

APPENDIX B

Technical Memorandum 5: Alternatives Development, Evaluation and Selection of Preferred Alternative

TECHNICAL MEMORANDUM 5 – ALTERNATIVES DEVELOPMENT, EVALUATION AND SELECTION OF PREFERRED ALTERNATIVE

JANUARY 28, 2009

INTRODUCTION

This technical memorandum describes the alternatives development and evaluation process and selection of the Preferred Alternative interchange types for Highway 169 from Elk River to Zimmerman.

The *Highway 101/169 CMP* (2002) determined that Highway 169 from TH 10 through Zimmerman must be converted to a freeway facility in order to meet IRC mobility goals, improve operations, and improve safety. The alternatives development process for the Highway 169 project through Elk River and Zimmerman involved the consideration of Highway 169 cross sections and vertical alignments as well as interchange and local access alternatives as described below.

The evaluation of interchange concepts and the identification of preferred interchange types throughout the project corridor was a collaborative effort that included input from Mn/DOT staff, Local Advisory Committees (Elk River, Livonia, Zimmerman, and Sherburne County staff) and local officials. Input from the public and business community throughout the project development process was also important in identifying preferred alternative interchange types.

ALTERNATIVES DEVELOPMENT AND EVALUATION

NO BUILD ALTERNATIVE

The No Build Alternative would maintain Highway 169 as an at-grade expressway with no changes in access from the Highway 10/101/169 interchange in Elk River to the 273rd Avenue intersection in Zimmerman. The No Build Alternative would not address the purpose and need of the project as described below, and is not identified as the preferred alternative for the project.

- The No Build Alternative would not address safety concerns along Highway 169. Maintaining the existing number of at-grade access points along the highway would perpetuate turning movement conflicts that contribute to the crash and severity rates observed on Highway 169.
- The No Build Alternative would not address traffic operations on Highway 169. A majority of intersections evaluated on Highway 169 from Elk River to Zimmerman are projected to operate at an unacceptable LOS D or worse under year 2030 No Build conditions.
- The No Build Alternative would not provide adequate capacity to accommodate future traffic volumes on Highway 169. Future ADTs on Highway 169 are forecast to range from 77,000 in Elk River to 49,000 in Zimmerman. The increased traffic volumes will result in congestion throughout the project corridor.

- The No Build Alternative would not meet travel speed performance goals for a High Priority IRC as identified by the *IRC Study*. The travel speed performance goal for a High Priority IRC is 60 mph. The travel speed for the Highway 169 corridor from Elk River to Zimmerman under future (2025) No Build conditions, based on studies completed with the *Highway 101/169 CMP* (2002), is predicted to be 26.2 mph, below the performance goal for High Priority IRCs.
- The No Build Alternative would perpetuate the 44 existing access points along Highway 169 in Elk River, Livonia Township, and Zimmerman, which is inconsistent with Mn/DOT guidelines for principal arterial/High Priority IRCs.

The No Build Alternative was used as the basis for comparison of social, economic, and environmental impacts of the Preferred Alternative.

ALTERNATIVES DEVELOPMENT AND EVALUATION HIGHWAY 169 CORRIDOR

1. Highway 169 Design Concept

The *Highway 101/169 CMP* (2002) evaluated several design concepts for the Highway 169 corridor. These concepts included a six-lane expressway alternative, a four-lane freeway alternative, and a six-lane freeway alternative (Highway 10 to 197th Avenue through Elk River). The CMP included traffic analyses documenting that an expressway facility will not meet target speed performance criteria for a High Priority IRC, and that signalized intersections would operate at an unacceptable LOS F under future conditions. In addition, an expressway facility would not enhance safety because at-grade intersections would remain in-place.

The analysis documented in the CMP determined that conversion of Highway 169 to a freeway facility from Elk River to Zimmerman is necessary from to meet High Priority IRC performance targets. Conversion of Highway 169 to a freeway facility through Elk River to CSAH 4 in Zimmerman will address the transportation need as identified in the CMP and as summarized below.

- **Safety:** Eliminating the at-grade signalized intersections through Elk River, conversion of Highway 169 from at-grade expressway facility to a grade-separated freeway facility, and eliminating the at-grade intersection at CSAH 4 in Zimmerman will meet safety goals and enhance safety. In general, freeway facilities are safer than expressway facilities because intersecting roadways are grade-separated. The proposed Highway 169 freeway facility will eliminate conflicting movements at at-grade intersections and eliminate at-grade access points.
- **Traffic Operations:** Conversion of Highway 169 to a freeway facility will eliminate at-grade intersections through Elk River and Zimmerman. As such, delays and congestion associated with at-grade intersections will be eliminated with conversion to a freeway facility. As shown in Table 1 below, the Highway 169 freeway is forecast to operate at an acceptable level of service C under future Build conditions.

- **Mobility (IRC Performance Targets):** Conversion of Highway 169 to a freeway facility will eliminate at-grade signalized intersections and subsequently, will eliminate the major performance problems created by the delays and congestion associated with the existing at-grade signalized intersections. Under future Build conditions, Highway 169 as a freeway facility is forecast to meet travel speed performance criteria for High Priority IRCs as shown in Table 1.

**TABLE 1
HIGHWAY 101/169 CMP – HIGHWAY 169 FREEWAY PERFORMANCE ⁽¹⁾**

Location Along Highway 169 Corridor	Four-Lane Freeway		Six-Lane Freeway	
	Speed (mph) (Year 2025)	LOS (Year 2025)	Speed (mph) (2025)	LOS (2025)
Highway 10 to warning flasher north of 197th Avenue	61	D	64	C
Warning flasher north of 197th Avenue to North Elk River city limits	67	C	N/A	N/A
North Elk River city limits to warning flasher south of Zimmerman	NC	C	N/A	N/A
Warning flasher south of Zimmerman to warning flasher north of Zimmerman	67	C	N/A	N/A

N/A = not applicable

NC = Speed performance for this portion of the project area was 69 mph under future No-Build conditions. As such, speed performance was not calculated for future Build conditions.

⁽¹⁾ Adapted from Table 4-3 and Table 4-5 of the *TH 101-TH 169 Corridor Management Plan* (April 2002).

- **Access:** Conversion of Highway 169 to a freeway facility will eliminate all existing at-grade access to Highway 169. Access to Highway 169 will be accommodated at grade-separated interchanges connected by a system of frontage roads east and west of Highway 169. Existing local roads and the proposed frontage road system would maintain accessibility to parcels where existing at-grade access is eliminated. Removal of all at-grade access with conversion to a freeway facility is consistent with Mn/DOT guidelines for High Priority IRCs and principal arterial roadways.

2. Urban Elk River: Freeway Cross Section, Interchange Spacing, and Operations

Freeway Cross Section

As described in the *Highway 101/169 CMP* (2002), the speed performance of a four-lane freeway facility (two lanes in the both the north- and southbound directions) through the urban Elk River segment is near the High Priority IRC speed performance goal of 60 mph. As acknowledged in the CMP, the conversion of Highway 169 from the existing signalized at-grade expressway to a four-lane freeway facility is “a reasonable first-step to address long-term mobility needs.”

However, the *Highway 101/169 CMP* (2002) also considered a six-lane freeway facility (three lanes in both the north- and southbound directions) on Highway 101 and Highway 169 through Elk River to 197th Avenue. As shown in Table 10 above, there is the potential for some congestion with the four-lane freeway as the urban Elk River segment (Highway 10 to 197th Avenue) is forecast to operate at LOS D under future Build conditions. The six-lane freeway is forecast to operate at LOS C with speed performance above the goal for a High Priority IRC. The six-lane freeway represents an option for improving the Highway 169 corridor through Elk River with less congestion under future Build conditions relative to the four-lane freeway.

The ultimate, long-term vision for Highway 169 through urban Elk River (Highway 101 and the Highway 10/101/169 interchange to 197th Avenue) is a six-lane section. A six-lane section provides adequate capacity to accommodate forecast traffic volumes and provides a greater margin to absorb increases in future travel demand. It is feasible to accommodate a phased approach for this section of the project corridor. Highway 169 would first be constructed as a four-lane freeway facility, with conversion to a six-lane facility in the future when warranted. The proposed design has been engineered to accommodate initial construction as a four-lane section with expansion to a six-lane facility through urban Elk River when warranted.

Interchange Spacing and Freeway Operations

In the urban Elk River segment of the project area, the location of Highway 169 access points also played a role in determining the Highway 169 design necessary to accommodate future traffic volumes at an acceptable level of operation. The existing interchange spacing along Highway 101 from CSAH 39 in Otsego to Highway 10/101/169 in Elk River is less than one mile. Through the urban Elk River segment of the project area, intersecting cross streets along Highway 169 (Main Street, School Street, Jackson Avenue/193rd Avenue, 197th Avenue) are located less than one mile apart from one another. The distance between intersecting cross streets on Highway 169 is summarized below.

- CSAH 39 (Otsego) to Highway 10/101/169: 0.8 miles (4,200 feet)
- Highway 10 to Main Street: 0.9 miles (4,700 feet)
- Main Street to School Street: 0.6 miles (3,200 feet)
- School Street to Jackson Avenue/193RD Avenue: 0.7 miles (3,500 feet)
- Jackson Avenue/193rd Avenue to 197th Avenue: 0.5 miles (2,600 feet)

Mn/DOT has established access guidelines for high priority IRC and principal arterial roadways. Mn/DOT access guidelines recommend that high priority IRCs such as Highway 169 be grade-separated facilities, with interchange access at select locations. According to Mn/DOT access spacing guidelines, typical interchange spacing in urban and urbanizing areas is a minimum of one mile. Interchange access points, without mainline auxiliary lanes, should ideally be spaced at least one mile apart to provide for lane changes associated with entering and exiting traffic between adjacent interchanges (i.e., weave movements). The following describes the Highway 169 mainline evaluation process with respect to interchange locations and mainline operations (i.e., weave movements).

Highway 101: CSAH 39 to Highway 10/101/169 Interchange

Design concepts were evaluated for the Highway 10/101/169 interchange to accommodate free-flow conditions for all movements at the interchange. Initially, the proposed project was to terminate at Highway 10 and the Highway 10/101/169 system interchange. However, during development of Highway 10/101/169 interchange concepts, operational problems were identified because of the forecast volumes for weave movements on Highway 101 between CSAH 39 and Highway 10, and the spacing between the Highway 10/101/169 interchange and the CSAH 39 interchange south of the Mississippi River in Otsego.

As such, the project was expanded to the south to CSAH 39 to evaluate weave movements between CSAH 39 and the Highway 10/101/169 interchange. Each of the Highway 10/101/169 interchange concepts included an exit ramp from westbound Highway 10 to southbound Highway 101 tying in to the Mississippi River bridge along the north side of the river. However, several concepts were considered for the exit ramps from northbound Highway 101 to east- and westbound Highway 10 ramps. In order to accommodate the northbound Highway 101 to east- and westbound Highway 10 free-flow movements, several design concepts were considered:

- Flyover ramp from northbound Highway 101 to westbound Highway 10 combined with an exit ramp from northbound Highway 101 to eastbound Highway 10. This flyover and exit ramp would diverge from northbound Highway 101 south of the Mississippi River and require a parallel bridge over the river. Under this concept, the weave distance between the CSAH 39 entrance ramp and Highway 10 exit ramps is less than 500 feet.
- Flyover ramp from northbound Highway 101 to westbound Highway 10 combined with an exit ramp from northbound Highway 101 to eastbound Highway 10. This flyover and exit ramp would diverge from northbound Highway 101 from the existing Mississippi River bridge north of the Mississippi River. Under this concept, the weave distance between the CSAH 39 entrance ramp and Highway 10 exit ramps is approximately 1,500 feet. The intent with this concept was to increase the weave distance between CSAH 39 and Highway 10 ramps.
- Loop ramp from northbound Highway 101 to westbound Highway 10 in the northeast quadrant of the Highway 10/101/169 interchange and exit ramp from northbound Highway 101 to eastbound Highway 10. The exit ramp to eastbound Highway 10 would diverge north of the Mississippi River. Under this concept, the weave distance between the CSAH 39 entrance ramp and Highway 10 exit ramps is approximately 1,500 feet. The intent with this concept was to increase the weave distance while also providing additional space for westbound Highway 10 traffic to sort out with northbound Highway 101/169 traffic.

The intent of this process was to analyze the weave movements between CSAH 39 traffic entering northbound Highway 101 and northbound Highway 101 traffic exiting to Highway 10 (east- and westbound) and to analyze the weave movement between Highway 10 traffic entering southbound Highway 101 and southbound Highway 101 traffic exiting to CSAH 39. The three concepts listed above for northbound Highway 101 were considered with and without an auxiliary lane. The southbound movement was considered with

and without an auxiliary lane. Operational levels of service were computed for the weave movements during the a.m. and p.m. peak hours. The results of this weave analysis (level of service) are shown in Table 2.

The results of this analysis show that while an auxiliary lane on southbound Highway 101 across the Mississippi River to CSAH 39 would provide an acceptable level of service for weave movements in the a.m. and p.m. peak hours, an acceptable level of service could not be met for the northbound weave movement with the alternative concepts identified above. While an auxiliary lane on northbound Highway 101 would operate at LOS B during the a.m. peak hour, the weave movement would operate at an unacceptable LOS E during the p.m. peak hour, even with an increased weave distance (see Table 2).

**TABLE 2
HIGHWAY 101 OPERATIONS: WEAVE ANALYSIS (CSAH 39 TO HIGHWAY 10/169)**

Weave Distance (CSAH 39 to Hwy 10/101/169)	Build (2030) Conditions ⁽¹⁾			
	Northbound Hwy 101		Southbound Hwy 101	
	No Auxiliary Lane AM Peak (PM Peak)	With Auxiliary Lane AM Peak (PM Peak)	No Auxiliary Lane AM Peak (PM Peak)	With Auxiliary Lane AM Peak (PM Peak)
<500' (CSAH 39 entrance to Hwy 10 exit)	D (F)	C (F)	--	--
1,500' (CSAH 39 entrance to Hwy 10 exit) (with NB 101 to WB 10 flyover ramp)	C (F)	B (F)	--	--
1,500' (CSAH 39 entrance to Hwy 10 exit) (with NB 101 to WB 10 flyover ramp)	C (F)	B (E)	--	--
1,525' (WB Hwy 10 exit to CSAH 39 exit)	--	--	E (C)	C (B)
Braided Ramp Alternative ⁽³⁾	N/A	N/A	N/A	N/A

⁽¹⁾ Assumes Highway 101 is a six-lane section from CSAH 39 to Highway 10/169.

⁽²⁾ LOS for weave movements on Highway 101 between CSAH 39 and the Highway 10/101/169 interchange. LOS D or better is considered acceptable. LOS E and F are considered unacceptable.

⁽³⁾ Weave analysis level of service not applicable for braided ramp alternative because it eliminates the weave movement between NB Highway 101 to Highway 10 traffic and CSAH 39 to NB Highway 101 traffic.

In order to address the weave movement operations for northbound Highway 101, a braided ramp concept was developed (see Figure 4A, Appendix A). Under the braided ramp concept, CSAH 39 entrance traffic would bridge over exiting traffic and merge into northbound Highway 101 at the Mississippi River bridge. Northbound Highway 101 traffic exiting to Highway 10 (east- and westbound) would exit Highway 101 between CSAH 39 and the Mississippi River, cross the river on a bridge parallel to the mainline bridge, and diverge to the east- and westbound Highway 10 ramps north of the river. A ramp would connect the CSAH 39 entrance ramp to the Highway 10 exit ramp before the ramp braid to accommodate the movement from CSAH 39 to east- or westbound Highway 10.

TRUNK HIGHWAY 169 PRELIMINARY DESIGN AND ENVIRONMENTAL DOCUMENTATION

While this concept would potentially have greater construction costs because of the additional bridges, it is consistent with transportation goals for the project because it addresses traffic operations associated with the weave movement between CSAH 39 and Highway 10. While it would also require a new structure in the Mississippi River, the structure is within the existing Highway 101 crossing corridor. The braided ramp concept eliminates the weave movement for entering and exiting traffic between CSAH 39 and Highway 10. As such, delays and congestion associated with the weave movement would be eliminated with the braided ramp concept. Because it was considered more important to accommodate the weave movements at acceptable levels of service, increased costs represented a trade-off to the transportation goals of the project.

The Highway 101 braided ramp design and Highway 10/101/169 interchange design is illustrated in Figure 4A, Appendix A. Additional detail regarding the Highway 101 weave analysis can be found in the traffic operations technical memorandum.

In addition to the challenges presented by the Highway 101 corridor from the Highway 10/101/169 interchange and Mississippi River crossing to CSAH 39 in Otsego, the Highway 169 corridor in Elk River also presented unique challenges because of the interchange spacing noted above. The project development process for Highway 169 through urban Elk River is described below.

Highway 169: Urban Elk River Segment

The interchange development process initially included the evaluation of overpasses only (e.g., School Street) and partial access only (e.g., 193rd Avenue/197th Avenue) to accommodate a corridor that would be consistent with the *Highway 101/169 CMP* (2002) recommendations and consistent with Mn/DOT interchange spacing guidelines. However, the in-depth traffic analysis that was completed as part of the project development process showed that providing Highway 169 access at select locations identified in the CMP resulted in overloading these interchanges (i.e., unacceptable levels of traffic operations). As such, interchange concepts were identified that would provide Highway 169 access at Main Street, School Street, Jackson/193rd Avenue and a partial access at 197th Avenue. While interchanges at these locations may not be consistent with Mn/DOT access guidelines, it allows for better distribution of traffic throughout the transportation network in Elk River, resulting in acceptable interchange operations. Options were then explored to mitigate the access spacing and weaving concerns by providing auxiliary lanes and collector-distributor lanes on the Highway 169 mainline.

Several design concepts were evaluated for the Highway 169 corridor to address traffic operations concerns associated with weaving movements between consecutive interchanges. This included the addition of auxiliary lanes on northbound and southbound Highway 169, and consideration of a collector-distributor roadway and braided ramps between the Main Street and School Street interchanges. Under the collector-distributor (C-D) alternative, a parallel roadway would separate Main Street and School Street ramp movements from the Highway 169 mainline. The braided ramp alternative would separate the Main Street and School Street ramp movements by bridging the Main Street southbound off-ramp and northbound on-ramp movements over the School Street southbound on and northbound off movements (see Figure C-6, Appendix C).

TRUNK HIGHWAY 169
PRELIMINARY DESIGN AND ENVIRONMENTAL DOCUMENTATION

An operations analysis was completed for north- and southbound Highway 169 with auxiliary lanes. The results of this analysis are shown in Table 12. The Highway 169 mainline with auxiliary lanes is forecast to operate at an acceptable LOS D or better during a.m. and p.m. peak periods under future (2030) Build conditions.

The braided ramp concept between Main Street and School Street would eliminate the weave movement for entering and exiting traffic. As such, delays and congestion associated with the weave movement between Main Street and School Street would be eliminated. However, the braided ramp concept would likely increase construction costs (relative to the C-D alternative) because of the additional costs associated with the bridge structures. As shown in Table 3, the C-D road is forecast to operate at acceptable LOS B under future (2030) Build conditions. Because the C-D road alternative is forecast to operate at acceptable levels of service, and is a less expensive option, it was identified as part of the preferred alternative design between Main Street and School Street.

**TABLE 3
HIGHWAY 169 OPERATIONS: HIGHWAY 10 TO 197TH AVENUE**

Highway Segment	Build (2030) Conditions ⁽¹⁾			
	Auxiliary Lanes Only ⁽²⁾		CD Road + Auxiliary Lanes ⁽³⁾	
	Northbound AM Peak (PM Peak)	Southbound AM Peak (PM Peak)	Northbound AM Peak (PM Peak)	Southbound AM Peak (PM Peak)
South of Hwy 10	A(D)	B(A)	A(D)	B(A)
Hwy 10 to Main	A(C)	B(A)	A(C)	B(A)
Main to School	A(C)	B(A)	A(C)	B(A)
C-D Road between Main and School	--	--	A(B)	A(B)
School to 193rd	A(C)	B(A)	A(C)	B(A)
C-D Road between School and 193rd	--	--	A(A)	B(B)
193rd to 197th	A(C)	B(A)	A(C)	B(A)
North of 197th	A(C)	B(A)	A(C)	B(A)

⁽¹⁾ Assumes Highway 169 is a six-lane section from Highway 10 to north of 197th Avenue.

⁽²⁾ Assumes auxiliary lanes on Highway 169 between interchanges from Highway 10 to 193rd Avenue.

⁽³⁾ Assumes auxiliary lanes on Highway 169 between Highway 10 and Main Street and between School Street and 193rd Avenue. Assumes CD road (collector-distributor roadway) between Main Street and School Street, as well as between School Street and 193rd Avenue.

The Highway 169 design through Elk River is illustrated in Figures 4A and 4B, Appendix A. The Highway 169 typical section through Elk River is illustrated in Figure 5C, Appendix A.

**ALTERNATIVES DEVELOPMENT AND EVALUATION
HIGHWAY 169 INTERCHANGES**

Conversion of Highway 169 to a freeway facility would close all existing at-grade access points within the project area. As described in the *Highway 101/169 CMP* (2002), a freeway facility was identified to address safety, operations, mobility, and access needs. However, the *Highway*

101/169 CMP (2002) did not and was not intended to define specific interchange designs, over/underpass designs, or linkages to local roadway systems. The following section describes the interchange development and selection process for the proposed conversion of Highway 169 from the existing expressway facility to a freeway facility.

Highway 169 interchange locations within the study area are described in the *Highway 101/169 CMP* (2002) and are summarized in Table 4. These locations were used as an initial guide in the interchange development process.

Interchange types considered for Highway 169 at the locations indicated in Table 4 would address the project need by providing grade-separated crossings and would eliminate existing at-grade intersections, consistent with Mn/DOT access guidelines for High Priority IRC roadways. Frontage roads between interchange locations would eliminate other at-grade access points and maintain access to Highway 169 for adjacent lands. Providing grade-separated interchanges would eliminate congestion and delays associated with the existing at-grade intersections and would address safety problems by eliminating conflicting movements along the Highway 169 mainline. Other transportation and social, economic, and environmental objectives were more important in identifying the preferred interchange-types at proposed interchange locations along the Highway 169 project corridor.

**TABLE 4
HIGHWAY 169 INTERCHANGE LOCATIONS
(As Initially Identified in Highway 101/169 CMP)**

Project Name (as identified in Highway 101/169 CMP)	Project Location	Project Description
Segment One: Urban Elk River		
Elk River A	Highway 10 Interchange (existing)	Improved Highway 10 interchange
Elk River B	Near Main and School Streets	New interchange at Main Street; overpass at School Street
Elk River C	Near Jackson and 197th Avenue	New interchange at Jackson/197th Ave., south of existing CR 33 interchange
Segment Two: Rural Elk River and Livonia Township		
Elk River D	CSAH 21 to 225th Avenue	New interchange at 221st Ave.
South of Zimmerman	225th Avenue to 247th Avenue	New interchange at CSAH 25/19
Segment Three: Zimmerman		
Zimmerman	Near CSAH 4	New interchange at CSAH 4

Source: Minnesota Department of Transportation. April 2002. *TH 101-TH 169 Corridor Management Plan*. Table 5-1 – Potential Highway Capacity Improvement Projects. Page 5-3.

The evaluation of interchange concepts and the identification of preferred interchange types throughout the project corridor was a collaborative effort that included input from Mn/DOT staff, Local Advisory Committees (Elk River, Livonia, Zimmerman, and Sherburne County staff) and

local officials. Input from the public and business community throughout the project development process was also important in identifying preferred alternative interchange types.

The project corridor has been divided into three segments: urban Elk River (Segment One), rural Elk River and Livonia Township (Segment Two), and Zimmerman (Segment Three). These segments were identified based on existing land use patterns and development along the Highway 169 corridor. The interchange alternative evaluation process described below is organized based on these three segments, beginning with the Highway 10/101/169 interchange in Elk River and ending with the Highway 169/ CSAH 4 interchange in Zimmerman. Interchange concepts described in the following sections are illustrated in Figures C-1 through C-12, Appendix C.

1. Segment One: Urban Elk River Interchanges

Highway 10/101/169 Interchange

The existing Highway 10/101/169 interchange is a partial cloverleaf interchange. A loop is located in the southwest quadrant of the existing interchange to accommodate the southbound Highway 169 to eastbound Highway 10 movement. The eastbound Highway 10 to northbound Highway 169 movement is controlled by a stop sign at the intersection of the eastbound ramp and Highway 101/169. The westbound Highway 10 to southbound Highway 101 movement is controlled by a traffic signal at the intersection of the westbound ramp and Highway 101/169. Highway 101 south of the interchange is a freeway facility; Highway 169 north of the interchange through Elk River is an expressway facility.

Free-flow conditions are necessary through the Highway 10/101/169 interchange to address mobility and traffic operations needs. Highway 10/101/169 interchange intersections currently operate at an unacceptable LOS E or worse during the p.m. peak hour. Under future No-Build conditions, these intersections are forecast to operate at an unacceptable LOS F during the a.m. and p.m. peak hours. Eliminating at-grade ramp intersections will increase efficiency by decreasing vehicle delay associated with the existing at-grade intersections and increase safety by decreasing unexpected slowing in traffic. Free-flow conditions through the Highway 10/101/169 interchange are consistent with conversion of Highway 169 to a freeway facility.

As part of the project development process, several interchange concepts were evaluated for the Highway 10/101/169 interchange that would provide free-flow movements between Highways 10, 101 and 169. The identification of a preferred Highway 10/101/169 interchange type was driven by a qualitative evaluation (relative to each alternative) of other transportation goals and environmental objectives: right-of-way impacts and project costs.¹

Highway 10/101/169 Interchange Design Types Considered But Rejected

Alternative A1 (Full Regional Interchange – Four Level): Alternative A1 would provide high speed, free flow for all interchange movements (see Figure C-1, Appendix C). Accommodating high speeds for all movements would result in higher costs due to the number, height (four-level

¹ Right of way and project cost estimates are conservative estimates based on concept-level design for the proposed Highway 10/101/169 interchange.

structures), and lengths of new bridges over the Mississippi River, BNSF Railway and other roadways. Compared to the other two alternatives, Alternative A1 was estimated to require the greatest amount of new right of way, primarily in the southwest and southeast quadrants of the interchange. The eastbound Highway 10 to northbound Highway 169 ramp would impact Babcock Rest Area, and potentially encroach the Mississippi River shoreline and its associated floodway. Because of these impacts, along with the high costs associated with the extensive height and number of structures (relative to other alternatives), Alternative A1 was eliminated from further consideration.

Alternative A2 (Interchange with Loops – Three Level): Alternative A2 would provide free-flow conditions for all interchange movements. High speed ramps would be provided for major traffic movements, and lower speed loops would be provided for minor traffic movements (see Figure C-2, Appendix C). Accommodating high speeds for major traffic movements results in lower costs relative to Alternative A1, but still higher costs result due to the number, height (three-level structures), and lengths of new bridges over the Mississippi River, BNSF Railway and other roadways. The northbound Highway 101 to eastbound Highway 169 ramp would also require additional right of way in the southeast quadrant of the interchange, although these right of way impacts would likely be similar in magnitude to Alternative A3 (see below). Because of the higher costs associated with three-level structures, Alternative A2 was eliminated from further consideration.

Highway 10/101/169 Build (Preferred) Alternative Interchange Type

Alternative A3 (Interchange with Loops – Two Level): A two-level, free-flow interchange with loops (Alternative A3) was identified as the preferred Highway 10/101/169 interchange type. Alternative A3 would provide for free-flow conditions for all major interchange movements. High speed ramps would be provided for selected major traffic movements. Lower speed loops would be provided in the southeast and northwest quadrants of the interchange for minor traffic movements (see Figure 4A, Appendix A).

The two-level interchange with loops was identified as the preferred Highway 10/101/169 interchange because it provides a free flow connection for a lower cost than other alternatives. Because Alternative A3 requires only two-level structures, the height and lengths of new (or widened) bridges over the Mississippi River, BNSF Railway, and other roadways is reduced compared to Alternatives A1 and A2. This results in lower costs for Alternative A3 relative to the other alternatives considered.

Highway 169/Main Street Interchange

The Highway 169/Main Street interchange was the subject of an exhaustive study process. Ultimately, the decision for a preferred Highway 169/Main Street interchange was based on input received from the Elk River City Council. The Highway 169/Main Street interchange-type design and evaluation process is summarized below.

Main Street presently intersects Highway 169 at a signalized intersection located 0.9 miles north of the Highway 10/101/169 interchange and 0.6 miles south of School Street. Other access to Highway 169 in the area includes: 5th Street (right-in/right-out only intersection 0.3 miles north

of Main Street along northbound Highway 169), driveway access to Great River Energy (right-in/right-out only intersection 0.3 miles south of Main Street along southbound Highway 169), and a full-access driveway to a Park and Ride south of Main Street.

Four interchange concepts were considered for the Highway 169/Main Street interchange. Each concept would remove the existing Main Street signalized intersection and close the adjacent access points to Highway 169. Interchange concepts evaluated for the Main Street interchange are listed below.

1. Standard Diamond Interchange (Figure C-3, Appendix C)
2. Folded Diamond Interchange with Loops in NW and NE Quadrants (Figure C-4, Appendix C)
3. Folded Diamond Interchange with Loops in the NW and SE Quadrants (Figure C-5, Appendix C)
4. Single Point Interchange (Figure 4A, Appendix A)

Interchange concepts considered for Main Street would address the transportation purpose and need by eliminating traffic operations and safety concerns associated with the existing signalized intersection. Existing land uses at Main Street consist primarily of commercial land uses. New commercial development is located in the southwest and southeast quadrants of the Main Street intersection. Guardian Angels, a senior-living community, is located in the northwest quadrant of the Main Street intersection. Commercial land uses are located between the Guardian Angels facility and Highway 169. Residential land uses are also located near the Main Street intersection, behind commercial land uses in the southwest and northeast quadrants of the intersection.

Each interchange concept would impact adjacent properties, although the magnitude and type of impact varied among alternatives. These impacts, combined with other transportation considerations, were critical in identifying a preferred alternative for the Main Street interchange. The evaluation of Main Street interchange concepts is described below.

Highway 169/Main Street Interchange Design Types Considered But Rejected

Standard Diamond Interchange: The standard diamond interchange concept would provide a single directional ramp for each entrance and exit movement to and from Highway 169 at a realigned Main Street. Under the standard diamond interchange concept, Main Street would be realigned to the north of its existing alignment to connect to CSAH 13 east of Highway 169. This alignment of Main Street would allow for a near perpendicular crossing of Highway 169 (see Figure C-3, Appendix C).

The standard diamond interchange concept was the first concept considered for the Main Street interchange. The standard diamond interchange concept would result in substantial right of way impacts in all four quadrants of the interchange. Because of these right of way impacts, the standard diamond interchange concept was dismissed from further consideration.

After the initial consideration of a standard diamond interchange, additional interchange concepts were identified for the Main Street interchange. The goal of Main Street interchange evaluation was to minimize right of way impacts and commercial business impacts while also addressing transportation goals and objectives.

Folded Diamond Interchange (Loops in NW and NE Quadrants): This interchange concept was initially considered with the School Street overpass concept. The modified diamond interchange concept would provide a single directional ramp for the entrance and exit movements from northbound Highway 169. A loop ramp in the northeast quadrant of the interchange would provide access from northbound Highway 169 to eastbound Main Street (major movement when no access is provided at School Street). A ramp would be provided in the northwest quadrant of the interchange for the southbound exit to Main Street. A loop ramp would be provided in the northwest quadrant for the eastbound Main Street to southbound Highway 169 movement, whereas a ramp in the southwest quadrant would accommodate the westbound Main Street to southbound Highway 169 movement (see Figure C-4, Appendix C).

The folded diamond interchange (loops in NW and NE quadrants) concept included a local road connection between the northbound Highway 169 entrance ramp and Baldwin Avenue (see Figure C-4, Appendix C). This local road connection would allow northbound traffic destined for School Street to exit at Main Street and connect to School Street via Baldwin Avenue and Dodge Avenue.

The folded diamond interchange (loops in NW and NE quadrants) concept would result in right of way impacts in all four quadrants of the interchange. The local road connection from the northbound entrance ramp is not consistent with Mn/DOT standard practice of not permitting local roadway connections to interchange ramps. Without the local road connection to the northbound entrance ramp, accessibility to the northeast quadrant of the interchange is more limited. Because of these reasons, the modified diamond interchange was dismissed from further consideration.

Two additional concepts were evaluated for the Main Street interchange: a modified folded diamond interchange with loops in the NW and SE quadrants and a single-point interchange. These concepts were initially developed and presented to the Elk River local advisory committee (LAC) and local officials for consideration. The LAC and local officials requested additional detailed design before identifying a preferred alternative interchange type. Part of these additional design studies included evaluating stormwater treatment needs, accounting for potential stormwater ponding locations, and refining local access needs from Main Street within the interchange area.

Following additional design and studies, the Main Street interchange concepts were presented to the Elk River City Council in April 2008. Because both interchange concepts would provide acceptable levels of service, the decision on a preferred alternative was influenced by social, economic and environmental concerns. The Elk River City Council identified the single-point interchange as the preferred alternative for Main Street. The evaluation of the folded diamond (loops in the NW and SE quadrants) and single-point concepts is summarized in Table 5, and these concepts are described in the following sections.

**TABLE 5
MAIN STREET INTERCHANGE ALTERNATIVES**

Evaluation Criteria	Highway 169/Main Street Alternatives		
	No-Build Alternative	Folded Diamond Interchange (Loops in the NW and SE Quadrants)	Build (Preferred) Alternative Single-Point Interchange
Transportation Goals and Objectives			
Intersection LOS A.M. Peak (P.M. Peak)	LOS F(F)	West Ramps: LOS A(B) East Ramps: LOS C(D)	LOS B(B)
Interchange Capacity	N/A	Provides most reserve capacity for constraining, high demand movement (e.g., WB Main to SB 169)	Provides limited reserve capacity for constraining, high demand movement (e.g., WB Main to SB 169)
Local Access (general)	Maintains existing access to all quadrants of the intersection	Provides full access to all quadrants of the interchange	Provides full access to all quadrants of the interchange
Local Access (commercial areas east of Hwy 169 and south of Main Street)	Maintains existing access	Right-in/right-out intersection and full access intersection to commercial area south of Main Street	Two full access intersections east of Hwy 169 to commercial area south of Main Street
Social, Economic and Environmental Considerations			
Right-of-Way Impacts (Acres) ⁽¹⁾	0	13 – 17 Acres	17 – 21 Acres
Right of Way Impacts (Total and partial commercial and residential acquisitions) ⁽¹⁾			
Commercial – Total Takes	0 Parcels 0 Businesses	10 – 14 Parcels 18 – 22 Businesses	16 – 20 Parcels 11 – 15 Businesses
Commercial – Partial Takings	0 Parcels	10 – 14 Parcels	16 – 20 Parcels
Residential – Total Takes	0 Parcels	None anticipated	2 – 6 Parcels
Residential – Partial Takings	0 Parcels	6 – 10 Parcels	11 – 15 Parcels

⁽¹⁾ Right of way impacts (acres and commercial/residential acquisitions) for Main Street Build Alternatives includes the interchange and associated local road improvements. The Preferred Alternative was identified to impact a greater number of parcels in part because of local road improvements east of Main Street at CSAH 13 and Twin Lakes Road. These local road improvements accommodate full access to the northeast quadrant of the interchange and increase intersection spacing east of Main Street, thereby improving operations of the single-point interchange intersection.

**TABLE 5
 MAIN STREET INTERCHANGE ALTERNATIVES**

Evaluation Criteria	Highway 169/Main Street Alternatives		
	No-Build Alternative	Folded Diamond Interchange (Loops in the NW and SE Quadrants)	Build (Preferred) Alternative Single-Point Interchange
Accommodates redevelopment (NE quadrant of Main St interchange)	Yes (NE quadrant of existing interchange could be redeveloped under future No-Build conditions)	Yes (NB entrance ramp folded to south avoids NE quadrant. Local access to NE quadrant via Baldwin Avenue across from ramp intersection.)	Yes (Single point design minimizes impacts to NE quadrant. Local access to NE quadrant via CSAH 13 to the east)
Construction Cost ⁽²⁾ (million \$)	\$0	Difference: 0 \$23 – \$28 million	Difference: +\$6 million \$29 – \$34 million

N/A: not applicable

⁽²⁾ Construction costs do not include costs associated with right-of-way. Difference is the comparison between the folded diamond interchange alternative and the single-point interchange alternative.

Folded Diamond Interchange (Loops in the NW and SE Quadrants): The folded diamond interchange (loops in the NW and SE quadrants) concept would provide a single directional ramp for the exit movements from northbound and southbound Highway 169. The northbound Highway 169 entrance ramp would be folded to the southeast quadrant of the interchange, and the southbound Highway 169 would be folded to the northwest quadrant of the interchange (see Figure C-5, Appendix C).

The folded diamond interchange (loops in the NW and SE quadrants) would provide acceptable levels of operation and would provide the most reserve capacity for the highest demand movement. Folding the northbound Highway 169 entrance ramp to the south avoids right of way impacts to the northeast quadrant of the interchange and provides better access to the northeast quadrant (i.e., redevelopment considerations). The folded diamond interchange (loops in the NW and SE quadrants) concept would minimize impacts to residential properties (relative to the single-point interchange) and would require less new right of way. This interchange was also estimated to have lower construction costs because the bridge area needed for the Main Street overpass is much smaller compared to single-point interchange.

While the folded diamond interchange (loops in the NW and SE quadrants) would minimize impacts to residential properties, was the least costly of the two alternatives, and would provide good connectivity to the commercial areas in northeast and southwest quadrants of the Main Street interchange, it was not identified as the preferred alternative. The folded diamond interchange would require the relocation of 18 to 22 businesses (northwest and southeast quadrants of the interchange) and would provide limited access to the commercial areas in the southeast quadrant of the interchange. Under the folded diamond (loops in the NW and SE quadrants) alternative, the first local intersection on Main Street east of Highway 169 would be restricted to right-in/right-out, and the first full access intersection would be located further to the east of the commercial area at Twin Lakes Road. Because of these impacts, the folded diamond alternative (loops in the NW and SE quadrants) was dismissed from further consideration.

Highway 169/Main Street Build (Preferred) Alternative Interchange Type

Single Point Interchange: The single-point interchange was identified as the preferred Main Street interchange type. The single-point interchange would provide a single directional ramp for the entrance and exit movements to and from Highway 169. However, unlike a standard diamond interchange, with a single-point interchange, the ramps are compressed towards the mainline and intersect at a single intersection at the ramp termini over the mainline (see Figure 4A, Appendix A). This single intersection over the mainline is located on a bridge and requires a larger structure to accommodate all movements, relative to other interchange types.

The single-point interchange was identified as the Main Street Build Alternative for the following reasons:

- The single point interchange would result in the relocation of 11 to 15 businesses, fewer than the folded diamond interchange alternative.

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- The single-point interchange would provide full access to commercial areas in the southeast quadrant of the Main Street interchange. The two intersections east of the Main Street interchange would be full access intersections. Under the folded diamond interchange concept, the first intersection east of Highway 169 would be a right-in/right-out only intersection.
- The folded diamond interchange would provide greater reserve capacity for the heaviest traffic movement (westbound Main Street to southbound Highway 169). However, the single-point interchange was forecast to operate at LOS B during the p.m. peak hour, slightly better than the LOS D for the east ramps under the folded diamond concept. Because both the single-point interchange and folded diamond interchange would operate at acceptable levels of service (see Table 5), this was not a determining factor in identifying the preferred alternative.
- Both the folded diamond interchange and single-point interchange would accommodate redevelopment in the northeast quadrant of the interchange, although the folded diamond interchange would provide more direct access to the northeast quadrant via the north leg of the ramp intersection. Local road improvements at CSAH 13 and Twin Lake Road with the single-point alternative would accommodate full access to the northeast quadrant of the interchange (see Figure 4A, Appendix A). Because both interchanges would accommodate redevelopment, this was not a determining factor in identifying the preferred alternative.
- The single-point interchange would result in potentially higher construction costs and greater residential relocation impacts. However, neither the folded diamond interchange nor single-point interchange would minimize both commercial and residential impacts at a comparable construction cost. Residential and commercial impacts represented a trade-off in identifying a preferred alternative (i.e., minimizing commercial impacts at the expense of residential impacts and vice versa). Because it was considered more important to minimize commercial/business relocations and provide adequate access to the southeast quadrant of the Main Street interchange, the Elk River City Council identified the single-point interchange as the preferred alternative for the Main Street interchange.

School Street Interchange

School Street currently intersects Highway 169 at a signalized intersection located 0.6 miles north of the Main Street intersection and 0.7 miles south of the Jackson/193rd Avenue intersection. Other access to Highway 169 near School Street includes 191st Avenue, which intersects southbound Highway 169 at a right-in/right-out only intersection located 0.4 miles north of School Street. Fifth Street intersects northbound Highway 169 at a right-in/right-out only intersection 0.4 miles south of School Street.

Three interchange concepts were considered for the Highway 169/School Street interchange. Each concept would remove the existing at-grade signalized intersection and close the adjacent right-in/right-out access to Highway 169. Interchange concepts evaluated for the School Street interchange are listed below.

1. School Street overpass (overpass only – no access to Highway 169) (Figure C-4, Appendix C)

2. Compressed Diamond Interchange with Braided Ramps (Figure C-6, Appendix C)
3. Compressed Diamond Interchange with Collector-Distributor Roads (Figure 4A, Appendix A)

Interchange concepts considered for School Street would address the transportation purpose and need by eliminating traffic operations and safety concerns associated with the existing signalized intersection. Existing land uses at School Street west of Highway 169 are primarily commercial. Land uses at School Street east of Highway 169 are a mix of commercial and residential land uses. Each interchange concept could be, for the most part, located within the existing highway right of way to minimize impacts to adjacent properties. However, shifting the Dodge Street alignment to the east to increase intersection spacing from the interchange ramps would require the acquisition of several properties in the northeast and southeast quadrants of the interchange. The realignment of Dodge Street would be necessary for each School Street concept. As such, transportation goals and objectives were more important in identifying a preferred interchange concept for School Street.

The evaluation of School Street concepts is described below.

Highway 169/School Street Interchange Design Type Considered But Rejected

School Street Overpass: Several initial design concepts for School Street included a bridge over Highway 169 with no direct access to Highway 169, consistent with recommendations from the *Highway 101/169 CMP* (2002). Because the distance between Main Street and School Street is approximately 0.6 miles, an overpass only at School Street would increase the distance between consecutive interchanges along Highway 169 in Elk River, which is more consistent with Mn/DOT interchange spacing guidelines for urban areas (see Figure C-4, Appendix C). However, an analysis of existing traffic volumes and forecast (2030) volumes under Build conditions at School Street without access to Highway 169 found that the local roadway system and adjacent interchange access points would be over capacity without access at School Street. Because of these impacts, the overpass only concept at School Street was dismissed from further consideration.

Compressed Diamond Interchange with Braided Ramps: The compressed diamond interchange with braided ramps would provide a single directional ramp for each entrance and exit movement to and from Highway 169 at School Street (i.e., full access interchange). The interchange ramps would be compressed towards the Highway 169 mainline to minimize right of way impacts to adjacent properties.

Under the braided ramp concept, the northbound entrance movement from Main Street and the northbound exit movement to School Street would cross over one another north of the proposed Main Street interchange. Likewise, the southbound Main Street exit ramp and the southbound School Street entrance ramp would cross over one another north of the Main Street interchange. Drivers exiting to School Street from northbound Highway 169 would access the School Street exit ramp near Main Street, remaining separated from the mainline traffic up to School Street (see Figure C-6, Appendix C).

The braided ramps would require two additional bridges to separate the Main Street and School Street ramp movements. The additional structures associated with the braided ramp concept would increase project costs relative to other alternatives considered for School Street. In addition, multiple comments were received from the Elk River business community concerning access to/from Highway 169 at School Street. Under the braided ramp concept, northbound motorists destined for the School Street area would have to access the School Street exit ramp south of Main Street. If a motorist inadvertently passes this exit, there is no opportunity to access School Street without “backtracking” from the Jackson/193rd Avenue interchange. Because of increased costs and concerns from the business community, the braided ramp concept was dismissed from further consideration.

Highway 169/School Street Build (Preferred) Alternative Interchange Type

Compressed Diamond Interchange with Collector-Distributor Roads: The compressed diamond interchange concept with collector-distributor roads was identified as the preferred alternative concept for the School Street interchange. The compressed diamond interchange with collector-distributor roads would provide a single directional ramp for each entrance and exit movement to and from Highway 169 at School Street (i.e., full access interchange). The interchange ramps would be compressed towards the Highway 169 mainline to minimize right of way impacts to adjacent properties (see Figure 4A, Appendix A).

Under the collector-distributor road concept, a collector-distributor road would connect the Main Street and School Street interchanges. A collector-distributor road functions to separate ramp entrance and exit movements from the mainline through traffic. For northbound Highway 169, exit movements to School Street would access the collector-distributor road north of Main Street. The entrance movements from the Main Street interchange would merge with the exit movements to School Street on the collector-distributor road. South of School Street, traffic from Main Street accessing Highway 169 would merge onto the mainline; traffic accessing School Street would continue north to the School Street overpass. A similar configuration would be located to the west for southbound Highway 169. As shown in Section IV.B.2, the collector-distributor road and Highway 169 mainline are forecast to operate at acceptable levels of service under future Build conditions.

The compressed diamond interchange with collector-distributor roads was identified as the Build (preferred) Alternative for the School Street interchange because it provides full access to Highway 169 and separates ramp movements from the mainline at a lower cost relative to the braided ramp concept.

Jackson Avenue/193rd Avenue/197th Avenue Interchanges

Jackson/193rd Avenue and 197th Avenue presently intersect Highway 169 at signalized intersections spaced approximately 0.5 miles apart, and 191st Avenue intersects Highway 169 on its west side at a right-in/right-out only intersection 0.3 miles south of the Jackson/193rd Avenue intersection.

Two interchange concepts were considered for the Highway 169/Jackson/193rd Avenue interchange and the Highway 169/197th Avenue interchange. Both interchange concepts would

remove existing at-grade signalized intersections and close the 191st Avenue right-in/right-out access. Interchange concepts considered for the Jackson/193rd Avenue and 197th Avenue are listed below.

1. Split Diamond Interchange with Partial Access at Jackson/193rd Avenue (Figure C-7, Appendix C)
2. Split Diamond Interchange with Full Access at Jackson/193rd Avenue (Figure 4B, Appendix A)

Both the interchange concepts considered for Jackson/193rd Avenue and 197th Avenue would address the transportation need by eliminating traffic operations and safety concerns associated with the existing at-grade intersections. Because of the spacing between Jackson/193rd Avenue and 197th Avenue, both alternatives include a split diamond concept (i.e., no south ramps at 197th Avenue), which is more consistent with Mn/DOT guidelines of one-mile interchange spacing in developed areas. The analysis of Jackson/ 193rd Avenue and 197th Avenue interchange concepts was completed at a scoping, qualitative level of analysis. Impacts associated with each interchange concept were compared relative to the other concept.

Land uses adjacent to Jackson/193rd Avenue and 197th Avenue consist of a mix of commercial and residential land uses. Both concepts would impact parcels along the proposed 197th Avenue interchange ramps, require relocation of buildings and businesses in the southeast quadrant of the Jackson/193rd Avenue interchange, and require removal of driveway access to 193rd Avenue between Evans Street and Dodge Avenue (see Figure 4B, Appendix A). Transportation considerations were more important in identifying a preferred interchange concept for Jackson/193rd Avenue and 197th Avenue.

The evaluation of Jackson Avenue/193rd Avenue interchange concepts is described below.

Highway 169/Jackson/193rd/197th Avenue Interchange Design Type Considered But Rejected

Split Diamond Interchange with Partial Access at Jackson/193rd Avenue: The split diamond interchange with partial access at Jackson/193rd Avenue would provide a bridge over Highway 169 at 197th Avenue and at Jackson/193rd Avenue. At 197th Avenue, access to Highway 169 would be provided by a half-diamond interchange oriented to the north (i.e., interchange ramps to and from the north). A southbound slip ramp would allow traffic exiting Highway 169 to directly access Holt Avenue (west frontage road) at 197th Avenue. At Jackson/193rd Avenue, a single directional ramp provides access from northbound Highway 169 and to southbound Highway 169. A loop ramp in the southeast quadrant of the interchange accommodates the entrance movement to northbound Highway 169 (see Figure C-7, Appendix C). This concept does not accommodate southbound exits from Highway 169 to Jackson/193rd Avenue.

This concept provides only partial access to Highway 169 at Jackson/193rd Avenue. As noted above, the split diamond with partial access concept does not accommodate southbound exits from Highway 169 to Jackson/193rd Avenue. Therefore, all southbound Highway 169 traffic destined for attractions at Jackson/193rd Avenue would have to exit at 197th Avenue, using the

local roadway system to access Jackson/193rd Avenue. Because this concept concentrates southbound exiting traffic at 197th Avenue, it was dismissed from further consideration.

Highway 169/Jackson/193rd/197th Avenue Build (Preferred) Alternative Interchange Type

Split Diamond Interchange with Full Access at Jackson/193rd Avenue: The split diamond interchange with full access at Jackson/193rd Avenue was identified as the preferred interchange concept for Jackson/193rd Avenue and 197th Avenue. At 197th Avenue, access to Highway 169 would be provided by a half-diamond interchange oriented to the north. At Jackson/193rd Avenue, full access would be provided to Highway 169. Ramps west of Highway 169 accommodate entrance and exit movements to southbound Highway 169. These ramps would be compressed towards the Highway 169 mainline to minimize impacts to adjacent properties. A single directional ramp would provide for the exit movement from northbound Highway 169 at Jackson/193rd Avenue. The northbound Highway 169 entrance ramp would be folded to the south, providing a loop in the southeast quadrant of the interchange (see Figure 4B, Appendix A).

The split diamond interchange with full access at Jackson/193rd Avenue was identified as the Build (preferred) Alternative for the Highway 169/Jackson/193rd Avenue and 197th Avenue interchanges because this concept provides for full access at Jackson/193rd Avenue. Full access to/from Highway 169 at Jackson/193rd Avenue would better distribute traffic between the Jackson/193rd Avenue and 197th Avenue interchanges and associated intersections, providing acceptable traffic operations in this portion of the study area. As noted in Section VII.A.21, ramp intersections and adjacent local road intersections at Jackson/193rd Avenue and 197th Avenue are predicted to operate at an acceptable LOS B or better during a.m. and p.m. peak hours.

A collector-distributor road will connect the School Street and Jackson/193rd Avenue interchanges. This collector-distributor road functions to separate ramp entrance and exit movements from the mainline through traffic. For northbound Highway 169, exit movements to Jackson/193rd Avenue would access the collector-distributor road north of School Street. The entrance movements from the School Street interchange would merge with the exit movements to School Street on the collector-distributor road. South of Jackson/193rd Avenue, traffic from School Street accessing Highway 169 would merge onto the mainline; traffic accessing Jackson/193rd Avenue would continue north to the Jackson/193rd Avenue overpass. A similar configuration would be located to the west for southbound Highway 169. As shown in Section IV.B.2, the collector-distributor road and Highway 169 mainline are forecast to operate at acceptable levels of service under future Build conditions.

2. Segment Two: Rural Elk River Livonia Township Interchanges

221st Avenue/Future CR 121 Interchange

Sherburne County, as identified in the *Sherburne County Transportation Plan (2007)*, plans to extend CR 121 to the west to intersect with 221st Avenue at Highway 169. The CR 121 extension, together with 221st Avenue west of Highway 169, would create a continuous east-west roadway through northern Elk River. The 221st Avenue/CR 121 (221st Avenue)

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corridor is identified as a future urban collector roadway in the *Sherburne County Transportation Plan* (2007).

Four interchange concepts were developed and considered for the Highway 169/221st Avenue interchange. All interchange concepts would replace direct access to Highway 169 at 221st Avenue and at the Elk River Landfill, located west of Highway 169 and directly north of 221st Avenue. The Elk River Landfill is located in the northwest quadrant of all interchange alternatives. The interchange concepts considered for the Highway 169/221st Avenue interchange are listed below.

1. Standard diamond interchange (Figure C-8, Appendix C)
2. Hybrid tight diamond interchange
3. Folded diamond interchange (ramps folded to the south)
4. Interchange with buttonhook ramp configuration in the SW quadrant and folded diamond ramps in the SE quadrant (referred to as the “buttonhook concept”) (Figure 4C, Appendix A)

All of the interchange type concepts considered for 221st Avenue/future CR 121 would address the project transportation need. Other transportation, social, economic, and environmental considerations were more important in identifying a preferred alternative interchange type for a Highway 169/221st Avenue interchange. The analysis of 221st Avenue interchange-types was completed at a scoping, qualitative level of analysis. Impacts associated with each interchange concept were compared relative to the other interchange concepts. The identification of a preferred alternative interchange concept for the 221st Avenue interchange was determined by the following transportation and environmental objectives: wetland impacts, right of way impacts, landfill impacts, and safety concerns associated with interchange ramp design (i.e., drivers being able to navigate loop ramps on a downgrade).

221st Avenue/future CR 121 Alignment

Before the Highway 169/221st Avenue interchange concepts could be evaluated, it was necessary to first determine whether it was more practical for 221st Avenue to bridge over Highway 169, or whether Highway 169 should bridge over a depressed 221st Avenue. Based on initial engineering work, it was determined to be more practical for Highway 169 to bridge over a depressed 221st Avenue. This was identified to avoid fill impacts to the landfill and wetlands east of Highway 169 if 221st Avenue were to bridge over Highway 169. In addition, the area surrounding 221st Avenue consists of active gravel mining operations, and future land uses for this area east of Highway 169 are identified for mineral excavation. Substantial amounts of fill would be necessary to bridge 221st Avenue over Highway 169 because of changes in topography associated with gravel mining activities.

It was also necessary to identify an alignment for the future 221st Avenue/CR 121 connection across Highway 169. The alignment of 221st Avenue/future CR 121 was determined by efforts to avoid/minimize impacts to Elk River Landfill and wetlands east of Highway 169 (see Figure 4C, Appendix A). There was no practicable alignment identified that would minimize impacts to the landfill as well as avoid wetland impacts east of Highway 169. Extending the existing 221st Avenue alignment directly east across Highway 169 would result in impacts to the

landfill and impact wetlands east of Highway 169. Aligning 221st Avenue to the north of its existing alignment would result in substantial impacts to the landfill, but could minimize, and potentially avoid, wetland impacts to the east of Highway 169. Because it was important to minimize impacts to the both landfill and wetland areas, the 221st Avenue alignment would be shifted to the south of its existing alignment. This alignment minimizes impacts to the landfill while also minimizing impacts to wetland areas east of Highway 169.

The evaluation of 221st Avenue interchange alternatives is summarized in Table 6 and is described below.

Highway 169/221st Avenue Interchange Design Types Considered But Rejected

Standard Diamond Interchange: The standard diamond interchange concept would provide a single directional ramp for each entrance and exit movement to and from Highway 169 at 221st Avenue (see Figure C-8, Appendix C). The existing County Road 33 interchange to the south of 221st Avenue is a standard diamond interchange. A standard diamond interchange is the most common interchange type in rural areas.

The standard diamond interchange was estimated to result in the greatest impacts to the Elk River Landfill. The standard diamond interchange concept would also impact wetland areas in the northeast quadrant of the interchange (wetland W3-8, see Figure 4C, Appendix A). Because of these impacts, the standard diamond interchange concept was dismissed from further consideration.

Following the initial consideration of a standard diamond interchange, the other three interchange configurations were evaluated and found to avoid or minimize wetland impacts to varying degrees. These interchange concepts are discussed below.

Hybrid Tight Diamond Interchange: The hybrid tight diamond interchange concept would provide a single directional ramp for the entrance and exit movements to and from northbound Highway 169. The northbound Highway 169 entrance and exit ramps would be compressed towards the mainline (relative to the standard diamond concept). The southbound Highway 169 exit ramp would be folded to the south, providing a loop in the southwest quadrant of the interchange. A single directional ramp would provide for the entrance movement to southbound Highway 169. This concept was identified in an effort to avoid wetland impacts and minimize property impacts east of Highway 169.

The hybrid tight diamond concept would avoid impacts to the Elk River Landfill by folding the southbound exit ramp to the southwest quadrant of the interchange. However, compressing the northbound entrance and exit ramps closer to the mainline would still impact wetlands areas in the northeast quadrant of the interchange, and would impact property in the southeast and northeast quadrants of the interchange. For these reasons, the hybrid tight diamond concept was dismissed from further consideration.

**TABLE 6
221ST AVENUE/CR 121 INTERCHANGE ALTERNATIVES**

Evaluation Criteria	Highway 169/221st Avenue Interchange Concepts				
	No Build Alternative	Standard Diamond	Hybrid Tight Diamond	Folded Diamond (To South)	Preferred Alternative (Button-Hook Concept)
Other Transportation Goals and Objectives					
Engineering/safety concerns: vehicles being able to navigate loop exit on a downgrade	N/A	Interchange consists of single directional ramps only. No loop ramp on downgrade.	Safety concerns with loop ramp on downgrade in southwest quadrant of interchange	Safety concerns with loop ramp on downgrade in southwest quadrant of interchange	Buttonhook ramps in southwest quadrant of interchange. No loop ramp on downgrade.
Accommodates local roadway/frontage road system	N/A	Yes	Yes	Yes	Yes
Social, Economic and Environmental Considerations⁽¹⁾					
Elk River Landfill impacts	Avoids landfill	Greater impacts	Avoids landfill	Avoids landfill	Avoids landfill
Wetland impacts (wetland areas east of Highway 169)	No impacts	Greater impacts	Greater impacts	Fewer impacts	Fewer impacts
Right of way impacts east of Highway 169 (residential and commercial land uses) (relative to other alternatives)	No impacts	Impacts to property in northeast and southeast quadrants	Impacts to property in northeast and southeast quadrants	Impacts to property in southeast quadrant	Impacts to property in southeast quadrant

⁽¹⁾Relative qualitative impacts between interchange concepts.

Folded Diamond Interchange: The folded diamond interchange concept would provide a single directional ramp for the exit movement from northbound Highway 169 and a single directional ramp for the entrance movement to southbound Highway 169. The southbound exit ramp and northbound entrance ramp would be folded to the south of 221st Avenue, providing a loop ramp in the southwest and southeast quadrants of the interchange. Under this interchange concept, folding interchange ramps to the south would avoid impacts to the landfill in the northwest quadrant and avoid impacts to wetlands in the northeast quadrant of the interchange.

The folded diamond interchange concept would avoid impacts to the landfill by folding the southbound exit ramp to the southwest quadrant of the interchange. The folded diamond interchange concept would also minimize impacts to wetlands areas by folding the northbound entrance ramp to the southeast quadrant of the interchange. Transportation and engineering considerations, unique to the 221st Avenue interchange, were more important in dismissing the folded diamond concept from further consideration.

As previously noted, the Elk River Landfill is located in the northwest quadrant of the interchange and lands west of Highway 169 are actively mined. As such, there is a large percentage of heavy truck traffic associated with the landfill and gravel mining operations that would utilize the proposed 221st Avenue interchange. Because 221st would be depressed under Highway 169, the southbound exit loop in the southwest quadrant of the interchange would be on a downgrade. During the layout review process, Mn/DOT Geometrics staff raised concerns about vehicles, including heavy truck traffic, being able to safely navigate the southbound exit loop on a downgrade. A larger radius was considered for the southbound exit loop as well as a parallel deceleration lane along southbound Highway 169 to provide for slower speeds as vehicles approach and enter the loop ramp. However, these modifications did not adequately address all safety concerns associated with the loop ramp on a downgrade. Therefore, the folded diamond concept was dismissed from further consideration.

Highway 169/221st Avenue Build (Preferred) Alternative Interchange Type

Buttonhook Concept: The buttonhook concept was identified as the preferred interchange concept for the 221st Avenue interchange. The buttonhook concept was developed to avoid the landfill and wetlands north of the proposed 221st Avenue alignment, while also addressing safety concerns with a ramp on a downgrade in the southwest quadrant of the interchange. West of Highway 169, the southbound entrance and exit ramps would connect into the west frontage road south of 221st Avenue. East of Highway 169, the northbound entrance ramp would be folded to the south of 221st Avenue, providing a northbound entrance loop and a northbound exit ramp in the southeast quadrant of the interchange (see Figure 4C, Appendix A).

The buttonhook concept was identified as the Build (preferred) Alternative for the Highway 169/221st Avenue interchange for the following reasons:

- The buttonhook concept avoids the landfill in the northwest quadrant of the 221st Avenue interchange by folding the southbound exit ramp to the south of 221st Avenue.
- The buttonhook concept avoids wetland impacts in the northeast quadrant of the 221st interchange. While the buttonhook concept will impact wetland areas east of Highway 169, folding the northbound entrance ramp to the south of 221st Avenue avoids impacts associated with construction of a single directional ramp in the northeast quadrant of the interchange.
- The buttonhook concept addresses safety concerns raised by Mn/DOT Geometrics staff associated with vehicles, including heavy truck traffic, being able to safely navigate a southbound exit loop on a downgrade. The buttonhook concept takes the southbound exit ramp and intersects it with the west frontage road, eliminating the loop ramp in the southwest quadrant of the interchange.

237th Avenue/239th Avenue (Livonia Township)

237th Avenue (County Road 74) and 239th Avenue are local roads in Livonia Township that currently intersects with Highway 169, approximately $\frac{3}{4}$ -mile south of the proposed CSAH 25/19 interchange. Several concepts were initially considered during the alternatives development process for 237th and 239th Avenues to provide connectivity across Highway 169.

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These concepts included realigning 237th Avenue and 239th Avenue along with an over- or underpass of Highway 169. Based on input from Livonia Township and Sherburne County, these concepts were dismissed from further consideration. Under the Preferred Alternative, the existing 237th Avenue and 239th Avenue intersections with Highway 169 would be closed, and local traffic would be redirected to the CSAH 25/19 interchange via frontage roads along the east and west sides of Highway 169.

CSAH 25/19 Interchange

CSAH 25 and CSAH 19, located in Livonia Township, are classified as minor and major collector roadways, respectively. CSAH 25 and CSAH 19 currently intersect Highway 169 at two “T” at-grade intersections approximately 1,300 feet apart from one another.

Four interchange concepts were considered for the CSAH 25/19 interchange. All interchange types considered for CSAH 25/19 would realign CSAH 19 to the south, directly across from CSAH 25 to improve local roadway connectivity. These interchange type concepts are listed below.

1. Standard diamond interchange (Figure C-9, Appendix C)
2. Folded diamond interchange (ramps folded to the north) (Figure C-10, Appendix C)
3. Folded diamond interchange (ramps folded to the south) (Figure C-11, Appendix C)
4. Folded diamond interchange (ramps folded to the northwest and southeast quadrants) (Figure 4D, Appendix A)

A concept design for these configurations was identified during the project development process. The evaluation of these interchange types is summarized in Table 7. The analysis of CSAH 25/19 interchange-types was completed at a scoping, qualitative level of analysis. Some evaluation criteria were quantified to provide a relative comparison among alternatives. However, when evaluation criteria were quantified, a range was provided (e.g., 0 to 5 residential relocations, 5 to 10 residential relocations, 10 to 15 residential relocations, etc.) because of the lower degree of accuracy associated with the concept-level designs. The discussion of these alternatives is included in the following sections.

All of the interchange types considered for CSAH 25/19 would address the project transportation need by grade-separating Highway 169 from intersecting local roadways (see Section III.C). Other transportation, social and environmental considerations were identified and considered for each interchange type, although these criteria were identified to not differ substantially among the CSAH 25/19 interchange concepts identified above (see Table 7). The identification of a preferred alternative interchange type for the CSAH 25/19 interchange was determined by the following transportation and environmental objectives: accommodating frontage road connections, local road access spacing, right of way impacts, and potential residential relocations.

The evaluation of CSAH 25/19 interchange alternatives is summarized in Table 7 and is described below.

Highway 169/CSAH 25/19 Interchange Design Types Considered But Rejected

Standard Diamond: The standard diamond interchange concept would provide a single directional ramp for each entrance and exit movement to and from Highway 169 at CSAH 25/19 (see Figure C-9, Appendix C). As previously noted, a standard diamond interchange is the most common interchange type in rural areas.

While potential residential relocations associated with the standard diamond concept were similar to the folded diamond concept (NW and SE quadrants), the standard diamond interchange was anticipated to result in greater overall right of way impacts (relative to other interchange concepts). Under the standard diamond interchange alternative, the south frontage road west of Highway 169 is also least consistent with access spacing goals (i.e., 750 feet from interchange ramps to first local road intersection). Because of these impacts, the standard diamond interchange concept was rejected from further consideration.

Folded Diamond (Ramps Folded to the North): The folded diamond (ramps folded to the north) concept would provide a single directional ramp for the entrance movement to northbound Highway 169 and a single directional ramp for the exit movement from southbound Highway 169. The southbound entrance ramp and northbound exit ramp would be folded to the north of CSAH 25/19, providing a loop ramp in the northwest and northeast quadrants of the interchange (see Figure C-10, Appendix C). Under this interchange concept, folding interchange ramps to the north would limit property impacts south of CSAH 25/19.

Folding the interchange ramps to the north would avoid woodland areas in the southwest quadrant of the interchange; however, this would also result in impacts to agricultural land uses in the northwest quadrant of the interchange. The folded diamond concept (ramps folded to the north) was estimated to require 140 to 150 acres of right of way, and was estimated to result in 10 to 15 residential relocations. Because of these impacts, the folded diamond concept (ramps folded to the north) was rejected from further consideration.

Folded Diamond (Ramps Folded to the South): The folded diamond (ramps folded to the south) would provide a single directional ramp for the exit movement from northbound Highway 169 and a single directional ramp for the entrance movement to southbound Highway 169. The southbound exit ramp and northbound entrance ramp would be folded to the south of CSAH 25/19, providing a loop ramp in the southwest and southeast quadrants of the interchange (see Figure C-11, Appendix C). Under this interchange concept, folding interchange ramps to the south would limit property impacts north of CSAH 25/19.

The folded diamond concept (ramps folded to the south) was estimated to require 150 to 160 acres of right of way, and was estimated to result in 10 to 15 residential relocations. In addition, wetland areas to the west of the interchange prohibited frontage road connections in the southeast quadrant of the interchange. Because of these impacts, the folded diamond concept (ramps folded to the south) was rejected from further consideration.

**TABLE 7
CSAH 25/19 INTERCHANGE ALTERNATIVES**

Evaluation Criteria	Highway 169/CSAH 25/19 Interchange Alternatives				
	No Build Alternative	Standard Diamond	Folded Diamond (To North)	Folded Diamond (To South)	Preferred Alternative (Folded Diamond in NW and SE Quadrants)
Other Transportation Goals and Objectives					
Consistent with interchange spacing guidelines	N/A	Yes	Yes	Yes	Yes
Maintain/enhance roadway connectivity	CSAH 25 and CSAH 19 intersect Highway 169 at two "T" intersections 1,300 feet apart	Improves CSAH 25/19 connectivity	Improves CSAH 25/19 connectivity	Improves CSAH 25/19 connectivity	Improves CSAH 25/19 connectivity
Accommodating frontage road connections	N/A	Accommodates frontage road in northeast quadrant and local access in southeast quadrant	Accommodates frontage road connection in northeast and southwest quadrants	Does not accommodate frontage road connection to 239th overpass because of wetland areas west of interchange	Accommodates frontage road connection in northeast and southwest quadrants
Consistency with access spacing goals (750 feet from interchange ramps to first local road intersection)	N/A	Least Consistent Frontage road within 750 feet of ramp intersections west of interchange	More Consistent Private driveway within 750 feet of ramp intersections west of interchange	Consistent Distance to frontage roads and private driveways exceeds 750-foot local access spacing goal	More Consistent Private driveway within 750 feet of ramp intersections west of interchange

⁽¹⁾ Does not include potential wetland impacts associated with stormwater ponds.

TABLE 7 – continued
CSAH 25/19 INTERCHANGE ALTERNATIVES

Evaluation Criteria	Highway 169/CSAH 25/19 Interchange Alternatives				
	No Build Alternative	Standard Diamond	Folded Diamond (To North)	Folded Diamond (To South)	Preferred Alternative (Folded Diamond in NW and SE Quadrants)
Social, Economic and Environmental Considerations					
Wetland impacts (number of wetland areas affected) ⁽¹⁾	No wetland areas impacted	10 to 15 areas	10 to 15 areas	10 to 15 areas	15 to 20 areas
Wetland impacts (acres) ⁽¹⁾	0 acres	5 to 10 acres	5 to 10 acres	5 to 10 acres	5 to 10 acres
Vegetation impacts (woodland) (acres)	0 acres	Less than 10 acres	Less than 10 acres	10 to 20 acres	10 to 20 acres
Estimated amount of right of way (acres) ⁽²⁾	0 acres	130 to 140 acres	140 to 150 acres	150 to 160 acres	100 to 110 acres
Potential residential relocation (relative to other alternatives)	No relocations	5 to 10	10 to 15	10 to 15	5 to 10
Commercial/business relocation (relative to other alternatives)	No relocations	Less than 5	Less than 5	Less than 5	Less than 5
Construction costs (million \$)	\$0	\$10 to \$15 million	\$10 to \$15 million	\$10 to \$15 million	\$10 to \$15 million

⁽²⁾ Estimated right of way impacts based on concept designs considered during evaluation of interchange types. Following identification of the folded diamond interchange (NW and SE quadrants) as the preferred alternative interchange type, preliminary design and engineering was completed. This resulted in an increase in right of way impacts associated with the Build Alternative. If this same level of preliminary engineering and design were applied to other interchange concepts considered, it is reasonable to assume that right of way impacts would also increase in a similar magnitude as the preferred alternative. Therefore, although right of way impacts associated with the folded diamond interchange (NW and SE quadrants) have increased with the CSAH 25/ 19 preferred alternative, the CSAH 25/19 preferred alternative still minimizes impacts relative to other concepts considered.

Highway 169/CSAH 25/19 Build (Preferred) Alternative Interchange Type

Preferred Alternative (Folded Diamond Interchange – Ramps folded to the Northwest and Southeast): The folded diamond concept (ramps folded to the northwest and southeast) was identified as the preferred interchange concept for the CSAH 25/19 interchange. West of Highway 169, the southbound Highway 169 entrance ramp would be folded to the north of CSAH 25/19, providing a southbound entrance loop and southbound exit ramp in the northwest quadrant of the interchange. East of Highway 169, the northbound entrance ramp would be folded to the south of CSAH 25/19, providing a northbound entrance loop and a northbound exit ramp in the southeast quadrant of the interchange (see Figure 4D, Appendix A).

The folded diamond (ramps folded to the northwest and southeast) was identified as the Build (preferred) Alternative for the Highway 169/CSAH 25/19 interchange for the following reasons:

- Frontage road connectivity:
- Right of way impacts: The folded diamond concept (ramps folded to the northwest and southeast) was estimated to require 100 to 110 acres of new right of way, which was less than the other interchange concepts considered (see Table 7).
- Residential relocations: The folded diamond concept (ramps folded to the northwest and southeast) was estimated to result in 5 to 10 residential relocations. This is similar to the amount residential relocations estimated for the standard diamond concept, but fewer than the folded diamond (ramps folded to the north or south) concepts.

3. Segment Three: Zimmerman CSAH 4 Interchange

Highway 169/CSAH 4 Interchange

As part of the preliminary design and project development process for interchange access in Zimmerman, the Zimmerman Local Advisory Committee (LAC)² first considered general access locations within the City. This did not include the consideration of specific interchange types or configurations. The general access location concepts considered moving Highway 169 as well as the main Zimmerman access point. The following five options were considered for Highway 169 access in Zimmerman:

- **Option 1:** Highway 169 stays on existing alignment; Zimmerman access stays on existing CSAH 4 alignment.
- **Option 2:** Highway 169 stays on existing alignment; Zimmerman access is on a new roadway alignment shifted to the south in the area of 249th or 257th Avenue.
- **Option 3:** Highway 169 is on a new alignment shifted to the east, but west of Lake Fremont; Zimmerman access stays on existing CSAH 4 alignment.
- **Option 4:** Highway 169 is on a new alignment shifted east of Lake Fremont; Zimmerman access stays on existing CSAH 4 alignment.

² The Zimmerman Local Advisory Committee consisted of representatives from Mn/DOT, Sherburne County, Zimmerman, and Livonia Township (see Section VIII).

- **Option 5:** Highway 169 stays on existing alignment; Zimmerman access is on a new alignment shifted north of Lake Fremont.

Any of the access location concepts would be consistent with the purpose and need for the project by providing a grade-separated crossing that improves Highway 169 operations and eliminates mainline at-grade conflicts. A screening process was used to identify the preferred location for access concepts. This process considered the following transportation goals and objectives: consistency with regional and local transportation plans, consistency with local land use and development plans, locating access near heavy local economic activity (i.e., near key traffic origin/destinations), and maintaining a cohesive business district along Highway 169 and CSAH 4. Based on this screening process, three general location concepts were rejected from further consideration as described below.

- **Option 2** (move the primary Zimmerman access south of CSAH 4): This alternative does not enhance connectivity and continuity for CSAH 4 or the existing local roadway system, and does not place the interchange at an area of heavy local economic activity (i.e., near key traffic origins/destinations) desiring access to Highway 169.
- **Option 4** (move Highway 169 east of Lake Fremont): This alternative is inconsistent with the TH 169 Corridor Management Plan, which calls for improvements to Highway 169 largely on its existing alignment, and moves interchange access at least one mile east of the area of heavy local economic activity desiring access to Highway 169.
- **Option 5** (move Zimmerman access north of Lake Fremont): This alternative does not provide connectivity and continuity between key transportation corridors, particularly existing CSAH 4, and does not provide interchange access at an area of heavy local activity desiring access to Highway 169.

Option 1 (CSAH 4 interchange along existing Highway 169 alignment) and Option 3 (CSAH 4 interchange along shifted Highway 169 alignment) were retained for further consideration as part of the interchange-type evaluation. These two options were retained because they maintain connectivity and continuity with CSAH 4 through Zimmerman, are consistent with local and regional transportation plans, and because they locate the proposed interchange near the downtown Zimmerman business district (i.e. near key traffic origin/destination location). The two interchange types considered for CSAH 4 in Zimmerman are described below.

1. Compressed diamond interchange on the existing Highway 169 alignment.
2. Compressed diamond interchange with a loop in the southeast quadrant on a Highway 169 shifted alignment.

The two Highway 169/CSAH 4 interchange concepts are illustrated in Appendix C. Both alternatives would address transportation goals. Both alternatives maintain connectivity along CSAH 4, and ramp intersections under both alternatives would operate under or near capacity. With changes to local road connections, the compressed diamond interchange along a shifted Highway 169 alignment would be consistent with access spacing guidelines. The compressed diamond interchange along the existing Highway 169 alignment would be less consistent with

access spacing guidelines, but this was considered not as important as other social, economic, and environmental considerations.

Social, economic, and environmental considerations were more important in identifying a preferred Highway 169/CSAH 4 interchange. The evaluation of the Highway 169/CSAH 4 interchange alternatives is summarized in Table 8 and is described below.

Highway 169/CSAH 4 Interchange Design Type Considered But Rejected

Compressed Diamond Interchange on Existing Alignment: The compressed diamond interchange option would provide a single directional ramp for the entrance and exit movement to and from Highway 169. Highway 169 would bridge over CSAH 4. The distance between interchange ramps would be approximately 300 feet. To accommodate the reduced distance, the Highway 169/CSAH 4 interchange ramp intersections would operate as one intersection. These operations mean that traffic signals allow left turn movements to go one at a time from CSAH 4 onto the on ramps. The signals also release traffic on the interchange ramps separately (one ramp at a time) because there is no space to store vehicles on CSAH 4 between the interchange ramps.

The compressed diamond interchange configuration was identified to minimize right of way impacts to the residential area along the east side of Highway 169 between the highway and Lake Fremont. Compressing the interchange ramps in towards on another minimizes the amount of right of way necessary to accommodate an interchange.

The intersection spacing between the interchange ramps and the first local road intersection west of Highway 169 is 200 feet (3rd Street East). Because of this spacing, it was assumed that this intersection would be closed. As such, the next intersection to the west is 2nd Street East, approximately 600 feet from the interchange ramp intersections, which is more consistent with Mn/DOT access spacing goals.

The compressed diamond interchange alternative would likely impact fewer wetland areas and require less new right of way because Highway 169 remains along its existing alignment.³ It was also estimated that the compressed diamond interchange alternative would require fewer residential relocations. However, the compressed diamond interchange alternative was estimated to result in up to 15 commercial/business relocations, and could result in an additional 5 to 10 commercial/business relocations depending upon design details. These commercial property impacts were primarily the result of expanding CSAH 4 through downtown. The compressed diamond interchange alternative would also divide the Zimmerman business district into east and west sides of Highway 169.

³ Estimated wetland impacts did not include stormwater management considerations. Wetland impacts could increase with this alternative when stormwater management, depending upon stormwater design, because there are no infield areas within the interchange for stormwater treatment.

**TABLE 8
CSAH 4 (ZIMMERMAN) INTERCHANGE ALTERNATIVES**

Evaluation Criteria	Highway 169/CSAH 4 Interchange Alternatives		
	No-Build Alternative	Compressed Diamond Interchange (existing Highway 169 alignment)	Preferred Alternative (Compressed Diamond/SE Loop Interchange along shifted Highway 169 alignment)
Other Transportation Goal and Objectives			
Interchange ramp intersection spacing (feet)	N/A	300 feet	900 feet
Maintain/enhance roadway connectivity	Maintains east-west CSAH 4 connectivity	Maintains east-west CSAH 4 connectivity	Maintains east-west CSAH 4 connectivity
Consistency with access spacing goals (750 feet from interchange ramps to first local road intersection)	N/A	Less consistent First local road (3rd Street East) is located 200 feet from the nearest interchange ramp intersection. Next adjacent intersection to the west is 2nd Street East, which would be 600 feet from the interchange.	More consistent First local road anticipated (the west frontage road located on southbound lanes of the existing Hwy 169 alignment) is located 500 feet from the nearest interchange ramp intersection. If City elects to use 2nd Street East as the west frontage road, the Alternative meets the 750-foot access spacing goal.
Intersection operations (interchange ramp termini) (critical lane volumes over/at/under capacity)	Over Capacity	Under/At Capacity	Under/At Capacity
Social, Economic and Environmental (SEE) Considerations			
Wetland impacts (number of wetland areas affected) ⁽¹⁾	0 wetland areas	Less than 5 wetlands	5 to 10 wetlands
Wetland impacts (acres) ⁽¹⁾	0 acres	Less than 5 acres	5 to 10 acres
Estimated amount of right of way (acres)	0 acres	80 to 90 acres	140 to 150 acres
Amount of right of way available for redevelopment	None	None	30 acres

⁽¹⁾ Does not include potential wetland impacts associated with stormwater ponds or frontage roads. Potential wetland impacts associated with Highway 169 alignment and interchange configuration only.

TABLE 8 – continued
CSAH 4 (ZIMMERMAN) INTERCHANGE ALTERNATIVES

Evaluation Criteria	Highway 169/CSAH 4 Interchange Alternatives		
	No-Build Alternative	Compressed Diamond Interchange (existing Highway 169 alignment)	Preferred Alternative (Compressed Diamond/SE Loop Interchange along shifted Highway 169 alignment)
Social, Economic and Environmental (SEE) Considerations			
Residential relocation (total acquisition)	None	None Anticipated	15 to 20
Potential residential relocation ⁽²⁾	None	None Anticipated	Less than 5
Commercial/business impacts (total relocation)	None	10 to 15	Less than 5
Potential commercial/business impacts ⁽²⁾	None	5 to 10	Less than 5
Maintain cohesive business district along Hwy 169 and CSAH 4	Maintains existing business district	Divides business district into east and west sides of Hwy 169	Creates cohesive business district on west side of Hwy 169 and accommodates redevelopment of existing Hwy 169 right of way
Constructability and impacts to local traffic circulation	N/A	Greater impacts because all construct would be completed along existing Highway 169 alignment	Fewer impacts because most construction would be completed off the existing Highway 169 alignment.
Construction costs (million \$)	\$0	\$30 to \$35 million	\$20 to \$25 million

(2)Potential residential relocation and potential commercial/business relocation. These residential and commercial properties would likely be impacted by the compressed diamond interchange or the compressed diamond (loop in SE quadrant) interchange. The need for total parcel acquisition and relocation would be determined by construction limits identified in detail design.

Construction staging for the compressed diamond alternative would be more complex, relative to the shifted alignment alternative, because the interchange would be constructed along the existing Highway 169 alignment. As a result, this would limit access to CSAH 4 and downtown Zimmerman during the construction period.

While the compressed diamond interchange was estimated to result in fewer wetland impacts and residential relocations, it was estimated to result in greater commercial/business relocations and impacts to the downtown business area as a result of widening CSAH 4. It also does not provide the opportunity to redevelop the existing Highway 169 right of way as part of a cohesive business district. Because of the commercial/business impacts, the compressed diamond interchange configuration was rejected from further consideration.

Highway 169/CSAH 4 Build (Preferred) Alternative Interchange Type

Preferred Alternative (Compressed Diamond Interchange with SE Loop on Shifted Alignment): A compressed diamond interchange with a loop in the southeast quadrant was identified as the preferred Highway 169/CSAH 4 interchange type. Under the preferred alternative, Highway 169 would be shifted approximately 700 feet to the east of its existing alignment at CSAH 4. This interchange would provide a single directional ramp for the entrance and exit movement to and from southbound Highway 169. A ramp would be provided for the exit movement from northbound Highway 169 to CSAH 4, and a loop in the southeast quadrant of the interchange would provide for the entrance movement from CSAH 4 to northbound Highway 169. CSAH 4 would bridge over Highway 169. The intersection spacing between interchange ramps would be 900 feet.

The compressed diamond interchange with a loop in the southeast quadrant was identified as the Build (preferred) Alternative for the Highway 169/CSAH 4 interchange for the following reasons:

- The compressed diamond (SE loop on shifted alignment) alternative was estimated to result in fewer impacts to commercial properties/businesses. Shifting Highway 169 and the proposed interchange to the east accommodates the expansion of CSAH 4 outside of the existing business district, allowing CSAH 4 to taper back down, requiring only partial right of way acquisitions from businesses along CSAH 4 west of Highway 169. The compressed diamond (SE loop on shifted alignment) would also maintain a cohesive business district west of Highway 169, whereas the existing Highway 169 alignment divides the business district.
- The compressed diamond (SE loop on shifted alignment) alternative would result in approximately 30 acres of existing highway right of way to be turned back for redevelopment following construction of the proposed Highway 169 realignment and interchange. Constructing an interchange along the existing Highway 169 alignment does not accommodate redevelopment opportunities.
- Construction of the compressed diamond (SE loop on shifted alignment) alternative would be less complex because the interchange would be constructed on a new

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Highway 169 alignment. This would allow the use of existing Highway 169 and would maintain better access to downtown Zimmerman during construction.

- Construction cost estimates for the compressed diamond (SE loop on shifted alignment) alternative were estimated to be approximately \$5 to \$10 million less than the compressed diamond (existing highway alignment) alternative.
- The compressed diamond (SE loop on shifted alignment) alternative was estimated to require more right of way and result in more residential relocations because of the shift in the Highway 169 alignment to the east of its existing alignment. The compressed diamond (SE loop on shifted alignment) was estimated to result in greater impacts to wetlands, also because of the shift in the Highway 169 alignment and the placement of the interchange ramp and loop in the southeast quadrant of the interchange. There was no interchange type identified for the proposed Highway 169/CSAH 4 interchange that would avoid wetland impacts while also minimizing commercial and residential impacts. As such, greater impacts to wetland areas and residential properties represented a trade-off to minimizing impacts to commercial properties and businesses and other social and economic considerations.
- The grade-separation of CSAH 4 from Highway 169 will improve pedestrian and bicycle safety. The distance between interchange ramp intersections would be greater with the compressed diamond (SE loop on shifted alignment) alternative compared to the compressed diamond (existing Highway alignment) alternative. This increased distance makes it easier for pedestrians and bicyclists to navigate through the interchange area because conflicting turning movements at ramp intersections are spaced further apart.