4.0 IDENTIFICATION OF DEFICIENCIES

4.1 PERFORMANCE MEASURES AND RESULTS OF ANALYSIS

4.1.1 Roadway Safety

As documented in Chapter 3, there were four key factors that were used to analyze the occurrence and characteristics of vehicle crashes in the TH 14 corridor. Those factors included: (1) crash rate, (2) critical crash rate, (3) severity rate, and (4) distribution of crash types. The evaluation of these safety-related factors for the TH 14 corridor is a function of three major criteria, including:

> ***Statistical Comparison*** – Intersections and segments where the actual crash rate is statistically significantly greater than the expected crash rate are considered deficient, and the high frequency of crashes is likely due to roadway or traffic control conditions as opposed to the random nature of crashes.
>
> ***IRC Crash Rate Target*** – Mn/DOT has developed a goal for crash rates at intersections and along segments of IRCs. A crash rate goal of 1.0 crash per million entering vehicles (MEV) has been selected for all intersections (signalized and unsignalized) and moderate crash incidence segments (urban and rural freeways, rural expressways, and rural two-lane). A crash rate goal of 1.0 crashes per MEV has been selected for rural expressways. Segments and intersections that exceed the crash rate goal are considered deficient.
>
> ***Comparison to Other TH 14 Corridor Locations*** – This criterion is based on the expected consistency of safety characteristics along the TH 14 corridor. For example, if many segments experience similar crash rates, with a particular segment much higher, that segment could violate drivers' expectations and would be considered deficient. This comparison is not affected by intersection traffic control or roadway cross-section, and is the more subjective of these two categories.

A total of three intersections in the TH 14 corridor were found to be deficient based on the above criteria. In addition, three corridor segments were classified as deficient. A summary of the deficient intersections and segments are documented in **Table 4.1-1**, including a comparison to the above listed criteria.

Table 4.1-1
Safety Deficiencies for Intersections and Segments

Intersection / Segment	Statistically Deficient	Above IRC Crash Rate Target	Comparison to Other Locations
ROADWAY SEGMENTS			
TH 15/CSAH 21 to CSAH 37	**YES**	**YES**	**High Severity**
Zieske Road to CSAH 12	No	**YES**	**High Severity**
TH 111/CSAH 23 to CR 72	No	**YES**	**Highest Segment Crash Rate** **High Severity**
UNSIGNALIZED INTERSECTIONS			
TH 14/TH 15 / CSAH 21	**YES**	**YES**	**Highest Intersection Crash Rate** **High Severity**
TH 14/CSAH 37	**YES**	No	**High Severity**
TH 14/TH 111/CSAH 23	**YES**	**YES**	**High Severity**

Source: Mn/DOT and Howard R. Green Company

Deficient Corridor Segments

Only Segment 1 had an actual rate above the critical rate. For the other seven segments in the TH 14 West corridor, actual crash rates were below the critical crash rate, and thus were not considered statistically deficient. Three segments were deficient when compared to the Mn/DOT crash rate target of 1.0 crash per million entering vehicles. A brief discussion of the deficiencies within these three segments follows.

Segment 1: TH 15/CSAH 21 to CSAH 37

The actual crash rate in this segment was 2.0 crashes per million vehicle miles (MVM), which exceeds the segment's critical crash rate and Mn/DOT's target of 1.0 crashes per MVM. Although this segment is just over 1.5 miles long, most of the crashes occurred at the intersection of TH 14/TH 15/CSAH 21 at the western end of this segment. Within this segment, 50% of the crashes were turn related crashes (right angle and left turn), which exceeds the expected rate of around 32%. This is consistent with the fact that most of the corridor crashes occurred at the intersection of TH 14/TH 15/CSAH 21. In addition, the severity rate of 6.5 is almost three times the expected rate. However, all four fatalities and nearly 70 percent of the injuries occurred at the deficient intersection. Aside from the single deficient intersection within this segment, the balance of the segment does not have safety deficiencies.

Segment 3: Zieske Road to CSAH 12

The actual crash rate in this segment was 1.6 crashes per million vehicle miles (MVM), which exceeds Mn/DOT's target of 1.0 crashes per MVM. The severity rate of this segment was also higher than most segments at 3.3. This segment is a rural section experiencing some urban development. The most common type of crash was rear end (approximately 40% of all crashes). This figure is higher than the Minnesota average rate for rural roads at 14%, but is near the rate of 36% for urban roads. Therefore, as this area develops, consideration may be given to the addition of left and right turn lanes and access management.

Segment 7: TH 111/CSAH 23 to CR 72

Segment 7 is an urban segment extending through the City of Nicollet. The actual crash rate in this segment was 2.5 crashes per million vehicle miles (MVM), which exceeds Mn/DOT's target of 1.0 crashes per MVM. Although this segment is just over 0.6 miles, nearly 80% of the crashes occurred at the intersection of TH 14/TH 111/CSAH 23. Nearly 80% of the crashes within this segment were right angle crashes, which exceeds the Minnesota average for urban roads of around 26%. This is consistent with the fact that most of the corridor crashes occurred at the intersection of TH 14/TH 111/CSAH 23. The severity rate of 4.5 is below the expected rate for urban roadways. Aside from the single deficient intersection within this segment, the balance of the segment does not have safety deficiencies.

Deficient Corridor Intersections

All public street intersections were analyzed to determine if safety deficiencies exist in a similar manner to that of corridor segments. Based on a statistical comparison between actual and expected safety characteristics, the following intersections have safety deficiencies:

- TH 14/TH 15/CSAH 21
- TH 14/CSAH 37
- TH 14/TH 111/CSAH 23

TH 14/TH 15/CSAH 21

This intersection has the highest intersection crash rate of any along the corridor with 1.4 crashes per million entering vehicles (MEV), which is above the critical crash rate of 0.6 crashes/MEV and Mn/DOT's target IRC rate of 1.0 crashes/MEV. Most of the intersection crashes are left turn (45%) or right turn (36%) crashes. The Minnesota average for rural intersections is 8% and 28%, respectively. In addition, the severity rate at this intersection is 4.6; over four times the expected severity rate. Currently, this intersection is a thru-STOP condition with the signs stopping traffic on eastbound TH 14. In reviewing the turn

movements for this intersection as shown on **Table 3.4-2**, it appears this leg carries more traffic than TH 15, and may violate motorists' expectations.

In August 2001, Mn/DOT completed a Road Safety Audit on this intersection. The audit recommended the following short-term and long-term improvements:

Short-Term

- Remove the existing overhead flasher and replace with sign mounted flashers.
- Conduct a speed study in the area, and consider changing the speed along the west leg of TH 14/TH 15 into New Ulm from 45 mph to 50 mph.
- Widen the northbound to eastbound right turn lane to function as a ramp.
- Remove the vegetation in all quadrants except the northeast.
- Remove the south leg directional sign and replace it with an overhead mounted sign.
- Explore the use of a four-way stop.

Long-Term

- Increases the length of the southbound and eastbound turn lanes.
- Channelize and realign all approaches to increase sight distance.
- Explore closing the CSAH 21 leg to form a T-intersection.
- Construct an interchange at this location.
- Construct a roundabout at this location.
- Reconstruct TH 14/TH 15 to bypass New Ulm.

To date, the overhead flashers have been removed from the intersection. In 2003, Mn/DOT District 7 is currently planning to make additional improvements to this intersection including widening the eastbound right-turn lane for TH 14.

TH 14/CSAH 37

This intersection is a T-intersection connecting into New Ulm, with vehicles on CSAH 37 stopping to a through condition on TH 14. The current crash rate is 0.7 crashes/MEV, exceeding the critical crash rate of 0.6 crashes/MEV. The severity rate of 2.2 is above the expected rate for similar Minnesota intersections. Two-thirds of the crashes at this intersection occur when a vehicle is turning onto or off of CSAH 37 in front of an eastbound vehicle on TH 14. Further review indicated that from the stop sign on CSAH 37, motorists are able to see the oncoming vehicle ten seconds before the vehicle enters the intersection. No correlation of the crashes existed between the motorists' age, motorists' residence, time of day, or time of year. The crashes indicate motorists are having difficulty selecting a gap for left-turn movements.

TH 14/TH 111/CSAH 23

Located within the City of Nicollet, this intersection connects TH 111 and CSAH 23, making the only continuous north-south route with a river crossing between Mankato and New Ulm. The intersection had overhead flashers until September 2001 when they were replaced with Thru-STOP traffic control. Not enough time has elapsed to do an assessment of the current condition, so the review was completed when the overhead flashers were in place. The current crash rate is 2.2 crashes/MEV, exceeding the critical crash rate of 0.6 crashes/MEV and Mn/DOT's target IRC rate of 1.0 crashes/MEV. The severity rate at 2.2 is almost three times the expected rate. Over 90% of the crashes at this intersection were right angle crashes, much higher than the Minnesota average of 28% at urban intersections. Most right angle crashes occurred on the far side of the intersection when motorists were attempting to cross TH 14. The minor road is skewed at just below 30 degrees. The direction of the skew may make it difficult for motorists to see cross traffic.

4.1.2 Traffic Operations

The quality of traffic operations was evaluated using the Level-of-Service (LOS) criteria established by the Highway Capacity Manual and described in **Section 3.4.3**. The levels of traffic operations (capacity) along TH 14 were calculated for two measures: (1) highway segments and (2) highway intersections. The purpose of providing two separate analyses is because isolated intersections may operate poorly along highway segments that operate relatively well along the balance of the segment. Likewise, there may be several intersections that operate well, even when the segment as a whole is considered to be deficient.

The single most important factor in determining if the quality of traffic operations is considered to be acceptable or deficient is selecting the "index of congestion." By definition, this is a measure that defines delays higher than a certain level will be considered unacceptable, whereas delays lower than this level are considered acceptable. The index of congestion also provides design guidance for the peak hour in forecast (2025) conditions. In order to be considered acceptable, the peak hour LOS should be at or below the designated index of congestion. Mn/DOT has selected the LOS C/D boundary as the index of congestion for this corridor.

Existing and Future Travel Times

Mn/DOT's target goal for mobility for medium priority corridors is above 55 mph. The existing travel speeds in each growth segment are documented in **Table 4.1-2.** Existing travel speeds are currently deficient in Segments 1, 4, 6, and 7. Three of these segments are located in the Cities of Courtland and Nicollet in which a reduced speed is posted. Overall, the corridor is operating at a speed above Mn/DOT's target goal.

Future travel speeds were estimated using Mn/DOT's IRC methodology of assessing the congestion index and number of moderate and high risk potential signalized intersections to

reduce travel speeds. Based on these future estimates, the 2025 peak hour travel speeds are expected to drop to an average of 50 mph, which is below the 55 mph goal. The segments with the lowest travel speeds (Segments 3, 4, 6, and 7) are located within urban or urbanizing areas.

Table 4.1-2
Existing Year 2002 and Future Year 2025 Travel Times

Segment	2002 Travel Speed (mph)	2002 Performance	2025 Travel Speed (mph)	2025 Performance
1	55.0	Below	49.1	Below
2	60.7	At	50.8	Below
3	56.6	At	31.2	Below
4	41.9	Below	27.9	Below
5	59.8	At	57.7	At
6	53.5	Below	41.0	Below
7	53.0	Below	27.8	Below
8	58.8	At	55.5	At
Total	**57.3**	At	**50.2**	**Below**

Source: Howard R. Green Company

Deficient Corridor Segments

As documented in **Table 4.1-3**, the current weekday operations are generally at LOS C during the PM peak hour with two segments at LOS D. The forecast 2025 volumes are meant to reflect average weekday conditions. The 2025 forecast conditions are anticipated to operate below the LOS C/D goal for the whole corridor.

Under 2025 forecast conditions, all intersections are expected to operate at an acceptable level except for the intersection of TH 14/TH 15/CSAH 21 as shown in **Table 4.1-4.** This intersection will operate at a LOS F if signage remains as a thru-STOP. The intersection was also analyzed with the traffic control increased to a four-way stop; the intersection operates at LOS B.

Table 4.1-3
Segment Level-of-Service

Segment	Start Point (West)	End Point (East)	Typical Section	2000 Segment LOS	2025 Segment LOS
1	TH 15/CSAH 21	CSAH 37	2 Lane Rural	At	Below
2	CSAH 37	Zieske Road	2 Lane Rural	Below	Below
3	Zieske Road	CSAH 12	2 Lane Urbanizing	At	Below
4	CSAH 12	CSAH 25	2 Lane Urban	At	Below
5	CSAH 25	TH 99	2 Lane Rural	At	Below
6	TH 99	TH 111/CSAH 23	2 Lane Urbanizing	At	Below
7	TH 111/CSAH 23	CR 72	2 Lane Urban	Below	Below
8	CR 72	CSAH 6	2 Lane Rural	At	Below

Source: Howard R. Green Company

Table 4.1-4
Intersection Level-of-Service

Intersection of:		Location	Traffic Control	2002 Intersection Level of Service	2025 Intersection Level of Service
TH 14	TH 15 / CSAH 21	Rural	Thru Stop	Above	Below
			All Stop	Above	Above
TH 14	CSAH 37	Rural	Thru Stop	Above	Above
TH 14	CSAH 24	Courtland	Thru Stop	Above	Above
TH 14	TH 99	Nicollet	Thru Stop	Above	Above
TH 14	TH 111 / CSAH 23	Nicollet	Thru Stop	Above	Above
TH 14	CSAH 6	Rural	Thru Stop	Above	Above

Source: Howard R. Green Company

4.1.3 Access

One of the key factors affecting the quality of traffic operations (mobility) and the safety characteristics of the TH 14 corridor is highway access. This section of the plan briefly describes the basic principles of access management, why the management of access is important, and how the existing level of access along TH 14 compares to recommended values established by Mn/DOT.

The Principles of Access Management

Access management can be defined as "the process that provides access to land development while simultaneously preserving the effective flow of traffic and safety on the roadway system"[1]. Typically, a comprehensive access management plan would consist of two components – a traffic engineering/roadway design component and a land-planning component. The engineering/design component controls the location and manner in which vehicles turn on/off a road, while the land-planning component requires/encourages developers to include access management strategies in their land development projects.

The engineering component uses roadway design to strike a balance between providing a certain level of mobility for through traffic and reasonable opportunities for turning traffic to access adjacent properties. The relative priority assigned to mobility versus the competing need for access is dependent upon the functional classification of the roadway. The relationship between functional classification and access/mobility is depicted on **Figure 3.1-1**. The key concept illustrated on the figure is that principal arterials are expected to carry non-local traffic at high speeds under restricted access conditions.

The land-planning component involves the incorporation of access management strategies into local ordinances. This is done to insure that access management issues are adequately considered during the initial stages of planning land development projects. One way of doing this is by providing and adopting access guidelines and, in some cases, specific access plans for roadways so that developers know what access options are available when developing their property.

The basic principles of access management for a corridor similar to TH 14 include the following[2]:

- Consider access management strategies early in the land planning process.
- Incorporate access management strategies in all major highway development projects.
- Limit the total number of access points along a segment of roadway.
- Separate conflict points so that the influence areas of adjacent intersections do not overlap.
- Separate turning volumes from through traffic.

[1] *Access Management – A Synthesis of Research, Minnesota Local Research Board, 1999*
[2] *Access Management – A Synthesis of Research, Minnesota Local Road Research Board, 1999*

- Maintain a hierarchy of access.
- Provide sufficient spacing between at-grade signalized intersections.

Mn/DOT's Land Use and Access Management Section of the Office of Investment Management is currently in the process of creating an official access management manual containing access spacing guidelines. These guidelines are based on the general principles described above. More specifically, *Mn/DOT's Access Management Manual* (2002) states that *Mn/DOT's Access Spacing Guidelines* are based on four key objectives[3]:

1. Promote a hierarchical network of functionally classified roads.
2. Maintain mobility goals on Interregional Corridors.
3. Promote mobility on signalized arterials through signal progression.
4. Accommodate roadway design and geometric standards related to safety.

Mn/DOT's Access Spacing Guidelines and how they apply to the TH 14 corridor are discussed in more detail in the following sections concerning access management.

The Importance of Access Management

The discussion of the principles of access management explains why access management is important. The proliferation of unmanaged/unplanned accesses on a roadway can negatively impact roadway capacity, safety, and speed. Therefore, managing access can increase roadway capacity, reduce crash rates, and increase travel speeds. These benefits can lead to spin-off effects such as improved motorist satisfaction and even increased economic vitality.

There is ongoing research regarding the relationship of access management and improvements in travel speed and roadway capacity. Currently, the *Highway Capacity Manual* provides adjustment factors for a number of access management-related improvements that, when implemented, are expected to improve roadway capacity by 5-15%. However, ongoing research indicates that 40-60% reductions in vehicle delay and 50% improvements in travel speeds can be achieved by implementing the following access management strategies[4]:

- Increasing the average spacing between signalized intersections from one-quarter to one-half mile spacing.
- Reducing the total number of driveways and intersections along segments of roadway by diverting driveways to cross-streets, sharing driveways, or developing frontage roads.
- Providing systems of left-turn lanes.
- Minimizing conflicts at the remaining intermediate intersections by converting full access intersections to partial access designs (either three-quarter access or right-turn in/right-turn out).

[3] *DRAFT Access Management Manual, Mn/DOT Land Use and Access Management Section – Office of Investment Management, 2001*
[4] *Access Management – A Synthesis of Research, Minnesota Local Road Research Board, 1999*

The most documented benefit associated with the management of access is roadway safety. Recently, two research reports investigating the relationship between access management and roadway safety were prepared; one report was completed by the Iowa Department of Transportation and Mn/DOT completed the other report.

The Iowa report[5] focused on a before-and-after analysis of eight highway corridor reconstruction projects that included some type of access management features (i.e., medians, turn lanes, frontage roads, driveway modifications, etc.). The results of this study documented an average crash reduction of approximately 40%. The crash reduction was statistically significant at the 95% confidence level for seven of the eight cases studied.

The Mn/DOT report[6], similar to the Iowa report, examined a before-and-after analysis of three highway corridors. However, the main focus of the report was an analysis of the statistical relationship between crashes and access points on over 400 trunk highway segments covering more than 750 miles of roadway. Some of the key findings documented in this report include the following:

- There was an observed positive relationship between access density and crash rates in 10 of the 11 categories of roadways examined. This suggests that higher levels of access density result in higher crash rates.
- The before-and-after case studies of three access management-related reconstruction projects found an average crash reduction of approximately 44%. This reduction is very similar to the findings in the Iowa Report. The crash reductions in all three cases were statistically significant at the 95% confidence level.

The Iowa report examining the before-and-after effects of eight reconstruction projects also looked at some spin-off effects of access management. As part of the study, motorist opinion surveys were conducted that showed 90% to 100% support of the access management improvements. Drivers saw the improved roadways as safer and easier to use. The Iowa report also looked at state sales tax information to document two measures of economic vitality: business survival and retail sales. The data indicated that business survival in the eight case study corridors was better than in the respective communities as a whole. The data also showed that the access-managed corridors have 20% higher growth in retail sales than the respective communities and concluded that the corridors were thriving following reconstruction.

Identification of Access Deficiencies Along TH 14

As previously documented in Chapter 3 of this plan, there are 221 accesses over the approximately 22 miles of TH 14 in the study area. The access count was completed consistent with the methodology used in previous research studies sponsored by the Federal

[5] *Access Management Awareness Program Phase II Summary Report, Iowa Department of Transportation, 1997*
[6] *Statistical Relationship Between Vehicular Crashes and Highway Access, Minnesota Local Road Research Board, 1998*

Highway Administration (FHWA) and Mn/DOT. In short, the count method counts four-legged intersections as two access points and "T"-intersections as one access point. The 221 accesses can be summarized as follows:

- About 26% (57) are public roads.
- Almost 74% (164) are private roads.
- About 7% of all accesses (16) are commercial driveways.

The benefits of access management relative to roadway safety/mobility and the principles of a comprehensive access management program were previously documented. Based on these principles and because of safety and mobility improvements, Mn/DOT has developed a set of access spacing guidelines for principal arterials through collector roadways.

Table 4.1-5 provides a summary of Mn/DOT's access spacing guidelines for Medium Priority Interregional Corridors, similar to TH 14. The breakdown of each access category into subcategories is intended to allow for some variation in access based on adjacent land use and access type. Different spacing guidelines are listed for full movement accesses, partial or restricted movement accesses, signalized accesses, and private accesses.

For each access management category segment, **Table 4.1-6** compares the access density and the actual number of accesses by type currently in existence along the corridor to the expected values based on Minnesota's average access density and Mn/DOT's IRC Guidelines for medium priority corridors. The results were as follows:

- The access density in Segment 2 and Segment 4 were higher than the Minnesota average for similar roadways.
- The number of partial accesses was high in Segments 1, 2, 3, and 5. Although all of these segments are within the expected guidelines for full accesses.

All segments except for Segment 7 were higher in the number of private accesses according to the guidance. It should be noted that Mn/DOT along with Nicollet County and the City of Nicollet have made efforts to control access along this segment. Segment 4 through the City of Courtland has 60 private accesses.

Table 4.1-5
Summary of Access Spacing Guidelines (March, 2002)

Category	Area or Facility Type	Typical Functional Class	Intersection Spacing		Signal Spacing	Private Access
			Full Movement I/S	Restricted I/S		
2	**Medium Priority Regional Corridors**					
2A-F	Full Grade Separation	Principal Arterials	Interchange Access Only		⊘	⊘
2A	Rural ExUrban By Pass		1 mile	1/2 mile	**Strongly Discouraged** By Deviation Only	By Deviation Only
2B	Urban Urbanizing		1/2 mile	1/4 mile	**Strongly Discouraged** By Deviation Only	By Deviation Only
2C	Urban Core		300-660 feet dependent upon block length		1/4 mile	Permitted Subject to Conditions

Source: Mn/DOT Office of Investment Management

As noted in **Section 3.3.3** under the subsection ***Land Use***, development is planned in the following areas adjacent to TH 14:

- Within Nicollet, the area surrounding TH 14 from TH 99 to TH 111 is planned for commercial development.
- Within Nicollet, the southeast quadrant of TH 14/TH 111/CSAH 23 is planned as an industrial park.
- Within Nicollet, multi-family residential is planned near the City boundaries.
- In Courtland, the area near CSAH 24 is planned for commercial development.
- The TH 14 Corridor west of Courtland was defined as urbanizing, and is planned for commercial development.

Based on an assessment of development and risk of increased access problems, Segments 3, 4, 6, and 7 were rated as a high risk. Segment 7 was rated a moderate risk, and Segments 1, 2, 5, and 8 were rated a low risk. In addition, whenever and wherever development or re-development occurs, it is essential that coordination is pursued between community development interests and Mn/DOT concerning future access requests, in order to minimize the impact of these adjacent land uses on the functional objective of a roadway.

Table 4.1-6
Access Deficiencies Based on Minnesota Average Access Density and Mn/DOT's IRC Guidelines

Segment	Segment Type	Segment Length (Miles)	Total Number of Public Full Intersections	Total Number of Public Partial Intersections	Total Number of Signalized Intersections	Total Number of Private Accesses	Access Density (Accesses / Mile)	Higher than MN Average Access Density[1]	Access Higher than IRC Guidelines[2]
1	Rural Area	1.8	1	2	0	7	6	No	**Yes**
2	Rural Area	3.8	1	5	0	29	10	**Yes**	**Yes**
3	Urbanizing Growth Area	0.4	0	1	0	2	7	No	**Yes**
4	Urban Growth Area	1.2	3	4	0	60	58	**Yes**	**Yes**
5	Rural Area	6.5	4	3	0	29	6	No	**Yes**
6	Urbanizing Growth Area	0.6	0	1	0	0	2	No	No
7	Urban Growth Area	0.6	1	3	0	6	19	No	**Yes**
8	Rural Area	6.8	7	4	0	31	7	No	**Yes**
Total		**21.6**	**17**	**23**	**0**	**164**	**10**		

Notes:
[1] Minnesota's average access is 8 accesses per mile in rural areas and 28 accesses per mile in urban areas.
[2] Mn/DOT's IRC Access Management Guidelines for medium priority IRC's are shown on **Table 4.1-6**.

Source: Howard R. Green Company Company

4.1.4 Signal Risk

As documented in previous sections, the assessment of future signal proliferation is one of the components used to estimate future levels of congestion and travel times. In order to estimate the signal risk at each at-grade intersection along the TH 14 corridor, Mn/DOT has developed criteria to be used based on volume on the mainline. To further refine these criteria, additional criteria to be used based on volume on the mainline. To further refine these criteria, additional criteria relating to functional classification and traffic volumes on cross-streets (and the satisfaction of signal warrants) was used. The criteria used to estimate signal risk are documented in **Table 4.1-7**

Table 4.1-7
Criteria for Assessment of Signal Risk

Signal Risk	Functional Classification	Minor Street ADT	Likely Signal Warrants Satisfied [1]
Low	Local Street	0-2500	None
Moderate	Collector	2501-4000	One Warrant
High	Arterial	> 4001	Two Warrants

Notes: 1) Based on ADT estimate of MMUTCD signal warrants

Source: Mn/DOT and Howard R. Green Company

The signal risk evaluation of the at-grade crossing can be seen in **Table 4.1-8**. As shown, signal risk is high at the following intersections:

- TH 14/TH 15/CSAH 21.
- TH 14/CSAH 37.
- TH 14/TH 111/CSAH 23.

Intersections with a moderate risk for signalization include:

- TH 14/CSAH 24/4th Street.
- TH 14/TH 99.

Table 4.1-8
Signal Risk for At-Grade Crossings of TH 14

Intersection with:	Functional Classification	Yr 2000 AADT	Yr 2000 Probablity of Future Signal Installation	Yr 2025 Projection	Yr 2025 Probablity of Future Signal Installation	Expected Yr for Signal Installation
TH 15 West	Principal Arterial	8000	MODERATE	12530	HIGH	Expected to move from moderate to high risk near Yr 2003
TH 15 North	Principal Arterial	3900		6110		
CSAH 21 East	Urban Collector	950		1490		
T 92	Local Road	NA	LOW	NA	LOW	-
CSAH 37	Minor Arterial	5500	HIGH	9830	HIGH	Currently high risk
T 97	Local Road	NA	LOW	NA	LOW	-
T 150	Local Road	NA	LOW	NA	LOW	-
T 155	Local Road	NA	LOW	NA	LOW	-
T 156	Local Road	NA	LOW	NA	LOW	-
Zieske Street	Local Road	NA	LOW	NA	LOW	-
CSAH 12	Urban Collector	355	LOW	600	LOW	-
5th Street	Local Road	NA	LOW	NA	LOW	-
CSAH 24 South	Urban Collector	1500	LOW	2530	MODERATE	Expected to move from low to moderate risk near Year 2018
4th Street North	Local Road	NA		NA		
3rd Street	Local Road	NA	LOW	NA	LOW	-
2nd Street	Local Road	NA	LOW	NA	LOW	-
1st Street	Local Road	NA	LOW	NA	LOW	-
Fiemeyer Drive	Local Road	NA	LOW	NA	LOW	-
	Local Road	NA	LOW	NA	LOW	-
CSAH 25	Local Road	310	LOW	550	LOW	-
CSAH 11 North	Minor Collector	115	LOW	204	LOW	-
CSAH 11 South	Minor Collector	215		380		-
T 101	Local Road	NA	LOW	NA	LOW	-
T 166	Local Road	NA	LOW	NA	LOW	-
T 169	Local Road	NA	LOW	NA	LOW	-
T 173	Local Road	NA	LOW	NA	LOW	-
TH 99	Minor Arterial	1950	LOW	3550	MODERATE	Expected to move from low to moderate risk near Year 2007
CSAH 23 South	Urban Collector	1150	MODERATE	2120	HIGH	Expected to move from moderate to high risk near Year 2018
TH 111 North	Minor Arterial	2600		4690		
Elm Street	Local Road	900	LOW	1620	LOW	-
CR 72	Local Road	345	LOW	620	LOW	-
T 217	Local Road	NA	LOW	NA	LOW	-
T 179	Local Road	NA	LOW	NA	LOW	-
T 104	Local Road	NA	LOW	NA	LOW	-
T 110	Local Road	NA	LOW	NA	LOW	-
CSAH 25	Minor Collector	80	LOW	140	LOW	-
CSAH 25	Minor Collector	400		720		-
CSAH 17	Local Road	315	LOW	570	LOW	-
CR 77	Local Road	55		100		-
T 120	Local Road	NA	LOW	NA	LOW	-
CSAH 6 East[1]	Urban Collector	1000	LOW	1830	LOW	-
CSAH 6 West[1]	Minor Collector	1250		2290		

Notes:
[1]Future projection on this roadway does not include possible development in North Mankato.

Source: Howard R. Green Company

4.1.5 Roadway Design/Geometrics

A review of the existing highway design/geometrics was performed to identify locations that were inconsistent with current Mn/DOT design standards. There are two categories of highway design standards: critical design elements, and general design elements. Any inconsistencies with the highway design standards would, at some level, violate drivers' expectations. Substandard highway geometrics would also have an adverse impact on traffic operations and roadway safety.

In general, TH 14 is classified as a rural two-lane arterial highway. The posted speed is generally 55 mph. This would likely indicate the design speed is 60 mph for the highway. This information is necessary for determining the appropriate design standards to compare to the existing highway.

Critical Design Elements

The critical design elements are the most important design features to both the Federal Highway Administration (FHWA) and Mn/DOT. New construction/reconstruction design standards for the critical design elements were researched and compared to the existing corridor characteristics to find any deficiencies. The critical design elements, as found in Section 2-6.0 in the *Mn/DOT Road Design Manual (RDM)*, include:

- Design Speed
- Stopping Sight Distance
- Grades
- Horizontal Alignment
- Vertical Alignment
- Cross Slopes
- Super Elevation
- Lane Width
- Shoulder Width
- Structural Capacity on Bridges
- Bridge Width
- Vertical Clearance
- Horizontal Clearance to Obstruction

The speed limit changes to less than 55 mph through the Cities of Nicollet and Courtland. In addition, the highway characteristics also change from rural to urban through these two communities. The design standards for urban, low speed, two-lane highways are met through these two towns. However, there is the departure from the rural design speed of 60 mph that is otherwise prevalent throughout the remainder of the corridor. Therefore, this may be considered a design speed deficiency and would have an effect on the other design elements through these two towns.

The horizontal alignment contains one curve that does not meet the 60 mph design speed. This curve is the first horizontal curve to the east of the TH 14/TH 15 intersection. The curve radius is approximately 1,130 feet, sufficient for the 55 mph posted speed limit. The curve also leads into a Thru-STOP controlled intersection so traffic is accelerating from the intersection or decelerating towards the intersection, reducing the effect of the horizontal curve.

The vertical grades for the corridor are mostly flat. However, the grades are steeper as the highway ascends from the Minnesota River Valley towards the City of Courtland. The grades in this area range from 2.5 to 3.3 percent. Most of the corridor can be characterized as having a flat terrain and therefore the grade would exceed the design maximum of 3 percent. However, this area of the highway could be characterized as having a rolling terrain and therefore would meet the design maximum of 4 percent.

General Design Elements

The general design elements are design features that are common on most projects. Some of these elements would include drainage, intersections, medians, sight distances, and turn lanes. A more extensive list of some of the general design elements can be found in Section 2-6.0 of the *Mn/DOT RDM*.

Center medians are present in three separate locations along the corridor. Two of these locations consist of raised concrete medians. These are somewhat unique in that they are typically an urban highway design feature within a rural highway setting. The raised concrete medians provide channelization at intersections and appear to meet minimum widths. The third location consists of a depressed grass median near the City of Nicollet. Turning vehicles from the side roads must make their turns as one movement at all three locations. There is insufficient room in the median area to store a vehicle making a two-step turning movement.

Several intersections were found to have poor geometry on their approaches to TH 14. These approaches had geometry that resulted in adverse skew angles and compromised intersection decision sight distance.

Left and right turn lanes are present at many of the intersections throughout the corridor. However, they are not located at all intersections. Turn lanes can provide important safety and operations benefits to an intersection and corridor. This is particularly true at intersections where safety deficiencies have been identified. The lack of turn lanes, especially left-turn lanes can be a major contributing factor to rear-end type crashes. Turn lanes are not necessarily warranted at all locations. They are only necessary for those intersections with higher turning volumes and previous crash histories. The crash analysis, as documented in **Section 4.1.1** Deficient Corridor Segments, indicates that only one area, Segment 3, the urbanizing area west of Courtland, would benefit from the addition of left-turn lanes. A plan for providing left-turn lanes at the other intersections along the corridor should be considered. This plan might begin with providing turn lanes at the highest priority

roads, such as County Roads. Then continuing in a way that would include city streets, township roads, and commercial/residential driveways as needed.

Summary

A summary of the existing highway design deficiencies is documented in **Table 4.1-9**.

4.1.6 Local and Supporting Roadway System Deficiencies

The components of a local and supporting road system are described in **Section 3.4.10**. This is followed by the identification of the components that are present in the TH 14 corridor. This section examines the sufficiency of the local and supporting road system in the corridor and documents any deficiencies present in the system.

A review of the functionally classified road system in the study area revealed that there are north-south and east-west minor arterials and collectors roughly spaced at regular intervals. To the north and south of TH 14, there are major roadways that run parallel to the highway for the length of the corridor. As a result, there does not appear to be supporting roadway deficiencies along the majority of the corridor, only in the Cities of Courtland and Nicollet.

Local and supporting roadway deficiencies have been identified within the Cities of Courtland and Nicollet. Within Courtland, a high concentration of direct private and public access to both sides of TH 14 indicates that there is a lack of an effective frontage road system to serve the direct access function in place of TH 14. These frontage road deficiency areas within Courtland are depicted on **Figure 4.1-1**. This figure also shows there is a lack of a connection in Courtland that would create a parallel roadway connecting CSAH 24 in Courtland to CSAH 23 south of Nicollet. This effectively limits the travel options between Courtland and Nicollet to TH 14. For vehicles traveling north-south through Courtland across TH 14, there are no effective options to complete this trip without traveling for a short distance on the highway. **Figure 4.1-1** also shows that, south of TH 14 in Nicollet, the concentration of direct private access on the highway indicates there is a lack of an effective frontage road system in this area.

The future land use plans for both Nicollet and Courtland depict proposed new roadway accesses to existing TH 14. Efforts should be made to minimize the creation of new "T" intersections on TH 14 resulting from these proposed roadway connections. This can be completed by aligning new roadway connections to TH 14 across from existing "T" intersections.

The Courtland land use plan shows the realignment of TH 14 to the north. The creation of bypasses of the city centers of Courtland and/or Nicollet would alleviate most of the local and supporting road system deficiencies in the short term. However, in order to ensure the long-term effectiveness of any bypass(es) proposed for the two communities, a supporting road network should be planned for the future, in conjunction with any bypass plans. That way, direct access to the bypasses can be limited to public roads at regularly spaced intervals. Doing this would maximize the safety and mobility of travel on TH 14.

Table 4.1-9
Existing Geometric Deficiencies on TH 14 IRC

Deficiency	Location	Description
Design Speed	Cities of Courtland and Nicollet	Speed Zones in these cities do not meet the IRC goal of 55 mph (See Section 4.1.2 Existing & Future Travel Times)
Horizontal Curvature	East Leg of TH 14 to MNTH 15	Curve radius does not meet 60 mph design speed, however meets 55 mph posted speed limit
Vertical Grades	East of New Ulm, Minnesota River Valley	Above 3% max for Flat Classification, In range for Rolling Classification
Poor Sight Distance	CSAH 21	Enters mainline on inside of curve
Poor Sight Distance	CSAH 37	Horizontal and Vertical Curves to west limit sight distance to approximately 10 seconds
Poor Sight Distance/High Intersection Skew Angle	T-92, T-150, T-155, Zieske Rd., CSAH 12, CSAH 24, MNTH 99, MNTH 111, Pine St., Elm St., CSAH 72, TC-217, T-179, T-104, T-110, CSAH 25, TC-318, CSAH 17, T-120, CSAH 6 and Various Driveways	Skew Angle approaching or above upper limit, creates poor driver sight line
Lack of Left Turn Lanes	T-92, T-155, T-156, Zieske Rd., CSAH 12, Downtown Courtland, Fiemeyer Dr., T-91, CSAH 25, CSAH 21, T-101, T-166, T-169, T-173, CR-72, TC-217, T-179, T-104, T-110, CSAH 25, TC-318, CSAH 17/CR 71, T-120	Further review of Intersection Crash History and Traffic Volumes needed

Source: Howard R. Green Company using Mn/DOT Design Guidelines.

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Courtland

High concentration of direct private access to TH 14 indicates there is a lack of an effective frontage road system.

Lack of a direct connection across TH 14 requires north-south travelers through Courtland to travel on TH 14.

There is a gap in the parallel roadway (CSAH 25) connecting Courtland to Nicollet.

Nicollet

High concentration of direct private access to TH 14 indicates there is a lack of an effective frontage road system.

New Ulm

Courtland

Nicollet

North Mankato

MINNESOTA RIVER

Legend

- U.S. and Minnesota Highways
- County State Aid Highways
- County, Township, and Local Roads
- Railroads
- Streams
- Lakes
- State Parks
- Counties
- Municipalities
- Frontage Road Deficiency Areas
- Parallel Road Deficiency Areas
- "Across Highway" Deficiency Areas

N

0 1 2 3 4 5 Miles

Source: Minnesota Department of Transportation and Howard R. Green Company

14 West Interregional Corridor:
North Mankato to New Ulm

Figure 4.1-1
Local and Supporting Road Deficiencies

4.2 SUMMARY OF DEFICIENCIES

A comprehensive analysis of the TH 14 Corridor identified safety, traffic operations, access, and roadway design deficiencies. A summary of the deficiencies and issues that were identified include:

- Lack of passing zones
- High crash rates at three intersections
- Increased traffic congestion forecast for the whole corridor as a result of high traffic volumes, high percentage of trucks, and geometric deficiencies
- Difficulty meeting Mn/DOT's IRC performance target of 55+ mph in the future
- Decreasing ability to meet Mn/DOT's access management guidelines, especially in the Cities of Courtland and Nicollet
- Risk of signal proliferation
- High percentage of trucks using the roadway passing through the Cities of Courtland and Nicollet
- Concern that TH 14 through-traffic could negatively impact community cohesiveness in the Cities of Courtland and Nicollet

Each of the eight roadway segments has at least two deficiencies (out of a total of 13 possible categories), one segment had ten deficiencies, two segments had nine deficiencies, one segment had seven deficiencies, one segment had six deficiencies and two segments had three deficiencies. A segment-by-segment summary of deficiencies is presented is **Figure 4.2-1**.

Therefore, during the alternatives identification and evaluation process the following needs should be considered:

- Provide additional opportunities for safe passing
- Provide intersection geometry and roadway design that have the potential to reduce the number of crashes on the roadway and at intersections
- Maintain mobility on the roadway by limiting the number of traffic signals and managing access
- Provide roadway capacity to accommodate forecast traffic volumes and meet Mn/DOT's IRC performance target
- Maintain community cohesiveness
- Provide reliable travel times for freight haulers
- Maintain year round 10-ton status of roadway.

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Summary of Deficiencies

Nicollet County

Brown County

New Ulm

Courtland

Nicollet

North Mankato

MINNESOTA RIVER

SWAN LAKE

MIDDLE LAKE

MIDDLE LAKE

Deficiencies	Growth Segment 1	2	3	4	5	6	7	8
	TH 15 / CSAH 21 East of New Ulm to CSAH 37 East of New Ulm	CSAH 37 East of New Ulm to Zieske Road West of Courtland	Zieske Road West of Courtland to CSAH 12 in Courtland	CSAH 12 in Courtland to CSAH 25 East of Courtland	CSAH 25 East of Courtland to TH 99 in Nicollet	TH 99 in Nicollet to TH 111 / CSAH 23 in Nicollet	TH 111 / CSAH 23 in Nicollet to CSAH 72 East of Nicollet	CSAH 72 East of Nicollet to CSAH 6 West Mankato
Existing Segment Level of Service		■					■	
Future Segment Level of Service	■	■	■	■	■	■	■	■
Existing Intersection Level of Service								
Future Intersection Level of Service	■							
Existing Segment Safety	■							
Existing Intersection Safety	■	■					■	
Existing Mobility	■			■		■	■	
Future Mobility	■	■	■	■		■	■	
MnDOT Access Averages		■		■				
IRC Access Guidelines	■	■	■	■	■		■	■
No-Passing Zones	■	■			■	■	■	
Signal Proliferation	■	■		■		■	■	
Geometric Deficiencies	■	■		■		■	■	
Total Number of Deficiencies	10	9	3	7	3	6	9	2

Legend

- U.S. and Minnesota Highways
- County State Aid Highways
- County, Township, and Local Roads
- Railroads
- Streams
- Lakes
- State Parks
- Counties
- Municipalities

N

- 2 Deficiencies
- 3 Deficiencies
- 6 Deficiencies
- 7 Deficiencies
- 9 Deficiencies
- 10 Deficiencies

0 1 2 3 4 5 Miles

Source: Minnesota Department of Transportation and Howard R. Green Company

Moving Minnesota

14 West Interregional Corridor:
North Mankato to New Ulm

Figure 4.2-1
Summary of Deficiencies