateway Drive/US 2

In the 4.8-mile section from Gateway Drive/US 2 to north of North Washington Street/CR 11/US 81, there were 24 crashes. There were 15 northbound crashes, eight of which were due to icy roadways or weather, two were mechanical failures and two were distracted driving. There were nine southbound crashes, seven of which were due to icy roadways or weather.

Multimodal

Multimodal facilities, including pedestrian and bicycle facilities and public transit, are important components of the transportation system. Enhancing the ability of travelers to select alternative modes can help alleviate some roadway issues. The Grand Forks metro area has an extensive network of non-motorized trails and transit in the study area. A map of multimodal facilities in the study area can be seen in Figure 2-25.

Currently, 72 miles of paved bicycle and pedestrian trails traverse the City and greenway areas. The multi-use trails located within the study area are listed below:

- **North Washington Street/CR 11/US 81.** There are no exclusive dedicated bicycle or pedestrian facilities. Bicycles can and do use the roadway; shoulders at this location are wide enough to support bicycle activity per AASHTO.
- **Gateway Drive/US 2**. East-west multi-use trail located along the south side of Gateway Drive/ US 2 which connects to the north-south 42nd Street multi-use trail.
- **DeMers Avenue/ND 297.** An east-west multi-use trail exists east of 42nd Avenue, which connects to the north-south multi-use trail along 42nd Street. In 2017, a multi-use trail is scheduled to be built to connect 42nd Street to 48th Street.
- **17th Avenue South.** An east-west multi-use trail exists east of 42nd Street, which connects to the north-south multi-use trail along 42nd Street. A north-south multi-use trail is present on the east side of 48th Street connecting 17th Avenue to 32nd Avenue/US 81B.
- **32nd Avenue/US 81B.** An east-west multi-use trail along the south side of 32nd Avenue/US 81B, east of 38th Street, as well as on the north side beginning at 42nd Street extending east into the city.
- **47th Avenue South.** There are no existing bicycle or pedestrian facilities.
- **Merrifield Road/CR 6**. There are no exclusive bicycle or pedestrian facilities. Bicycles can and do use the roadway; shoulders at this location are wide enough to support bicycle activity per AASHTO.
- East-west connectivity is limited to Gateway Drive/ US 2, University Avenue and 32nd Avenue South/ US 81B. There are no other dedicated facilities for bicycles or pedestrians to cross the interstate.

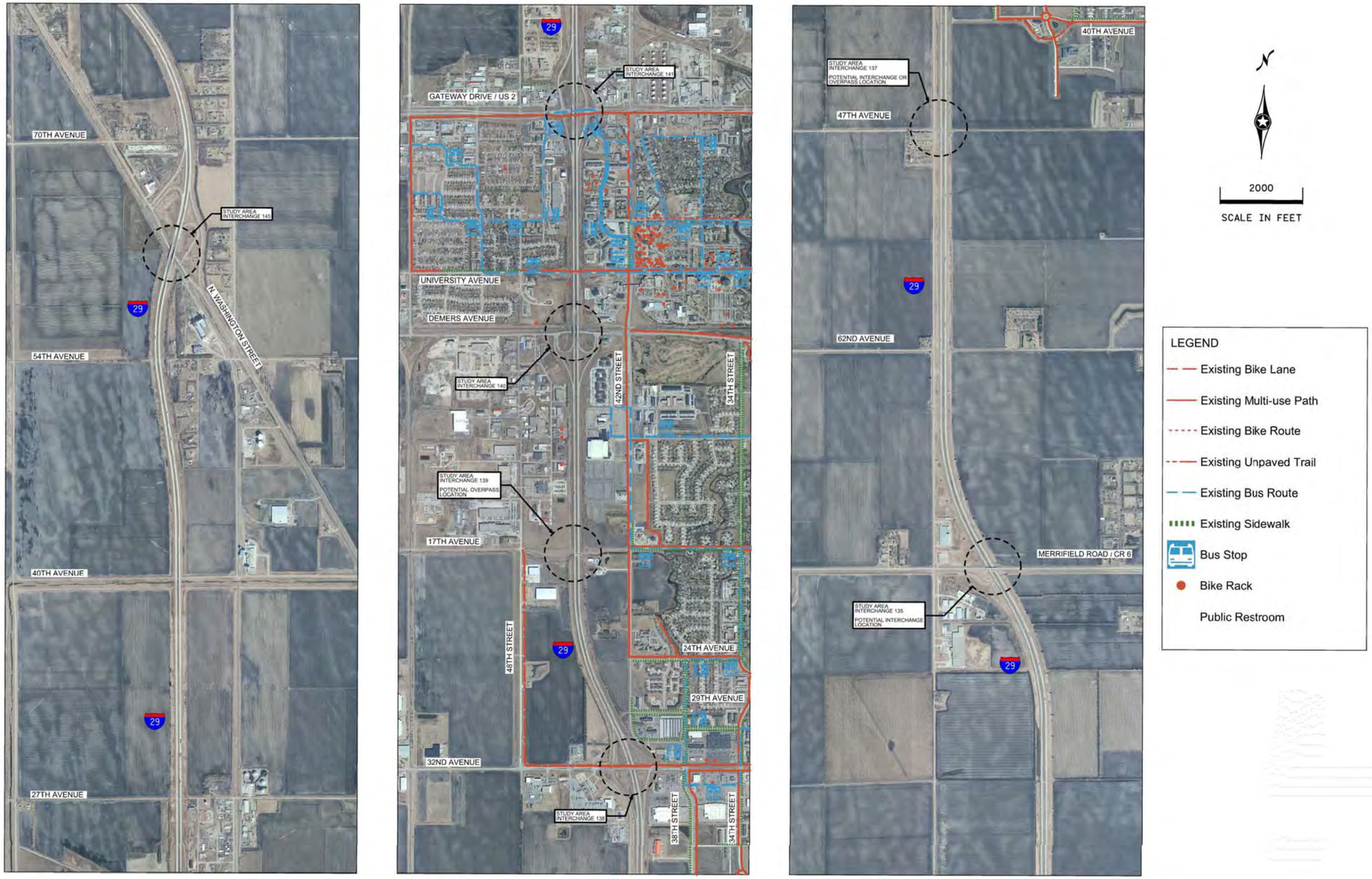
Five-foot concrete sidewalks exist on many of the local neighborhood streets near the study area. There are no sidewalks on 47th Avenue South or Merrifield Road/CR 6.

Cities Area Transit (CAT) is the public transportation serving the Grand Forks metro. Five weekday hourly routes serve the community within the study area: Route 6, Route 8, Route 9, Route 12 and Route 13.

- Route 6 travels primarily along University Avenue between Downtown Grand Forks and UND between 7:00 A.M. and 6:00 P.M.
- Route 8 travels along Columbia Road and University Avenue between Altru Hospital, the UND campus and Wal-Mart between 6:30 A.M. and 6:00 P.M.

- Route 9 provides service between Altru Rehab, the commercial district along 32nd Avenue/US 81B and a variety of schools along 17th Avenue South and 20th Street between 7.00 A.M. and 6:00 P.M.
- Route 12 provides service between the CanadInn, the commercial district along 32nd Avenue/US 81B and the residential neighborhoods surrounding 47th Avenue South and Cherry Street between 5:40 A.M. and 5:15 P.M.
- Route 13 provides service between Altru South, the 32nd Avenue/US 81B commercial district and Altru Hospital between 6:00 A.M. and 6:00 P.M.

Figure 2-25: Multimodal Facilities



Infrastructure Conditions

According to AASHTO, timely pavement rehabilitation has the potential to be six to 14 times more cost effective than rebuilding a deteriorated road. Another AASHTO study found that rough roads add an average of $335 to the annual cost of owning a car due to damaged tires, suspensions, reduced fuel efficiency and accelerated vehicle depreciation. The 2040 LRTP included a consolidated "State of Good Repair" project with the goal of preserving and maintaining the existing roadways in the corridor: CPR & Grind for I-29 from 32nd Avenue/US 81B to North Washington Street/CR 11/US 81 in both directions to be completed in 2026.

The GF-EGF MPO uses the Pavement Condition Index (PCI). The PCI is a measure of the condition of the surface of the roadway based on a visual inspection of sample sections of pavement and measuring the distresses in that sample. The higher the PCI, the better the condition of the roadway, where "Very Poor" (0-40) is the worst condition, followed by "Poor"(40-60), "Fair" (60-80), "Satisfactory" (60-80) and "Good" (80-100) as the best condition.

- Pavement through the North Washington Street/CR 11/US 81 interchange was "Fair" or "Satisfactory".
- Pavement through the Gateway Drive/US 2 interchange was rated "Good".
- Pavement through the DeMers Avenue/ND 297 interchange was rated as "Satisfactory" or "Good". There is a planned rehabilitation project on DeMers Avenue/ND 297 for 2017.
- Pavement through the 32nd Avenue/US 81B interchange was rates as "Good".
- Pavement in the Merrifield Road/CR 6 corridor was rated "Poor" or "Satisfactory".

Grand Forks County uses the Present Serviceability Rating (PSR) calculated by the Upper Great Plains Transportation Institute in their *Study of County and Local Roadway Needs: 2013 – 2015*. The PSR uses a scale from zero to five, where zero is the worst possible condition, "Very Poor" (zero to two), followed by "Fair" (two to three), and "Good" (three to four) and "Very Good" (four to five).

NDDOT uses the International Roughness Index (IRI). The IRI is a measure of pavement smoothness that is calculated from the longitudinal profile of the roadway surface. The higher the IRI, the worse the condition of the pavement. All mainline I-29 roadway sections are in "Good" (60-99) or "Excellent" (less than 60) condition; no IRI was above 67.

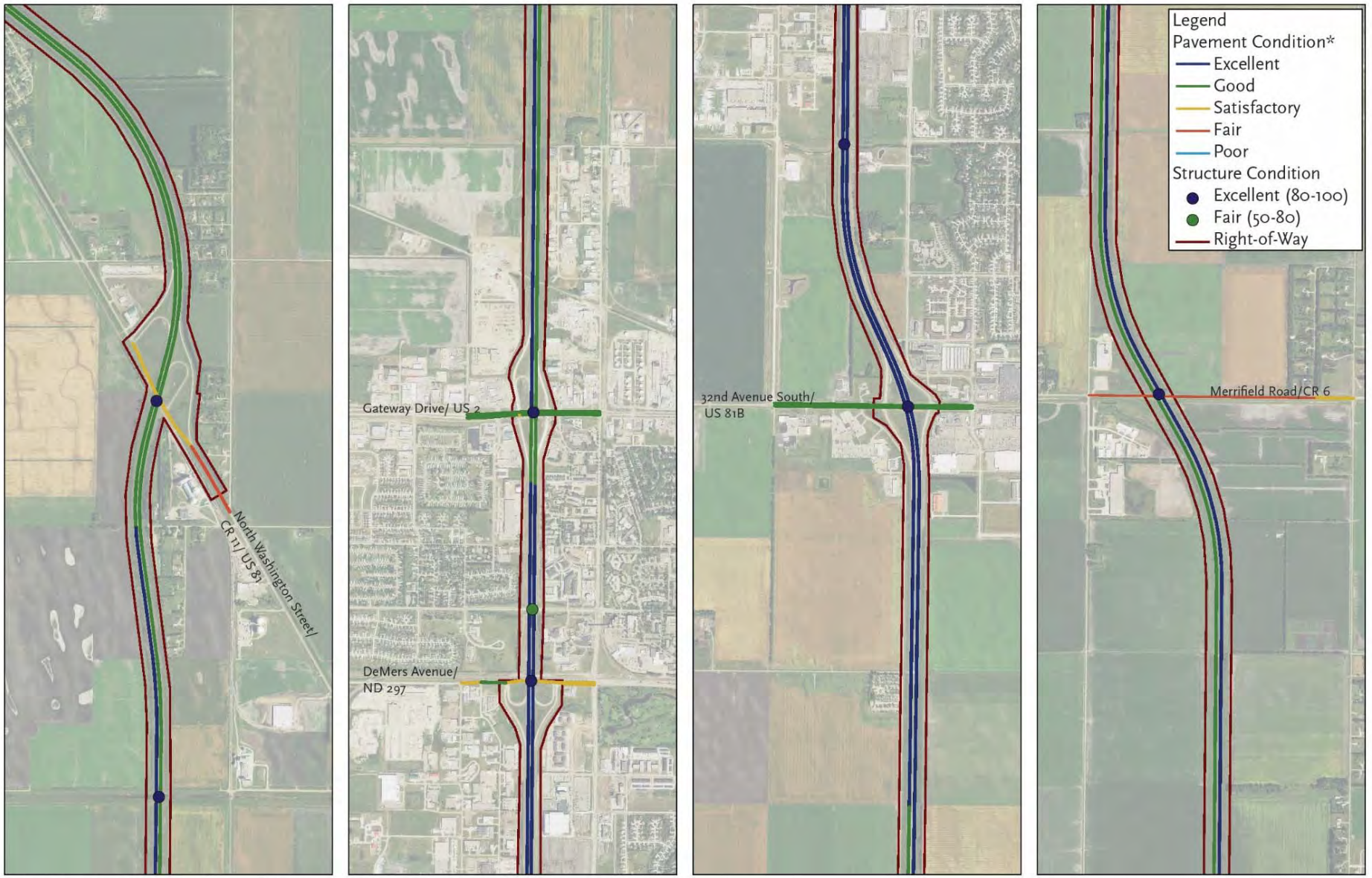
Additionally, NDDOT bridge inspection reports were evaluated to determine the existing sufficiency rating of the bridges in the study area and whether any bridges are classified as functionally obsolete or structurally deficient. Sufficiency ratings are translated into Excellent, Fair and Poor categories. Generally, a bridge with a sufficiency rating of 80 or less can receive Federal bridge rehabilitation funding while a bridge with a sufficiency rating of 50 or less can receive Federal bridge replacement funding. While no bridges were found to be functionally obsolete or structurally deficient, the University Avenue overpass has a sufficiency rating of 78.4, making it potentially eligible for Federal bridge rehabilitation funding. There is a planned deck overlay in 2017.

Right-of-Way and Utilities

NDDOT maintains land adjacent to I-29 for any and all state highway purposes. Around I-29, there is approximately 400 feet of ROW, including I-29. NDDOT permits utility facilities to be accommodated within ROW when they do not adversely affect highway safety, maintenance or operations. A variety of overhead and underground utilities exist within the I-29 ROW. As of August, 2015, the following entities had some type of utilities within the study area ROW. Determining specific locations and alignment is unknown and determining this is beyond the scope of this report.

- Agassiz Water Users, Inc.
- Century Link
- Dakota Carrier Network
- Walsingham Group
- Drees Farming Association
- Grand Forks Traill Water Users
- City of Grand Forks
- Minnkota Power
- Meridan Environmental
- NDDOT
- North Dakota Pipeline Company
- Xcel Energy
- Nodak Electric
- Polar Communications
- Midcontinent Communications
- University of North Dakota
- UND Telecommunications
- Magellan Midstream Partners LP

Figure 2-26: Infrastructure Conditions and Right-of-Way



*Refer to the Infrastructure Conditions section for a summary of the pavement condition methodology, as it differs based on roadway jurisdiction.
- Pavement conditions for Gateway Drive/ US 2, DeMers Avenue/ ND 297 and 32nd Avenue South/ US 81B are presented based on the Pavement Condition Index provided by the GF-EGF MPO.
- Pavement conditions for North Washington Street/ CR 11/ US 81 and Merrifield Road/ CR 6 are presented based on the Present Serviceability Rating provided by Grand Forks County as reported by Upper Great Plains Transportation Institute's *Study of County and Local Roadway Needs: 2013 - 2015.*
- Pavement conditions for mainline I-29 are presented based on the International Roughness Index as provided by NDDOT.

Railroad Conflicts

The Grand Forks Subdivision and Glasston Subdivision have frequent train events that often negatively impact operations within the interchange functional areas. The Grand Forks Subdivision runs parallel to DeMers Avenue/ND 297 and averages 14 trains per day. Each train event produces an average delay at the crossing of just over five minutes. However, during switching maneuvers, a back and forth local movement common near switching yards or railroad crossovers, the delay can range from 10 to 20 minutes. Switching delays often create motorist frustration that leads to risk-taking maneuvers to avoid delays. This grade crossing is currently being studied for a grade separation project.

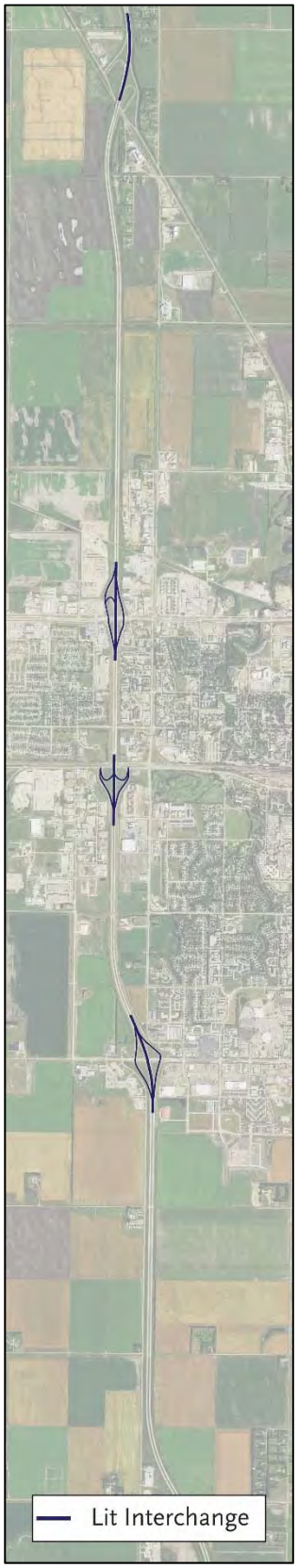
Figure 2-27: Glasston and Grand Forks Subdivision Railways near I-29

The Glasston Subdivision runs parallel to 42nd Street within City limits and then curves west to follow North Washington Street/CR 11/US 81; this subdivision experiences an average of three trains per day. However, with the completion of the Northern Plains Nitrogen fertilizer plant, train traffic on the Glasston Subdivision stands to increase by at least one unit train per week. Additional train traffic is also expected from stimulated coal and gravel activity headed to-and-from the north. Each of these train events produces an average delay of greater than five minutes. During these delays, queues on Gateway Drive/US 2 extend onto I-29. This creates major delays on Gateway Drive/US 2 and increased crash potential on the interstate by introducing stopped vehicles onto the highway, where posted speeds are 75 miles per hour. These issues are currently being studied in another MPO sponsored project, the Glasston Subdivision Railroad Crossings Mitigation Study. Upon completion, its results will be incorporated into this study, thus no recommendations for this crossing will be developed as a part of this study.

The Glasston Subdivision Railroad Crossings Mitigation Study will also evaluate the feasibility of rerouting the Mill Spur Line. The Mill Spur Line connects the North Dakota State Mill to the Grand Forks Subdivision. Currently, the State Mill generates two trains per day with plans to increase production 30 percent. It is expected that frequency and length of trains on the Mill Spur will also increase. Rerouting the Mill Spur would shift trains to the Glasston Subdivision, further increasing train traffic on the Glasston Subdivision and result in increased vehicle traffic delays.

The alignment of both the Grand Forks Subdivision and Glasston Subdivision limit the geometric alternatives that are possible for the DeMers Avenue/ND 297 interchange and the North Washington Street/CR 11/US 81 interchange.

Figure 2-28: Interstate Lighting



Lighting

Currently, roadway lighting is limited to the interchanges:

- Merrifield Road/CR 6 has no lighting near the existing overpass bridge.
- The 32nd Avenue/US 81B interchange has two high mast lighting structures in each quadrant, for a total of eight structures.
- The DeMers Avenue/ND 297 interchange has two high mast lighting structures in the northwest, southeast and southwest quadrants, for a total of six structures.
- The Gateway Drive/US 2 interchange has two high mast lighting structures in the northwest, northeast and southwest quadrants and one structure in the southeast quadrant, for a total of seven structures.
- The North Washington Street/CR 11/US 81 interchange has multiple non-decorative davit type poles with cobra head luminaires in the northwest and northeast quadrants at the on- and off-ramps.

NDDOT provides six lighting warrants, updated May, 2015, for continuous freeway or interstate lighting. They are based on traffic volumes, rural/ urban context, densely spaced interchanges and engineering judgment.

Based on these warrants, continuous interstate lighting between 32nd Avenue/US 81B and Gateway Drive/US 2 is warranted based on three successive interchanges located with an average spacing of 1.5 miles or less.

Access Control

MAINLINE I-29

FHWA provides guidelines on access points on-to and off-of the interstate system. They consider each entrance and exit point an access point. FHWA permits a minimum spacing for urban interchanges of one mile, with a preference of two miles. In rural areas, the minimum spacing for interchanges is three miles. Within the I-29 study corridor, there are four interchanges: North Washington Street/CR 11/US 81, Gateway Drive/US 2, DeMers Avenue/ND 297 and 32nd Avenue/US 81B. Between the North Washington Street/CR 11/ US 81 and Gateway Drive/US 2 interchanges, is approximately 3.25 miles, acceptable according to FHWA's access guidelines. Between Gateway Drive/US 2 and DeMers Avenue/ND 297 is approximately 0.8 miles, and from DeMers Avenue/ND 297 to 32nd Avenue/US 81B is a 1.6 mile gap with no interchange or grade separation. South of 32nd Avenue/US 81B, the next grade separation with access across I-29 is 2.75 miles away at Merrifield Road/CR 6 and the next interchange with access onto I-29, is eight miles south, and outside the scope of this report.

Frequent access deteriorates operations and diminishes the regional significance of I-29. However, large gaps in access across and onto the interstate limit development potential around the interstate and divert traffic to roadways with access to the interstate. This may unnecessarily stress roadways, as students, commuters and visitors to Grand Forks find the fastest route to their destination.

INTERCHANGE FUNCTIONAL AREA

FHWA encourages strict access management within the interchange functional area (Figure 2-30) to reduce conflicting movements of mixed traffic with different speeds, increase safety and maintain acceptable operations to prevent queueing onto the high-speed mainline. Crash potential and access management can be improved at three locations:

- **North Washington Street/CR 11/US 81 interchange functional area.** In less than 1.25 miles, there are eight access points.
  - The driveways to Sproule Farms and Simplot Grower Solutions may have to be mitigated if traffic increases and results in traffic control at the West Ramp intersection.
  - At the East Ramp intersection, the off-ramp and the on-ramp are separated by 800 feet. Merging the ramps into one intersection and improve the turning radii may prevent trucks from off-tracking as they make an eastbound to northbound left-turn.
  - The two intersections of North Washington Street/CR 11/US 81 and 42nd Street and North Washington Street/ CR 11/US 81 and 54th Avenue are closely spaced (375 feet apart) and may create additional conflicts. Merging or realigning these intersections may provide improved operations and safety.
- **Gateway Drive/ US 2 interchange functional area.** Within this interchange functional area, there are four signalized intersections in 0.40 miles which leads to poor traffic flow. During the peak hours, congestion and queueing onto the interstate and across adjacent intersections contributes to an increased rear-end crash potential. Additionally, at Gateway Drive/US 2 and 43rd Street, there is an angle crash trend when north- or south-bound vehicles attempt to enter the traffic stream. The recently completed US 2 Corridor Study, which focused on this interchange functional area recommended to add a new loop ramp in the northeast quadrant of the interchange and relocate the southbound 43rd Street access and convert it to a right-in/right-out (RIRO) access with the northbound access is converted to a ¾ access point. These revisions should mitigate queueing and congestion and reduce the left-turning conflict at 43rd Street.
- **DeMers Avenue/ND 297 and the Cenex Driveway.** Currently, there is a Cenex with access onto DeMers Avenue/ND 297. While there were no crash trends due to this access, it introduces additional conflicts and mixed speeds to the traffic stream. The grade separation study resulted in a preferred design that will likely impact this access point, either by converting to a RIRO or relocating, as shown in Figure 2-29.
- **47th Avenue.** As it exists now, there is one intersection at 47th Avenue and 42nd Street. Analysis at this location will include potential interchange configurations, including more specific locations for ramp spacing and other access points along 47th Avenue.

Figure 2-29: One Alternative for 42nd Street Grade Separation

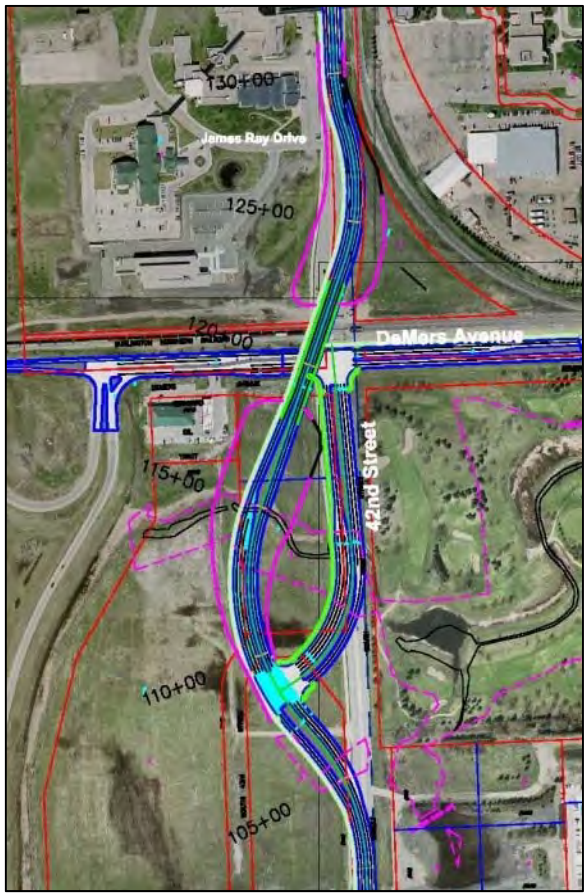
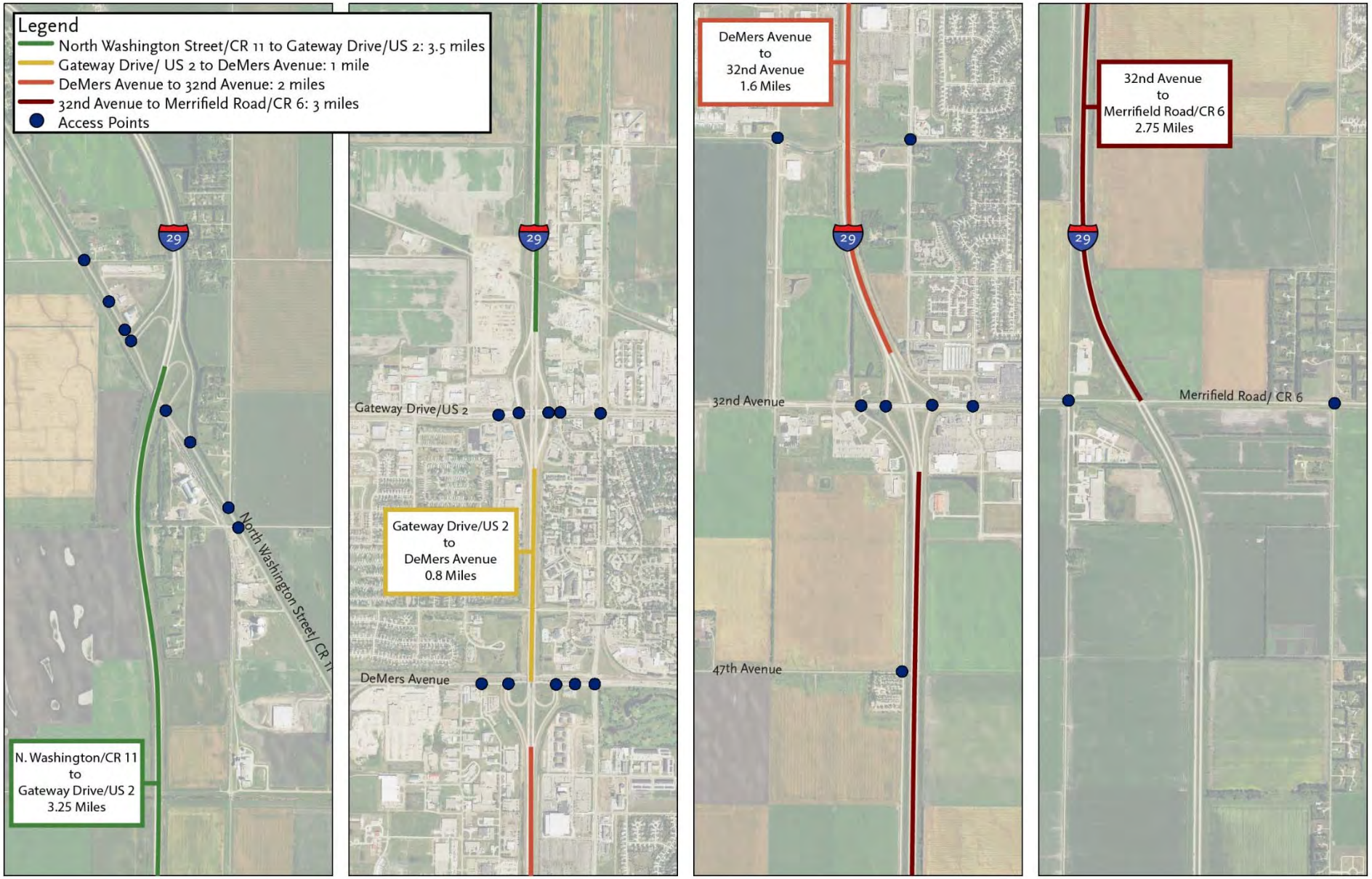


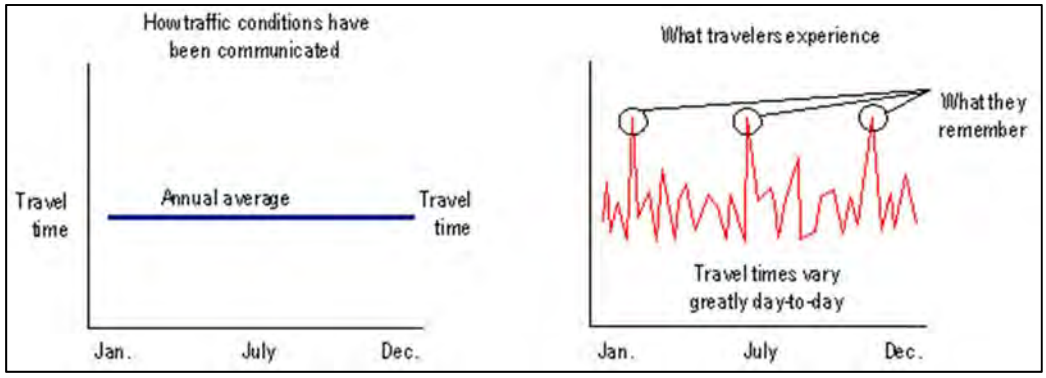
Figure 2-30: Access Points and Spacing



Travel Time Reliability

Travel time reliability is a measure of consistency to indicate day-to-day travel times on a given roadway. Most travelers are less tolerant of unexpected delays because they cannot be incorporated into planned travel time, resulting in late arrivals; alternatively budgeting twice as long as needed for a trip also can result in wasted time. For these reasons, travel time reliability has become a major focus of FHWA, which has supported the development of a "Reliability Module" through their Strategic Highway Research Program to estimate travel time reliability. This tool incorporates lane capacity and geometry, speeds, average daily traffic and the presence of incident management systems and heavy truck traffic. Based on this tool, the travel time index is one throughout the entire corridor, indicating minimal variability in travel time under existing conditions.

Figure 2-31: Average Travel Time Measurement versus Actual Traveler Experience



Source: FHWA's Operations Benefit/Cost Analysis Desk Reference

Summary of Existing Conditions

OVERREPRESENTED CRASH LOCATIONS

There were five locations in the study area that are overrepresented, indicating there is a high probability that conditions at the site could be contributing to the higher crash rate.

- **I-29 Mainline between Gateway Drive/US 2 and DeMers Avenue/ND 297**. This one-mile section of I-29 experienced 28 crashes over five years, with 14 being due to weather or winter roadway conditions. However, three occurred when a vehicle tried to merge onto southbound I-29.
- **The DeMers Avenue/ND 297 and East Ramps intersection.** There were 14 total crashes at this intersection, of which five were northbound rear-end crashes. Often times, at locations with a yield controlled right-turn, motorists look upstream for gaps in traffic and not forward, and then collide with vehicles ahead.
- **The DeMers Avenue/ND 297 and 42nd Street intersection.** There were 28 left-turn crashes at this intersection. Special events at the Alerus Center and train events may result in long queues and delays. As motorists become frustrated, they become more likely to take risks to avoid these long delays.
- **The 32nd Avenue/US 81B and West Ramps intersection.** Seven crashes occurred at this intersection when a driver ran a red light. Adjustments to clearance intervals may mitigate this trend.
- **The 32nd Avenue/US 81B and 38th Street intersection.** There were 42 total crashes at 38th Street, of which 14 were left-turn crashes. Negative offset turn lanes may obstruct views of conflicting traffic. Six additional crashes were caused by drivers running red lights. Finally, this intersection experienced 15 rear-end crashes that may be linked to stop-and-go traffic. Improved operations at this intersection can mitigate most of these crash trends.

LIGHTING

Currently, roadway lighting on I-29 is limited to the interchanges. Based on updated (May, 2015) NDDOT lighting warrants, continuous interstate lighting between 32nd Avenue/US 81B and Gateway Drive/US 2 is warranted based on three successive interchanges located with an average spacing of 1.5 miles or less.

TRAFFIC OPERATIONS

Under existing conditions, all study intersections and mainline I-29 links operate at LOS "C" or better, which is acceptable according to both GF-EGF MPO standards and NDDOT standards.

MULTIMODAL

The following barriers were noted for the existing network of paved bicycle and pedestrian trails in the study area:

- No existing dedicated bicycle or pedestrian facilities at the North Washington Street/CR 11/US 81 interchange functional area, the 47th Avenue South corridor or the Merrifield Road/CR 6 corridor. Bicycles can and do use the roadway; shoulders at this location are wide enough to support bicycle activity according to AASHTO.
- Yield controlled right-turns, like at Gateway Drive/US 2 and DeMers Avenue/ND 297 are difficult crossing environments for bicyclists and pedestrians.
- There is limited transit accessibility in the study area.
- Dedicated facilities for east-west connectivity across I-29 is limited to Gateway Drive/US 2, University Avenue and 32nd Avenue/US 81B.

INFRASTRUCTURE CONDITIONS

Currently, all sections of I-29 are in "Good" or "Excellent" condition. There are no functionally obsolete or structurally deficient bridges in the study area. However, the University Avenue overpass has a sufficiency rating of 78.4, which may make it eligible for Federal bridge rehabilitation funding.

RAILROAD CONFLICTS

The Grand Forks Subdivision and Glasston Subdivision have frequent train events that often negatively impact operations within the interchange functional areas at Gateway Drive/US 2 and DeMers Avenue/ND 297. These issues are being studied in the Glasston Subdivision Railroad Crossings Mitigation Study; results from that study will be incorporated into this study. Further, the railroad limits design alternatives at DeMers Avenue/ND 297 and North Washington Street/CR 11/US 81.

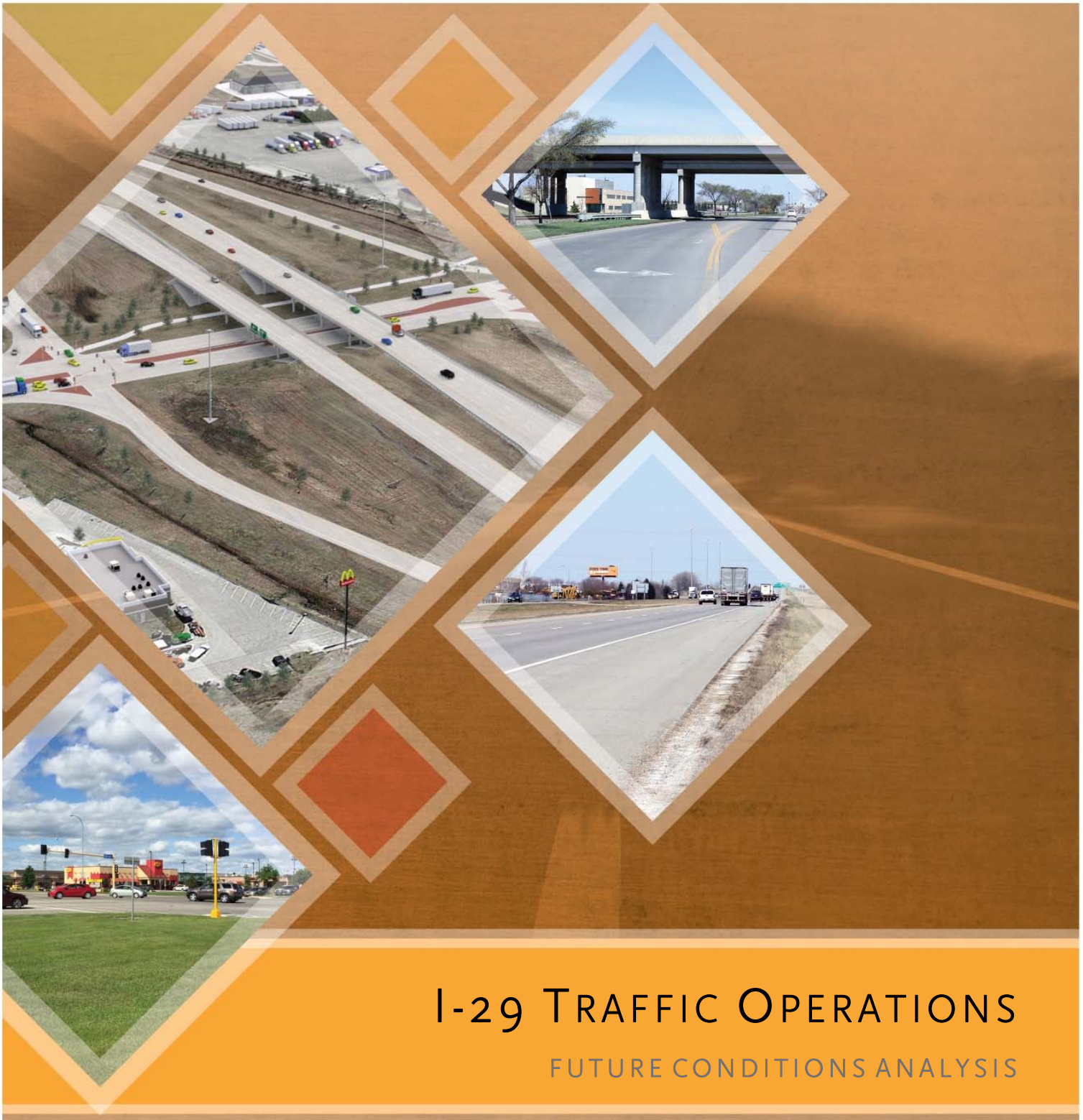
INTERCHANGE FUNCTIONAL AREA ACCESS CONTROL

Three interchanges have access spacing concerns:

- North Washington Street/CR 11/US 81. In less than 1.25 miles, there are eight access points. Merging or realigning these access points may provide improved operations and safety.
- Gateway Drive/US 2. Within this interchange functional area, there are four signalized intersections (and one two-way stop controlled intersection) in 0.40 miles. Access control at 43rd Street will reduce left-turning conflict.
- DeMers Avenue/ND 297. The Cenex driveway introduces additional conflicts and mixed speeds. The prioritized alternative from the 42nd Street Grade Separation Project will likely impact this access point, either converting to a RIRO or relocating.

TRAVEL TIME RELIABILITY

Analysis completed using the FHWA sponsored "Reliability Module" found minimal variability in travel time on I-29.



I-29 Traffic Operations

Future Conditions Analysis

ALLIANT ENGINEERING

KLJ

3. FUTURE CONDITIONS ANALYSIS

This chapter presents analysis that identified issues along the interstate system and through the interchange functional areas through 2040. This chapter first analyzed potential future traffic scenarios to develop a refined forecast through 2040 and then used the refined forecasts to project future operations within the study area.

Future Traffic Scenarios

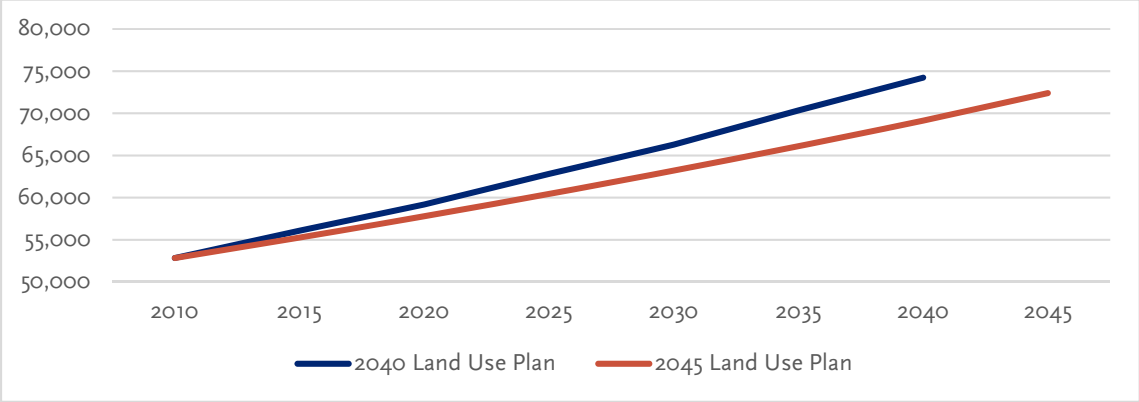
Many factors impact traffic growth; these include, but are not limited to land use, regional traffic growth, travel demand management (defined later), funding and improvement of parallel routes.

Land Use

The City of Grand Forks and the Grand Forks – East Grand Forks Metropolitan Planning Organization (MPO) recently updated the Grand Forks Land Use Plan. This plan guides how the city manages growth and development through 2045. At the time of this writing, the December 1st, 2015 revision to the Land Use Plan – Task #2 Growth Tiers Technical Memorandum was the most recent information available. On balance, there are no major changes from the 2040 Land Use Plan to the 2045 Land Use Plan:

- **Population Projections.** As part of the 2045 Land Use Plan, population projections were updated using a 0.9 percent annual growth rate, for a projected 2045 population of 72,402. This estimate is just slightly lower than the population projection used in the 2040 Land Use Plan, which projected a 2040 population of 74,234, based on a 1.2 percent annual growth rate. This is shown in Figure 3-1.

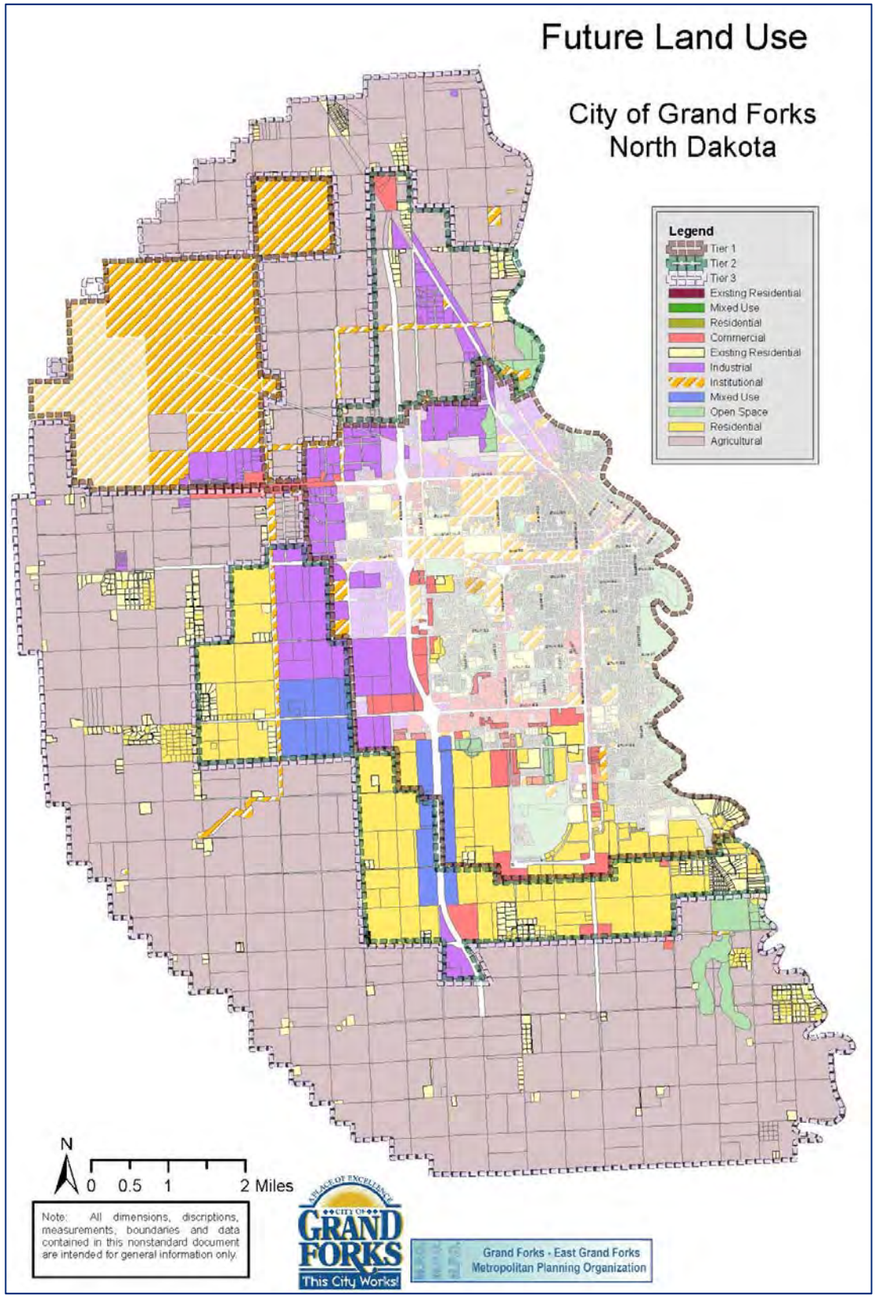
Figure 3-1: Population Projections from 2040 and 2045 Land Use Plans



- **Future Land Use.** There were minimal changes to the 2045 future land use map, when compared to the 2040 future land use map. Most notably is new Mixed-Use land uses south of DeMers Avenue/ND 297 and new Urban Residential uses west and south of the 32nd Avenue/ US 81B interchange. The 2040 and 2045 future land use plans can be seen in Figure 3-2 below. The asterisks included in the 2045 Future Land Use map denotes residential development that will only occur when no other land is available for residential development.

With few changes, revising the socioeconomic data used in the 2040 LRTP Travel Demand Model (TDM) would be a costly and time consuming effort that would not likely yield notable changes. Employment and household growth included in the 2040 TDM is shown in Figure 3-3. As such, the 2040 TDM was used as the foundation for future traffic projections. Traffic forecasts at DeMers Avenue/ND 297 will be evaluated closely to determine if the proposed new Urban Residential and Mixed-Use land use, west of I-29, will create any new operational deficiencies.

Figure 3-2: 2040 (Left) and 2045 (Right) Future Land Use Plans



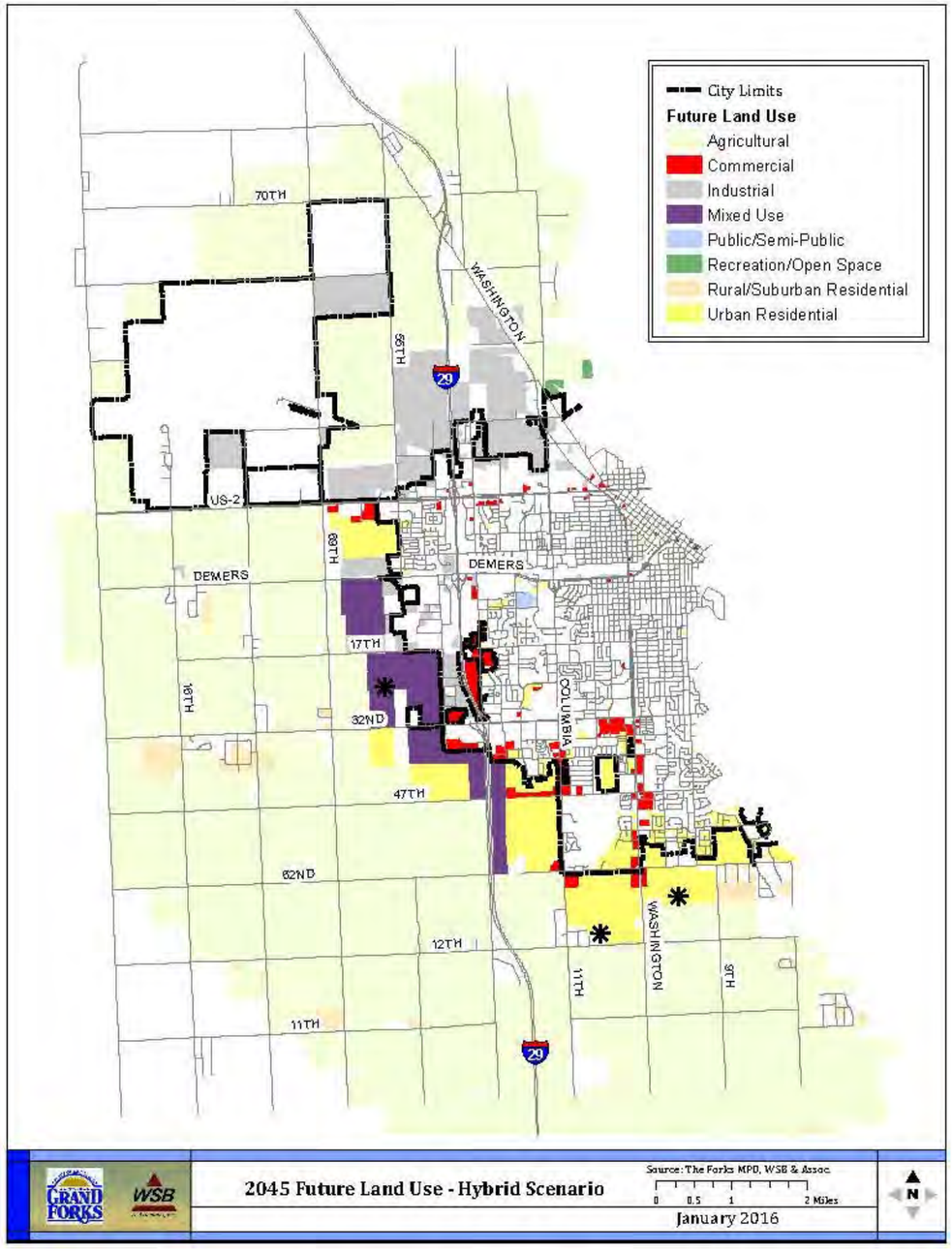
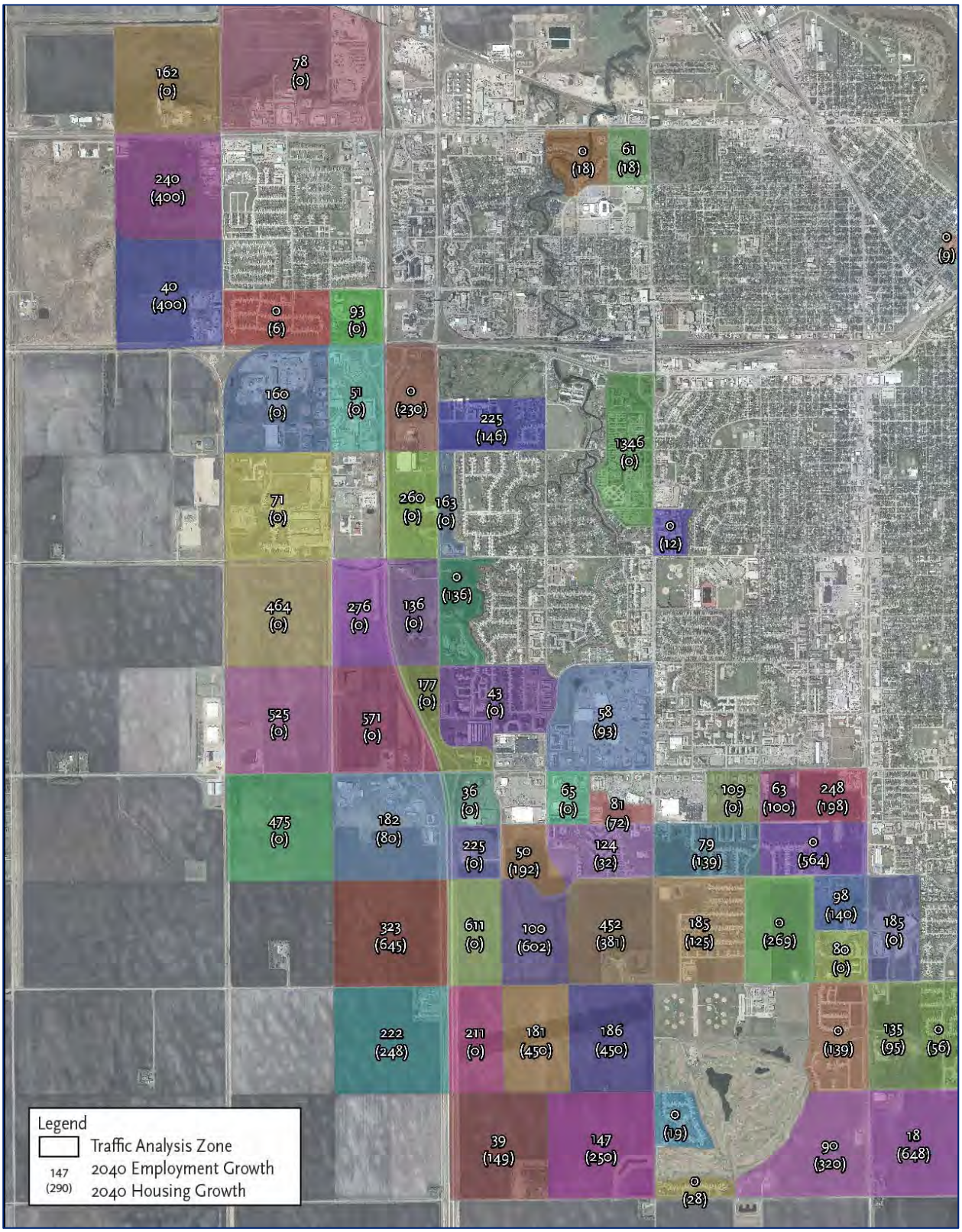


Figure 3-3: Employment and Housing Growth included in 2040 Travel Demand Model



Regional Traffic Growth

Travel demand models (TDM) often under- or over-produce forecasts on the fringes of a metropolitan area due to the uncertainty of traffic volumes to-and-from external nodes. A review of assumptions on the external nodes of I-29 indicates that a two to 2.5 percent annual growth rate was used for 2025 and 2040 TDM inputs. Based on a review of historic traffic volumes, this is a slight under-production when evaluating traffic growth over the past 20 years but a dramatic over-production when compared to trends the past five to 10 years. This is not surprising as vehicle miles travelled per capita has steadily declined in recent years across the nation. Providing an accurate growth rate on the external node of the TDM can change forecasts along I-29, a primarily regional corridor, by several thousand vehicles a day. According to 2015 NDDOT ADT counts, the south node experienced 12,515 vehicles per day and the north node 10,120 vehicles per day. Three regional traffic growth scenarios were prepared by the Advanced Traffic Analysis Center (ATAC) at North Dakota State University (NDSU).

HIGH GROWTH ON EXTERNAL NODES

Analyzing historic growth rates over the past 20 years for several miles north and south of Grand Forks, a 2.5 percent growth rate appeared appropriate; carrying this growth rate to 2040 produced the following inputs:

- 2040 Southern I-29 External Node: 23,100 ADT
- 2040 Northern I-29 External Node: 19,090 ADT

Results

This scenario is negligibly different from the 2040 LRTP TDM outputs in both rural and urban sections of I-29; it results in ADTs sometimes two or three times the 2013 or 2015 counts.

MEDIUM GROWTH ON EXTERNAL NODES

Analyzing historic growth rates over the past 10 years for several miles north and south of Grand Forks, a 1.25 percent growth rate appeared appropriate; carrying this growth rate to 2040 produced the following inputs:

- 2040 Southern I-29 External Node: 17,040 ADT
- 2040 Northern I-29 External Node: 14,100 ADT

Results

The 2040 LRTP TDM outputs are most notably different in rural sections of I-29. North of Gateway Drive/US 2, and south of 32nd Avenue/US 81B, ADTs are nearly 30 percent lower. Along the urban sections of I-29, this scenario results in ADTs between 14 and 20 percent lower than the 2040 LRTP TDM outputs.

LOW GROWTH ON EXTERNAL NODES

Analyzing historic growth rates over the past five years for several miles north and south of Grand Forks showed a wide range of growth rates, all of which were negative, as shown in Table 3-1.

Table 3-1: Average Annual Growth Rates for Selected Locations North and South of Grand Forks

North of Grand Forks	Average Annual Growth Rate	South of Grand Forks	Average Annual Growth Rate
16 Miles North	-2.04%	8 Miles South*	-0.15%
23 Miles North	-3.15%	15 Miles South	-1.18%
31 Miles North	-2.22%	27 Miles South	-3.40%

*2010 ADT not available at this location, used 2008 ADTs.

Understanding the ebbs and flows of traffic growth, a 0.50 percent growth rate was conservatively assumed for this scenario. Carrying this growth rate to 2040 produced the following volume inputs:

- 2040 Southern I-29 External Node: 14,120 ADT
- 2040 Northern I-29 External Node: 11,730 ADT

Results

North of Gateway Drive/US 2, this scenario produces ADTs 32 to 40 percent lower than the 2040 LRTP TDM and just 10 to 25 percent higher than 2015 traffic counts. South of 32nd Avenue/US 81B, this scenario results in interstate ADTs 40 percent lower than the LRTP TDM outputs and just 11 percent higher than 2015 counts. In the urban sections of I-29, this scenario resulted in outputs between 19 and 22 percent lower than the LRTP TDM outputs, but still resulted in projected ADTs 42 to 45 percent higher than 2015 counts.

SUMMARY OF REGIONAL TRAFFIC GROWTH SCENARIOS

As noted earlier, the LRTP forecasts are very similar to the High Growth Scenario, projecting growth not seen on the interstate in over a decade. After a review of traffic volumes, the Study Team felt the Medium Growth Scenario produced outputs that more accurately reflect recent traffic growth trends over the past 10 years while balancing the need to provide slightly conservative projections to account for unforeseen growth. The Medium Growth Scenario reduces projected ADTs when compared to the 2040 LRTP projected ADTs:

- North of Gateway Drive: 28 percent
- Gateway Drive/US 2 to 32nd Avenue/US 81B: 14 to 20 percent
- South of 32nd Avenue/US 81 B: 28 percent

It provides ample annual growth for rural and urban segments of I-29:

- North of Gateway Drive/US 2: 5.4 to 6.2 percent
- Gateway Drive/US 2 to 32nd Avenue/US 81B: 7.5 percent
- South of 32nd Avenue/US 81B: 5.4 percent

However, the Study Review Committee determined that no changes should be made to regional traffic growth. This would result in the highest traffic growth on the interstate and provide a universe of alternatives appropriate for that scenario, allowing for a more thorough accounting of future interstate needs.

A summary of the regional traffic growth scenario outputs is shown in Figure 3-4.

Figure 3-4: Summary of Regional Traffic Growth Scenarios

Local Traffic Growth

Two major factors contribute to a metro area's reliance on the interstate system for local trips: availability and operations of parallel arterials and reliance on the automobile. Two additional scenarios were analyzed to determine their effect on the transportation network.

TRAVEL DEMAND MANAGEMENT

Travel demand management is an action or set of actions aimed at influencing people's travel behavior in such a way that increase the use of alternative mobility options to reduce traffic congestion. Typical strategies of this nature include implementing high density land use policies conducive to transit use, encouraging alternatives to single occupancy vehicles (i.e. carpools, vanpools, transit, bicycles etc.) and implementing alternative work hour programs such as flex-time, compressed work weeks and telecommuting.

As evidenced by UND's Climate Action Plan, the Green Grand Forks Action Plan and 2045 Land Use Plan, there is a clear focus on alternative modes of transportation and reducing vehicle emissions. According to a Transportation Research Board (TRB) study, a vehicle trip reduction of up to five percent is possible through the implementation of a system wide transit and travel demand management program (TDMP).

Using this information, a five percent reduction on trip generation rates was applied to the 2040 TDM outputs to determine the implications of a very aggressive and effective TDMP on the interstate. While the details of such a plan are outside the scope of this project, this generally involves increased availability to alternative modes of transportation (biking, walking and bus) in the city's urban core and an increased flex-time, telecommuting and ridesharing program for motorists traveling long distances from outside the study area to work in Grand Forks.

Results

This scenario does show minor changes, an eight to 14 percent reduction to the overall traffic on the network, but unlikely to the extent that will dramatically change any sort of capacity needs. As noted above, a five percent reduction is resultant from a very aggressive travel demand management approach. The Study Team felt like this information would be valuable to MPO, city and state staff toward understanding the potential benefits of such a program. However, without any indication that funding will be directed toward implementing such a program in the foreseeable future, the Study Team felt that utilizing this reduction factor applied wholesale induced too much risk. Based upon 2010-2014 ACS five year estimates, around 5.16 percent of people in the Grand Forks metro take public transportation or walk to work so it may be appropriate to reduce work trips by some factor. The Steering Committee decided not to carry this scenario forward into the 2040 refined projections.

INCREASED FUNDING SCENARIO

The major challenge facing the Grand Forks transportation system is funding. Currently, the City of Grand Forks and NDDOT have over $150 million worth of unfunded, illustrative projects in their LRTP. These projects would have a dramatic effect of the transportation system's efficiency. The current LRTP included minimal capacity improvements. Without capacity improvements, reliance on I-29 will increase as this corridor will continue to be maintained at efficient levels.

Funding environments and philosophies often change, particularly within the scope of a 25-year planning horizon. The original I-29 Corridor Study scope included a reduced funding scenario. However, due to the lack of capacity projects to eliminate, there was not much to remove that could be reflected in a high-level TDM model run. Instead, a higher funding growth scenario analysis was pursued.

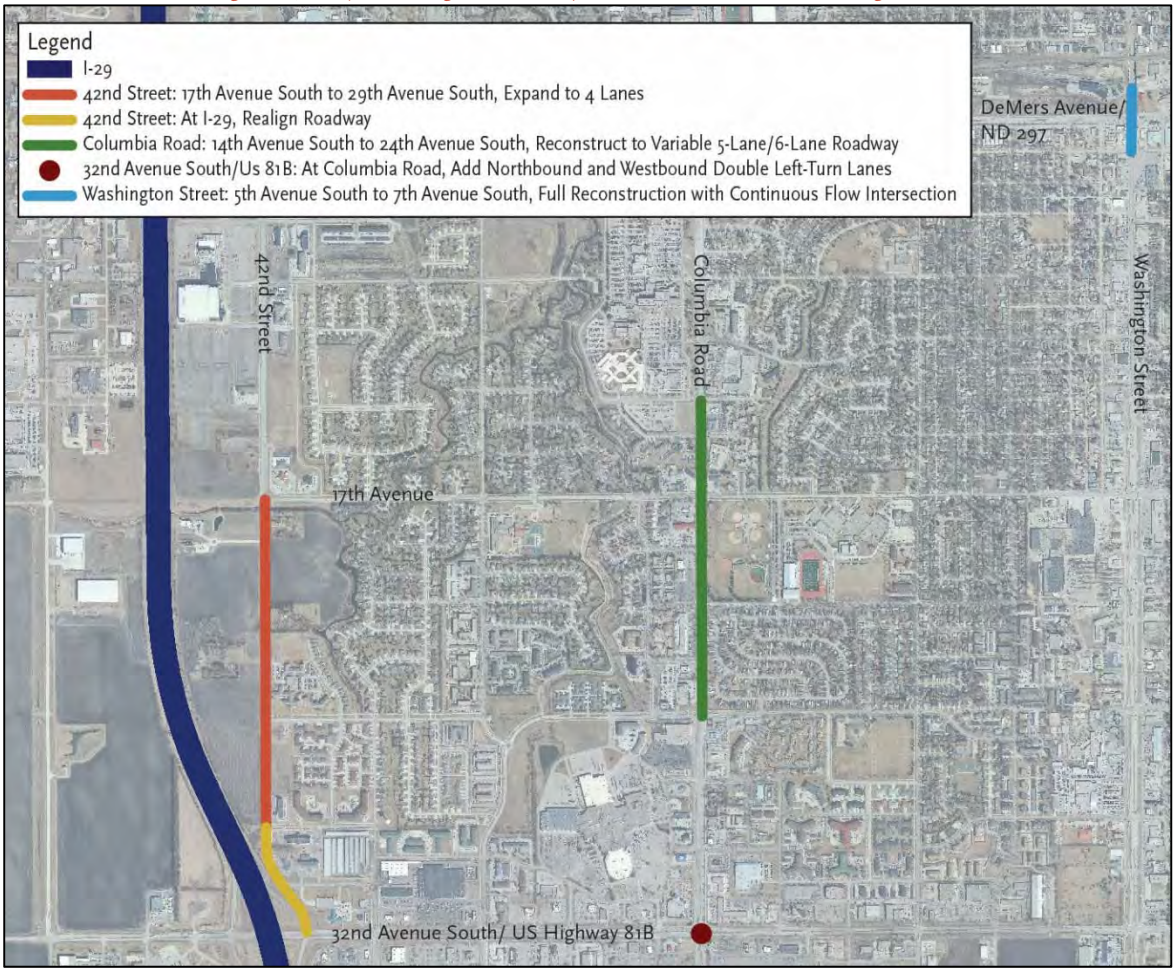
This analysis allows NDDOT, City and MPO stakeholders to understand the benefits to I-29 if further investment is pursed on the local system. This allows for more informed decisions regarding whether certain I-29 improvements are needed. For example, could widening 42nd Street eliminate the need to widen I-29 in the future and provide dual benefit of improving local capacity and keeping local trips off the regional I-29 corridor?

This scenario assumes select capacity-specific projects would be built by 2040 (Figure 3-5 and Table 3-2). The projects below were improvements on parallel north-south arterials detailed in the LRTP as illustrative Projects of Significance. Improvements parallel to I-29 have the greatest potential benefit to traffic reduction on I-29.

Table 3-2: Projects of Significance Implemented in Increased Funding Scenario

Roadway	Termini	Project Scope	Cost (2013)	Modelling Approach
42nd Street	▪ 17th Ave ▪ 29th Ave	Expand to four lanes.	$5,947,000	Increase capacity to four lanes on 42nd Street.
42nd Street	▪ At I-29	Realign roadway to meet the northbound off-ramp intersection. Realigned roadway would have four lanes of capacity.	$8,857,000	Add link in model.
Columbia Road	▪ 14th Ave S ▪ 24th Ave S	Reconstruct to variable five-lane to six-lane roadway, replacement of signing, signals, lights, construction of shared-use path and replacement of sidewalks.	$12,750,000	Increase capacity to six lanes.
32nd Avenue /US 81B	▪ At Columbia Road	Add northbound and westbound dual left-turn lanes.	$152,000	Reduce intersection delay penalty in model.
Washington Street	▪ 5th Ave S ▪ 7th Ave S	Full pavement reconstruction with continuous flow intersection (CFI) at DeMers Avenue/ND 297.	$11,716,000	Minimize intersection delay penalty in model.

Figure 3-5: Projects of Significance implemented in Increased Funding Scenario



Another project that would have benefits toward reducing local trips on I-29 is the 42nd Street railroad grade separation project. This project is not recommended in the table above because rail delay penalties are not incorporated into the travel demand model. Developing a rail delay penalty is beyond the scope of the I-29 Corridor Study. It should be noted however that when a model is calibrated, manual traffic adjustments are made to the model to reflect current patterns. Thus, rerouting caused by rail delays may have been manually factored in this fashion during the modelling process.

Results

Upon detailed inspection, it became clear that the improvements highlighted in Table 3-2 did not reduce demand onto I-29. A few locations actually incurred a slight increase in traffic demand as patterns were changed network-wide. While this is unlikely to occur, this does highlight the fact that the location of I-29 on the west periphery of Grand Forks results in few pattern changes when improvements are made to the urban core of Grand Forks. This does not necessarily mean that these improvements do not have significant value to the City of Grand Forks, instead that the benefits do not reduce traffic volumes on the interstate. This, combined with the fact that increased funding is marred with uncertainty, the Study Team recommended not including these improvements in the 2040 models.

SUMMARY OF LOCAL TRAFFIC GROWTH SCENARIOS

Neither of the Local Traffic Growth Scenarios appear to result in refinements that improve the model outputs; the Steering Committee elected to discard both scenarios. A summary of the local traffic growth scenario outputs is shown in Figure 3-6.

Summary of Traffic Growth Refinements

Below is a brief summary of the traffic growth scenario analysis:

- External Growth: Upon review of the model, it appears the external growth assumptions project growth well beyond trends seen over the past decade. A reduced growth rate on the external node is recommended for consideration. This reduces traffic volumes between 3,200 and 6,300 vehicles on I-29 from North Washington Street/CR 11/US 81 to 32nd Avenue/US 81B and nearly 6,700 vehicles south of 32nd Avenue/US 81B.
- Travel Demand Management: This scenario does show minor adjustments to the overall traffic, but it is unlikely to dramatically change any sort of capacity needs. Applied wholesale, this traffic volume reduction is likely too aggressive.
- Increased Funding Scenario: Inspection of the model made it clear that the key improvements outlined in the LRTP to parallel corridors in Grand Forks did not reduce demand on I-29. Due to its location on the western edge of Grand Forks, few pattern changes result when improvements are made to the urban core. Certainly, these improvements are of significant value to the City of Grand Forks, but they do not permeate to the interstate. Thus, this scenario was not included in the 2040 TDM. This output is valuable when considering the necessity for improvements on I-29 versus adjacent corridors.

Figure 3-6: Summary of Local Traffic Growth Scenarios

LRTP Travel Demand Model Refinement

Based on Steering Committee feedback, the LRTP TDM was used for 2025 and 2040 traffic operations analysis; none of the scenarios detailed above (High Growth, Medium Growth, Low Growth, Travel Demand Management and Increased Funding scenarios) were included in these refinements. A variety of refinements were made to the 2025 and 2040 LRTP TDM outputs to address growth and routing assumptions that have changed since the model was developed in 2010. The most significant are included below:

- **Updated Signal Timing:** Outdated signal timing was incorporated into the 2025 and 2040 TDM resulting in counterintuitive routing. For example, by 2040 the TDM projected the northbound off-ramp at Gateway Drive/US 2 to have volumes around 10,980 but the southbound on-ramps at Gateway Drive/US 2 had volumes around 5,460. Routing behavior is generally circular, meaning the majority of drivers take the same or similar route to work as they would from work. Thus, these two volumes should be approximately equal. Updated signal timing was incorporated, resulting in more intuitive volumes with 9,145 on the northbound off-ramp and 8,080 for the southbound on-ramps.
- **Increased Growth at DeMers Avenue/ND 297 and 42nd Street:** 2040 TDM outputs resulted in negative growth rates, based on 2015 collected ADTs. Since 2010, new student housing has been constructed, not included in 2010 TAZ data. To account for new development, growth included in the TDM from 2010 to 2040 was added to the 2015 collected ADTs, resulting in a positive growth rate around five percent per year. While high, this was considered acceptable given the strong growth potential surrounding this intersection.
- **Access to 32nd Avenue/US 81B**: West of the interchange, significant growth is expected south of 32nd Avenue/US 81B. As the model network is currently defined, this growth is routed along the future 48th Street (Figure 3-7). The major roadway network will need to be in place before development in this area can occur. However, using current travel patterns and depending on development timing and location, it was assumed two-thirds of new traffic would use 42nd Street to access 32nd Avenue/US 81B.

Figure 3-7: Projected 2040 ADTs from Unrefined LRTP TDM

ADTs based on the refined LRTP TDM for 2015, 2025 and 2040 can be seen in Figure 3-8. Projected turning movements for 2025 and 2040 A.M. and P.M. peak hours can be found in Figure 3-9 and Figure 3-10, respectively.

Figure 3-8: Refined 2015, 2025 and 2040 ADTs

Figure 3-9: 2025 A.M. and P.M. Peak Hour Turning Movements from Refined LRTP Volumes

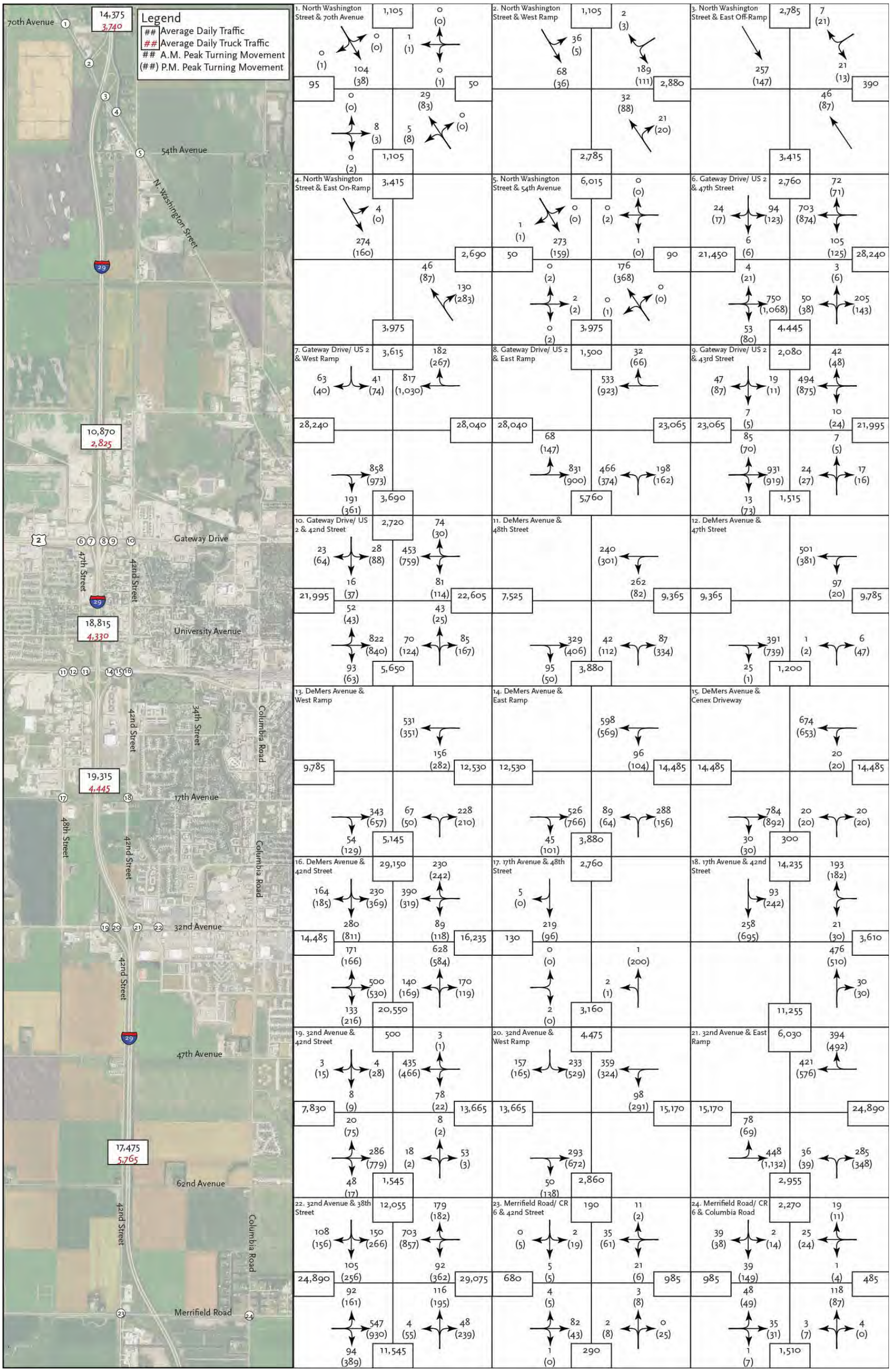
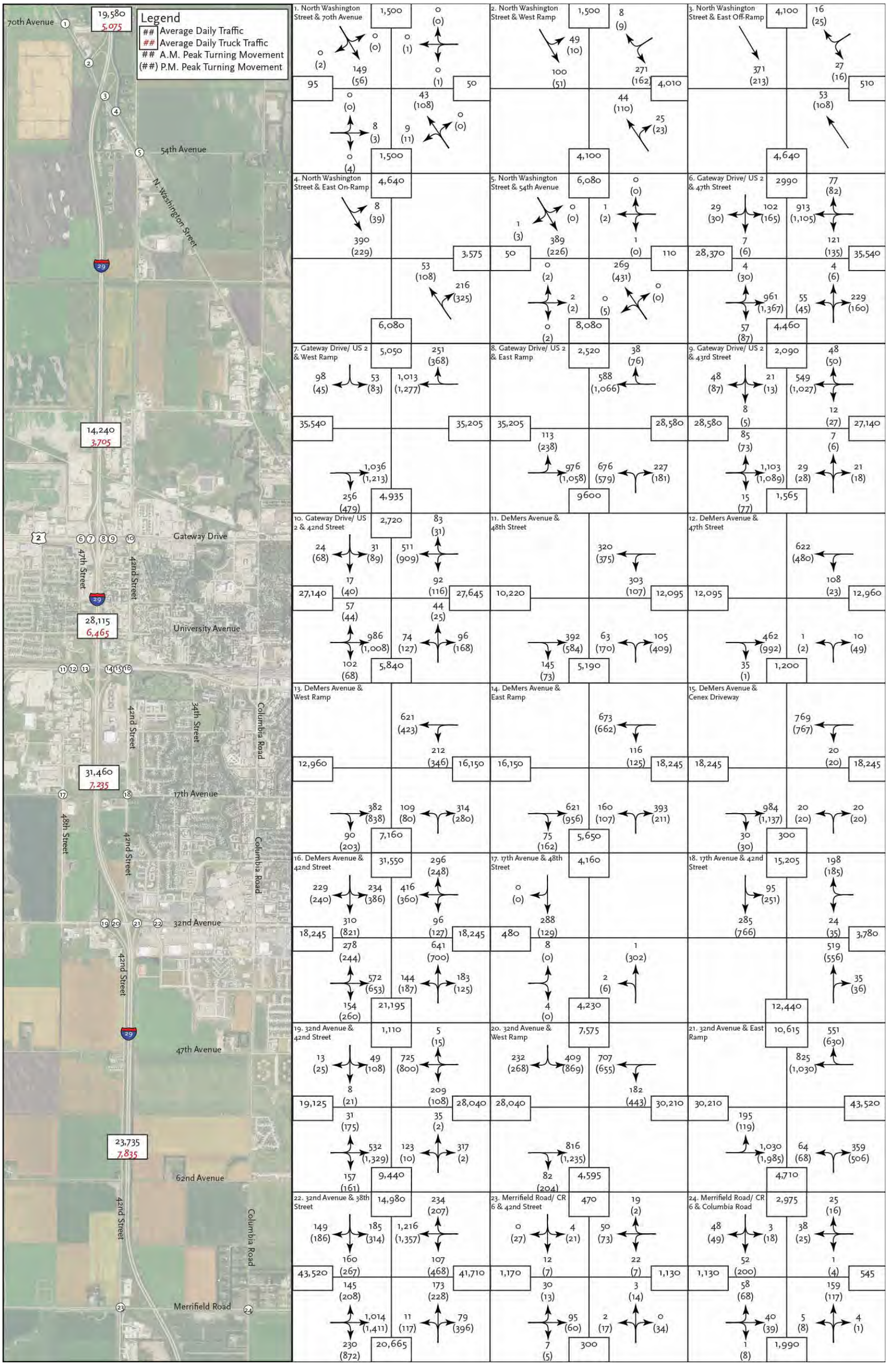


Figure 3-10: 2040 A.M. and P.M. Peak Hour Turning Movements from Refined LRTP Volumes



Traffic Operations

Two models were used to evaluate traffic operations in the study area. The first used Synchro software, which applies equations published in the Highway Capacity Manual (HCM). HCM is an industry and NDDOT standard. This model was used for the corridor periphery including the North Washington Street/CR 11/US 81 interchange and the Merrifield Road/CR 6 overpass. Where merging, diverging, weaving and queueing complications may exist, a more rigorous model was developed using Vissim software. Vissim simulates the movement of every vehicle through an intersection and then collects information for associated performance measures like delay, queue lengths, travel times and density. Because the Vissim models require substantially more effort to develop and calibrate, this model was used only for urban I-29, which includes the interchange functional areas from Gateway Drive/US 2 to 47th Avenue South, where queueing impacts, weaving, merging and diverging would be most prevalent. This microsimulation model was calibrated to queue length data, traffic volumes and speed.

Traffic operations analyses in this report are based on the 2040 Refined LRTP TDM outputs.

Signal Warrant Analysis

The *Manual on Uniform Traffic Control Devices* (MUTCD) provides guidance and standards on the installation of traffic control methods, including warrants for the installation of traffic control signals. The most relevant warrants include:

- Eight-Hour Vehicular Volume Warrant
- Four-Hour Vehicular Volume Warrant
- Crash Experience Warrant

Currently, as traffic patterns exist today, the only additional intersections included in this study area that meet traffic control warrants are the DeMers Avenue/ND 297 East Ramp and West Ramp intersections. Furthermore, the ramps only meet warrants if right turns are included, which is the dominant movement for the minor approach at both intersections. Given the deficient operations present at the ramp intersection without traffic control signals in 2025 and 2040, right-turning traffic was accounted for and traffic control signals were included in future traffic operations analysis.

While current traffic volumes or patterns do not meet traffic control signal warrants, as development occurs west of the interstate, the following two intersections should be re-evaluated to determine when/if they meet traffic control signal warrants:

- DeMers Avenue/ND 297 and 48th Street. Serving the industrial park, and with connectivity to 32nd Avenue/US 81B, this intersection will likely absorb a lot of the future anticipated growth. This intersection is expected to meet traffic control signal warrants by 2025 if right turns are included. If 2040 projections are met, it is likely this intersection will meet traffic control signal warrants by 2040, without right turns.
- 32nd Avenue/US 81B and 42nd Street west frontage road. As currently built, and dependent on the timing of future expected development, it is likely this intersection will attract many trips from the new residential and commercial developments. However, based on current traffic patterns, there is very little traffic outside the A.M. peak hour. While the daily distribution will likely change with new development into the future, without more information on development characteristics, it is too uncertain to say whether this intersection will meet warrants in the future.

A more detailed review of traffic control and geometric analysis was completed during the alternative analysis phase of this project.

Measures of Effectiveness

LEVEL OF SERVICE

Capacity analysis was evaluated for intersections in the interchange functional area in terms of delay and level of service (LOS). LOS is a term used to describe the operational performance of transportation infrastructure elements; essentially, LOS is a grade value that corresponds to specific traffic characteristics within a given system, as shown in Table 3-3. NDDOT updated the Traffic Operations Manual in January 2017 to accept LOS "D". The GF-EGF MPO accepts LOS "D" as the

minimum acceptable value, but strives for LOS "C". For the purposes of this study, LOS "D" is considered acceptable where other alternatives were not feasible or cost-effective.

Capacity analysis was also evaluated for mainline I-29 as it intersects with the on- and off-ramps at the various interchanges. Different interchange configurations result in different mainline operations; operations were studied at the 500-foot section upstream of off-ramps and the 500-foot section downstream of on-ramps. The HCM reports freeway operations as density (passenger cars per lane mile).

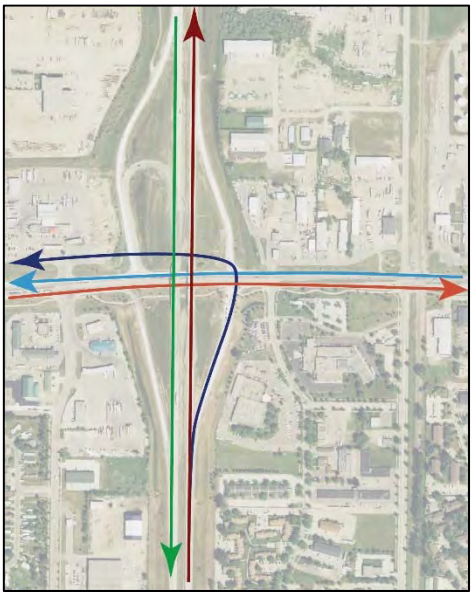
Table 3-3: HCM Level of Service for Intersections and Freeway Facilities

Level of Service	Control Delay (sec/veh)		Density (pc/lm*)
	Unsignalized	Signalized	
A	≤ 10	≤ 10	≤ 11
B	10 – 15	10 – 20	11 – 18
C	15 – 25	20 – 35	18 – 26
D	25 – 35	35 – 55	26 – 35
E	35 – 50	55 – 80	35 – 45
F	> 50	> 80	> 45

*Passenger cars per lane mile

Because the City of Grand Forks routinely updates signal timing plans, signal timing within the models for the calibrated existing models were optimized to get a realistic understanding of actual capacity problems, not signal timing deficiencies.

Figure 3-11: Travel Times Collected for the Gateway Drive/ US 2 Interchange Functional Area



TRAVEL TIME AND CUMULATIVE DELAY

LOS is designed to replicate motorist frustration. Looking at each intersection or merge area in isolation ignores the fact a congested area like Gateway Drive/US 2 with four signals in less than one-half mile forces motorists to stop frequently. This cumulative delay results in increased motorist frustration. Furthermore, the closely spaced nature of traffic control signals common around interchanges often times results in motorists queued at upstream locations, which limits the overall traffic volume and delay occurring at each intersection. Figure 3-11 shows travel time routes collected for A.M. and P.M. peak hours through the Gateway Drive/US 2 interchange functional area. The following measures of effectiveness (MOE) were also collected in the urban areas using the Vissim simulation model:

- Average travel time for the highest volume movement off-of or on-to the interstate through the study area.
- Average travel time for the highest volume movement through the study area on the cross street.

2015 Traffic Operations

LEVEL OF SERVICE

After model calibration, the 2015 traffic operations were updated based on field-collected data. Refer to Figure 3-14 for detailed results of traffic operations analysis; a summary is provided below.

- All intersections in the North Washington Street/CR 11/US 81 functional area are LOS "A" during both A.M. and P.M. peak hours. All approaches are LOS "B" or better during the A.M. and P.M. peak hours.
- All intersections in the Gateway Drive/US 2 interchange functional area are LOS "B" or better during both A.M. and P.M. peak hours. The southbound approach at the West Ramp intersection, during the P.M. peak, falls to LOS "D".

- During the A.M. peak hour, all intersections in the DeMers Avenue/ND 297 interchange functional area are LOS "B" or better. However, during the P.M. peak hour, the DeMers Avenue/ND 297 and 48th Street intersection and the DeMers Avenue/ND 297 and 42nd Street intersection falls to LOS "C". Two approaches during the P.M. peak fall deficient, the northbound approach at the 48th Street intersection and the northbound approach at the West Ramp intersection to LOS "F" and "E" respectively.
- The two study intersections at 17th Avenue South operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are at LOS "B" or better during both peak hours.
- At the 32nd Avenue/US 81B interchange functional area, all intersections are LOS "B" or better during the A.M. peak and LOS "C" or better during the P.M. peak. At the West Ramp intersection, the westbound approach operates at LOS "D" during the P.M. peak. The southbound approach at the 38th Street intersection, operates at LOS "E" during the P.M. peak.
- The two study intersections at Merrifield Road/CR 6 operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are LOS "B" or better during both peak hours.

Figure 3-12: Queued Vehicles at 32nd Avenue/US 81B

TRAVEL TIME AND CUMULATIVE DELAY

Travel time runs for A.M. and P.M. peak were calculated for mainline I-29 in both directions, the major through movement on the cross road (Gateway Drive/US 2, DeMers Avenue/ND 297 and 32nd Avenue/US 81B) and the major ramp movement for that peak hour. Table 3-4 shows 2015 A.M. peak travel time and Table 3-5 shows 2015 P.M. peak travel times.

2015 A.M. Peak

- Mainline I-29 experienced very little travel time change from free flow to 2015 A.M. peak travel time, just 15 seconds greater for northbound traffic and 11 seconds greater for southbound traffic.
- The Gateway Drive/US 2 interchange experiences a 33 percent increase in travel time over free flow.
- Travel time during the A.M. peak for the DeMers Avenue/ND 297 interchange functional area is 28.8 percent or higher over free flow travel time.
- Travel time for eastbound traffic on 32nd Avenue/US 81B was just 18.8 percent higher than free flow. Travel time for Westbound 32nd Avenue/US 81B to Southbound I-29 was 38.7 percent higher than free flow travel time.

Table 3-4: 2015 A.M. Peak Travel Time

Travel Time Movement	Free Flow Travel Time	A.M. Peak 2015	Change (Seconds)	Change (Percentage)
I-29				
Southbound	283	294	11	3.9%
Northbound	283	298	15	5.3%
Gateway Drive/US 2				
Eastbound	117	156	39	33.3%
Northbound I-29 to Westbound Gateway Drive/US 2	89	119	30	33.7%
DeMers Avenue/ND 297				
Westbound	118	152	34	28.8%
Southbound I-29 to Eastbound DeMers Avenue/ND 297	136	183	47	34.6%
32nd Avenue/US 81B				
Eastbound	133	158	25	18.8%
Westbound 32nd Avenue/US 81B to Southbound I-29	62	86	24	38.7%

2015 P.M. Peak

- Mainline I-29 traffic experienced just over a four percent increase in travel time during the 2015 P.M. peak when compared to the free flow travel time.
- At the Gateway Drive/US 2 interchange, travel time was 43.6 percent higher for westbound traffic and 47.2 percent higher for northbound I-29 to westbound Gateway Drive/US 2 traffic.
- Travel time for westbound DeMers Avenue/ND 297 traffic was 40.7 percent higher, or 48 seconds. Westbound DeMers Avenue/ND 297 to southbound I-29 traffic experiences more than double the travel time when compared to free flow travel time, an extra 95 seconds.
- Eastbound 32nd Avenue/US 81B traffic experienced a 33.3 percent increase in travel time when compared to free flow travel time; southbound I-29 to eastbound 32nd Avenue/US 81B experienced just an 8.9 percent increase in travel time.

Table 3-5: 2015 P.M. Peak Travel Time

Travel Time Movement	Free Flow Travel Time	P.M. Peak 2015	Change (Seconds)	Change (Percentage)
I-29				
Southbound	283	295	12	4.2%
Northbound	283	297	14	4.9%
Gateway Drive/US 2				
Westbound	117	168	51	43.6%
Northbound I-29 to Westbound Gateway Drive/US 2	89	131	42	47.2%
DeMers Avenue/ND 297				
Westbound	118	166	48	40.7%
Westbound DeMers Avenue/ND 297 to Southbound I-29	94	189	95	101.1%
32nd Avenue/US 81B				
Eastbound	135	180	45	33.3%
Southbound I-29 to Eastbound 32nd Avenue/US 81B	180	196	16	8.9%

2015 INTERSTATE NETWORK PERFORMANCE

The overall interstate network has an average link density of 6.16 passenger cars per lane mile (pcplm) during the A.M. peak and 7.98 pcplm during the P.M. peak (Table 3-6). The average speed during both peak hours is around 70 miles per hour. Link densities were evaluated more closely at the 500-foot upstream and downstream sections of the three urban interchanges. Only the southbound upstream section at 32nd Avenue/US 81B was LOS "B" during the P.M. peak. All other sections were LOS "A", as can be seen in Figure 3-13.

Table 3-6: Overall 2015 Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
A.M. Peak	6.16 (A)	70.1
P.M. Peak	7.98 (A)	69.7

Figure 3-13: 2015 I-29 Densities for Upstream and Downstream Sections for Urban Interchanges

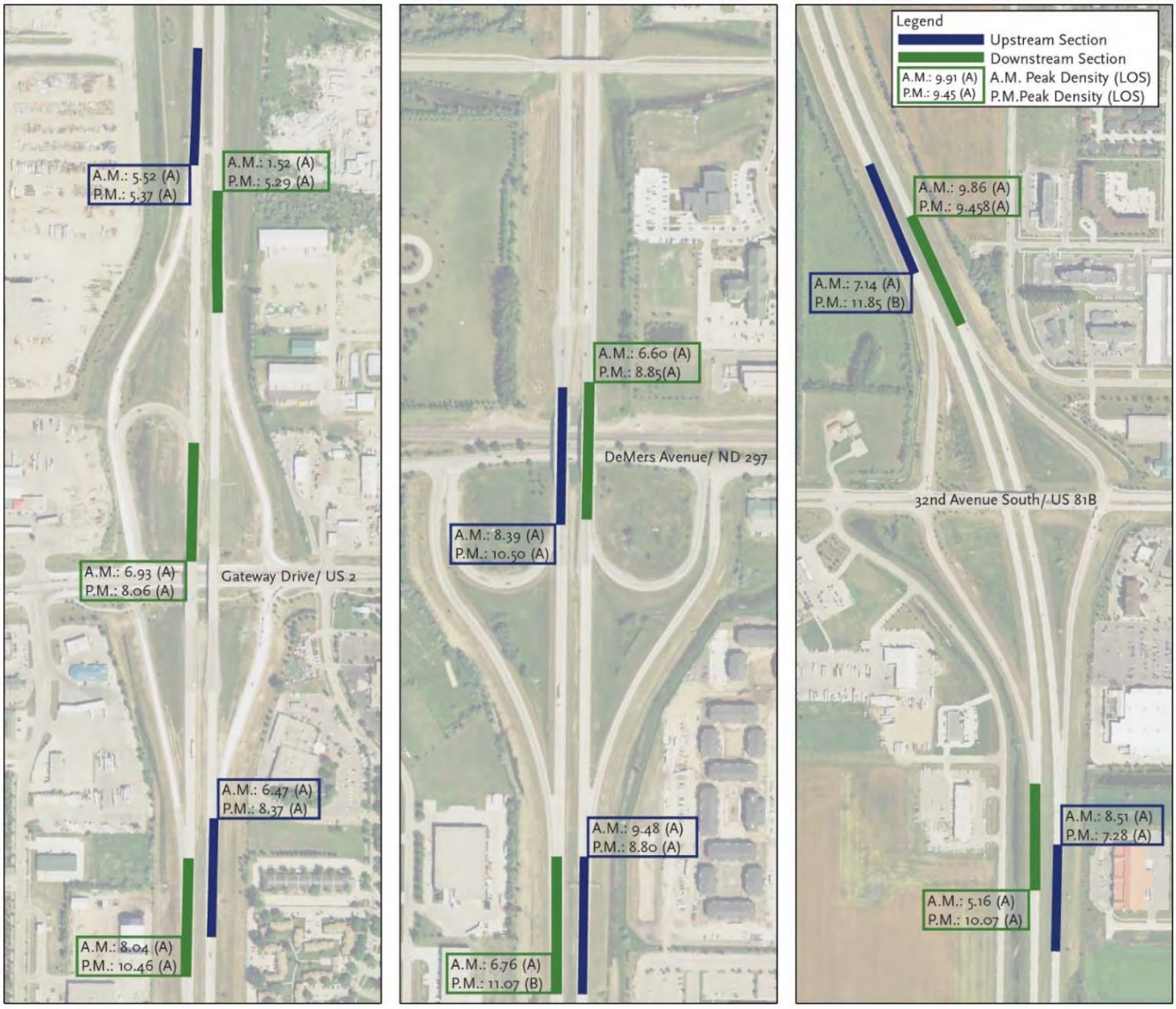
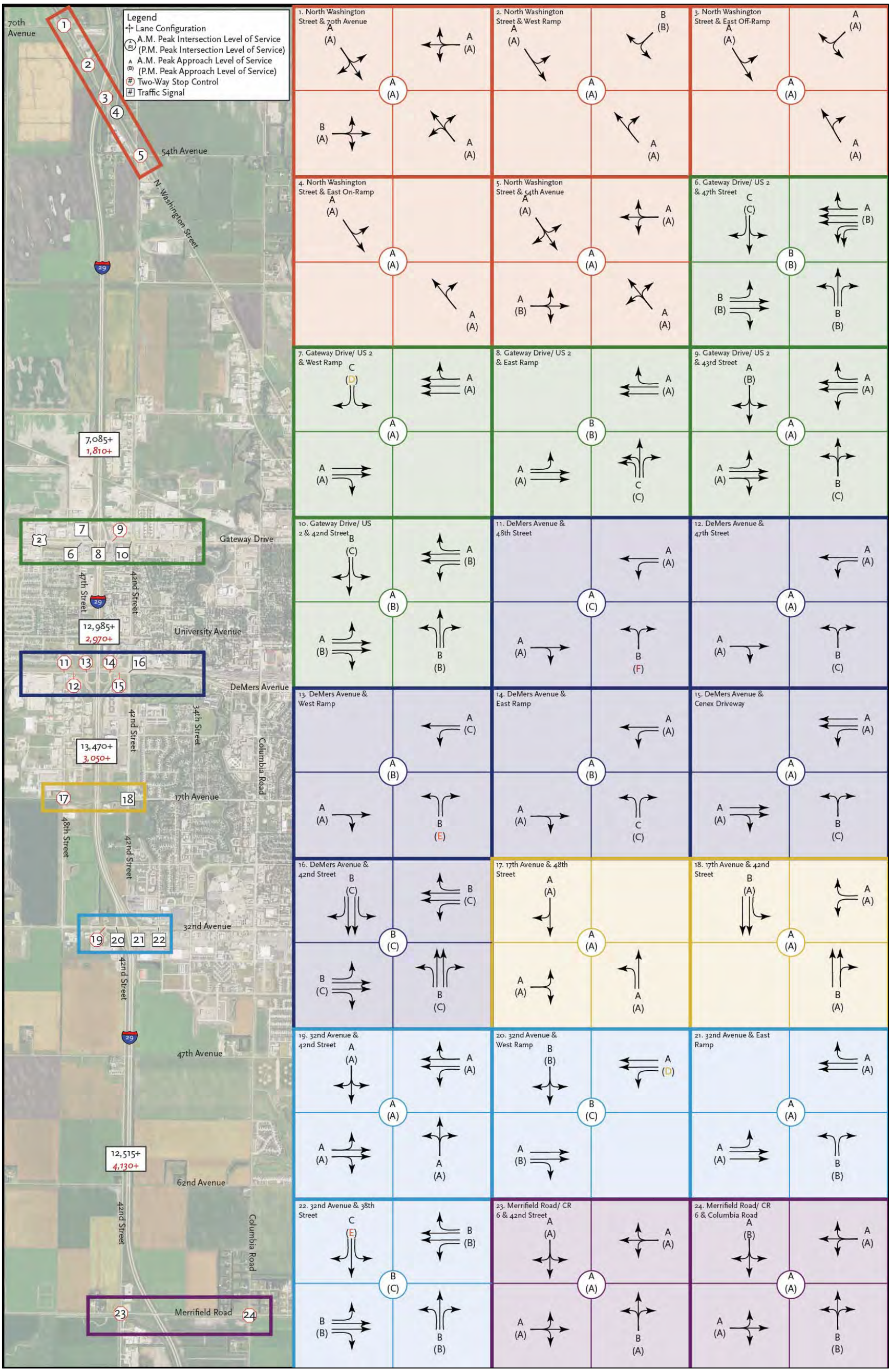


Figure 3-14: 2015 A.M. and P.M. Peak Hours Levels of Service



2025 Traffic Operations

LEVEL OF SERVICE

No geometric changes were made to the modeled network. However, traffic control signals were added at the DeMers Avenue/ND 297 ramps. It is expected these traffic control signals will be warranted by 2025; without the addition of these traffic control signals, the model broke down entirely as queues backed up onto the interstate and limited overall capacity. Refer to Figure 3-18 for detailed results of traffic operations analysis; a summary is provided below:

- North Washington Street/CR 11/US 81
  - All intersections in the North Washington Street/CR 11/US 81 functional area are LOS "A" during both A.M. and P.M. peak hours. All approaches are LOS "B" or better during the A.M. and P.M. peak hours.
- Gateway Drive/US 2
  - During the A.M. peak, all intersections are LOS "B" or better. The northbound approach at the 43rd Street falls to LOS "D".
  - During the P.M. peak, all intersections are LOS "B" or better. The northbound approaches at the East ramp intersection and the 43rd Street intersection fall to LOS "D" and "E" respectively. Queueing for westbound traffic extends through the 43rd Street intersection.
- DeMers Avenue/ND 297
  - During the A.M. Peak, all intersections are LOS "B" or better.
    - The northbound approach at the West Ramp intersection and the eastbound approach at the East Ramp intersection fall to LOS "D".
    - The northbound approach at the Cenex Driveway intersection falls to LOS "F".
  - During the P.M. peak, the 48th Street intersection falls to LOS "F", the West Ramp intersection operates at LOS "E" and the 42nd Street intersection operates at LOS "D"; all others operate at LOS "C" or better.
    - The northbound approaches at the 48th Street intersection, 47th Street intersection, the West Ramp intersection and the East Ramp intersection operate deficiently.
    - The westbound approach at the West Ramp intersection operates deficiently at LOS "E". Westbound queues approach 1,000 feet, blocking turn lanes and reaching back through the East Ramp intersection (Figure 3-15).
  - Prior to coding traffic signals at each ramp intersection, these locations operated at LOS "F" during both the A.M. and P.M. peak hours.

Figure 3-15: Eastbound Queues at the DeMers Avenue/ND 297 West Ramp Intersection during 2025 P.M. Peak

- The two study intersections at 17th Avenue South operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are at LOS "B" or better during both peak hours.
- 32nd Avenue/US 81B
  - During the A.M. peak, all intersections operate at LOS "B" or better. No approaches are deficient.
  - During the P.M. peak, the West Ramp, East Ramp and 38th Street intersections fall deficient to LOS "F", "E" and "F" respectively. Northbound queues extend onto the interstate while eastbound queues extend back through the West Ramp intersection (Figure 3-16).
- The two study intersections at Merrifield Road/CR 6 operate at LOS "A" during both the A.M. and P.M. peak hours; all approaches are LOS "B" or better during both peak hours.

Figure 3-16: Queue Spillback during 2025 P.M. Peak at 32nd Avenue South/US81B

TRAVEL TIME AND CUMULATIVE DELAY

Travel time runs for A.M. and P.M. peak were calculated for mainline I-29 in both directions, the major through movement on the cross road (Gateway Drive/US 2, DeMers Avenue/ND 297 and 32nd Avenue/US 81B) and the major ramp movement for that peak hour. Table 3-7 shows 2025 A.M. peak travel times and Table 3-8 shows 2025 P.M. peak travel times.

2025 A.M. Peak

- Mainline I-29 experienced very little travel time change from 2015 A.M. peak to 2025 A.M. peak. Travel time on mainline I-29 is between five and six percent higher than free flow travel time.
- The Gateway Drive/US 2 interchange functional area also experienced very little travel time change from 2015 to 2025. However, when compared to free flow, travel time through the interchange functional area is more than 36 percent higher.
- Westbound DeMers Avenue/ND 297 saw an additional minute, or 40 percent increase from 2015 to 2025, with the I-29 southbound to eastbound DeMers Avenue/ND 297 movement increasing almost 90 seconds, or 46.7 percent. When compared to free flow, traveling through the DeMers Avenue/ND 297 takes 80 percent or more time, or more than 90 seconds.
- Eastbound 32nd Avenue/US 81B increased less than 30 seconds. When compared to free flow, traveling through this interchange functional area is 40 percent or higher, leading to almost an entire minute.

Table 3-7: Travel Time Changes during the A.M. Peak from 2015 to 2025

Travel Time Movement	A.M. Peak			Change from Free Flow (Seconds)	Change from Free Flow (Percentage)	Change from 2015 (Seconds)	Change from 2015 (Percentage)
	Free Flow Travel Time	2015	2025				
I-29							
Southbound	283	294	298	15	5.3%	4	1.4%
Northbound	283	298	300	17	6.0%	2	0.7%
Gateway Drive/US 2							
Eastbound	117	156	160	43	36.8%	4	2.6%
Northbound I-29 to Westbound Gateway Drive/US 2	89	119	125	36	40.4%	6	5.0%
DeMers Avenue/ND 297							
Westbound	118	152	212	94	79.7%	60	39.5%
Southbound I-29 to Eastbound DeMers Avenue/ND 297	136	183	268	132	97.1%	85	46.4%
32nd Avenue/US 81B							
Eastbound	133	158	186	53	39.8%	28	17.7%
Westbound 32nd Avenue/US 81B to Southbound I-29	62	86	99	37	59.7%	13	15.1%

2025 P.M. Peak

- Northbound I-29 experienced an additional 40 seconds to travel through the network. An increase of 13.2 percent; southbound travel time increased just nine seconds. However, when compared to free flow, travel time through mainline I-29 increased more than two minutes.
- The Gateway Drive/US 2 interchange functional area also experienced very little travel time change from 2015 to 2025. When compared to free flow, travel time through the Gateway Drive/US 2 interchange area added nearly a minute to 2025 P.M. peak travel time.
- Westbound DeMers Avenue/ND 297 experienced a more than 65 percent, 109 seconds, increase in travel time from 2015 to 2025. Westbound DeMers Avenue/ND 297 to Southbound I-29 experienced a 51.4 percent increase or 97 seconds. Travel time through this interchange when compared to free flow travel time is more than 2.5 minutes, an increase of 233 percent or more.
- Travel time for Eastbound 32nd Avenue/US 81 B nearly doubled from 180 seconds in 2015 to 324 seconds in 2025. The Southbound I-29 to Eastbound 32nd Avenue/US81B movement more than doubled, adding more than three minutes to the travel time. Travel time more than doubles through the 32nd Avenue/US 81B when compared to free flow speed, adding more than three minutes.

Table 3-8: Travel Time Changes during the P.M. Peak from 2015 to 2025

Travel Time Movement	P.M. Peak			Change from Free Flow (Seconds)	Change from Free Flow (Percentage)	Change from 2015 (Seconds)	Change from 2015 (Percentage)
	Free Flow Travel Time	2015	2025				
I-29							
Southbound	183	295	303	120	65.6%	8	2.7%
Northbound	183	297	336	153	83.6%	39	13.2%
Gateway Drive/US 2							
Westbound	117	168	169	52	44.4%	1	0.6%
Northbound I-29 to Westbound Gateway Drive/US 2	89	131	145	56	62.9%	14	10.7%
DeMers Avenue/ND 297							
Westbound	118	166	275	157	133.1%	109	65.7%
Westbound DeMers Avenue/ND 297 to Southbound I-29	94	189	285	191	203.2%	99	50.8%
32nd Avenue/US 81B							
Eastbound	135	180	324	189	140.0%	144	80.0%
Southbound I-29 to Eastbound 32nd Avenue/US 81B	180	196	397	217	120.6%	201	102.6%

2025 INTERSTATE NETWORK PERFORMANCE

During the A.M. peak, the overall I-29 network is expected to have an average link density of 8.96 pcplm, LOS "A" with an average speed was 69.1 miles per hour (Table 3-9). During the P.M. peak, the overall I-29 network is expected to have an average link density of 16.52 pcplm, LOS "B". Average speeds begin to decline to around 65 miles per hour. Link densities around the 500-foot upstream and downstream sections of the three urban interchanges found two deficient sections; both upstream sections at the 32nd Avenue/US 81B interchange, the I-29 southbound off-ramp and the I-29 northbound off-ramp had densities that were considered LOS "E" and "F" respectively during the P.M. peak, as shown in Figure 3-17.

Table 3-9: 2025 Overall Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
A.M. Peak	8.96 (A)	69.1
P.M. Peak	16.52 (B)	64.8

Figure 3-17: 2025 I-29 Densities for Upstream and Downstream Sections for Urban Interchanges

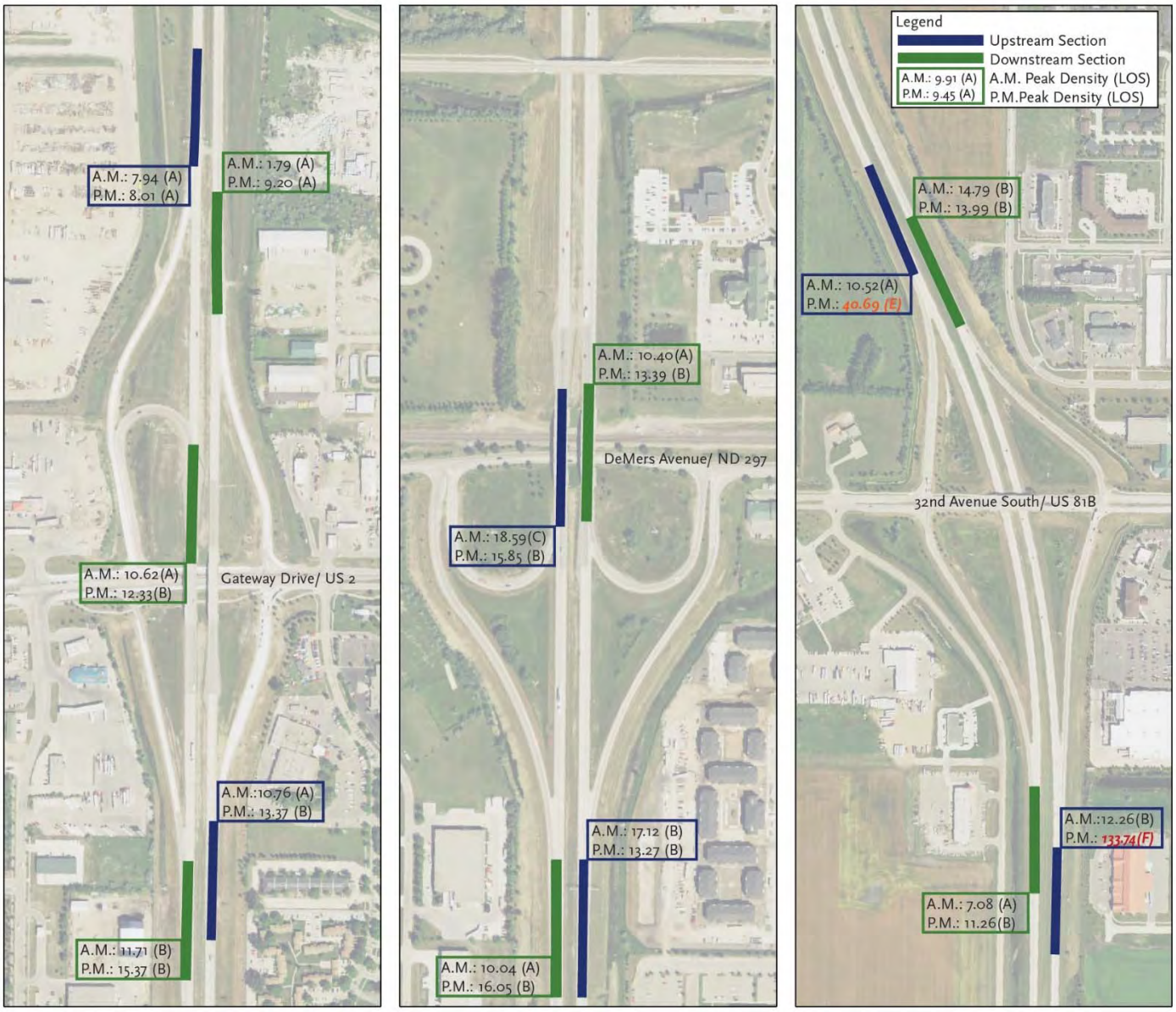
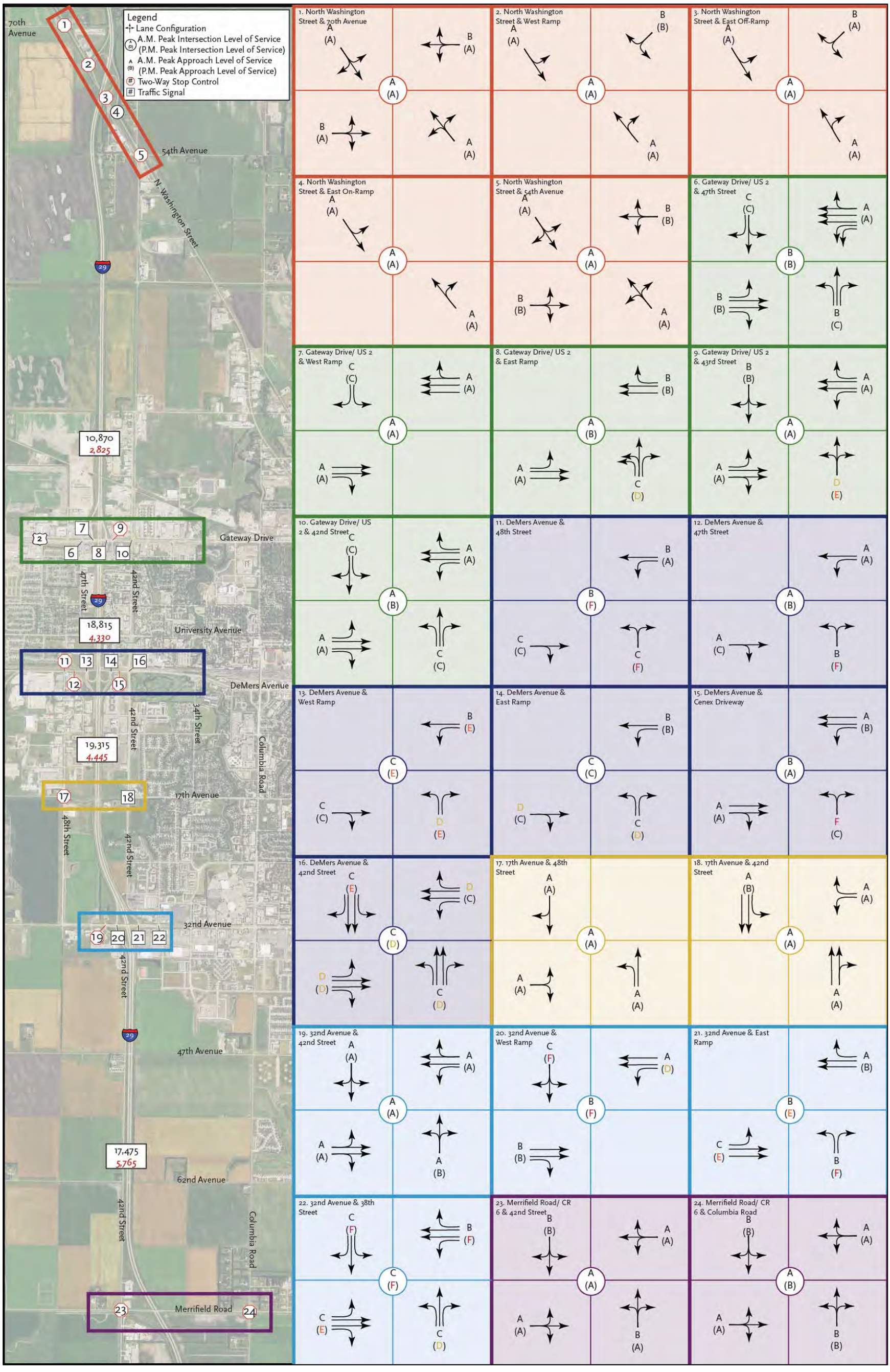


Figure 3-18: 2025 A.M. and P.M. Levels of Service



2040 Traffic Operations

LEVEL OF SERVICE

Refer to Figure 3-22 for detailed results of traffic operations analysis; a summary is provided below:

- North Washington Street/CR 11/US 81
  - All intersections in the North Washington Street/CR 11/US 81 functional area are LOS "A" during both A.M. and P.M. peak hours. All approaches are LOS "C" or better during the A.M. and P.M. peak hours.
- Gateway Drive/US 2
  - During the A.M. peak, all intersections are LOS "B" or better.
    - The southbound approach at the 47th Street intersection falls to LOS "D".
    - The northbound approaches at the East Ramp intersection and 43rd Street intersection fall to LOS "D".
  - During the P.M. peak, all intersections are LOS "C" or better.
    - The northbound approaches at the East Ramp intersection and 43rd Street intersection fall to LOS "F".
    - The southbound approaches at the 47th Street intersection and West Ramp intersection fall to LOS "D". The Southbound approach at 42nd Street falls to LOS "F".
    - The eastbound approach at 47th Street falls to LOS "E".
    - Queues originating at the East Ramp intersection extend through adjacent intersections and onto the interstate (Figure 3-19).

Figure 3-19: Queues Extend onto I-29 at the Gateway Drive/US 2 Interchange

- DeMers Avenue/ND 297
  - During the A.M. Peak, all intersections, except at the Cenex Driveway, operate at LOS "E" or worse. Few approaches operate efficiently.
  - During the P.M. peak, the 48th Street intersection falls to LOS "F". The West Ramp intersection falls to LOS "E" which is considered deficient (Figure 3-20). Most approaches are deficient. Due to limited capacity, queues originating at the West Ramp intersection block both 47th Street and 48th Street.

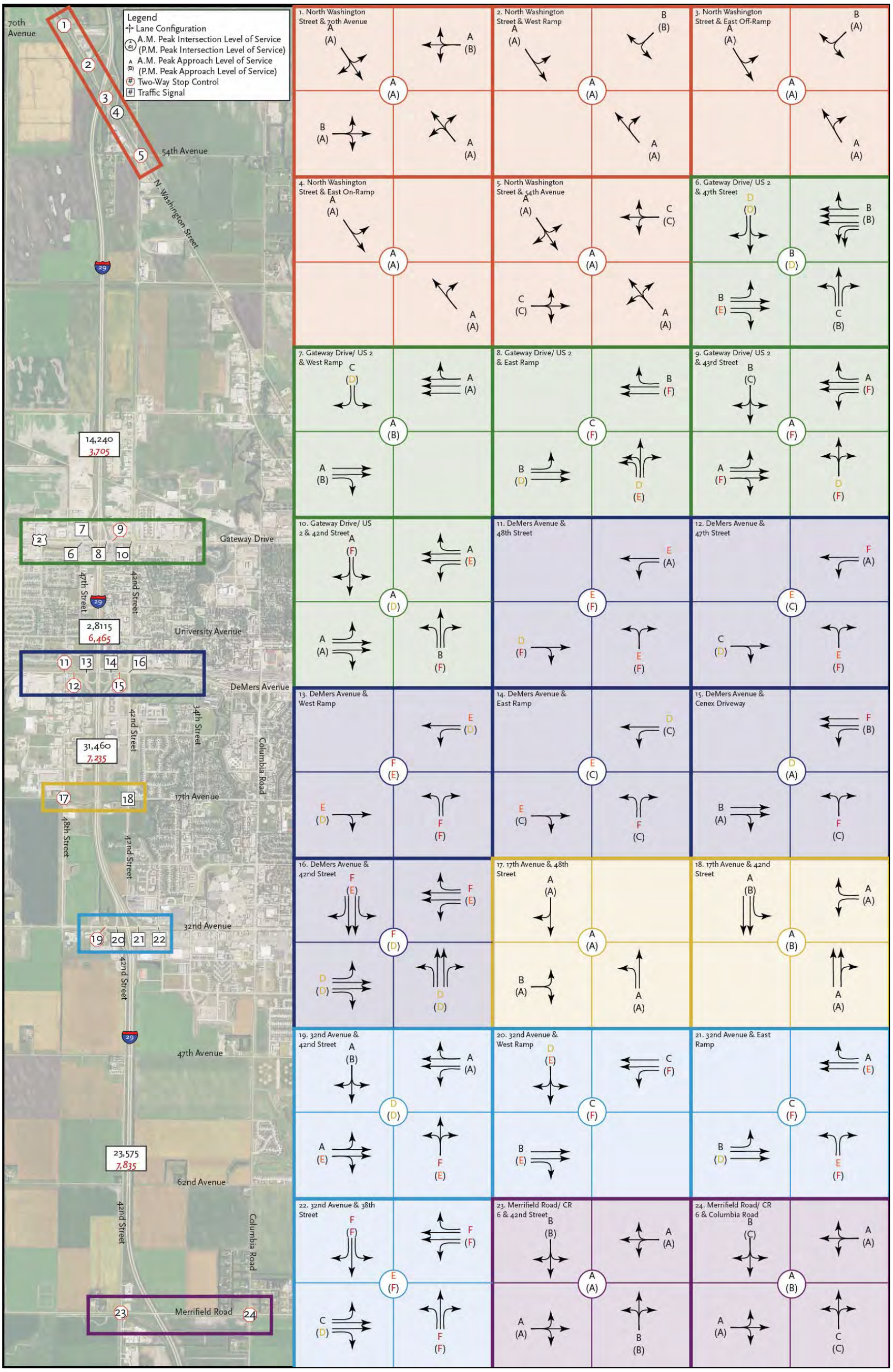
Figure 3-20: Queues on DeMers Avenue/ND 297 Impact Ramp Operations

- The two study intersections at 17th Avenue South operate at LOS "B" or better during both the A.M. and P.M. peak hours; all approaches are at LOS "B" or better during both peak hours.
- 32nd Avenue/US 81B
  - » During the A.M. peak, the 42nd Street intersection operates at LOS "D" and the 38th Street intersection operates at LOS "E". The ramp intersections operate at LOS "C".
    - The northbound approaches at 42nd Street, the East Ramp and 38th Street operate deficiently.
    - The southbound approaches at the West Ramp and the 38th Street intersection operates deficiently.
    - The westbound approach at the 38th Street intersection operates at LOS "F".
  - » During the P.M. peak, only the 42nd Street intersection operates efficiently at LOS "D". Few approaches operate at acceptable LOS (Figure 3-21).

Figure 3-21: Queues Extend through Ramp Intersections at 32nd Avenue South/US 81B

- The two study intersections at Merrifield Road/CR 6 operate at LOS "B" or better during both the A.M. and P.M. peak hours; all approaches are LOS "C" or better during both peak hours.

Figure 3-22: 2040 A.M. and P.M. Levels of Service



TRAVEL TIME AND CUMULATIVE DELAY

Travel time runs for A.M. and P.M. peak were calculated for mainline I-29 in both directions, the major through movement on the cross road (Gateway Drive/US 2, DeMers Avenue/ND 297 and 32nd Avenue/US 81B) and the major ramp movement for that peak hour. Table 3-10 shows 2040 A.M. peak travel times and Table 3-11 shows 2040 P.M. peak travel times.

2040 A.M. Peak

- Mainline I-29 experienced more than a two-minute increase in travel time for southbound vehicles from 2015 to 2040, an increase of 45.6 percent. Northbound vehicles saw an increase of just 19 seconds. When compared to free flow travel time, southbound traffic increased 51 percent, or more than two minutes, while northbound traffic increased just 34 seconds.
- For eastbound traffic on Gateway Drive/US 2, travel time increased just 19 seconds or 12.2 percent, while the northbound I-29 to westbound Gateway Drive/US 2 movement increased 39 seconds or 32.4 percent from 2015 to 2040. When compared to free flow, travel time for eastbound Gateway Drive/US 2 increased 49.6 percent; northbound I-29 to westbound Gateway Drive/US 2 increased 77.5 percent or 69 seconds.
- Westbound DeMers Avenue/ND 297 saw a travel time nearly eight minutes higher in 2040 than 2015, an increase of 305.8 percent. The southbound I-29 to eastbound DeMers Avenue/ND 297 movement saw a similar increase.
- Eastbound 32nd Avenue/US 81B increased 27.2 percent or 43 seconds while the westbound 32nd Avenue/US 81B to southbound I-29 movement nearly doubled with an 81 second increase in travel time from 2015 to 2040. Eastbound 32nd Avenue/US 81B travel time increased 51 percent, or 68 seconds when compared to free flow travel time. For westbound 32nd Avenue/US 81B to southbound I-29, travel time increased 167 percent, nearly two minutes, when compared to free flow travel time.

Table 3-10: Travel Time Changes for A.M. Peak from 2015 to 2040

Travel Time Movement	A.M. Peak			Change from Free Flow (Seconds)	Change from Free Flow (Percentage)	Change from 2015 (Seconds)	Change from 2015 (Percentage)
	Free Flow Travel Time	2015	2040				
I-29							
Southbound	283	294	428	145	51.2%	134	45.6%
Northbound	283	298	317	34	12.0%	19	6.4%
Gateway Drive/US 2							
Eastbound	117	156	175	58	49.6%	19	12.2%
Northbound I-29 to Westbound Gateway Drive/US 2	89	119	158	69	77.5%	39	32.8%
DeMers Avenue/ND 297							
Westbound	118	152	616	498	422.0%	464	305.3%
Southbound I-29 to Eastbound DeMers Avenue/ND 297	136	183	647	511	375.7%	464	253.6%
32nd Avenue/US 81B							
Eastbound	133	158	201	68	51.1%	43	27.2%
Westbound 32nd Avenue/US 81B to Southbound I-29	62	86	166	104	167.7%	80	93.0%

2040 P.M. Peak

- Southbound I-29 added just 22 seconds to its travel time from 2015 to 2040 while northbound I-29 increased 40.6 percent, adding more than two minutes. When compared to free flow travel time, southbound traffic added 33 seconds with northbound traffic adding more than two minutes.
- Westbound Gateway Drive/US 2 increased just nine seconds from 2015 to 2040, but when compared to free flow, added 50.4 percent more time, or 59 seconds. The northbound I-29 to westbound Gateway Drive/US 2 increased 23.5 percent or 31 seconds from 2015 to 2040, but when compared to free flow, added 77.5 percent or 69 seconds.
- Westbound DeMers Avenue/ND 297 more than doubled, adding 306 seconds to its travel time from 2015 to 2040; when compared to free flow travel time, its 422 percent higher, or more than eight minutes. The westbound

DeMers Avenue/ND 297 to southbound I-29 movement added 90 seconds, or 47.7 percent from 2015 to 2040; when compared to free flow travel time, it added 375 percent, again more than eight minutes.

- The eastbound 32nd Avenue/US 81B added more than three minutes to its travel time from 2015 to 2040 while the southbound I-29 to eastbound 32nd Avenue/US 81B added nearly three minutes, increasing 84.5 percent in the same time period. When compared to free flow travel time, eastbound 32nd Avenue/US 81B's travel time increased 171 percent, or nearly four minutes, with southbound I-29 to eastbound 32nd Avenue/US 81B increased 101 percent, or three minutes.

Table 3-11: Travel Time Changes for P.M. Peak from 2015 to 2040

Travel Time Movement	P.M. Peak			Change from Free Flow (Seconds)	Change from Free Flow (Percentage)	Change from 2015 (Seconds)	Change from 2015 (Percentage)
	Free Flow Travel Time	2015	2040				
I-29							
Southbound	283	295	316	33	11.7%	21	7.1%
Northbound	283	297	417	134	47.3%	120	40.4%
Gateway Drive/US 2							
Westbound	117	168	176	59	50.4%	8	4.8%
Northbound I-29 to Westbound Gateway Drive/US 2	89	131	162	73	82.0%	31	23.7%
DeMers Avenue/ND 297							
Westbound	118	166	473	355	300.8%	307	184.9%
Westbound DeMers Avenue/ND 297 to Southbound I-29	94	189	278	184	195.7%	90	47.1%
32nd Avenue/US 81B							
Eastbound	135	180	366	231	171.1%	186	103.3%
Southbound I-29 to Eastbound 32nd Avenue/US 81B	180	196	362	182	101.1%	166	84.7%

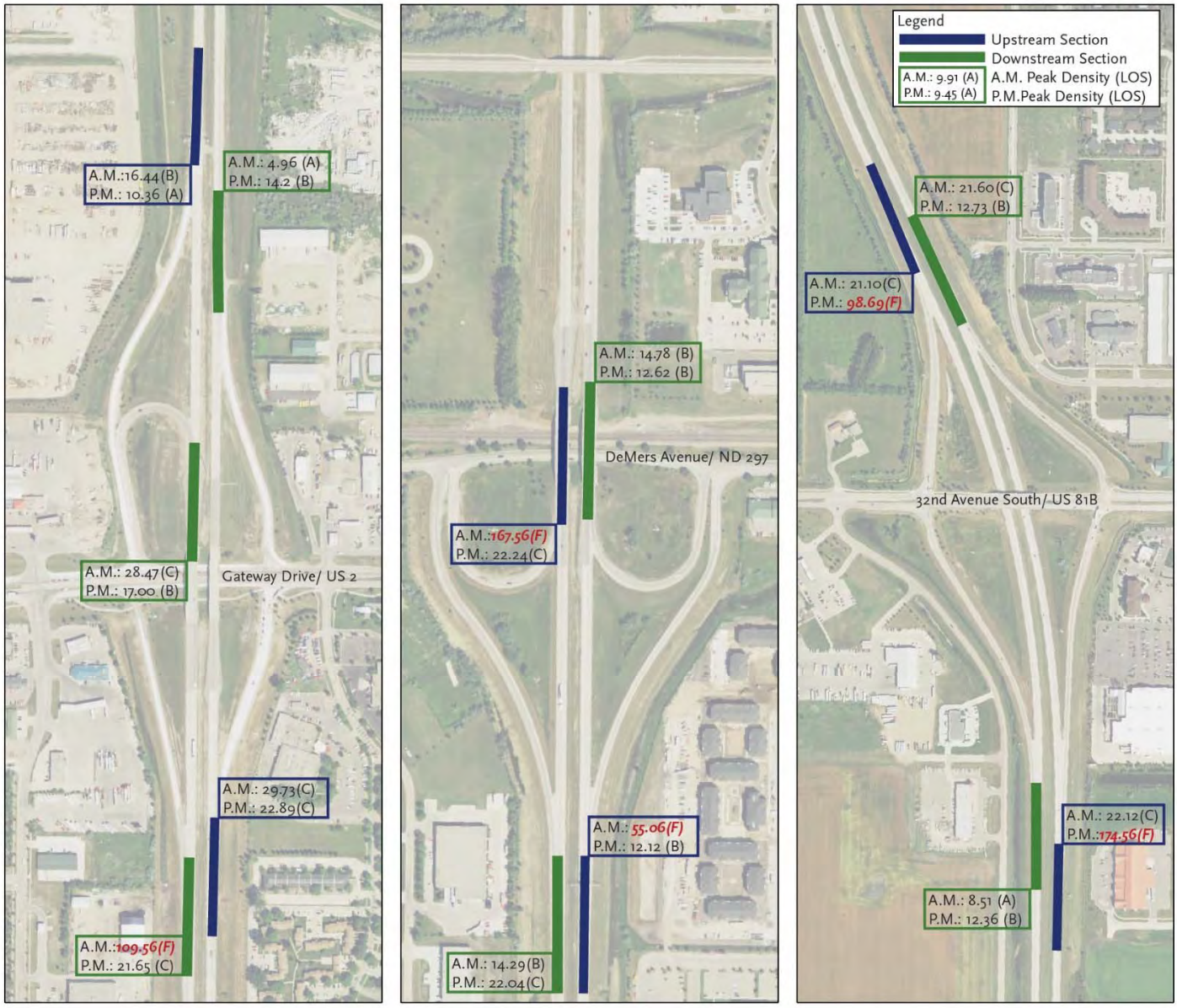
2040 INTERSTATE NETWORK PERFORMANCE

During the A.M. peak, the overall I-29 network is expected to have an average link density of 24.43 pcplm, LOS "C" with average speeds of 60 miles per hour (Table 3-12). The northbound and southbound upstream sections at DeMers Avenue/ND 297, as well as the southbound downstream section have densities greater than 40 pcplm, which is considered deficient (Figure 3-23). The P.M. peak is expected to have an average link density that falls deficient at 26.25 pcplm with average speeds of just 60 miles per hour as well (Table 3-12). Again, both upstream sections at the 32nd Avenue/US81B interchange are deficient at LOS "F" (Figure 3-23). Even though queues at Gateway Drive/US 2 extend back onto I-29, the impacts are limited; Vissim reporting is done by link, and not by lane, so while the right-most lane may have slowed or stopped cars, the left lane operates at free flow speeds, improving the reported link density.

Table 3-12: Overall 2040 Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
A.M. Peak	24.43 (C)	60.6
P.M. Peak	26.25 (D)	60.3

Figure 3-23: 2040 I-29 Densities for Upstream and Downstream Sections for Urban Interchanges



OVERALL NETWORK PERFORMANCE

By 2040, the model becomes oversaturated (Table 3-13). To be able to effectively get all of the traffic through the study area, additional capacity is necessary. This limits the LOS outputs summarized above in the following ways:

- Congestion along the interstate or through the interchange functional area may impede that driver's ability to go through the intersection their route requires. This impacts the total number of vehicles entering an intersection, resulting in better-than-expected LOS.
- Queues and delays attributed to other intersections. For example, a northbound to eastbound vehicle on 48th Street may not be able to get onto DeMers Avenue/ND 297 because of queues and delays actually occurring at the West Ramp intersection.

- The 2040 models include some amount of traffic, latent demand, (2.4 percent during the A.M. peak and 13.9 percent during the P.M. peak) that cannot enter the models at all because congestion and queues back up beyond where links begin. This results in delay not accounted to specific intersections.

Table 3-13: Overall Network Performance for 2040 Peak Hours

	Total Network Delay (hours)	Average Delay per Vehicle (minutes)	Latent Demand (vehicles)	Latent Demand as Percent of Total Traffic
A.M. Peak	655.5	3.2	289	2.4%
P.M. Peak	1,962.0	7.3	2,255	13.9%

Special Events

The focus of the operational analysis included in this report was during a normal business day (Monday through Thursday). The following event scenarios also contribute to operational issues within the study area.

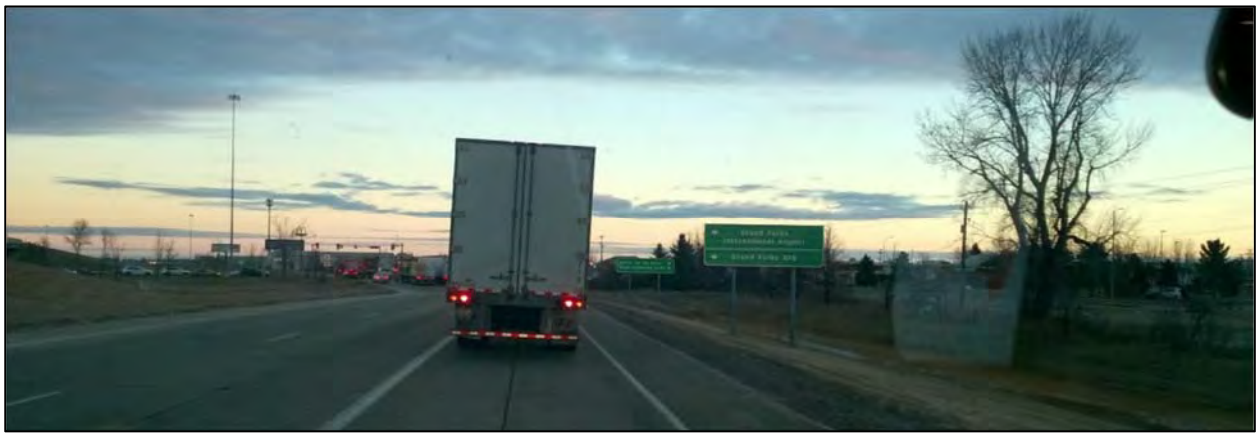
ALERUS CENTER EVENTS

The Alerus Center is a 21,000-seat event center located at the southeast quadrant of the DeMers Avenue/ND 297 interchange. Analysis of an event at this location is included in Chapter 4.

TRAIN EVENTS

Train events produce significant operational deficiencies along the corridor. The area most impacted by train events is Gateway Drive/US 2. Currently the Glasston Subdivision is located east of 42nd Street. This line carries an average of three trains per day currently, but with the completion of the Northern Plains Nitrogen fertilizer plant, train traffic on the Glasston Subdivision will likely increase by at least one unit train per week; furthermore, additional coal and gravel activity to the north will also likely lead to increases in train traffic. When train events occur on this line, Gateway Drive is completely blocked, creating delays and queues that back up onto the interstate (Figure 3-24). Efforts to model this event provided minimal value as queues blocked the ability for modeled vehicles to enter the network.

Figure 3-24: Traffic Stopped on I-29 Due to Train Blockages at the Glasston Line on Gateway Drive



The railroad crossing on 42nd Street north of DeMers Avenue/ND 297 carries on average 14 trains per day. When trains block 42nd Street, the intersection of 42nd Street and DeMers Avenue/ND 297 experiences delays of just over five minutes, on average. According to the 42nd Street Grade Separation Technical Needs Assessment Memorandum, dated January 6, 2015, train delays oversaturate the intersection of 42nd Street and DeMers Avenue/ND 297 leading to long queues. By 2040, queued vehicles will block access to I-29 and the Alerus Center (Figure 3-25). Furthermore, when 42nd Street is blocked,

Figure 3-25: Simulation of Nine-Minute Train Event on US 2/Gateway Drive with 2040 Projected Traffic

motorists often reroute. According to the analysis included in the referenced memo, 41 percent of this traffic would choose to reroute to I-29 when 42nd Street is blocked. Depending upon the timing of trains, this is likely to route several thousand vehicles per day on the Interstate that would normally use 42nd Street.

Summary of Traffic Operations

Provided below is a summary of traffic operations. With the exception of traffic control signals at the DeMers Avenue/ND 297 ramp intersections, no additional traffic control or capacity enhancements were made.

MAINLINE I-29

Deficient operations on mainline I-29 are expected at multiple merging and diverging areas by 2040. The majority of congestion can be attributed to the interchanges and are discussed in detail below. The section of I-29 between Gateway Drive/US 2 and 32nd Avenue/US 81B carries between 28,000 and 31,500 vehicles per day, the approximate threshold for requiring added capacity. Once bottlenecks at the interchanges are alleviated during alternatives analysis, it will be identified whether these sections can adequately operate with four lanes.

NORTH WASHINGTON STREET/CR 11/US 81 INTERCHANGE FUNCTIONAL AREA

No operational deficiencies are expected at the North Washington Street/CR 11/US 81 interchange functional through 2040.

GATEWAY DRIVE/US 2 INTERCHANGE FUNCTIONAL AREA

Increasing commercial and industrial demand is expected to cause this interchange functional area to operate deficiently by 2040, with LOS "F" expected at the East Ramp and 43rd Street intersections. Closely spaced signalized intersections results in queues that extend back through intersections, limiting overall capacity. Deficient operations are driven primarily at the East Ramp intersection due to significant traffic growth on all approaches. By 2040, the East Ramp intersection will generate queues that extend nearly onto I-29. This currently happens when a train event occurs at the Glasston Subdivision, just east of 42nd Street.

DEMERS AVENUE/ND 297 INTERCHANGE FUNCTIONAL AREA

With just one through lane in each direction, and strong growth anticipated west of I-29, this interchange functional area is expected to operate deficiently by 2025. Strong growth in the industrial park increases traffic making gap acceptance difficult at the West Ramp intersection. The ramp intersections were signalized to improve operations and prevent the model from breaking down entirely. By 2040, nearly every intersection in this functional area operates deficiently during the A.M. peak and travel time through the interchange functional area increases to eight minutes, taking nearly four times longer to get through the interchange than during free flow conditions. Furthermore, train blockages at 42nd Street just north of DeMers Avenue/ND 297 create queueing that extends to the interchange and will likely reroute several thousand vehicles onto the interstate by 2040.

17TH AVENUE

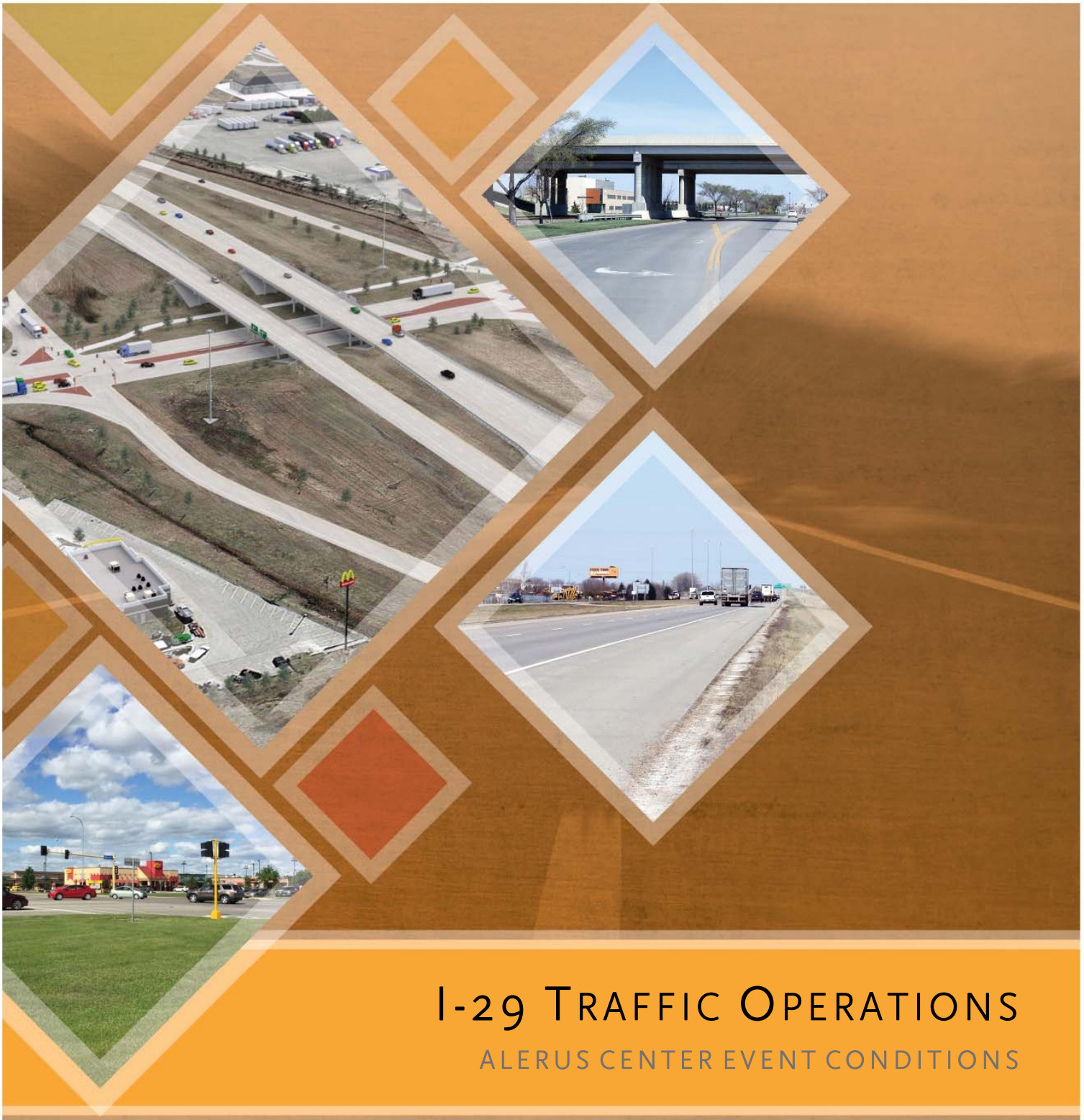
No deficient operations are expected to occur at the two 17th Avenue study intersections.

32ND AVENUE/US 81B INTERCHANGE FUNCTIONAL AREA

Under current conditions, 32nd Avenue/US 81B operates very effectively. The massive amount of growth forecasted within one mile of this interchange (more than 2,800 new jobs and 725 new households by 2040), starts to overburden this interchange as soon as 2025. Specifically, in the future scenarios 2025 and 2040, deficient operations are expected at the West Ramp, East Ramp and 38th Street. These delays begin to affect mainline I-29, producing deficient operations at the northbound and southbound off-ramp diverge areas due to queues extending onto mainline I-29. Travel time more than doubles from 2015 to 2040 through this interchange functional area, adding nearly two minutes over free flow travel time.

MERRIFIELD ROAD/CR 6

No deficient operations are expected to occur through 2040 for the Merrifield Road/CR 6 study intersections.



I-29 Traffic Operations

ALERUS CENTER EVENT CONDITIONS

ALLIANT ENGINEERING

KLJ

4. ALERUS CENTER EVENT CONDITIONS

Background

The focus of this analysis is to evaluate possible operational impacts to Interstate 29, the interstate ramp intersections and surrounding intersections in Grand Forks during a major Alerus Center event. The Alerus Center is a multi-use event center owned by the City of Grand Forks. The Alerus Center is situated in the southeast quadrant of the DeMers Avenue/ND 297 and I-29 interchange (Figure 4-1). The following seating capacities illustrate the variety of event types hosted at the Alerus Center throughout the year.

- Concerts (full-house sets): 21,000
- Concerts (half-house sets): 11,000
- Theater: 4,600
- Football: 12,283
- Basketball: 9,500

Currently, the Alerus Center has 4,200 parking spaces, 13 bus spaces and 16 secured parking spaces available during events. There have been two traffic operations studies completed previously for the Alerus Center. However, these studies are 10 and 15 years old, and were completed prior to the opening of the Canad Inn expansion. They did not consider event impacts to I-29 mainline or the interchanges. Signal coordination was installed in 2010 and updated in 2012 which included specific timing plans for Alerus Center events.

Figure 4-1: Alerus Center Location

CONCERT STUDY

Event traffic conditions were analyzed for a popular country music artist on Thursday, January 28th, 2016. The concert drew 14,550 fans (69 percent of the Alerus Center's maximum concert capacity). The concert started at 7:30 P.M. and ended at 11:00 P.M. This is important to note because the peak P.M. traffic period in Grand Forks typically ends by 6 P.M. Event promoters stressed new security measures and encouraged attendees to arrive early. The parking lot and doors opened earlier than usual.

CURRENT EVENT TRAFFIC MANAGEMENT PRACTICES

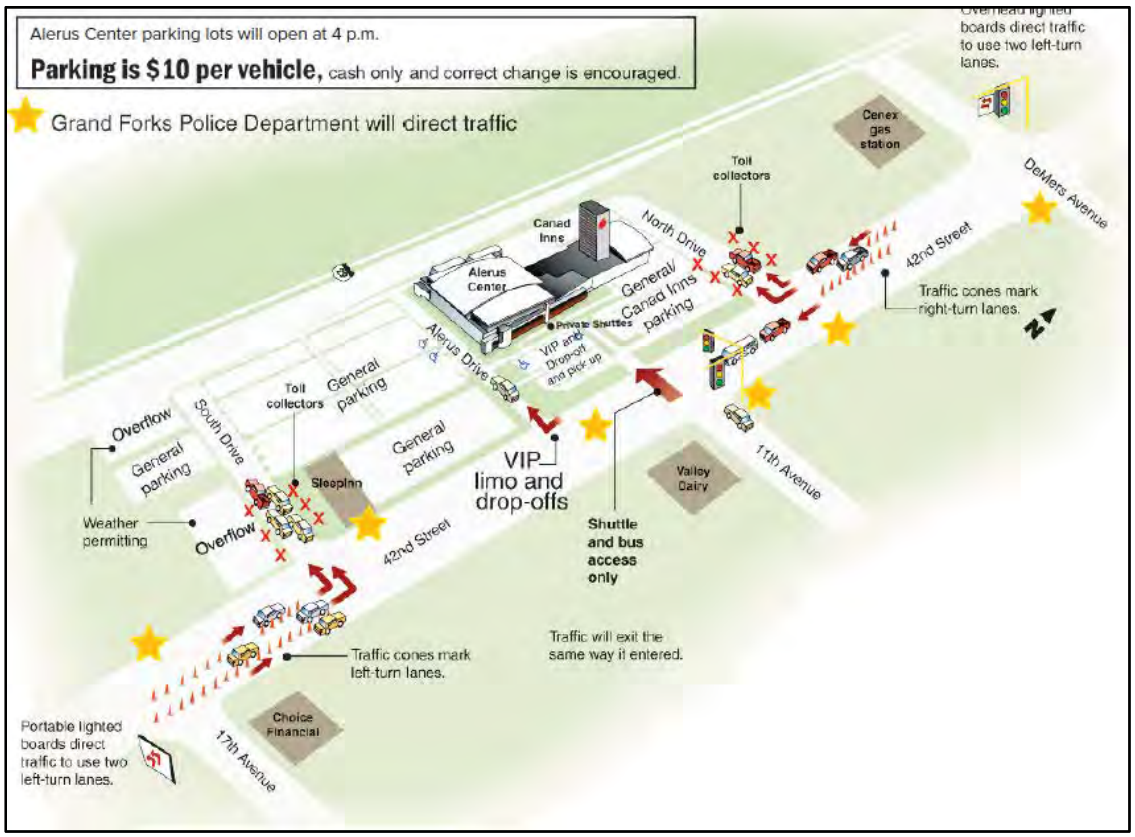
Below is a summary of the ingress/egress plan maintained by the Alerus Center staff and City of Grand Forks Engineering and Police Departments. Further details are shown in Figure 4-2:

- Ingress
  - » Interstate 29 traffic is instructed to follow dynamic message signs (DMS) posted on I-29.
    - Northbound traffic is instructed to use Exit 138 (32nd Avenue/US 81B).
    - Southbound traffic is instructed to use Exit 140 (DeMers Avenue/ND 297).

- » Local traffic is instructed to access 42nd Street using DeMers Avenue/ND 297 or 17th Avenue South.

- Egress
  - » All the north lot departs using the north entrance and is directed north on 42nd Street. The north lot has 1,163 parking stalls.
  - » Lot 3, adjacent to the SleepInn, and VIP lot vehicles departs through the Alerus Drive entrance and are sent both north and south on 42nd Street. Lot 3 has 550 parking stalls and the VIP lot has 225 parking stalls.
  - » South lot general parking departs using the south entrance and is directed south on 42nd Street. This lot has 2,260 parking stalls.
  - » Limousines and cabs pick up at the east Alerus Center entrance and exit in various directions.

Figure 4-2: Alerus Center Event Parking



- Traffic Control Event Staff
  - » The full traffic management plan goes into effect for an event exceeding 3,000 attendees. It includes the following additional staff:
    - Six police officers
    - Eight Alerus Center staff
    - One City of Grand Forks staff
  - » The traffic control plan for an event with 10,000 or more in attendance includes the following additional staff:
    - Six police officers
    - Twelve Alerus Center staff
    - Three City of Grand Forks staff

        - Eight additional University of North Dakota (UND) staff for football games
- Traffic signal control timing plans exist to improve signal coordination for event traffic.
- Dynamic Lane Assignment
    - The westbound DeMers Avenue/ND 297 left-turn lane at 42nd Street can be reassigned as a double left-turn lane during events. For the event studied, the double left-turn lane was not used. Therefore, for the purposes of this study, all scenarios were evaluated under single left-turn lane conditions. Preliminary analysis indicates that this intersection operates more efficiently with one lane under protected/permitted phasing than it does with two left-turn lanes under protected-only phasing, even while acknowledging the double left-turn lane has more queue storage.

Data Collection

Event traffic data was collected at the intersections contained in Table 4-1.

Table 4-1: Study Intersections

32nd Avenue South/US 81B	DeMers Avenue/ND 297	Gateway Drive/US 2
38th Street	42nd Street	42nd Street
East Ramps	Cenex Driveway	East Ramps
West Ramps	East Ramps	West Ramps
	West Ramps	47th Street

Video data collectors were used to monitor traffic conditions related to the concert. The Advanced Traffic Analysis Center (ATAC) Traffic Analysis Tool was primarily used to evaluate traffic volumes at intersections where video cameras are already installed. At locations within the I-29 study area that were not critical event intersections, traffic estimates were made using a combination of normal traffic patterns, daily traffic variations and upstream traffic. Data estimates were used at the following intersections: 32nd Avenue/US 81B and 42nd Street; DeMers Avenue/ND 297 and 47th Street and DeMers Avenue/ND 297 and 48th Street. These intersections are expected to have minimal event activity, but were analyzed for consistency with the larger I-29 Traffic Operations Report's study area.

Data was collected during the following time periods:

- Ingress: one hour prior to the concert beginning (6:30 to 7:30 P.M.).
- Egress: one hour after the concert ends (11:00 to 12:00 P.M.).
- One hour during the concert to gain insight into normal Thursday evening traffic patterns. This data allowed the study team to evaluate normal operations during a Thursday evening to better understand and isolate event traffic and normal traffic. This information was valuable when developing future forecasts.

Video data collection was utilized to collect turning movement counts. At the DeMers Avenue/ND 297 and West Ramp intersection and the Gateway Drive/US 2 and 47th Street intersection, errors occurred resulting in video collection equipment to stop recording prior to egress. The availability of various other traffic scenarios (i.e. normal operations, ingress operations and data collected between ingress and egress scenarios) at these intersections and upstream traffic data allowed the study team to estimate traffic movements at these locations with confidence.

Traffic Scenarios

The following event scenarios were analyzed for this study:

- **2015 Normal Event Scenario:** This scenario evaluates the collected traffic data for the concert held January 28th, 2016.
- **2015 Maximum Congestion Scenario:** This scenario includes the following augmentations to the field collected data:
  - » Background traffic was adjusted to evaluate how this event would operate on a Friday.
  - » Background traffic was adjusted to evaluate how this event would operate in December, one of the busier times of the year.
  - » Event traffic was adjusted to evaluate a maximum capacity event (attendance of 21,000).
- **2040 Normal Event Scenario:** This scenario estimates how a similar event would operate in 2040 by segregating the event traffic and background traffic and applying the event traffic to the projected 2040 traffic. TDM outputs for 2040 were utilized to forecast background traffic growth.

Many Alerus Center events are scheduled on Fridays and Saturdays. Weekend events may result in varied operations, particularly on 32nd Avenue/US 81B, due to the commercial nature of the corridor; 32nd Avenue/US 81B is home to many of Grand Forks' largest retail stores and shopping centers, which leads to the corridor experiencing prolonged peak hours on weekends.

The following assumptions were made to develop this scenario:

- Data from Friday, December 18th, 2015 was collected using ATAC's Traffic Analysis Tool at 32nd Avenue/US 81B and Gateway Drive/US 2, where this data was available. The event traffic was isolated from field collected data and added to the data from the ATAC tool. This represented a 24 percent increase in total traffic at the 32nd Avenue/US 81B intersections with 38th Street, East Ramp and West Ramp. This represented a 26 percent increase in total volumes at the Gateway Drive/US 2 intersections with 42nd Street, East Ramps and West Ramps.
- Intersections where the ATAC tool was not available on 32nd Avenue/US 81B and Gateway Drive/US 2, were adjusted based on upstream volumes. None of these locations were identified as critical event intersections.
- Off-ramp volume growth at the DeMers Avenue/ND 297 interchange functional area was assumed to be the same percentage as Gateway Drive/US 2 volume growth to account for traffic traveling to downtown locations.
- An adjustment factor was applied to the isolated event traffic to estimate a maximum capacity event. All other inputs were held constant (i.e. directional distribution, mode of travel, percentage of attendants driving, etc.).

Future turning movement counts were generated using the following techniques:

- Annual growth rates were calculated using 2015 ADTs and the 2040 Long Range Transportation Plan's TDM outputs, applied to the existing turning movement counts using *NCHRP Report 765: Analytical Travel Forecasting Approaches for Project Level Planning and Design* methodology. This methodology uses an iterative equilibrium spreadsheet to reassign turning movement counts based on future daily projections and existing directional and peaking factors.
- Event traffic was then added to the 2040 estimated background turning movements.

Ingress and egress periods were evaluated for each scenario noted above, resulting in a total of six traffic scenarios studied. The turning movements for all six scenarios can be seen in Figure 4-3, Figure 4-4 and Figure 4-5.

Figure 4-3: 2015 Normal Event Scenario Turning Movements

Gateway Drive/ US 2

1. Gateway Drive/ US 2 & 47th Street

33 (13) | 118 (49) | 9 (4)

70 (33) | 470 (440) | 80 (35)

2. Gateway Drive/ US 2 & West Ramp

43 (14) | 36 (7)

98 (53) | 602 (508)

7 (3) | 864 (241) | 56 (23)

6 (3) | 27 (13) | 141 (32)

727 (194) | 356 (81)

3. Gateway Drive/ US 2 & East Ramp

66 (50) | 674 (338)

4. Gateway Drive/ US 2 & 42nd Street

17 (3) | 24 (9) | 20 (6)

23 (1) | 580 (217) | 353 (85)

9 (12) | 733 (137)

177 (11) | 92 (72)

9 (7) | 593 (189) | 117 (49)

12 (19) | 58 (92) | 23 (92)

DeMers Avenue/ ND 297

5. DeMers Avenue & West Ramp

216 (240) | 98 (232)

6. DeMers Avenue & East Ramp

300 (461) | 27 (88)

275 (63) | 20 (16)

7 (10) | 99 (56)

387 (112) | 7 (10)

39 (17) | 274 (39)

7. DeMers Avenue & Cenex Driveway

314 (495) | 60 (109)

8. DeMers Avenue & 42nd Street

45 (56) | 200 (94) | 861 (284)

256 (192) | 207 (131) | 409 (171)

688 (145) | 52 (20)

39 (81) | 84 (46)

91 (49) | 225 (72) | 307 (55)

472 (726) | 66 (382) | 131 (461)

32nd Avenue South/ US 81B

9. 32nd Avenue & West Ramp

55 (33) | 255 (48)

301 (229) | 196 (428)

10. 32nd Avenue & East Ramp

582 (271) | 521 (698)

324 (79) | 59 (73)

24 (14) | 632 (117)

60 (17) | 426 (68)

11. 32nd Avenue & 38th Street

131 (544) | 174 (148) | 167 (140)

325 (107) | 674 (276) | 181 (29)

359 (35) | 638 (148) | 125 (24)

307 (37) | 281 (96) | 114 (32)

Figure 4-4: 2015 Maximum Congestion Event Scenario Turning Movements

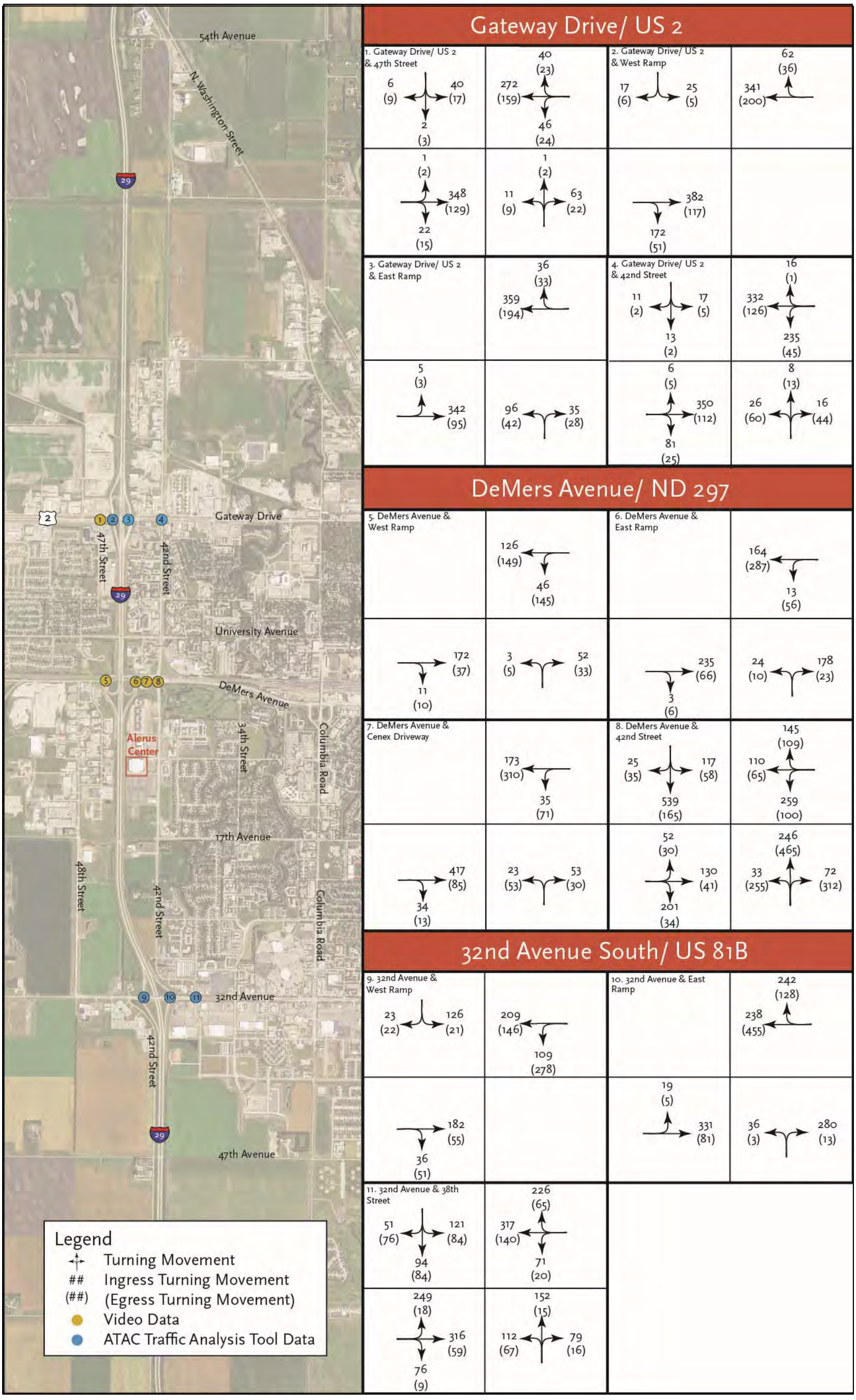


Figure 4-5: 2040 Normal Event Scenario Turning Movements

Gateway Drive/ US 2

1. Gateway Drive/ US 2 & 47th Street

	17 (5)	
15 (6)	465 (181)	15 (5)
	232 (42)	10 (0)

6 (5)	6 (12)	
493 (163)	27 (60)	18 (49)
97 (32)		

2. Gateway Drive/ US 2 & West Ramp

	149 (63)	
18 (8)		42 (5)
	547 (229)	

	607 (255)	
	241 (78)	

3. Gateway Drive/ US 2 & East Ramp

	49 (43)	
	541 (288)	

65 (34)		
514 (183)	231 (86)	31 (24)

4. Gateway Drive/ US 2 & 42nd Street

	3 (4)	
26 (29)		28 (5)
1 (2)	514 (295)	
	33 (26)	

	42 (25)	
470 (357)		0 (1)
36 (14)		20 (18) 56 (15)

DeMers Avenue/ ND 297

5. DeMers Avenue & West Ramp

	128 (151)	
	107 (206)	

164 (32)	30 (32)	111 (92)
51 (50)		

6. DeMers Avenue & East Ramp

	196 (319)	
	23 (66)	

259 (90)	50 (36)	201 (46)
22 (25)		

7. DeMers Avenue & Cenex Driveway

	217 (354)	
	35 (71)	

472 (140)	23 (53)	53 (30)
34 (13)		

8. DeMers Avenue & 42nd Street

	220 (184)	
60 (70)	123 (78)	186 (126)
643 (269)	231 (72)	

	115 (93)	
	194 (27)	131 (42)

	363 (582)	
32 (254)		47 (287)

32nd Avenue South/ US 81B

9. 32nd Avenue & 42nd Street

	16 (0)	
16 (19)	275 (186)	32 (9)
0 (0)	65 (44)	

3 (4)	0 (0)	
483 (431)	86 (77)	266 (239)
118 (106)		

10. 32nd Avenue & West Ramp

	426 (218)	
	167 (275)	

362 (132)		
109 (146)		

11. 32nd Avenue & East Ramp

	607 (189)	
443 (507)		

20 (10)		
751 (228)	32 (2)	476 (54)

12. 32nd Avenue & 38th Street

	300 (73)	
65 (382)	724 (251)	179 (91)
113 (85)	202 (37)	

268 (30)		172 (18)
739 (189)		221 (23) 187 (27)
182 (26)		

Traffic Operations

Operational analysis was completed using the Vissim microsimulation model developed for the I-29 study area. Capacity analysis was evaluated for intersections in the interchange functional area in terms of delay and level of service (LOS). LOS is a term used to describe the operational performance of transportation infrastructure elements; essentially, LOS is a grade value that corresponds to specific traffic characteristics within a given system, as shown in Table 4-2. NDDOT updated the Traffic Operations Manual in January 2017 to accept LOS "D". The GF-EGF MPO accepts LOS "D" as the minimum acceptable value, but strives for LOS "C". For the purposes of this study, LOS "D" is considered acceptable where other alternatives were not feasible or cost-effective.

Capacity analysis was also evaluated for mainline I-29 as it intersects with the on- and off-ramps at the various interchanges. Different interchange configurations result in different mainline operations; operations were studied at the 500-foot section upstream of off-ramps and the 500-foot section downstream of on-ramps. The HCM reports freeway operations as density (passenger cars per mile per lane).

Table 4-2: HCM Level of Service for Intersections and Freeway Facilities

Level of Service	Control Delay (sec/veh)		Density (pcplm)
	Unsignalized	Signalized	
A	≤ 10	≤ 10	≤ 11
B	10 – 15	10 – 20	11 – 18
C	15 – 25	20 – 35	18 – 26
D	25 – 35	35 – 55	26 – 35
E	35 – 50	55 – 80	35 – 45
F	> 50	> 80	> 45

*Passenger cars per lane mile

The City of Grand Forks routinely updates signal timing plans, therefore, signal timing within the models was optimized to get a realistic understanding of actual capacity problems, not signal timing deficiencies.

2015 TRAFFIC OPERATIONS

After traffic signal optimization, the 2015 traffic operations were analyzed based on field-collected data. While, the current event traffic management plan states the intersection of DeMers Avenue/ND 297 and 42nd Street westbound approach is to operate as a double left-turn for large Alerus Center Events, during the concert it did not. Operational analysis presented here did not utilize a double left-turn lane at that intersection. The existing weekday operations scenario was analyzed under observed event management practices to better understand existing conditions.

2015 NORMAL EVENT SCENARIO TRAFFIC OPERATIONS

2015 Normal Event Scenario Ingress Traffic Operations

All study intersections were found to operate acceptably for 2015 ingress traffic operations. Refer to Figure 4-7 for detailed results of traffic operations analysis; a summary is provided below.

- All study intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "A" during the ingress scenario. The southbound approach at the West Ramp intersection did operate deficiently with LOS "E", which is attributable to signal timing and not necessarily congestion. Queue lengths never exceeded five cars, based on model outputs.
- At the DeMers Avenue/ND 297 interchange functional area, all study intersections, except at 42nd Street, operate at LOS "A" during the ingress scenario; 42nd Street operates at LOS "B". During regular P.M. peak hour conditions, this intersection operates at LOS "C".
- At the 32nd Avenue/US 81B interchange functional area, all study intersections operate at LOS "A", with the exception of the 38th Street intersection, which operates at LOS "B".

2015 Normal Event Scenario Egress Traffic Operations

All study intersections were found to operate acceptably for 2015 egress traffic operations. Refer to Figure 4-7 for detailed results of traffic operations analysis; a summary is provided below.

- All study intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "A" during the egress scenario. Again, the southbound approach at the West Ramp intersection was deficient due to signal timing; queues never exceeded four cars.
- At the DeMers Avenue/ND 297 interchange functional area, all study intersections, except at 42nd Street, operate at LOS "A" during the egress scenario; 42nd Street operates at LOS "C".
- At the 32nd Avenue/US 81B interchange functional area, all study intersections operate at LOS "A", with the exception of the 38th Street intersection, which operates at LOS "B".

No study intersection saw an increase in total volumes or worse operations during the event conditions, ingress or egress, when compared to normal P.M. peak hour conditions. However, during ingress certain approaches did experience increased traffic volumes: the 32nd Avenue/US 81B East Ramp intersection's northbound approach saw a 64 percent increase in volumes and the northbound approach at the DeMers Avenue/ND 297 East Ramp intersection saw an increase of 40 percent, while all other approaches saw a stark decrease in traffic volumes compared to normal peak hour operations.

Under the 2015 Normal Event Scenario, there was no operational advantage to using the westbound approach at DeMers Avenue/ND 297 and 42nd Street as double left-turn lanes. The overall intersection delay actually decreases from 25 seconds under double left-turn lane operations to 22 seconds under single left-turn lane operations. Double left-turn lanes typically only operate with protected signal phasing, unlike a single left-turn lane, which can operate with protected or permissive signal phasing.

Interstate Network Performance for 2015 Normal Event Scenario

The overall interstate network has an average link density of 6.29 passenger cars per lane mile (pcplm) during the ingress and 3.07 pcplm during egress, as shown in Table 4-3. The average speed during both peak hours was around 71 miles per hour. Link densities were evaluated more closely at the 500-foot upstream and downstream sections of the three urban interchanges (Figure 4-6). All sections were LOS "A".

Table 4-3: 2015 Normal Event Scenario Overall Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
Ingress	6.29 (A)	71.9
Egress	3.07 (A)	71.2

Figure 4-6: 2015 Normal Event Scenario I-29 Densities for Upstream and Downstream Sections for Urban Interchanges

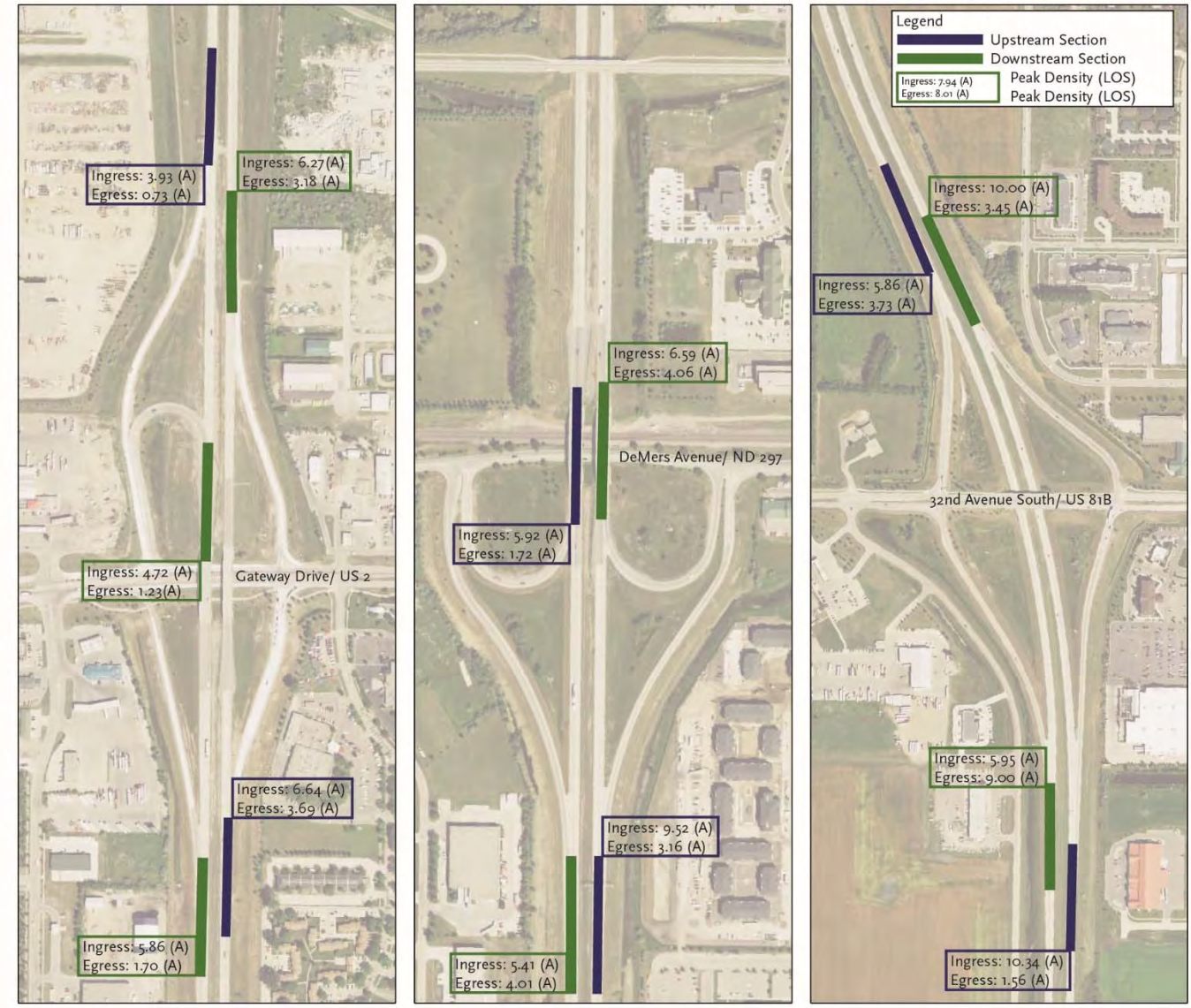
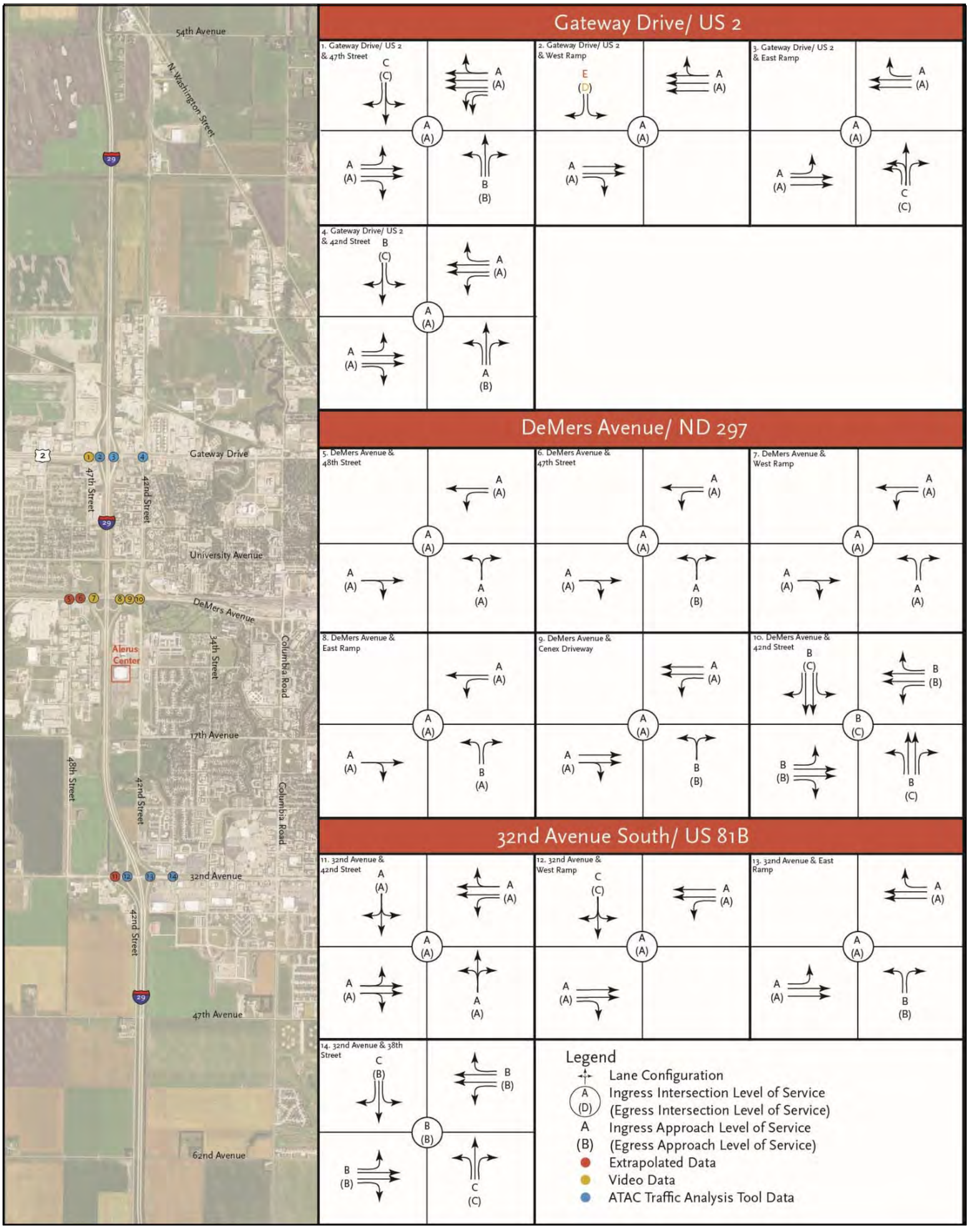


Figure 4-7: 2015 Normal Event Scenario Ingress and Egress Levels of Service



2015 MAXIMUM CONGESTION EVENT SCENARIO TRAFFIC OPERATIONS

As noted earlier, this scenario assesses a sold-out event occurring on a Friday during the holiday season, one of the busier times of the year for traffic on surrounding corridors.

2015 MAXIMUM CONGESTION EVENT SCENARIO INGRESS TRAFFIC OPERATIONS

Under this scenario, traffic operations begin to deteriorate. Refer to Figure 4-9 for detailed results of traffic operations analysis; a summary is provided below.

- All study intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "B" or better during ingress, which is comparable to normal P.M. peak hour operations.
- All study intersections in the Demers Avenue/ND 297 interchange functional area operate at LOS "A" during ingress, except for the DeMers Avenue/ ND 297 and 42nd Street intersection, which operates at LOS "D" during ingress (LOS "C" during normal P.M. peak hours).
- At the 32nd Avenue/US 81B interchange function area, only the 42nd Street intersection operates acceptably at LOS "C"; the West Ramp intersection operates at LOS "D", while the East Ramp and 38th Street intersections operate at LOS "F".

2015 MAXIMUM CONGESTION EVENT SCENARIO EGRESS TRAFFIC OPERATIONS

All study intersections were found to operate acceptably for the 2015 Maximum Congestion Event Scenario egress traffic operations. Refer to Figure 4-9 for detailed results of traffic operations analysis; a summary is provided below.

- All intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "A" during egress, with the exception of Gateway Drive/US 2 and 42nd Street intersection which operates at LOS "B". This is comparable to regular P.M. peak hour operations.
- All intersections in the Demers Avenue/ND 297 interchange functional area operate at LOS "A" during egress, except for the DeMers Avenue/ND 297 and 42nd Street intersection, which operates at LOS "D". During regular P.M. peak hour operations, the interchange functional area operates at LOS "C" or better.
- All 32nd Avenue/US 81B interchange functional area study intersections operate at LOS "A" during egress, with exception of the LOS "C" experienced at the 32nd Avenue/US 81B and 38th Street intersection. This is comparable to regular P.M. peak hour operations.

Five study intersections saw an increase in total volumes and/or worse operations during event conditions when compared to normal P.M. peak hour conditions:

- DeMers Avenue/ND 297 intersections
  - East Ramp: 42 percent increase during ingress
  - 42nd Street: 15.3 percent increase and LOS "D" during ingress
- 32nd Avenue/US 81B intersections
  - West Ramp: 35 percent increase and LOS "D" during ingress
  - East Ramp: 16.8 percent increase and LOS "F" during ingress
  - 38th Street: 14.9 percent increase and LOS "F" during ingress

Certain approaches related to event traffic experienced significant volume increases as well:

- Northbound approach at 32nd Avenue/US 81B and East Ramp intersection: 264.6 percent increase during ingress
- Eastbound approach at 32nd Avenue/US 81B and 38th Street intersection: 242.6 percent increase during ingress
- Northbound approach at DeMers Avenue/ND 297 and East Ramp intersection: 228.3 percent increase during ingress

Other intersections and approaches did not experience significant traffic volume increases or levels of service impacts when compared to normal P.M. peak hour operations.

INTERSTATE NETWORK PERFORMANCE FOR 2015 MAXIMUM CONGESTION EVENT SCENARIO

The overall interstate network has an average link density of 13.82 passenger cars per lane mile (pcplm) during ingress and 4.63 pcplm during egress, as shown in Table 4-4. The average speed during ingress was around 68 miles per hour, but higher during egress around 71 miles per hour. Link densities were evaluated more closely at the 500-foot upstream and downstream sections of the three urban interchanges (Figure 4-8). Only the upstream section for northbound I-29 at the 32nd Avenue South/US 81B was deficient, at LOS "F" with a density of 150 pcplm.

Table 4-4: 2015 Maximum Congestion Event Scenario Overall Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
Ingress	13.82 (B)	67.8
Egress	4.63 (A)	71.0

Figure 4-8: 2015 Maximum Congestion Event Scenario I-29 Densities for Upstream and Downstream Sections for Urban Interchanges

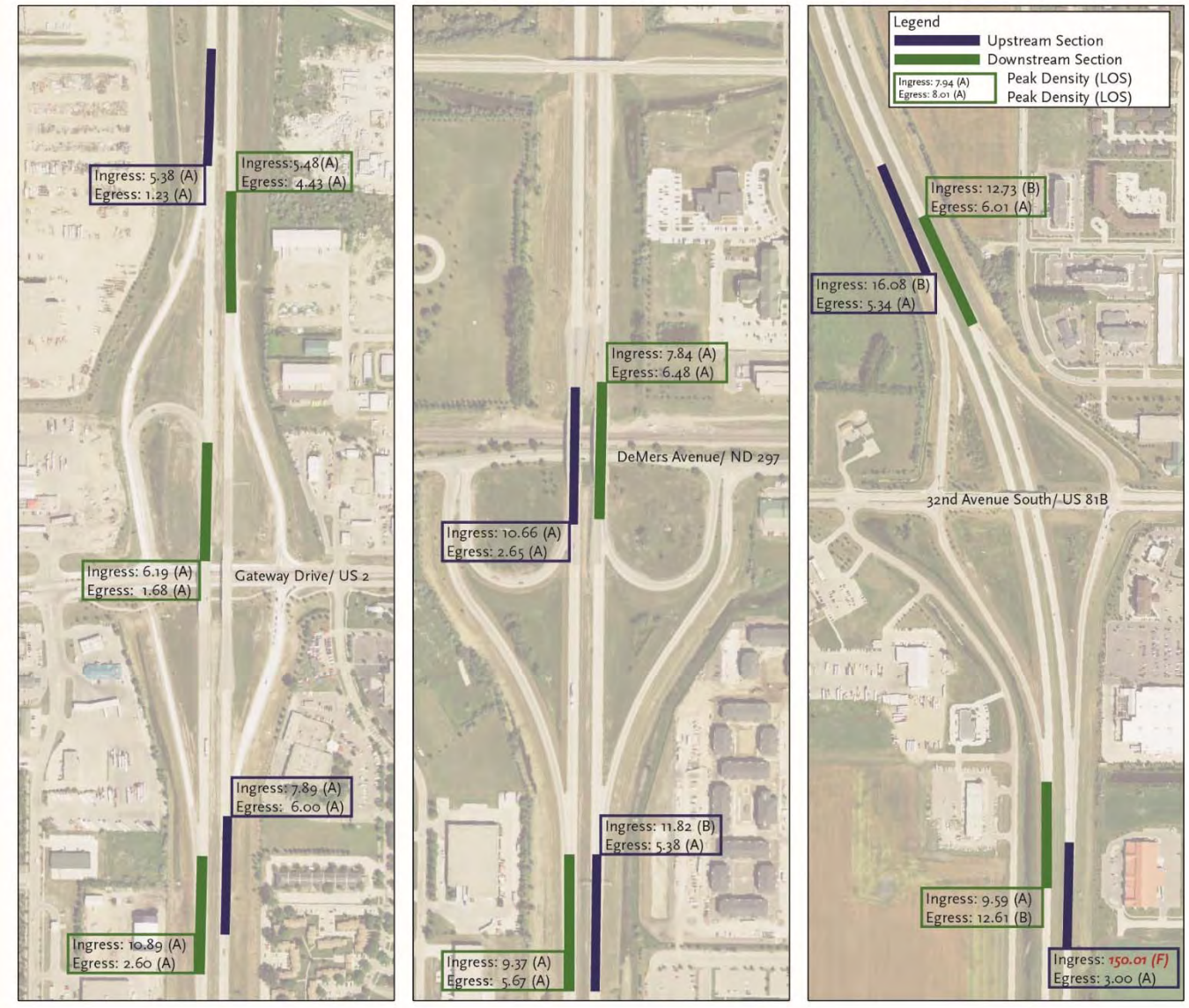
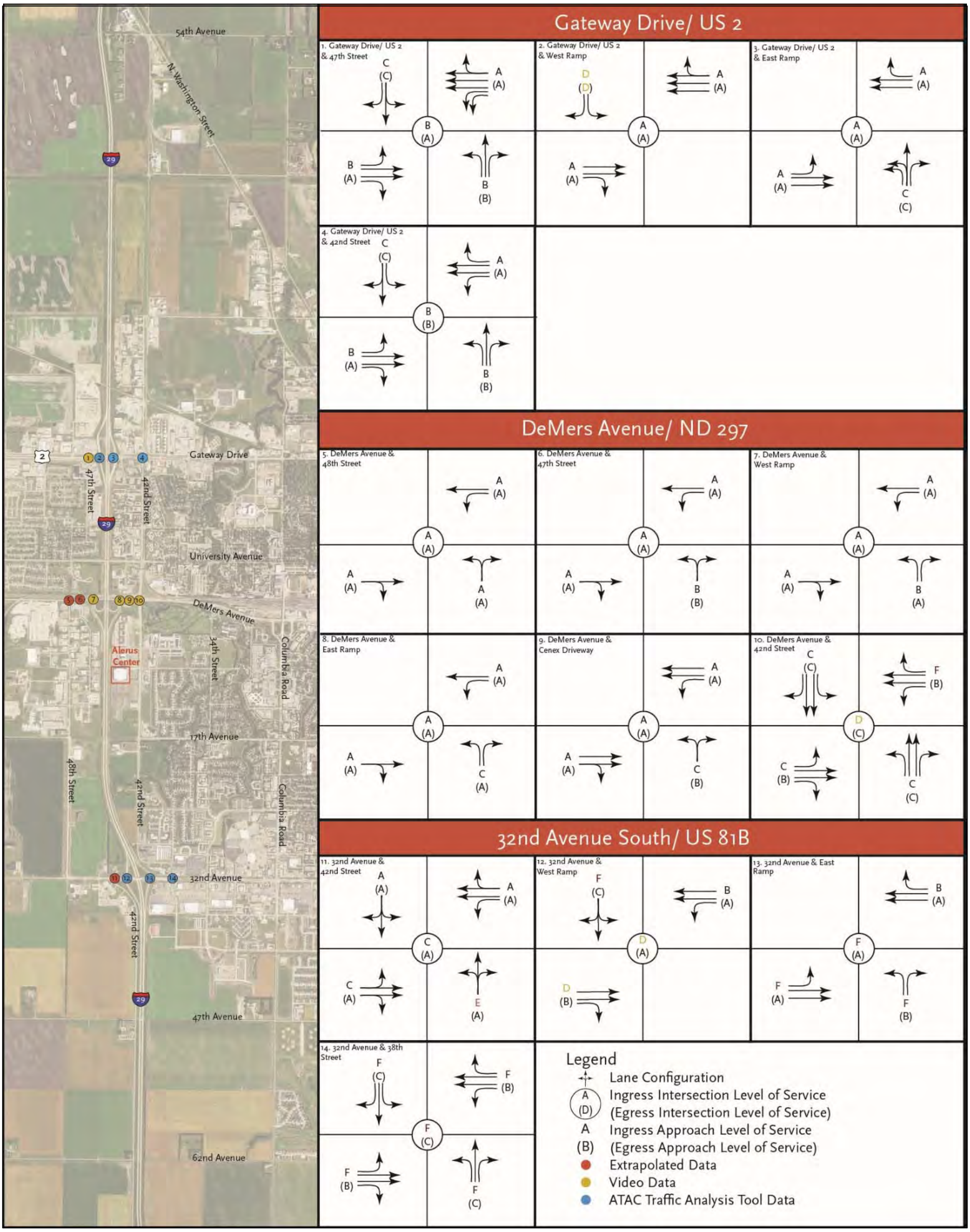


Figure 4-9: 2015 Maximum Congestion Event Scenario Ingress and Egress Levels of Service



2040 TRAFFIC OPERATIONS

This scenario estimates how a similar event at the Alerus Center would operate in 2040. During 2025 and 2040 operations analysis completed for the Future Conditions Analysis in Chapter 3, it was noted that traffic control signals at the DeMers Avenue/ND 297 East Ramp and West Ramp intersections were needed, with specific geometry determined in Chapter 7. Under these event scenarios, traffic control signals were not warranted. Due to the uncertainty of the specific control and design, no traffic control signals were included in this analysis.

2040 NORMAL EVENT SCENARIO TRAFFIC OPERATIONS

2040 Normal Event Scenario Ingress Traffic Operations

Under 2040 Normal Event Scenario ingress, all intersections operate at acceptable levels of service. Refer to Figure 4-11 for detailed results of traffic operations analysis; a summary is provided below.

- All study intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "B" or better during ingress. This is an improvement compared to daily future 2040 P.M. peak hour operations, where the East Ramp intersection is expected to operate at LOS "F".
- All study intersections in the Demers Avenue/ND 297 interchange functional area operate at LOS "B" or better during ingress. This is an improvement compared to daily future 2040 P.M. peak hour operations, where deficient operations are expected at multiple locations throughout the interchange functional area.
- All 32nd Avenue/US 81B interchange functional area study intersections operate at LOS "B" or better with exception the LOS "C" experienced at the 32nd Avenue/US 81B and 38th Street intersection during ingress. The southbound approach at 32nd Avenue South/US 81B and 38th Street experiences excessive delay and operates at LOS "F". Overall, this interchange functional area operates better under ingress conditions when compared to future 2040 P.M. peak hour operations, where the West Ramp, East Ramp and 38th Street intersections operate at LOS "F.

2040 Normal Event Scenario Egress Traffic Operations

Under 2040 Normal Event Scenario egress, all intersections operate above minimum standards with the exception of 32nd Avenue South/US 81B and 38th Street which experiences deficiencies at the southbound approach. Refer to Figure 4-11 for detailed results of traffic operations analysis; a summary is provided below.

- All intersections in the Gateway Drive/US 2 interchange functional area operate at LOS "A" during egress. This is an improvement compared to daily future 2040 P.M. peak hour operations.
- All intersections in the Demers Avenue/ND 297 interchange functional area operate at LOS "A" before an event except for the 42nd Street intersection, which operates at LOS "B" during egress. This is an improvement compared to daily future 2040 P.M. peak hour operations.
- All 32nd Avenue/US 81B interchange functional area study intersections operate at LOS "A" with exception of the LOS "B" experienced at the 38th Street intersection during egress. This is an improvement compared to future 2040 P.M. peak hour operations where the West Ramp, East Ramp and 38th Street intersections are expected to operate at LOS "F".

Similar to the 2015 Normal Event Scenario traffic operations, intersection volumes do not increase nor do operations worsen during Alerus Center events when compared to projected regular P.M. peak hour operations.

Interstate Network Performance for 2040 Normal Event Scenario

The overall interstate network has an average link density of 12.74 passenger cars per lane mile (pcplm) during ingress and 4.37 pcplm during egress, shown in Table 4-5. These densities are slightly lower when compared to the Maximum Congestion Event Scenario, caused by other background traffic with the extended P.M. peak hours during the Maximum Congestion Event Scenario. The average speed during ingress and egress was around 71 miles per hour. Link densities were evaluated more closely at the 500-foot upstream and downstream sections of the three urban interchanges; all links operated acceptably (Figure 4-10).

Table 4-5: 2015 Maximum Congestion Event Scenario Overall Interstate Performance

	Average Link Density (LOS)	Average Speed (mph)
Ingress	12.74 (B)	70.7
Egress	4.37 (A)	70.9

Figure 4-10: 2040 Normal Event Scenario I-29 Densities for Upstream and Downstream Sections for Urban Interchanges

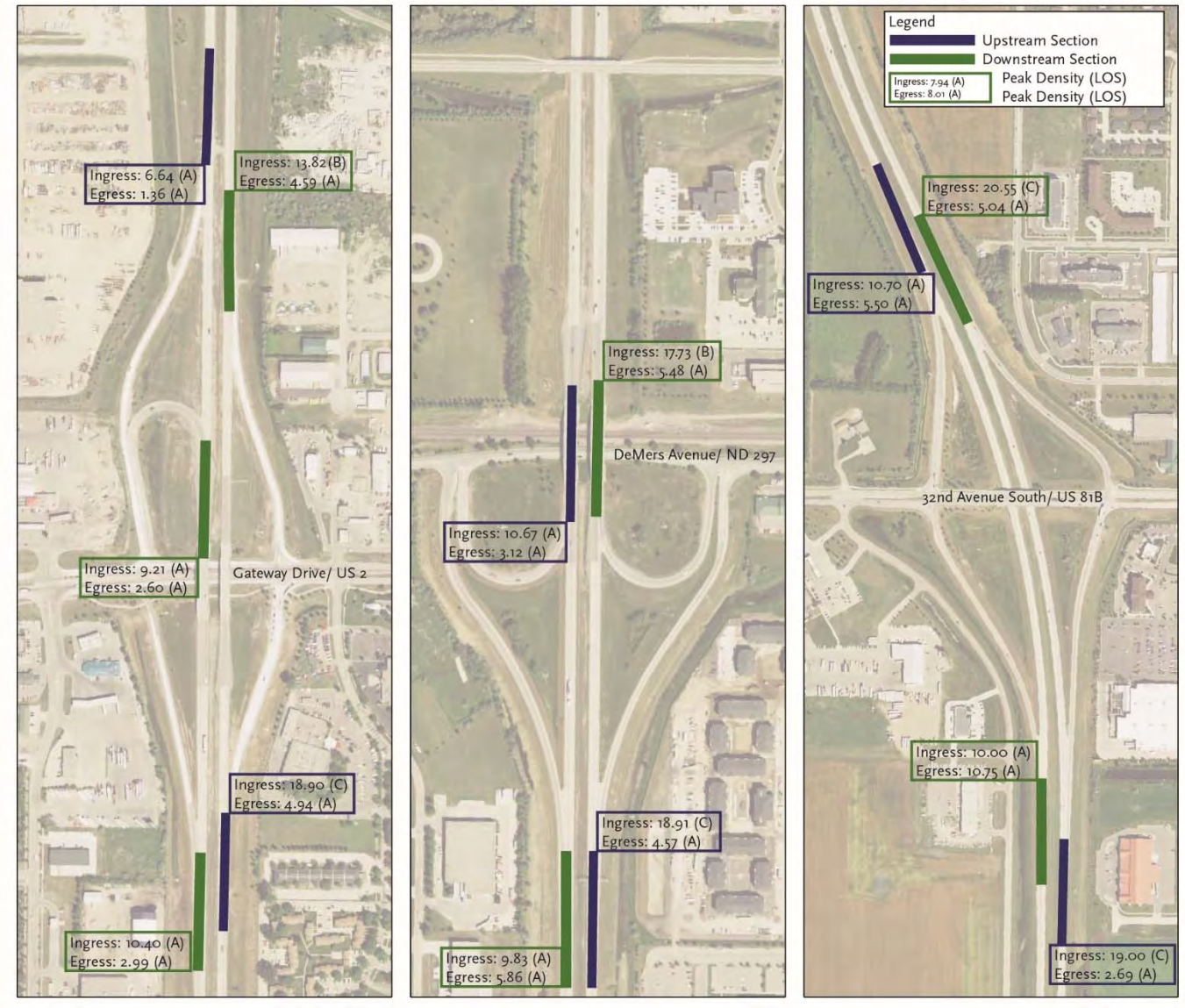
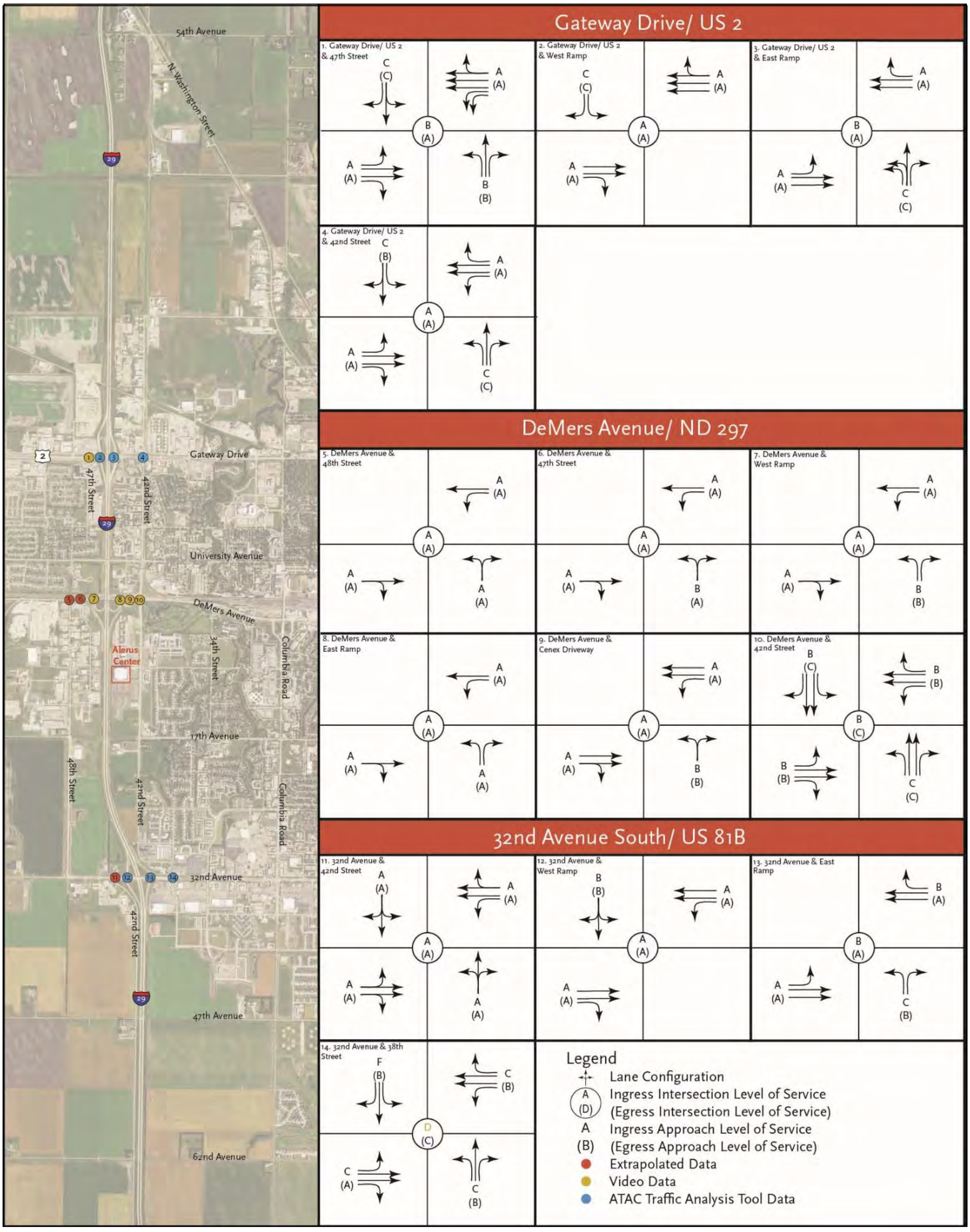


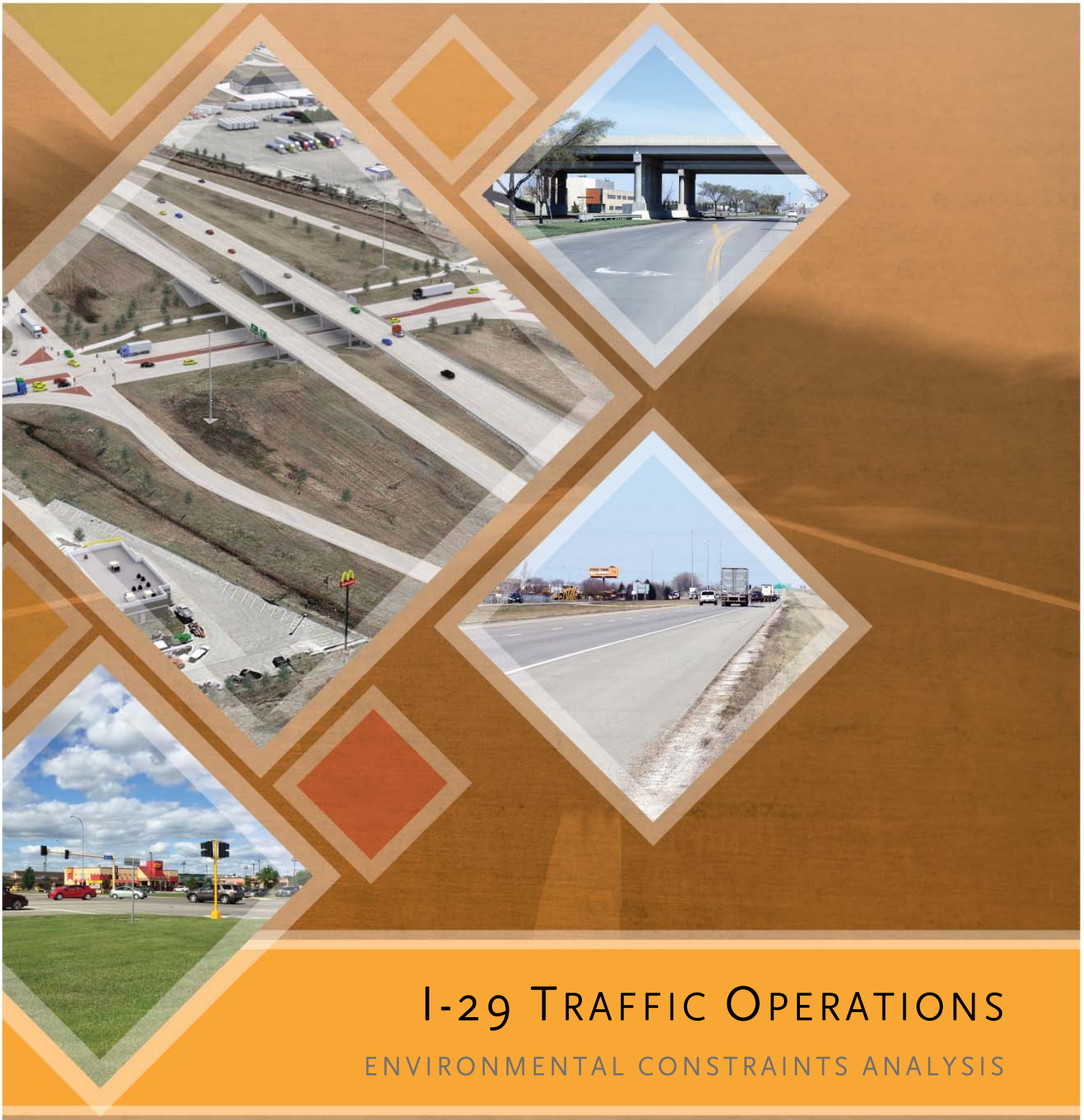
Figure 4-11: 2040 Normal Event Scenario Ingress and Egress Levels of Service



SUMMARY OF TRAFFIC OPERATIONS

Below is a summary of key findings from the chapter. This information will be used when assessing improvement needs and evaluating alternatives.

- *2015 Normal Event Scenario:* The divergence of Alerus Center event traffic and normal P.M. peak hour traffic resulted in no deficiencies at study intersections or on mainline I-29 for both ingress and egress. When compared to normal P.M. peak hour operations, each study intersection operates at the same level or better.
- *2015 Maximum Congestion Scenario:* The convergence of retail holiday and weekend traffic with a sold out Alerus Center event will generate clear operational deficiencies on 32nd Avenue/US 81B. Congestion oversaturates the intersections with 38th Street and the East Ramp, two intersections that operate effectively under normal peak hour operations. This will continue to deteriorate operations as traffic volumes increase into the future. The corridors of Gateway Drive/US 2 and DeMers Avenue/ND 297 operate efficiently under this scenario except for the intersection of 42nd Street and DeMers Avenue/ND 297 which approaches capacity.
- *2040 Normal Event Scenario:* The divergence of Alerus Center event traffic and normal P.M. peak hour traffic resulted in no deficiencies at study intersections or on mainline I-29 for both ingress and egress. When compared to normal 2040 forecasted P.M. peak hour operations, each study intersection operates at the same level or better.



I-29 Traffic Operations

Environmental Constraints Analysis

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5. ENVIRONMENTAL CONSTRAINTS

Project Purpose and Need

The purpose and need for the project have been developed under guidance pursuant to 23 CFR 450 Appendix A (Linking the Transportation Planning and NEPA Processes). Identifying project needs and developing a project purpose at the corridor planning level aids in the development, evaluation, prioritization and elimination of alternatives. The overall project purpose and needs identified during this corridor level planning study will be carried into the NEPA phase of project development (if applicable) and further refined to aid in the selection of a preferred alternative.

PURPOSE OF THE PROJECT

The purpose of the corridor study is to identify existing and future transportation issues within the study corridor and develop project alternatives to address them. Transportation issues may include capacity deficiencies, current or future transportation demands, social or economic demands, model interrelationships, safety and roadway deficiencies.

NEED FOR THE PROJECT

The analysis of existing and future conditions throughout the Grand Forks I-29 project corridor has identified numerous needs/deficiencies that either currently exist or are expected to develop based on future traffic projections. These needs vary by location but carry common themes throughout the project corridor. A summary of these needs is presented in Table 5-1 below.

Table 5-1: I-29 Project Corridor Needs

FHWA Purpose and Need Guidelines	Functional Area	Specific Needs Within Functional Area
Capacity	Gateway Drive/US 2 Interchange	Increasing commercial and industrial demand is expected to cause the interchange functional area to operate deficiently by 2040, with LOS "F" expected at the East Ramp and 43rd Street intersections. In addition, train events produce significant operational deficiencies along Gateway Drive/US 2. When train events occur on the Glasston Subdivision Line, Gateway Drive/US 2 is completely blocked, creating delays and queues that back up onto the interstate.
	DeMers Avenue/ND 297 Interchange	The interchange functional area is expected to operate deficiently by 2025. Nearly every intersection in the functional area operates deficiently during the A.M. peak by 2040 and travel time through the interchange functional area is nearly four times longer than during free flow conditions.
		Train blockages at 42nd Street just north of DeMers Avenue/ND 297 create queueing that extends to the interchange and will likely reroute several thousand vehicles onto the interstate by 2040.
	32nd Avenue South/US 81B Interchange	Massive amounts of growth forecasted within one mile of interchange (more than 2,800 new jobs and 725 new households by 2040), starts to overburden interchange as soon as 2025. Deficient operations are expected at the West Ramp, East Ramp and 38th Street intersections. These delays are anticipated to affect mainline I-29, producing deficient operations at the northbound and southbound off-ramp diverge areas due to queues extending onto mainline I-29. Travel time more than doubles from 2015 to 2040 through this interchange functional area, adding nearly two minutes over free flow travel time.
Transportation Demand	47th Avenue South	An interchange at this location was included in the 2040 LRTP's illustrative project list.
	32nd Avenue South/US 81B Interchange	Improvements along 32nd Avenue South/US 81B through the study area include widening to six lanes which was planned for construction between 2031 and 2040. Additionally, realigning 42nd Street to the East Ramp intersection in this interchange functional area was included in the 2040 LRTP's illustrative project list.
	17th Avenue South	The 2035 LRTP included an overpass as a mid-term project; however, this project was moved to the illustrative project list in the 2040 LRTP.
	DeMers Avenue/ND 297 Interchange	No capacity enhancements have been included in previous LRTPs, but the 2040 LRTP did include an illustrative project for traffic control signals at the East Ramp and West Ramp intersections.
	Gateway Drive/US 2 Interchange	Improvements at this intersection were studied during the US 2 Corridor Study but have not been included in any cost constrained list of projects for the 2040 LRTP.
Social or Economic Demand	Corridor Wide	East-west connectivity for all modes of transportation is impeded by current and future forecasted congestion.
		East-west bicycle and pedestrian connectivity is limited to Gateway Drive/ US 2, University Avenue and 32nd Avenue South/US 81B, leaving a 2.25 mile gap between University Avenue and 32nd Avenue South/US 81B to cross the interstate.
		No existing dedicated bicycle or pedestrian facilities at the North Washington Street/CR 11/ US 81 interchange functional area, the 47th Avenue South corridor or the Merrifield Road/ CR 6 corridor. Bicycles can and do use the roadway; shoulders at this location are wide enough to support bicycle activity according to AASHTO.
	32nd Avenue South/US 81B Interchange	Massive amount of growth forecasted within one mile of interchange (more than 2,800 new jobs and 725 new households by 2040). This growth is expected to overburden existing transportation facilities resulting in deficient traffic operations. This breakdown in traffic operations would have associated social and economic impacts to the traveling public as well as businesses within the study area. Improving

FHWA Purpose and Need Guidelines	Functional Area	Specific Needs Within Functional Area
		overall traffic operations would satisfy these social demands and promote economic development within the surrounding area.
Modal Interrelationships	Gateway Drive/US 2 Interchange & University Avenue Overpass	Limited transit accessibility at the University Avenue overpass and Gateway Drive/US 2 interchange.
Safety	I-29 Mainline between Gateway Drive/ US 2 and DeMers Avenue/ ND 297	This one-mile section of I-29 experienced 28 crashes over five years, with 14 being due to weather or winter roadway conditions. Three occurred when a vehicle tried to merge onto southbound I-29.
	DeMers Avenue/ND 297 and East Ramps Intersection	A total of 14 total crashes over five years at this intersection, of which five were northbound rear-end crashes. Often times, at locations with a yield controlled right-turn, motorists look upstream for gaps in traffic and not forward, and then collide with vehicles ahead.
	DeMers Avenue/ND 297 and 42nd Street intersection	A total of 28 left-turn crashes at this intersection over five years. Special events at the Alerus Center and train events may result in long queues and delays. As motorists become frustrated, they become more likely to take risks to avoid these long delays.
	32nd Avenue South/US 81B and West Ramps Intersection	Seven crashes have occurred at this intersection over the past five years when a driver ran a red light. Adjustments to clearance intervals may mitigate this trend.
	32nd Avenue South/US 81B and 38th Street Intersection	A total of 42 crashes at 38th Street have occurred over the past five years, of which 14 were left-turn crashes. Negative offset turn lanes may obstruct views of conflicting traffic. Six additional crashes were caused by drivers running red lights. This intersection also experienced 15 rear-end crashes that may be linked to stop-and-go traffic. Improved operations at this intersection could mitigate these crash trends.
Roadway Deficiencies	North Washington Street/CR 11/US 81 Interchange	Eight access points currently exist in less than 1.25 miles.
	Gateway Drive/US 2 interchange	Four signalized intersections (and one two-way stop controlled intersection) in 0.4 miles.
	DeMers Avenue/ ND 297 interchange	Current Cenex driveway introduces conflicts and mixed speeds.

Affected Environment

To properly assess potential impacts of a project, a baseline of existing environmental conditions was developed. A desktop assessment of the project corridor was completed using a variety of state, federal and local resources. This baseline information was divided into resources categories and the potential for impacts to each resources category was assessed based on the project information known to date. As project alternatives are developed and refined, this assessment of impacts will also become more refined. Please refer to Figure 5-1 for a visual overview of known environmental considerations within or adjacent to the *General Travel Corridor*.

» **Development of General Travel Corridor.** For the purposes of the environmental screening for the I-29 Traffic Operations Study, a G*eneral Travel Corridor* was defined to assist with the screening of project alternatives. The development of the *General Travel Corridor* defines the general corridor within which smaller scale project alternatives would be developed at the planning level and potentially transitioned into NEPA. The I-29 Traffic Operations Study considers both the I-29 Mainline as well as existing and future intersecting arterials. Therefore, the *General Travel Corridor* includes existing and future roadways outside of I-29 mainline (e.g. 47th Avenue, 17th Avenue, Gateway Drive/US 2, 42nd Street, etc.).

WETLANDS

The United States Fish and Wildlife Service National Wetland Inventory (NWI) Map indicates the potential for presence of wetlands within the project corridor. NWI wetlands are identified in the general area of the Demers Avenue/ND 297 and Gateway Drive/US 2 interchanges. Aerial imagery reveals additional wetland signatures within the interstate right-of-way and the English Coulee bisects I-29 near 17th Avenue South. Once project alternatives have been developed, it is recommended a field wetland delineation be completed and submitted to the US Army Corps of Engineers (USACE) for a jurisdictional determination. A permit from the USACE may be required in the event project activities result in permanent impacts to jurisdictional wetlands.

The majority of the wetlands located along the project corridor appear to be artificially created. Impacts to artificial wetlands do not require mitigation per Executive Order 11990; however, wetland mitigation may still be required in the event the USACE assumes jurisdiction and impacts exceed established thresholds.

FLOODPLAIN

According to the Federal Emergency Management Agency's (FEMA) flood hazard mapping program, the majority of the study area is located within a Zone X flood hazard area. This area is protected from a one-percent-annual-chance or greater flood hazard by a levee system. In addition, there are two areas (Legal Drain 27 and the flood diversion channel south of North Washington Street/CR 11/US 81 interchange) that are designated as a Zone AE flood hazard area. These areas are subject to inundation by the one-percent-annual-chance or greater flood hazard and base flood elevations have been determined. It is recommended that any proposed projects be coordinated with FEMA to ensure compliance with the National Flood Insurance Program.

CULTURAL

A review of the State Historical Society of North Dakota's site records was completed for the study area. This review identified several site leads and unevaluated cultural resources within or adjacent to the study area. Most of these cultural resources were associated with the University of North Dakota campus and its buildings as well as the railroad. It is unlikely that a proposed project would result in an adverse impact to any of these identified cultural resources; however, it is recommended that additional cultural investigations be completed for any future projects.

NOISE

Construction and operation of a transportation facility has the potential to result in noise impacts on noise sensitive receptors in proximity to the proposed action. Noise sensitive receptors within or near the project corridor included

residential housing, schools, parks and medical facilities. Once project alternatives have been developed, it is recommended that a noise analysis be completed to assess existing and future noise levels. Should project alternatives result in noise impacts, analysis of noise abatement should be completed to determine if the implementation of noise abatement would be considered reasonable and feasible.

SECTION 4 (F)

Section 4(f) properties located within or near the project corridor include parks and shared-use paths. The potential for impacts to these properties would be determined during the alternatives analysis later in this report. In the event that project alternatives would result in impacts to Section 4(f) properties, those impacts would be coordinated with the official with jurisdiction to determine the level of impact and develop potential mitigation or minimization measures.

ENVIRONMENTAL JUSTICE

Using the Grand Forks-East Grand Forks Metropolitan Planning Organization's (MPO) Environmental Justice Program Manual, it was determined that a low-income/minority block group occurs directly east of the project area between the DeMers Avenue/ND 297 and Gateway Drive/US 2 interchanges. In the event that a proposed project alternative were to be developed within this area, it would be the responsibility of FHWA to identify and address any potential disproportionately high effects of the project on minority and low-income populations.

VISUAL

The modification/addition of interchanges and overpasses could add obstructions to the view shed in the region. The potential for visual impacts should be assessed during project design. In the event that adverse visual impacts are anticipated to result from a proposed project alternative, the incorporation of aesthetic design enhancements and visual barrier should be considered to mitigate for any potential adverse impacts.

SOCIAL/ECONOMIC IMPACTS

All transportation projects have some level of associated social and economic impacts. One of the primary needs identified at several locations throughout the project corridor is the need for additional roadway capacity to accommodate existing and future traffic volumes. The 32nd Avenue South/US 81B interchange and DeMers Avenue/ ND 297 interchange in particular have a high amount of forecasted growth occurring within a one-mile radius. Under existing conditions, this growth is expected to overburden several intersections within the corridor resulting in deficient traffic operations. This breakdown in traffic operations would have associated social and economic impacts to the traveling public as well as businesses within the study area. Improving overall traffic operations would satisfy these social demands and promote economic development within the surrounding area.

Positive social impacts may also be realized through the incorporation of additional shared-use paths and pedestrian facilities into project alternatives. As highlighted previously, there are currently significant gaps in the overall network of pedestrian facilities throughout the project corridor, particularly in terms of east/west connectivity across I-29. Incorporation of additional facilities would satisfy this need and have positive social impacts to users and the surrounding community.

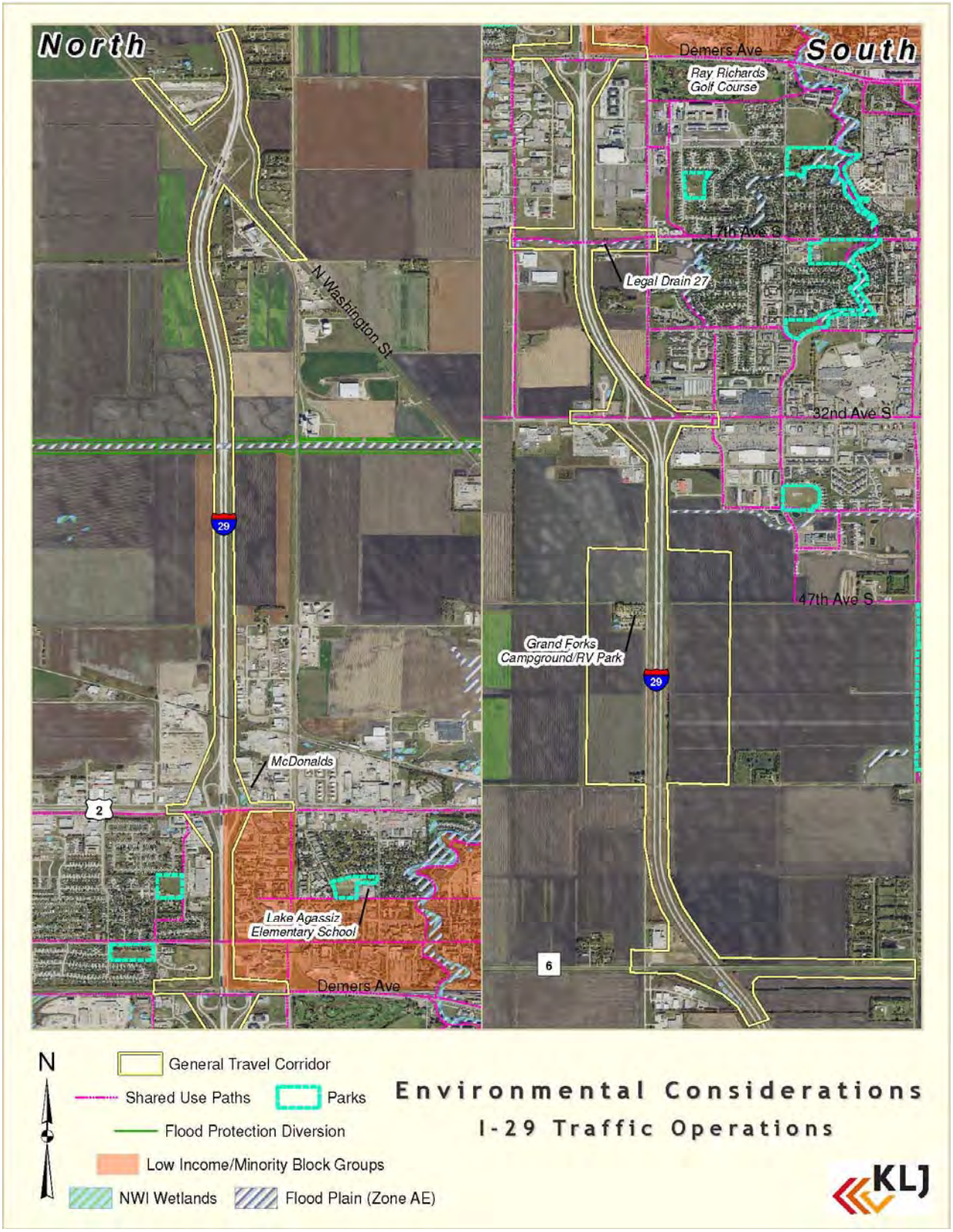
Project alternatives may also have the potential for negative social and economic impacts in the form of buyouts/relocations. Previous studies have identified the potential for interchanges at 47th Avenue South and Grand Forks County Road 6, as well as an overpass at 17th Avenue South. Construction of these facilities would require the acquisition of right-of-way from adjacent land owners and could potentially result in the buyout/relocation of adjacent businesses. At 47th Avenue South, cropland comprises the majority of the existing land use with the exception of the southwest corner which is currently occupied by the Grand Forks Campground/RV Park. Construction of an interchange at this location would likely necessitate a buyout/relocation of this business. Additional potential for relocations identified in previous studies include the McDonalds restaurant northeast of the Gateway Drive/US 2 Interchange. Preliminary concepts for redesigning this interchange have identified the potential for right-of-way acquisitions within this area.

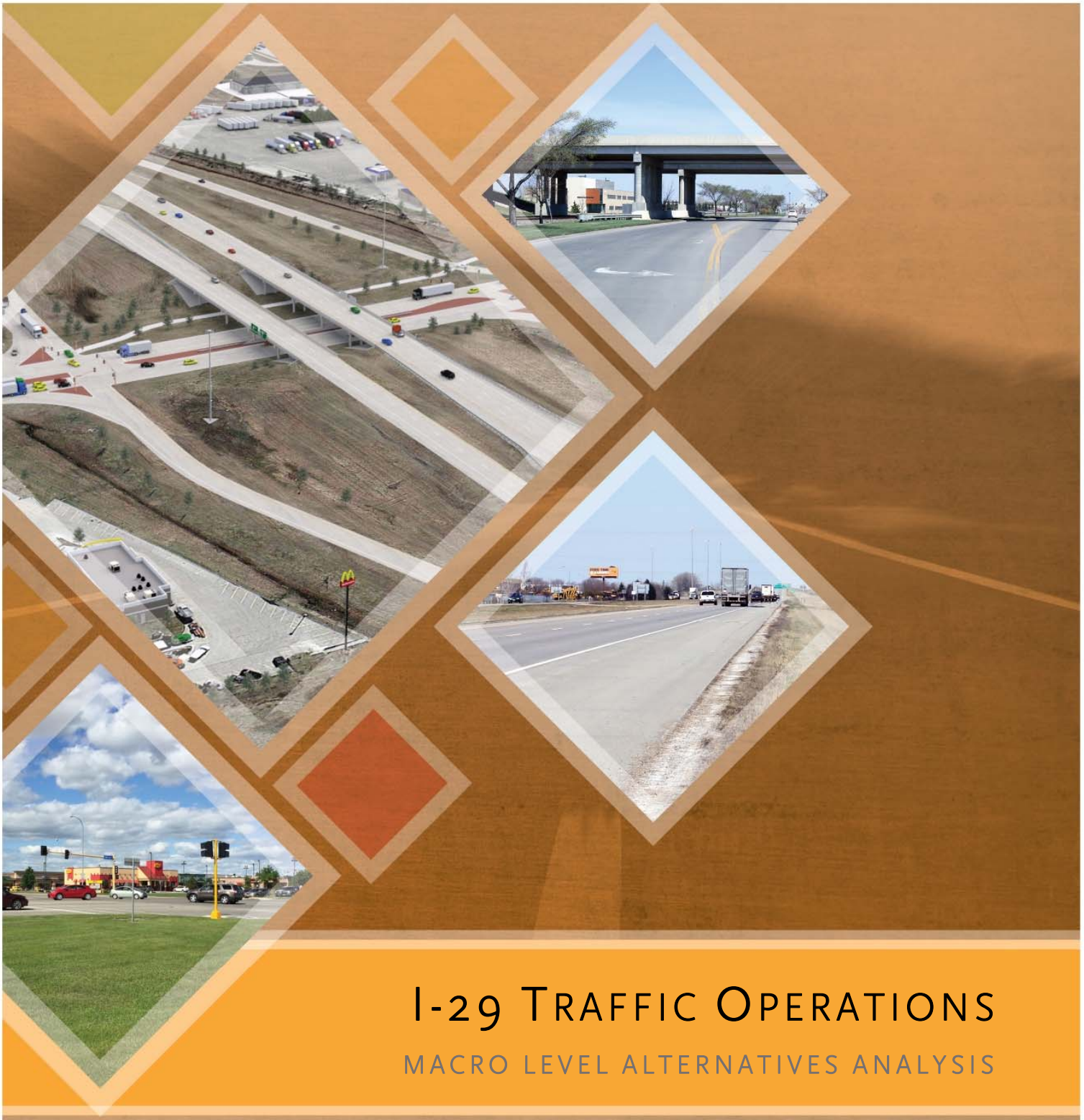
ALTERNATIVE EVALUATION

Alternatives are presented in later chapters of this study. The information provided in this chapter will be critical to screen alternatives and evaluate planning level environmental impacts as detailed below.

- **Screen Alternatives.** According to 23 CFR 450 Appendix A (Linking the Transportation Planning and NEPA Processes), there are two ways in which the transportation planning process can limit the alternative solutions to be evaluated during the NEPA process: (a) shaping the purpose and need for the project or (b) evaluating and eliminating alternatives from detailed study in the NEPA process prior to its start.
- **Evaluate Planning Level Environmental Impacts.** Alternatives were evaluated using a planning level assessment of environmental impacts. Impacts will be evaluated quantitatively where possible (i.e. acres of ROW impacts) with certain impacts evaluated qualitatively (i.e. social).

Figure 5-1: Environmental Considerations





I-29 Traffic Operations

Macro Level Alternatives Analysis

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6. MACRO LEVEL ALTERNATIVES ANALYSIS

Introduction

The purpose of this study is to identify infrastructure investments that will be required to meet the area's transportation needs (safety, capacity, mobility, accessibility and multimodal infrastructure). The macro level alternatives analysis will utilize the regional travel demand model (TDM) as the primary analysis tool. The Advanced Traffic Analysis Center (ATAC) at North Dakota State University (NDSU) has provided TDM outputs to compare a variety of future major infrastructure scenarios:

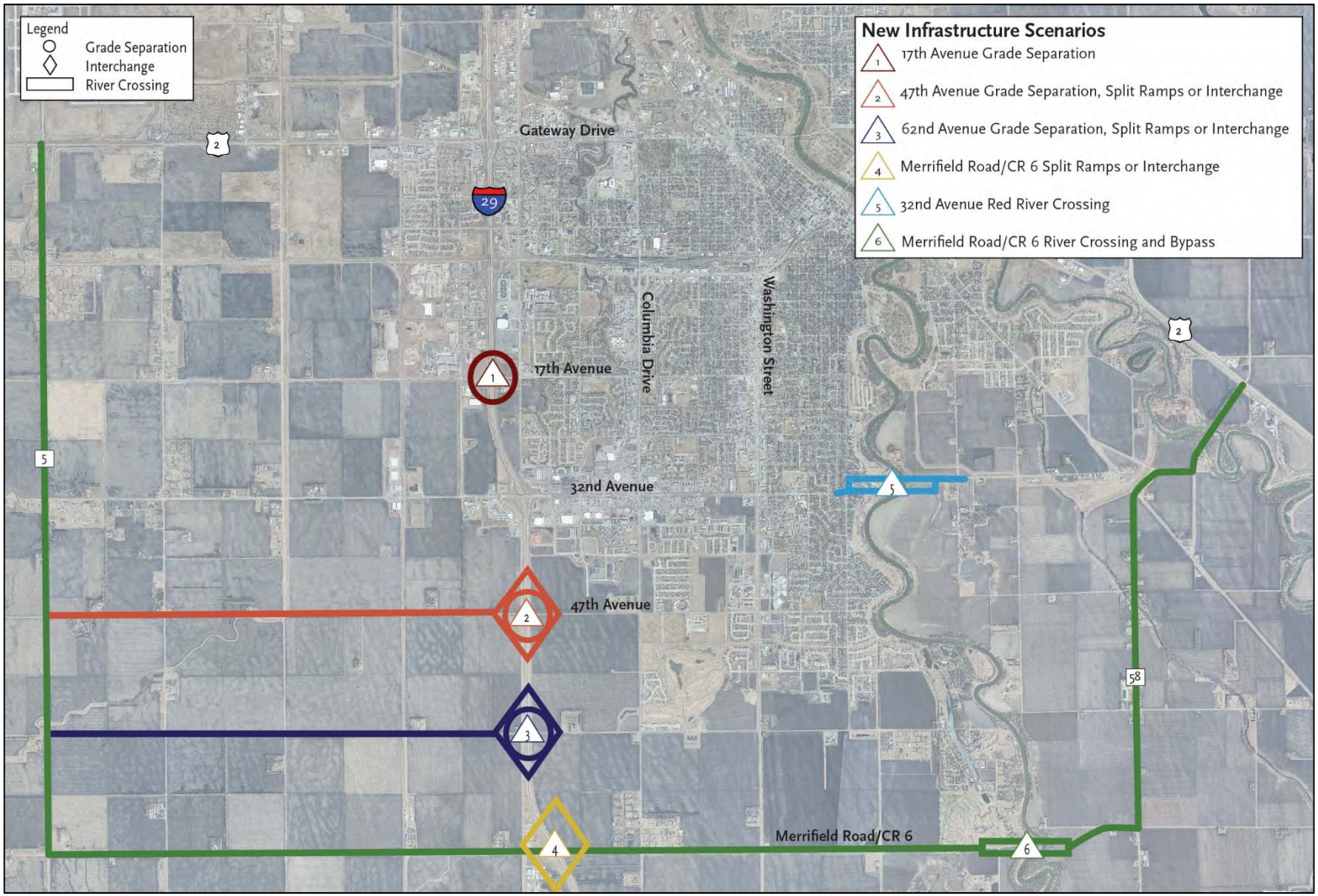
- Merrifield Road/CR 6 Interchange
- Merrifield Road/CR 6 Red River Crossing
- Merrifield Road/CR 6 Interchange and Red River Crossing
- 32nd Avenue Red River Crossing
- 32nd Avenue Red River Crossing with Merrifield Road/CR 6 Interchange and Red River Crossing
- 17th Avenue Grade Separation
- 47th Avenue Grade Separation
- 17th Avenue and 47th Avenue Grade Separation
- 47th Avenue Interchange
- 47th Avenue Interchange and 17th Avenue Grade Separation
- 47th Avenue and Merrifield Road/CR 6 Interchanges
- 62nd Avenue Grade Separation
- 62nd Avenue Interchange
- 62nd Avenue and Merrifield Road/CR 6 Interchanges
- 47th Avenue Southbound Off-Ramp and Northbound On-Ramp with Merrifield Road/CR 6 Northbound Off-Ramp and Southbound On-Ramp
- 62nd Avenue Southbound Off-Ramp and Northbound On-Ramp with Merrifield Road/CR 6 Northbound Off-Ramp and Southbound On-Ramp

Each of the infrastructure scenarios have different benefits to the study area and overall metro transportation network. However, given the list of unfunded needs in the Grand Forks – East Grand Forks metro, only the most productive infrastructure scenarios should move forward for further analysis. For the purposes of alternatives screening, scenarios were broken into two categories based on their major impact areas: Mainline Improvements and Interchange Improvements.

- Mainline improvement scenarios provide more significant benefit to I-29 than to the existing interchanges. They are designed to provide more direct and efficient routes as alternatives to I-29. These scenarios result in large reductions to vehicle miles traveled.
- Interchange improvement scenarios provide congestion relief to existing interchanges. They are designed to provide additional and alternative I-29 crossings. These scenarios result in large reductions to vehicle hours traveled.

If in isolation the scenario did not meet the screening criteria established in this document, any related hybrid scenario was discarded. Because the TDM does not include alternative modes of transportation, this element was not included in the macro level alternatives analysis. However, pedestrian, bicycle and transit improvements were studied in greater detail during later stages of the study.

Figure 6-1: Infrastructure Scenarios



IMPROVEMENT ASSUMPTIONS

32ND AVENUE/US 81B

The TDM incorporated all existing and committed infrastructure projects from the cost constrained 2040 Long Range Transportation Plan (LRTP), including widening and reconstruction of 32nd Avenue/US 81B from the East Ramp intersection to Columbia Road. However, analysis completed for this study found additional 32nd Avenue/US 81B improvements may be necessary for acceptable operations.

Some alternatives eliminate the need to include the widening, reconstruction and reconfiguration of the 32nd Avenue/US 81B interchange functional area. While this could be evaluated as a benefit, NDDOT requested all 32nd Avenue/US 81B improvements be evaluated as a cost because it more accurately represented the financial burden in the Grand Forks District. They believed that including 32nd Avenue/US 81B reductions in improvement costs as a benefit understates all I-29 system needs and could lead to specific improvements that do not have system-wide benefits. For this reason, all improvements that do not mitigate capacity constraints include a 32nd Avenue/US 81B six-lane widening with interchange reconfiguration cost.

East Ramp to Columbia Road

The 2040 LRTP included widening and reconstruction of 32nd Avenue/US 81B from the East Ramp intersection to Columbia Road, approximately a one-mile segment, with a 2013 cost estimate of $6.0 million, or $1.0 million per lane mile. Recent project experience suggested this cost estimate was too low and the study team put together an estimate around $1.5 million per lane mile. Based on comments received from the Steering Committee, this cost was again increased using four recent and comparable projects from Bismarck, Fargo and Grand Forks:

- North Washington Street, Bismarck (2015): $1.6 million per lane mile
- East Divide Avenue, Bismarck (2013): $2.0 million per lane mile
- 13th Avenue, Fargo (2015): $2.5 million per lane mile
- Columbia Road, Grand Forks (2013): $3.0 million per lane mile

Ultimately, costs were increased to $2.025 million per lane mile, or $12.1 million for the 32nd Avenue/US 81B widening and reconstruction. For the purposes of the benefit-cost analysis, only two lane-miles were included in the costs. Acknowledging that 32nd Avenue/US 81B widening and reconstruction is still a cost that must be incurred, none of the alternatives can mitigate pavement quality, but some can mitigate capacity constraints.

Table 6-1: Cost Estimates for 32nd Avenue/US 81B Reconstruction and Widening

Estimate Source	Lane Mile Cost
2040 LRTP	$1.0 Million
Itemized Estimate	$1.5 Million
Similar Project Cost	$2.025 Million

48th Street to East Ramp

The following infrastructure was included to estimate baseline 32nd Avenue/US 81B interchange reconfiguration improvements to permit the 32nd Avenue/US 81B interchange to operate efficiently, based on the heaviest movements through the interchange:

- Widen 32nd Avenue/US 81B from 48th Street through the East Ramp intersection.
- Northbound double right-turn lane for significant right-turn movements at the East Ramp intersection.
- Northwest or southwest loop ramp to address significant left-turn movements at the West Ramp intersection. Consideration should be given to a fourth eastbound lane to be dropped at 38th Street.

These improvements will be refined later in the study, but have been used to develop preliminary cost estimates for this analysis, estimated at $12.4 million (2016 dollars). Cost estimates can be found in Appendix D. The widening, reconstruction and interchange improvements will be referred to as baseline 32nd Avenue/US 81B improvements throughout this chapter.

Capacity

Because the TDM already includes capacity enhancements along 32nd Avenue/US 81B, service volume tables were developed using the ARTPLAN module of the HCS 2010 computer software. The software implements concepts and methodologies from the *Highway Capacity Manual* at the corridor level. Based on the characteristics of the 32nd Avenue/US 81B corridor between I-29 and Columbia Road, including signal spacing and turning percentages, LOS "D" or better could be expected with the existing roadway configuration with daily traffic volumes up to approximately 27,000 vehicles per day. Deficient operations (LOS "E" or worse) are expected to be triggered at volumes above 27,000 vehicles per day.

While these volume thresholds appeared low, the results were confirmed by cross-checking with Volume/Capacity (V/C) ratios in the TDM. The 2040 TDM includes 32nd Avenue/US 81B from the East Ramp to Columbia Road as a six-lane section, so links west of the East Ramp and east of Columbia Road were used to provide indicators of the approximate volume thresholds and V/C ratios.

Table 6-2: ADT Thresholds by Lanes and Expected LOS

Lanes	LOS "D"	LOS "E"
4	26,600	35,800
6	42,300	54,500
8	57,800	73,300

OTHER INFRASTRUCTURE ASSUMPTIONS

The analysis completed for this study assumed no infrastructure could be constructed before 2025. The Grand Forks – East Grand Forks Transportation Improvement Plan (TIP) and the North Dakota STIP have been completed through 2019. Construction of large infrastructure projects, like the alternatives included in these infrastructure scenarios, take several years for environmental documentation, design and construction. This does not account for the challenging financial environment in the Grand Forks – East Grand Forks metro. It is expected that the earliest any of these major projects could be built would be 2020 through 2025. To be conservative, 2025 was used, which also aligned with the first analysis year for the travel demand modeling completed for each scenario.

Cost Assumptions

The following resources were used to develop cost estimates:

- 2040 LRTP included many of the infrastructure scenarios included in this report. These costs were used where available.
- NDDOT Project Cost History per mile construction and engineering costs were used for cost estimates for the pavement improvements along the bypass corridor, which would connect US 2 in Minnesota to Merrifield Road/CR 6, Grand Forks County Road 5 (CR 5) and Gateway Drive/US 2. These costs were included to design the road to accommodate the increase in heavy truck traffic.
  - The bypass alignments in these scenarios are not expected to generate significant amounts of new traffic, but heavy truck traffic the roads may not be designed to accommodate. Alternative cost estimates were provided using the $2.0 million project from the 2040 LRTP to add turn lanes at key intersections. This does not include estimates for accelerated pavement deterioration that may be necessary with additional truck traffic.
- Roadway improvements were needed for 47th Avenue infrastructure scenarios. These improvements assume that a three-lane section is provided from 48th Street to 42nd Street is provided west of I-29 and from 38th Street to Belmont Road. All 47th Avenue infrastructure scenarios require a five-lane urban section from 48th Street to Columbia Road.
  - Alternative cost estimates for roadway improvements include a paved two-lane rural section from CR 5 to 48th Street.
- Roadway improvements were needed for 62nd Avenue infrastructure scenarios. These improvements assume that a paved two-lane rural section is provided from 48th Street to 42nd Street west of I-29 and from 38th Street to

Belmont Road east of I-29. Some 62nd Avenue infrastructure scenarios require a five-lane urban section from 42nd Street to 38th Street.

  - » Alternative cost estimates for roadway improvements include a paved two-lane rural section from CR 5 to 48th Street.
- Roadway improvements were needed for 42nd Street and 38th Street under the split ramp interchange infrastructure scenarios. This is assumed to be a two-lane rural roadway from 62nd Avenue to Merrifield Road/CR 6.
- Planning level, itemized cost estimates were compiled by the study team for all other infrastructure items.

All cost estimates were brought forward to 2025 using the MPO annual interest rate of 4.0 percent. Itemized costs are included in each set of infrastructure scenarios. Itemized cost estimates not included in the 2040 LRTP can be found in Appendix D.

I-29 MAINLINE

Neither the existing or future conditions analysis indicated additional capacity on I-29 mainline would be necessary. Many of the interchange infrastructure scenarios included in this analysis result in increased traffic on the I-29 mainline. Based on the TDM outputs, no additional capacity would be needed under any infrastructure scenario.

Universe of Infrastructure Scenarios

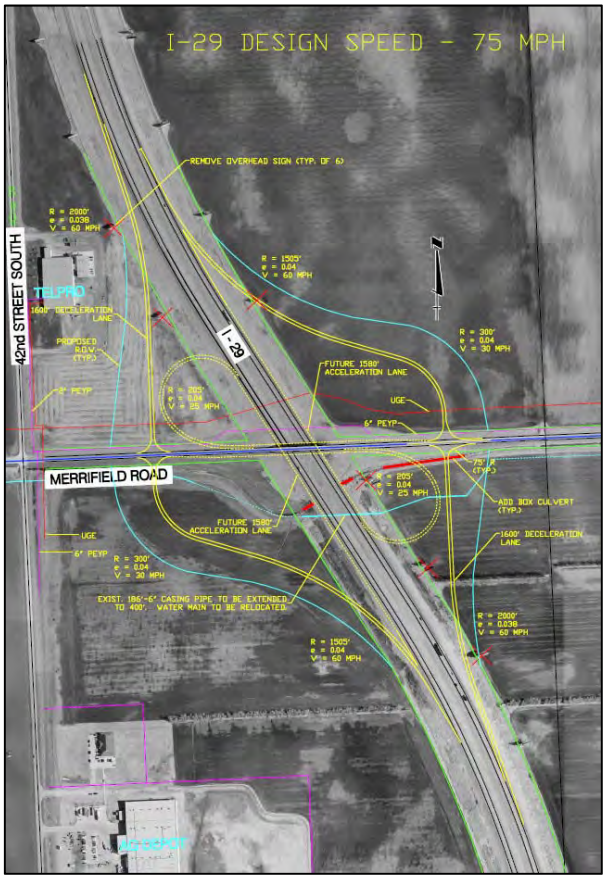
MERRIFIELD ROAD/CR 6

Merrifield Road/CR 6 is an important roadway to the county for many reasons. First, for several decades, efforts have been made to identify an alternative bypass/reliever route around the metro area, primarily for truck traffic. Currently, trucks are routed through dense urban areas on Gateway Drive/US 2 or DeMers Avenue/ND 297. One major area of concern is during beet harvest, when high volumes of trucks use DeMers Avenue/ND 297 through the heart of downtown Grand Forks and East Grand Forks. This route creates conflicts with local traffic, pedestrians, bicycles and school activity. Second, Merrifield Road/CR 6 is the southern edge of flood protection for the City of Grand Forks and will likely be the furthest south any development can reach.

Since the mid-1990s, the Merrifield Road/CR 6 corridor has been the center of the reliever route plan. To serve this purpose, major projects would be required, including converting the existing overpass into an interchange and a new bridge over the Red River to connect Merrifield Road/CR 6 to Polk County Highway 220 and County Road 58, ultimately connecting to U.S. Highway 2 in Minnesota.

Infrastructure improvements desired at Merrifield Road/CR 6 have been included in multiple LRTPs even before the 2035 and 2040 LRTPs. In 2002 an Interchange Justification Report (IJR) was completed for the Merrifield Road/CR 6 infrastructure improvements.

Figure 6-2: Proposed Interchange Ramp Design from Merrifield Interchange Justification Report



PAST STUDIES

Merrifield Interchange Justification Report (2002)

Completed in 2002, the IJR identified the Merrifield Road/CR 6 interchange as helping to reduce congestion along 32nd Avenue/US 81B and reduce truck traffic on county roads. They found the project to have a cost benefit greater than one with an estimated cost of ramp construction of $4.32 million in 2002 dollars.

Merrifield Road Red River Bridge Feasibility Study (2005)

This study evaluated multiple alignments for the potential Red River crossing, including vertical roadway profile requirements for flood mitigation. This report found the most cost-effective bridge design would cost $7.0 million with total roadway costs (both North Dakota and Minnesota side) of $5.5 million and other related costs of $2.9 million. The total estimated cost of the Red River Bridge crossing in this report was $15.4 million in 2005 dollars and was found to have a benefit-cost ratio greater than one.

2040 LRTP (2013)

These projects have been listed in many previous LRTPs. However, in the 2040 LRTP, the cost of converting the overpass to an interchange and to implement a new river crossing were such that these projects could not be cost-constrained. Thus, they were placed on the illustrative project list with an estimated cost of $9.0 million for the interchange conversion, $21.4 million for the river crossing and $2.0 million to complete paving and add turn lanes so that the corridor functions as a bypass, in 2013 dollars. These cost estimates do not include pavement improvements to the existing Merrifield Road/CR 6 and CR 5 corridors to support increased heavy truck traffic.

Figure 6-3: Proposed Red River Bridge Crossing and Reliever Route Alignment from 2035 LRTP

INFRASTRUCTURE SCENARIOS

This analysis will evaluate three infrastructure scenarios for the Merrifield Road/CR 6 corridor:

- Merrifield Road/CR 6 interchange
- Merrifield Road/CR 6 Red River crossing
- Merrifield Road/CR 6 interchange and Red River crossing with and without pavement improvements for the truck bypass from US 2 to Grand Forks County Road 5 to Gateway Drive/US 2

Using the TDM, these infrastructure scenarios were modeled and estimated vehicle hours traveled (VHT) and vehicle miles traveled (VMT) were calculated.

Merrifield Road/CR 6 Interchange

An interchange at Merrifield Road/CR 6 is projected to increase traffic by nearly 6,000 vehicles per day east of I-29, while west of I-29, traffic is to remain around 1,100 vehicles per day. The change in travel patterns results in minor changes to

32nd Avenue/US 81B, reducing traffic east of I-29 by about 4,230 vehicles per day but increasing traffic west of I-29 by more than 950 vehicles per day. These changes in ADT are unlikely to change the need to include the baseline 32nd Avenue/US 81B improvements.

It is projected that the heavy truck traffic distribution will increase if a connection is made to allow trucks to bypass the urbanized core of I-29. However, given the forecasted traffic using this connection, it would result in around 370 trucks per day using truck distributions common on bypass routes in the region. The county noted that they feel this projection is low and would expect more traffic, particularly trucks to use this route. Two alternatives were developed that included costs with and without pavement improvements.

A summary of ADT and V/C ratios can be found in Figure 6-4 and Figure 6-5, respectively.

Merrifield Road/CR 6 Red River Crossing

A Red River crossing would add nearly 3,000 vehicles per day to Merrifield Road/CR 6, but would result in few changes to travel patterns surrounding the I-29 study area. The scenario would reduce traffic in the 32nd Avenue/US 81B interchange functional area around 300 vehicles per day east of I-29 and nearly 500 vehicles per day west of I-29. It would not change the need for baseline 32nd Avenue/US 81B improvements needed for efficient operations through 2040. A summary of ADT and V/C ratios can be found in Figure 6-6 and Figure 6-7, respectively.

Merrifield Road/CR 6 Interchange and Red River Crossing with Pavement Improvements and Turn Lanes for Truck Bypass

A Red River crossing and interchange ramp would add nearly 4,000 vehicles per day to Merrifield Road/CR 6 at the Red River crossing, more than 7,000 vehicles per day immediately east of I-29 and around 1,500 vehicles per day immediately west of I-29. The change in travel patterns results in such small changes at 32nd Avenue/US 81B, it is unlikely to reduce the need for the baseline 32nd Avenue/US 81B improvements to ensure efficient operations through 2040. East of I-29, this scenario reduces traffic on 32nd Avenue/US 81B by nearly 4,300 vehicles per day; west of I-29 this scenario increased vehicles per day by more than 800. A summary of ADT and V/C ratios can be found in Figure 6-8 and Figure 6-9, respectively.

It is projected that the heavy truck traffic distribution will increase if a connection is made to allow trucks to bypass the urbanized core of I-29. This cost includes pavement improvements for Grand Forks County roads designed to support increased heavy truck traffic.

Other hybrid scenarios presented in this report were only analyzed if the infrastructure in isolation provided benefits to the study area. However, since this alternative was able to provide a truck bypass alternative at this location, it was studied as a hybrid scenario.

Merrifield Road/CR 6 Interchange and Red River Crossing with Turn Lanes for Truck Bypass

The impacts in travel patterns is unchanged without pavement improvements. It would not change the need for 32nd Avenue/US 81B baseline improvements. This scenario would only change in terms of cost to provide the infrastructure.

It is projected that the heavy truck traffic distribution will increase if a connection is made to allow trucks to bypass the urbanized core of I-29. Cost estimates were provided using the $2.0 million project from the 2013 LRTP to add turn lanes at key intersections. This does not include estimates for accelerated pavement deterioration that may be necessary with additional truck traffic.

Other hybrid scenarios presented in this report were only analyzed if the infrastructure in isolation provided benefits to the study area. However, since this alternative was able to provide a truck bypass alternative at this location, it was studied as a hybrid scenario.

Table 6-3: Summary of Merrifield Road/CR 6 Infrastructure Scenarios

Infrastructure Scenario	Key Benefits in Study Area	Infrastructure Requirements (Cost in 2025 $)		Additional Roadway Costs (2025 $)	VHT Reduction	VMT Reduction
Merrifield Road/CR 6 Interchange	▪ 4.8 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 4.1 percent reduction in traffic on I-29	Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[1]	$33.4 Million[2]: Pavement Improvements	2.8 Million Hours	74.7 Million Miles
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	*$37.8 Million*			
Merrifield Road/CR 6 Red River Crossing	▪ 1.2 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 0.5 percent *increase* in traffic on I-29	Merrifield Road/CR 6 Red River Bridge	$34.3 Million[1]	$3.2[1] Million: Turn Lanes or $33.4 Million[2]: Pavement Improvements	2.9 Million Hours	24.7 Million Miles
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	*$60.9 Million*			
Merrifield Road/CR 6 Red River Crossing and Interchange with Pavement Improvements and Turn Lanes for Truck Bypass	▪ 5.1 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 6.3 percent reduction in traffic on I-29	Merrifield Road/CR 6 Red River Bridge	$34.3 Million[1]	$33.4 Million[2]: Pavement Improvements	4.4 Million Hours	75.9 Million Miles
		Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[1]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	*$75.3 Million*			
Merrifield Road/CR 6 Red River Crossing and Interchange with Turn Lanes for Truck Bypass	▪ 5.1 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 6.3 percent reduction in traffic on I-29	Merrifield Road/CR 6 Red River Bridge	$34.3 Million[1]	$3.2[1] Million: Turn Lanes	4.4 Million Hours	75.9 Million Miles
		Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[1]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	*$75.3 Million*			

[1]Costs based on the 2040 LRTP brought to 2025 using the MPO discount rate of 4.0 percent.
[2]The study team used NDDOT Project Cost History as the basis for the pavement improvements to the truck bypass.
[3]The study team used recent project experience to develop itemized cost estimates.

Figure 6-4: Select Link Analysis for Merrifield Road/CR 6 Interchange

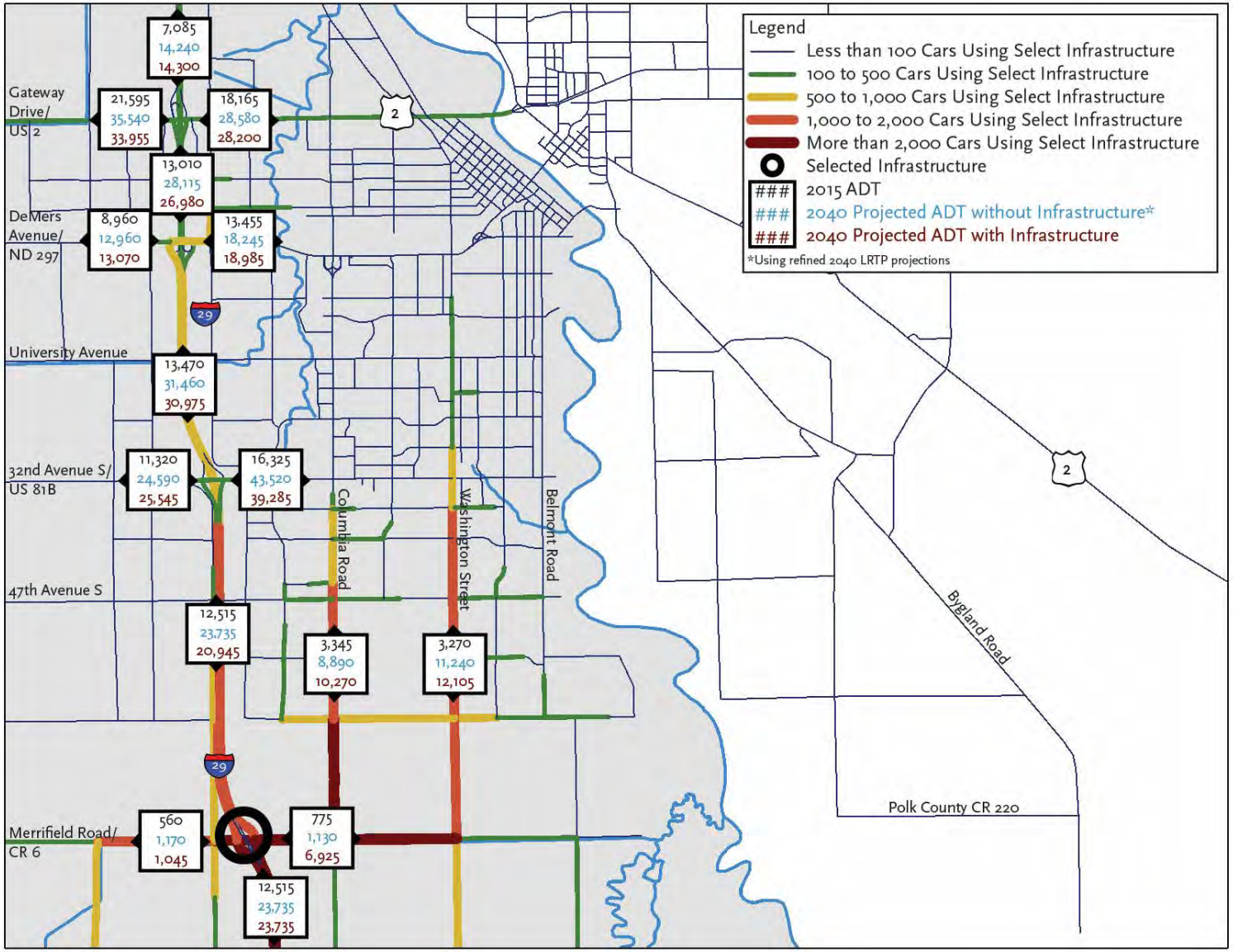


Figure 6-5: Volume/Capacity Ratios for Existing and Committed Network and Merrifield Road/CR 6 Interchange

Figure 6-6: Select Link Analysis for Merrifield Road/CR 6 Red River Crossing

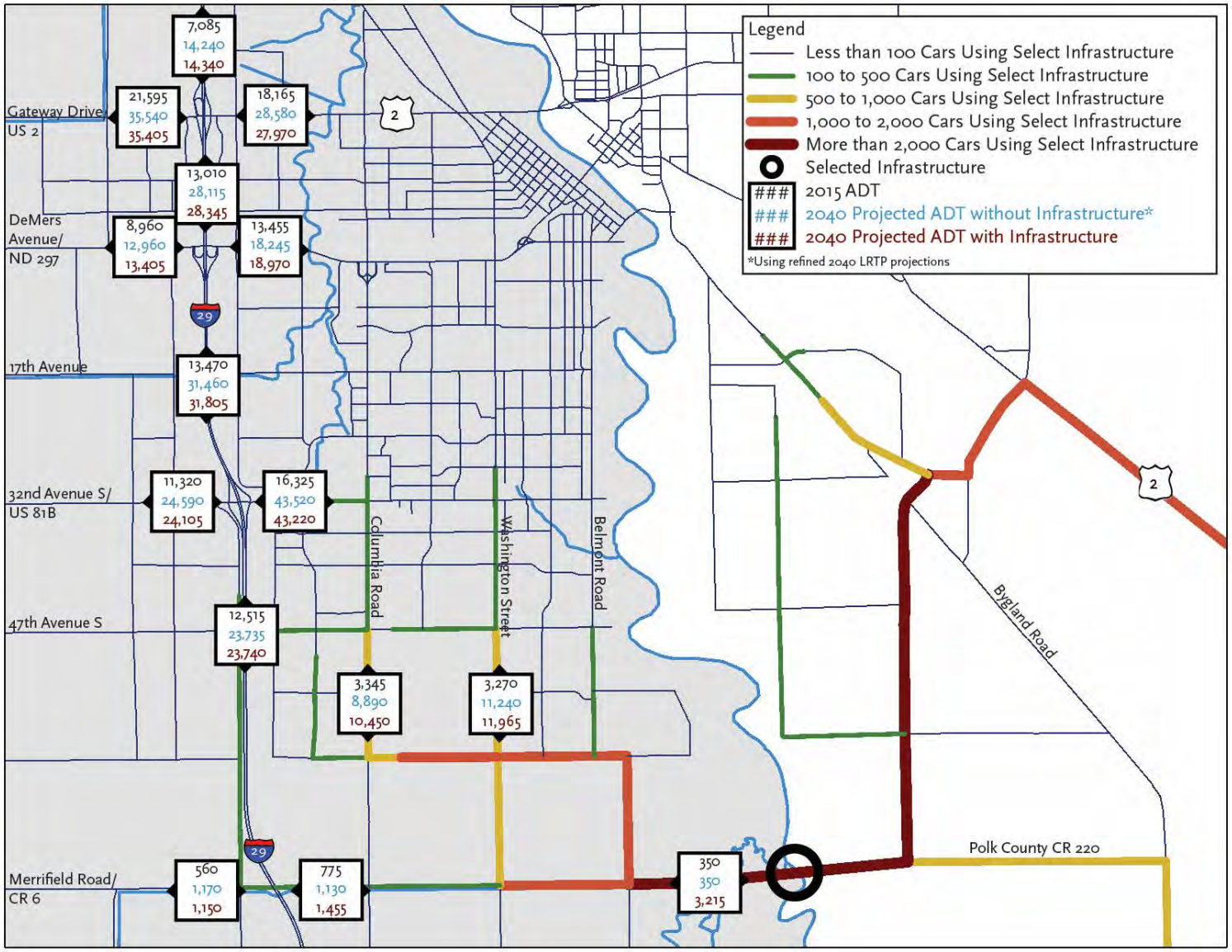


Figure 6-7: Volume/Capacity Ratios for Existing and Committed Network and Merrifield Road/CR 6 Red River Crossing

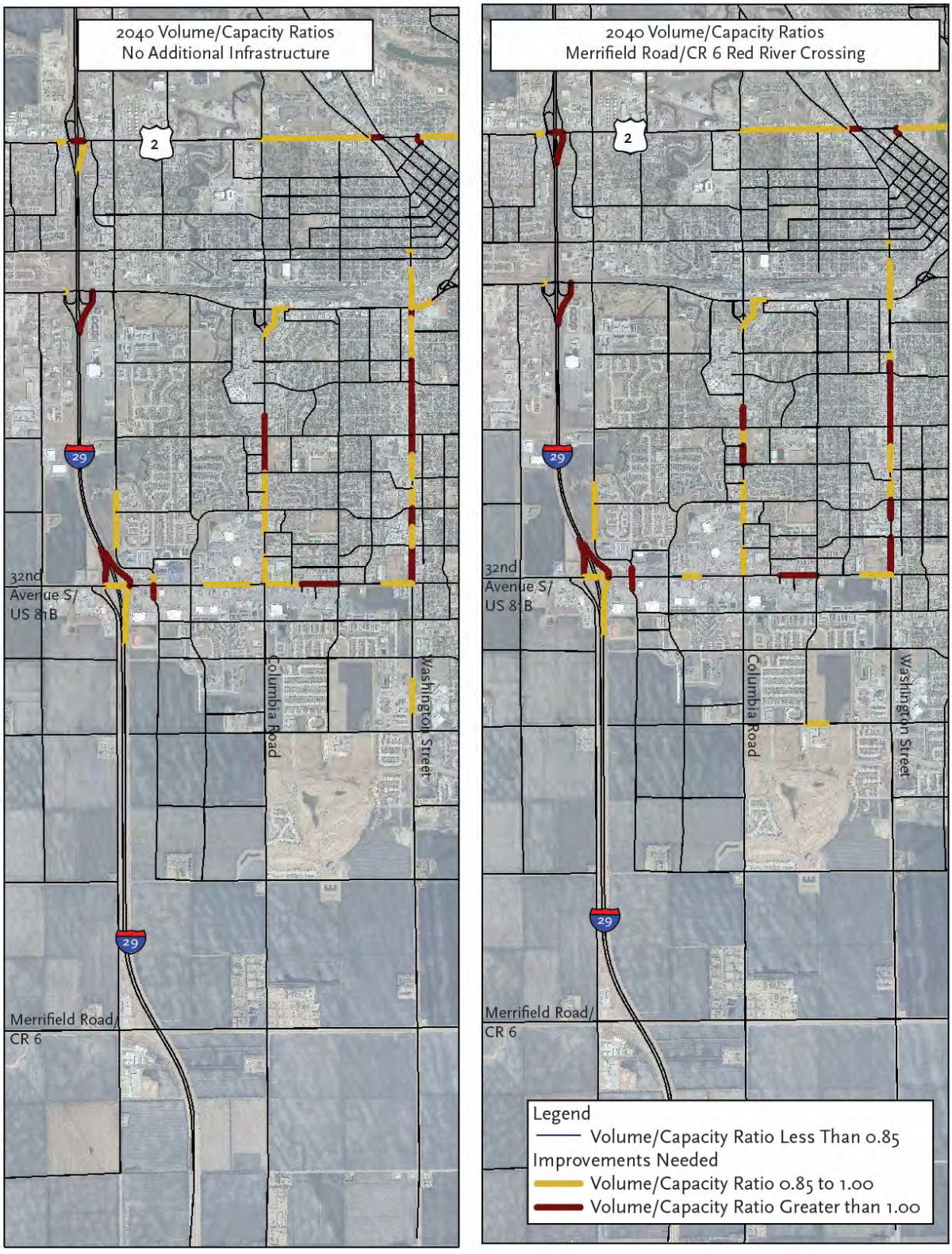


Figure 6-8: Select Link Analysis for Merrifield Road/CR 6 Red River Crossing and Interchange

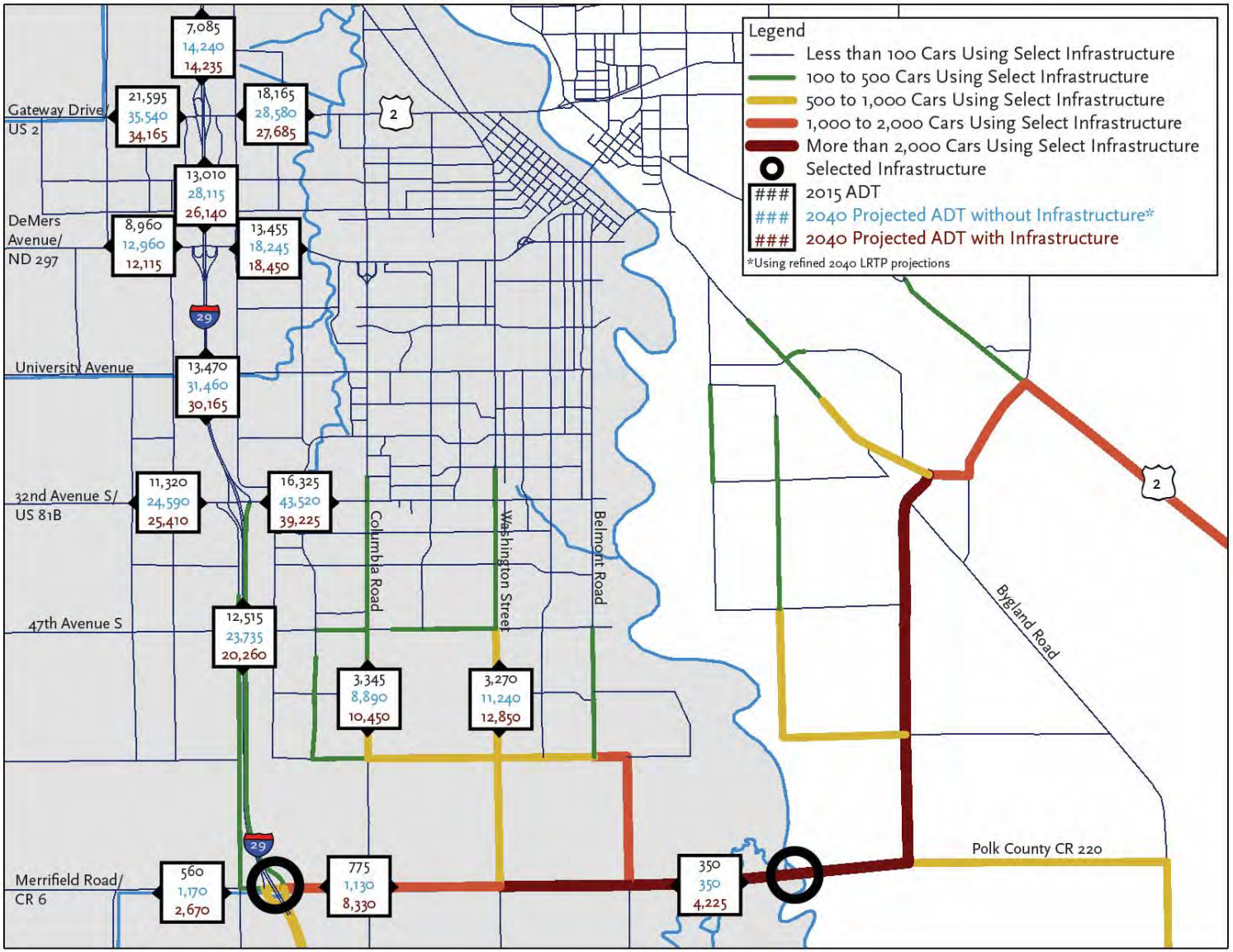
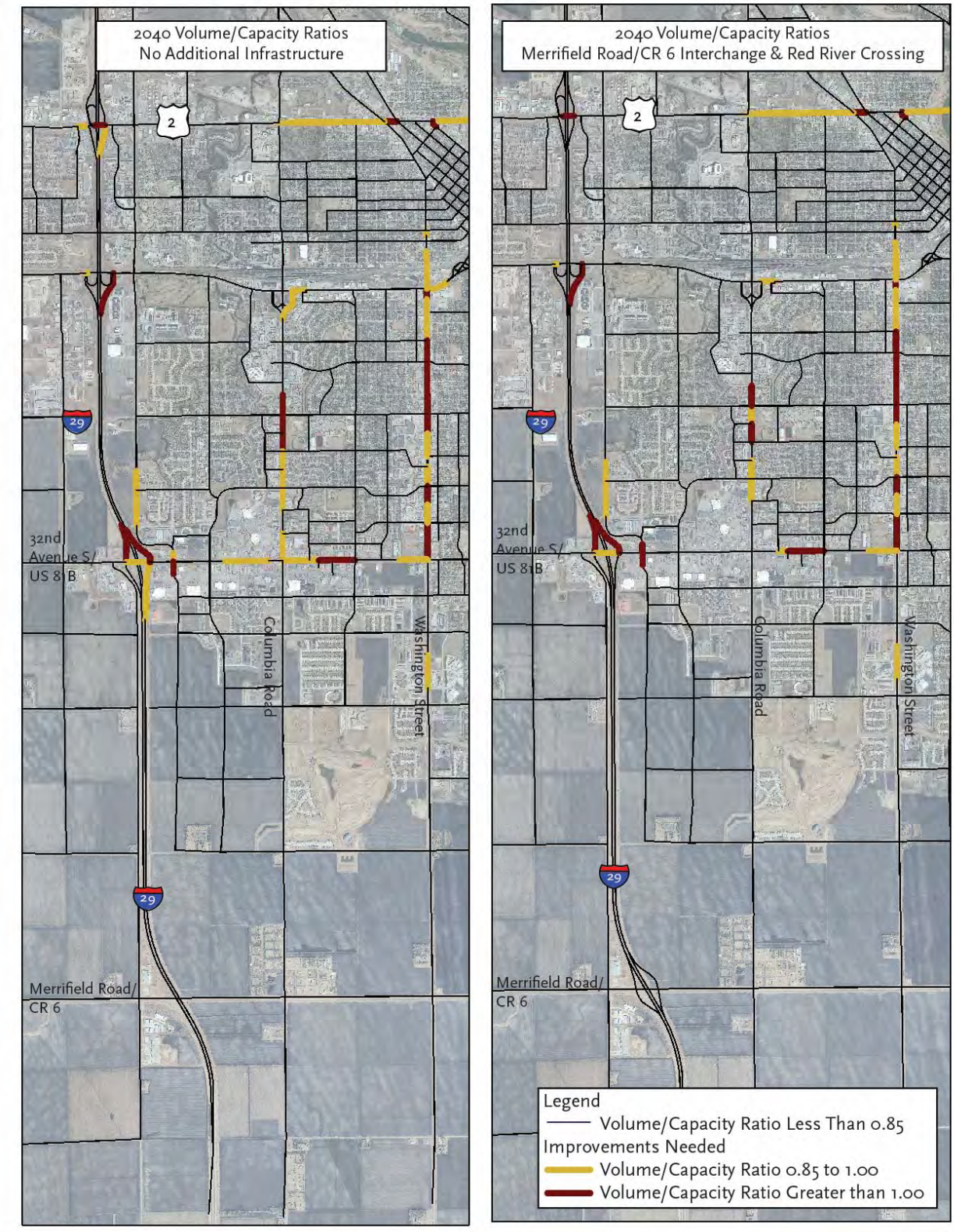


Figure 6-9: Volume/Capacity Ratios for Existing and Committed Network and Merrifield Road/CR 6 Interchange and Red River Crossing



32ND AVENUE/US 81B RED RIVER CROSSING

Since before the 2035 LRTP, a river crossing on an arterial south of DeMers Avenue/ND 297 has been discussed to connect East Grand Forks and Grand Forks on the south end of the metro, with the intention of relieving congestion on existing bridges. This project has faced difficulties because of its low regional priority, high cost and controversial nature of the improvement. This section evaluated the impacts a 32nd Avenue/US 81B Red River crossing will have on interstate and interchange operations within the study area. Although it is unclear whether this infrastructure has direct benefits to the study area, it was requested to be included in this study.

Figure 6-10: 32nd Avenue/US 81B Red River Crossing Concept from 2035 LRTP

PAST STUDIES

2040 LRTP

The 2040 LRTP moved this project to the illustrative project list. With an estimated cost of $25.6 million in 2013 dollars, it could not be cost constrained.

INFRASTRUCTURE SCENARIOS

This section evaluated a 32nd Avenue/US 81B Red River crossing, as well as the impacts of a 32nd Avenue/US 81B Red River crossing with a Merrifield Road/CR 6 interchange and Red River crossing.

32nd Avenue/US 81B Red River Crossing

This infrastructure scenario would increase traffic on 32nd Avenue/US 81B near the Red River crossing by nearly 7,000 vehicles per day. Further it would increase traffic in the 32nd Avenue/US 81B interchange function area by more than 500 vehicles per day both east and west of I-29. This would not prevent the 32nd Avenue/US 81B baseline improvements from being necessary by 2040. A summary of ADT and V/C ratios can be found in Figure 6-11 and Figure 6-12, respectively.

32nd Avenue/US 81B Red River Crossing with Merrifield Road/CR 6 Interchange and Bridge with Pavement Improvements and Turn Lanes for Truck Bypass

A Red River crossing at 32nd Avenue/US 81B and Merrifield Road/CR 6 with an interchange at Merrifield Road/CR 6 results in increased traffic on 32nd Avenue/US 81B near the Red River crossing by more than 6,300 vehicles per day. Near the 32nd Avenue/US 81B interchange, this infrastructure scenario reduces traffic by nearly 4,400 vehicles per day east of I-29 but increases traffic west of I-29 by more than 950 vehicles per day. At Merrifield Road/CR 6, this infrastructure scenario increases traffic by nearly 1,400 vehicles per day near the Red River crossing; near the Merrifield Road/CR 6 interchange functional area it increases traffic nearly 7,000 vehicles per day east of I-29 and more than 1,300 vehicles per day west of I-29.

This infrastructure scenario would not prevent the 32nd Avenue/US 81B baseline improvements, from being necessary by 2040. A summary of ADT and V/C ratios can be found in Figure 6-13 and Figure 6-14, respectively.

It is projected that the heavy truck traffic distribution will increase if a connection is made to allow trucks to bypass the urbanized core of I-29. This cost includes pavement improvements for Grand Forks County roads designed to support increased heavy truck traffic.

32nd Avenue/US 81B Red River Crossing with Merrifield Road/CR 6 Interchange and Bridge with Turn Lanes for Truck Bypass

The impacts in travel patterns is unchanged without pavement improvements. It would not change capacity enhancements needed, including the 32nd Avenue/US 81B baseline improvements. This scenario would only change in terms of cost to provide the infrastructure.

It is projected that the heavy truck traffic distribution will increase if a connection is made to allow trucks to bypass the urbanized core of I-29. Cost estimates for this scenario were provided using the $2.0 million project from the 2013 LRTP to add turn lanes at key intersections. This does not include estimates for accelerated pavement deterioration that may be necessary with additional truck traffic.

Table 6-4: Summary of 32nd Avenue/US 81B Infrastructure Scenarios

Infrastructure Scenario	Key Benefits in Study Area	Infrastructure Requirements (Cost in 2025 $)		Additional Roadway Costs (2025 $)	VHT Reduction	VMT Reduction
32nd Avenue/US 81B Red River Crossing	▪ 0.04 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 0.8 percent reduction in traffic on I-29	32nd Avenue/US 81B Red River Bridge	$41.0 Million[1]	NA	4.5 Million Hours	124.1 Million Miles
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$64.4 Million***			
32nd Avenue/US 81B Red River Crossing with Merrifield Road/CR 6 Interchange and Red River	▪ 5.0 percent reduction in traffic to 32nd Avenue interchange functional area ▪ 6.6 percent reduction in traffic on I-29	32nd Avenue/US 81B Red River Bridge	$41.0 Million[1]	$3.2[1] Million: Turn Lanes or $33.4 Million[2]: Pavement Improvements	6.4 Million Hours	160.8 Million Miles
		Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[1]			
		Merrifield Road/CR 6 Red River Bridge	$34.3 Million[1]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$113.1 Million***			

[1]Costs based on the 2040 LRTP brought to 2025 using the MPO discount rate of 4.0 percent.
[2]The study team used NDDOT Project Cost History as the basis for the pavement improvements to the truck bypass.
[3]The study team used recent project experience to develop itemized cost estimates.

Figure 6-11: 2040 ADT with 32nd Avenue/US 81B Red River Crossing

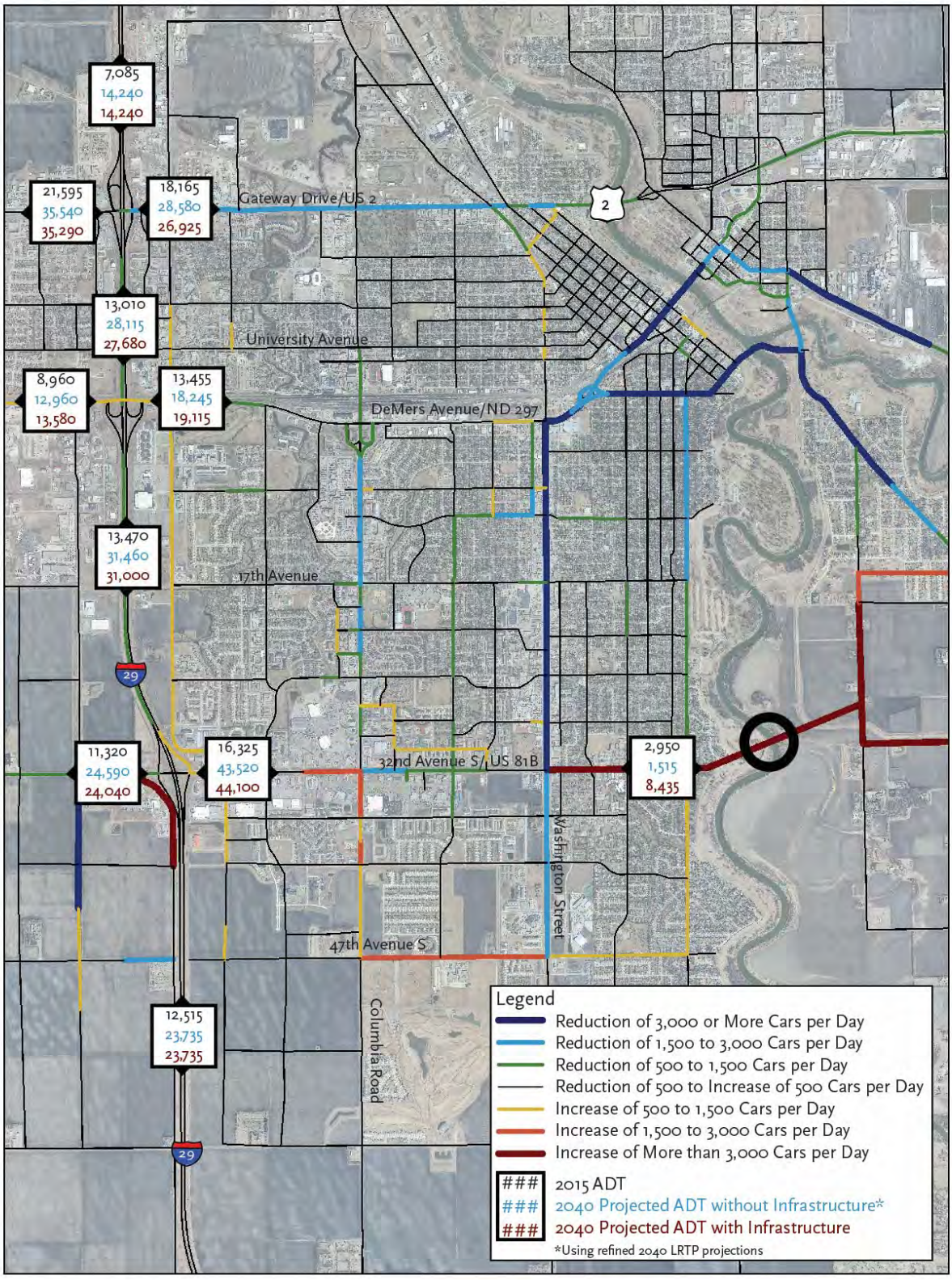


Figure 6-12: Volume/Capacity Ratios for Existing and Committed Network and 32nd Avenue/US 81B Red River Crossing

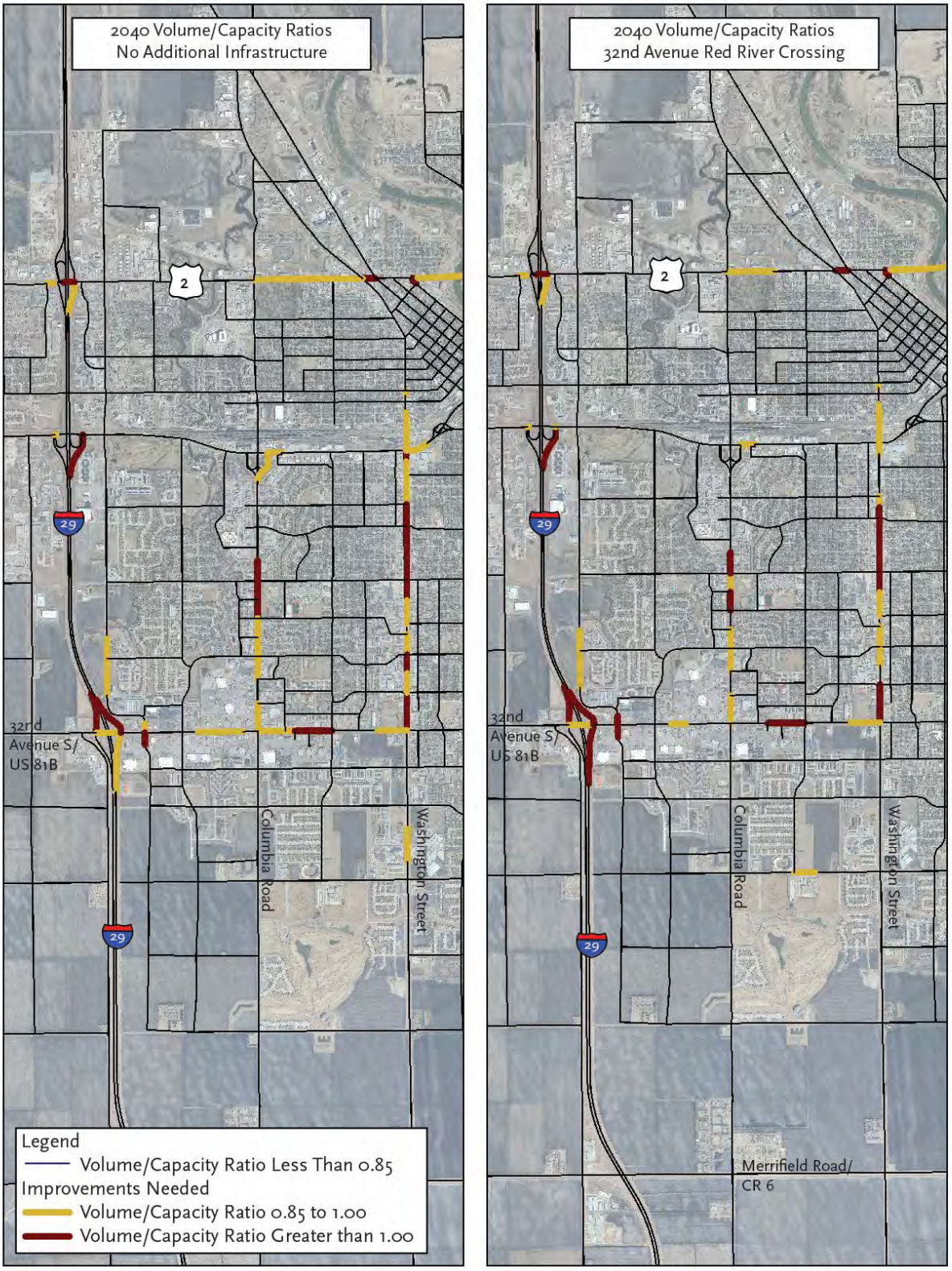


Figure 6-13: 2040 ADT with 32nd Avenue/US 81B Red River Crossing, Merrifield Road/CR 6 Interchange and Red River Crossing

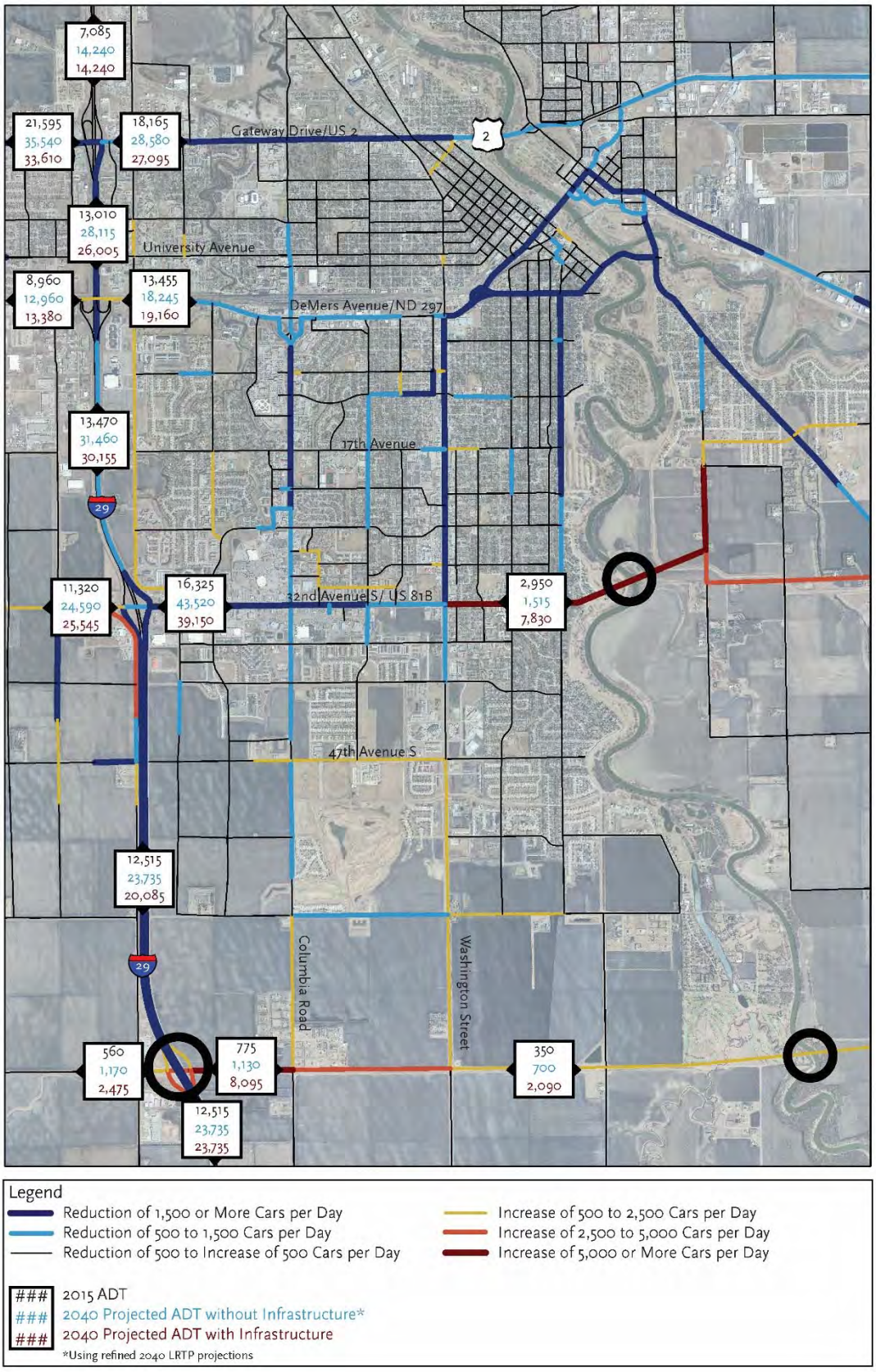


Figure 6-14: Volume/Capacity Ratios for Existing and Committed Network and 32nd Avenue/US 81B Red River Crossing, Merrifield Road/CR 6 Interchange and Red River Crossing

GRADE SEPARATIONS AND INTERCHANGES

PAST STUDIES

17th Avenue

In past LRTPs, a 17th Avenue grade separation of I-29 was recommended to connect 42nd and 48th Streets. The concept would provide a more direct route into the industrial park west of I-29 and provide the only crossing of I-29 between DeMers Avenue/ND 297 and 32nd Avenue/US 81B, currently a two-mile gap in system continuity.

The 2040 LRTP placed this project on the illustrative project list and estimated the cost to be $10.6 million in 2013 dollars. This project has not been fiscally constrained.

Analysis completed for this study found DeMers Avenue/ND 297 to operate deficiently by 2025 during P.M. peak periods and by 2040, in both A.M. and P.M. peak periods. A 17th Avenue grade separation may provide alternative capacity serving the industrial park and the core of the metro.

Figure 6-15: 17th Avenue Grade Separation Concept from 2035 LRTP

32nd Avenue/US 81B

Improvements to 32nd Avenue/US 81B were identified in the 2040 LRTP, including reconstructing and widening 32nd Avenue/US 81B to six lanes from I-29 to Columbia Road due to capacity constraints and pavement quality. This project was planned as a long-range project for implementation between 2031 and 2040.

Analysis completed for this study found deficient intersection operations by 2040 in the P.M. peak with queues that extend onto the interstate. Alternative routing infrastructure like grade separations at 17th Avenue or interchanges at 47th Avenue and 62nd Avenue, respectively may help alleviate congestion and traffic volumes at this interchange.

As mentioned above, analysis completed for this study indicates that interchange configuration revisions may also be necessary. The following infrastructure was included to estimate baseline infrastructure improvements to permit the 32nd Avenue/US 81B interchange to operate efficiently, based on the heaviest movements through the interchange:

- Widen 32nd Avenue/US 81B from 48th Street through the East Ramp intersection
- Double right-turn lane for significant northbound to eastbound movements at the East Ramp intersection.
- Northwest of Southwest loop ramp to address significant southbound to eastbound movements at the West Ramp intersection. Consideration should be given to a fourth eastbound lane that is dropped at 38th Street.

These improvements will be refined in Chapter 7, but were used to develop preliminary cost estimates for this analysis. Based on these improvements the interchange modifications are estimated to cost $12.4 million (2016 dollars). During the micro-level alternatives analysis, multiple interchange configurations were evaluated to help mitigate expected congestion on 32nd Avenue/US 81B.

47th Avenue

47th Avenue was studied in the last LRTP as a potential interchange location. The 2040 LRTP placed this project on the illustrative project list with an estimated cost of $20.8 million in 2013 dollars.

Further, a preliminary Interchange Access Modification Request (IAR) was completed by the City of Grand Forks in June 2014. The IAR cited the need for a 47th Avenue interchange to mitigate deficient operations along 32nd Avenue/US 81B by 2040. Analysis completed for the IAR anticipated that a 47th Avenue interchange will significantly improve operations of 32nd Avenue/US 81B without additional capacity.

Assumptions and data included in the IAR need to be updated. Traffic has increased just slightly since 2013, when data was collected for this report but updated projections as part of this study show higher growth potential on 32nd Avenue/US 81B west of I-29. Growth assumptions for the southern edge of Grand Forks have changed, with more mixed-use and higher density residential planned around 32nd Avenue/US 81B and 47th Avenue. Finally, the relationship to other infrastructure scenarios and specific needs of 32nd Avenue/US 81B will be studied in-depth in this chapter and can be used to guide more targeted investment strategies.

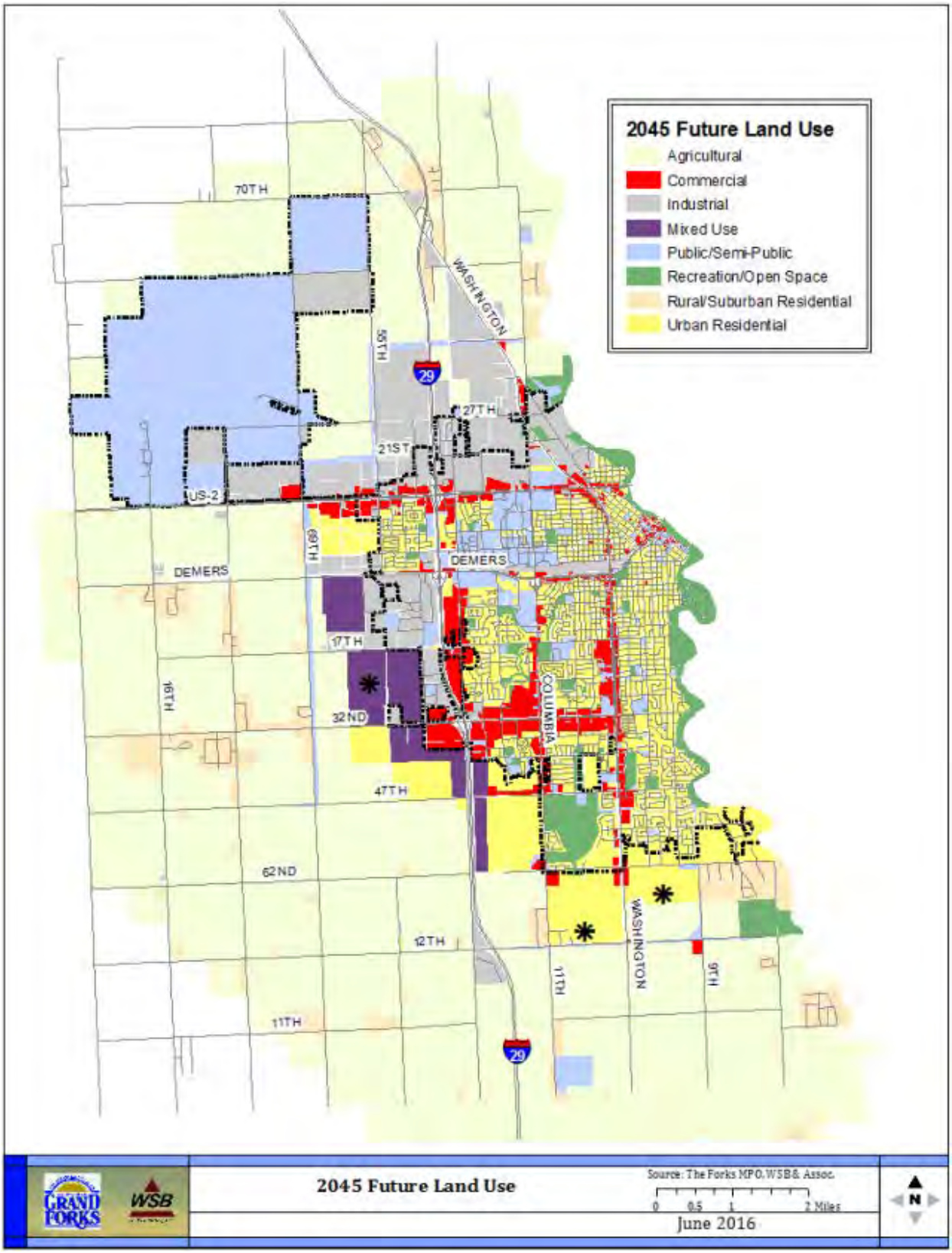
A 47th Avenue grade separation scenario has not been studied previously, but will be as part of this study.

62nd Avenue

The *Interstate System Access Information Guide* permits a minimum spacing of one-mile for urban interchanges, with a preferred spacing of two-miles to help ensure efficient operations and safety. To meet this spacing, a 47th Avenue interchange would need to be shifted south and built with a folded diamond configuration. Noting potential interchange spacing constraints, FHWA and NDDOT requested 62nd Avenue infrastructure scenarios be studied, including a grade separation and interchange as well as hybrid scenarios.

62nd Avenue alignments have not previously been studied for a variety of reasons. First, it is very near to Merrifield Road/CR 6 and an interchange at the 62nd Avenue location would preclude an interchange at Merrifield Road/CR 6 if two-mile spacing standards were maintained. Merrifield Road/CR 6 is the southernmost boundary of Grand Forks flood protection, is surrounded by industrial and rural residential developments and has been receiving incremental infrastructure improvements readying it for an eventual interchange and truck bypass. Second, 62nd Avenue has limited existing or future planned growth but also does not really serve agricultural or industrial users. Any future land use would be limited to the northeast quadrant (Figure 6-16).

Figure 6-16: Draft 2045 Future Land Use Plan



Split Ramp Alternatives

To help mitigate some of the spacing constraints, the Steering Committee recommended studying split ramp interchanges. These scenarios included a southbound on-ramp and northbound off-ramp at Merrifield Road/CR 6 with a southbound off-ramp and northbound on-ramp at 47th Avenue or 62nd Avenue. Guidance provided in the *Interstate System Access Information Guide* includes very strong language against partial, or split ramp interchanges like "rare and extraordinary circumstances that consideration is given" and "sufficient and compelling justification for consideration" that suggest it may be difficult for any split ramp alternatives to be approved and implemented by NDDOT and FHWA, especially considering that significant number of other scenarios analyzed in this report. The primary concerns against split ramp interchanges is that they are contrary to driver expectation, eliminate alternate corridors and incident and emergency management. However, the split ramp interchange configurations could be acceptable with a parallel collector-distributor network. This will require additional costs to pave 42nd Street and 38th Street from 62nd Avenue to Merrifield Road/CR 6.

INFRASTRUCTURE SCENARIOS

This analysis will evaluate 11 infrastructure scenarios for 32nd Avenue/US 81B congestion relief using the travel demand model to estimate VHT and VMT:

- 17th Avenue Grade Separation
- 47th Avenue Grade Separation
- 17th Avenue and 47th Avenue Grade Separation
- 47th Avenue Interchange
- 47th Avenue Interchange and 17th Avenue Grade Separation
- 62nd Avenue Grade Separation
- 62nd Avenue Interchange
- Split Ramps with southbound on-ramp and northbound off-ramp at Merrifield Road/CR 6 and southbound off-ramp and northbound on-ramp at 62nd Avenue
- Split Ramps with southbound on-ramp and northbound off-ramp at Merrifield Road/CR 6 and southbound off-ramp and northbound on-ramp at 47th Avenue
- 47th Avenue Interchange and Merrifield Road/CR 6 Interchange
- 62nd Avenue Interchange and Merrifield Road/CR 6 Interchange

Impacts of Infrastructure

17th Avenue Grade Separation

A grade separation at 17th Avenue would increase traffic along 17th Avenue by 1,340 vehicles per day by 2040, with more than 2,800 vehicles per day using the grade separation. A grade separation at 17th Avenue results only in small changes to the surrounding network. On DeMers Avenue/ND 297, this infrastructure scenario would reduce traffic around 1,000 vehicles per day both east and west of I-29. On 32nd Avenue/US 81B, this infrastructure scenario would reduce traffic east of I-29 by nearly 1,300 vehicles per day and practically unchanged west of I-29. These impacts would not eliminate the 32nd Avenue/US 81B baseline improvements necessary by 2040. A summary of ADT and V/C ratios can be found in Figure 6-17 and Figure 6-18, respectively.

47th Avenue Grade Separation

A grade separation at 47th Avenue would increase traffic along 47th Avenue by 5,965 vehicles per day east of I-29 and 2,365 west of I-29. This infrastructure scenario assumes that a three-lane section is provided when development pressures necessitate. An alternative scenario also included pavement improvements for a two-lane rural section from 48th Street to CR 5.

Based on the ARTPLAN analysis, the impacts of the 47th Avenue grade separation would not prevent the 32nd Avenue/US 81B baseline improvements from being necessary by 2040. On 32nd Avenue/US 81B, this infrastructure scenario reduces traffic east of I-29 by more than 7,600 vehicles per day and west of I-29 by more than 7,000 vehicles per day. A summary of ADT and V/C ratios can be found in Figure 6-19 and Figure 6-20, respectively.

17th Avenue Grade Separation and 47th Avenue Grade Separation

A grade separation at both 17th Avenue and 47th Avenue would provide additional access across I-29 to access the core of the city, but would not provide any additional interstate access; it would result in some significant shifts in traffic routing. On DeMers Avenue/ND 297, this infrastructure scenario reduces traffic east of I-29 by more than 200 vehicles per day but increases traffic west of I-29 by more than 150 vehicles per day. On 32nd Avenue/US 81B, this infrastructure scenario reduces traffic by more than 7,600 vehicles per day east of I-29 and more than 7,000 vehicles per day west of I-29.

This infrastructure scenario assumes that a three-lane section is provided when development pressures necessitate. An alternative scenario also included pavement improvements for a two-lane rural section from 48th Street to CR 5. None of the reductions in traffic would be enough to prevent the 32nd Avenue/US 81B baseline improvements. A summary of ADT and V/C ratios can be found in Figure 6-21 and Figure 6-22, respectively.

47th Avenue Interchange

A 47th Avenue interchange would have major impacts to the study area; it would increase traffic along 47th Avenue by 11,755 vehicles per day east of I-29 and 7,260 vehicles west of I-29, with more than 22,000 vehicles using the interchange.

This infrastructure scenario results in major traffic rerouting. On 32nd Avenue/US 81B, this infrastructure scenario reduces traffic by more than 17,600 vehicles per day east of I-29 and more than 9,800 vehicles per day west of I-29. These changes in traffic patterns is likely to change the types and locations of improvements necessary, specifically the 32nd Avenue/US 81B baseline improvements, including the widening from the East Ramp intersection to Columbia Road and the potential reconfiguration of the 32nd Avenue/US 81B interchange.

This scenario significantly increases traffic on mainline I-29 through 2040, however not enough to require widening on I-29; it also impacts operations on 47th Avenue, requiring widening to five-lanes from 48th Street to Columbia Road. An alternative scenario also included pavement improvements for a two-lane rural section from 48th Street to CR 5. A summary of ADT and V/C ratios can be found in Figure 6-23 and Figure 6-24, respectively.

47th Avenue Interchange and 17th Avenue Grade Separation

A 47th Avenue interchange and 17th Avenue grade separation would improve connectivity to and across I-29 and would have major impacts to the study area. This project is likely to reduce the needs of improvements, specifically, the 32nd Avenue/US 81B baseline improvements. This infrastructure scenario would reduce traffic on 32nd Avenue/US 81B east of I-29 by more than 19,200 vehicles per day and west of I-29 by more than 11,500 vehicles per day. On 17th Avenue, this infrastructure scenario would increase traffic around 1,400 vehicles per day both east and west of I-29, and on DeMers Avenue/ND 297, this infrastructure scenario would increase traffic east of I-29 by more than 2,200 vehicles per day but decrease traffic west of I-29 by nearly 900 vehicles per day.

The increased demand on 47th Avenue would likely require capacity enhancements to a five-lane section from 48th Street to Columbia Road. An alternative scenario also included pavement improvements for a two-lane rural section from 48th Street to CR 5. A summary of ADT and V/C ratios can be found in Figure 6-25 and Figure 6-26, respectively.

62nd Avenue Grade Separation

A 62nd Avenue grade separation would have minor impacts to the study area. It would decrease traffic on I-29 by just 1,520 vehicles per day (1.0 percent). Since there is minimal traffic currently on 62nd Avenue and minimal growth expected, a grade separation would result in less than 4,000 vehicles per day east of I-29 and around 900 west of I-29, with just under 4,000 vehicles per day using the grade separation. On 32nd Avenue/US 81B, this infrastructure scenario would decrease traffic east of I-29 by more than 2,700 vehicles per day and west of I-29 by more than 1,300 vehicles per day. None of the changes in traffic patterns would be enough to prevent any already committed infrastructure project from being necessary by 2040, including the 32nd Avenue/US 81B baseline improvements, for efficient operations.

An alternative scenario also included pavement improvements for a two-lane rural section from 42nd Street to CR 5. A summary of ADT and V/C ratios can be found in Figure 6-27 and Figure 6-28 respectively.

62nd Avenue Interchange

A 62nd Avenue interchange would have some impacts to the study area. It results in a slight increase to I-29 traffic; on 32nd Avenue/US 81B it reduces traffic by more than 8,400 vehicles per day east of I-29 and more than 2,200 vehicles per day west of I-29. Since there is minimal traffic currently on 62nd Avenue, a grade separation would result in nearly 12,300 vehicles per day east of I-29 and around 4,500 vehicles west of I-29.

This infrastructure scenario requires a five-lane urban section from 42nd Street to 38th Street. An alternative scenario also included pavement improvements for a two-lane rural section from 42nd Street to CR 5. This infrastructure increases traffic on I-29 and does not prevent the baseline 32nd Avenue/US 81B infrastructure needs. A summary of ADT and V/C ratios can be found in Figure 6-29 and Figure 6-30 respectively.

62nd Avenue and Merrifield Road/CR 6 Split Ramps

This infrastructure scenario would include a southbound on-ramp and northbound off-ramp at Merrifield Road/CR 6 and southbound off-ramp and northbound on-ramp at 62nd Avenue. It results in a small increase, 1.6 percent, to traffic on I-29 through 2040. On 62nd Avenue, this infrastructure results in more than 10,000 vehicles per day east of I-29 and more than 5,300 vehicles west of I-29; on Merrifield Road/CR 6 the infrastructure increases traffic east of I-29 to 4,200 vehicles on Merrifield Road/CR 6 and west of I-29 to nearly 1,400 vehicles per day. On 32nd Avenue/US 81B, this infrastructure scenario reduces traffic by more than 8,300 vehicles per day east of I-29 and more than 2,200 vehicles per day west of I-29.

This infrastructure scenario would require a five-lane urban section from 42nd Street to 38th Street. An alternative scenario also included pavement improvements for a two-lane rural section on 62nd Avenue from 42nd Street to CR 5 and pavement improvements to Merrifield Road/CR 6. This infrastructure increases traffic on I-29 and does not prevent the baseline 32nd Avenue/US 81B infrastructure needs. A summary of ADT and V/C ratios can be found in Figure 6-31 and Figure 6-32, respectively.

47th Avenue and Merrifield Road/CR 6 Split Ramps

This infrastructure scenario would include a southbound on-ramp and northbound off-ramp at Merrifield Road/CR 6 and southbound off-ramp and northbound on-ramp at 47th Avenue. It results in a 14.9 percent increase to traffic on I-29, or more than 21,600 vehicles per day. On 32nd Avenue/US 81B, this infrastructure reduces traffic by 10,595 vehicles west of I-29 and 18,850 vehicles per day east of I-29, which based on the ARTPLAN analysis, would prevent the need for the baseline 32nd Avenue/US 81B infrastructure.

On 47th Avenue, this infrastructure scenario increases traffic more than 10,800 vehicles per day to 17,070 vehicles per day east of I-29 and more than 8,200 vehicles per day to 3,265 west of I-29. This increase in traffic would require a five-lane section from 48th Street to Columbia Road. An alternative scenario also included pavement improvements for a two-lane rural section on 47th Avenue from 48th Street to CR 5 and pavement improvements to Merrifield Road/CR 6. A summary of ADT and V/C ratios can be found in Figure 6-33 and Figure 6-34, respectively.

62nd Avenue Interchange and Merrifield Road/CR 6 Interchange

This hybrid scenario includes interchanges at both 62nd Avenue and Merrifield Road/CR 6. This scenario may face difficulties with interchange spacing constraints; 62nd Avenue would likely need to be shifted north, potentially with a folded diamond configuration on 62nd Avenue and/or Merrifield Road/CR 6. On 62nd Avenue, this infrastructure results in more than 5,000 vehicles west of I-29 and nearly 13,000 vehicles east of I-29; on Merrifield Road/CR 6 this infrastructure results in less than 500 vehicles west of I-29 and around 1,600 vehicles east of I-29. This infrastructure scenario would require a five-lane urban section on 62nd Avenue from 42nd Street to 38th Street. An alternative scenario also included pavement improvements for a two-lane rural section on 62nd Avenue from 42nd Street to CR 5 and pavement improvements to Merrifield Road/CR 6.

This infrastructure scenario increases traffic on I-29 by 4.4 percent, but reduces traffic on 32nd Avenue/US 81B west of I-29 by 2,485 vehicles per day and east of I-29 by 9,005 vehicles per day. This reduction in traffic is not enough to prevent the baseline 32nd Avenue/US 81B improvements. A summary of ADT and V/C ratios can be found in Figure 6-35 and Figure 6-36, respectively.

47th Avenue Interchange and Merrifield Road/CR 6 Interchange

This hybrid scenario includes interchanges at both 47th Avenue and Merrifield Road/CR 6. On 47th Avenue, this infrastructure results in nearly 11,000 vehicles per day west of I-29 and nearly 18,000 vehicles east of I-29, while on Merrifield Road/CR 6 this infrastructure results in nearly 850 vehicles west of I-29 and nearly 4,800 vehicles east of I029 This infrastructure increases traffic on I-29 by 18.0 percent or more than 26,000 vehicles per day. This infrastructure scenario would require a five-lane section on 47th Avenue from 48th Street to Columbia Road. An alternative scenario also included pavement improvements for a two-lane rural section on 47th Avenue from 48th Street to CR 5 and pavement improvements to Merrifield Road/CR 6.

On 32nd Avenue/US 81B, this infrastructure reduces traffic west of I-29 by 10,580 vehicles per day and east of I-29 by 19,060 vehicles per day. Using the ARTPLAN analysis, the impacts of this infrastructure scenario would likely prevent the baseline 32nd Avenue/US 81B improvements. A summary of ADT and V/C ratios can be found in Figure 6-37 and Figure 6-38, respectively.

Table 6-5: Summary of 17th Avenue and 47th Avenue Overpass and Interchange Scenarios

Infrastructure Scenario	Key Benefits in Study Area	Scenario and Network Infrastructure Requirements (2025 $, Million)		Potential Roadway Costs (2025 $)	VHT Reduction	VMT Reduction
17th Avenue Grade Separation	▪ 3.4 percent reduction in traffic to 32nd Avenue/US 81B and DeMers Avenue/ND 297 interchange functional areas ▪ 3.1 percent reduction in traffic on I-29	17th Avenue Grade Separation	$17.0 Million[1]	NA	1.5 Million Hours	42.9 Million Miles
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$40.4 Million***			
47th Avenue Grade Separation	▪ 21.6 percent reduction in traffic to 32nd Avenue/US 81B functional area ▪ 3.8 percent reduction in traffic on I-29	47th Avenue Grade Separation	$17.0 Million[1]	$18.8 Million[2]: Roadway Paving 48th Street to CR 5	1.9 Million Hours	50.4 Million Miles
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$40.4 Million***			
17th Avenue and 47th Avenue Grade Separations	▪ 21.0 percent reduction in traffic to 32nd Avenue/US 81B and DeMers Avenue/ND 297 interchange functional areas ▪ 4.6 percent reduction in traffic on I-29	17th Avenue Grade Separation	$17.0 Million[1]	$18.8 Million[2]: Roadway Paving 48th Street to CR 5	2.1 Million Hours	57.7 Million Miles
		47th Avenue Grade Separation	$17.0 Million[1]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$57.4 Million***			
47th Avenue Interchange	▪ 40.3 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 21.2 percent ***increase*** in traffic on I-29 ▪ Eliminates need to widen 32nd Avenue or reconfigure 32nd Avenue interchange	47th Avenue Interchange	$33.3 Million[1]	$18.8 Million[2]: Roadway Paving 48th Street to CR 5	4.4 Million Hours	53.3 Million Miles
		47th Avenue Widening 48th Street to Columbia Road	$8.6 Million[2]			
		Total Cost	***$42.0 Million***			
47th Avenue Interchange and 17th Avenue Grade Separation	▪ 29.6 percent reduction in traffic to 32nd Avenue/US 81B and DeMers Avenue/ND 297 interchange functional areas ▪ 21.0 percent ***increase*** in traffic on I-29 ▪ Eliminates need to widen 32nd Avenue or reconfigure 32nd Avenue interchange	47th Avenue Interchange	$33.3 Million[1]	$18.8 Million[2]: Roadway Paving 48th Street to CR 5	4.5 Million Hours	59.4 Million Miles
		47th Avenue Widening 48th Street to Columbia Road	$8.6 Million[2]			
		17th Avenue Grade Separation	$17.0 Million[1]			
		Total Cost	***$58.9 Million***			
62nd Avenue Grade Separation	▪ 5.9 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 1.0 percent decrease in traffic on I-29	62nd Avenue Grade Separation	$17.0 Million[1]	$20.3 Million[2]: Roadway Paving 42nd Street to CR 5	1.7 Million Hours	14.3 Million Miles
		62nd Avenue 3-Lane Reconstruction 42nd Street to Columbia Road	$10.8 Million[3]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$51.2 Million***			
62nd Avenue Interchange	▪ 15.7 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 5.0 percent ***increase*** in traffic on I-29	62nd Avenue Interchange	$33.3 Million[3]	$20.3 Million[2]: Roadway Paving 42nd Street to CR 5	3.8 Million Hours	28.8 Million Miles
		62nd Avenue 5-Lane Reconstruction 42nd Street to Columbia Road[4]	$15.2 Million[3]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$71.9 Million***			
62nd Avenue and Merrifield Road/CR 6 Split Ramps	▪ 15.5 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 1.6 percent ***increase*** in traffic on I-29	62nd Avenue Split Ramp Interchange	$24.2 Million[3]	$52.2 Million ▪ $20.3 Million[2]: Roadway Paving 42nd Street to CR 5 for 62nd Avenue ▪ $33.4 Million[2]: Merrifield Road/CR 6 Pavement Improvements	3.7 Million Hours	31.2 Million Miles
		62nd Avenue 5-Lane Reconstruction 42nd Street to Columbia Road[4]	$15.2 Million[3]			
		Merrifield Road/CR 6 Split Ramp Interchange	$20.7 Million[3]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$83.5 Million***			
47th Avenue and Merrifield Road/CR 6 Split Ramps	▪ 43.2 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 14.0 percent ***increase*** in traffic on I-29 ▪ Eliminates need to widen 32nd Avenue or reconfigure 32nd Avenue interchange	47th Avenue Split Ramp Interchange	$24.2 Million[3]	$52.2 Million ▪ $18.8 Million[2]: 47th Avenue Roadway Paving 48th Street to CR 5 ▪ $33.4 Million[2]: Merrifield Road/CR 6 Pavement Improvements	3.2 Million Hours	31.0 Million Miles
		47th Avenue Widening 48th Street to Columbia Road	$8.6 Million[2]			
		Merrifield Road/CR 6 Split Ramp Interchange	$20.7 Million[3]			
		Total Cost	***$53.6 Million***			
62nd Avenue and Merrifield Road/CR 6 Interchanges	▪ 16.9 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 4.4 percent ***increase*** in traffic on I-29	62nd Avenue Interchange	$33.3 Million[3]	$52.2 Million ▪ $20.3 Million[2]: Roadway Paving 42nd Street to CR 5 for 62nd Avenue ▪ $33.4 Million[2]: Merrifield Road/CR 6 Pavement Improvements	3.5 Million Hours	28.4 Million Miles
		62nd Avenue 5-Lane Reconstruction 42nd Street to Columbia Road[4]	$15.2 Million[3]			
		Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[3]			
		32nd Avenue Roadway Expansion	$5.8 Million[3]			
		32nd Avenue/US 81B Interchange Improvements	$17.6 Million[3]			
		Total Cost	***$86.3 Million***			
47th Avenue and Merrifield Road/CR 6 Interchanges	▪ 43.5 percent reduction in traffic to 32nd Avenue/US 81B interchange functional area ▪ 18.0 percent ***increase*** in traffic on I-29 ▪ Eliminates need to widen 32nd Avenue or reconfigure 32nd Avenue interchange	47th Avenue Interchange	$33.3 Million[1]	$52.2 Million ▪ $18.8 Million[2]: 47th Avenue Roadway Paving 48th Street to CR 5 ▪ $33.4 Million[2]: Merrifield Road/CR 6 Pavement Improvements	3.4 Million Hours	24.1 Million Miles
		47th Avenue Widening 48th Street to Columbia Road	$8.6 Million[2]			
		Merrifield Road/CR 6 Interchange Ramps	$14.4 Million[1]			
		Total Cost	***$56.4 Million***			

[1]Costs based on the 2040 LRTP brought to 2025 using the MPO discount rate of 4.0 percent. [2]The study team used NDDOT Project Cost History as the basis for the pavement improvements to the truck bypass. [3]The study team used recent project experience to develop itemized cost estimates. [4]Assumes 5-lane urban section from 42nd Street to 38th Street and 3-lane urban section from 38th Street to Columbia Road.

Figure 6-17: 2025 and 2040 ADT with 17th Avenue Grade Separation

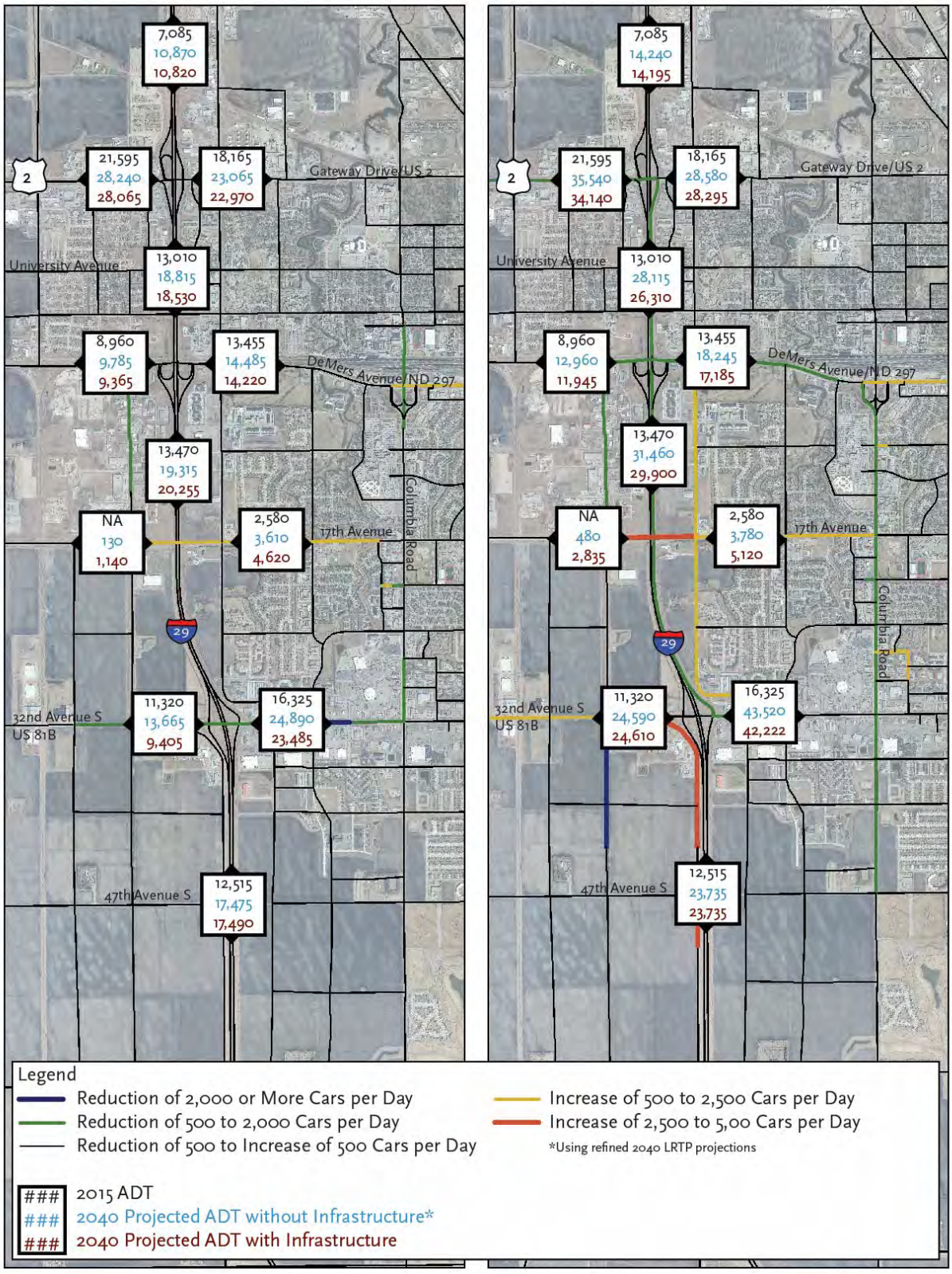


Figure 6-18: Volume/Capacity Ratios for Existing and Committed Network and 17th Avenue Grade Separation

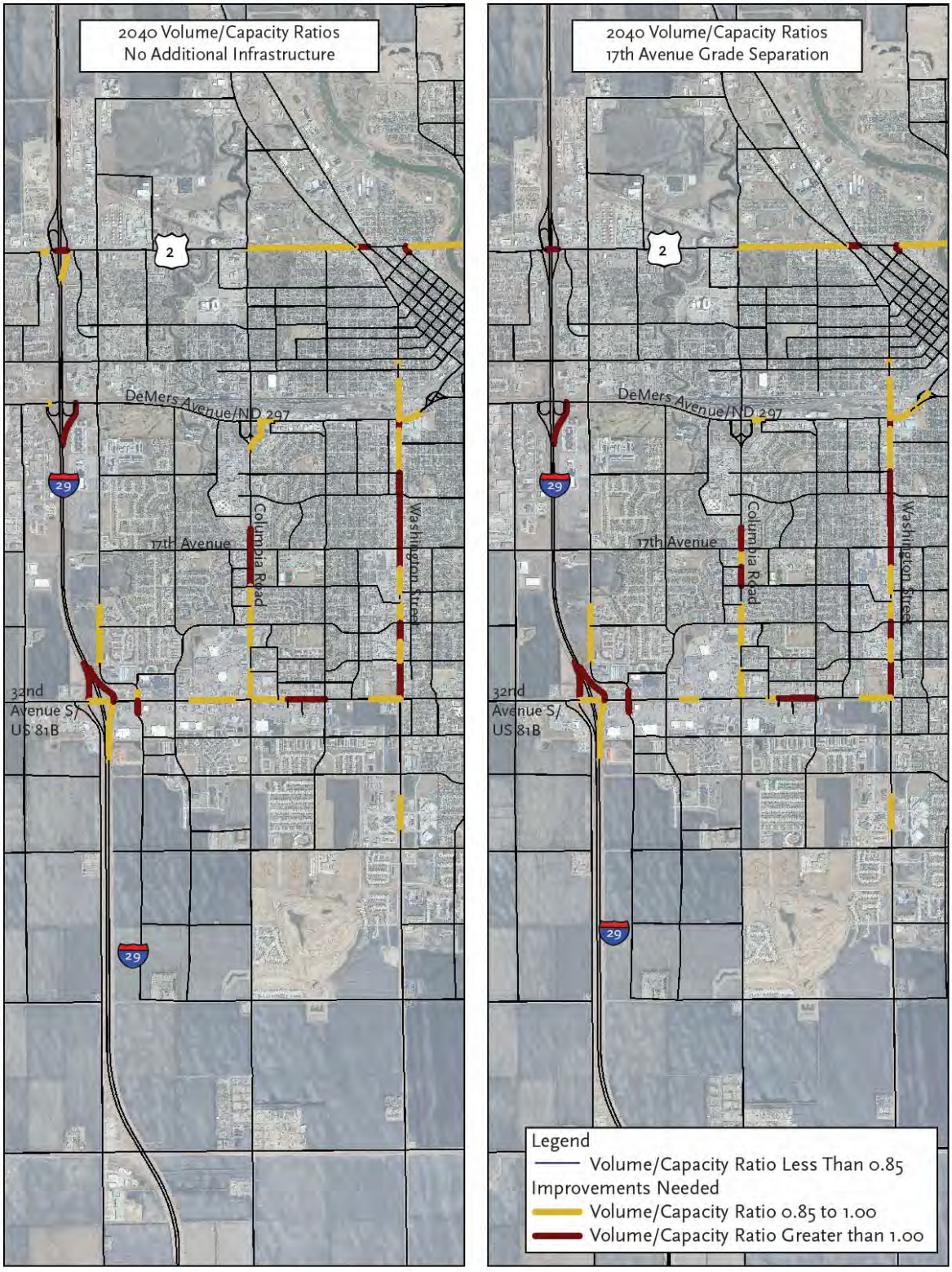


Figure 6-19: 2025 and 2040 ADT with 47th Avenue Grade Separation

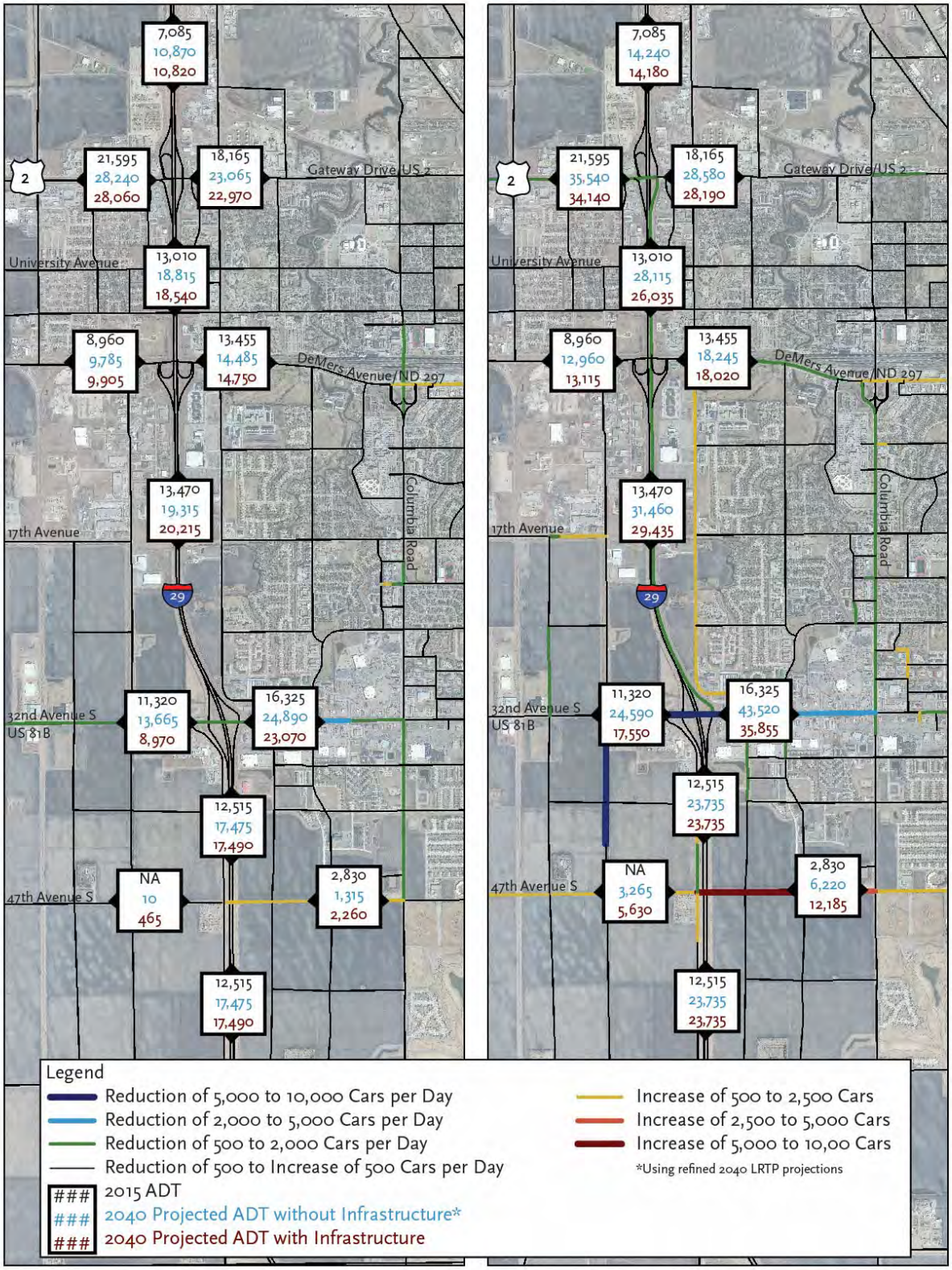


Figure 6-20: Volume/Capacity Ratios for Existing and Committed Network and 47th Avenue Grade Separation

Figure 6-21: 2025 and 2040 ADT with 17th Avenue and 47th Avenue Grade Separations

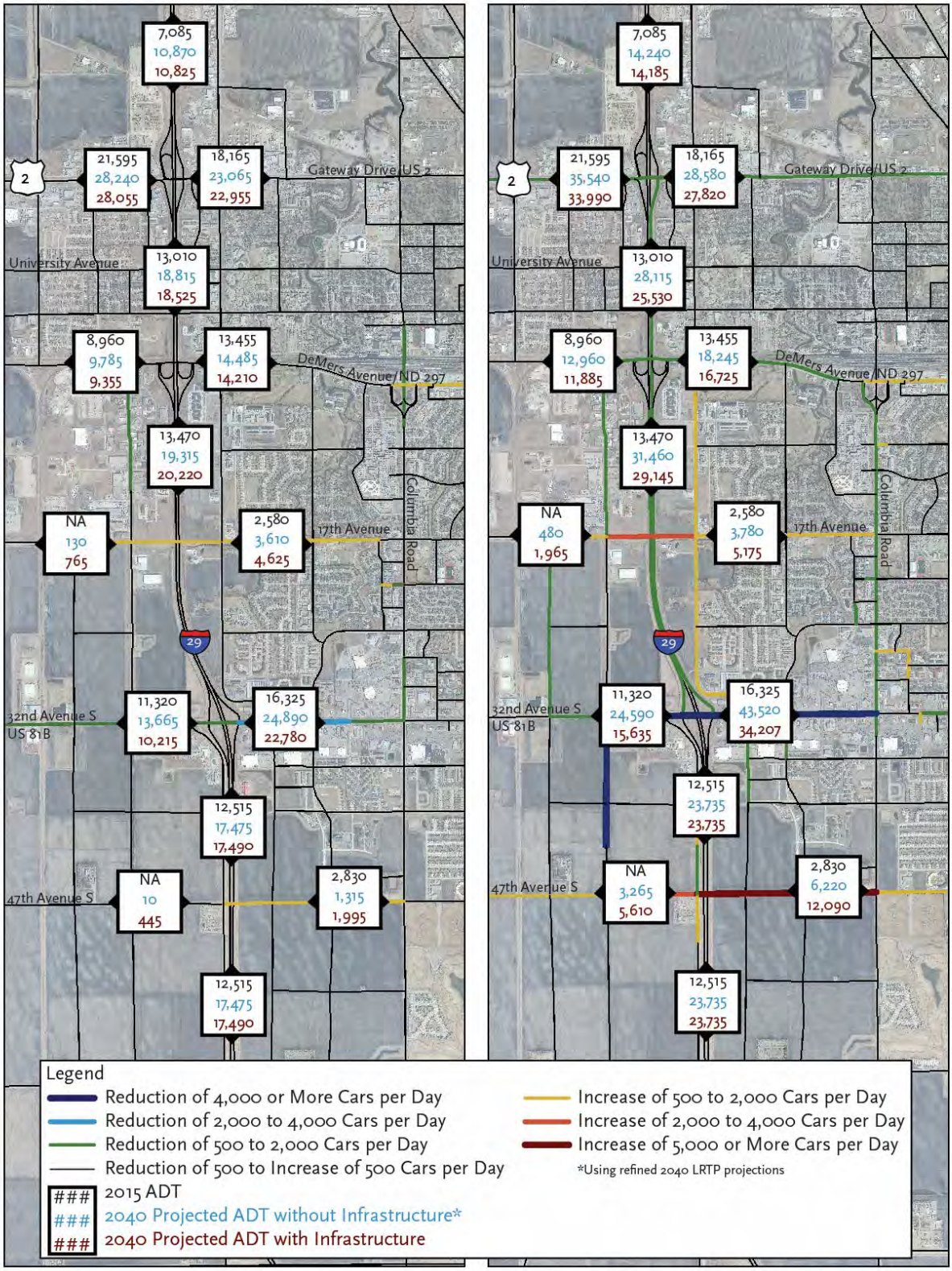


Figure 6-22: Volume/Capacity Ratios for Existing and Committed Network and 17th Avenue and 47th Avenue Grade Separations

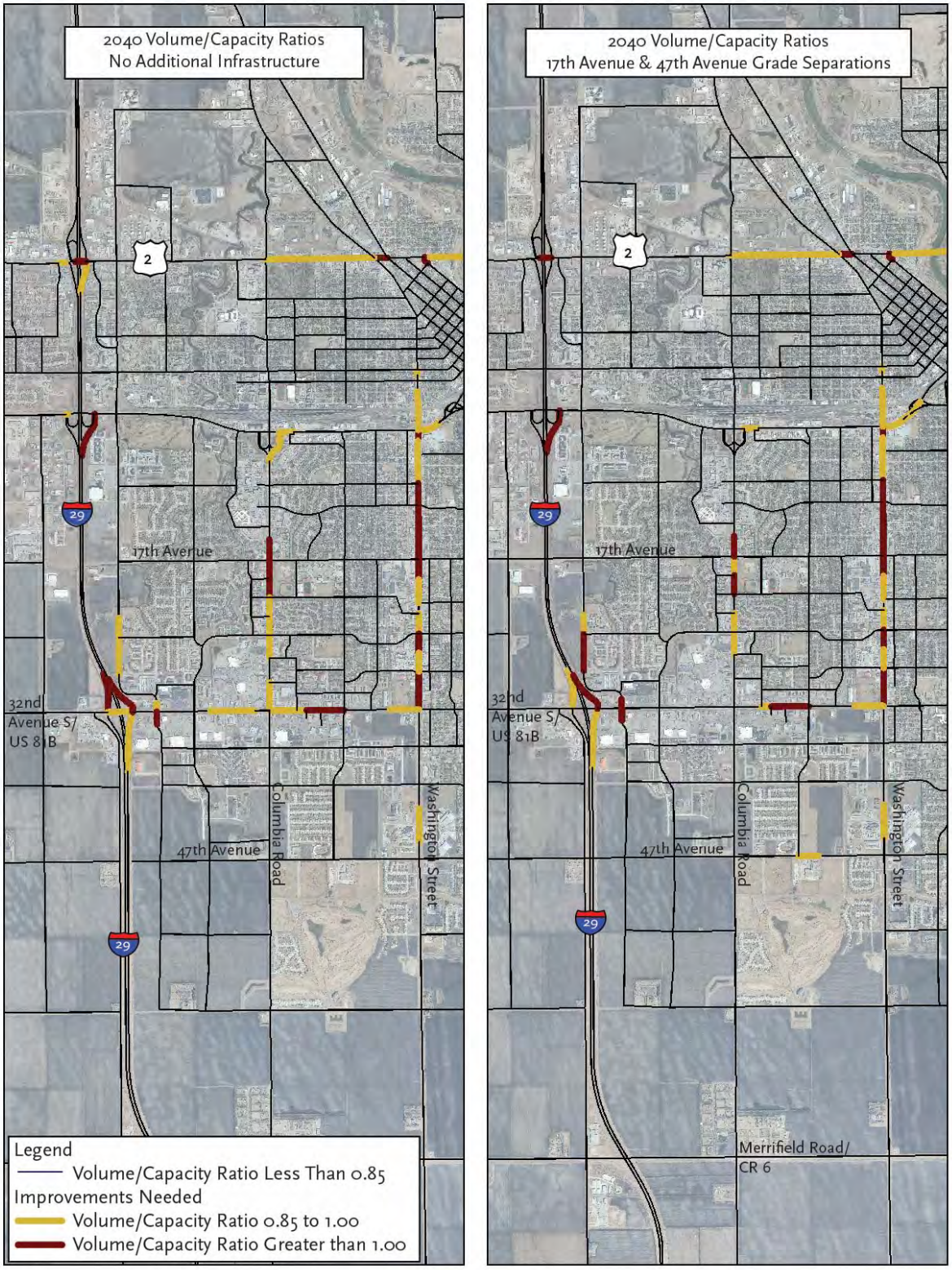


Figure 6-23: 2025 and 2040 ADT with 47th Avenue Interchange

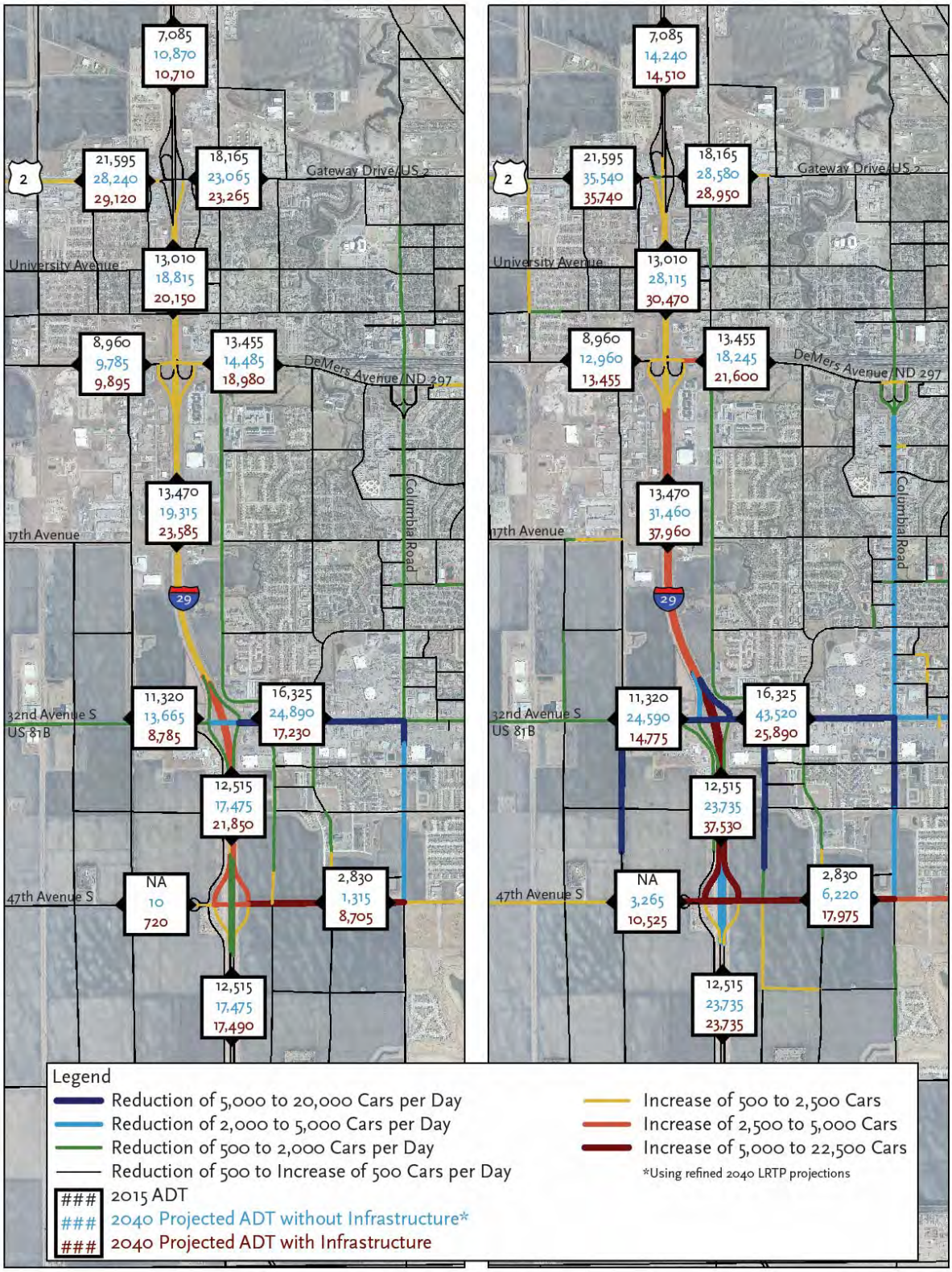


Figure 6-24: Volume/Capacity Ratios for Existing and Committed Network and 47th Avenue Interchange

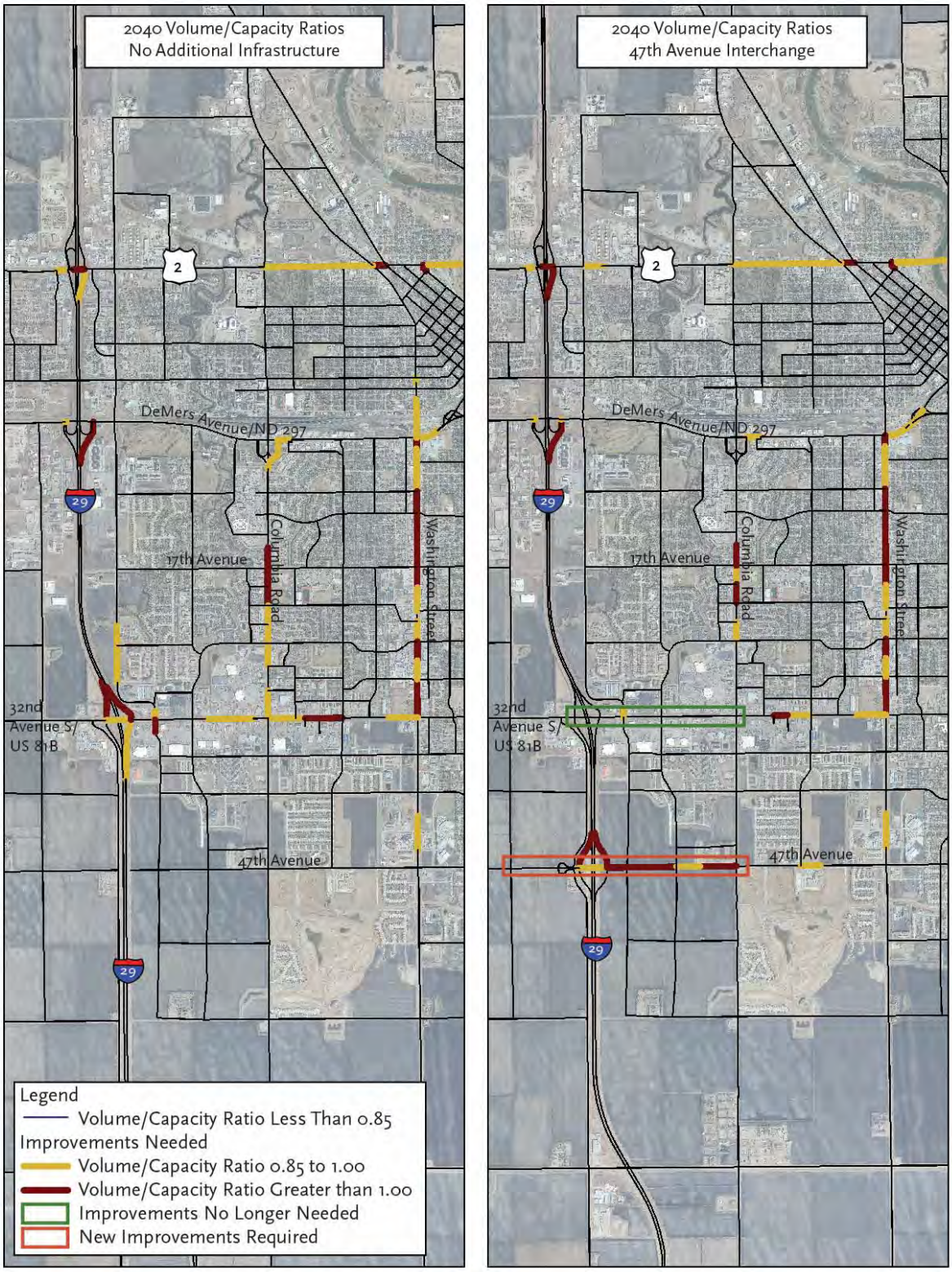


Figure 6-25: 2025 and 2040 ADT with 47th Avenue Interchange and 17th Avenue Grade Separation

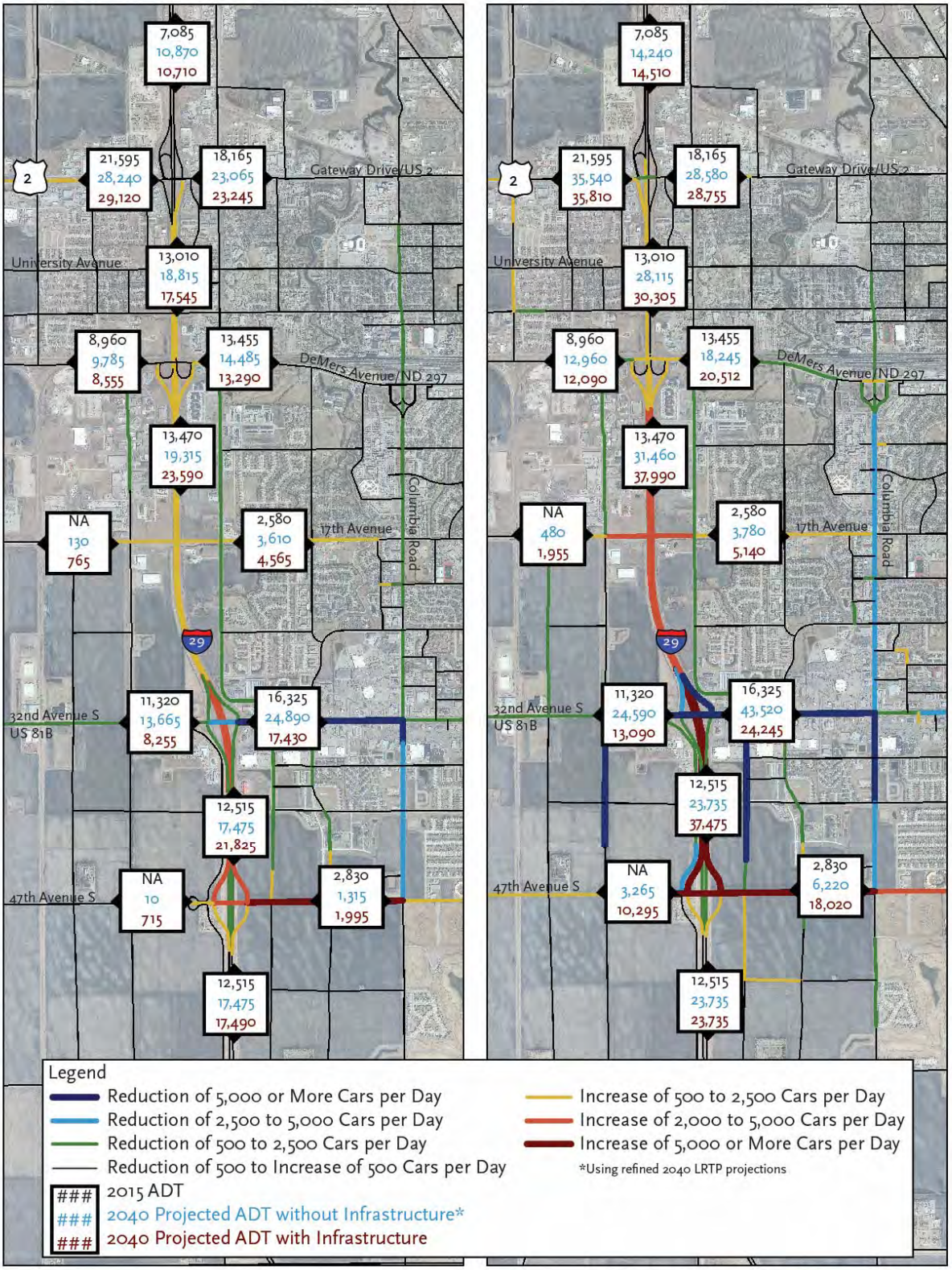


Figure 6-26: Volume/Capacity Ratios for Existing and Committed Network and 47th Avenue Interchange and 17th Avenue Grade Separation Scenario

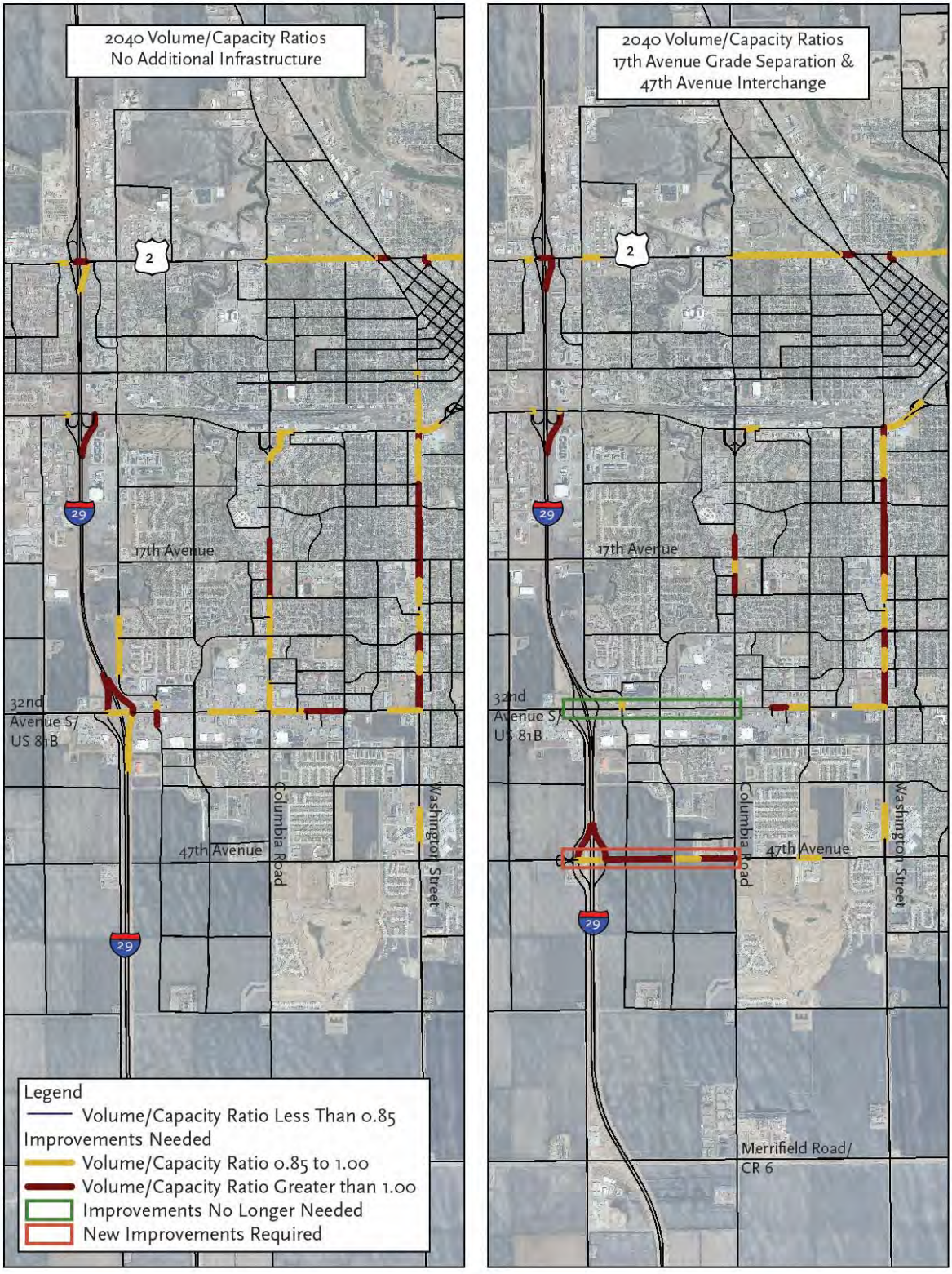


Figure 6-27: 2025 and 2040 ADT with 62nd Avenue Grade Separation

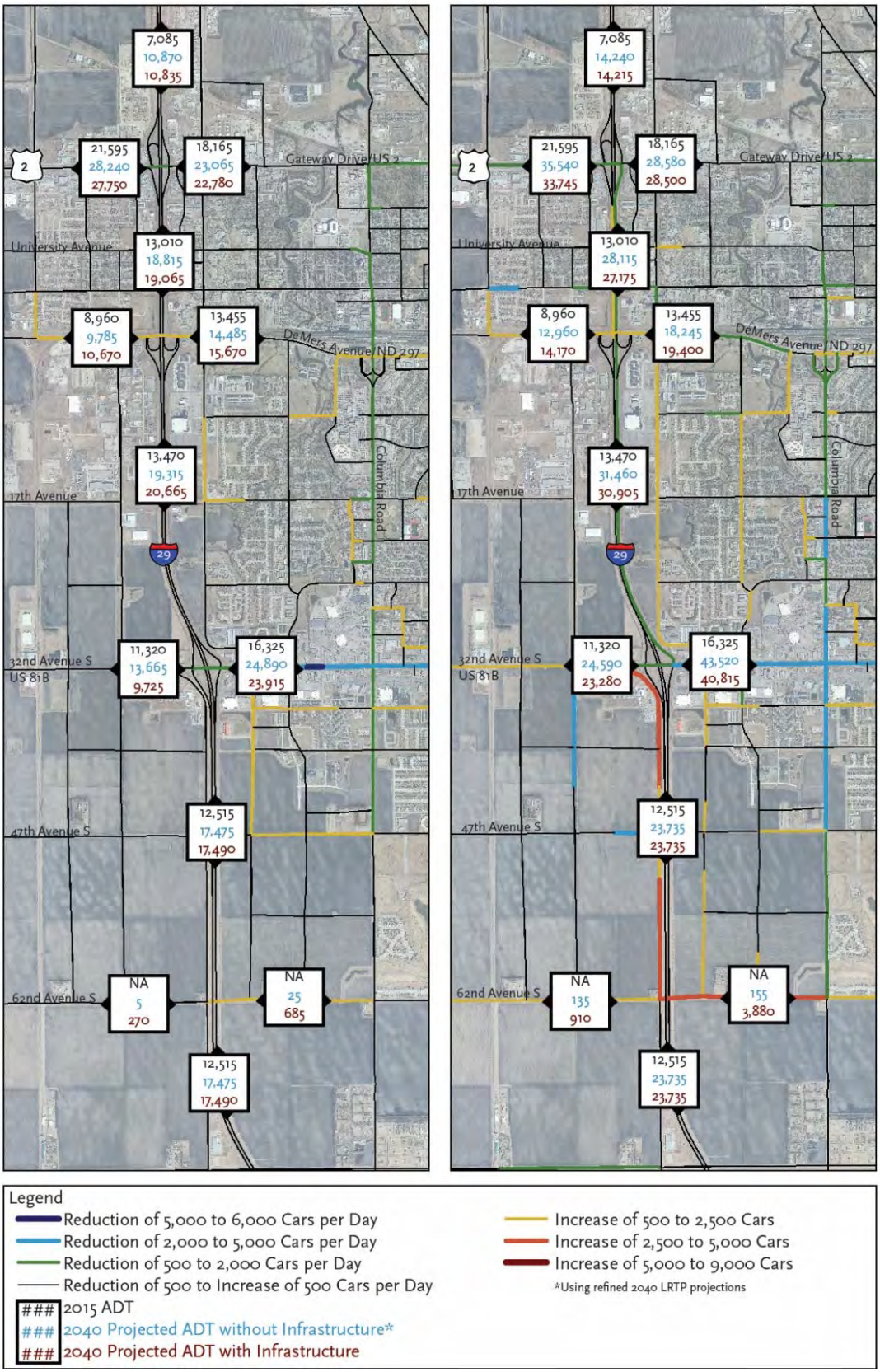


Figure 6-28: Volume/Capacity Ratios for Existing and Committed Network and 62nd Avenue Grade Separation

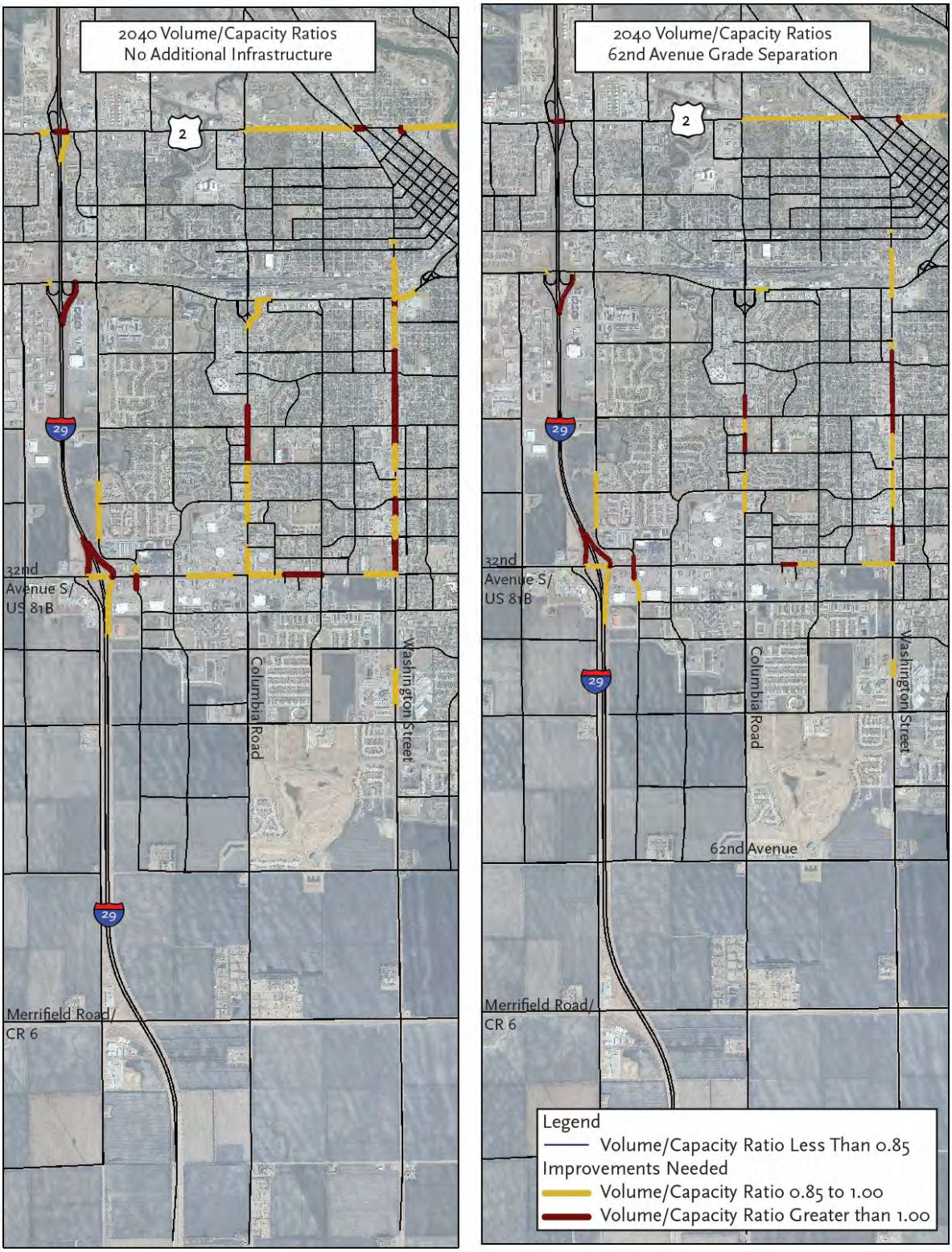


Figure 6-29: 2025 and 2040 ADT with 62nd Avenue Interchange

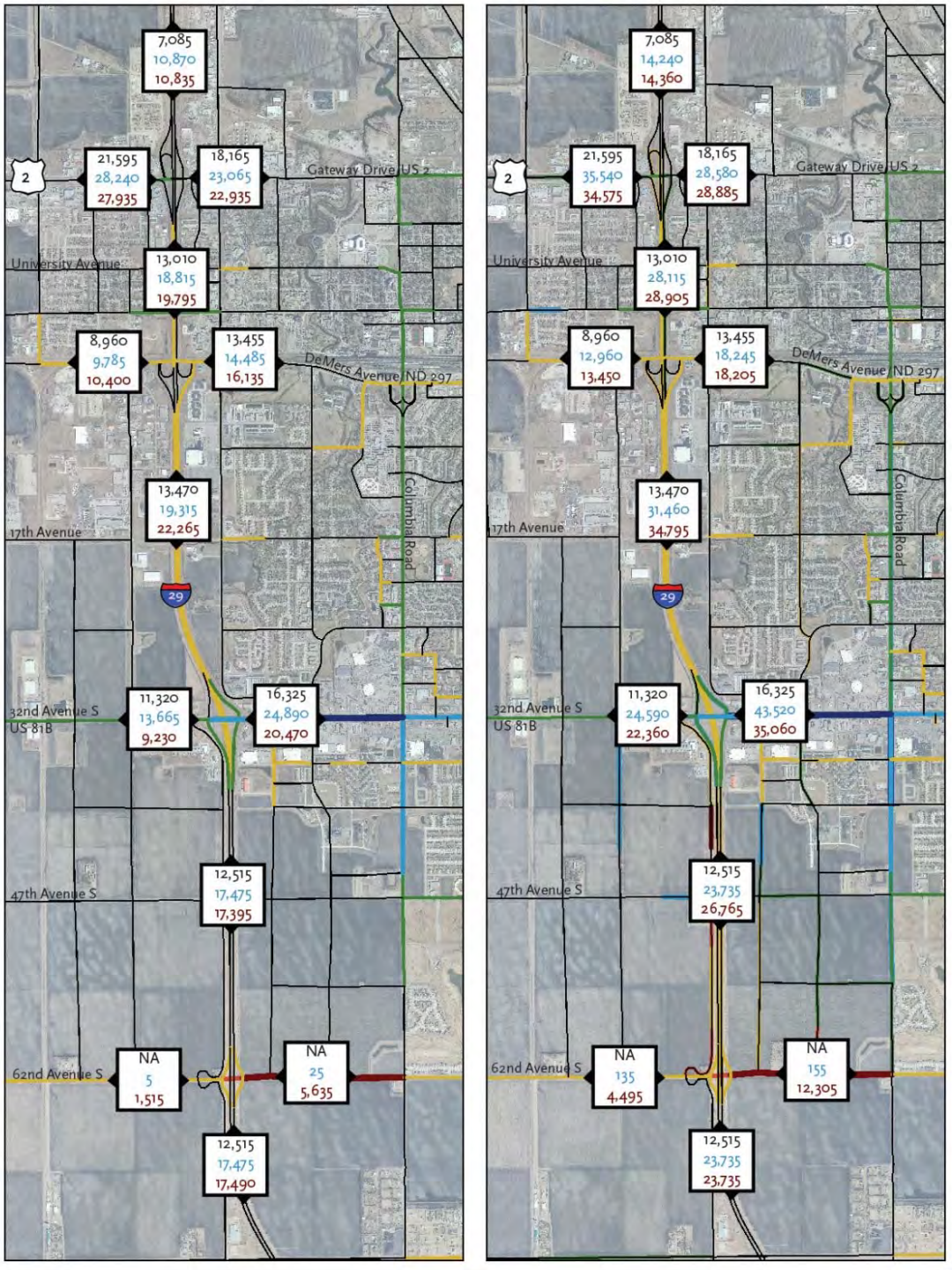


Figure 6-30: Volume/Capacity Ratios for Existing and Committed Network and 62nd Avenue Interchange

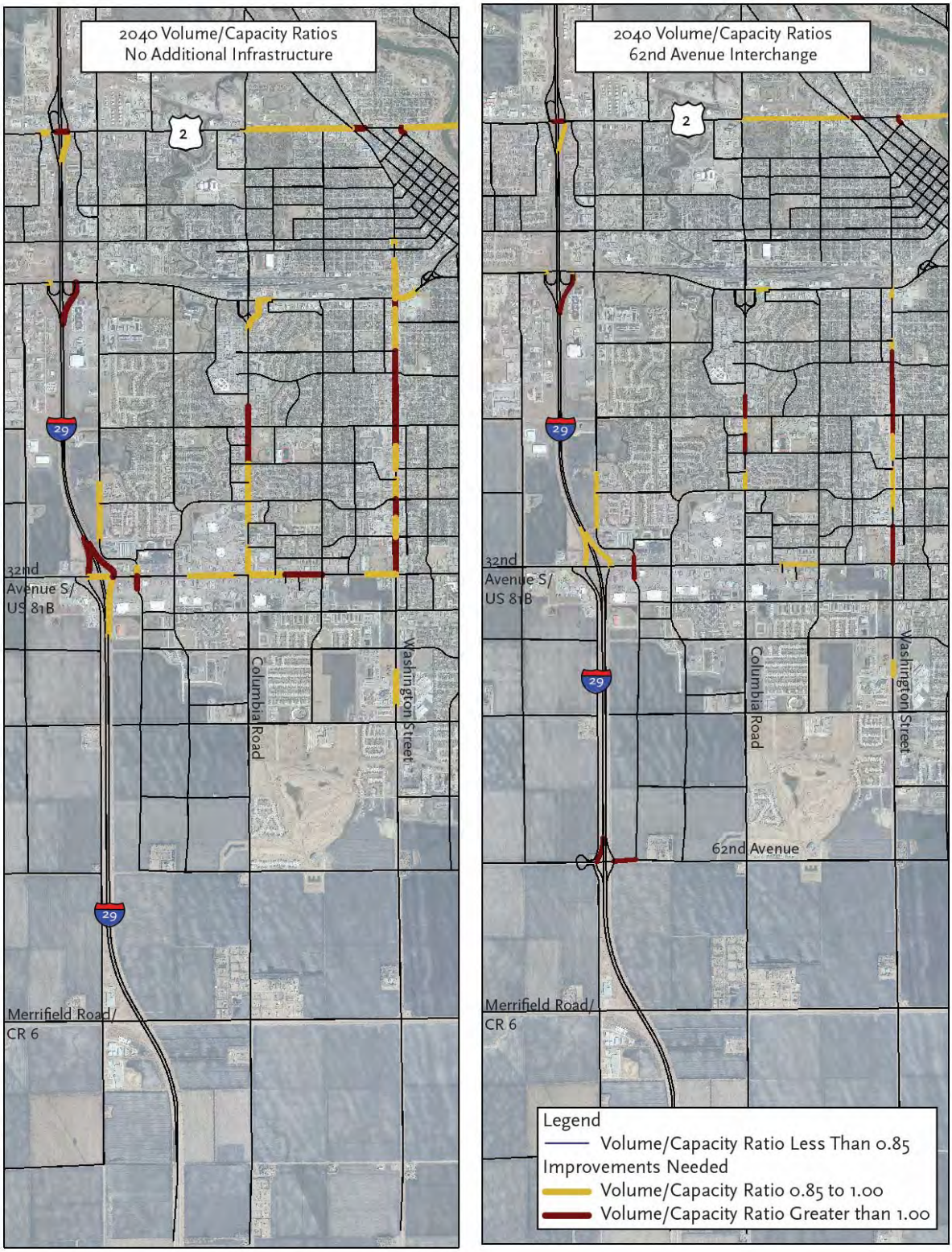


Figure 6-31: 2025 and 2040 ADT with 62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges

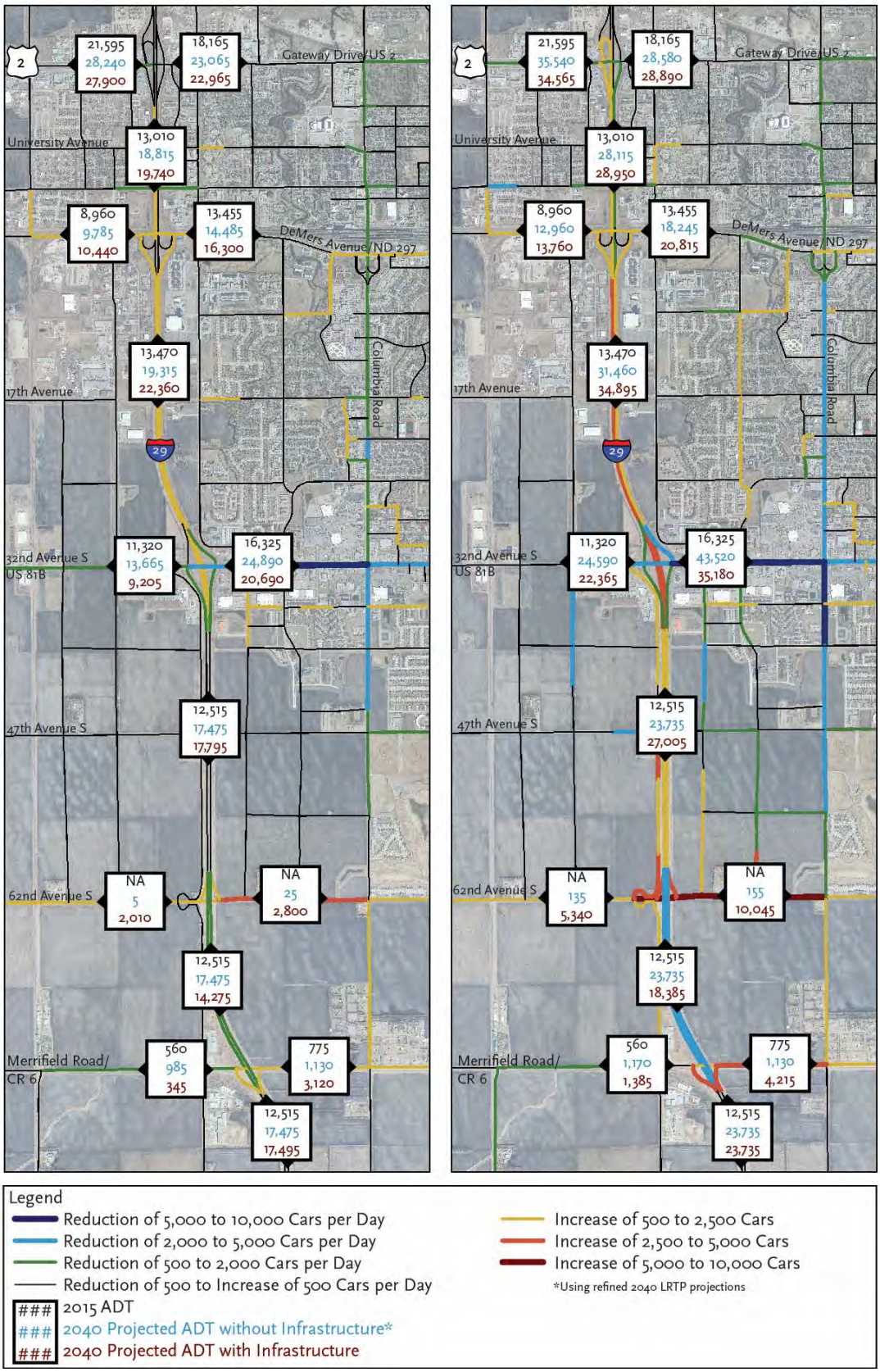


Figure 6-32: Volume/Capacity Ratios for Existing and Committed Network and 62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges

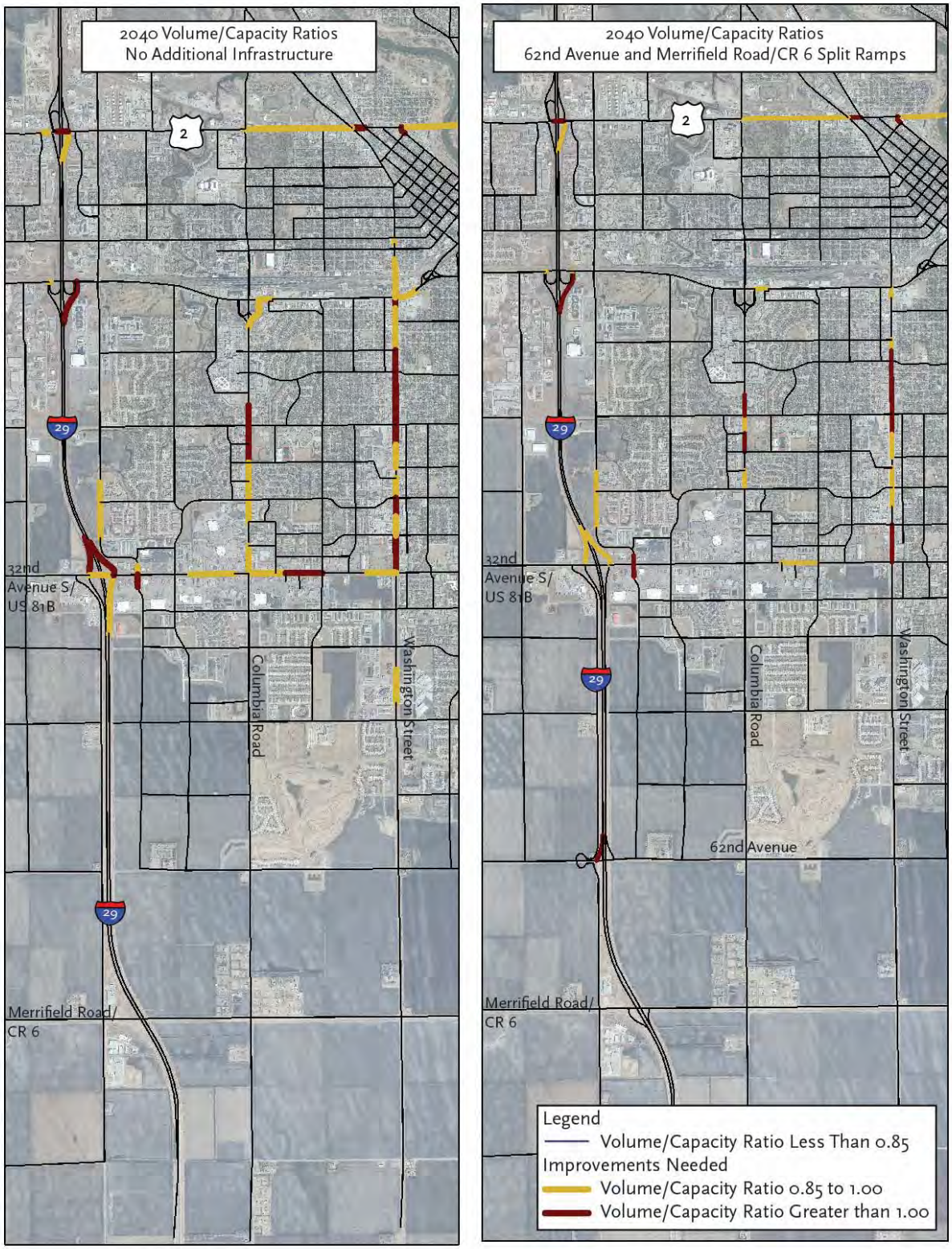


Figure 6-33: 2025 and 2040 ADT with 47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges

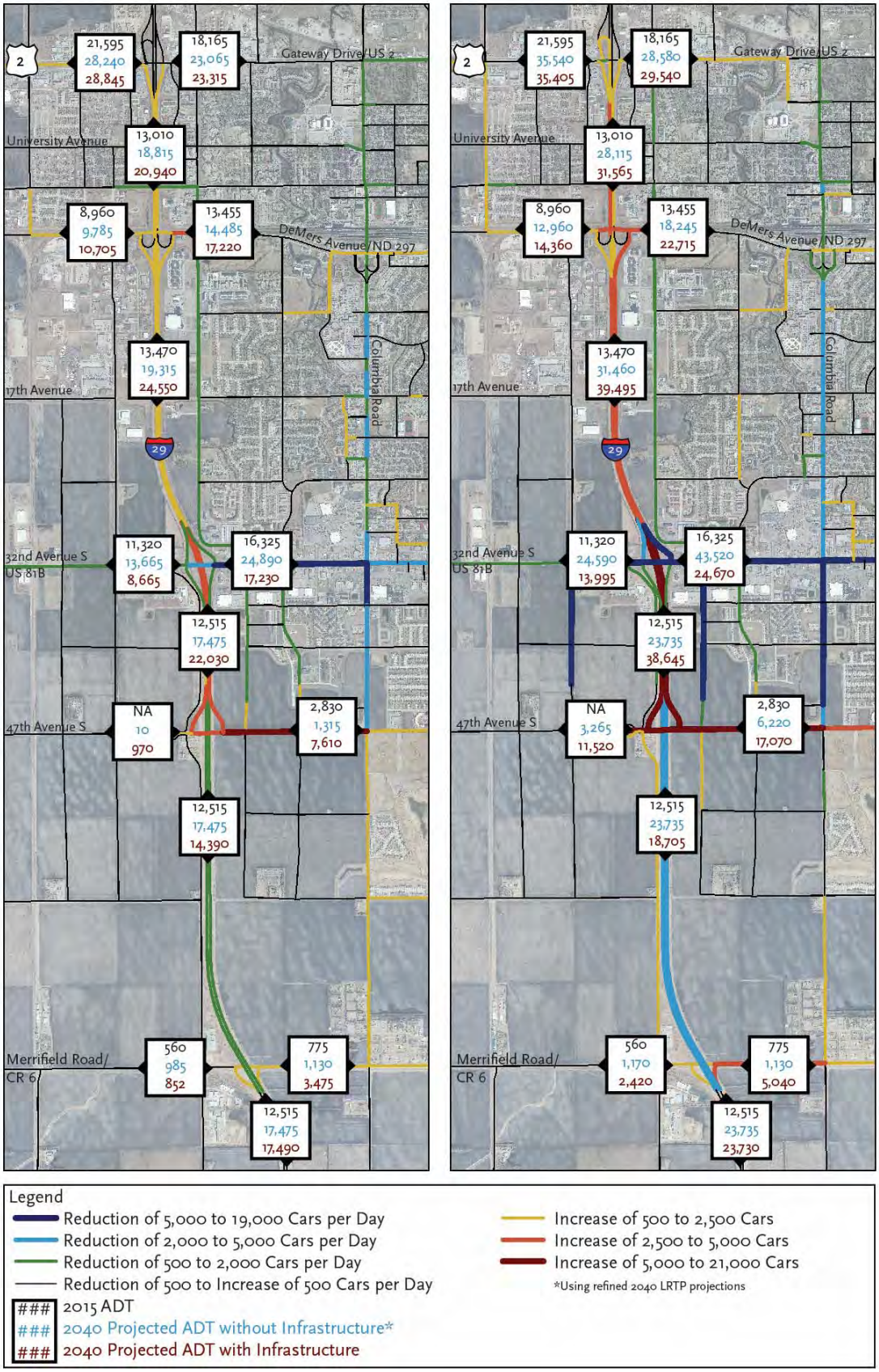


Figure 6-34: Volume/Capacity Ratios for Existing and Committed Network and 47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges

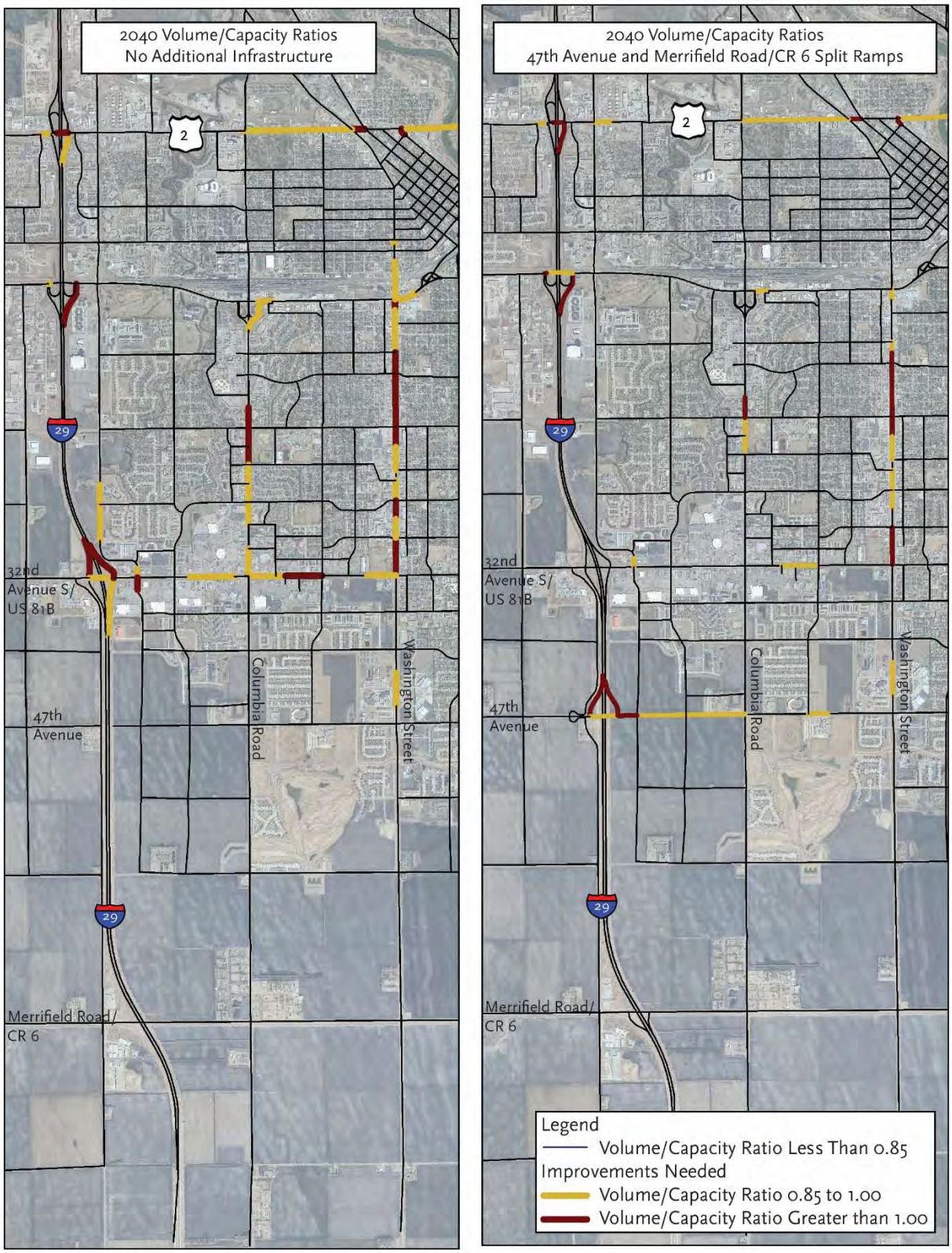


Figure 6-35: 2025 and 2040 ADT with 62nd Avenue and Merrifield Road/CR 6 Interchanges

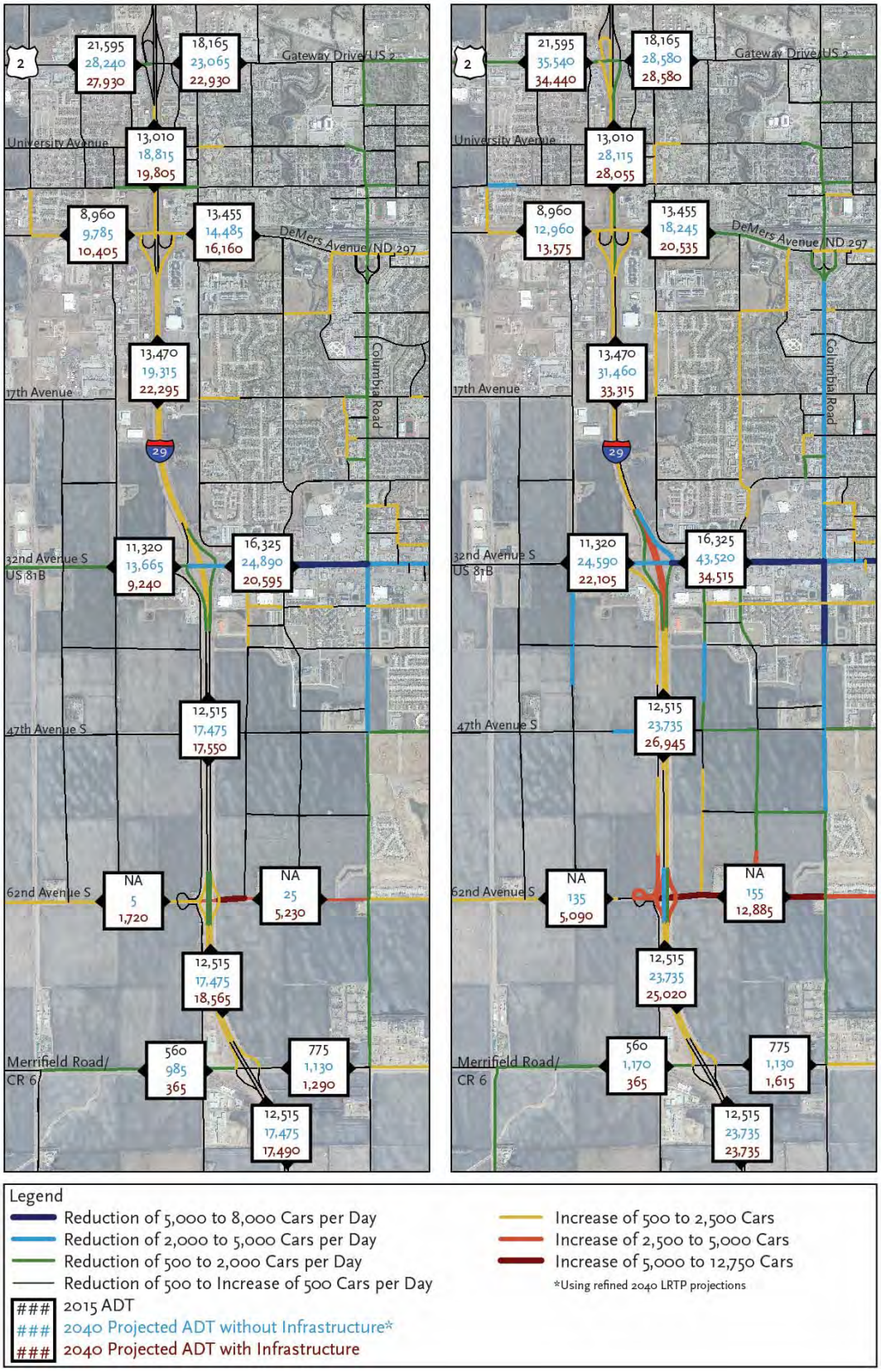


Figure 6-36: Volume/Capacity Ratios for Existing and Committed Network and 62nd Avenue and Merrifield Road/CR 6 Interchanges

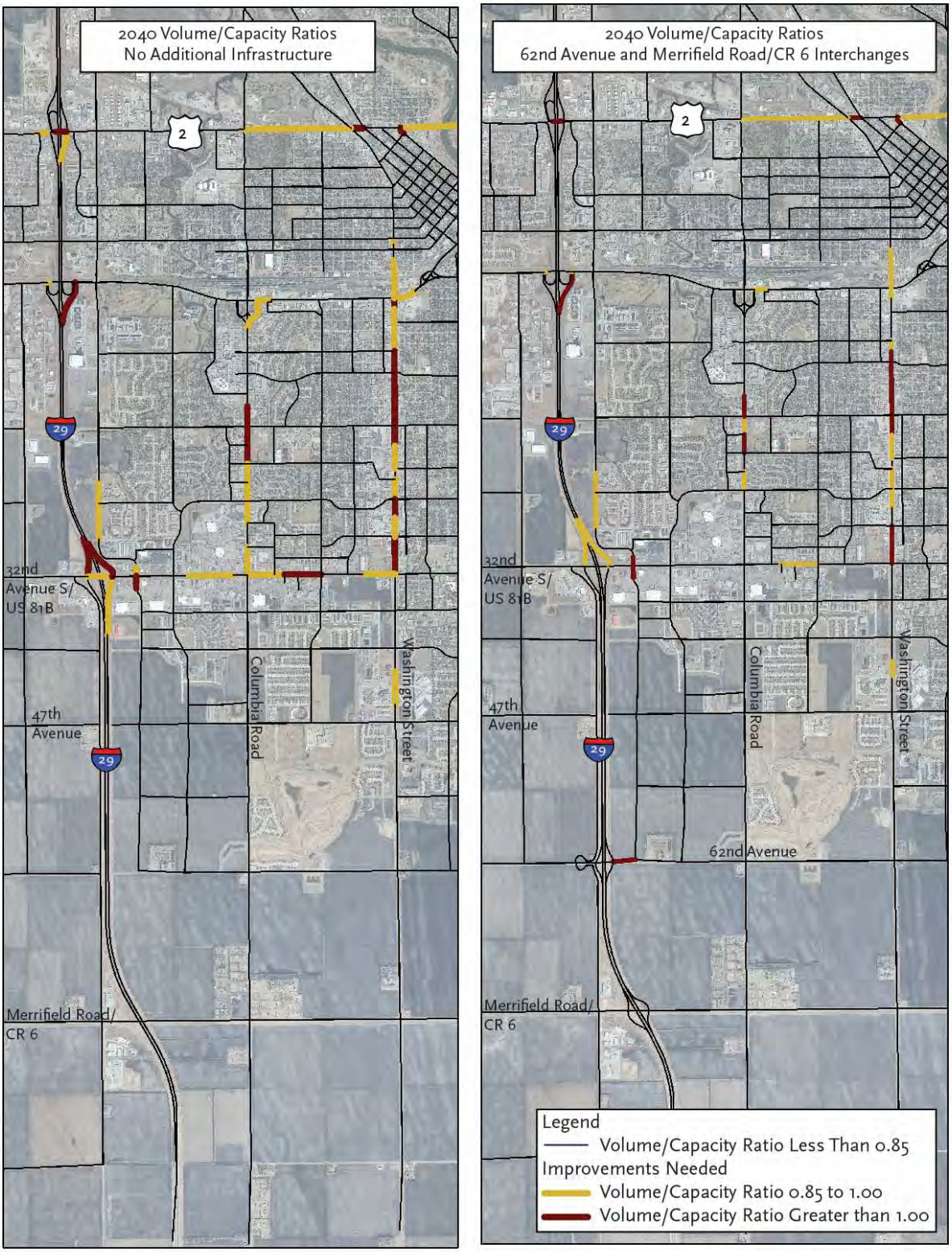


Figure 6-37: 2025 and 2040 ADT with 47th Avenue and Merrifield Road/CR 6 Interchanges

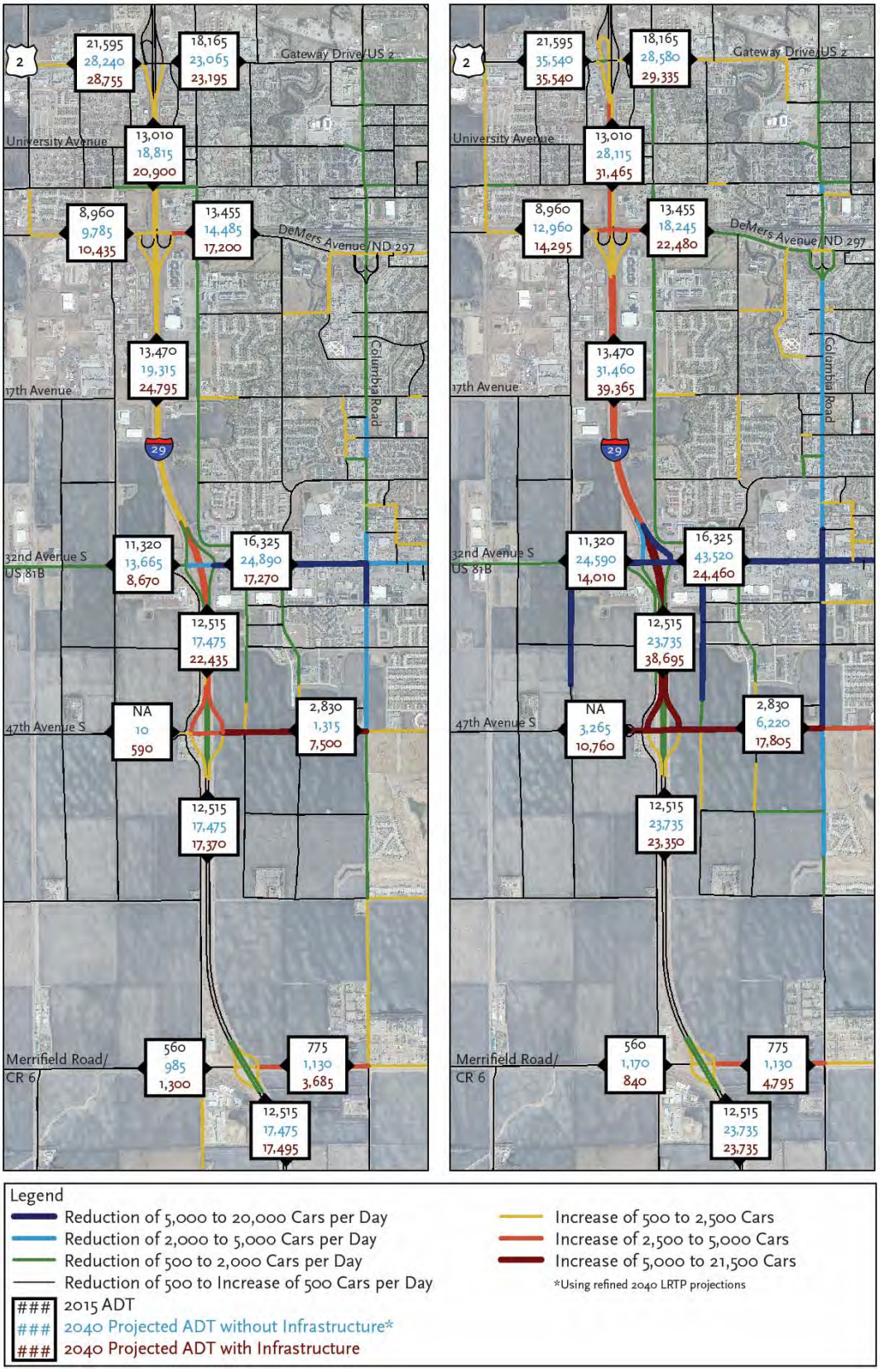
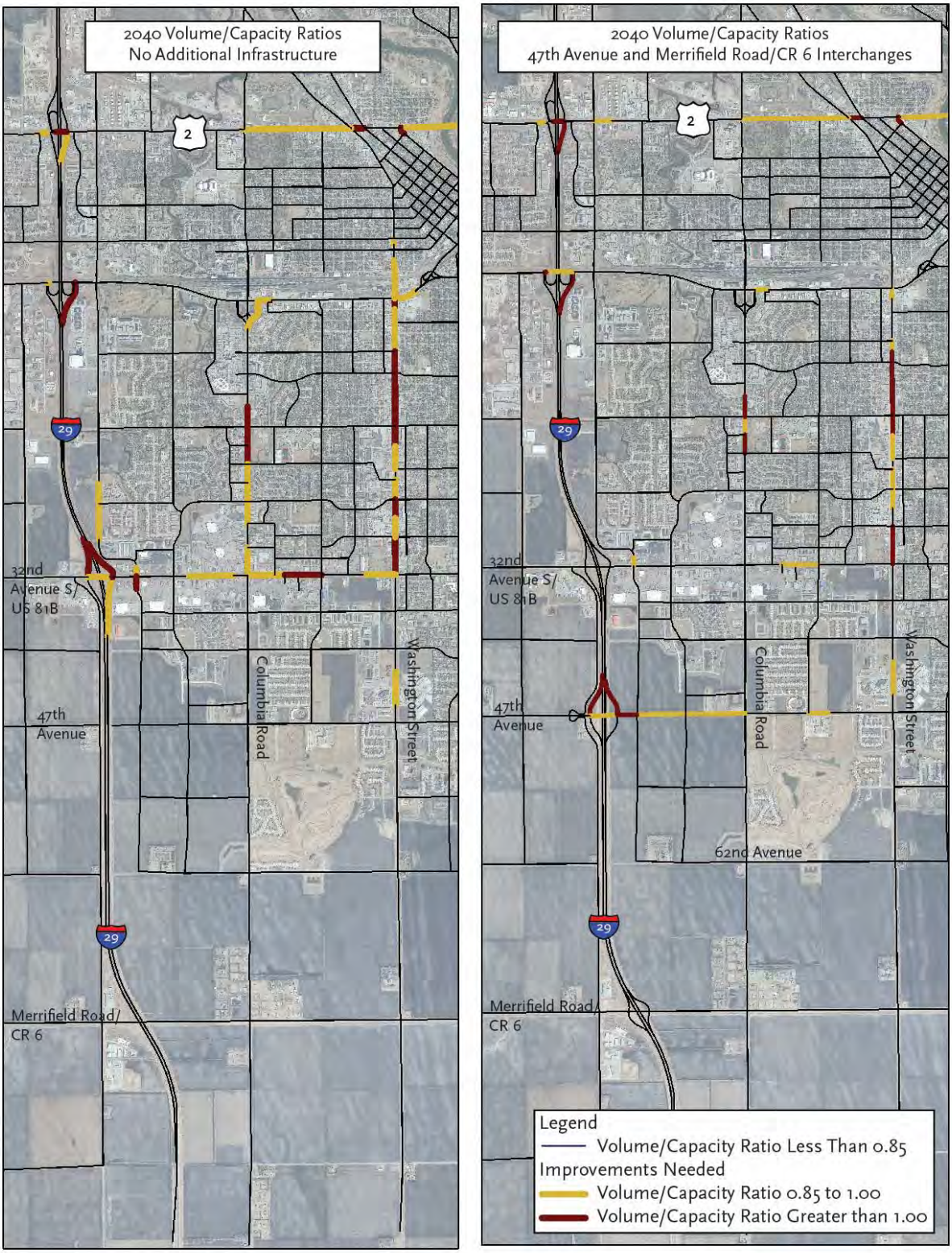


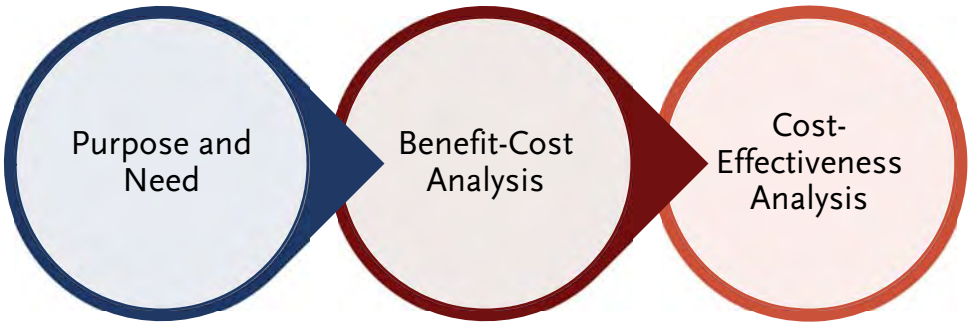
Figure 6-38: Volume/Capacity Ratios for Existing and Committed Network and 47th Avenue and Merrifield Road/CR 6 Interchanges



Screening Process

A three-part screening process was applied to each infrastructure scenario. The first was project Purpose and Need using criteria from Chapter 5, second was benefit-cost analysis to determine whether benefits to the regional transportation network outweighed the costs and finally cost-effectiveness to determine the cost per unit of benefit. It is important to emphasize that just because an infrastructure scenario is discarded through this project, does not mean there are no benefits or that the alternative should not be pursued, instead that the benefits the project provides are not relevant to the study area.

Figure 6-39: Scenario Screening Process



SCREEN 1: PURPOSE AND NEED

Scenarios were screened first using the criteria established in Chapter 4, which defined the Project Purpose and Need (PNS). The PNS of the project is to identify existing and future transportation issues on I-29 and the interchanges, within the study corridor and develop alternatives to address them. Therefore, the infrastructure scenarios must have a positive benefit on their respective impact area:

- Mainline Improvements: Using the TDM, the infrastructure scenario must reduce traffic by 1.0 percent on the interstate links from Gateway Drive/US 2 to Merrifield Road/CR 6.
- Interchange Improvements: Using the TDM, the infrastructure scenario must reduce traffic by 1.0 percent on the nearest interchange north, and south where applicable.

While seemingly arbitrary, the 1.0 percent threshold identifies infrastructure scenarios that provide benefits to I-29 and the existing infrastructure. Several Steering Committee members believed that one percent was too low and expressed that benefits as great as 25 percent should be considered the screening criteria. The one percent was maintained to allow for further analysis to be completed on a wider array of alternatives.

Only two infrastructure scenarios do not meet *Screen 1: Purpose and Need*: Merrifield Road/CR 6 Red River Crossing, with and without pavement improvements to the Merrifield Road/CR 6 truck bypass corridor, and the 32nd Avenue/US 81B Red River Crossing. The 32nd Avenue/US 81B Red River Crossing and Merrifield Road/CR 6 Interchange and Red River Crossing infrastructure scenario was not analyzed because in isolation, the 32nd Avenue/US 81B Red River Crossing did not meet the Purpose and Need for the project. These scenarios were discarded for the purpose of this study, because they do not have benefits specific to the I-29 study area. The results of *Screen 1: Purpose and Need* can be seen in Table 6-6.

- MnDOT values for remaining service life and discounting benefits from future years to present values were used for alternatives expected to exceed the 25-year study horizon of this project.

Table 6-8: Summary of Purpose and Need for Mainline Improvement Infrastructure Scenarios

Scenario	Traffic Reduction	Meets Screen 1: Project Purpose and Need
Mainline Reduction		
Merrifield Road/CR 6 Red River Crossing	+0.5%	No
Merrifield Road/CR 6 Red River Crossing and Interchange	-6.3 %	Yes
32nd Avenue/US 81B Red River Crossing	-0.84%	No
Interchange Reduction		
Merrifield Road/CR 6 Interchange	-4.8%	Yes
Merrifield Road/CR 6 Interchange with Pavement Improvements and Turn Lanes	-4.8%	Yes
17th Avenue Grade Separation	-3.4%	Yes
47th Avenue Grade Separation	-21.6%	Yes
17th Avenue and 47th Avenue Grade Separations	-21.0%	Yes
47th Avenue Interchange	-40.3%	Yes
47th Avenue Interchange and 17th Avenue Grade Separation	-29.6%	Yes
62nd Avenue Grade Separation	-5.9%	Yes
62nd Avenue Interchange	-15.7%	Yes
62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	-15.5%	Yes
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	-43.2%	Yes
62nd Avenue and Merrifield Road/CR 6 Interchanges	-16.9%	Yes
47th Avenue and Merrifield Road/CR 6 Interchanges	-43.5%	Yes

SCREEN 2: BENEFIT-COST ANALYSIS

If the infrastructure scenario meets *Screen 1: Purpose and Need* criteria, it was analyzed using benefit-cost analysis. Using the TDM outputs and high-level planning cost estimates, a benefit-cost analysis was completed to compare the costs, including construction, engineering and right-of-way, and benefits, including travel time and delay benefits to vehicles and trucks network-wide. A benefit-cost ratio greater than one meets this screen.

BENEFIT-COST METHODOLOGY

Using guidance from the "User Benefit Analysis for Highways" developed by AASHTO, a benefit-cost (B/C) analysis was conducted to provide a systematic evaluation of the economic advantages (benefits) and disadvantages (costs) of each interchange alternative. This analysis was conducted using the following additional resources:

- US DOT's "Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis" published July 9th, 2014 quantifies the value of travel time for passenger and freight transportation. MnDOT updated these values to represent in-state conditions. MnDOT values were used as they provide a greater representation of the Grand Forks-East Grand Forks metro area's financial environmental than national figures.
- The estimation of travel time savings included both the driver and passengers in the vehicle (i.e. vehicle occupancy rates). This information was collected from the National Household Travel Survey.
- MnDOT values for remaining service life and discounting benefits from future years to present values were used for alternatives expected to exceed the 25-year study horizon of this project.

Benefit Components

The following components were used for benefit calculations for 2025 to 2040.

- Vehicle Miles Traveled (VMT) – estimated for each alternative using regional travel demand model
- Vehicle Hours Traveled (VHT) – estimated for each alternative using regional travel demand model

MnDOT provides VMT and VHT cost estimates for both autos and trucks based on US DOT's "Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis."

Table 6-7: Operating Costs and Travel Time Costs for Autos and Trucks

	Autos	Trucks
Per-Mile Operating Costs	$0.28	$1.09
Per-Hour Travel Time	$17.00	$27.90

Cost Components

The analysis completed for this study assumed no construction could occur before 2025. The Grand Forks – East Grand Forks TIP and the North Dakota STIP have been completed through 2019. Construction of large infrastructure projects, like the alternatives included in these infrastructure scenarios, take several years for environmental documentation, design and construction. This does not account for the challenging financial environment in the Grand Forks – East Grand Forks metro, which may make identifying funding for the projects difficult. It is expected that the earliest any of these major projects could be built would be 2020 through 2025. To be conservative, 2025 was used, which also aligned with the first analysis year for the travel demand modeling completed for each scenario. The scenario specific cost assumptions were detailed earlier in this report.

Other Assumptions

The following assumptions were also made:

- The lifespan of benefit-cost analysis was through 2040, which aligned with the second analysis year for the travel demand modeling completed for each scenario.
- Infrastructure includes some remaining useful life through the analysis period based on MnDOT's *Recommended Remaining Capital Value Factors for Use in Benefit-Cost Analysis in SFY 2016* table.
- Daily model benefits of VMT and VHT were multiplied by 347, which is based on the NDDOT 2015 Traffic Report. This essentially normalizes weekday and weekend traffic patterns.
- While the metro-wide roadway network, according to MnDOT and NDDOT traffic counts, experiences an average truck percentage of 14.5 percent, the impacts the different infrastructure scenarios have on VMT and VHT for autos and trucks would be specific to each scenario. Table 6-8 includes estimates of heavy truck percentages for each infrastructure scenario.

EXAMPLE CALCULATION

An example calculation for a benefit-cost analysis can be found in Appendix C.

Table 6-8: Truck Traffic Assumptions

Scenario	Basis	Truck Percentage
Merrifield Road/CR 6 Interchange	This interchange would primarily serve truck traffic beginning or ending in the existing and future development along the Merrifield Road/CR 6 corridor. Parallel north-south routes experience truck traffic around 8.0 percent.	8.0%
Merrifield Road/CR 6 Red River Crossing	Typical bypasses around the State of North Dakota experience around 30 percent truck traffic. Cross-checking against the existing truck traffic on the Gateway Drive/US 2 and DeMers Avenue/ND 297 river crossings would result in approximately 25.0 percent truck traffic on a new river crossing and bypass.	25.0%*
Merrifield Road/CR 6 Interchange and Red River Crossing	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	25.0%*
17th Avenue Grade Separation	A 17th Avenue grade separation is expected to provide direct access to the industrial park, much of which would be pulled from existing traffic using DeMers Avenue or 32nd Avenue currently. The weighted average truck traffic percentage is 2.75 percent.	2.75%
47th Avenue Grade Separation	47th Avenue is expected to take away a large percentage of 32nd Avenue/US 81B traffic. For this reason, the average truck traffic on 32nd Avenue/US 81B east of I-29 to Columbia Road was applied to the expected traffic on 47th Avenue.	2.5%
17th Avenue and 47th Avenue Grade Separations	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	2.75%
47th Avenue Interchange	47th Avenue is expected to take away a large percentage of 32nd Avenue/US 81B traffic. For this reason, the average truck traffic on 32nd Avenue/ US 81B east of I-29 to Columbia Road was applied to the expected traffic on 47th Avenue.	2.5%
47th Avenue Interchange and 17th Avenue Grade Separation	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	2.75%
32nd Avenue/US 81B Red River Crossing	A Red River crossing at 32nd Avenue/US 81B would likely have similar characteristics as the existing river crossings at DeMers Avenue/ND 297 and Gateway Drive/US 2.	4.0%
32nd Avenue/US 81B Red River Crossing with Merrifield Road Red River Crossing and Interchange	Traffic expected on 32nd Avenue/US 81B is significantly heavier than that on Merrifield Road/CR 6 infrastructure so truck traffic was weighted based on total expected traffic of 32nd Avenue/US 81B and Merrifield Road/CR 6. This results in significantly lower heavy truck percentage for this scenario.	13.5%
62nd Avenue Grade Separation	62nd Avenue is expected to take away some percentage of 32nd Avenue/US 81B traffic and some percentage of Merrifield Road/CR 6. For this reason, a weighted average based on truck traffic on 32nd Avenue/ US 81B east of I-29 to Columbia Road (2.5%) and Merrifield Road/CR 6 (8.0%) was applied to the expected traffic on 62nd Avenue.	3.0%
62nd Avenue Interchange	62nd Avenue is expected to take away some percentage of 32nd Avenue/US 81B traffic and some percentage of Merrifield Road/CR 6. For this reason, a weighted average based on truck traffic on 32nd Avenue/ US 81B east of I-29 to Columbia Road (2.5%) and Merrifield Road/CR 6 (8.0%) was applied to the expected traffic on 62nd Avenue.	3.0%
62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	8.0%
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	8.0%
62nd Avenue and Merrifield Road/CR 6 Interchanges	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	8.0%
47th Avenue and Merrifield Road/CR 6 Interchanges	To be conservative, the higher of the two combined scenario's truck traffic percentage was used.	8.0%

**2015 traffic on Gateway Drive/US 2 was 7.7 percent heavy truck traffic while on DeMers Avenue/ND 297 heavy truck traffic was just 1.5 percent heavy truck traffic.*

RESULTS OF SCREEN 2: BENEFIT-COST ANALYSIS

Nineteen infrastructure scenarios met *Screen 2: Benefit-Cost Analysis* and can be seen in Table 6-9. However, many scenarios met the benefit-cost analysis criteria without roadway improvements, but do not have a benefit-cost ratio greater than one if roadway improvements are included.

Table 6-9: Summary of Benefit-Cost Analysis for Mainline Improvement Infrastructure Scenarios

Scenario	Benefit-Cost Ratio	Meets Screen 2: Benefit-Cost Analysis
Merrifield Road/CR 6 Interchange	6.32	Yes
▪ with Roadway Improvements	1.47	Yes
Merrifield Road/CR 6 Interchange and Red River Crossing	3.64	Yes
▪ with Roadway Improvements	1.78	Yes
17th Avenue Grade Separation	2.74	Yes
47th Avenue Grade Separation	3.34	Yes
▪ with Roadway Improvements	1.06	Yes
17th Avenue and 47th Avenue Grade Separations	1.89	Yes
▪ with Roadway Improvements	1.06	Yes
47th Avenue Interchange	5.66	Yes
▪ with Roadway Improvements	2.41	Yes
47th Avenue Interchange and 17th Avenue Grade Separation	1.80	Yes
▪ with Roadway Improvements	1.32	Yes
62nd Avenue Grade Separation	1.19	Yes
▪ with Roadway Improvements	0.63	No
62nd Avenue Interchange	1.58	Yes
▪ with Roadway Improvements	1.04	Yes
62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	0.79	No
▪ with Roadway Improvements	0.63	No
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	2.55	Yes
▪ with Roadway Improvements	0.76	No
62nd Avenue and Merrifield Road/CR 6 Interchanges	1.22	Yes
▪ with Roadway Improvements	0.58	No
47th Avenue and Merrifield Road/CR 6 Interchanges	2.40	Yes
▪ with Roadway Improvements	0.76	No

SCREEN 3: COST-EFFECTIVENESS ANALYSIS

Ultimately, any infrastructure scenario recommended in this study will need to be cost-constrained in the next LRTP before it can proceed into design and construction. The 2040 LRTP forecasted $267.2 million dollars will be available from 2016 through 2040 for all Grand Forks-East Grand Forks metro transportation infrastructure projects but has identified more than $470 million worth of projects. After cost-constraining, there is still $204 million worth of projects with no identified funding. This study is not meant to prioritize these infrastructure scenarios relative to other projects identified for the metro area, but to identify the infrastructure scenarios that make the most impact to the I-29 study area at the lowest relative cost through the study horizon, given the difficult financial environment and the extensive list of projects in the metro. The cost-effectiveness (CE) analysis is based on the following criteria:

- Mainline Improvements: Scenarios that improve mainline I-29 seek to reduce vehicle miles traveled by providing a direct route and will be compared on a per dollar cost to reduce vehicle miles. Scenarios that can deliver a VMT reduction at a lower cost than the economic value of the per mile travel (based on a weighted average of heavy truck traffic) will be carried forward.
- Interchange Improvements: Scenarios that improve existing interchange operations seek to reduce congestion on existing interchanges and vehicle hours traveled, so will be compared on a per dollar cost to reduce vehicle hours. Scenarios that deliver a per hour reduction at a lower cost than the economic value of the vehicle hour (based on a weighted average of heavy truck traffic) will be carried forward.

This analysis did not remove remaining capital value from the project cost. This was intentional, to provide contrast to the benefit-cost analysis. While the benefit-cost analysis was designed to demonstrate if the projects total benefits outweigh its total costs, the cost-effectiveness analysis was designed to demonstrate projects that provide the most benefit during the study horizon at the lowest cost. Essentially, the benefit-cost analysis is intended to determine whether an improvement should ever be built, whereas the cost-effectiveness analysis is intended to show whether the improvement should be built before 2040. An example of the cost-effectiveness analysis is provided below.

EXAMPLE CALCULATION

An example calculation for a benefit-cost analysis can be found in Appendix C.

RESULTS OF SCREEN 3: COST-EFFECTIVENESS ANALYSIS

Five scenarios, shown in Table 6-10, met the cost-effectiveness analysis: Merrifield Road/CR 6 interchange, 47th Avenue interchange with and without roadway improvements, 47th Avenue and Merrifield Road/CR 6 split ramp interchanges, and 47th Avenue and Merrifield Road/CR 6 interchanges. These alternatives provide the biggest benefit to the study area in the most cost-effective way. However, only the 47th Avenue interchange scenario meets the cost-effectiveness screening with and without additional roadway improvements.

While the 47th Avenue Interchange is the most cost-effective scenario ($9.54 per travel time hour reduced, versus $13.45 per travel time hour reduced on Merrifield Road/CR 6), it comes at a slightly higher 2025 cost of $42.0 million, compared to $37.8 million for Merrifield Road/CR 6, and will face interchange spacing constraints.

Table 6-10: Summary of Cost-Effectiveness Analysis for Mainline Improvement Infrastructure Scenarios

Scenario	Cost-Effectiveness		Economic Value	Meets Screen 3: Cost-Effectiveness Analysis
Merrifield Road/CR 6 Interchange	$13.45 per Hour	<	$17.87 per Hour	Yes
▪ with Roadway Improvements	$25.33 per Hour	>	$17.87 per Hour	No
Merrifield Road/CR 6 Interchange and Red River Crossing	$0.99 per Mile	>	$0.48 per Mile	No
▪ with Roadway Improvements	$1.39 per Mile	>	$0.48 per Mile	No
17th Avenue Grade Separation	$27.71 per Hour	>	$17.30 per Hour	No
47th Avenue Grade Separation	$21.44 per Hour	>	$17.27 per Hour	No
▪ with Roadway Improvements	$31.41 per Hour	>	$17.27 per Hour	No
17th Avenue and 47th Avenue Grade Separations	$27.32 per Hour	>	$17.30 per Hour	No
▪ with Roadway Improvements	$36.27 per Hour	>	$17.30 per Hour	No
47th Avenue Interchange	$9.54 per Hour	<	$17.27 per Hour	Yes
▪ with Roadway Improvements	$13.81 per Hour	<	$17.27 per Hour	Yes
47th Avenue Interchange and 17th Avenue Grade Separation	$12.98 per Hour	<	$17.30 per Hour	No*
▪ with Roadway Improvements	$17.12 per Hour	<	$17.30 per Hour	No*
62nd Avenue Grade Separation	$30.70 per Hour	>	$17.33 per Hour	No
62nd Avenue Interchange	$19.09 per Hour	>	$17.33 per Hour	No
▪ with Roadway Improvements	$24.47 per Hour	>	$17.33 per Hour	No
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	$16.80 per Hour	<	$17.87 per Hour	Yes
62nd Avenue and Merrifield Road/CR 6 Interchanges	$25.03 per Hour	>	$17.87 per Hour	No
47th Avenue and Merrifield Road/CR 6 Interchanges	$16.60 per Hour	<	$17.87 per Hour	Yes

**Because the 17th Avenue Grade Separation does not meet cost-effectiveness in isolation, it is discarded from hybrid scenarios.*

SUMMARY OF INFRASTRUCTURE SCENARIOS SCREENING

The impacts to vehicle hours traveled and vehicle miles traveled vary with each alternative, with different per unit benefit-cost ratios due to varying costs associated with each alternative. For example, while the 32nd Avenue/US 81B Red River crossing scenarios have the greatest regional impacts in terms of VMT reduction, they come with the highest costs and offer little benefit to operations on I-29.

Five infrastructure scenarios passed three levels of screening based on the PNS, B/C analysis and CE analysis. As noted above, some scenarios pass all three screening criteria if roadway improvements are not included, but when included in the cost alternatives, do not pass the B/C analysis or the CE analysis. Excluding the numerous other alternatives does not suggest they are without merit and should be discarded from the universe of alternatives, but instead that their value to the traffic operations of the I-29 study area is not significant enough for their inclusion in this study. Contained in Table 6-11 is a summary of the alternatives and the results of the screening criteria.

Table 6-11: Summary of Infrastructure Scenarios

Scenario	VHT Reduction 2025 – 2040	VMT Reduction 2025 - 2040	2025 Cost Estimate	2025 Cost Estimate with Roadway Improvements	Screen 1: Purpose and Need	Screen 2: Benefit-Cost	Screen 3: Cost-Effectiveness
Merrifield Road/CR 6 Infrastructure Scenarios							
Merrifield Road/CR 6 Interchange	2.8 Million	74.7 Million	$37.8 Million	$71.3 Million	Yes -4.82%	Yes 6.32	Yes -24.76%
Merrifield Road/CR 6 Red River Crossing	2.9 Million	24.7 Million	$60.9 Million	$91.1 Million	No +0.54%	-	-
Merrifield Road/CR 6 Interchange and Red River Crossing	4.4 Million	75.9 Million	$75.3 Million	$105.5 Million	Yes -6.30%	Yes 3.64	No +105.50%
32nd Avenue/US 81B Infrastructure Scenarios							
32nd Avenue/US 81B Red River Crossing	4.5 Million	124.1 Million	$64.4 Million	NA	No -0.84%	-	-
Grade Separation and Interchange Infrastructure Scenarios							
17th Avenue Grade Separation	1.5 Million	42.9 Million	$40.4 Million	NA	Yes -3.38%	Yes 2.74	No +60.18%
47th Avenue Grade Separation	1.9 Million	50.4 Million	$49.0 Million	$59.2 Million	Yes -21.59%	Yes 3.34	No +24.12%
17th Avenue and 47th Avenue Grade Separations	2.1 Million	57.7 Million	$57.4 Million	$76.1 Million	Yes -21.00%	Yes 1.89	No*
47th Avenue Interchange	4.4 Million	53.3 Million	$42.0 Million	$60.7 Million	Yes -40.30%	Yes 5.66	Yes -44.79%
47th Avenue Interchange and 17th Avenue Grade Separation	4.5 Million	59.4 Million	$58.9 Million	$77.7 Million	Yes -29.58%	Yes 1.80	No*
62nd Avenue Grade Separation	1.7 Million	14.3 Million	$51.2 Million	$71.5 Million	Yes -5.90%	Yes 1.19	No +77.17%
62nd Avenue Interchange	3.8 Million	28.8 Million	$71.9 Million	$92.2 Million	Yes -15.70%	Yes 1.58	No +10.15%
62nd Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	3.7 Million	31.2 Million	$83.5 Million	$137.2 Million	Yes -15.50%	No 0.79	-
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	3.2 Million	31.0 Million	$53.6 Million	$105.8 Million	Yes -43.20%	Yes 2.55	Yes -5.98%
62nd Avenue and Merrifield Road/CR 6 Interchanges	3.4 Million	28.4 Million	$86.3 Million	$140.0 Million	Yes -16.90%	Yes 1.22	No +40.44%
47th Avenue and Merrifield Road/CR 6 Interchanges	3.4 Million	24.1 Million	$56.4 Million	$108.6 Million	Yes -43.50%	Yes 2.40	Yes -7.12%

Does not meet Screen 3, because in isolation the 17th Avenue Grade Separation is not cost-effective.

ADDITIONAL CONSIDERATIONS

LOCAL V. REGIONAL TRAFFIC

Before any new interchange is approved by the Federal Highway Administration, the City of Grand Forks and the Grand Forks – East Grand Forks Metropolitan Planning Organization will need to show that any new access onto I-29 supports the "role of the Interstate System as a thoroughfare for high-speed, high-volume, and long-haul travel, and not for local access between adjacent areas." So while the five infrastructure scenarios met the screening criteria in this chapter, there are additional considerations that must be given to the infrastructure scenarios, especially since most scenarios increases traffic onto I-29. Any new access onto I-29 must demonstrate that it functions as a regional connection and not as another local arterial. Additional analysis was done on regional (external) nodes in the TDM based select link analysis provided by ATAC. Regional nodes identify traffic on regional corridors entering and exiting the Grand Forks modeled area.

Methodology

The following approach was used to estimate the proportion of regional traffic using the 32nd Avenue/US 81B interchange and the five infrastructure scenarios that met all three screening criteria.

1. The fourteen regional/external nodes' select link totals (the number of vehicles on that external link using the selected infrastructure) and average daily traffic were identified.
2. The selected infrastructure links were identified and total traffic using these links was identified.
3. Regional select link totals were divided by the selected infrastructure links to determine the percent of users on the selected infrastructure with regional origins or destinations.

Table 6-12: Regional Traffic on Infrastructure Scenarios

	% of Vehicles Using the Selected Infrastructure with Regional Trip Ends
32nd Avenue/US 81B Interchange	22.2%
Gateway Drive/US 2	17.1%
47th Avenue Interchange	17.6%
Merrifield Road/CR 6 Interchange	46.3%
47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges	18.8%
47th Avenue and Merrifield Road/CR 6 Interchanges	18.1%

The 32nd Avenue/US 81B interchanges serves about 22.2 percent regional users, while the Gateway Drive/US 2 serves about 17.1 percent regional users. The three 47th Avenue infrastructure scenarios are estimated to be between 17.6 and 18.8 percent regional traffic. The 47th Avenue interchange scenario includes with and without pavement improvements, but the TDM outputs, and thus estimated regional traffic, remain the same. Alternatively, it is estimated that 46.3 percent of Merrifield Road/CR 6 interchange users will be regional. Based on this analysis, Merrifield Road/CR 6 provides a clear benefit to regional traffic, but the remaining infrastructure scenarios are comparable to existing interchange infrastructure.

LOGICAL TERMINI

Guidance from the Steering Committee suggested that additional roadway improvements may be needed for new interchange infrastructure. While typical logical termini would be the next major intersection east and west of ramp intersections, the 47th Avenue and 62nd Avenue infrastructure scenarios would be built along corridors that are not currently fully developed and the infrastructure scenarios along Merrifield Road/CR 6 are likely to attract higher volumes of truck traffic. For these reasons, additional cost estimates were prepared for roadway improvements to Grand Forks CR 5 for 47th Avenue and 62nd Avenue. If the Steering Committee determines all scenarios must include full roadway improvements, only the 47th Avenue interchange infrastructure scenario would meet all three screening criteria.

RECOMMENDATIONS

DO NOT CARRY FORWARD FOR FURTHER ANALYSIS

Using the screening criteria and the expected impact to regional traffic, the following infrastructure is not recommended to be carried forward, despite meeting all three screening criteria.

- 47th Avenue and Merrifield Road/CR 6 Split Ramp Interchanges. With the strong language included in the *Interstate System Access Information Guide* regarding partial interchanges it is unlikely this alternative would ever be approved. Furthermore, if additional roadway improvements are required, this infrastructure scenario would not pass the benefit-cost ratio or the cost-effectiveness requirements. This scenario should only be considered for further analysis if a full interchange at this location require rare and extraordinary measures to ensure effectiveness.

CARRY FORWARD FOR FURTHER ANALYSIS

Three interchange infrastructure scenarios are recommended to be carried forward for additional analysis. A comparison of the scenarios are provided in Table 6-13.

Table 6-13: Comparison of Infrastructure Scenarios to be Carried Forward

	47th Avenue Interchange	Merrifield Road/CR 6 Interchange	Combined
Benefits to 32nd Avenue	-40.3%	-4.8%	-43.5%
Impacts to I-29 Mainline	+21.2%	-4.1%	+18.0%
2025 Cost	**$42.0 Million** ▪ Interchange: $33.3 Million ▪ 47th Avenue Roadway: $8.6 Million	**$37.8 Million** ▪ Interchange Ramps: $14.4 Million ▪ 32nd Avenue: $23.4 Million	**$56.4 Million** ▪ 47th Avenue Interchange: $33.3 Million ▪ 47th Avenue Roadway: $8.6 Million ▪ Interchange Ramps: $14.4 Million
Total User Benefits (through 2040)	$47.9 Million	$39.1 Million	$35.2 Million
Daily Users	26,690	7,100	26,315
Vehicle Hours Traveled Reduced (through 2040)	4.4 Million Hours	2.8 Million Hours	3.4 Million Hours
Daily VHT Benefit/Primary User	-3 Minutes per User	-5.5 Minutes per User	-1.9 Minutes per User
Vehicle Miles Traveled Reduced (through 2040)	53.3 Million Miles	74.7 Million Miles	24.1 Million Miles
Daily VMT Benefit/Primary User	-0.6 Miles per User	-2.5 Miles per User	-0.25 Miles per User
Benefit-Cost Ratio	5.66	6.32	2.40
Cost-Effectiveness	$9.54 per VHT Reduced	$13.45 per VHT Reduced	$16.60 per VHT Reduced
Cost-Effectiveness with Roadway Improvements	$13.81 per VHT Reduced	$25.33 per VHT Reduced	$31.98 per VHT Reduced
Regional Users	17.6%	46.3%	18.1%
Distance to Nearest Interchange	One Mile with Proper Configuration	More Than Two Miles	Will Meet FHWA Requirements

47th Avenue Interchange

This infrastructure scenario provides significant benefits to 32nd Avenue/US 81B and the overall transportation network as demonstrated with a strong benefit-cost ratio and cost-effectiveness. It comes at a cost of $42.0 million, which does not

include additional 47th Avenue roadway costs, but does mitigate baseline capacity needs at 32nd Avenue/US 81B. An interchange at 47th Avenue would reduce network VHT by 4.4 million hours, which is 57.1 percent more than the Merrifield Road/CR 6 interchange and VMT by 53.3 million miles. Applied to the average daily user, this saves approximately three minutes and about 0.6 miles.

The 47th Avenue interchange would be less than one mile from the 32nd Avenue/US 81B interchange, but design solutions could abate the spacing constraints. Based on TDM outputs, it is estimated that just 17.6 percent of all users will be regional users.

Finally, the 47th Avenue interchange scenario meets the screening criteria with and without roadway improvements.

Merrifield Road/CR 6 Interchange

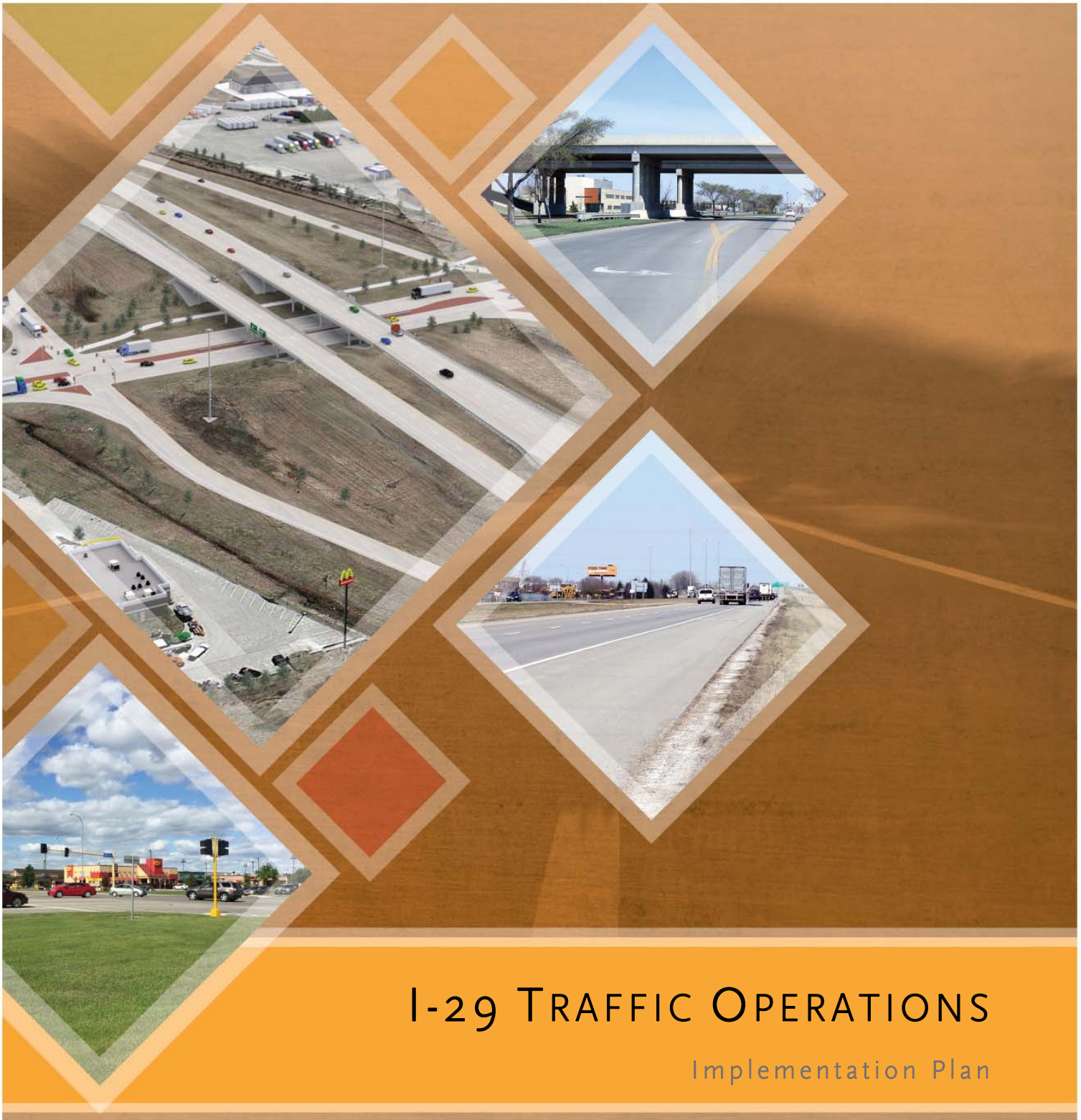
This infrastructure scenario provides minor benefits to 32nd Avenue/US 81B and I-29, which is not enough to mitigate the capacity needs at 32nd Avenue/US 81B. It has a cost of $37.8 million, which does not include additional Merrifield Road/CR 6 roadway costs to improve the roadway to a truck bypass.

An interchange at Merrifield Road/CR 6 would reduce VHT by just 2.8 million hours, but would reduce VMT by 74.7 million miles which is 40 percent more than the 47th Avenue interchange. Each average user of the Merrifield Road/CR 6 interchange would see a VHT reduction of 5.5 minutes per day and 2.5 miles. Based on TDM outputs, 46.3 percent of all users would be regional.

The Merrifield Road/CR 6 interchange scenario does not pass the cost-effectiveness analysis if roadway improvements are determined to be necessary.

47th Avenue and Merrifield Road/CR 6 Interchange

Because independently these infrastructure scenarios have significant positive benefits to the I-29 corridor, it is reasonable to expect that both would be implemented in the future even though the increased costs do not result in increased proportional benefits. This is evidenced by the cost-effectiveness results: the Merrifield Road/CR 6 interchange has a cost-effectiveness rate of $13.45 per vehicle hour reduced and the 47th Avenue interchange has a cost-effectiveness rate of $9.54, but the combined Merrifield Road/CR 6 and 47th Avenue interchange hybrid scenario has a cost-effectiveness rate of $16.60. This cost per vehicle hour reduced is 23.4 percent higher than the Merrifield Road/CR 6 interchange in isolation and 74.0 percent higher than the 47th Avenue interchange in isolation.



I-29 Traffic Operations

Implementation Plan

ALLIANT ENGINEERING

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8. IMPLEMENTATION PLAN

Intent

The Implementation Plan for the I-29 Corridor Study is intended to assist the creation of an overall project development and programming architecture for interrelated infrastructure needs throughout the study area. To achieve full build out of the envisioned corridor improvements, a full complement of investments are needed from the City of Grand Forks, Grand Forks County and NDDOT. The GF-EGF MPO Transportation Improvement Program (TIP) will also be a critical tool to implement improvements along the I-29 Corridor.

Major investments identified by the I-29 Corridor Study were related back to the currently approved goals within the 2040 GF-EGF MPO LRTP. Table 8-1 shows the relationship between the 2040 LRTP Goals and major investments discussed through the I-29 Corridor Study.

Table 8-1: Linkages to the LRTP Goals

Project	LRTP Goals							
	Economic Vitality	Security	Accessibility & Mobility	Environmental/ Quality of Life	Efficient System Management	Integration & Connectivity	System Preservation	Safety
North Washington/CR 11/US 81								
Access Modification + Ramp Modification			x				x	x
Gateway Drive/US 2								
Northeast Loop Modification	x	x	x				x	x
Gateway Drive Grade Separation	x	x	x	x		x		x
DeMers Avenue/ND 297								
42nd Street Grade Separation	x	x	x	x	x	x		x
Capacity Enhancements (No Bridge Widening)	x		x				x	x
32nd Avenue/US 81B								
Reconstruct 38th Street to Columbia Road	x		x				x	
47th Avenue								
Construct New Interchange	x	x	x	x			x	
Merrifield Road/CR 6								
Modify Overpass to Full Interchange	x	x	x					

Figure 8-1 demonstrates the overall range of identified projects for the I-29 Corridor. Note that identified non-interstate rehabilitation projects on Gateway Drive/US 2 and 32nd Avenue/US 81B are included in this discussion. Their inclusion is done due to their impact on investments in projects directly related to the I-29 Corridor Study. The development of the I-29 Corridor Study identifies several improvements which are dependent upon each other (E.g. 32nd Avenue/US 81B and 47th Avenue), therefore coordinating the various parts of several individual projects is critical to realize the full implementation of significant infrastructure along the I-29 corridor. To assist with initiating a trajectory towards completion of the most essential projects along the I-29 Corridor, the Implementation Plan lays a framework for moving projects into project development and eventual implementation.

The plan has been developed with three distinct stages. Given the complexity of several projects identified within the I-29 Corridor Study, several projects will take five to 10 years (or more in some cases) to complete project development activities. The most challenging aspect of implementation of the I-29 Corridor Study will be the actual programming of local, state and federal funds. It is important to recognize that as a corridor level study, the I-29 Implementation Plan is not cost constrained; it demonstrates the orchestration of needed next steps to achieve full build out and is based on needs identified in previous phases of this report, occasionally influenced by pavement reconstruction needs and schedules. Of

those improvements included in the I-29 Corridor Study, none are currently cost constrained in the GF-EGF MPO Long Range Transportation Plan (LRTP).

Needs Comparison

Comparing needs for different improvements can be a very complicated process. For example, how do you compare a railroad grade separation improvement to a new interchange to a new loop? A railroad grade separation generates major delays but only occurs a few times per day, mostly during off-peak periods. A new interchange may provide massive relief for several hours of the day but may not be needed for several years.

The current Transportation Improvement Program (TIP) process utilizes a project scoring and ranking process. A more technically based project specific evaluation process was needed to support the I-29 Corridor Study Implementation Plan. To assess needs, a five point needs index was developed to show relative need. This starts with the technical information compiled in this study and other studies as necessary to compare quantified benefits. Quantified benefits incorporate vehicle hours of delay, vehicle miles travelled and crash reduction factors. For example, the 2040 yearly quantified benefits for an interchange at 47th Avenue is $3.2 million and for a railroad grade separation at 42nd Street and DeMers Avenue is $0.6 million. Where quantified benefits were not readily available, level of service and railroad crossing exposure were compared.

This information was used to provide an educated estimate of need for every improvement over $1 million for existing, 2025 and 2040 time periods. This information will be refined by the Steering Committee. The results are illustrated in Table 8-2.

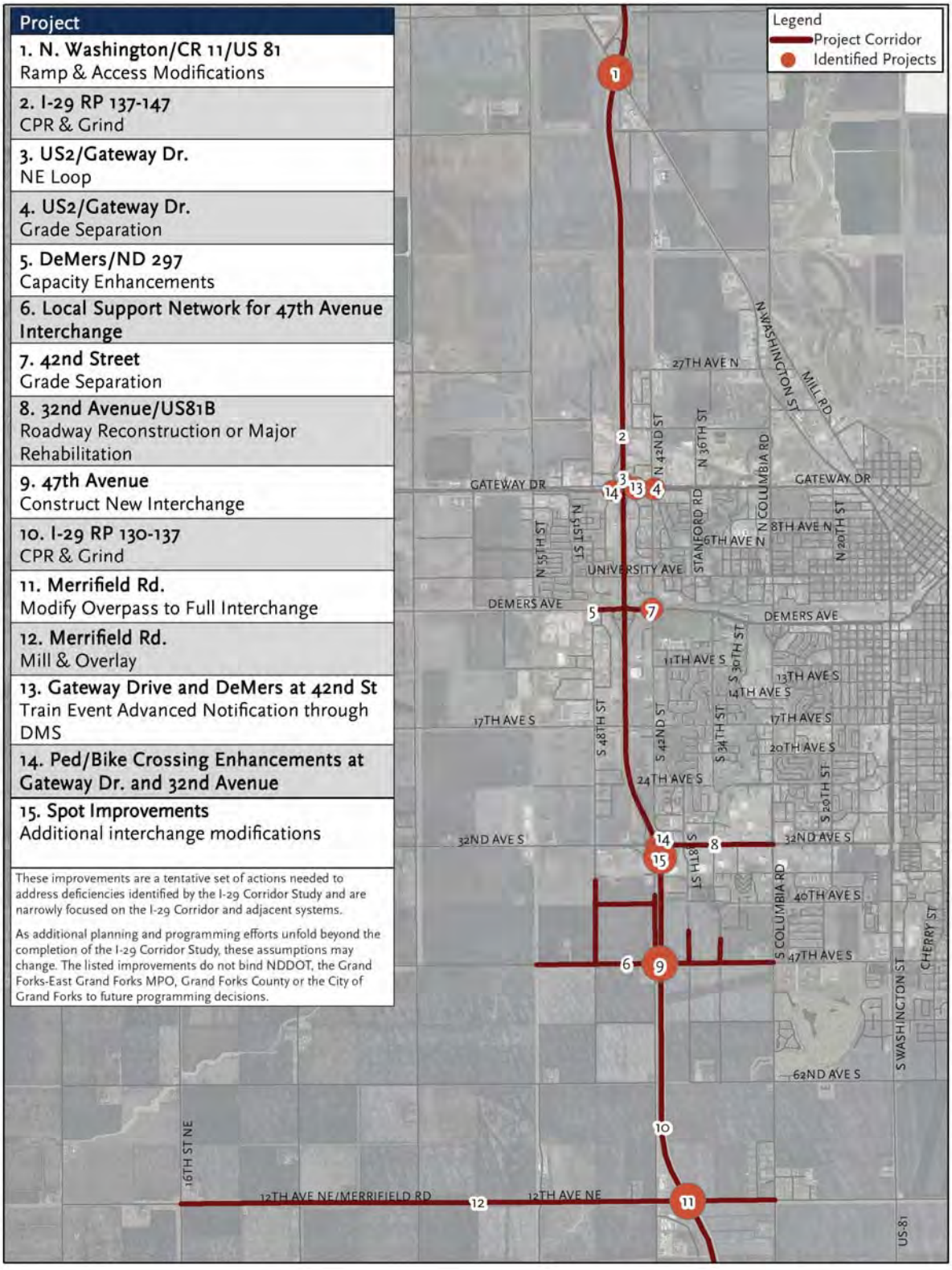
Table 8-2: Needs by Year

Location	Improvement	Need			
		Existing	2025	2040	Notes
North Washington Street/CR 11/US 81	Interchange and Access Improvements	0	0.5	1	The Washington Street improvements are preventive in nature and not based on quantified deficiencies.
Gateway Drive/US 2	Interchange Improvements	1	2	5	The Gateway Drive interchange operates at LOS "F" by 2040.
	Railroad Grade Separation	2	2.5	3	Queuing onto the interstate when train events and peak hours coincide. The railroad grade separation has a crossing exposure of 245,000 by 2040.*
DeMers Avenue/ND 297	Interchange Improvements	2	4	5	The DeMers Avenue interchange operates at LOS "E" by 2025 and LOS "F" by 2040.
	42nd Street Railroad Grade Separation	3	3.5	4	The grade separation has a yearly quantified benefit of $0.6 million dollars by 2040 and crossing exposure of 749,700 by 2040.*
32nd Avenue/US 81B	New Interchange at 47th Avenue	2	5	5	32nd Avenue Operates at LOS "F" by 2025, has a yearly quantified benefit of $3.2 M by 2040.
Merrifield Road/CR 6	New Interchange	2.5	3	3.5	The Merrifield Interchange has a yearly quantified benefit of 2.4 million dollars by 2040.

0 = No need, 5 = Greatest Need

* Based on previous study, may require updating

Figure 8-1: Full Buila



Project Implementation Phases

Three distinct project implementation phases have been developed to support the I-29 Corridor Study. Given both the complexity and interrelationships of several projects, each implementation phase is structured to show the gradual progression of projects from the I-29 Corridor Study (planning phase) further into project development and towards eventual programming and construction.

COMMITTED PROJECTS & SHORT RANGE: 2017 - 2025

The first phase of the implementation plan includes the period of the imminent GF-EGF TIP plus the next four years thereafter. This window also matches the interim modeling period (2025) developed for the I-29 Corridor Study. The imminent TIP for the GF-EGF MPO will include regionally significant local, state and federal projects to the year 2021. Therefore project needs for the years 2017 to 2021 are considered committed. The only committed project within the I-29 Study area is the recently programmed Mill & Overlay of Merrifield Road (CR 6) from CR 5 to Columbia Road. Even still, many significant smaller scale improvements, all costs estimates are below $1 million, have scalable programming limits such that they could move into the TIP in the short range.

- ITS Queue Flushing Preemption at Gateway Drive/US 2 and 32nd Avenue/US 81B: Improvement will help reduce potential for queuing to and onto the Interstate until permanent interchange improvements can be built. The cost of this improvement is estimated at $60,000 for the three ramps.
- Train Event Advanced Notification through DMS at Gateway Drive/US 2 and 42nd Street Railroad Crossings: This improvement will help reduce potential for queuing to and onto the Interstate until grade separation can permanently resolve problems. A more detailed evaluation of communication mechanisms between the railroad crossings and the NDDOT DMS system needs to be completed prior to developing a reliable cost estimate.
- Pedestrian Crossing Enhancements at Gateway Drive/US 2 and 32nd Avenue/US 81B: Improvements to signalize crossings of the ramp and across 32nd Avenue and Gateway. The cost of this improvement is estimated at $100,000 for the three ramps.

Figure 8-4 demonstrates the short-range phase of project implementation efforts required to realize the gradual build out of the I-29 Corridor Study. Cost shown demonstrate a year of expenditure estimate to the mid-range of the phase for which construction is anticipated per the I-29 Corridor Study. Projects in the short-range are adjusted to YOE of 2022. Table 8-3 demonstrates a more descriptive dialogue of the implementation efforts needed at each phase of implementation for the most significant projects.

Table 8-3 should be treated as a tentative set of actions needed to address needs identified by the I-29 Corridor Study. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change.

MID-RANGE 2026-2030

This phase of implementation represents the midyear of the current LRTP. The stage of the implementation plan would be considered a mid-range set of action items. Figure 8-5 demonstrates the mid-term phase of project development efforts required to implement the I-29 Corridor Study.

Costs shown demonstrate a year of expenditure estimate to the mid-range of the phase for which construction is anticipated per the I-29 Corridor Study. Projects in the mid-range are adjusted to YOE of 2028. Included in Figure 8-5 are two NDDOT planned Concrete Pavement Repair (CPR) projects which have been tentatively defined by the Grand Forks District. These CPR projects are related study area investments, even if not directly related to earlier recommendations of the I-29 Corridor Study. Table 8-3 demonstrates a more descriptive dialogue of the implementation efforts needed at each phase of implementation for the most significant projects. Table 8-3 should be treated as a tentative set of actions needed to address needs identified by the I-29 Corridor Study. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change.

LONG RANGE: 2031-2040+

This stage represents year 11 and beyond the current TIP and extends to the life of the current 2040 Long Range Transportation Plan (LRTP). Figure 8-6 demonstrates the long-range phase of project development efforts required to implement the I-29 Corridor Study.

Costs shown demonstrate a year of expenditure estimate to the mid-range of the phase for which construction is anticipated per the I-29 Corridor Study. Projects in the mid-range are adjusted to YOE of 2036. Table 8-3 demonstrates a more descriptive dialogue of the implementation efforts needed at each phase of implementation for the most significant projects. Table 8-3 should be treated as a tentative set of actions needed to address needs identified by the I-29 Corridor Study. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change.

Stages of Project Development & Delivery

The I-29 Implementation Plan assists with stratifying the stage of planning and project development required to deliver each of the above mentioned projects. This is specifically important for more of the complex projects and for those projects which will require additional scoping to move out of the planning phase and deeper into advanced project development. The Implementation Plan has been developed around the following generalized Stages of Project Delivery:

- **Planning & Environmental (Preliminary Engineering/Scoping)**: Reflects additional planning or project level scoping to continue to define and delineate alternatives and project feasibility. This phase also includes the transition into the development of relevant environmental documentation. In many cases, the alternatives developed as part of the I-29 Corridor Study are assumed to be ready to move further into project development (i.e. environmental/NEPA). In the case of interchanges at 47th Avenue and Merrifield Road/CR 6, this phase includes completion of an IJR. However, some of these actions may not result in a signed environmental document until such time as Federal funds are programmed, or FHWA fiscal constraint requirements can be met.
- **Right-of-Way, Design and Construction (Advanced Project Development):** Reflects efforts following completion of a signed environmental document. These are stages of advanced project development involving actual final design and right of way. Included in this phase would also be efforts to secure final programming (or project selection). Advanced project development includes the construction phase.

The implementation plan will assign one of these two general categories to identified improvements listed in the I- 29 Corridor Study. Smaller less significant projects which will likely fit more easily into the GF-EGF TIP or move quickly in the first phase or two are not noted. For more complex projects, the transition through these stages is more gradual, and more thoughtfulness is needed on how these projects continue to transition out of planning and further into project development.

32ND AVENUE/US 81B NEEDS

Due to the major investment needed at 32nd Avenue/US 81B, and the coordinated needs between 32nd Avenue/US 81B and 47th Avenue, additional analysis was completed to determine the approximate thresholds where 32nd Avenue/US 81B begins to breakdown. This analysis increased the modeled traffic volumes based on linear growth between the existing and approved 2025 ADT projections and then between the approved 2025 ADT and 2040 ADT projections.

- According to the 2025 P.M. peak hour analysis, deficiencies along the corridor emerged. However, there are key issues that emerge before 2025.
  - » At around 40 percent (2019) of the growth between 2015 and 2025, deficient operations are expected at 38th Street.
  - » By 70 percent (2022) of the growth between 2015 and 2025, the northbound off-ramp begins to queue onto the interstate.
  - » By 2025, deficient operations are expected at the West Ramp, East Ramp and 38th Street intersections during the P.M. peak hour.

- With the Spot Improvements on 32nd Avenue/US 81B, 2025 operations are improved to LOS "D" across the corridor. However, as growth continues capacity constraints on the overpass bridge begin to emerge around 2030, or 30 percent of growth expected between 2025 and 2040. The capacity constraints result in deficient operations at the West Ramp intersection and queues onto the interstate.

Figure 8-2: 2015 to 2025 Growth Thresholds with Existing Configuration on 32nd Avenue/US 81B

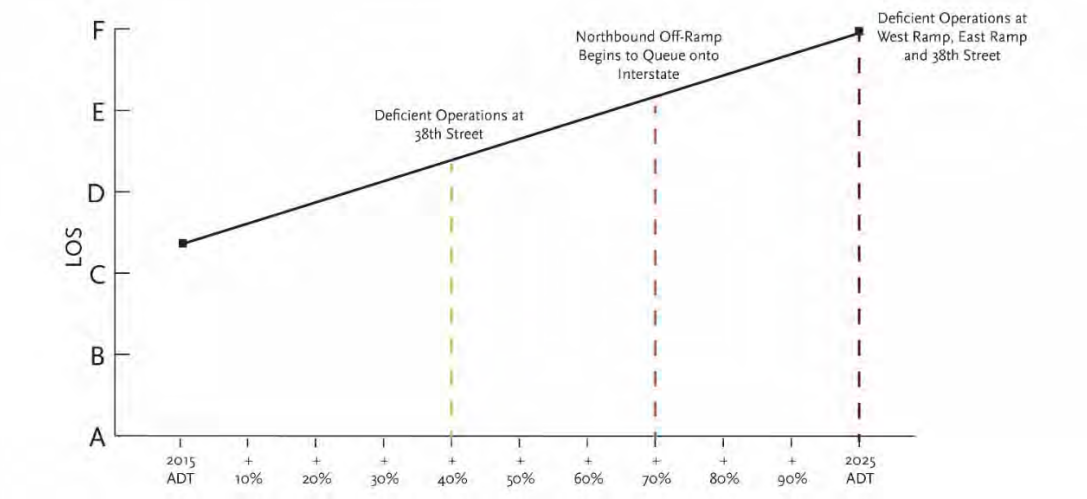
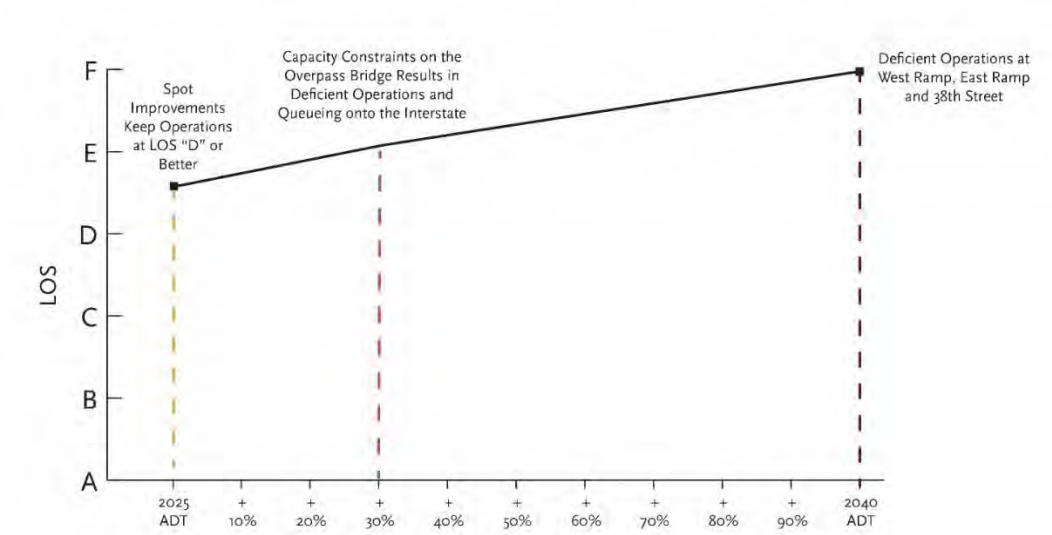


Figure 8-3: 2025 to 2040 Growth Thresholds with Spot Improvements on 32nd Avenue/US 81B



ANCILLARY INVESTMENTS TO SUPPORT 47TH AVENUE INTERCHANGE

As noted, the Implementation Plan for the I-29 Corridor Study is not cost constrained. Further, it is a demonstration of needed improvements more narrowly focused on the I-29 Corridor and adjacent systems. To that end, development of a future interchange at 47th Avenue will require substantial additional investment in local roadways. In current year dollars, total needs to provide local roadway system to support 47th Avenue is estimated at nearly $17.0 million. This system of roadways is shown as part of Figure 8-1 and Figure 8-4, and includes extension and/or completion of 34th Street, 38th Street,

42nd Street, 47th Street, 48th Street and 40th Avenue. These needs are necessary to support the development of the 47th Avenue interchange and outpace constrained and unfunded needs listed in the 2040 LRTP or Grand Forks CIP. These improvements could be considered the minimum commitment in local roadway investments to achieve FHWA or NDDOT support for a new interchange at 47th Avenue.

Table 8-3: Implementation Matrix

Project	Implementation Phase		
	2017-2025	2026-2030	2031 -2040+
North Washington/CR 11/US 81			
Access Modification + Ramp Modification	No Action	Revaluate potential access changes and ramp modifications as part of scoping process for I-29 CPR Project (2030). Develop more detailed programming assessment for these improvements at that time.	If no action taken in previous phase, reevaluate to reflect changing conditions.
Gateway Drive/US 2			
Northeast Loop Modification	No Action	No Action	Proceed with planning level alternative into preliminary engineering and advanced project development. Program in TIP.
Gateway Drive Grade Separation	Evaluate region wide project need with 2045 LRTP Update to determine relative regional significance.	Develop additional planning/scoping documents to assist to further refine alternatives and feasibility.	
DeMers Avenue/ND 297			
42nd Street Grade Separation	Complete Preliminary Engineering. Complete NEPA. Move into Advanced Project Development. Secure Project Programming.	Advanced Project Development. Secure Project Programming (if applicable)	
Demers Capacity Enhancements (No Widening)	Preliminary Engineering. Move into Advanced Project Development.		
32nd Avenue/US 81B			
Reconstruct or Major Rehabilitation 38th Street to Columbia Road	Evaluate project concepts with 2045 LRTP update. Preliminary Engineering. Evaluate capacity needs based on progress of 47th Avenue Interchange implementation.	Advanced Project Development. Project developed in step with the coordinated efforts for future 47th Avenue Interchange.	
Interim Improvements	Preliminary Engineering. Move into Advanced Project Development.		
47th Avenue			
Construct New Interchange	Initiate IJR. Complete NEPA	Advanced Project Development. Secure Project Programming.	
Merrifield Road/CR 6			
Modify Overpass to Full Interchange	No Action	Update IJR and restart project scoping. Consider potential coordination with I-29 CPR Project (2030).	Proceed into Advanced Project Development.
Planning & Environmental			
Advanced Project Development & Programming			
Planning, Environmental + Advanced Project Development			

Figure 8-4: Short Term Implementation Plan (2017-2025)

Project *	Cost (YOE)**
1. Gateway Dr. & 32nd Ave ITS Queue Flushing	$60,000
2. Gateway Drive and DeMers at 42nd St Train Event Advanced Notification through DMS	<$1 Million
3. DeMers/ND 297 Capacity Enhancements (No Widening) Preliminary Engineering + Advanced Project	$9.0 Million
4. 42nd St. Grade Separation Preliminary Engineering (Complete NEPA) Proceed into Advanced Project Development	NA
5. 32nd Ave/US81B Reconstruction 38th Street to Columbia Rd. Preliminary Engineering	NA
6. 47th Avenue Initiate IJR and Complete NEPA	NA
7. I-29 RP 130-137 CPR & Grind Advanced Project Development	NA
8. Ped/Bike Crossing Enhancements at Gateway Drive/US 2, 32nd Avenue/US 81B	$100,000
9. Local Support Network for 47th Avenue Interchange	$17.0 Million
10. Merrifield Road/CR 6 Mill and Overlay	NA***
11. 32nd Ave Interchange Spot Improvements	$700,000

*These improvements are a tentative set of actions needed to address deficiencies identified by the I-29 Corridor Study and are narrowly focused on the I-29 Corridor and adjacent systems. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change. The listed improvements do not bind NDDOT, the Grand Forks-East Grand Forks MPO, Grand Forks County or the City of Grand Forks to future programming decisions.
**Costs only include construction and ROW acquisition.
***Project has yet to be scoped so costs are not available. Cost estimates are beyond the scope of this study.

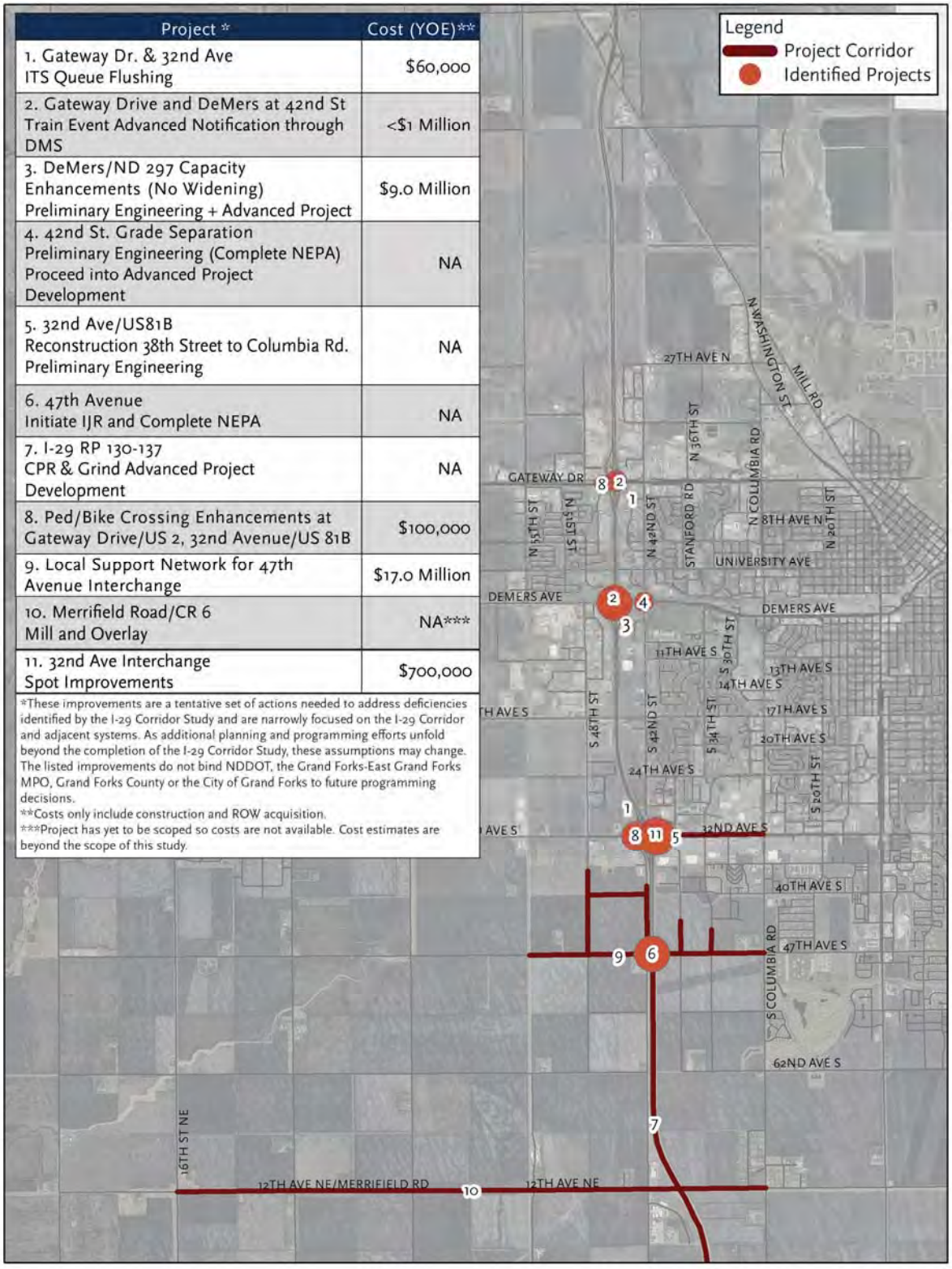


Figure 8-5: Mid Term Implementation Plan (2026-2030)

Project*	Cost (YOE)**
1. N. Washington/CR 11/US 81 Planning/Scoping Potential Coordination with I-29 CPR	NA
2. I-29 RP 137-147 CPR & Grind Advanced Project Development	NA
3. 42nd Street Grade Separation Advanced Project Development	$61.58 Million
4. 32nd Ave/US81B Reconstruction 38th to Columbia Rd. Advanced Project Development	$12.1 Million
5. 47th Avenue Advanced Project Development	$43.87 Million
6. Merrifield Rd./CR 6 Interchange Planning/Scoping	NA

*These improvements are a tentative set of actions needed to address deficiencies identified by the I-29 Corridor Study and are narrowly focused on the I-29 Corridor and adjacent systems. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change. The listed improvements do not bind NDDOT, the Grand Forks-East Grand Forks MPO, Grand Forks County or the City of Grand Forks to future programming decisions.
**Costs only include construction and ROW acquisition.

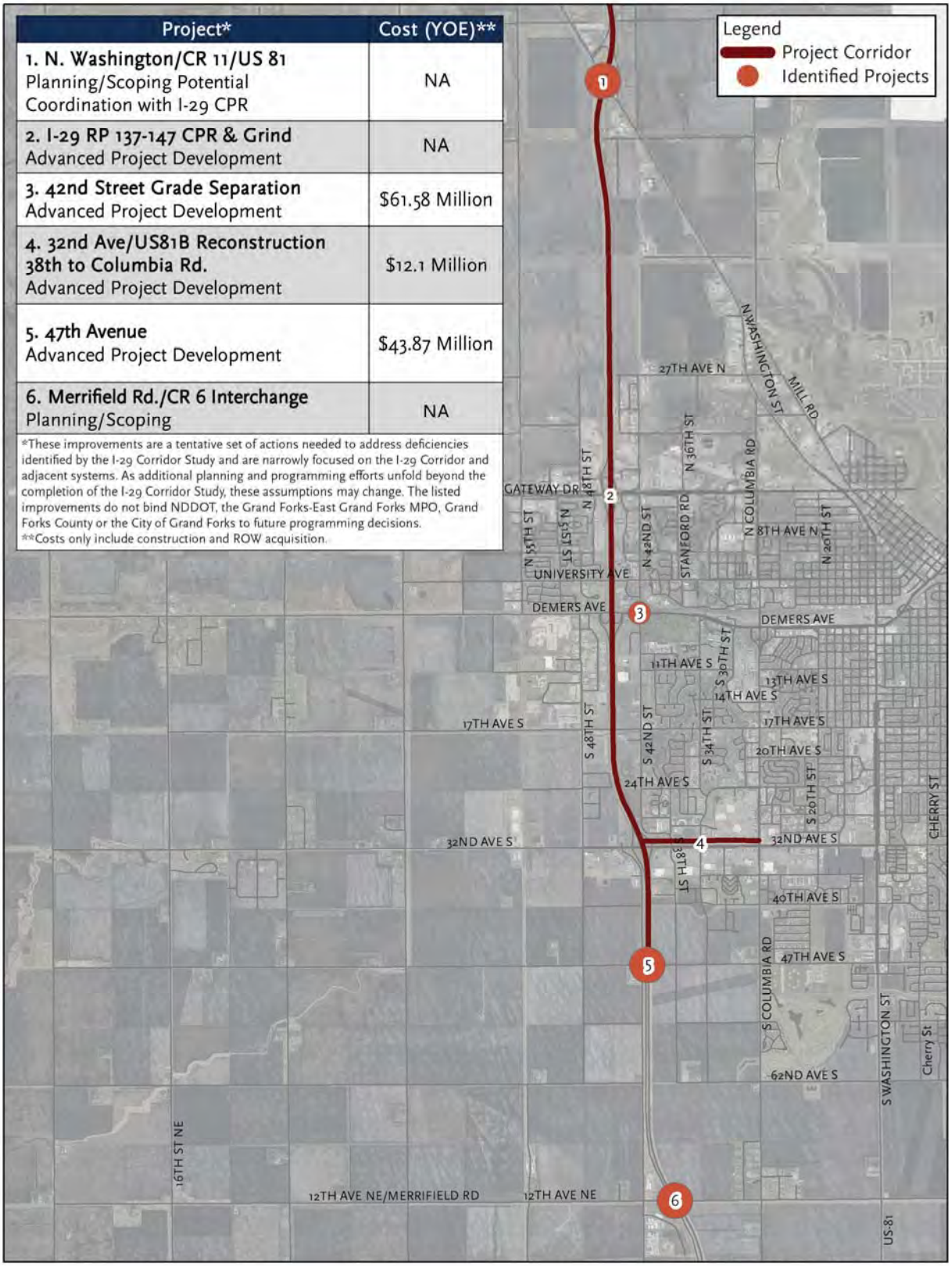
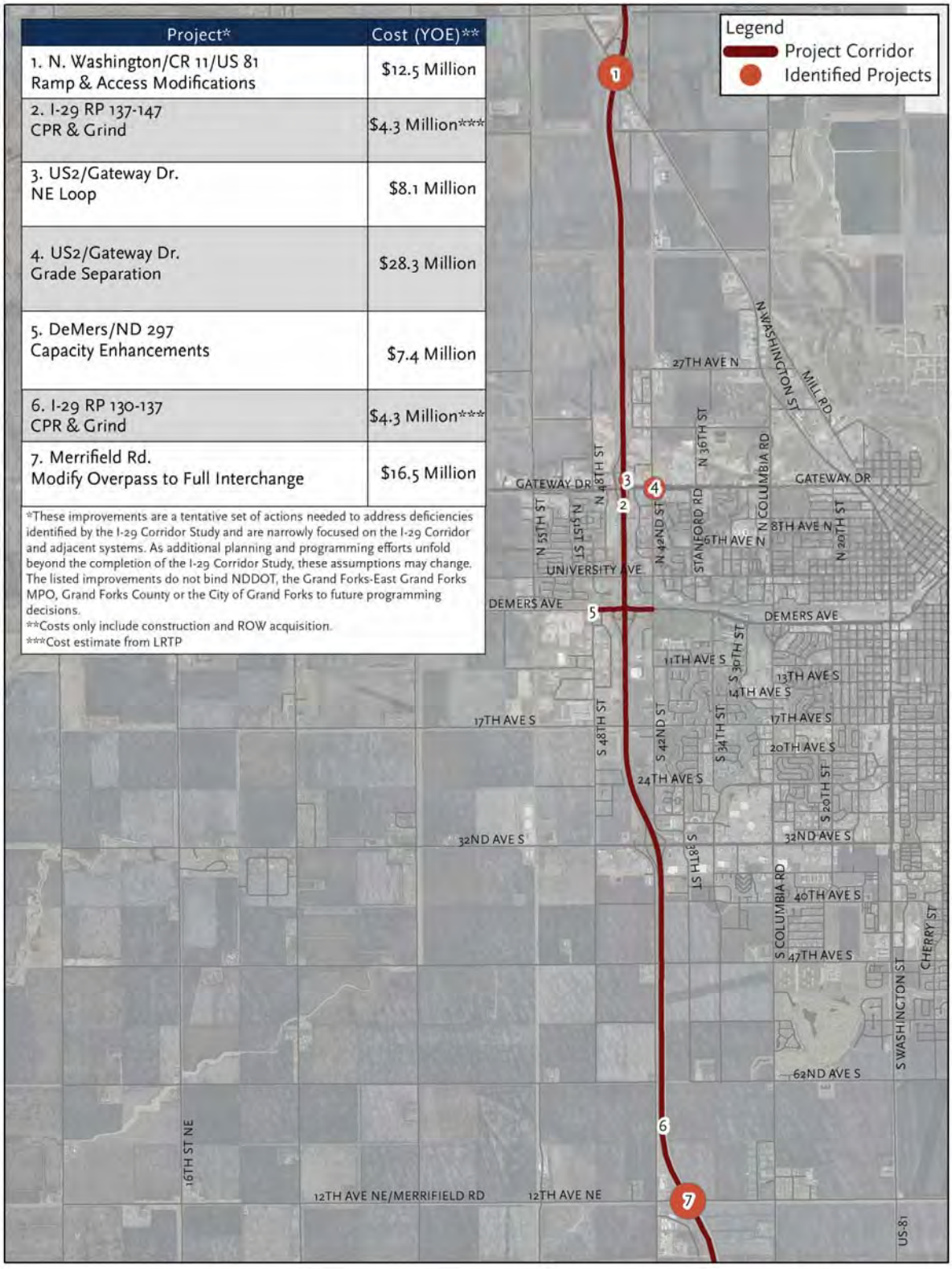


Figure 8-6: Long Term Implementation Plan (2031 - 2040+)



Project*	Cost (YOE)**
1. N. Washington/CR 11/US 81 Ramp & Access Modifications	$12.5 Million
2. I-29 RP 137-147 CPR & Grind	$4.3 Million***
3. US2/Gateway Dr. NE Loop	$8.1 Million
4. US2/Gateway Dr. Grade Separation	$28.3 Million
5. DeMers/ND 297 Capacity Enhancements	$7.4 Million
6. I-29 RP 130-137 CPR & Grind	$4.3 Million***
7. Merrifield Rd. Modify Overpass to Full Interchange	$16.5 Million

*These improvements are a tentative set of actions needed to address deficiencies identified by the I-29 Corridor Study and are narrowly focused on the I-29 Corridor and adjacent systems. As additional planning and programming efforts unfold beyond the completion of the I-29 Corridor Study, these assumptions may change. The listed improvements do not bind NDDOT, the Grand Forks-East Grand Forks MPO, Grand Forks County or the City of Grand Forks to future programming decisions.
**Costs only include construction and ROW acquisition.
***Cost estimate from LRTP

Programming Matrix

Given the range of investment needs along the I-29 Corridor, a multitude of funding partnerships will be needed to bring projects to fruition. Table 8-4 demonstrates a Programming Matrix to assist with understanding the funding strategy for implementation of the I-29 Corridor Study. The following programming matrix identifies the broad funding partnership for each of the prioritized improvements identified in the I-29 Implementation Plan. Project programming is subject to future Federal and State legislative changes in authorization bills, funding categories and amount of funding available. Excluded from the programming matrix are projects with a total cost less than $1.0 million.

Table 8-4: Programming Matrix

Project	Programming					
	Interstate Maintenance (NHPP)	Regional (NHPP)	Urban (STP)	State	City	County
North Washington/CR 11/US 81						
Access Modification + Ramp Modification	x	x		x		x
Gateway Drive/US 2						
Northeast Loop Modification	x	x	o	x	o	
Gateway Drive Grade Separation		x	x	x	x	
DeMers Avenue/ND 297						
42nd Street Grade Separation		x	x	x	x	
Demers Capacity Enhancements (No Widening)	o	x	o	x	x	
32nd Avenue/US 81B						
Reconstruct 38th Street to Columbia Road		x	o	x	x	
47th Avenue						
Construct New Interchange	x		o	x	o	
Merrifield Road/CR 6						
Modify Overpass to Full Interchange	x		o	x	o	o

x = Eligible Program Participant **o** = Eligible but not required Program Participant
Not shown but relevant would be the FAST Freight Program. Assumes these funds would be allocated through NHPP.

Funding splits and cost sharing agreements for each project listed in Table 8-4 may vary based on the uniqueness of how projects are developed. However, the baseline guidance for project cost eligibility and cost sharing is per the *NDDOT Local Government Manual*.

The NDDOT will fund mainline Interstate improvements and modifications to existing or new interchanges needed to alleviate congestion at existing interchanges as a result of mainline traffic. Approval from FHWA will be required and the proposed project will need to meet FHWA's access requirements.

The LPAs will be required to fund grade-separated non-interchange roads and interchange projects which are a result of cross-road traffic. There may be some exceptions if the project is built in conjunction with an Interstate mainline project. To obtain funding, an LPA may request regional highway funds if the project is part of that system, or may use part of their Urban Roads program allocation.

In regard to NHPP funds, NDDOT must address statewide needs with these funds so investments of NHPP funds within the study area are balanced by NDDOT against statewide needs.

Projects such as Merrifield Road (CR 6) are currently fully within the jurisdiction of Grand Forks County. However, by the time a full interchange nears project development, it may well be inside of Grand Forks city limits. Therefore, programming participation is shown for both the city and county. Projects on or adjacent to the NDDOT Regional System (I.e. 42nd Street

Grade Separation) are shown with a potential for Regional funding. Urban funds are shown on both Regional and or Interstate projects. This is done to indicate that broad partnerships may be needed to fully program these investments on a more accelerated time frame.

Programming Splits

Table 8-5 demonstrates a tentative set of programming and cost splits for the most significant project improvements identified through the I-29 Corridor Study. These cost splits are based upon current local, state and federal funding guidance. More specific guidance regarding local, state and federal funding splits is available in the *NDDOT Local Government Manual*. These splits generally follow that guidance, however Table 8-5 represents a best-case scenario. It is likely many of these improvements will require more local resources to construct improvements in the phases identified by the I-29 Corridor Study.

Table 8-5: Funding Matrix

Project	Total Cost (2017 $)	Total Cost (YOE $)	Funding Split (YOE $)			
			Federal	State	City	County
North Washington/CR 11/US 81						
Access Modification + Ramp Modification	**$5.700**	**$12.489**	$9.99	$1.25	$0.000	$1.25
Gateway Drive/US 2						
Northeast Loop Modification	**$6.600**	**$14.461**	$11.57	$1.45	$1.45	$0.000
Gateway Drive Grade Separation	**$28.300**	**$62.009**	$49.61	$6.20	$6.20	$0.000
DeMers Avenue/ND 297						
42nd Street Grade Separation*	**$40.000**	**$61.578**	$21.55	$0.000	$40.026	$0.000
Capacity Enhancements (No Bridge Widening)	**$7.400**	**$9.003**	$7.20	$0.90	$0.90	$0.000
32nd Avenue/US 81B						
Reconstruct 38th Street to Columbia Road	**$12.000**	**$18.473**	$14.78	$1.85	$1.85	$0.000
47th Avenue						
Construct New Interchange	**$28.500**	**$43.874**	$39.49	$4.39	$0.000	$0.000
Merrifield Road/CR 6						
Modify Overpass to Full Interchange	**$16.480**	**$36.110**	$32.50	$3.61	$0.000	$0.000

** 25% Urban Roads + 10% Regional; Balance of cost Local*
***YOE costs were estimated using the midpoint of the implementation phase for which they are anticipated to be constructed.*