



# North Mandan Subarea Transportation Study

August 2013



# North Mandan Subarea Transportation Study

## *Final Report*

Prepared for:  
Bismarck-Mandan Metropolitan Planning Organization  
221 North 5<sup>th</sup> Street  
Bismarck, ND 58701

August 13, 2013

# Table of Contents

---

<b>Introduction .....</b>	<b>1</b>
Background .....	1
Corridor Study Process .....	1
Identifying Study Area Needs .....	4
<b>Purpose and Need for Action in the Study Area .....</b>	<b>6</b>
Purpose of Subarea Improvements .....	7
Need for Improvements in the Study Area .....	8
<b>Existing Conditions .....</b>	<b>10</b>
Background/Purpose .....	10
Roadway Geometry and Intersection Traffic Control .....	10
Traffic Data Collection .....	11
Average Daily Traffic .....	11
Intersection Hourly Turning Movements .....	14
Non-motorized System .....	14
Introduction .....	14
Non-motorized System Gaps .....	20
Public Transit Service .....	21
Crash Assessment .....	22
Current (2013) Traffic Operations .....	25
Background .....	25
Intersection and Corridor Traffic Operations Results .....	25
<b>Planning Horizon (2040) Traffic and Traffic Operations .....</b>	<b>28</b>
Household and Employment Growth (2010 to 2040) .....	28
North Mandan Study Area Change in Trip Generation .....	29
2040 Existing Plus Committed Network Daily Traffic .....	30
2040 Peak Hour Traffic and Traffic Operations .....	32
Needs Identified Through Public and Stakeholder Committee Outreach .....	34
<b>Alternatives to Address Current and Future Issues/Needs .....</b>	<b>44</b>
Introduction .....	44
Screening Process .....	44
Evaluation Criteria .....	45

Alternatives Evaluated.....	45
Screening Assessment.....	46
<b>Conclusions.....</b>	<b>61</b>
Roadway Improvement Concepts – Highlighting the Technically Feasible Alternatives .....	61
Non-Motorized System Concepts .....	66
Public Transit System Modifications.....	67
Financial Consideration of the Roadway Improvements.....	67
<b>Next Steps in North Mandan Project Development .....</b>	<b>71</b>
Traffic Impact Study Process .....	71
Project Development Steps .....	72
<b>Appendix</b>	

# List of Figures

---

Figure 1.	Study Area Boundaries .....	2
Figure 2.	Corridor Study Process .....	3
Figure 3.	Transportation System Needs Identified by Stakeholders Committee and Public.....	5
Figure 4.	Transportation Project Development Sequencing and Elements.....	7
Figure 5.	General Purpose Travel Lanes and Intersection Control – Collectors and Arterials (Existing – 2013) .....	12
Figure 6.	Current (2009 and 2012) Daily Traffic Counts.....	13
Figure 7.	Existing Multi-Use Trails and Collector Route Sidewalks .....	19
Figure 8.	Current Capital Area Transit Routes Serving Study Area .....	23
Figure 9.	Crashes Reported in 2010 – 2012 and Crash Rates .....	24
Figure 10.	Current (2012) Conditions Morning and Afternoon Peak Traffic Intersection Operations .....	26
Figure 11.	Current and 2040 Forecasted Daily Traffic.....	31
Figure 12.	Forecasted 2040 Conditions Morning and Afternoon Peak Traffic Intersection Operations .....	33
Figure 13.	Old Red Trail – Primary Route Serving the Northwest Area .....	36
Figure 14.	Considerations Associated with an I-94/Collins Avenue Interchange.....	37
Figure 15.	Locations and General Land Uses of Short Term Future Development Areas Relative to Sunset Drive.....	39
Figure 16.	Alternate ND 1806-Sunset Drive-38 <sup>th</sup> Street Alignments.....	40
Figure 17.	I-94/Mandan Avenue Issues.....	43
Figure 18.	Universe of Improvement Alternatives Considered.....	47
Figure 19.	Alternatives Retained Through Initial Screening.....	60
Figure 20.	Technically Feasible Improvements and Implementation Plan.....	62
Figure 21.	Future Trail and Sidewalk Extension Concepts .....	68
Figure 22.	2012 Transit Development Plan Recommended Routes/ Transit Friendly Development Sites .....	69
Figure 23.	Alternate Next Steps in Project Development Process.....	73

## List of Tables

---

Table 1.	2012 AM and PM Peak Period Turning Movement Counts at Key Study Area Intersections .....	15
Table 2.	Smoothed 2012 AM and PM Peak Hour Turning Movements .....	17
Table 3.	Level of Service Criteria for Intersections .....	25
Table 4.	Change in Socioeconomic Data Estimates.....	29
Table 5.	2010 and 2040 Daily Trip Generation (North Mandan Study Area) .....	30
Table 6.	Comparison of ND 1806-Sunset Drive-38 <sup>th</sup> Street Alignments .....	41
Table 7.	Alternatives Screening Summary (Concepts and Results).....	49
Table 8.	Summary of the Technical Feasible Alternatives Retained for Further Development .....	63

# Introduction

---

## Background

The purpose of completing the North Mandan Subarea Transportation Study is to identify multimodal transportation improvements needed to support the current and proposed levels of development within and influencing the study area. Figure 1 displays the study area limits which encompass areas within and outside the city from north of I-94 to Square Butte Drive (north end of the Schlosser Addition) and from the Missouri River to approximately 47<sup>th</sup> Avenue NW.

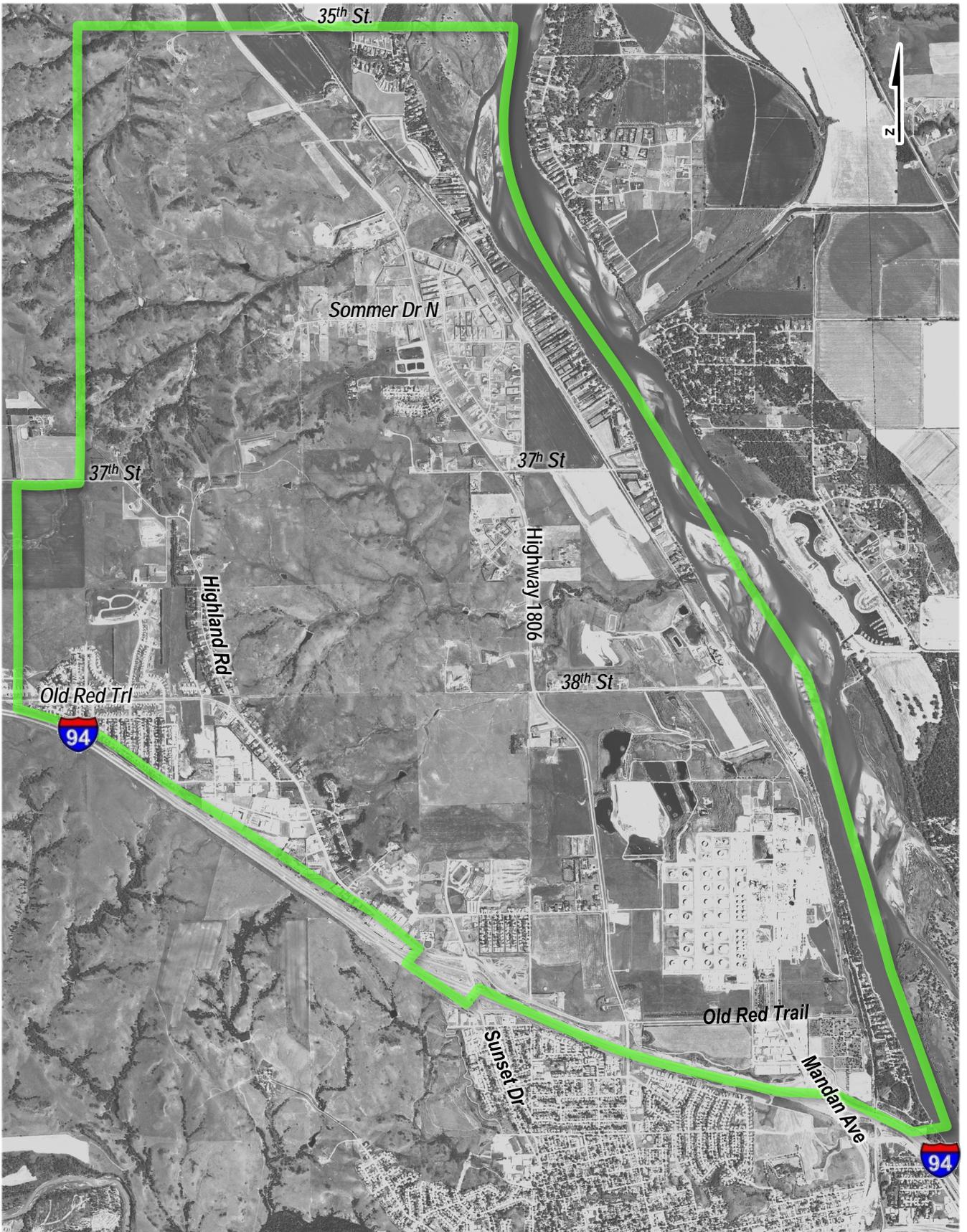
The importance of addressing the study area needs can be defined in part through quantifying the level of development that has recently occurred in the area relative to the city as a whole. Over the last five years, a substantial amount of the residential and commercial development acreage completed in Mandan has been within the identified study area. The observed relationship of study area to remainder of the city and Morton County development of the last five years is expected to continue through the foreseeable future. Through the 2040 planning horizon, approximately 60 percent of the anticipated urban residential development and 65 percent of the commercial increment of development anticipated to occur in Mandan and Morton County has been allocated to the North Mandan study area.

Development in the study area cannot continue at the current pace without additional investment into the transportation infrastructure. Looking again at developments over the last five years, the vast majority have come onboard with very little expansion of the transportation infrastructure. Thus, trip generation has been added to the system without adding substantially to the carrying capacity, which draws down the amount of reserve capacity. To this point in time, the reserve capacity drawdown has not resulted in a substantial increase in congestion across the study area, however, traffic volumes at a number of intersections adjacent to the interstate are approaching their acceptable capacity. Unless system/network expansion is coordinated with developments coming on line, the increasing congestion levels observed at intersections adjacent to the interstate will spread outward to other areas, reducing the quality of service for travelers.

## Corridor Study Process

Analysis of the North Mandan subarea was divided into three inter-related phases/stages, displayed in Figure 2, including:

- Phase 1 – Identify and document the purpose and need for making improvements within the study area. Documentation of what needs to be addressed in the study area and how the range of ideas will be compared/reviewed requires a combination of technical



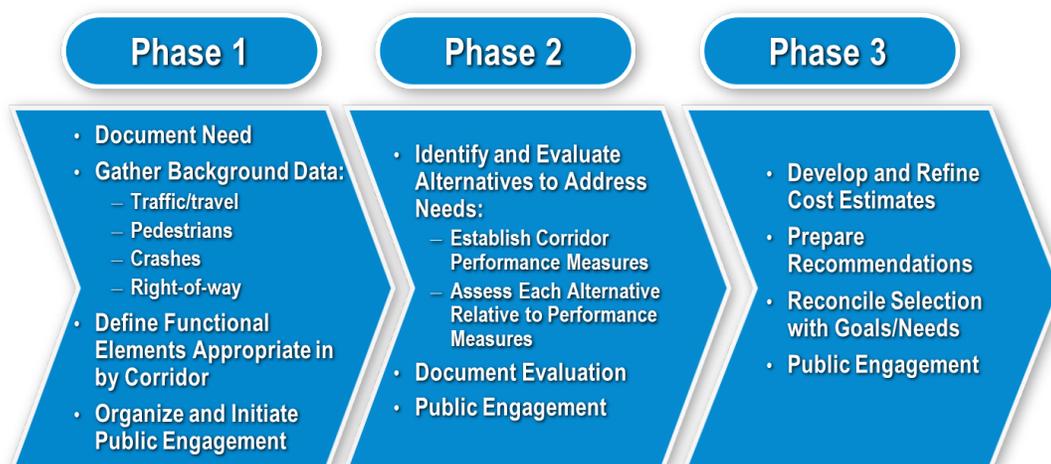
**Figure 1**  
**Study Area Boundaries**



analysis and real life experience input from travelers and stakeholders that live, work or own businesses within the study area. Defining the needs also requires understanding the range of functions that routes in the study area are being asked to provide, accommodate or serve. A corridor that is being asked to provide a route for through auto traffic coming from outside town to a regional retail center will look much different than a corridor being asked to serve through traffic, pedestrian travel, direct access to adjacent properties and bicycle travel. Thus, understanding the purpose of various corridors helps to define the applicable functional elements to be incorporated in each.

- Phase 2 – Develop a range of alternatives and screen to a preferred range of concepts for the study area. Consistent with the background developed in Phase 1, potential improvement alternatives need to be inclusive of the range of functions a corridor is proposed to serve. As the number of functions served increases (auto through traffic, adjacent property access, pedestrian travel for recreation and/or commuting, bicycle travel for recreation and/or commuting, utility accommodation, parking, transit, etc.) the range of alternatives generally also increases. This is due to the need to mix together facilities that serve the individual functions desired in the corridor. Additionally, increasing the number of functions to be accommodated/considered, increases the complexity of the screening process as more diverse perspectives are brought into consideration.
- Phase 3 – Recommendations for study area improvements and reconciliation of the recommendations relative to the corridor needs identified at the beginning of the process. The desired product of the study is a set of multimodal corridor improvement recommendations that support the documented needs. The decision process involves a diverse range of perspectives. Thus, the screening and documentation must demonstrate how each was and was not addressed in support of the purpose and need for action.

Figure 2. Corridor Study Process



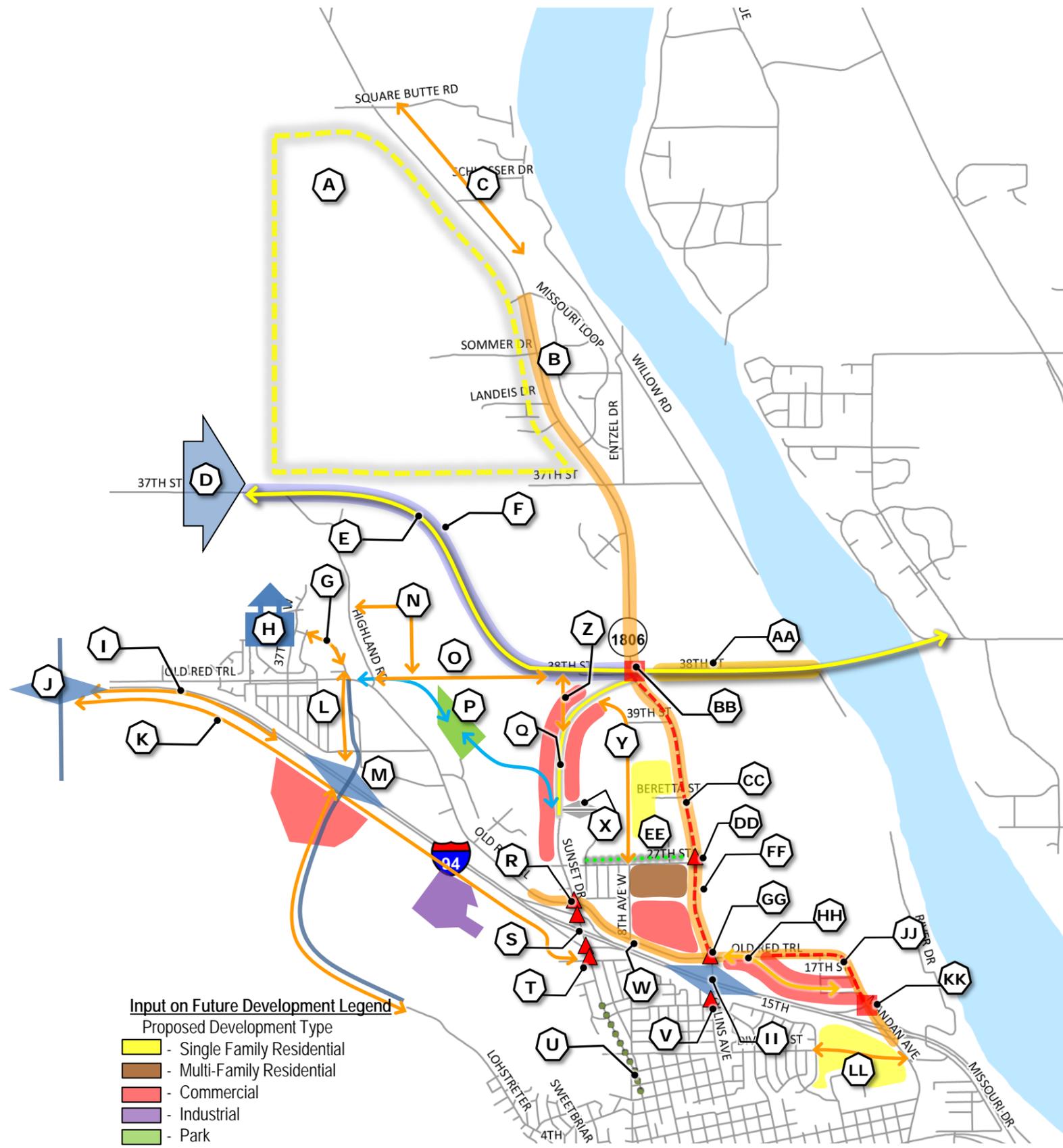
Providing a number of ways and range of opportunities for people to gather information and provide input throughout the decision process is critical to determining the technically feasible alternatives to address issues and needs.

## Identifying Study Area Needs

Study area needs were identified through a combination of the outreach/engagement program and technical analysis of a range of data collected. Meeting with and discussing travel in the North Mandan study area with local, state and federal agency staff, stakeholders with an interest in the study area and the public at large was an initial step in the overall study process. Through a series of meetings and group discussions, the study team was able to gain a more complete understanding of how the broad range of stakeholders perceive needs and concerns within the study area. Technical assessment of traffic operations, roadway geometrics and crashes supplemented the information gathered from various local sources to provide a complete picture of the current conditions.

Figure 3 highlights the issues/study area needs identified through the staff discussions and public outreach. As part of the discussion of study area needs, participants were also asked to identify the importance of each of the issues they either brought up or they heard over the course of discussion. At both the initial Stakeholder Committee meeting and the initial public meeting, participants were provided four different colored dots, each representing most important to the fourth most important. Each participant was given the opportunity to associate each of their four dots with a specific issue or need identified and mapped during the discussion. The table connected with Figure 3 displays the results of issue importance/priority voting. The most often identified as the highest priority issue are listed below:

- Congested conditions through the I-94/Sunset Drive corridor from north of Old Red Trail to Boundary Road. This issue/need was by far received the greatest number of highest priority votes across the range of groups involved in discussion.
- The need to extend Sunset Drive to the north to provide access to potential development areas received the most second highest priority votes of the issues/needs identified. Tied with extending Sunset Drive north was addressing the arterial congestion on Sunset Drive through the I-94 interchange area.
- Votes for the third and fourth highest priority needs in the study area were much more distributed across the range of identified needs compared to the highest priority and even the second highest.



Item	Description	Priority Hierarchy Preference Votes			
		Highest	2nd Highest	3rd Highest	4th Highest
A	Low density development – Not much traffic				
B	ND 1806 – Congested in peaks (need more lanes)			1	
C	Develop a Truck Route Away from School/Residential				3
D	Need to address traffic from developments outside study area		1		
E	What are impacts/costs of Northern Bridge improvements?			1	1
F	Consider west portion of Northern Bridge as separate project	1		2	
G	Provide collector connection				
H	Need to address pedestrian and bus impacts of new school				
I	Need truck by-pass				
J	Add New Interchange at 56th Avenue		1		
K	Frontage road needed to provide access to potential development sites				
L	Consider new Interstate grade crossing (not interchange)		2		1
M	Need a new interchange at 30th Avenue W		1	2	1
N	Additional Access to/from Highland Road			1	
O	Create new arterial corridor from Highland Rd to ND 1806			1	2
P	Trail connections needed to new park area			1	
Q	Extend Sunset Drive North to ND 1806		3	1	
R	Old Red Trail/Sunset Drive – Highly congested	3			
S	Interchange ramp intersections congested	10	3		
T	Sunset Drive/Boundary Road – Congested				
U	Reconstructing Sunset Drive, but no added capacity/signals – Hard getting out of driveways				
V	Collins Avenue/14th Street – Congested	2			
W	Old Red Trail– Widen to 4 Lanes for Safety and Capacity	1			
X	Need to consider land uses between Middle School and commercial (transition buffer)				
Y	Extend 8th Avenue W as collector to extended Sunset Drive (as develops)				
Z	Sunset Drive extension should go directly north to 38th Street				
AA	38th Street – Widen to 4 Lanes			1	
BB	Configuration/Safety at Future ND 1806/Sunset/Northern Bridge Crossing intersection?			1	3
CC	Need access management along ND 1806 – As more development comes in				
DD	ND 1806/27th Street Add a Signal			2	
EE	27th Street – Need to address pedestrian access from Middle School to neighborhood				
FF	Collins Avenue – Congested: Needs to be 5-lanes		1	1	
GG	Old Red Trail/Collins Avenue – Congested	1	1	2	2
HH	Alternate alignment of Old Red Trail – Opens are for development, reduces auto-truck conflicts, closely spaced Mandan to I-94 intersection	2	1		
II	Need new interchange at Collins Avenue	2	1		
JJ	Safety concern with auto-truck mixing along Old Red Trail			1	
KK	Safety (Intersection Skew)/Congestion At Mandan Avenue/I-94		2	1	1
LL	Division Street Should be Extended to Mandan Avenue		1		

People attending the meetings were asked to:

- Identify issues/needs they see in the study area.
- Rank by importance to them resolution of the need/issue relative all identified..

**Input by Issue Type legend**

- Congested Intersection
- Congested Corridor
- Need for New Vehicle Connection
- New Interchange/Connection Desired
- Safety Concerns in Corridor
- Intersection Safety Concern (No Capacity Issue)
- New Corridor Discussed in LRTP or Other Studies

- Highest Priority/Most Important to Address
- Second Most Important
- Third Most Important
- Fourth Most Important

**Figure 3**  
**Transportation System Needs and/or Issues Identified by Stakeholders Committee and/or Public**  
 (Information from meetings held on November 27 and 28, 2012)

## Purpose and Need for Action in the Study Area

---

Traditionally in the transportation project development process planning phase decisions many times have been somewhat disconnected from the decisions in the environmental review process, many times referred to as the NEPA process (associated with the Nation Environmental Policy Act or NEPA). A part of the potential for disconnect is that the agencies/organizations responsible for planning (at the regional, subarea and corridor levels) are many times different than the agencies/organizations responsible for the NEPA portion of project development. The metropolitan planning organization (MPO) in areas of greater than 50,000 population is responsible for transportation planning, while one of the MPO member jurisdictions is responsible for leading NEPA efforts.

Since 2007, FHWA has emphasized the critical connection between the project development tasks accomplished in the planning phase to the NEPA phase decisions<sup>1</sup>. Figure 4 provides an overview and sequencing of the lifecycle of a project from planning to implementation. A critical change was that federal regulations were revised through the updated transportation bill to allow FHWA to use decisions made in the planning phase to streamline continued development of a project in the NEPA stage, as long as the planning decision process addressed several key elements, including:

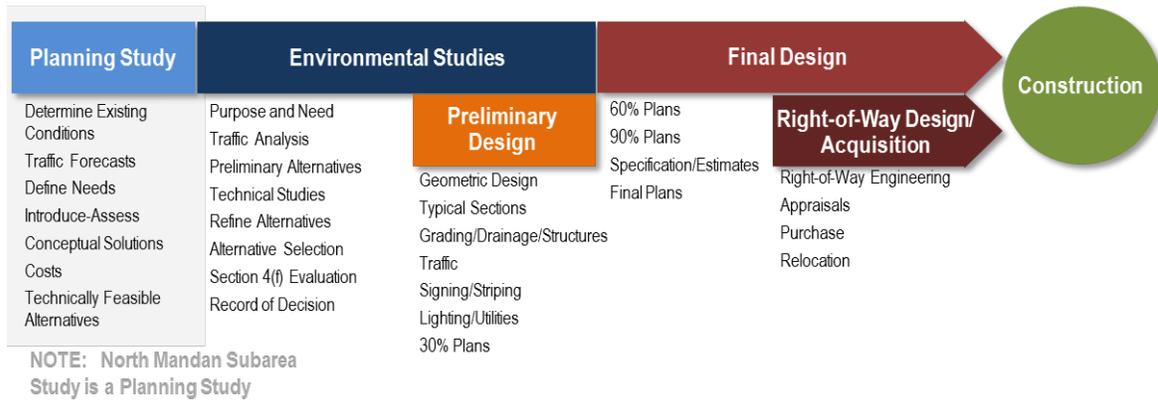
- Define a purpose and need for transportation improvements.
- There is consultation with agencies.
- The public must be included in the planning process.
- Agencies and the public were provided reasonable opportunity to comment on the study information and process.
- Relevant decisions have been documented such that the information is consistent with the NEPA process, which means that decisions incorporated the potential for social, economic and engineering evaluation criteria.

The purpose of this section is to document the first step in the orderly process for establishing the linkage between the planning and NEPA process; definition of the purpose and need for action.

---

<sup>23</sup> Code of Federal Regulations (CFR) Part 450) and 40 CFR 1502.21.

Figure 4. Transportation Project Development Sequencing and Elements



## Purpose of Subarea Improvements

The purpose of conducting the North Mandan Subarea Study, and subsequently identifying multimodal improvements is to support the orderly investment into transportation infrastructure to meet the following goals:

- Provide a safe transportation system – The City of Mandan, Morton County and the North Dakota Department of Transportation as the owners of the vast majority of the street and highway infrastructure have the responsibility of ensuring that the traveling public has access to a system that meets design standards based on safety. Through the subarea study, crashes occurring over the most recent three-year period provide the basis of determining whether there are locations where safety hazards exist.
- Provide a transportation system that meets the demand. The MPO has established a regional threshold of level-of-service C as the minimum acceptable intersection operations. The subarea study includes an analysis of the current (2012) and the forecasted horizon year (2040) peak period operations at each of the key intersections. Locations that in the current or forecasted conditions experience operations lower than level-of-service C represent locations needing actions that increase the capacity or reduce the level of traffic through the intersection.
- Support the forecasted level of development through the planning horizon (2040). A critical condition for promoting and supporting development that will create a sustainable community is a multimodal transportation system that provides access to development sites and can carry the forecasted level of traffic. Through the subarea study, locations of future residential, commercial and industrial development, as well as current developments will be reviewed relative to the adequacy of the current network to provide access. In addition, the level of traffic from development areas outside the North Mandan area, but generate traffic that will travel through the study area will be evaluated to identify improvements that support forecasted development and provide adequate capacity.

- Promote a multimodal transportation system. The North Mandan area transportation infrastructure is the combined network of local, collector and arterial roadways, sidewalks and off-street trails connecting housing areas, work areas, non-work activity areas. Through the study gaps in the current network and expansion of the multimodal network that support forecasted development will be identified.
- Balance maintaining the current system with expansion that supports new development in the study area. As the operators of the system, the City of Mandan, Morton County and the NDDOT each have the responsibility to invest into maintenance and repair of the system to provide a good quality network. As there is not adequate public and/or private funding for both expansion of the system to support future development and maintain the substantial investment already made in the system decisions must be made that strike an equitable balance between expansion and maintenance of the current.

## **Need for Improvements in the Study Area**

Needs associated with recommending transportation system improvements within the North Mandan subarea of the city and the metropolitan area were derived from a range of sources/input including:

- Discussion with residents, business owners and people working in Mandan held as part of the public engagement process. The focus of the initial public information meeting was to gather firsthand input on where bottlenecks exist, where travelers experience safety concerns, development parcels that need system improvements to allow development to occur, milling links/gaps in the multimodal network.
- Discussion with the study Stakeholders Committee regarding deficiencies in the current roadway and non-motorized system and locations where development is anticipated to occur over the planning period.
- Analysis of crash records for the three-year period from 2010-2012, which provided the basis for identifying locations where roadway geometrics, intersection control or allowable speeds contribute to higher than typical crash rates.
- Evaluation of morning and afternoon peak hour traffic operations along key roadway segments and intersections using current traffic, current intersection layouts and current intersection traffic control devices. Using this information locations in the network where unacceptable levels of congestion were identified and documented. Unacceptable levels of intersection congestion are defined as level-of-service D or worse operations in the AM or PM peak hours.
- Identification of where future residential, commercial and industrial development is likely to be located and review of whether the current roadway and non-motorized networks provide adequate access and connectivity to support development. A need for improvements to the current system would be warranted in conditions where the collectors and/or arterial network or the sidewalk/trail network do not provide reasonable access to proposed development areas. Reasonable access would be the

ability to connect proposed development areas with the current system either directly or through extending the local street network.

- Analysis of intersection traffic operations reflective of future year traffic (2040) and the current roadway network and intersection control and any improvements expected to be in place by the horizon year. A need for improvement would be defined at intersections and along roadway segments where 2040 operations are level-of-service D or worse.
- Review of the current sidewalk and trail systems relative to where complementary development activities exist. The goal would be to provide residents who cannot or chose not to drive with the ability to travel from their homes to schools, to basic needs shopping areas, to recreational areas and to their places of work, and back. Gaps would exist when areas of the community are inaccessible by sidewalks, trails or by lower-volume roadways that provide a reasonably safe walking or bicycling environment.

The next two sections, Existing Conditions and Planning Horizon (2040) Traffic and Operations, provide information on locations in the subarea where there are needs to consider network improvements. Each of the areas identified in the preceding bullet points, additional information on thresholds of determining need for action, and locations where needs presently or are anticipated to exist by the planning horizon are included as appropriate.

## Existing Conditions

---

### Background/Purpose

The purpose of the Existing Conditions section is to provide the City of Mandan, Morton County, the North Dakota Department of Transportation (NDDOT), Federal Highway Administration (FHWA), Federal Transit Administration (FTA), and local stakeholders with status of the study area transportation system as it stands today (2013). Gaining an understanding of the current system is vital to the overall improvement planning process in that the existing system forms the underlying structure/foundation of the future system and the needs. Study area transportation system elements/conditions investigated as part of the study included the following:

- Roadway geometry and intersection traffic control.
- Land use and access along the corridor.
- History of reported crashes in the study area for the most recent three-year period.
- Daily and peak period traffic volumes.
- Traffic operations for the morning and afternoon peak periods.
- Pedestrian and bicycle facilities.
- Transit routes and stops within the corridor

### Roadway Geometry and Intersection Traffic Control

The majority of the roadway corridors in the study area are two-lane routes with intersections controlled by stop signs on the minor cross streets. Exceptions to the general condition are:

- Old Red Trail from 37<sup>th</sup> Street NW to Sunset Drive: The cross section is a four-lane undivided route, with the west approach to Sunset Drive configured with one shared through-left turn lane and one right turn lane.
- Old Red Trail/Sunset Drive: The intersection is the only location in the study area with signal control at the intersection. In addition to the west approach lane description provided in the previous bulletpoint, through and turn lanes on the other approaches are described below:
  - North Approach: One right turn lane, one through lane and one left turn lane.
  - East Approach: One shared right-through lane and one shared left through lane.

- South Approach: One shared right-through lane and two (dual) left turn lanes.
- I-94/Sunset Drive Interchange: With the exceptions of the westbound off-ramp, the remaining three ramps provide one lane entering or exiting Sunset Drive. Starting as a single lane off-ramp from I-94, the westbound off-ramp expands to provide a right turn lane and a left turn lane at Sunset Drive. At the north terminal intersection of I-94, Sunset Drive provides one through and one left-turn lane on the south approach. The north approach is divided into a through lane and one right-turn lane.
- The south terminal intersection approaches are all one lane with the exception of the north approach, which provides one through lane and one left-turn lane.
- I-94/Mandan Avenue Interchange: The north and south terminal interchanges at Mandan Avenue are configured the same relative to intersection control and lane geometry. For each stop signs control the ramp approaches and have the following lane geometry:
  - Mandan Avenue: North and south approaches accommodating left turning traffic to an I-94 on-ramp provide a left turn lane and a through lane. Right turn lanes to on-ramps are not striped.
  - Off-ramps: The eastbound and westbound off-ramps provide detached left turn lanes to Mandan Avenue and a right turn lane.
- Old Red Trail/ND 1806 (Collins Avenue): Traffic control at the intersection is a four-way stop.
- Figure 5 displays the current lanes and intersection control.



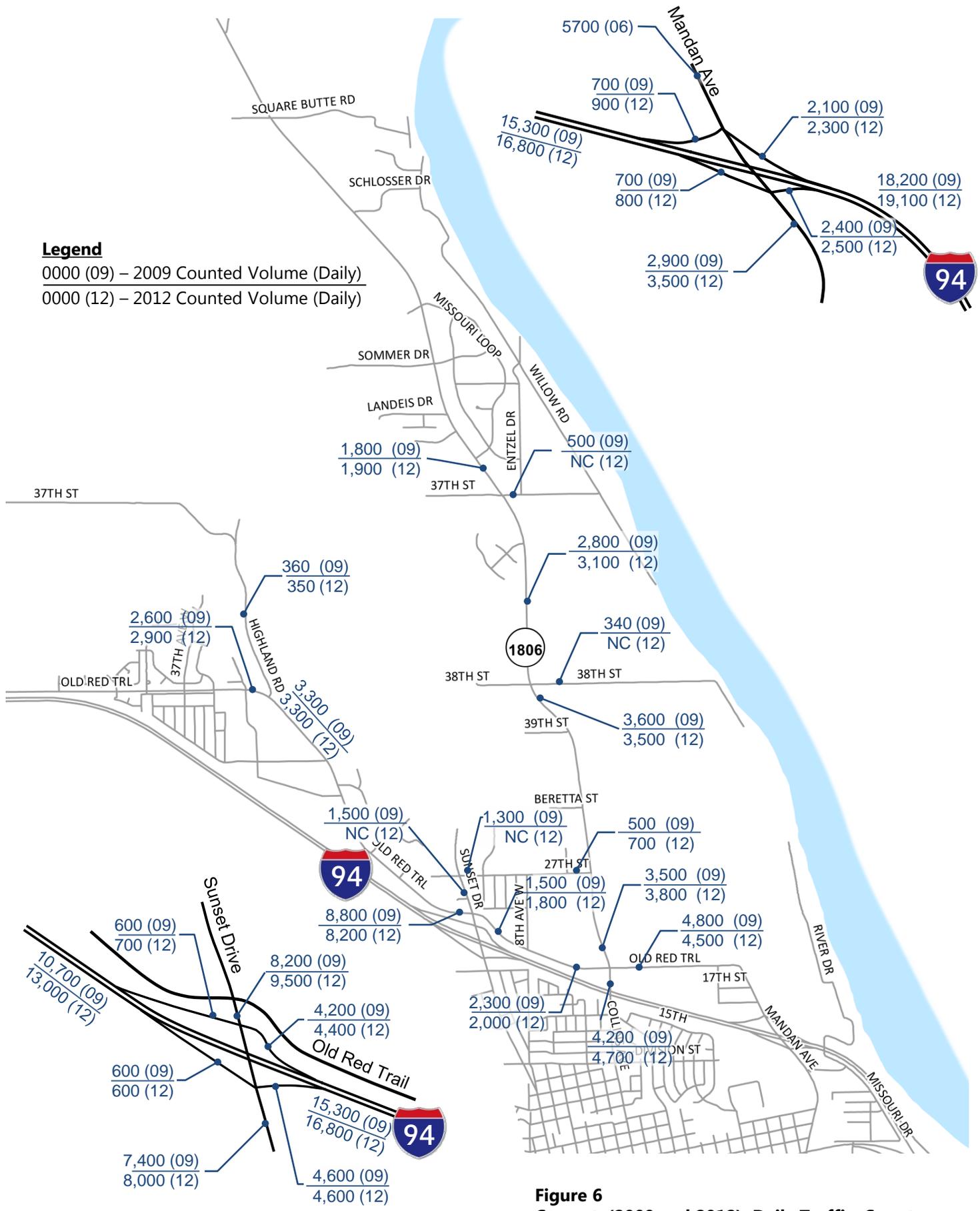
*I-94/Mandan Avenue – Left turn lanes are “detached” from the through and right turn lanes*

## Traffic Data Collection

### Average Daily Traffic

Generally, the NDDOT collects traffic counts once every three years along a series of collector and arterial roadways throughout the city. Within the study area, the latest count years for stations in the study area were 2009 and 2012. Average daily count data reported by the North Dakota DOT are displayed in Figure 6.





**Figure 6**  
**Current (2009 and 2012) Daily Traffic Counts**



## Intersection Hourly Turning Movements

As part of the corridor study, the Bismarck-Mandan MPO staff and URS manually collected turning movement counts at 12 intersections throughout the study area. For each of the key intersections turning movements were collected over the following periods:

- AM Peak Period: Count data was collected from 7:00 AM to 9:00 AM.
- PM Peak Period: Count data was collected from 3:15 PM to 5:15 PM.

Table 1 displays 2012 turning movement counts for the AM and PM peak hours. The field count information has been separated into autos and trucks/buses. Count data was collected over a three week period, which requires that the information collected for individual intersections in corridors with multiple adjacent intersections be reconciled to ensure that total intersection-to-intersection flow is logical. Reconciliation of the field data (also referred to as raw counts) entailed the following:

- Adjustment to improve the fit between peak hour and daily segment traffic counts. As the peak hour and daily counts were not collected on the same days there is likely to be some location-to-location variation in the percentage of daily traffic occurring in each of the observed peak periods. For those locations where the hourly percent deviated noticeably from the up and/or downstream locations, adjustments were considered to bring the outlier more in line with data observed to be more consistent.
- Adjustments to smooth the leaving volume from one intersection with the entering volume at the next intersection. In most locations, the recorded peak hour turning movement data balanced relatively well at consecutive intersections (examples include the Sunset Drive corridor from Boundary Road through 27<sup>th</sup> Street). In most cases, raw count data observed departing an “upstream” intersection were similar to the observed traffic entering the adjacent “downstream” intersection. Professional judgment was used to proportionally adjust entering volumes for individual peak hour volumes at two intersections. The goal was to have at most 10 to 15 percent variation between the departing and entering volume at consecutive intersections.

Table 2 displays the smoothed counts at the key intersections throughout the study area.

## Non-motorized System

### Introduction

With residential uses located throughout the study area, it is desirable to have a continuous pedestrian system linking living areas-work areas-recreation areas-shopping areas. The current pedestrian and bicycle system is made up of a combination of sidewalks and wider multi-use trails, supplemented by lower volume local and collector routes that provide linkages between the more formal sidewalk and trail system. Figure 7 displays locations in the study area where sidewalks and/or detached multi-use trails are presently in place.



Location	SOUTHBOUND						WESTBOUND						NORTHBOUND						EASTBOUND						Totals		
	Right		Thru		Left		Right		Thru		Left		Right		Thru		Left		Right		Thru		Left				
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
<b>Collins Avenue/27th Street</b>																											
All	36	10	274	84	0	0	0	0	0	0	0	0	0	0	0	65	180	68	37	35	67	0	0	3	17	481	395
Auto	34	10	274	84	0	0	0	0	0	0	0	0	0	0	0	63	180	67	37	34	67	0	0	3	17	475	395
Truck/Bus	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	6	0
<b>Collins Avenue/38th Street</b>																											
All	2	0	274	102	2	1	0	2	0	0	12	21	10	5	51	204	2	1	1	1	2	0	0	0	0	356	337
Auto	1	0	272	95	1	1	0	2	0	0	11	19	10	5	45	201	2	1	0	1	2	0	0	0	0	344	325
Truck/Bus	1	0	2	7	1	0	0	0	0	0	1	2	0	0	6	3	0	0	1	0	0	0	0	0	0	12	12
<b>Old Red Trail/8th Avenue</b>																											
All	7	6	0	3	19	15	13	27	106	74	1	1	0	1	0	0	0	0	0	0	39	76	3	9	188	212	
Auto	6	6	0	3	19	14	12	27	93	72	1	1	0	0	0	0	0	0	0	0	36	74	3	9	170	206	
Truck/Bus	1	0	0	0	0	1	1	0	13	2	0	0	0	1	0	0	0	0	0	0	3	2	0	0	18	6	
<b>Collins Avenue/Division Street</b>																											
All	13	19	198	195	10	10	16	20	20	14	11	13	9	20	168	234	5	13	10	9	6	14	18	13	484	574	
Auto	13	18	197	194	9	10	16	18	20	14	11	13	9	20	160	224	4	13	10	9	6	14	17	13	472	560	
Truck/Bus	0	1	1	1	1	0	0	2	0	0	0	0	0	0	8	10	1	0	0	0	0	0	1	0	12	14	
<b>Collins Avenue/Old Red Trail</b>																											
All	20	6	115	65	192	63	34	124	26	37	42	138	157	81	71	83	54	45	34	48	25	26	8	16	778	732	
Auto	18	6	113	63	191	61	30	121	22	36	38	138	157	80	68	83	53	45	33	48	22	23	8	16	753	720	
Truck/Bus	2	0	2	2	1	2	4	3	4	1	4	0	0	1	3	0	1	0	1	0	3	3	0	0	25	12	

Source: URS and Bismarck-Mandan MPO (2012)



Location	SOUTHBOUND						WESTBOUND						NORTHBOUND						EASTBOUND						Totals		
	Right		Thru		Left		Right		Thru		Left		Right		Thru		Left		Right		Thru		Left				
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
<b>Collins Avenue/27th Street</b>																											
All	36	10	274	84	0	0	0	0	0	0	0	0	0	0	0	65	180	68	37	35	67	0	0	3	17	481	395
Auto	34	10	274	84	0	0	0	0	0	0	0	0	0	0	0	63	180	67	37	34	67	0	0	3	17	475	395
Truck/Bus	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	6	0
<b>Collins Avenue/38th Street</b>																											
All	2	0	274	102	2	1	0	2	0	0	12	21	10	5	51	204	2	1	1	1	2	0	0	0	356	337	
Auto	1	0	272	95	1	1	0	2	0	0	11	19	10	5	45	201	2	1	0	1	2	0	0	0	344	325	
Truck/Bus	1	0	2	7	1	0	0	0	0	0	1	2	0	0	6	3	0	0	1	0	0	0	0	0	12	12	
<b>Old Red Trail/8th Avenue</b>																											
All	7	6	0	3	19	15	13	27	106	74	1	1	0	1	0	0	0	0	0	0	0	39	76	3	9	188	212
Auto	6	6	0	3	19	14	12	27	93	72	1	1	0	0	0	0	0	0	0	0	0	36	74	3	9	170	206
Truck/Bus	1	0	0	0	0	1	1	0	13	2	0	0	0	1	0	0	0	0	0	0	0	3	2	0	0	18	6
<b>Collins Avenue/Division Street</b>																											
All	13	19	198	195	10	10	16	20	20	14	11	13	9	20	168	234	5	13	10	9	6	14	18	13	484	574	
Auto	13	18	197	194	9	10	16	18	20	14	11	13	9	20	160	224	4	13	10	9	6	14	17	13	472	560	
Truck/Bus	0	1	1	1	1	0	0	2	0	0	0	0	0	0	8	10	1	0	0	0	0	0	1	0	12	14	
<b>Collins Avenue/Old Red Trail</b>																											
All	20	6	115	65	192	63	34	124	26	37	42	138	157	81	71	83	54	45	34	48	25	26	8	16	778	732	
Auto	18	6	113	63	191	61	30	121	22	36	38	138	157	80	68	83	53	45	33	48	22	23	8	16	753	720	
Truck/Bus	2	0	2	2	1	2	4	3	4	1	4	0	0	1	3	0	1	0	1	0	3	3	0	0	25	12	

Source: URS and SRF Consulting Group



**Figure 7**  
**Existing Multi-use Trails and Collector Route Sidewalks**

In February 2013, the City of Mandan was awarded a grant through the Safe Routes to School funding program for a project that would improve the safety and connectivity of neighborhoods adjacent to the proposed new elementary school west of 37<sup>th</sup> Avenue NW and north of Lewis Road NW. The grant will fund the following crossing and sidewalk improvements:

- Adding a pedestrian crossing of Old Red Trail at 37<sup>th</sup> Avenue NW.
- Adding a pedestrian crossing of a 43<sup>rd</sup> Street NW at 37<sup>th</sup> Avenue NW.
- Completing the west side sidewalk along 37<sup>th</sup> Avenue NE from Old Red Trail to 48<sup>th</sup> Street NW.
- Installing pedestrian crossing beacons to east and westbound Old Red Trail as it approaches 37<sup>th</sup> Avenue NW.



2013 Safe Routes to School Grant Improvements

### Non-motorized System Gaps

Neither the city nor the Park District has established non-motorized system programs or policies for connecting uses throughout the city. Thus, for the

North Mandan subarea study a non-motorized system gap is defined as a missing connection that leaves a residential area, a park, a school, a retail area and/or a major employment center difficult to access by walking or biking. An acceptable connection generally varies based on the mode and the specific use. Uses such as parks and schools are destinations for a broader, and younger, segment of the community. Thus, it is more desirable to provide access via sidewalks and/or multi-use trails, with low volume (less than 500 vehicles per day) local streets being acceptable in some instances. Access to commercial centers and employment districts assumes that the traveler is more experienced and more comfortable sharing the travelway with autos and trucks. While it is desirable to provide sidewalks along collector and arterial routes, using lower volume collectors and local streets (less than 2,000 vehicles per day), is acceptable as a non-motorized mode connection.

Figure 6 displays non-motorized travel gaps identified in the current transportation network. As can be observed in the figure information, much of the area north of I-94 that is presently developed is well served by the combination of multi-use trails and sidewalks that are the two active parts of the non-motorized system. The more significant gaps include:

- Highland Road residential area to new elementary school site. While there is a combination of sidewalks, multi-use trails and low volume local streets that provide pedestrian and bicyclist connectivity between these areas, the path is circuitous. Residents on the north end of Highland Road have a trip of more than 1.3 miles

between their homes and the school. In addition, travels between Highland Road and the new school area must cross Old Red Trail twice in order to get to and from the multi-use trail on the south side.

- Northwest Mandan to/from North Mandan along ND 1806 (Collins Avenue). Currently, multi-use paths connect these areas via ND 1806 (Collins Avenue) and Old Red Trail, however, the path is circuitous, especially for those areas north of 38<sup>th</sup> Street. A consideration in evaluation of the priority of filling the gap is addressing the question of how many people would actually desire to make this trip. While employment areas are located along Old Red Trail east of 30<sup>th</sup> Avenue NW (which would have a logical daily connection to residential areas along ND 1806), the vast majority of the uses in both areas are residential. Residential-to-residential areas do have some level of attraction on a daily basis, however, level of demand between these two lower density residential areas is likely low.
- Northwest of Old Red Trail and ND 1806 (Collins Avenue). The developing area has little infrastructure in place today and the undeveloped 100 plus acre parcel creates a gap in east-west and north-south flow in the subarea. As the area develops over the next few years, it is anticipated that the current gap will be addressed.
- Access between Riverbend and Mandan north of I-94. The combination of the Burlington-Northern Santa Fe Railroad line, Tesoro Refinery and Union Cemetery form a barrier that separates the residential subdivision from the remainder of the community north of I-94.
- Pedestrian Crossings of Busier Routes. Persons attending the public information meeting raised concerns about crossing Sunset Drive near Mandan Middle Schools and traversing any of the approaches at the Old Red Trail/ND 1806 (Collins Avenue) intersection. Crossing Sunset Drive concerns were associated with students living west of Sunset Drive needing to cross the busy route both going to and getting home from school. The idea of providing a grade separated pedestrian crossing was brought up by meeting attendees.

Congestion observed at the Old Red Trail/ND 1806 (Collins Avenue) intersection, controlled by four-way stops, creates an added challenge for pedestrian and bicyclists desiring to cross to and from the multi-use trails along the east side of ND 1806 (Collins Avenue) and the south side of Old Red Trail. While pedestrians have the right-of-way, drivers at this intersection likely become impatient due to their wait and compete for being the next vehicle with the right-of-way as the order may get confusing when pedestrians are added to the mix.

## **Public Transit Service**

The North Mandan Subarea Study area is served by both fixed route and paratransit service through Bis-Man Transit. Fixed route service along the M-1 Route connects residents and businesses along Collins Avenue, 27<sup>th</sup> Street NW, Sunset Drive and Old Red Trail to the remainder of the city and the metro area. The M-1 Route circulates through Mandan from 27<sup>th</sup> Street NW on the north to 19<sup>th</sup> Street SW on the south side. The M-1 provides a direct

connection to Bismarck via Bismarck Expressway (south route) and I-94 (north route). The route alignment in the study area is displayed in Figure 8.

The 2012 Transit Development Plan characterizes the M-1 Route as one of the most productive in the metro area; with an average daily ridership of 65 customers. As part of the transit development plan locations where customers boarded and exited the M-1 Route were collected. The results of the survey information showed very few people getting on or off an M-1 bus north of I-94. Thus, while the route was characterized as a very productive route, the vast majority of the activity occurs south of I-94.

Service frequency north of I-94 is two-hours between buses. On the south side of I-94 the two Capital Area Transit (CAT) routes circulate in opposite directions and are scheduled to be offset by one hour at any one location. The result is that residents, businesses, schools and other uses south of the interstate are served each hour, rather than the two hours north of the interstate.

## Crash Assessment

Crash data for the three-year period (2009 through 2011) collected from the North Dakota Department of Transportation (NDDOT) was studied to gain an understanding of current conditions and identify whether there are safety deficiencies that can be attributed to the current design. Crash rates derived from the north Mandan study area data were compared to average intersection crash rates established by NDDOT for similar facilities. Intersection crashes were the focus of the initial study as they represent the locations of the highest number of crashes. Crash rates along segments between intersections would be evaluated only if the intersection data (where the vast majority of the crashes occurred) resulted in rates that exceeded the acceptable threshold.

Intersection crash rates are reported as the number of crashes occurring per million entering vehicles (Crashes/MEV) at the intersection. NDDOT, as well as many other Midwestern states, generally uses the rates of 1.0 crashes per million entering vehicles as the threshold of whether an intersection warrants additional safety review.

Figure 9 displays the current period crash rate for each of the intersections in the study area where data is available. The observed crash rate at two intersections exceeds the NDDOT threshold of 1.0 crashes/MEV. The locations are:

- Old Red Trail/Collins Avenue: 1.23Crashes/MEV
- Old Red Trail/47<sup>th</sup> Avenue NW: 1.13 Crashes/MEV

While the crash rate at Old Red Trail/47th Avenue NW exceeds the NDDOT rate threshold, volume entering this intersection is relatively low and the rate results from one crash occurring of a three year period. The number of crashes is relatively low and will be taken into account as alternatives are identified and reviewed, however neither of the intersections would be considered as high crash locations.



**Figure 8**  
Existing Capital Area Transit Routes

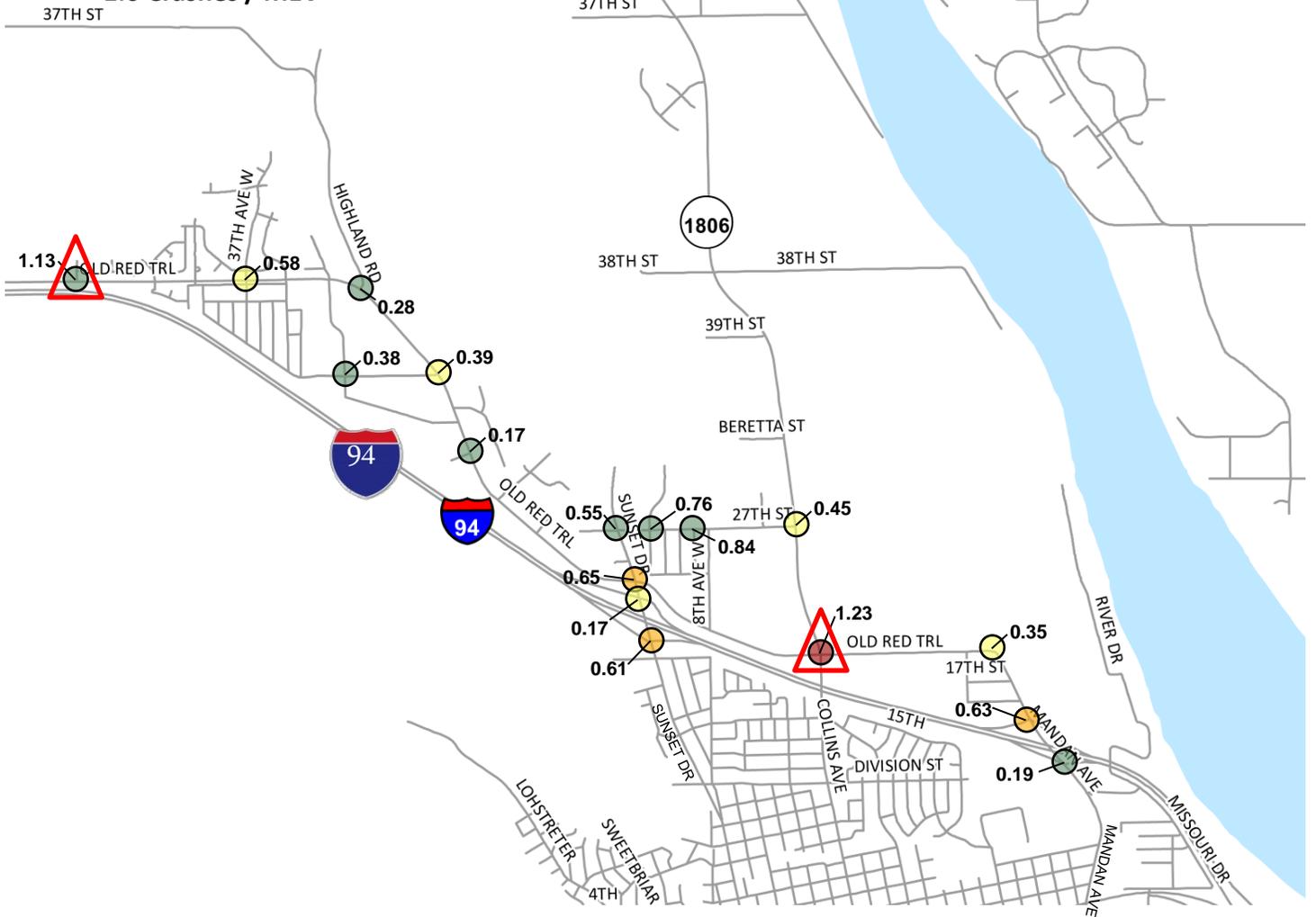
## Legend

Crashes in Three Plus Year  
Period (1/2009 – 8/2012)

- 1
- 2 – 4
- 5 – 7
- 8 – 10

X.XX Crash Rate (Crashes / Million  
Entering Vehicles – MEV)

△ 2009–2012 Crash Rate Exceeds  
1.0 Crashes / MEV



**Figure 9**  
Crashes Reported from 1/2009 – 8/2012 and Crash Rates

## Current (2013) Traffic Operations

### Background

Existing conditions traffic operations were evaluated at each of the signalized and unsignalized intersections using the highest peak period traffic for 2013. The quality of flow through the corridor was characterized by quantifying the level-of-service at each of the signalized and unsignalized intersections resulting from applying the Highway Capacity Manual (HCM) methodologies. At signalized intersections, level-of-service is tied to the weighted average of delay experienced by each vehicle entering an intersection. For unsignalized intersections, the level-of-service is a measure of the average delay per vehicle on the worst cross street movement (usually the left turn movements on the cross street). Level-of-service is expressed as a letter grade from A through F, with each grade representing a range of vehicle delay. Table 3 provides the average vehicle delay ranges for the signalized and unsignalized intersection operations grades.

**Table 3. Level of Service Criteria for Intersections**

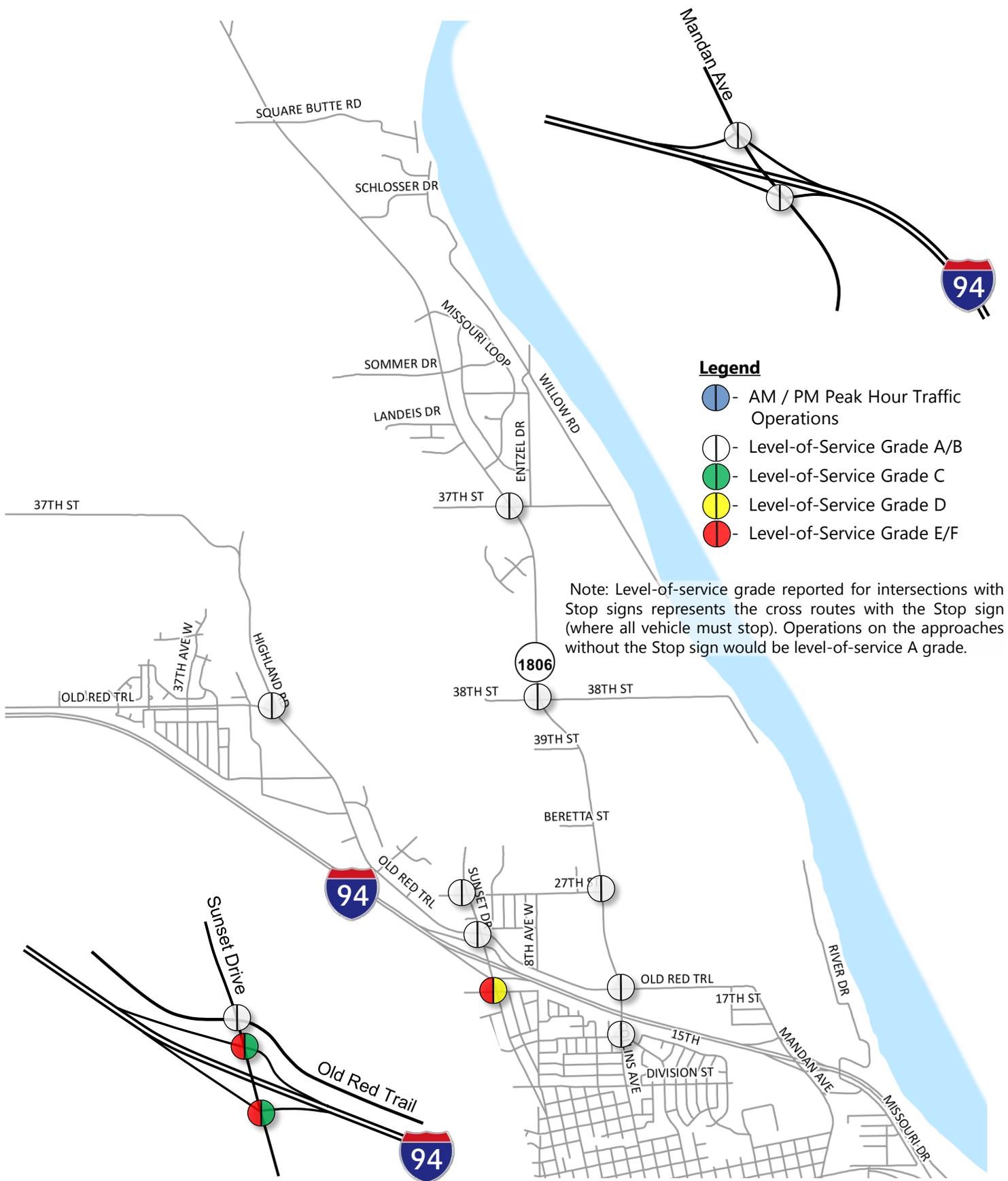
Level-of-Service Indicator	Control Delay per Vehicle (Second Per Vehicle)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

Source: 2010 Highway Capacity Manual

### Intersection and Corridor Traffic Operations Results

Figure 10 highlights the current (2013) traffic operations at the 13 key intersections in the north Mandan study area. The following findings are drawn from the information:

- In the current conditions, Sunset Drive/Old Red Trail, the only signalized intersection in the study area operate at an acceptable to good level-of-service in the AM and PM peak hours.
- The north side and south side I-94 interchange terminal intersections on Sunset Drive operate at level-of-service E/F in the AM peak and level-of-service C in the PM peak. Traffic congestion observed in the AM peak reflects that people exiting the interstate and turning left experience delay that falls into the unacceptable category.



**Figure 10**  
**Current (2012) Conditions Morning and Afternoon Peak Traffic**  
**Intersection Operations**

- Congestion in both the morning and afternoon peak hours for travelers on Boundary Road at Sunset Drive is in the unacceptable category (worse than level-of-service C).
- All other intersections in the study area experience acceptable levels of congestion over the AM and PM peak hour. While over the hour operations are well within the category of acceptable, there are likely short periods in both peaks when travelers on the cross routes (controlled by stop signs) experience longer delays. As peaks in the peak hours occur over periods likely less than 15 to 20 minutes. Over the remaining 40 to 45 minutes of the peak hours, the average delay observed is much less than in the 15 to 20 minutes of the peak of the peak. As the operations analysis completed for the study blends together higher and lower volumes over the peak hour, the reported congestion may be less than observed by some travelers.

## Planning Horizon (2040) Traffic and Traffic Operations

---

Long range planning documents presently being developed by the MPO reflect a consistent horizon period of 2040. Increments of traffic between the base model year (2010 for the North Mandan Subarea Study) and 2040 are forecasted using the Bismarck-Mandan regional travel model, which is a computer simulation that estimates daily traffic growth based on:

- The added number of households and employees in the region and the relative orientation of where the new households and employment areas are located relative to each other and current development.
- Extrapolating historical traffic change at routes into and out of the region (I-94, ND 1804, ND 1806 and others) between the base year and 2040.
- Changes in the roadway network that are expected to be in place by 2040. These projects are contained in the transportation improvement program (TIP), which is updated annually by the MPO and the member jurisdictions.

### Household and Employment Growth (2010 to 2040)

In the spring of 2012 the Bismarck-Mandan MPO completed a major update of the regional travel model input assumptions for each module in the four-step process (trip generation, trip distribution, mode split and traffic assignment), revalidated the model performance relative to current travel characteristics, and developed 2040 socioeconomic data projections reflective of the changing development climate in the region. Historically, population and employment in the region has grown at a rate of slightly less than one percent per year. Over the most recent three years, the level of new housing starts, new commercial business construction and expansion of the industrial sector has far outpaced the historical growth. The MPO Policy Board recognized in approving the 2040 population and employment projections that the next 20 to 25 years is more likely to reflect the recent trends than it is to reflect the longer term and pre-oil production forecasts. For the region, the population and employment projections for the period through 2040 reflect the following assumptions:

- 2012 through 2025: Population and employment growth of approximately 3.5 percent per year.
- 2026 through 2040: Population and employment growth moderating to approximately 1.25 percent per year.

Table 4 provides documentation of the base year (2010), intermediate year (2025) and 2040 horizon estimates of growth for the region and the North Mandan Subarea Study limits.

**Table 4. Change in Socioeconomic Data Estimates**

Variable	Period					
	2010		2025		2040	
	Region	Study Area	Region	Study Area	Region	Study Area
Population	108,600	2,280	159,000		191,600	
Households	41,800	1,080	64,400	2,670	73,100	3,890
Employment	64,300	2,270	99,900	5,440	124,500	8,290

Variable	Change			
	2010-2025		2025-2040	
	Region	Study Area	Region	Study Area
Population	50,400		32,600	
Households	22,600	1,590	8,700	1,220
Employment	35,600	3,170	24,600	2,850

Source: Bismarck-Mandan MPO

## North Mandan Study Area Change in Trip Generation

The increment of development (defined in the model as households and employees) allocated to the study area is the key variable in determining the level of traffic growth projected for arterial and collector roads in the study area. Table 5 displays the base year (2010) and projected 2040 vehicle trip generation corresponding to the level of development allocated to the study area. Over the planning period households and employment in the study area are forecasted to increase by over 260 percent. In the modeling process, there is a linear relationship between development and trip generation. Thus, a similar level of trip generation would be expected unless other factors were introduced to the study area. Over the planning period trip generation in the study area is forecasted to increase by more than 400 percent. The substantially greater increase in daily trips relative to the increment of development is associated with much of the new employment related development being in the retail commercial category. Retail commercial uses generate substantially more trips per unit of development than does residential, office, service, or industrial sectors. Presently, there is a relatively small amount of retail commercial in the study area. As a disproportionate amount of the development increment is retail, it is expected that trip generation should grow more than the increment of development.

**Table 5. 2010 and 2040 Daily Trip Generation (North Mandan Study Area)**

	Period		Percent Change in Period
	2010 (Base Year)	2040 (Horizon Year)	
Daily Trips	13,700	74,100	+440%

Source: Bismarck Mandan MPO Regional Travel Demand Model

## 2040 Existing Plus Committed Network Daily Traffic

Initial traffic forecasts for the 2040 horizon year represented the current network plus those improvements expected to be in place by 2040. Roadway improvements in the study area and adjacent areas that influence the study area included in the 2040 Existing Plus Committed network are limited to Sunset Drive extended north from its present terminus north of 27<sup>th</sup> Street to a junction with ND 1806 (Collins Avenue) at 38<sup>th</sup> Street. While there are more Mandan and Morton County area short term improvements in the transportation improvement program, none create a noticeable traffic impact on the study area.

Figure 11 displays forecasted 2040 daily traffic on the Existing Plus Committed network. Corridors in the study area anticipated to experience the most significant growth are:

- Sunset Drive from I-94 through the northern terminus: Much of the anticipated commercial development in the North Mandan Subarea study area is expected to be located along the Sunset Drive corridor. As the route is expected to become a major commercial arterial route, traffic volume will reflect the intensity of development. Current corridor volume of just under 2,000 vehicles per day north of 27<sup>th</sup> Street NW is expected to grow to almost 12,000 vehicles per day in 2040. Sunset Drive south of 27<sup>th</sup> Street to Old Red Trail is expected to carry daily traffic approaching 27,000 vehicles per day, almost three times the 9,500 daily vehicles observed today.
- Old Red Trail west of Sunset Drive: The area to the west on the top of the hill is anticipated to develop as a mixture of residential uses. As many destinations for these home-based trips will be retail areas along Sunset Drive, employment areas south of the interstate and areas in Bismarck, Old Red Trail will experience substantial increases in daily traffic west of Sunset Drive. Segments of Old Red Trail east of Sunset Drive are not expected to see the same increment of growth as to the west of Sunset Drive, the commercial development will drive substantial increases in the Old Red Trail corridor east of Sunset Drive. The highest forecasted traffic in the corridor is identified to occur just west of Sunset Drive. There are no other connections to the regional system (other than Old Red Trail) from the developments from Highland Road to 47<sup>th</sup> Avenue NW, therefore, much of the traffic generated from residential uses to the west will funnel through the Old Red Trail corridor, increasing daily traffic to over 17,000 vehicles per day.



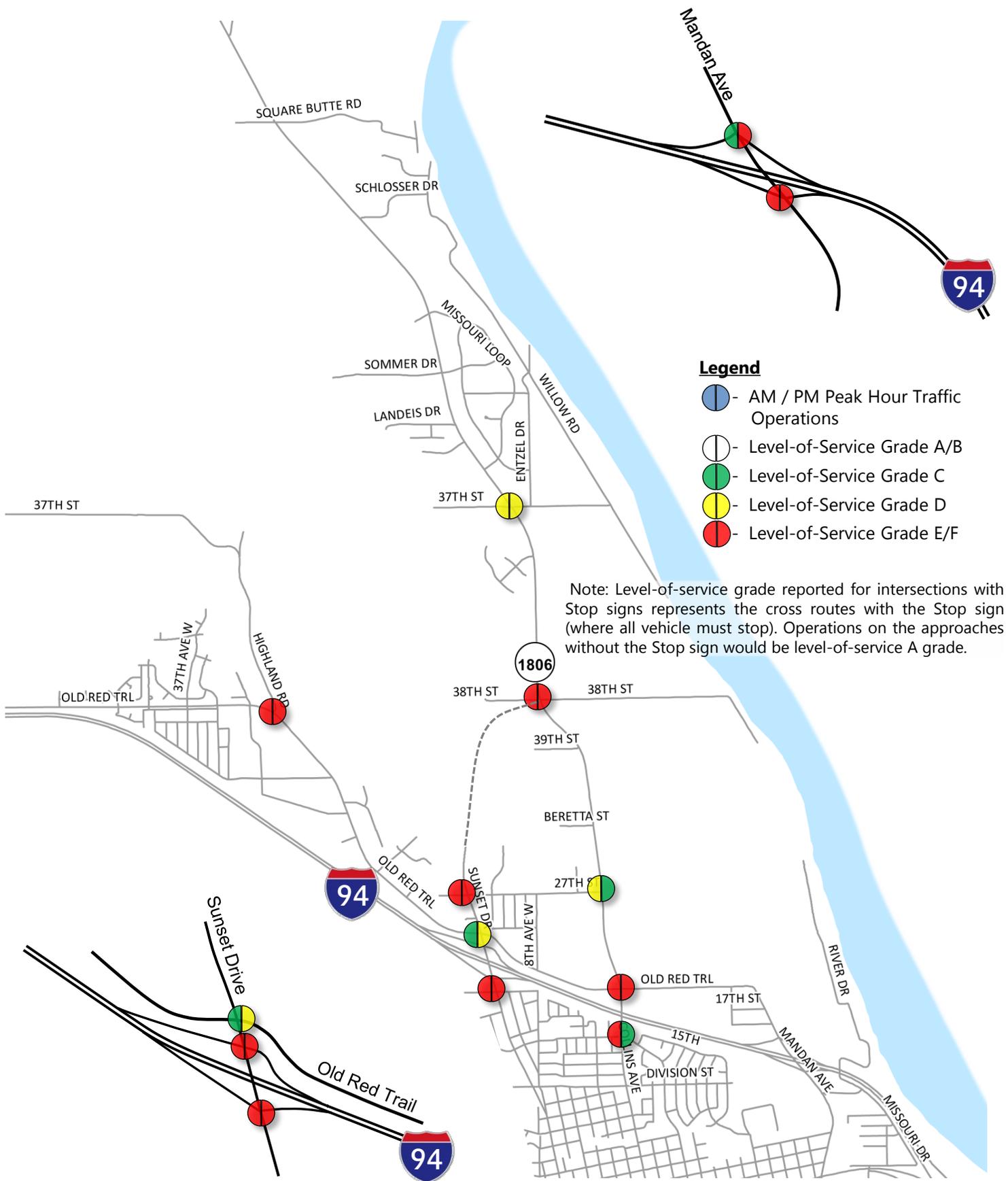
- Old Red Trail east of Sunset Drive: Increases in traffic on Old Red Trail on the portion of this segment from 8<sup>th</sup> Avenue to Sunset Drive are influenced more directly by construction of the Walmart center north of Old Red Trail. A secondary contributor to traffic growth along the segment is the residential expansion north of Old Red Trail and adjacent to ND 1806 (Collins Avenue) that is traveling to Bismarck via the Mandan interchange on I-94. Daily traffic in this segment is expected to grow to almost 13,000 vehicles per day.
- ND 1806 (Collins Avenue): North of 38<sup>th</sup> Street development density and intensity is not expected to be as great as growth to the south of 38<sup>th</sup> Street. South of 38<sup>th</sup> Street most of the area will be within the city limits and likely served by city water and sewer. Thus, can support higher density development relative to north of 38<sup>th</sup> Street. Traffic growth rates south of 38<sup>th</sup> Street will outpace growth to the north by more than double. Forecasted volume south of 38<sup>th</sup> Street is expected to increase to almost 10,000 vehicles per day. North of 38<sup>th</sup> Street the lower density uses will generate less traffic growth, with a maximum estimated daily volume of 4,900 vehicles per day.
- I-94: Forecasted daily traffic along I-94 through the study area is expected to increase by approximately 9,000 vehicles per day west of Sunset Drive to almost 20,000 vehicles per day on segments east of Sunset Drive. Increases of the reported amounts will result in daily traffic ranging from 24,000 to 39,000 vehicles per day.

## **2040 Peak Hour Traffic and Traffic Operations**

The projected increases in traffic along the arterial and collector corridors in the study area will change dramatically the relatively uncongested conditions observed today. While today only the I-94/Sunset Drive terminal intersections are congested for longer portions of the AM and PM peaks, by 2040 the list of intersections experiencing failing operations will reflect most of arterial-to-arterial and arterial-to-collector intersections in the study area.

Figure 12 displays the forecasted morning and afternoon peak hour intersection operations with 2040 forecasted volume on what is essentially the current roadway system. The only significant addition/expansion of the network is the Sunset Drive extension north to ND 1806 (Collins Avenue)/38<sup>th</sup> Street. This network addition, however, represents a more localized alternate (providing access to adjacent development parcels) than a regional improvement (designed to carry through traffic). As in the current conditions, level-of-service C is the target threshold for acceptable operations. Loading 2040 traffic onto what is essentially the current network, results in unacceptable/poor operations at the following intersections:

- Sunset Drive/Boundary Road: Level-of-service F
- I-94 at the north and south terminal intersections of Sunset Drive: Level-of-service F.
- Sunset Drive/Old Red Trail: Level-of-service D in the PM peak.



**Figure 12**  
**Forecasted 2040 Conditions Morning and Afternoon Peak Traffic**  
**Intersection Operations (Existing Plus Committed Network)**



- Sunset Drive/27<sup>th</sup> Street: Level-of-service F.
- Old Red Trail/Highland Road: Level-of-service F in that AM and PM peaks.
- ND 1806/38<sup>th</sup> Street/Sunset Drive extended: Level-of-service F in the AM and PM peaks.
- ND 1806 (Collins Avenue)/27<sup>th</sup> Street: Level-of-service D in the AM peak.
- ND 1806 (Collins Avenue)/37<sup>th</sup> Street: Level-of-service D in the AM and PM peaks.
- I-94 at the south terminal intersection of Mandan Avenue: Level-of-service F in the AM and PM peak periods.
- I-94 at the north terminal intersection of Mandan Avenue: Level-of-service F in the PM peak period.

## Needs Identified Through Public and Stakeholder Committee Outreach

The technical analyses of crash records and intersection traffic operations and comparison of roadway geometrics to guidelines in design manuals play a large role in establishing the needs in the study area; however, they cannot provide the entire picture of how well the system serves travel needs. Crash records do not include near misses or identify locations where drivers are extra cautious as they know it is an issue. Traffic operations do not reflect that some people alter their travel plans to avoid certain areas at certain times of the day. To complete the picture of how well the current system is serving travel needs, much of the first public information meeting and the first Stakeholder Committee meeting were dedicated to discussing needs and gaps in the system. Attendees to these meetings were divided into small groups and were asked to mark up maps to identify areas where they encounter congestion, locations think are safety concerns and locations where the current network is incomplete relative to travel needs.

An important focusing exercise included in the issues/needs mapping was gathering input from people attending which of the range of issues were most important to them. Each person was given a series of colored tape dots with each representing a different measure of importance. People were asked to place one colored dots next to the issues they believed to be most important to address.

All of the issues identified at the meetings were included in the final compiled map along with the results of the preference voting on which issues needed the most attention. Figure 3 displays the results of the public and Stakeholder Committee input and the preference voting results. Areas of the transportation system that the combined Committee and public input identified are:

- **Increasing Pace of Development.** Study area development has accelerated in the last few years and is now resulting in congestion along Sunset Drive from Old Red Trail through the I-94 interchange (Figure 3 identifiers R, S and T). If development continues at the pace expected and few roadway improvements are made, traffic associated with

the forecasted population and employment will result in substantial delay at most of the primary intersections in the study area.

- **Additional access is needed across/to I-94 to relieve growing congestion on Sunset Drive.** Sunset Drive and Old Red Trail serve as the primary access routes to much of the currently developed area north I-94 and until new arterial corridors are added, more pressure will be placed on these routes. North and west of the intersection of Old Red Trail and Sunset Drive, Old Red Trail is the only route (see Figure 13) serving all of the residential and commercial developments through 47<sup>th</sup> Avenue NW. By 2040, this area will contain more than 2,000 new households and over 5,000 more employees. As part of the alternatives analysis, concepts that provide relief to Old Red Trail and Sunset Drive need to be considered for the following trips:
  - Short distance trips that remain within the North Mandan Study area.
  - Medium distance trips that cross over I-94 or presently use I-94 between the Sunset Drive interchange and the Mandan Avenue interchange.
  - Regional trips between the study area and Bismarck or destinations outside the metropolitan area.

Suggested by people attending both the public information meeting and Stakeholders Committee meeting that focused on identifying needs was to provide a new I-94 interchange at Collins Avenue. While the interchange would be relatively central to where development is anticipated into the future, there are issues/concerns with the following (see Figure 14):

- Adding an interchange at Collins Avenue did not substantially reduce the level of traffic/resulting congestion on Sunset Drive. Forecasted 2040 traffic with an interchange at I-94/Collins Avenue reduced Sunset Drive corridor traffic by at most 1,000 vehicles per day; not enough to produce a noticeable improvement in congestion. In addition, adding an interchange will create on Collins Avenue many of the same poor operating efficiency issues that are present on Sunset Drive; with the most significant being very closely spaced intersections between the ramp terminals and Old Red Trail and the ramp terminals and 14<sup>th</sup> Street NW.
  - Spacing between Sunset Drive and Mandan Avenue. The Federal Highway Administration (FHWA) requires a minimum of one mile with a preferred spacing of two miles. The distances from Collins Avenue to Sunset Drive is approximately three-quarters of the mile while the distance to Mandan Avenue to just over 0.9 miles.
  - Proximity of ramp terminal intersections to Old Red Trail and 14<sup>th</sup> Street. Many of the same closely spaced intersection issues that are present at Sunset Drive would be repeated at Collins Avenue.
  - Impacts to Eagles Park. The southeast ramp of a typical diamond interchange would likely encroach onto the park, which is highly undesirable.
- **The intersection of Old Red Trail/ND 1806 (Collins Avenue) is congested** in the morning and evening peaks (Figure 3 identifier GG). Total vehicles counts through the intersection rank this intersection as one of the most active intersections in the study area. Adding traffic associated with the Walmart that will open in the fall of 2013, will increase the level of congestion observed in the afternoon peak.

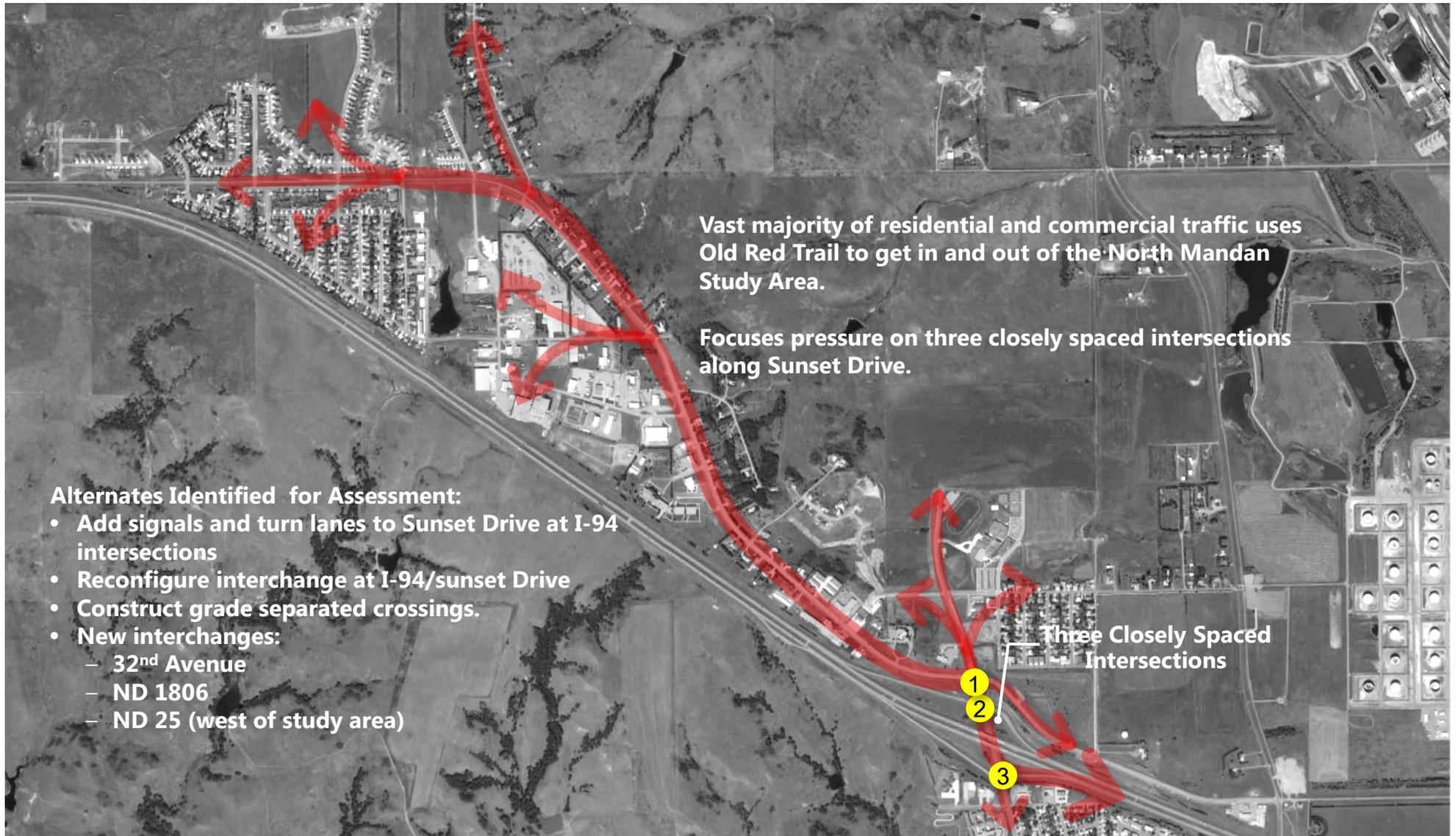


Figure 13  
Old Red Trail – Primary Route Serving the Northwest Area

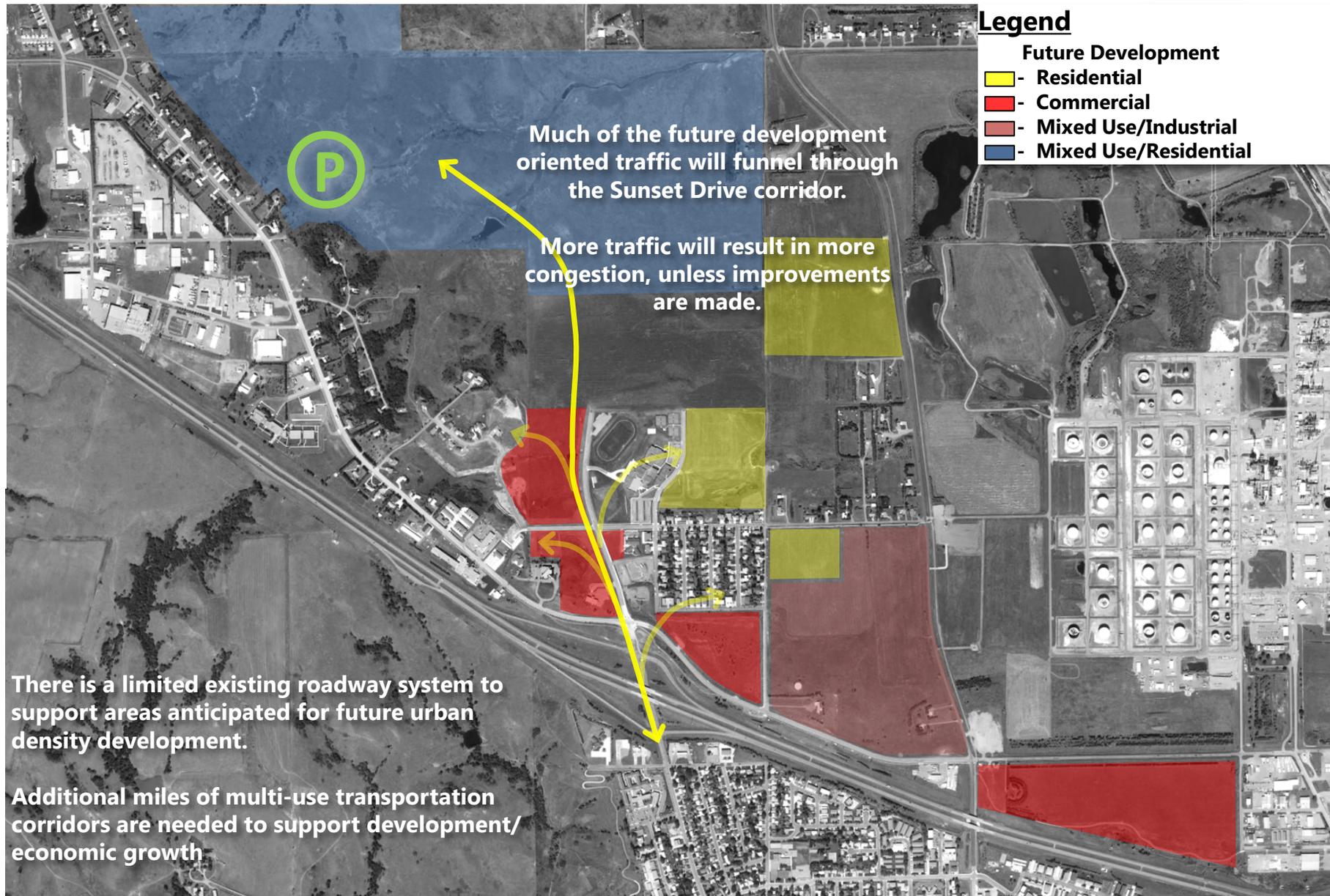


**Figure 14**  
**Considerations Associated with an I-94/Collins Avenue Interchange**

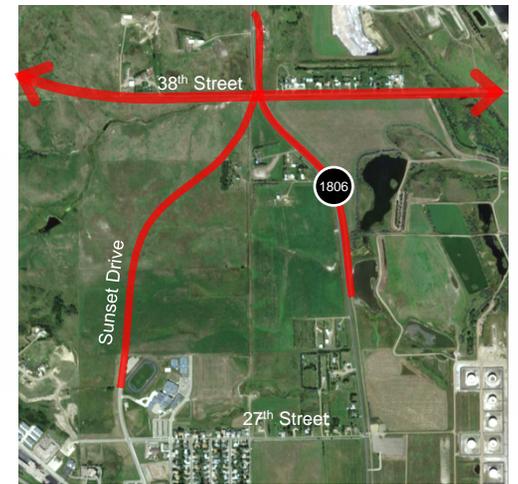
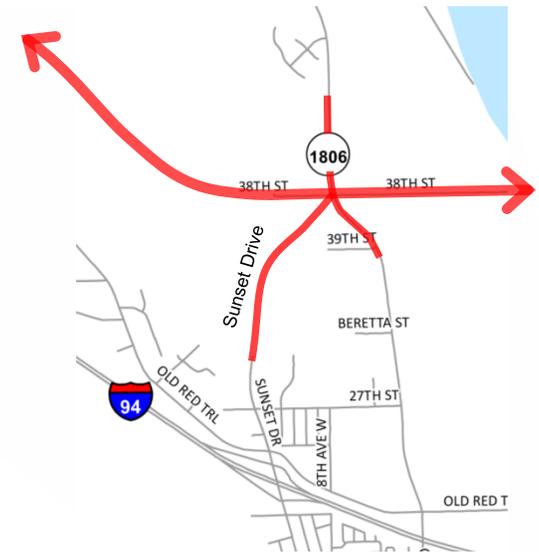
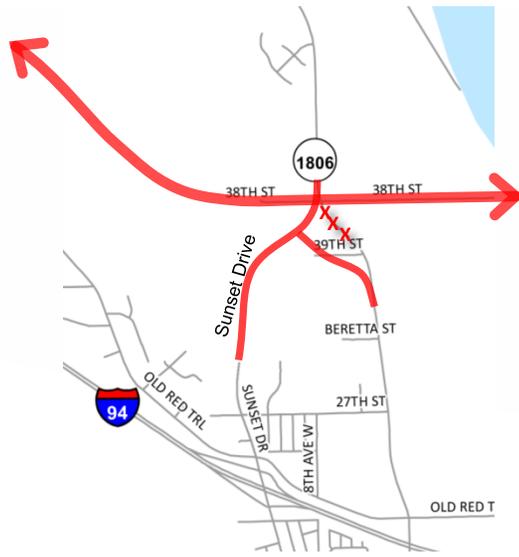
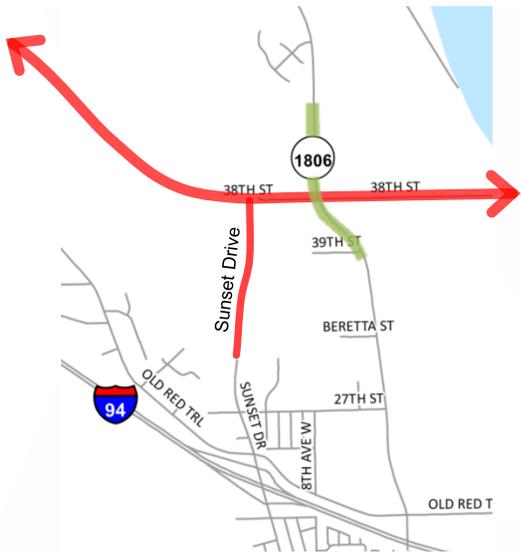
- Sunset Drive needs to be extended to the north to support on-going and future development** (Figure 3 identifier Q). Sunset Drive represents the corridor where the vast majority of commercial development has been occurring over the last four to five years and is expected to be located for the foreseeable future. To provide access to commercial development property the route needs to be extended to the north from its terminus just north of 27<sup>th</sup> Street. As is displayed in Figure 15, simply extending Sunset Drive to the north will not resolve both the access and volume issues observed in the corridor. Extending Sunset Drive to the north, without considering alternate east-west outlets, will result in high volumes of traffic being funneled through an already congested route. The alternatives analysis needs to include assessment of alternate routes that will distribute the load from the sources along Sunset Drive.
- Determining the appropriate future configuration of the junction of ND 1806 (Collins Avenue)/38<sup>th</sup> Street/Extension of Sunset Drive** (Figure 3 identification BB). The junction of ND 1806 (Collins Avenue), an extension of Sunset Drive and 38<sup>th</sup> Street (which is anticipated to be upgraded to an arterial) represents one of the more complex issues in the North Mandan study area. 38<sup>th</sup> Street has been identified as a key portion of the Beltway discussed in the region for a number of years. The Beltway would provide a regional arterial corridor whose purpose is to move higher volumes of traffic from one part of the Bismarck-Mandan metropolitan area to another; including across the Missouri River. 38<sup>th</sup> Street has also been discussed as a location where an extension of Sunset Drive would connect with ND 1806 (Collins Avenue). The combination of the current ND 1806, upgrading 38<sup>th</sup> Street to a regional arterial and extending Sunset Drive to the north results in the potential for five approaches to the intersection (38<sup>th</sup> Street east and west [2 approaches], ND 1806 north and south [2 approaches] and Sunset Drive [1 approach]), which generally does not provide safe and efficient flow.

Complexity is created by the unique condition where three corridors currently or anticipated to be principal arterial routes come together/interact. The junction represents the only location in the Bismarck-Mandan metropolitan area where three arterial routes come together at one point. The unique junction warrants a two-step process of first assessing the configuration of the approaches relative to which routes represent the primary through connections; followed by assessing the junction type (signalized intersection, roundabout, etc.). Determining the appropriate junction configuration requires involvement and concurrence by the following jurisdictions; the City of Mandan, Morton County and the NDDOT, as each has responsibility for current routes or new routes that may be developed in the future.

Figure 16 displays schematic drawing of the three alternate primary through route alternatives for the ND 1806 (Collins Avenue)/Sunset Drive/38<sup>th</sup> Street junction. Table 6 highlights the positives and negatives associated with each of the alternatives. The information in the table is supplemented by junction types/configurations highlighted in the next section.



**Figure 15**  
**Locations and General Land Uses of Short Term Future Development Areas Relative to Sunset Drive**



**Figure 16**  
**ND 1806-Sunset Drive-38<sup>th</sup> Street Alternate Alignments**

**Table 6. Comparison of ND 1806-Sunset Drive-38<sup>th</sup> Street Alignments**

Alternate Junction	Positives	Negatives
<p>Retain ND 1806 Through Route – Sunset Drive Connects to 38<sup>th</sup> Street West of ND 1806</p>	<p>No spillback with signals at ND 1806/38<sup>th</sup> St and at Sunset Dr/38<sup>th</sup> St</p> <p>At ND 1806/38<sup>th</sup> Street and Sunset/38<sup>th</sup> Street can accommodate future traffic at reasonable level-of-service.</p> <p>Provides capacity to accommodate 2040 traffic</p> <p>Allows Sunset Dr to continue to north of 38<sup>th</sup> St. to development areas</p> <p>Can meet NDDOT spacing/ access guidelines</p> <p>Moderate ROW impacts</p>	<p>Sunset Dr alignment–May or may not be consistent with adjacent development concepts (Must be confirmed)</p>
<p>ND 1806 to Sunset Drive Reassigned as Through Route – Connect Current Collins into Sunset Extension South of 39<sup>th</sup> St</p>	<p>Access from ND 1806 to I-94 is more direct.</p> <p>Can signalize intersections and accommodate queues (No spillback)</p> <p>Can meet NDDOT spacing/ access guidelines</p> <p>At ND 1806/Sunset and Sunset/38<sup>th</sup> Street can accommodate future traffic at reasonable level-of-service.</p>	<p>Need to add another north-south route west of junction to provide collector access to development property</p> <p>Which route (Collins Ave or Sunset Dr) is designated as ND 1806?</p> <p>If cannot change ND 1806 designation, state route becomes the minor route.</p> <p>Creating a more direct connection between the regional route of ND 1806 to the north and Sunset Dr (including the interchange with I-94) has the potential to increase vehicle traffic (including more through trucks) through an already congested area along Sunset Drive (Old Red Trail, I-94 terminal intersections, Boundary Road). Shortens the useful life of the short-term improvements (signalization and adding turn lanes).</p> <p>If more trucks in Sunset Dr corridor, negative associated with Mandan Middle School pedestrian/bike traffic.</p> <p>Negative impact to residential development proposal north of Beretta Street (if Collins Ave is routed through).</p> <p>Greater ROW impacts than other options</p>

Alternate Junction	Positives	Negatives
<p>Create 5-Legged Junction between ND 1806-Sunset Drive-38<sup>th</sup> Street</p>	<p>Lower ROW (If Signalized Intersection) Retains ND 1806 as through route</p>	<p>If signal controlled at junction - Traffic operations are poor - Likely fail (5-legged is very inefficient) with 2040 traffic- Roundabout could accommodate traffic.  Roundabout interior diameter - 130-150 feet to accommodate larger trucks. If propose 2-lane roundabout - diameter would be up to 200 feet. Larger footprint than signalized intersection. Beltway speeds will require added roundabout approach treatments to slow vehicles - Requires more ROW and added access control  5-legged signalized intersections - Typically result in higher crash rates.</p>

- Need to better accommodate truck/auto traffic mixing along Old Red Trail** adjacent to the Tesoro Refinery access, including a possible alternate route for auto traffic (Figure 3 identifiers HH and KK). As areas of Mandan north of I-94 have developed with commercial and residential uses, Mandan Avenue, that at one time was more of the industrial/truck access to industrial and utility uses to the north, has become a mixing zone of commuter auto, trucks to/from Tesoro Refinery and Heskett Station. The volume level and vehicle mix approaches levels where the present two lanes (and a narrow two lanes) are no longer acceptable. Alternatives that address not only the total volume demand, but the truck, auto and non-motorized traveler mix need to be investigated.
- I-94/Mandan Avenue Geometric Deficiencies.** The traffic growth issues that are arising along Mandan Avenue are compounded by the substandard design of the interchange ramps as they approach Mandan Avenue. Both the westbound and eastbound off-ramps approach Mandan Avenue at an angle of less than 30 degrees, see Figure 17, which is the minimum preferred. While the current design has not been connected to a crash issue, it does reduce the efficiency of the interchange, which will become an issue as volume increases.

Input received through the preference voting aided in focusing efforts in the alternatives analysis step relative to each of the issues identified in the meetings and supplemented the technical data analyses conducted for the study area.

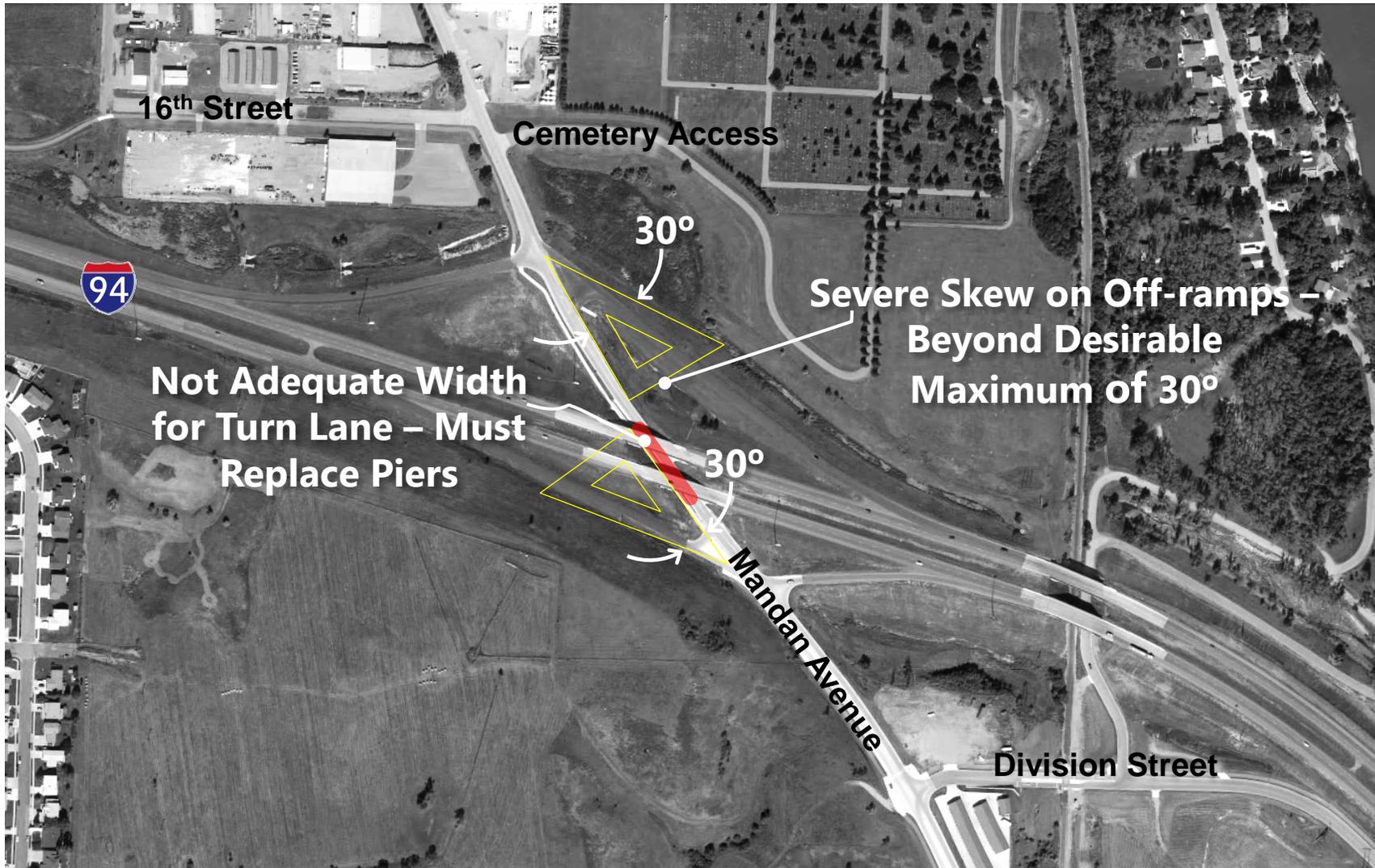


Figure 17  
I-94/Mandan Avenue Interchange Area Issues

# Alternatives to Address Current and Future Issues/Needs

---

## Introduction

The purpose of this section of the study report is to present the range of alternatives that were developed to address identified subarea deficiencies. Alternatives for the study area were developed based on the input received through meetings/workshops with the public and stakeholders, from meetings with MPO, Mandan staff, Morton County staff, NDDOT staff, and FHWA staff and through the traffic operations and safety analyses. Concepts that were developed as part of this study include the following range of concepts:

- **Transportation System Management (TSM) Alternatives:** Concepts in the category are relatively small-scale, lower-cost improvements that do not attract/divert traffic to a corridor, but improve intersection capacity and/or safety. These alternatives include intersection improvements such as additional turn lanes, intersection control improvements, and corridor access management.
- **Transportation System Expansion:** These concepts are larger-scale improvements that increase capacity and/or address safety concerns in the study area by adding through lanes to an existing roadway corridor, adding a new interchange or crossing of the interstate or adding an entirely new corridor. Contrary to the TSM projects, expansion concepts are intended to create traffic diversion from other areas to the “expansion” corridor.
- **Non-Motorized Facilities:** These alternatives include new or improved pedestrian and bicycle facilities within and crossing the study area. For the North Mandan Subarea study, non-motorized facility concepts were limited to:
  - Establishing sidewalks adjacent to one or both sides of an arterial or collector corridor as a standalone project or as part of a roadway expansion/construction alternative.
  - Incorporating a multi-use trail adjacent to an arterial corridor.

The primary differentiator between a sidewalk and a multi-use trail is the width of the corridor. A sidewalk may be as narrow as five feet (six feet preferred), while the preferred width of a multi-use trail is 10 feet.

## Screening Process

The alternative analysis phase of this study was completed using a combined qualitative measure and quantitative measure screening of the broad range of alternatives across the three types of projects. For each of the issue areas addressed based on input from the public and/or Stakeholder Committee or through the technical analyses, a wide range of

alternatives were evaluated with the end product of placing an alternative into one of three categories:

1. Maintain the alternative for the additional review in this study or into more detailed corridor specific assessment (including environmental review).
2. Eliminate the alternative from further consideration due to an identified fatal flaw that could not be avoided without substantially reducing the concept's utility.
3. Modify the concept initially presented prior to deciding to maintain the alternative as a technically feasible alternative.

## **Evaluation Criteria**

The initial screening of the alternatives applied a set of evaluation criteria that would allow review of the concepts from the following perspectives:

- Social impacts and benefits, which are characterized through the following:
  - Economics – Access provided to current and/or future development areas.
  - Public support/opposition heard through the outreach program.
  - Consistency with other plans (MPO Long Range Transportation Plan, Comprehensive Plan, Park District Strategic Plan, etc.).
- Engineering feasibility – The focus was on the impacts terrain would have on constructability.
- Environmental impacts – Reflective to the potential to create significant negative impacts on the surrounding physical and/or social environment. Included in the category would be impacts to residential or business properties, impacts to parkland, river impacts, etc.

## **Alternatives Evaluated**

The alternatives identified for this study were developed to address a specific capacity or continuity deficiency and/or an issue raised during the public meeting. The concepts were not necessarily developed with the intention that they would act as a standalone solution to the deficiencies and issues in the study area.

Some of the alternatives evaluated for this study had been previously analyzed in other studies. Specifically, the information used in evaluating selected alternatives came from three different sources:

- The 2009 Bismarck-Mandan Long Range Transportation Plan.

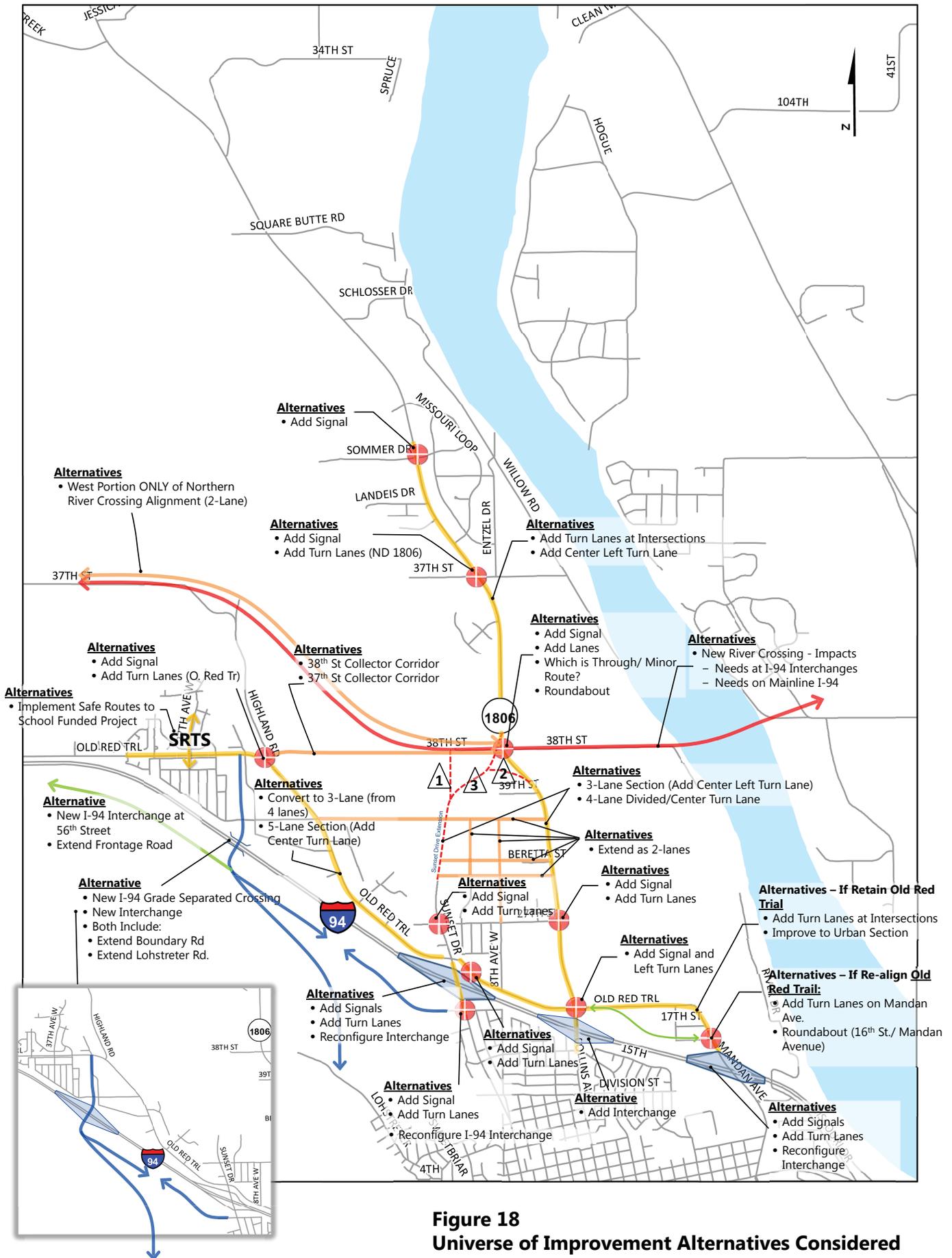
- Mandan-Morton County Fringe Area Road Master Plan.
- Bismarck-Mandan Regional North South Beltway Corridor Study.

The universe of alternatives evaluated is documented in Figure 18.

## Screening Assessment

The alternatives were screened in a workshop with the study Technical Committee using a combination of a matrix and concept drawings to document the transportation impacts/benefits, adjacent land use impacts and costs of each alternative considered. The matrix, included as Table 7, has been set up using the following format:

- Column 1: Description of the issue/need that the listed alternatives are intended to address. The descriptions reference specific intersection and/or corridor areas identified in Figure 1, which is a composite of the issues identified through the public engagement and current/future conditions analyses.
- Column 2: Issue reference letter for the map included in Figure 3.
- Column 3: Description of the concept. In most of the issue areas a progression of alternatives from the simple (such as converting from two-way stop control to four-way stop control), to the more complex (adding new interchanges to distribute the travel demand) have been identified and documented. To aid in organizing the process, the progression of alternative in a corridor or at a specific intersection has been grouped by the primary issue to be addressed.
- Column 4-6: Contains a description of the positive and negative aspects of each alternative relative to the following perspectives:
  - Social Benefits and Impacts: These are primarily the potential for impacts to the adjacent built environment and/or supporting areas where development is anticipated in the future.
  - Environmental Impacts: Summary of the key/critical impacts that could result in eliminating the alternative. A general rule followed was that if the identified improvement could be constructed inside the current right-of-way (ROW) the environmental impacts would be minor.
  - Engineering: Summary of the traffic volume and operations impacts of the specific concept and input on engineering design challenges associated with a particular alternative.
- Column 7: Category of cost from Low (L), to Moderate (M) to High (H). The following general guidelines have been used to define each category:
  - Low (L): Less than \$500,000 in construction costs.
  - Moderate (M): \$500,000 to \$1 million in construction costs.
  - High (H): Greater than \$1 million in construction costs.



**Figure 18**  
**Universe of Improvement Alternatives Considered**

- Column 8: The Technical Committees findings as to whether the idea/concept should be retained for additional screening/review or eliminated from further consideration. The determination was based primarily on whether the idea addressed the issues identified, the potential for immitigable impacts, or a cost that would likely far exceed the benefit provided.

For many of the alternatives, a conceptual drawing of the corridor/improvement concept has been developed. For those ideas/concepts with drawings, a note as to the figure number is included in the description column and the figures are provided in the appendix of this report.

The alternatives retained at the conclusion of the screening assessment are displayed in Figure 19.

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Sunset Drive Extension to North (Note: Junction Alternatives for Connections to 38 <sup>th</sup> Street and/or ND 1806 Address Separately)	Q	Three-Lane Section	<ul style="list-style-type: none"> <li>Less pedestrian crossing distance - compared to 4/5-lane options (Assuming narrow route – not likely).</li> </ul>	<ul style="list-style-type: none"> <li>Less impervious surface than 4/5-lane options</li> <li>No existing ROW - Convert open space. 80± foot ROW minimum for 3-lane.</li> </ul>	<ul style="list-style-type: none"> <li>Provides adequate capacity - Max segment forecast is for 11,900 VPD</li> <li>Add second southbound through lane at Old Red Trail.</li> </ul>	M	<b>Retain for Continued Review</b> Provides the capacity needed to accommodate traffic demand and provides access corridor for development.
		Four-Lane Divided/5-Lane Section	<ul style="list-style-type: none"> <li>Long pedestrian crossing distance – School proximity will yield pedestrians.</li> </ul>	<ul style="list-style-type: none"> <li>More impervious surface than current (approx. 8 feet).</li> <li>No existing ROW - Convert open space. 120+ foot ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Provides capacity to accommodate Oil Boom growth and retain reserve capacity - Max Volume - 25,000 (Forecast - 11,900)</li> </ul>	H	<b>Retain for Continued Review</b> Provides the capacity needed to accommodate traffic demand and provides access corridor for development.
Sunset Drive Congestion - Old Red Trail to Boundary Road	R/S/T	Add Stop Control to Sunset Drive (4-Way Stop Control)			<ul style="list-style-type: none"> <li>Unacceptable Congestion – Fatal Flaw</li> </ul>		<b>Eliminate</b> Does not provide adequate capacity.
		Add Signals ONLY to I-94 Ramp Terminals and Boundary Road			<ul style="list-style-type: none"> <li>North-Southbound queues on Sunset Drive spill back to Old Red Trail and Boundary Road – Fatal Flaw.</li> </ul>		<b>Eliminate</b> Does not provide adequate capacity.
		<ul style="list-style-type: none"> <li>Add Signals at I-94 Ramp Terminals, Boundary Drive and Restripe to Provide Left-turn lane on Sunset to I-94.</li> <li>(NDDOT alternative included northbound right turn lane at south terminal and separate left and right turn lanes on the ramps - These improvements provide minor benefits and increase cost).</li> </ul>	<ul style="list-style-type: none"> <li>Pedestrian crossing would be made easier as PED phase in signal operations.</li> </ul>		<ul style="list-style-type: none"> <li>Management changes will provide acceptable traffic operations can for a period (± 5 years), after which queues on Sunset Drive overlap.</li> </ul>	M	<b>Retain as SHORT TERM Improvement</b> <ul style="list-style-type: none"> <li>Adding signals at I-94 terminal intersections will improve operations for a while, after which (with growing traffic) intersection queues will overlap - unacceptable (Spillback condition).</li> <li>Discuss with NDDOT the benefits/costs associated with adding northbound right turn lane and separating lanes on ramps. Limited benefit.</li> </ul>
		Reconfigure Old Red Trail Intersection: <ul style="list-style-type: none"> <li>Add East/Westbound Left Turn Bay at Old Red Trail</li> <li>Add North/Southbound Through Lane</li> <li>Add Westbound Through Lane to Old Red Trail</li> </ul>	<ul style="list-style-type: none"> <li>Adding lanes - More crossing distance for pedestrians - Negative</li> </ul>	<ul style="list-style-type: none"> <li>Sunset Drive - Limited new ROW - Minor impacts.</li> <li>Old Red Trail - Assuming added lanes are transitioned by 1000 west of Sunset Drive - Limited impacts of added ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Cannot eliminate overlapping queues on Sunset Drive (spillback) through coordination and adding lanes - Fatal Flaw.</li> <li>Adding lanes to Sunset Drive under Interstate - Results in needing to replace bridges (Piers are just back of curb).</li> </ul>		<b>Eliminate</b> <ul style="list-style-type: none"> <li>Implementing changes results in little change to queuing concerns between Old Red Trail and the I-94 terminal intersections.</li> <li>Through capacity at Old Red Trail is not the issue, it is the limited distance between Old Red Trail and I-94.</li> </ul>
		Reconfigure I-94 Interchange to Add Southbound to Eastbound Loop Ramp (Retain Current Ramp for Northbound to Eastbound Movement).	<ul style="list-style-type: none"> <li>Preferred radius loop (230 feet) footprint extends outside the current ROW line in the southwest quadrant - Impacts adjacent uses.</li> <li>Can reduce loop radius to 150 feet and not require more ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Land use impacts - Moderate with 230 ft radius (No Buildings). Can stay within current ROW with 150 ft radius</li> </ul>	<ul style="list-style-type: none"> <li>Eliminates need to signalize the South Terminal intersection - Southbound queue at Boundary Road spills back to South Terminal Intersection</li> <li>Overlapping queues between North Terminal intersection and Old Red Trail remain</li> <li>Loop speed is 25 MPH - Accelerating uphill - Extends ramp length.</li> </ul>	M-H	<b>Retain</b> As NDDOT has retained it as an alternative in their assessment.  Not a long term solution.

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Sunset Drive Congestion - Old Red Trail to Boundary Road	R/S/T	Reconstruct I-94 Interchange to Single Point Urban Interchange Configuration (Appendix Figure A-1 and A-2)	Substantially smaller footprint. Can be accommodated in current ROW.	Change in impacts from current - Marginal	Acceptable Sunset Drive operations (including queuing) are achieved at Old Red Trail, I-94 terminals and Boundary Road.	H	<b>Retain for Continued Review</b> Likely a Longer Term Improvement as cost is high and lower cost intermediate improvements will work for a while.
	II	Add New I-94 Interchange at Collins Avenue (Appendix Figure A-3)	<ul style="list-style-type: none"> <li>Diamond Interchange concept impacts buildings in NW (Commercial/ Industrial), SW (MF residential) and SE(Eagles Park) quadrants</li> <li>Collins Ave to south of Division St is residential - More traffic is negative.</li> <li>Increases accessibility to commercial areas north of Division St.</li> </ul>	<ul style="list-style-type: none"> <li>Impacts to Eagles Park, Section (4f) property, is a negative of concept.</li> <li>Adding traffic to residential area is a negative of concept.</li> </ul>	<ul style="list-style-type: none"> <li>Little impact to traffic volume/ intersection congestion on Sunset Dr - Traffic reduction is goal.</li> <li>Diamond results in closely spaced intersections from Old Red Trail through 14<sup>th</sup> St NW (Similar to Sunset Dr).</li> <li>Desirable left turn lanes under Interstate require replacing I-94 bridges (piers close to curb).</li> <li>Takes advantage of an existing "continuous" corridor through town and provides access to Interstate.</li> <li>I-94 bridges would be replaced - Pier placement outside current pavement interfere with adding turn lane.</li> </ul>	H	<b>Eliminate</b> <ul style="list-style-type: none"> <li>Does not address Sunset Dr congestion, does not meet spacing requirements, and creates closely spaced N-S intersections.</li> <li>Cost is high relative to "benefits". Following implementing alternative would still need to modify Sunset Dr interchange.</li> </ul>
	L	Provide 32 <sup>nd</sup> Avenue NW Grade Separated Crossing of I-94 (Appendix Figure A-4)	<ul style="list-style-type: none"> <li>Industrial use at 3601 30<sup>th</sup> Ave SW likely impacted (need to be acquired).</li> <li>Morton County RR Museum parcel - Significantly impacted. Not likely a Section 4(f) issue, but could be contentious community impact.</li> </ul>	<ul style="list-style-type: none"> <li>Significant drainage and wetland impacts will need to be mitigated on north and south sides of I-94.</li> <li>Wetlands impacts - Significant</li> <li>Residential impacts moderate (proximity).</li> <li>New arterial roadway corridor will add new nighttime light source adjacent to residential properties (Negative).</li> <li>Traffic on new arterial roadway will generate new noise source - If federal funds are used need to address potential noise impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Most logical (for traffic operations) Old Red Trail connection is at 30<sup>th</sup> Ave NW. 34<sup>th</sup> Ave NW. If desire to extend connection to north- Negative impact on existing residential. If connect with Old Red Trail half way between 30<sup>th</sup> Ave and 34<sup>th</sup> Ave - Additional drainage accommodation (adds to cost).</li> <li>With connection need to signalize Old Red Trail intersection at 30<sup>th</sup> Ave NW. Can provide acceptable operations.</li> <li>Add east/westbound left turn to Old Red Trail.</li> <li>Reduces traffic on Sunset Dr at I-94 by approximately 1,000 - 1,500 vpd.</li> <li>Reduces traffic on Old Red Trail east of Highland Dr by 2,000 vpd. Not enough substantially reduce/change outcome of Old Red Trail alternatives review. Helps the three-lane Old Red Trail concept some, but not dramatically.</li> <li>Does not eliminate congestion/ spillback issues on Sunset Dr from Old Red Trail to Boundary Rd. (Assuming Sunset Dr corridor signalization Boundary through north I-94 terminal.</li> </ul>	H	<b>Retain for Continued Review</b> Provides the most relief/ congestion reduction to Sunset Dr of the alternate route improvement alternatives.  Initial preference is for an OVERPASS

Continued On Next Page

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
					Underpass Vs. Overpass: <ul style="list-style-type: none"> <li>• East of drainage pond, terrain supports overpass. I-94 is lower than north-south side ground.</li> <li>• Overpass allows intersection at 37<sup>th</sup> St NW (underpass does not).</li> <li>• Underpass - Significant drainage costs.</li> <li>• Overpass - More existing development impacts.</li> </ul>		
	M	Add New I-94 Interchange at 32 <sup>nd</sup> Ave NW (Appendix Figure A-5)	<ul style="list-style-type: none"> <li>• Distance to Scenic Overlook is approximately 5,000 feet from bridge location - Slightly less than desirable spacing - Consider alternate access to overlook from frontage road included in concept. An alternate would be to include an eastbound auxiliary lane from a 30<sup>th</sup> Ave NW interchange to the Scenic Overlook exit ramp.</li> <li>• Industrial use at 3601 30<sup>th</sup> Ave SW likely impacted (may need to be acquired).</li> <li>• If locate terminal intersection &gt;450 feet west of 30<sup>th</sup> Ave NW, likely create 37<sup>th</sup> St NW/33<sup>rd</sup> Ave NW residential impacts.</li> <li>• Morton County RR Museum parcel - Could be significantly impacted. Not likely a Section 4(f) issue, but could be contentious community impact.</li> </ul>	<ul style="list-style-type: none"> <li>• Drainage and wetland impacts will need to be mitigated on north and south sides of I-94.</li> <li>• New arterial roadway corridor will add new nighttime light source adjacent to residential properties.</li> <li>• Traffic on new arterial roadway will generate new noise source - It is unlikely that homes would be located within Federal Noise Abatement impact area.</li> </ul>	<ul style="list-style-type: none"> <li>• Provides the greatest level of traffic reduction in Sunset Dr corridor.</li> <li>• For traffic operations, the most logical Old Red Trail connection of new N-S is at 30<sup>th</sup> Ave NW. If desire to extend connection to north at 30<sup>th</sup> Avenue NW- Negative impact on existing residential. North of Old Red Trail least impacts of extension are at halfway between 30<sup>th</sup> Ave and 34<sup>th</sup> Avenue NW. Creates closely spaced intersections (approx. 400 feet), very undesirable. If connect with Old Red Trail half way between 30<sup>th</sup> Ave and 34<sup>th</sup> Ave - Additional drainage accommodation (adds to cost).</li> <li>• Old Red Trail intersection assumed to meet signal warrants. Provide east/westbound left turn lanes on Old Red Trail.</li> <li>• Reduces traffic on Sunset Dr north of I-94 by approximately 6,000 vpd. Sunset Dr south of I-94 very little change (drivers get on I-94 at 30<sup>th</sup> Ave and off at Sunset - Not desirable from DOT/ FHWA perspective)</li> <li>• Does not eliminate congestion/spillback issues on Sunset Dr from Old Red Trail to Boundary Rd. (Assuming Sunset Dr corridor signalization Boundary through north I-94 terminal.</li> </ul> <p>Two I-94 crossing/access options:</p> <ul style="list-style-type: none"> <li>• Arterial over I-94 closer to 30<sup>th</sup> Ave NW. Lower cost, but more land use impacts.</li> <li>• Arterial under I-94 along "dam" alignment. Higher construction/maintenance cost, fewer land use impacts.</li> </ul>	H	<p><b>Retain For Continued Review</b> Provides the most relief/congestion reduction to Sunset Rive of the alternate route improvement alternatives.</p>

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
	J	Add New I-94 Interchange at 56 <sup>th</sup> Street	<ul style="list-style-type: none"> <li>Ramps and Frontage Road would impact Landeis property buildings.</li> <li>Improves accessibility to areas with development potential. There are equally acceptable areas closer to Mandan that are served by existing interchanges.</li> </ul>	<ul style="list-style-type: none"> <li>Lagoons owned by City of Mandan would need to be relocated. Does relocation result in reconnection to residences in Rough Rider Estates? Who pays for reconnection/relocation of lagoon?</li> </ul>	<ul style="list-style-type: none"> <li>Provides few traffic volume reduction benefits in the study area. 56<sup>th</sup> Street is located ½ mile west of residential and &gt;1 miles west of commercial development areas. Not much traffic will divert that far.</li> <li>Transmission lines on west side of 56<sup>th</sup> Street - Relocate several poles?</li> <li>West side ramps would impact I-94 culvert connecting Strinden property to Old Red Trail on north side of I-94. Need to accommodate in alternate connection.</li> </ul>	H	<p><b>Relative to the North Mandan Study - Discontinue Reviewing the Alternative. The 56<sup>th</sup> Street interchange and corridor improvements are the preferred corridor for the North-South Beltway concept.</b></p> <p><b>Thus, the interchange concept should be retained as part of the I-94 corridor needs that are being evaluated separately.</b></p>
Sunset Drive Congestion - Old Red Trail to Boundary Road	O	Develop 38 <sup>th</sup> Street from ND 1806 to Old Red Trail (Appendix Figure A-6)	<ul style="list-style-type: none"> <li>Approximately 2 residential units would need to be acquired for roadway.</li> </ul>	<ul style="list-style-type: none"> <li>Moderate - Residential impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Steep grade for 1,000 to 1,200 feet east of Old Red Drive junction at Highland Rd.</li> <li>Highland Drive realigned to 38<sup>th</sup> St - New corridor as arterial provides primary connection to Old Red Trail.</li> <li>Reduces Old Red Trail daily traffic by 1000 vehicle per day. Not enough to reduce Old Red Trail needs.</li> </ul>	M-H	<p><b>Eliminate</b></p> <ul style="list-style-type: none"> <li>Connection at Highland/Old Red Trail is problematic based on residential impacts .</li> <li>Grade east of Old Red Trail and Highland would require substantial fill/ earthwork.</li> <li>Benefit of Old Red Trail and Sunset Dr traffic reduction is minor.</li> <li>An alternate is extending 37<sup>th</sup> St NW east of Old Red Trail to Sunset Dr extension.</li> <li>Could retain 38<sup>th</sup> Street as a collector, but not with a connection to Highland/Old Red Trail.</li> </ul>
		Develop 37 <sup>th</sup> Street from ND 1806 to Old Red Trail (Appendix Figure A-6)	<ul style="list-style-type: none"> <li>Approximately 1 residential unit would need to be acquired for roadway.</li> </ul>	<ul style="list-style-type: none"> <li>Minor</li> </ul>	<ul style="list-style-type: none"> <li>Grade east of Old Red Drive Old Red Trail similar to 38<sup>th</sup> St alignment.</li> <li>Can establish Old Red Trail connection as east approach to 37<sup>th</sup> St NW. (Adequate ROW available)</li> <li>Fewer residential impacts.</li> <li>Reduces Old Red Trail daily traffic by 1000 vehicle per day. Not enough to reduce Old Red Trail needs.</li> </ul>	M-H	<p><b>Retain for Continued Review</b></p> <ul style="list-style-type: none"> <li>The impacts are relatively minor.</li> <li>Grade east of Old Red Trail - Will required substantial fill/ earthwork.</li> <li>Minor benefit to Sunset Dr would connect timing to when development occurs (not put in before to aid Sunset Dr).</li> </ul>

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Sunset Drive Congestion - Old Red Trail to Boundary Road	AA	Construct Northern Bridge Crossing - Including Arterial Corridor to ND 25	<p>14 residential units on north side of 38<sup>th</sup> St:</p> <ul style="list-style-type: none"> <li>High volume road added.</li> <li>Median preferred for safety - results in right-in-right-out only from residential properties.</li> </ul> <p>Increases access to developable land</p>	<ul style="list-style-type: none"> <li>Potential for negative impacts to Missouri River.</li> <li>Potential for wetland impacts. Mitigation (extending structure) will increase cost.</li> </ul>	<ul style="list-style-type: none"> <li>To significantly reduce Sunset Dr at I-94 volume - Corridor needs to reflect higher speed (40+ MPH) and limited access (1/2 mile spacing) route.</li> <li>At 30 MPH - Reduces Sunset Drive corridor traffic at I-94 by 1,300 vehicles per day.</li> <li>At 40 MPH - Reduces Sunset Dr corridor traffic at I-94 by 1,800 vehicles per day.</li> <li>I-94 traffic falls by approximately 3,900, but drivers still use Sunset Dr through interchange area to get from Mandan origin/destination to Bismarck via Northern Bridge Crossing.</li> <li>Bridge across Missouri River - significant engineering considerations to reduce river impact.</li> <li>Volumes reflect demand for two lane route, but is a two lane route worth the investment?</li> </ul>	H	<p><b>Retain for Continued Review</b> As continue to develop the recommended improvement plan, costs and ability to fund projects will take a larger role. Consider separating into 3 projects:</p> <ul style="list-style-type: none"> <li>Arterial corridor from ND 1806 (Collins Ave) to Highland Rd.</li> <li>Highland Rd to west (Longer term).</li> <li>ND 1806 (Collins Avenue) to Burleigh County (including bridge)</li> </ul>
I-94/Mandan Avenue Interchange Congestion	KK	Add Stop Signs to North and South Approaches to northbound and southbound Mandan Ave at north and south terminals.			<ul style="list-style-type: none"> <li>AM and PM peak hour operations - Still fail. Fatal Flaw of alternative.</li> </ul>		<p><b>Eliminate</b> Does not provide minimum operations at key intersections.</p>
		Signalize the north and south ramp intersections and operate under semi-actuated control. Off-ramps would not receive greentime unless there is demand.	<ul style="list-style-type: none"> <li>Minimal or no impacts - Adding signals can be accommodated in current right-of-way.</li> </ul>	Minimal/None	<ul style="list-style-type: none"> <li>LOS C or better traffic operations can be provide in the AM and PM peak periods.</li> </ul>		<p><b>Retain for Continued Review</b> Addresses capacity needs with little impact.</p>
		Re-design ramps to reduce skew. (Appendix Figure A-7)	<ul style="list-style-type: none"> <li>Minimal or no impacts - Revised alignment is all within the current right-of-way.</li> </ul>	Minimal/None	<ul style="list-style-type: none"> <li>Substantial improvement sight distance, skews reduced, offset left turns to/from ramps is eliminated.</li> <li>Would not result in need to replace bridges.</li> </ul>	M	<p><b>Retain for Continued Review</b></p> <ul style="list-style-type: none"> <li>Removes/reduces the current skewed intersection condition (Severe skew reduces sight distance - Creating a safety concern).</li> </ul>
Realign Old Red Trail to Connect with 16 <sup>th</sup> Street NE at Mandan Avenue - Development Enhancement	HH/JJ /KK	Based on Traffic - A 3-lane Old Red Trail would accommodate the 8,000 to 10,000 VPD forecasted. Forecasts assume that current Old Red Trail alignment is retained for Tesoro Refinery access and other industrial use access between 16 <sup>th</sup> St NE and Old Red Trail. (Appendix Figure A-8)	<ul style="list-style-type: none"> <li>Increases access internal to a potential development parcel.</li> <li>Relocation of south side sidewalk along current 16<sup>th</sup> Street need to occur to provide separate eastbound right turn lane at Mandan Avenue.</li> <li>Outside the current 16<sup>th</sup> St</li> </ul>	<ul style="list-style-type: none"> <li>Minimal - There is potential for wetlands adjacent to identified alignment, however, likely local/ collector that does not involve federal funds.</li> </ul>	<ul style="list-style-type: none"> <li>Much of the northbound through volume in current configuration, re-oriented as northbound left. 2040 AM with realignment - 500 northbound lefts, opposed by 160 southbound throughs. 2040 PM with realignment - 450 northbound lefts, opposed by 170 southbound throughs.</li> </ul>	H	<p><b>Retain for Continued Review</b></p> <ul style="list-style-type: none"> <li>Corridor concepts identified to date by developer reflect access of a collector/local route.</li> <li>Local route - Privately funded.</li> <li>Collector route. Unlikely to include federal participation.</li> </ul>

Continued On Next Page

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Realign Old Red Trail to Connect with 16 <sup>th</sup> Street NE at Mandan Avenue - Development Enhancement	HH/JJ /KK		<ul style="list-style-type: none"> <li>segment, the alignment of new roadway was assumed to avoid the current bike/ped trail</li> <li>Relocate cemetery access north to 16<sup>th</sup> Street or convert east approach to right-in-right-out only.</li> </ul>		<ul style="list-style-type: none"> <li>Volumes (large left turn) PERIODICALLY results in queue overlaps between I-94/Mandan Ave terminal and relocated Old Red Trail/Mandan Ave</li> <li>If cannot coordinate 16<sup>th</sup> Street and I-94 ramp terminals, queues will more often overlap (spillback) and operations will suffer.</li> </ul>		<ul style="list-style-type: none"> <li>From traffic operations perspective, prefer to eliminate based on spillback concerns. Local support suggests retaining through initial screening.</li> <li>NDDOT has presented the city with a letter containing a list of questions and conditions. Must address prior to plan approvals along the alignment.</li> </ul>
		<ul style="list-style-type: none"> <li>Realign Old Red Trail from current to an alignment that connects with Mandan Avenue at 17<sup>th</sup> St NE. (Appendix Figure A-8)</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Conclusion assumes redevelopment of the current industrial parcels is a positive.</li> <li>80 feet of ROW exists along developed portion. Adequate for three lane, plus detached sidewalk on one side.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal - There is potential for wetlands adjacent to identified alignment, however, likely local/ collector that does not involve federal funds.</li> </ul>	<ul style="list-style-type: none"> <li>Much of the northbound through volume in current configuration, re-oriented as northbound left. 2040 AM with realignment - 500 northbound lefts, opposed by 160 southbound throughs. 2040 PM with realignment - 450 northbound lefts, opposed by 170 southbound throughs.</li> </ul> <p>Signals are warranted at:</p> <ul style="list-style-type: none"> <li>I-94 Ramp Terminals</li> <li>16<sup>th</sup> Street (Assuming relocation of Old Red Trail)</li> </ul> <ul style="list-style-type: none"> <li>Can provide acceptable operations with single left turn bays. Southbound queue at I-94 north terminal will overlap with northbound queue at 16<sup>th</sup> Street. If peak hour volume is 200 VPH higher than estimate, southbound queue at I-94 north terminal extends beyond 16<sup>th</sup> Street.</li> <li>Approximately 850 feet of separation from I-94/Mandan Ave north terminal intersection. No queue spillback/overlap.</li> <li>Desired access is greater than NDDOT allowed for state route.</li> </ul>	M-H	<p><b>Retain for Continued Review</b></p> <p>Need to gain additional input from NDDOT regarding:</p> <ul style="list-style-type: none"> <li>Access points along corridor.</li> <li>Traffic operations along Mandan Avenue.</li> </ul>
		<ul style="list-style-type: none"> <li>Roundabout at 16<sup>th</sup> Street/Mandan Avenue to provide continuous flow and eliminate spillback.</li> </ul>	<ul style="list-style-type: none"> <li>Added ROW to accommodate 150 feet radius roundabout results in land use impacts in NE, NW and SW quadrants. Including natural gas tank in NE quad.</li> </ul>	<ul style="list-style-type: none"> <li>ROW impacts are most significant of the potential issues. If adjacent landowners are in favor, minimal impact. If oppose, substantial potential for impact.</li> </ul>	<ul style="list-style-type: none"> <li>High truck volume in the corridor creates a likely fatal flaw in the concept.</li> <li>Operations are acceptable with 2040 traffic.</li> </ul>	M-H	<p><b>Eliminate</b></p> <ul style="list-style-type: none"> <li>Truck volume too high - Long term maintenance issues.</li> </ul>
Congestion in Old Red Trail Corridor - West Study Limits to 37 <sup>th</sup> Street NW	Not in Figure	<ul style="list-style-type: none"> <li>Add Center Left Turn Lane to establish 3-Lane Section (Appendix Figure A-9)</li> </ul>	<ul style="list-style-type: none"> <li>90 feet of ROW exists from west limits to Highland Rd. Highland Road to 37<sup>th</sup> St NW - 150 feet - Can accommodate 3-lane section without additional acquisition.</li> <li>Center left turn lane - Supports retaining all driveways.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal impacts. No acquisitions.</li> </ul>	<ul style="list-style-type: none"> <li>Center left turn lane - Provides adequate capacity.</li> <li>Center left turn lane - Enhances safety while not reducing access points.</li> </ul>	M	<p><b>Retain for Continued Review</b></p> <p>Can accommodate expansion in current ROW/ Allows retaining driveways (limited number exist)/</p>

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Congestion in Old Red Trail Corridor - 37 <sup>th</sup> Street NW to West of Sunset Drive	Not in Figure	<ul style="list-style-type: none"> <li>Add Center Left Turn Lane</li> </ul> <b>(Appendix Figure A-9)</b>	<ul style="list-style-type: none"> <li>Current ROW is 80 feet/ To retain detailed sidewalk on one side, need to acquire another ±20 feet of ROW. Moderate level of impact to adjacent properties. No building impacts, but parking and landscaping impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Minor to Moderate depending on reaction to adjacent property owners regarding additional ROW acquisition.</li> <li>Mainly within current ROW which has been disturbed.</li> <li>Minor additional impervious surface.</li> </ul>	5-lane section provides reserve capacity through 2040. Assumes the following signal installations: <ul style="list-style-type: none"> <li>37<sup>th</sup> Ave NW</li> <li>Highland Rd</li> </ul>	M	<b>Retain for Continued Review</b> Obtaining ROW in segment from 37 <sup>th</sup> Ave NW to west of Sunset Dr will be most problematic of the corridor, but also segment where turn lane is most warranted.
		<ul style="list-style-type: none"> <li>Convert Inside Lanes in Westbound and Eastbound Directions to Two-Way Left Turn Lane</li> </ul> <b>(Appendix Figure A-9)</b>	<ul style="list-style-type: none"> <li>Minimal - No additional ROW is needed to provide turning capacity</li> <li>Concept promotes retaining all property access points</li> </ul>	<ul style="list-style-type: none"> <li>Minimal - All construction in current ROW</li> </ul>	<ul style="list-style-type: none"> <li>14,000 VPD forecasted volume approaches the maximum comfortable in moderate sized metros for 3-lane section</li> <li>About 25% of traffic from west of Sunset Dr to Highland Rd is turning traffic. Two-way left turn lane supports the level of traffic</li> </ul>	L-M	<b>Retain for Continued Review</b> With the potential for impacts of adding left turn lane (to make 5-lane) on adjacent properties, 4-lane to 3-lane conversion is worth discussing.
ND 1806 (Collins Avenue) Corridor - North of 38 <sup>th</sup> Street Capacity	B	Add Stop Signs to ND 1806 at: <ul style="list-style-type: none"> <li>Sommer Drive</li> <li>37<sup>th</sup> Street</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide acceptable operations. Fatal flaw.</li> </ul>	L	<b>Eliminate</b> Does not provide acceptable AM and PM operations in 2040.
		Add signals at: <ul style="list-style-type: none"> <li>Sommer Drive</li> <li>37<sup>th</sup> Street</li> </ul> <b>(Appendix Figure A-10)</b>	<ul style="list-style-type: none"> <li>Minimal impacts as no additional lanes are added.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>ND 1806 will now need to stop when mainline light is red. Will likely result in more rearend crashes on ND 1806 (rate can be reduced with advances warning signs/beacon). Signal will likely reduce the number/rate for side swipe and right angle crashes for vehicles entering ND 1806 from the cross routes or leaving ND 1806 at signalized cross routes.</li> <li>LOS B or better in AM and PM peaks.</li> <li>Spacing is approximately ½ mile - Progression can be established in peak direction.</li> </ul>	M	<b>Retain for Continued Review</b> Provides acceptable operations. Potential for increase in rearend crashes
ND 1806 (Collins Avenue)/ 38 <sup>th</sup> Street Junction Configuration	CC	Option 1 - ND 1806 Retained as Through <b>(Appendix Figure A-11)</b> See Triangle Number in Figure 15 to depict alignment 	<ul style="list-style-type: none"> <li>Substantially improve the north-south and east-west accessibility of properties.</li> </ul>	<ul style="list-style-type: none"> <li>Minor. Convert substantial amount of ROW from agriculture/open space to roadway.</li> </ul>	<ul style="list-style-type: none"> <li>Signalizing ND 1806/North River Crossing provides acceptable LOS as four-lane with left turn lanes.</li> <li>Can reasonably provide ¼ mile intersection spacing to Sunset Extension intersection.</li> </ul>	H	<b>Retain for Continued Review</b> Concept meets most goals and is consistent with design guidelines
ND 1806 (Collins Avenue)/ 38 <sup>th</sup> Street Junction Configuration (Continued)	BB	Option 2 - Connect ND 1806 to Sunset Drive Extension as the Through Route, Collins Avenue as the Minor Route <b>(Appendix Figure A-12)</b> See Triangle Number in Figure 15 to depict alignment 	<ul style="list-style-type: none"> <li>Substantially improve the north-south and east-west accessibility of properties.</li> <li>Collins Avenue Relocated - Very close to residential properties. Does not result in residential parcel acquisition (unless ¼ mile intersection spacing is needed).</li> <li>Promotes adding traffic to Sunset Dr corridor that results in more traffic to/from Sunset south of I-94</li> </ul>	<ul style="list-style-type: none"> <li>Minor. Convert substantial amount of ROW from agriculture/open space to roadway.</li> </ul>	<ul style="list-style-type: none"> <li>Signalizing ND 1806/North River Crossing provides acceptable LOS as four-lane with left turn lanes.</li> <li>Difficult to provide ¼ mile spacing/offset between ND 1806/Sunset Drive and Sunset Dr/Collins Ave intersections. Residential uses would need to be acquired. Not likely acceptable impact for benefit.</li> <li>Spacing will impact ability to provide</li> </ul>		<b>Retain</b> Options 1 and 3 better support the connection desires, however, this alternative is more compatible with adjacent development concepts than Option 1. Retain at least until can see if issues with Option 1 can be resolved.

Continued On Next Page

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
			(residential area).		progression along main route through both signalized intersections.		
	BB	Option 3 - Roundabout Connecting ND 1806/Northern Bridge Crossing (38 <sup>th</sup> Street/Sunset Drive Extension at One Location (Appendix Figure A-13)  See Triangle Number e in Figure 15 to depict alignment	<ul style="list-style-type: none"> <li>Substantially improves the north-south and east-west accessibility of properties.</li> <li>Eliminates one signalized intersection in corridor, relative to Options 1 and 2. Compared to Option 2, eliminates one closely spaced intersection.</li> <li>Requires an orientation period/ leap that it will operate properly.</li> </ul>	<ul style="list-style-type: none"> <li>Minor. Convert substantial amount of ROW from agriculture/open space to roadway.</li> </ul>	<ul style="list-style-type: none"> <li>Continuous flow intersection has more capacity than signalized intersections of Options 1 and 2.</li> <li>Truck traffic on ND 1806 will increase the radius of the center.</li> </ul>	M	<p><b>Retain for Continued Review</b></p> <ul style="list-style-type: none"> <li>While not likely the optimal location/ configuration (5 legs) provides a means of connecting all of the routes that want to come together.</li> <li>If the North River Crossing corridor is a long term concept, the roundabout will provide very good traffic operations.</li> </ul>
ND 1806 (Collin Avenue) South of 38 <sup>th</sup> Street to North of Old Red Trail	CC	Add Center Turn Lane to Create 3-Lane Section (Appendix Figure A-14)	<ul style="list-style-type: none"> <li>Minimal impacts - 120 to 140 feet of ROW exists.</li> </ul>	<ul style="list-style-type: none"> <li>Minor. All expansion could occur within current ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Provides adequate capacity for the forecasted volume of 9,800 VPD in 2040.</li> <li>Adding an extension of Sunset Drive to ND 1806 at 38<sup>th</sup> Street reduces volume in the corridor.</li> </ul>	M	<p><b>Retain for Continued Review</b></p> <ul style="list-style-type: none"> <li>Provides the capacity and access needed.</li> </ul>
		Expand to 5-Lane/4-Lane Divided (Appendix Figure A-14)	<ul style="list-style-type: none"> <li>Minimal impacts - Can be accommodated in current 120-140 feet of ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Minor. All expansion could occur within current ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Likely more reserve capacity than is justified based on forecasted traffic of less than 10,000 VPD. 4-Lane divided/5-Lane not needed until volume approach 16-18,000.</li> </ul>	H	<p><b>Eliminate</b></p> <p>More cost than can be justified for the capacity need.</p>
ND 1806 (Collins Avenue) at 27 <sup>th</sup> Street Capacity	DD	Add Stop Control to ND 1806 (Collins Ave)	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide adequate capacity.</li> <li>Fatal Flaw - Does not provide 2040 capacity need.</li> <li>Creates rearend crash potential on ND 1806 relative to current.</li> </ul>	L	<p><b>Eliminate</b></p> <p>Does not provide adequate capacity.</p>
		Add Stop Control to ND 1806 (Collins Ave) and Right Turn Lane to West Approach	<ul style="list-style-type: none"> <li>Need to adjust the location of the south side multi-use trail to allow for right turn lane.</li> <li>Heck property extends to the center of the road. Need to acquire ROW to allow expansion to south.</li> <li>Need to close eastern driveway to Miller residential property (too close to intersection)</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Heck Property dedication/ acquisition</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide adequate capacity.</li> <li>Fatal Flaw - Does not provide 2040 capacity need.</li> <li>Creates rearend crash potential on ND 1806 relative to current.</li> </ul>	L	<p><b>Eliminate</b></p> <p>Does not provide adequate capacity.</p>
		Add Left Turn Bays to North-South Approaches on ND 1806 (Collins Avenue)	<ul style="list-style-type: none"> <li>Minimal. Adequate ROW exists.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<p>Continued On Next Page</p> <ul style="list-style-type: none"> <li>Limited improvement to operations.</li> <li>Adding left turn lane generally reduces crash rate, but not observed as crash issue today.</li> </ul>	L	<p><b>Retain for Continued Review</b></p> <p>Provides a short term improvement.</p>
	DD	Add Signal/Right Turn Lane to West Approach	<ul style="list-style-type: none"> <li>Need to adjust the location of the south side multi-use trail to allow for right turn lane.</li> <li>Heck property extends to the center of the road. Need to acquire</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Heck Property dedication/ acquisition</li> </ul>	<ul style="list-style-type: none"> <li>Provides more than the amount of capacity needed. Most movements from west are right turns, which can occur on Red.</li> <li>Large percent right turns are</li> </ul>	M	<p><b>Retain for Continued Review</b></p> <p>Provides the capacity needed with few negative impact. Might be best reserved for longer term implementation.</p>

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
			<ul style="list-style-type: none"> <li>ROW to allow expansion to south.</li> <li>Need to close eastern driveway to Miller residential property (too close to intersection)</li> </ul>		<ul style="list-style-type: none"> <li>problematic in alternatives review as most improvement analysis discounts delay.</li> </ul>		
		Reconfigure Intersection to be Roundabout	<ul style="list-style-type: none"> <li>Slight negative relative to pedestrian and bicyclists</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Additional property acquisition.</li> </ul>	<ul style="list-style-type: none"> <li>Through volume to turn volume ratio does not support roundabout as control measure. Too few turns at 27<sup>th</sup> Street relative to through volume on ND 1806.</li> </ul>	M	<p><b>Eliminate</b> Not the appropriate intersection control device for the location.</p>
Old Red Trail/Collins Avenue Congestion	GG	Add Signal	<ul style="list-style-type: none"> <li>Minimal impact/benefit</li> </ul>	<ul style="list-style-type: none"> <li>Minimal impact/benefit</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide acceptable traffic operations in AM and PM peaks in 2040.</li> </ul>	M	<p><b>Eliminate</b> Does not provide adequate capacity.</p>
		Add Signal and Add Left Turn Lanes to All Approaches	<ul style="list-style-type: none"> <li>Minimal - Approximately 140 feet of ROW. Can accommodate section.</li> <li>Through refinery area - Only 66 feet of ROW. Would need to acquire ROW from refinery (Minimum is 80 feet - Desirable is 100 feet) - First choice is provide all new ROW on north (refinery).</li> </ul>	<ul style="list-style-type: none"> <li>Minor.</li> </ul>	<ul style="list-style-type: none"> <li>Provides adequate capacity through 2040.</li> </ul>	M	<p><b>Retain for Continued Review</b> Provides the capacity needed.</p>
		Reconfigure Intersection to be Roundabout	<ul style="list-style-type: none"> <li>Slight negative relative to pedestrian and bicyclists</li> </ul>	<ul style="list-style-type: none"> <li>Utility impacts are possible - 150 diameter of inscribed circle, impacts overhead utilities. Not gas.</li> </ul>	<ul style="list-style-type: none"> <li>Provides adequate capacity for 2040 traffic (2-lane roundabout).</li> <li>Segment of Old Red Trail - three lane. Need to reconfigure somewhere near intersection.</li> <li>If increase diameter to better accommodate trucks, negative impacts on gas utilities.</li> </ul>	M	<p><b>Eliminate</b> Potential for utilities impacts is pretty great - traffic operations improvement does not offset.</p>
Old Red Trail Congestion - East of Sunset Dr to Mandan Avenue	W	Add Center Left Turn lane (3-Lane Section) (Appendix Figure A-15)	<ul style="list-style-type: none"> <li>Sunset Drive through 8<sup>th</sup> Ave to refinery property - 200 feet of ROW (more than adequate). Minimal impacts.</li> <li>Refinery area to Mandan Ave - need to acquire ROW from refinery. Need to acquire 50 feet (desirable) - Minor impacts based on setback.</li> <li>Mandan Avenue - 80 feet of ROW - Adequate, but desire 100 feet to provide area for detached trail.</li> </ul>	<ul style="list-style-type: none"> <li>Minor even with needing to acquire 50 feet from refinery.</li> </ul>	<ul style="list-style-type: none"> <li>3-lane provides adequate capacity through 2040.</li> </ul>	M	<p><b>Retain for Continued Review</b> Provides the capacity needed and accessibility to adjacent parcels.</p>
Core Area In-fill Minor Arterial and Collector Network  Core Area - Sunset Drive to ND 1806 (Collins Avenue) and 27 <sup>th</sup> Street NW to 37 <sup>th</sup> Street NW.	Y	Extend 8 <sup>th</sup> Ave to north as 2-lane and determine most appropriate/desirable junctions with: <ul style="list-style-type: none"> <li>31<sup>st</sup> Street</li> <li>37<sup>th</sup> Street</li> <li>38<sup>th</sup> Street</li> <li>Sunset Drive Extension</li> </ul> (Appendix Figure A-16)	<ul style="list-style-type: none"> <li>Generally a positive as more access is needed to support development (SF/MF/Commercial).</li> <li>Primarily new ROW (80 feet).</li> <li>Approx. 30 feet exists today (west side of center line) inside city limits.</li> <li>North of City - No current ROW.</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Impacts to streams, wetlands and conversion of Ag land.</li> </ul>	<ul style="list-style-type: none"> <li>2-lane provides adequate capacity.</li> </ul>	M	<p><b>Retain for Continued Review</b> Assumed privately financed collector. Enhances development concept by supporting Collins and Sunset Dr for short trips.</p>
		Establish a Beretta Street corridor from ND 1806 (Collins Avenue) to Sunset Drive Extended.	<ul style="list-style-type: none"> <li>Increases the level of traffic in front of 3 residential properties on south side of Beretta St.</li> </ul>	<ul style="list-style-type: none"> <li>Minor - Increased traffic noise at rural residential properties on south side of Beretta St.</li> </ul>	<ul style="list-style-type: none"> <li>2-lane route provides capacity likely required.</li> <li>Can provide ¼ mile access spacing on</li> </ul>	L-M	<p><b>Eliminate</b> Desire more access control on collector/minor arterial than can</p>

Table 7: Alternatives Screening Summary (Concepts and Results)

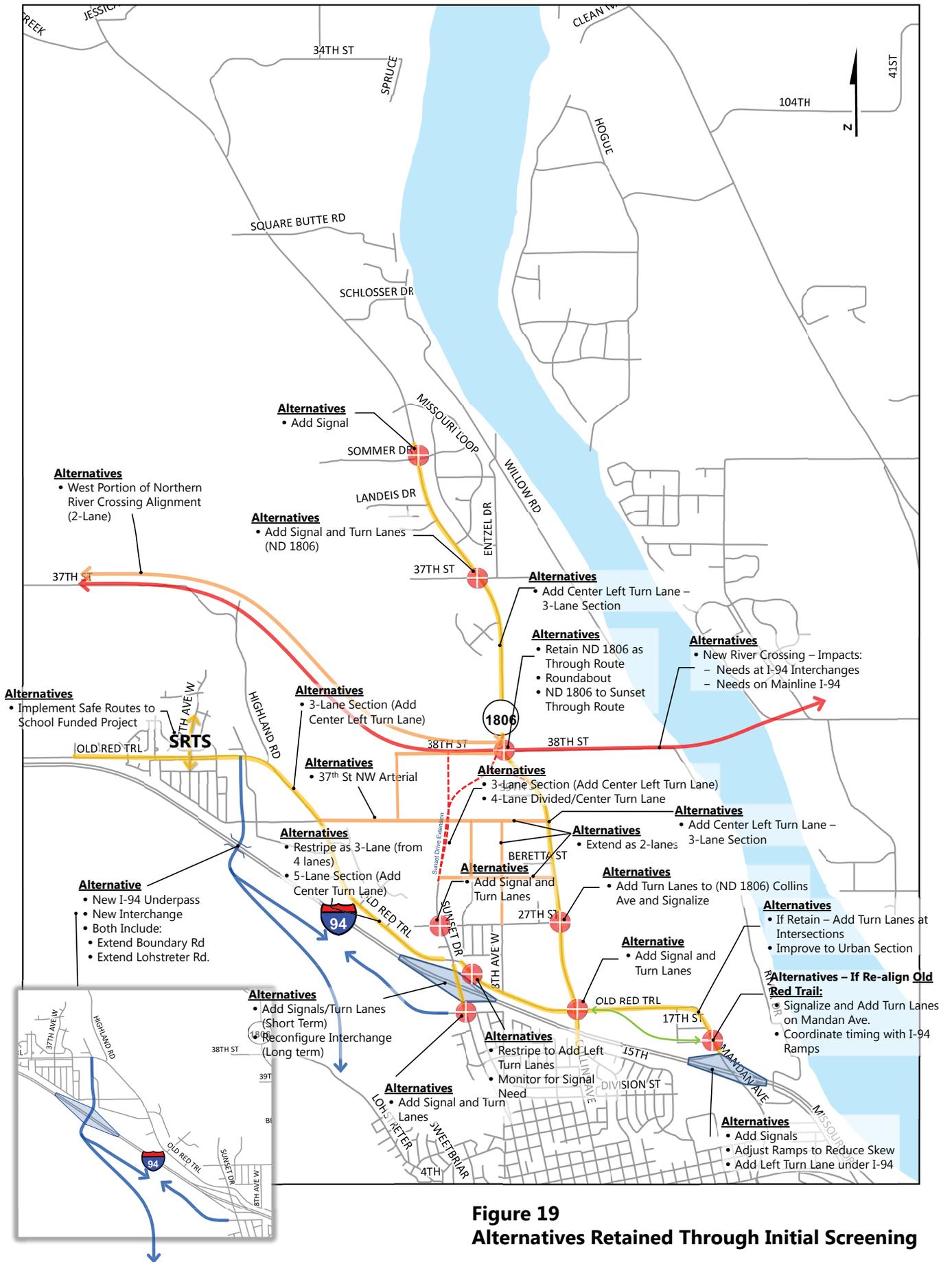
Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
			<ul style="list-style-type: none"> <li>Requires obtaining ROW from north side of street - Presently approximately 40 feet of ROW exists south of Beretta St. Desire would be 80 feet of ROW width.</li> <li>Provides a needed east-west collector route to support economic development.</li> </ul>		ND 1806 (Collins Avenue).		likely provide (unless can create frontage road). 31 <sup>st</sup> Street provides better access control opportunity
		Create 31 <sup>st</sup> Street corridor from ND 1806 (Collins Avenue) to an extension of Sunset Drive.	<ul style="list-style-type: none"> <li>Requires new 80 foot ROW. Likely impacts south side residential wind breaks and/or north side out buildings.</li> </ul>	<ul style="list-style-type: none"> <li>Property acquisition will create moderate impact.</li> </ul>	<ul style="list-style-type: none"> <li>2-lane route provides capacity likely required.</li> <li>Can provide ¼ mile access spacing on ND 1806 (Collins Avenue).</li> </ul>	L-M	<b>Retain for Continued Review</b> While there is potential for adjacent impacts, fewer access points than along Beretta St.
		Extend 12 <sup>th</sup> Ave to north as 2-lane and determine most appropriate junction with: <ul style="list-style-type: none"> <li>31<sup>st</sup> Street</li> <li>37<sup>th</sup> Street</li> <li>38<sup>th</sup> Street</li> <li>Sunset Drive Extension (Appendix Figure A-16)</li> </ul>	<ul style="list-style-type: none"> <li>Generally a positive as more access is needed to support development (SF/MF/Commercial).</li> <li>Primarily new ROW (80 feet).</li> <li>North of City - No current ROW.</li> <li>Extending street to north - Brings more traffic past Mandan Middle School as areas develops.</li> </ul>	<ul style="list-style-type: none"> <li>Minor</li> </ul>	<ul style="list-style-type: none"> <li>2-lane provides adequate capacity.</li> </ul>	M	<b>Retain for Continued Review</b> Assumed privately financed collector. Enhances development concept by supporting Collins and Sunset Dr for short trips.

**Non-Motorized System Alternatives**

Pedestrian Grade Separated Crossing of Sunset Drive adjacent to Mandan Middle School	Not Shown	Construct an over/underpass of pedestrian (primarily students of Mandan Middle School) Sunset Drive.	<ul style="list-style-type: none"> <li>Removes the pedestrian conflict that is a concern at Old Red Trail/Sunset Drive.</li> <li>Would students/others use it? If the connection cannot be made convenient, people will not use it. If Sunset is 3-lane, crossing time differential between grade crossing and at-grade, suggests less use than if Sunset Drive is 5-lane.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal.</li> </ul>	<ul style="list-style-type: none"> <li>East side to west side elevations suggest an underpass.</li> <li>Would not meet warrant - Typically - 300 pedestrians per hour for four-hour period. Middle School enrollment is 770. Do not meet the warrant.</li> </ul>	M	<b>Eliminate</b> Does not meet minimums for warrant
Enhanced Pedestrian Crossing at Sunset Drive/27 <sup>th</sup> Street	Not Shown	Provide a pedestrian actuated crossing beacon at 27 <sup>th</sup> Street (similar to the concept proposed at in the 2013 SRTS project at Old Red Trail/37 <sup>th</sup> Avenue NW/43 <sup>rd</sup> Street NW	<ul style="list-style-type: none"> <li>Improves crossing visibility and safety.</li> <li>Directs pedestrians to a single location - people will expect to see students crossing as opposed to numerous uncontrolled locations.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal</li> <li>Safe Routes to School program has been consolidated into other federal programs. Must compete for dollars with a more broad range of needs.</li> </ul>	<ul style="list-style-type: none"> <li>Can provide adequate operations in peak hours. School peak is before the workday peak.</li> </ul>	L	<b>Retain</b> Provides safer crossing concept than current crossing. Can be coordinated with crossing guard.
Provide multi-use trails along one side of arterial extensions	Not Shown	As arterial extensions are being considered, addressing how a multi-use trail can be accommodated in ROW should be considered. Key routes to consider: <ul style="list-style-type: none"> <li>Old Red Trail west of 34<sup>th</sup> Avenue.</li> <li>Sunset Drive north of 27<sup>th</sup> Street/Mandan Middle School.</li> <li>Northern River Crossing corridor.</li> <li>32<sup>nd</sup> Avenue crossing of I-94</li> <li>Boundary Road extension west of Sunset Drive.</li> </ul>	<ul style="list-style-type: none"> <li>Improves safety along higher volume, higher speed routes.</li> <li>Promotes reducing growth vehicle miles of travel.</li> </ul>	<ul style="list-style-type: none"> <li>Minimal assuming ROW acquisition does not impact sensitive areas (not likely).</li> </ul>	<ul style="list-style-type: none"> <li>Primary benefit is safety.</li> <li>No substantial engineering constraints exist.</li> </ul>	L	<b>Retain</b> Supports a truly multimodal transportation system

Table 7: Alternatives Screening Summary (Concepts and Results)

Issue to Address	Map ID	Alternative Description	Evaluation by Perspective			Cost Range	Screening Recommendation
			Social	Environmental	Engineering		
Provide Multi-use Trails Along New Arterial Routes	Y	New arterial routes should be developed to accommodate all modes. These include: <ul style="list-style-type: none"> <li>• 32<sup>nd</sup> Avenue NW extension</li> <li>• Northern River Crossing Route (38<sup>th</sup> Street)</li> <li>• 37<sup>th</sup> Street NW</li> <li>• Boundary Road</li> </ul>	<ul style="list-style-type: none"> <li>• Improves safety along higher volume, higher speed routes.</li> <li>• Promotes reducing growth vehicle miles of travel.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal assuming ROW acquisition does not impact sensitive areas (not likely).</li> </ul>	<ul style="list-style-type: none"> <li>• Primary benefit is safety.</li> <li>• No substantial engineering constraints exist.</li> </ul>	L	<p><b>Retain</b></p> <p>Supports a truly multimodal transportation system</p>
Develop a Riverbend Subdivision Pedestrian/ Bicycle Connection to north Mandan	Not Shown	Most "logical" location is along Union Cemetery Road and across the BNSF rail line. To north, much more new ROW is required through private property.	<ul style="list-style-type: none"> <li>• Improves connectivity to residential areas along the river.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal.</li> <li>• Cost likely becomes prohibitive for the relatively small number of properties accessed.</li> </ul>	<ul style="list-style-type: none"> <li>• Safety will be a concern at the BNSF railroad. Would not warrant a grade separated crossing. Would RR require gates? Adds to cost.</li> </ul>	M-H	<p><b>Retain</b></p> <p>Very low priority concept, whose feasibility is controlled by the RR. RR generally prefers to reduce pedestrian access, not increase. Pursue through holding discussion with RR.</p>
Provide sidewalk extensions to reduce/eliminate gaps.	Not Shown	Provide sidewalks as collector/local system is developed and extend in following developed areas: <ul style="list-style-type: none"> <li>• 37<sup>th</sup> Street NW: Extend from 30<sup>th</sup> Avenue NW to Old Red Trail</li> <li>• 30<sup>th</sup> Avenue NW from 37<sup>th</sup> Street NW to Old Red Trail</li> </ul>	<ul style="list-style-type: none"> <li>• Improves internal circulation and safety in neighborhoods.</li> <li>• Is the 30<sup>th</sup> Avenue NW connection through an industrial area really needed? Will be a difficult sell to landowners paying special assessments.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal</li> </ul>	<ul style="list-style-type: none"> <li>• Primary benefit is safety.</li> <li>• No substantial engineering constraints exist.</li> </ul>	L	<p><b>Retain</b></p> <p>Supports a truly multimodal transportation system</p>



**Figure 19**  
**Alternatives Retained Through Initial Screening**

## Conclusions

---

Presented in preceding chapters of the North Mandan Subarea Study report is information intended to:

- Document the study goals.
- Provide a summary of the existing transportation system elements.
- Document current transportation system issues perceived by area residents and travelers within the study area, issues identified through analysis of available traffic and crash data and information provided by local staff.
- Provide an overview of travel demand forecasts within the study area for a 2040 horizon year.
- Identify congested locations anticipated for 2040 with only those programmed system improvements in place.
- Document the alternatives screening process and findings.

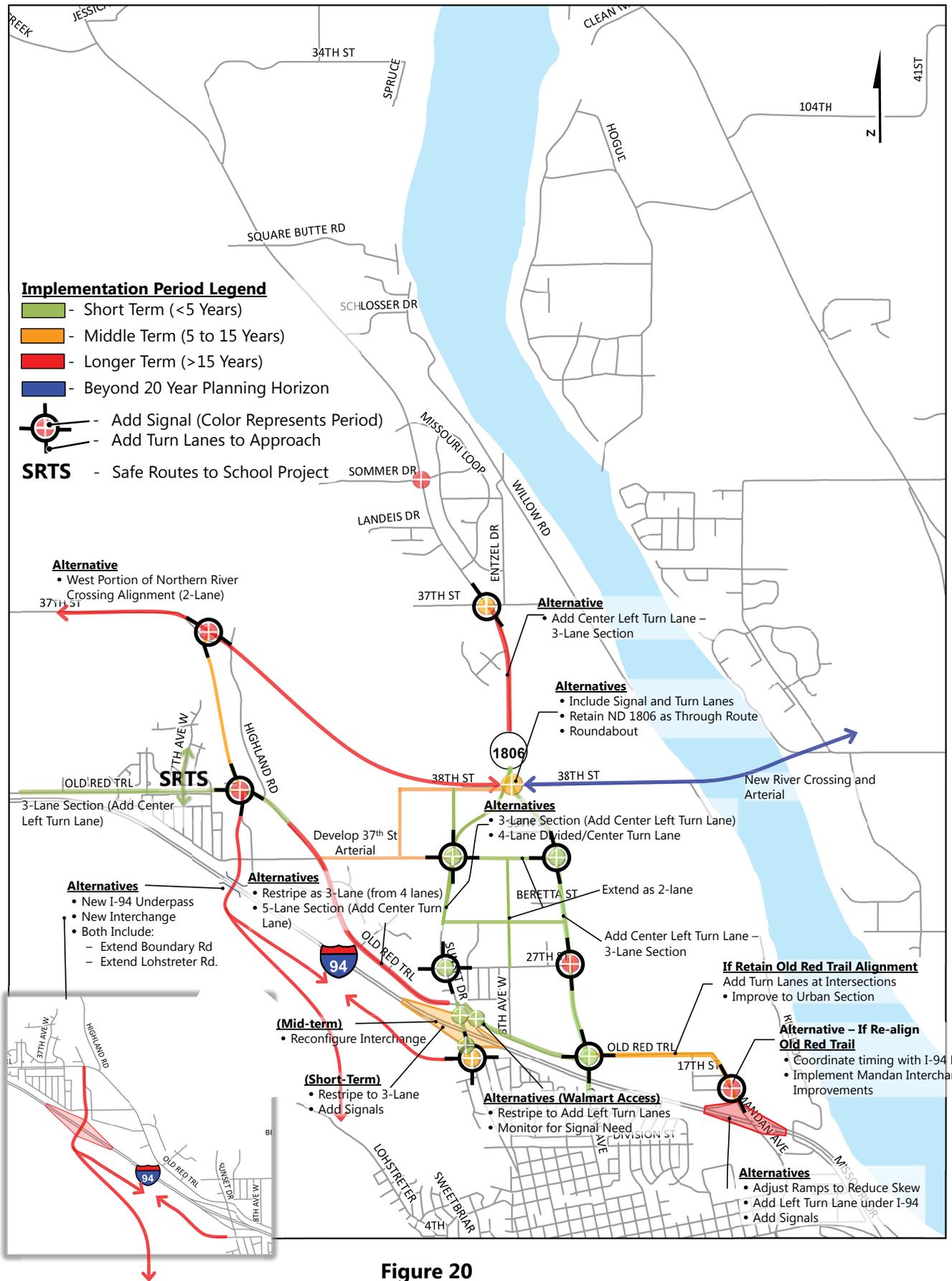
The purpose of this chapter is to provide documentation of the technically feasible alternatives to be carried forward into more detailed corridor specific planning and engineering analyses. The intent is to provide stakeholders with direction adequate to enter into the environmental planning/review process, not to provide corridor-specific recommendations as to the improvement to implement. Determination of the locally preferred alternative is the purpose of the environmental review process.

Determining the appropriate study area actions to ultimately be taken, based on the recommendations included in this chapter, is the responsibility of the City Commission, the public and local staff.

### Roadway Improvement Concepts – Highlighting the Technically Feasible Alternatives

A conceptual timing for action on the improvement concepts included in the list of Technically Feasible Alternatives are displayed in Figure 20 and briefly described in Table 8. Included in both the figure and the table is an estimate of the future period in which the concept may be warranted based on, including:

- Anticipated development of the available areas within the study area and the density of the assumed development types.
- Current traffic operations at intersections and along arterial and collector segments.
- Future traffic and traffic operations assuming the current roadway network (lanes and intersection control).
- High-level assessment of project cost versus the likely transportation budget.



**Figure 20**  
**Technically Feasible Improvements and Implementation Plan**

**Table 8. Summary of the Technical Feasible Alternatives Retained for Further Development**

Corridor/Route	Concept Description	Implementation Period
I-94		
	<p>Mandan Avenue - Reconstruct Interchange to address ramp skew and widen Mandan Avenue to provide north-southbound turn lanes to I-94</p> <p><b>See Figure A-7</b></p>	Longer-term - > 15 Years
	<p>Sunset Drive – Install traffic signals at north and south terminal intersections and restripe Sunset Drive to provide north and southbound turn lanes to I-94. Planned NDDOT project in 2014.</p>	Short-term – 0-5 Years Concept will not accommodate 2040 traffic. Consider only for short term
	<p>Sunset Drive – Reconstruct the current diamond interchange to increase capacity. One design option identified is single point urban design.</p> <p><b>See Figure A-2</b></p>	Mid-term – 5 to 15 years
	<p>Consider additional interchange or grade separated crossing at 32<sup>nd</sup> Avenue.</p> <p><b>See Figure A-4 (Grade Separation)</b> <b>See Figure A-5 (Diamond Interchange)</b></p> <p>New interchange could include reconstruction of the I-94 mainline to add auxiliary lanes to/from Sunset Drive.</p> <p>Associated with providing either a new crossing or interchange at 32<sup>nd</sup> Avenue NW would be:</p> <ul style="list-style-type: none"> <li>• Extending the Boundary Road corridor to the west to provide connectivity to areas of Mandan south of I-94.</li> <li>• Creating an extended southern connection from 32<sup>nd</sup> Avenue NW to Lohstreter Road.</li> </ul>	Longer term – >15 years
Sunset Drive		
	<p>Extend the corridor to the north to 38<sup>th</sup> Street as an arterial roadway with the following lane options:</p> <ul style="list-style-type: none"> <li>• 3-lanes (one through lane in each direction with a center left turn lane)</li> <li>• 5-lanes (two through lanes in each direction with a center left turn lane)</li> </ul> <p>Obtain adequate right-of-way for 5-lane (100 feet)</p>	Short-term – 0-5 Years
	<p>Junction options with 38<sup>th</sup> Street:</p> <ul style="list-style-type: none"> <li>• Establish a new intersection ¼ mile west of ND 1806 (Collins Avenue) – Includes constructing 38<sup>th</sup> Street <b>(See Figure A-11)</b></li> <li>• Construct a roundabout at ND 1806 (Collins Avenue) at 38<sup>th</sup> Street, with Sunset Drive (along with 38<sup>th</sup> Street) providing a west approach. <b>(See Figure A-12)</b></li> <li>• Re-align ND 1806 to create a through movement with a Sunset Drive northern extension. Connect Collins Avenue into Sunset Drive south of 38<sup>th</sup> Street. <b>(See Figure A-13)</b></li> </ul>	Mid-Term - 5-15 Years

Corridor/Route	Concept Description	Implementation Period
<b>ND 1806 (Collins Avenue)</b>		
	<p>North end of Study Area to 37<sup>th</sup> Street – Current 2-lane accommodates demand. Add signals at Sommer Drive and 37<sup>th</sup> Street NE to improve accessibility from the rural residential neighborhoods.</p> <p>Provide left turn lanes on ND 1806 at 37<sup>th</sup> Street.</p>	<p>Sommer Drive signal - Longer-term - &gt;15 Years</p> <p>37<sup>th</sup> Street signal – Mid-term – 5-15 Years</p>
	<p>37<sup>th</sup> Street through 38<sup>th</sup> Street – Through lanes are adequate, however, left turn lanes or a center continuous left turn lane is included as technically feasible alternatives.</p>	<p>No Action in Immediate Future along this Segment.</p> <p>Action on possible 3-lane – Longer-term - &gt;15 Years</p>
	<p>38<sup>th</sup> Street – The following options are included as technically feasible alternatives:</p> <ul style="list-style-type: none"> <li>• Add a traffic signal and turn lanes to each of the approaches (whether 38<sup>th</sup> Street is upgraded to be the North Beltway or retained as the current arterial). <b>(See Figure A-11)</b></li> <li>• Construct a roundabout at ND 1806 (Collins Avenue) at 38<sup>th</sup> Street, with Sunset Drive (along with 38<sup>th</sup> Street) providing a west approach. <b>(See Figure A-12)</b></li> <li>• Construct a roundabout – Only if the North Beltway segment east of ND 1806 is not constructed due to the cost of a Missouri River Bridge (approximately \$75 to \$100 million). <b>(See Figure A-12)</b></li> </ul>	<p>Mid-term – 5-15 Years</p>
	<p>38<sup>th</sup> Street NE to Old Red Trail – Retain the following as technically feasible alternatives:</p> <ul style="list-style-type: none"> <li>• Expand the corridor to a 3-lane to support current mid-block access and accommodate traffic growth.</li> <li>• Add signal (and turn lanes) at 27<sup>th</sup> Street</li> <li>• Add signal and turn lanes to all approaches at Old Red Trail.</li> </ul>	<p>Segment improvements in Short-term – 0-5 Years</p> <p>Signalize 27<sup>th</sup> Street in Longer-term - &gt;15 Years</p> <p>Old Red Trail intersection improvements – Short-term- 0-5 Years</p>
<b>Old Red Trail</b>		
	<p>West end of Study Area to East of Highland Road - Widen to 3-lane section to provide one through lane in each direction and a continuous center left turn lane. Traffic volume at Highland Road should be monitored and when warrants are met, a signal should be installed <b>(See Figure A-16)</b></p> <p>If develop the 32<sup>nd</sup> Avenue NW corridor, monitor the 30<sup>th</sup> Avenue/Old Red Trail traffic relative to signal warrants. If develop and signalize 30<sup>th</sup> Avenue NW, do not signalize Highland Road.</p>	<p>Short-term – 0-5 Years</p>
	<p>Implement the Safe Routes to Schools improvements included in the approved grant – Enhanced pedestrian crossing at 37<sup>th</sup> Avenue NW (including a beacon). <b>(See Figure A-16)</b></p>	<p>Short-term – 0-5 Years</p>
	<p>Highland Road to Sunset Drive – The technically feasible alternatives retained through the screening are:</p> <ul style="list-style-type: none"> <li>• Convert the 4-lane to a three lane (Narrowing the 50 foot cross section to about 36-38 feet).</li> <li>• Expand the 4-lane section to five lanes (the more</li> </ul>	<p>Longer-term - &gt;15 Years</p>

Corridor/Route	Concept Description	Implementation Period
	continuous turn accommodation is consistent with access density in corridor. <b>(See Figure A-9)</b>	
	Sunset Drive to ND 1806 (Collins Avenue) – Restripe the 44 foot wide 2-lane section to a 3-lane section.  Monitor traffic at Walmart access and consider signalization when warrants are met.  Add signal and left turn lanes to all approaches at ND 1806 (Collins Avenue).	Short-term – 0-5 Years
	ND 1806 (Collins Avenue) to Mandan Avenue Interchange with I-94 – Widen the 26 foot wide 2-lane section to a 3-lane section (one through lane in each direction and a continuous center, two-way left turn lane). <b>(See Figure A-15)</b>	Mid-term – 5-15 Years
<b>Mandan Avenue</b>		
	16 <sup>th</sup> Street NW - If the 16 <sup>th</sup> Street collector corridor south of Old Red Trail (through development area) is constructed and signal warrants are met, install a traffic signal. The signal should be provide ONLY if the I-94/ Mandan Avenue interchange reconstruction is completed. Adding a signal at 16 <sup>th</sup> Street with the present interchange configuration will result in overlapping queues on Mandan Avenue (northbound left turn queue at 16 <sup>th</sup> Street will overlap with the southbound queue at the north I-94 ramp terminal intersection).	Longer-term - >15 Years
<b>Northern River Crossing and Beltway</b>		
	Divided into two segments: <ul style="list-style-type: none"> <li>• Sunset Drive east to across the Missouri River (Including new bridge).</li> <li>• Sunset Drive west to 37<sup>th</sup> Street NW and remaining segments of the identified Beltway Corridor.</li> </ul> Divided into two segments due to cost and environmental complexity of developing a new crossing of the Missouri.  Each segment provides independent utility and is functionally independent from the other. Maximum utility (providing alternate to I-94 for carrying regional through traffic), however, is provided when both segments are in place.	West of ND 1806: Longer-term - >15 Years  East of ND 1806: Beyond 2040 (Period could be adjusted through projects in 2040 horizon LRTP which is on-going).
<b>37<sup>th</sup> Street from Old Red Trail to ND 1806 (Collins Avenue)</b>		
	Arterial corridor with 2 through lanes (one in each direction) provides accessibility to proposed commercial and residential development areas as well as to the city park being developed by the Mandan Parks District on 37 acres located east of Old Red Trail and south of the 37 <sup>th</sup> Street extension. <b>(See Figure A-17)</b>  Along 37 <sup>th</sup> Street NW at the junctions with Sunset Drive and ND 1806 (Collins Avenue) turn lanes are likely needed to accommodate intersection volumes, as volume is likely to meet signal warrants by 2040. <b>(See Figure A-18)</b>	ND 1806 (Collins Avenue) to Sunset Drive – Short-term – 0-5 Years  Sunset Drive to west – Mid-term – 5-15 Years (with development)

Corridor/Route	Concept Description	Implementation Period
<b>8<sup>th</sup> Avenue West Extension to North</b>		
	<p>Extend to the north from the current terminus at 27<sup>th</sup> Street to a new east-west arterial corridor at 37<sup>th</sup> Street.</p> <p>Traffic volumes associated with development support a 2-lane roadway with stop sign control at intersections with 27<sup>th</sup> Street and 37<sup>th</sup> Street. (See Figure A-18)</p>	Short-term – 0-5 Years
<b>31<sup>st</sup> Street NW</b>		
	<p>Construct a 31<sup>st</sup> Street NW 2-lane collector from Sunset Drive through ND 1806 (Collins Avenue).</p> <p>As collector, it is unlikely that volumes will warrant signals at Sunset Drive or ND 1806 (Collins Avenue) or intersections in between. (See Figure A-18)</p>	Short-term – 0-5 Years (Assumes privately funded street)
<b>38<sup>th</sup> Street Improvement</b>		
	<p>Upgrade the current minimum maintenance road to a paved 2-lane collector roadway.</p> <p>Extent of the improvement – ND 1806 (Collins Avenue) to approximately ½ mile to the west.</p> <p>At the west terminus, a new north-south collector would provide access to 37<sup>th</sup> Street (Arterial).</p> <p>The corridor would provide the west approach to ND 1806 (Collins Avenue), which connects an extension of Sunset Drive to ND 1806 (Collins Avenue). (See Figure A-17)</p>	<p>Mid-Term – 5-15 Years</p> <p>Dependent on increments and locations of development.</p>
<b>Non-motorized System Improvements</b>		
	<p>Develop policy to provide combination of multi-use trail and/or sidewalks adjacent to collector and arterial corridors.</p> <p><b>Figure 21</b> displays arterial multi-use trail and collector sidewalk concept.</p>	Development program to ensure system is completed concurrent with development (throughout planning period).

## Non-Motorized System Concepts

Non-motorized corridor improvement concepts associated with the technically feasible alternatives focus on the following types of improvements:

- Sidewalks along arterial and/or collector roadways in the study area. Right-of-way reservation/preservation for street and roadway improvements should be of a sufficient width to allow sidewalks on both sides of roadway.
- Multi-use trails along arterial corridors that provide regional connectivity between residential areas, from residential areas to employment areas and between residential areas and parks and schools.

Figure 21 highlights the collector and arterial corridors where it is suggested that expansion of the roadway system also include sidewalk and/or multi-use trail enhancements. Along corridors where a multi-use trail is identified, sidewalks would not likely be proposed. This concept is consistent with current conditions throughout the city. When a multi-use trail is included on one side of a roadway, sidewalk is not included on the other side of the roadway.

## **Public Transit System Modifications**

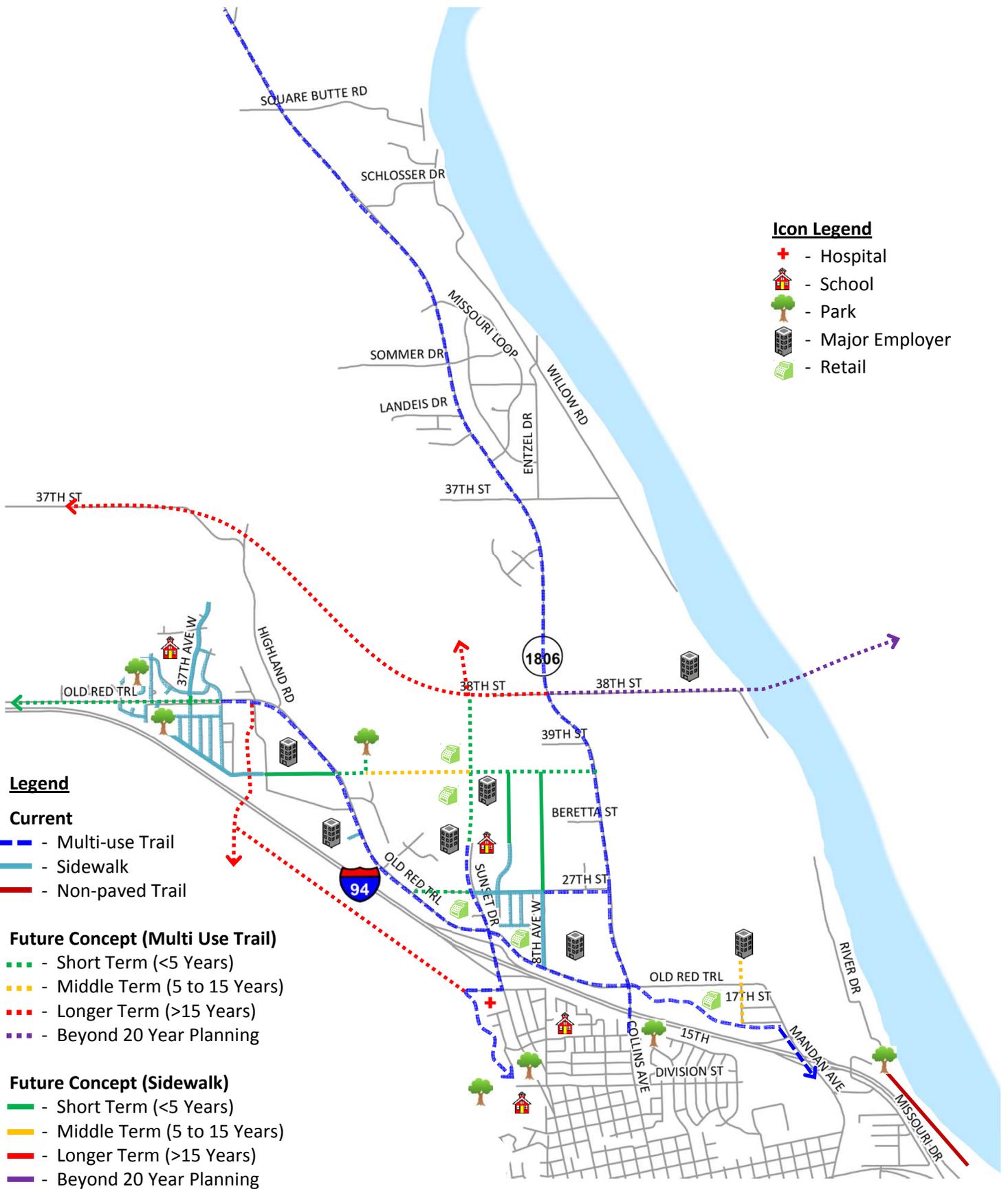
The 2012 Transit Development Plan provided recommendations for substantial restructuring of the M1 and M2 Routes within Mandan, including eliminating regular fixed route service north of I-94. This conclusion was developed in part based on the on-off survey information gathered as part of the TDP, which showed very little use of the M-1 route north of I-94. One of the key goals of the TDP was to improve the overall efficiency of fixed route service by reducing circuitous travel, reducing multiple route coverage redundancies, and eliminating unproductive segments. The product of the streamlining efforts in Mandan was a focusing of the M-1 and M-2 Routes to those corridors providing access to/from larger trip generators and generators complementary to transit customers (medical services, basic shopping, banking, and civic building). Figure 22 displays the recommended routing adjacent to the study area. Streamlining also resulted in eliminating service on ND 1806 (Collins Avenue), 27<sup>th</sup> Street NW and parts of Sunset Drive north of I-94. Regular fixed route service north of I-94 was replaced with M-1 deviation on request with the following guidelines:

- Pick-ups: two hour notice.
- Drop-offs: Made to driver as customer boards.

The 2012 Transit Development Plan was completed prior to proposals for many of the ongoing and planned developments. These include the Walmart being constructed at Sunset Drive/Old Red Trail or the Sanford Clinic north of Old Red Trail or other commercial, industrial and higher density residential developments in the plan approval stage. As a result of the increase in transit oriented developments north of I-94 and the relative proximity of many of the developments (along Old Red Trail and/or Sunset Drive) it is suggested that Bis-Man Transit and the City of Mandan reconsider the M-1 route deviation concept as part of the 2014 long range transportation plan development process. The locations of key transit oriented uses are shown in Figure 22.

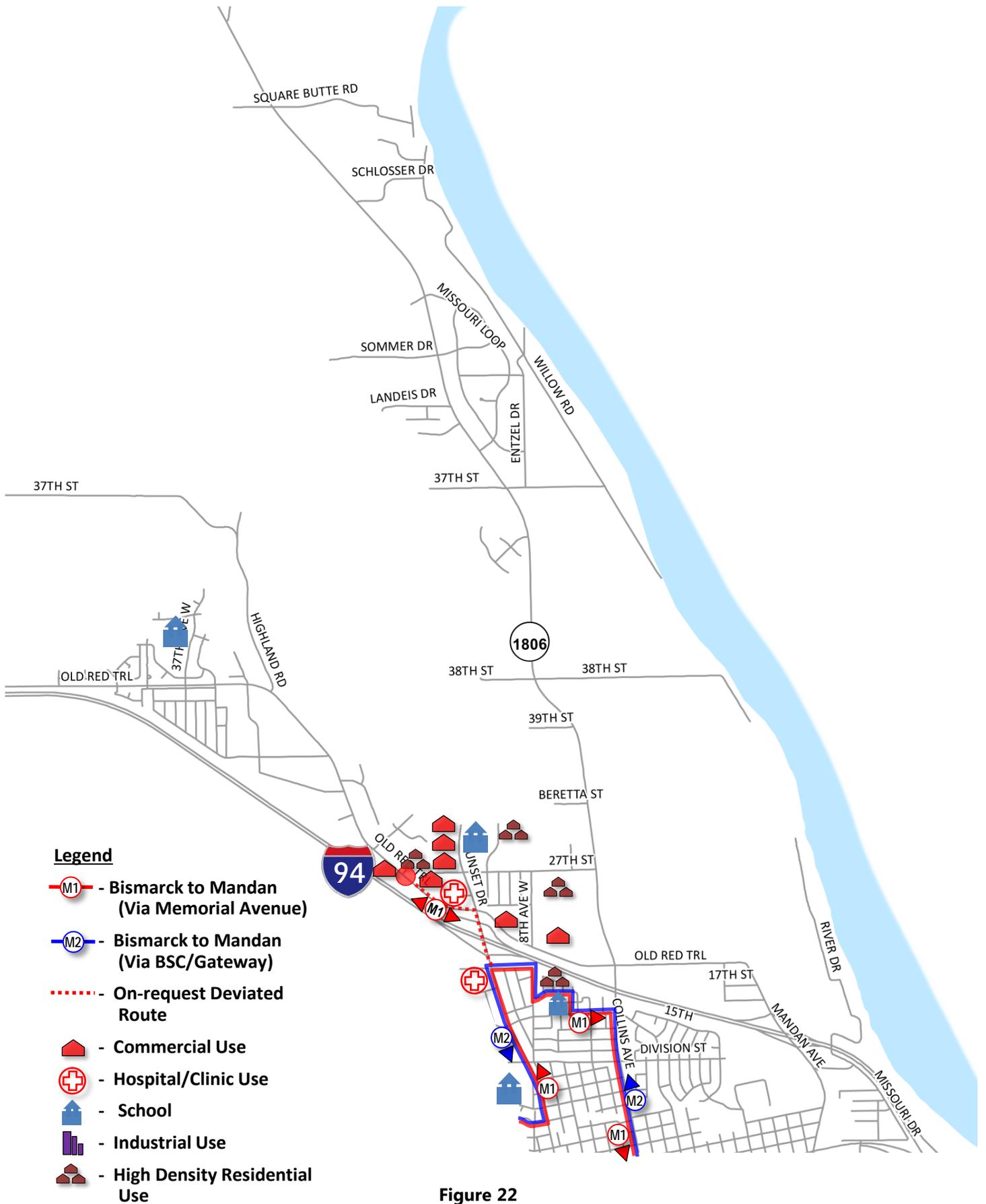
## **Financial Consideration of the Roadway Improvements**

Information on the transportation budget was obtained from the 2009 Bismarck-Mandan Long Range Transportation Plan. In the 2009 LRTP projects in the Mandan area totaled approximately \$56.16 million in 2009 dollars, which reflected the year the plan was completed. The figure can be used as a reasonable expectation of the dollars available in the community for many/most of the improvements included in this report. This conclusion is



Note: Sidewalks to be included with all future residential / local street development.

**Figure 21**  
**Future Trail and Sidewalk Extension Concepts**



**Figure 22**  
**2012 Transit Development Plan Recommended Routes/  
 Transit-Friendly Development Sites**

based on the combination of the requirement that the LRTP project list must be cost constrained and the assumption that all available funding would be used to provide improvements (no available dollars would be left on the table).

While the figure seems like a substantial amount, it reflects approximately \$42 million in projects located outside the North Mandan Subarea study area. Reduced to an annual amount, the 2009 LRTP project budget for the North Mandan Study area would be approximately \$600,000 per year.

Thus, implementing a substantial portion of the technically feasible project list would require reallocation of most, if not all, of the funding capacity for Mandan area transportation projects and/or identifying additional sources of transportation funding.

## Next Steps in North Mandan Project Development

---

The North Mandan Subarea Study is an initial stage of a multi-step process for identifying, designing, approving and implementing multimodal transportation system improvements that meet identified needs in the focus area. The preceding section of the North Mandan Subarea Study final report delineated the technically feasible alternatives for addressing needs that were identified through the public and stakeholder outreach programs, review of the anticipated increment, type and location for development, analysis of current and future traffic, and crashes that have occurred in the study area.

Two critical elements of next steps in the short and longer term planning process are:

- Develop a program for integrating a traffic impact study process into project development.
- Advance the list of technically feasible projects through the planning and funding process, whether it is a local/county/state funded or a federally funded project.

### Traffic Impact Study Process

A traffic impact analysis is a study through which the effects of a particular development, or group of developments, have on the transportation network in the community. Studies vary in their range of detail and complexity depending on the type, size and location of the development. Traffic impact studies should accompany developments which have the potential to impact the transportation network and should be considered an important tool in assisting the City in making land use decisions. The primary goal of a traffic impact study is to identify what type of transportation improvements may be necessary to accommodate site generated traffic.

The primary purpose of conducting impact studies are:

- To ascertain the operational conditions on the adjacent roadway network when a proposed development is accommodated within the existing transportation infrastructure along with other proposed developments (as reflected in the Comprehensive Development Plan).
- To identify transportation improvements required to maintain the existing operational conditions.
- To determine whether access to the proposed development will hamper traffic operations and safety near the site.
- To identify present or future transportation system deficiencies without the new development.
- To provide decision makers with a basis for assessing the transportation implications of approving proposed zoning changes and development applications.

- To provide a basis for estimating the cost of proposed mitigating measures

The first key element of establishing the traffic impact study process is determining the threshold of when a study is needed. Small scale residential developments of 10 to 12 houses will, in most cases, not generate enough traffic to result in intersection improvements. While no specific threshold is provided, many locations establish a sliding scale by land use type and intensity that can be tied to peak hour trips generation.

Listed below are the parts of a traffic impact study that is recommended for Mandan:

1. Description of the site development including the location, development concept and phasing.
2. Site trip generation for daily and peak hour periods.
3. Trip distribution and estimating intra-site trips (for mixed use developments).
4. Traffic forecasts for specified periods in the future with and without site traffic.
5. Traffic operations analysis, with and without site traffic.
6. Mitigation alternatives identification and screening.
7. Development of a mitigation plan.

## Project Development Steps

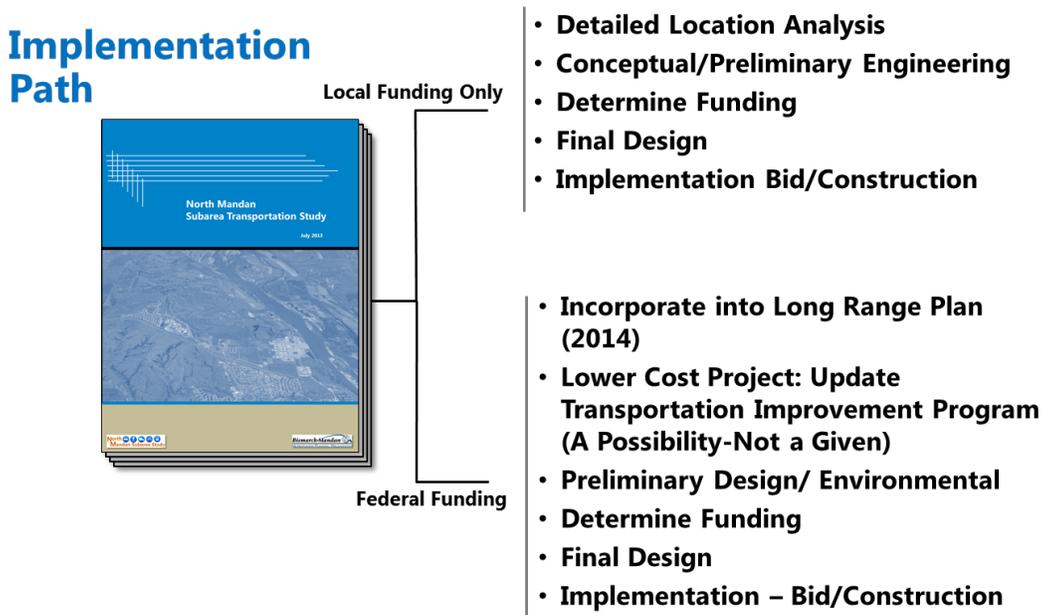
The path the city, county or NDDOT take to selecting and implementing the preferred alternative will depend on a number of factors, with “how is the project being funded” as one of the critical determinants to the path to implementation.

Funding comes into play as a critical determinant to the pathway to implementation because if federal funds are involved, whether from a federal program where funds are distributed by a formula (i.e. each state is apportioned some amount of dollars based on a defined formula) or through a discretionary program, project development must include an assessment of the potential environmental impacts. Determination of the preferred alternative for action is generated out of this step of the process. Projects that are entirely funded with local money (City of Mandan, Morton County or developer dollars) or using state money, the environmental review process is not required and projects included in this document could be moved to the next step of concept design.

Figure 23 highlights the alternate next step paths for projects identified as technically feasible in the North Mandan Subarea Study. Listed below are the primary steps in the process:

- **Planning Studies:** The first step of the project development process, a planning study, provides an evaluation of the existing and expected future transportation issues. Next, a set of alternatives is developed and screened based on a set of evaluation criteria that are consistent with the regional planning process. The study concludes with a set of technically feasible alternatives to address the identified transportation issues.

Figure 23. Alternate Next Steps in Project Development Process



- **Environmental Study:** In the second step of the project development process, the technically feasible alternatives of the Planning Study are brought through the necessary permitting processes in an environmental study. Depending on the location and scale of the project, it may require permits at the local, state and/or federal level before it proceeds. The output of the Environmental Study is a preliminary design for the project (commonly called 30% Design for roadway projects).
- **Funding Process:** Once a project has a completed preliminary design concept, the project proponents (a city, county, transit agency or NDDOT) need to identify funding for the project. This step requires working in within the MPO project funding process (inclusion in the LRTP, inclusion in the TIP, etc.).
- **Final Design:** With funding in place, the next phase of project development is the final design. During this phase the final layout of the project and the design details are determined. In addition to the necessary plans, project proponents must also prepare final specifications and estimates. For projects with federal or state funding, final plans, specifications, and estimates must be submitted for review and approval by the appropriate NDDOT Division. The product of this step is the Final Design (commonly called the 100% design for both roadway and transit projects).
- **Implementation:** The final step of the project development process is implementation of the project. During this phase, the project or service is advertised for bidding, a contract is awarded and the improvements are constructed under the supervision of the responsible jurisdiction.