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Intersection-Roundabout Feasibility Study

County Road 33 (Diamond Path) at 140th Street/ Connemara Trail

CP 33-15

Dakota County, MN

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November 12, 2020

Certification

Feasibility Report

For

County Road 33 Roundabout
CP33-15

Dakota County
Diamond Path and 140th Street/Connemara Trail
T43.120065

November 12, 2020

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: _____

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License No. 43354

Date: 11/12/2020

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I. EXECUTIVE SUMMARY

Dakota County, with the support of the Cities of Apple Valley and Rosemount, explored improved traffic control for the intersection of County State Aid Highway 33 (Diamond Path) and 140th Street W/Connemara Trail. The recommendations developed through this study feasibility report prepared the project for approvals, permits, preliminary and final engineering design, and construction.

Overall, the current all-way stop control has provided acceptable operations but there have been public comments concerning the safety of the intersection and driver confusion due to the traffic control and the number of traffic lanes. Safety review of the intersection indicated that there were a high number of crashes and the types of crashes that occurred are not normal for an all-way stop controlled intersection. The crashes resulted in the current intersection experiencing a crash rate double the expected crash rate for an all-way stop controlled intersection. This indicated a need for improvements to increase safety and improve the functions for motorists and all other users. Therefore, the analysis considered options to improve the safety of the intersection, reduce conflicts, maintain acceptable traffic operations, and benefit pedestrians in the area.

Both the current all-way stop control and a roundabout were considered as traffic control options. A signal was also considered but eliminated due to the surrounding land use, area context, speeds through the intersection, and queuing. The public was invited to an open house on February 6, 2020 to discuss the current intersection and issues. Following the open house, the analysis and evaluation was conducted, resulting in the recommendation for a single-lane roundabout. A single-lane roundabout was determined to mitigate the existing and potential traffic safety issues and provided acceptable traffic operations. An online engagement opportunity was provided to solicit public comment on the evaluation and the roundabout concept in May 2020. Overall, the public was in support of the roundabout.

A single-lane roundabout was determined to be the preferred traffic control at the intersection of CSAH 33 (Diamond Path) and 140th Street/Connemara Trail. The County has implemented roundabouts in similar environments in numerous locations across Dakota County and strongly supports the installation of a single-lane roundabout intersection at CSAH 33 (Diamond Path) and 140th Street/Connemara Trail. The preferred roundabout is located offset to the northwest to provide for improved geometry and to limit property impacts. The design includes an adjacent multi-use trail, bus stops for the Minnesota Valley Transit Authority (MVTA), and bike ramps.

With the design of the intersection as a single-lane roundabout, the connecting corridors also had recommendations to align them with the proposed roundabout. This included:

- Extending the current 3-lane roadway section on Connemara Trail into the roundabout on the east leg,
- Restriping 140th Street from a 4-lane undivided roadway section to a 3-lane roadway section from 141st Street to CSAH 33 (Diamond Path),
- Restriping CSAH 33 (Diamond Path) from 145th Street to 140th Street/Connemara Trail to one through lane in each direction, and
- Connecting the multi-use trail north of the roundabout into the existing shoulders on CSAH 33 north of the intersection.

On September 15, 2020, the Dakota County Physical Development Committee accepted a presentation of the findings and recommendations of this Feasibility Study. The County Board then officially adopted the recommendation to proceed with the roundabout project on September 22, 2020. Final design and right-of-way activities will proceed into 2021 and 2022, with construction of the project planned for 2023.

II. BACKGROUND

County Road/County State Aid Highway (CSAH) 33 (Diamond Path) and 140th Street/Connemara Trail is an all-way stop controlled intersection at the border between the cities of Apple Valley and Rosemount. It has been a top priority for periodic review among the County's all-way stop controlled locations due to traffic growth, safety, and operations. The intersection currently provides efficient traffic operations and is anticipated to sufficiently accommodate future traffic growth. The intersection does have a notable crash history though, with half of the reported crashes at the intersection between 2016 and 2018 involving right angle and left-turn collisions.

Dakota County, with the support of the Cities of Apple Valley and Rosemount, is exploring improved traffic control for this location with a focus on the feasibility of a roundabout at the intersection to improve the operations and safety of the intersection, and to benefit the existing pedestrian facilities in the area. This study will assess operations of the intersection and approaching roadways to develop an engineering evaluation and stakeholder involvement. This study feasibility report also discusses the elements involved to prepare the project for approvals, permits, preliminary and final engineering design, and construction.

III. EXISTING CONDITIONS

CSAH 33 (Diamond Path) provides a north-south connection to CSAH 31 (Pilot Knob Road) and CR 46 (160th Street), serving large areas of eastern and southern Apple Valley and Rosemount. At the intersection with 140th Street/Connemara Trail, Diamond Path is a four-lane undivided highway with left turn lanes. The four-lane urban section transitions to a two-lane rural section approximately 600' north of the intersection. The four-lane section is carried south through the Independent School District (ISD) 196 campus and is transitioned back to a two-lane section at the intersection with 145th Street. The speed limit on CR 33 is 45 miles per hour (mph).

140th Street runs west of Diamond Path while Connemara Trail runs east of Diamond Path. The 140th Street/Connemara Trail east-west connection intersects Diamond Path as a four-lane, urban section without turn lanes and serves as a connecting route between Rosemount and Apple Valley. Connemara Trail was restriped from a four-lane undivided roadway to a three-lane section in 2019 approximately 200' east of Diamond Path. The speed limit is posted at 35 mph east of Diamond Path and 45 mph west of Diamond Path.

The intersection operates under all-way stop control and there are fences, hills, monuments, and trees on the intersection corners that can block some sight lines.

There are pedestrian facilities in place along both sides of 140th Street and Connemara Trail, as well as the south leg of Diamond Path. Minnesota Valley Transit Authority (MVTA) serves two bus stops at the intersection. Overhead electric transmission lines and utility poles run along the east side of Diamond Path.

A. Functional Classification

Roadway classifications identify the functions for roads before determining street widths, speed limits, intersection control, or other design features. Non-transportation features, such as land use and development, are also considered for planning and designing streets and highways. An area roadway functional classification map is provided in **Exhibit 1**.

CSAH 33 (Diamond Path) is functionally classified as an "Other Arterial" roadway. As identified by the Metropolitan Council, a minor arterial roadway in an urban area is typically designed for medium to short trips, moderate travel speeds, and have an emphasis on mobility, with intersections that are typically controlled by roundabouts, signals, and cross-street stops. Transit is to be accommodated and bicycle and pedestrian accommodations should be provided to allow for adequate crossing opportunities. Diamond Path connects to both CSAH 31 (Pilot Knob Road) and CSAH 42 (150th Street). CSAH 31 is an A-Minor

Arterial while CSAH 42 is a Principal Arterial. A-Minor arterials are minor arterials that supplement the principal arterial system in densely developed or developing areas while Principal Arterials have an emphasis on mobility versus land access with intersection control being high-capacity controlled at-grade intersections or grade separated interchanges.

Both 140th Street and Connemara Trail are classified as Major Collector roadways. According to the Metropolitan Council, Collectors connect neighborhoods for short trips and have an equal emphasis on mobility and land access. Typical intersection control includes cross-street stops, all-way stops, roundabouts, and some traffic signals. They are designed for use by transit and have bicycle and pedestrian accommodations to provide adequate crossing opportunities.

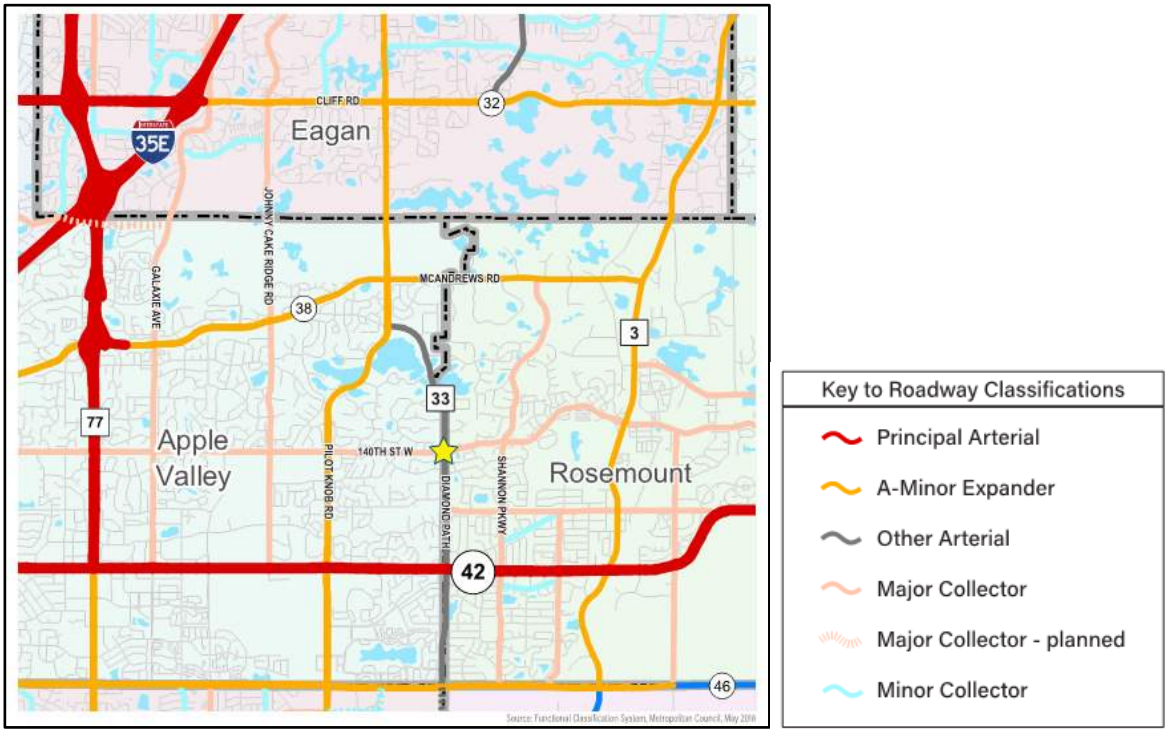


Exhibit 1. Roadway Functional Classification Map

B. Traffic Volumes

Traffic volume data was collected in September 2019. The AM peak hour was found to be from 7:00 to 8:00 AM and the PM peak hour was found to be from 4:00 to 5:00 PM. The PM peak hour includes the school dismissal time at Diamond Path Elementary School. The AM school start time is after the AM peak hour. **Table 1** includes the daily traffic volumes on each leg of the intersection.

Table 1. Existing Average Daily Traffic Volume

Intersection Leg	Traffic Volume
Diamond Path north of 140th Street/Connemara Trail	8,250
Diamond Path south of 140th Street/Connemara Trail	11,000
140th Street west of Diamond Path	7,050
Connemara Trail east of Diamond Path	6,150

Future traffic volumes for 2040 were obtained from Dakota County. **Table 2** includes the forecasted Annual Average Daily Traffic (AADT) volumes used in the study.

Table 2. Future 2040 Annual Average Daily Traffic Volume	
Intersection Leg	**Traffic Volume**
Diamond Path north of 140th Street/Connemara Trail	9,200
Diamond Path south of 140th Street/Connemara Trail	11,800
140th Street west of Diamond Path	7,500
Connemara Trail east of Diamond Path	6,500

Minimal pedestrian and bicyclists were counted but are anticipated to be higher during weekends, especially during the summer months. The peak hour traffic volume turning movement counts are shown in **Figure 1** and can also be found in **Appendix A: Roundabout Justification Report**. Approximately 60% of the traffic volume at the intersection is on Diamond Path while 40% is on 140th Street and Connemara Trail. A roundabout is considered to be appropriate and operates effectively when intersecting roadway traffic volumes are relatively balanced, as currently identified at this intersection.

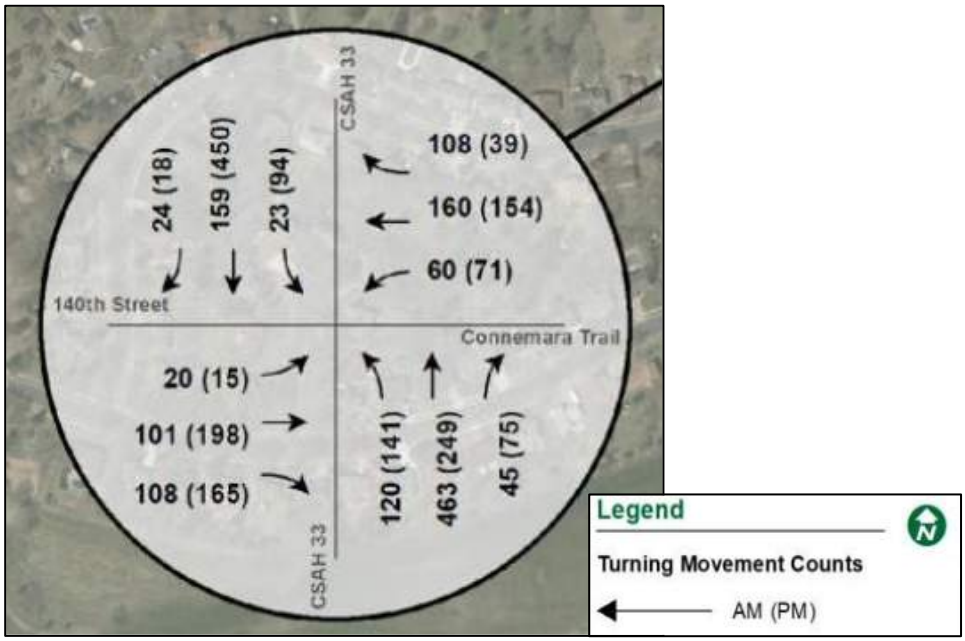


Figure 1. Existing Turning Movement Volume Counts

Traffic is anticipated to increase due to population growth. Traffic projections for 2030 and 2040 are indicated in **Figure 2**.

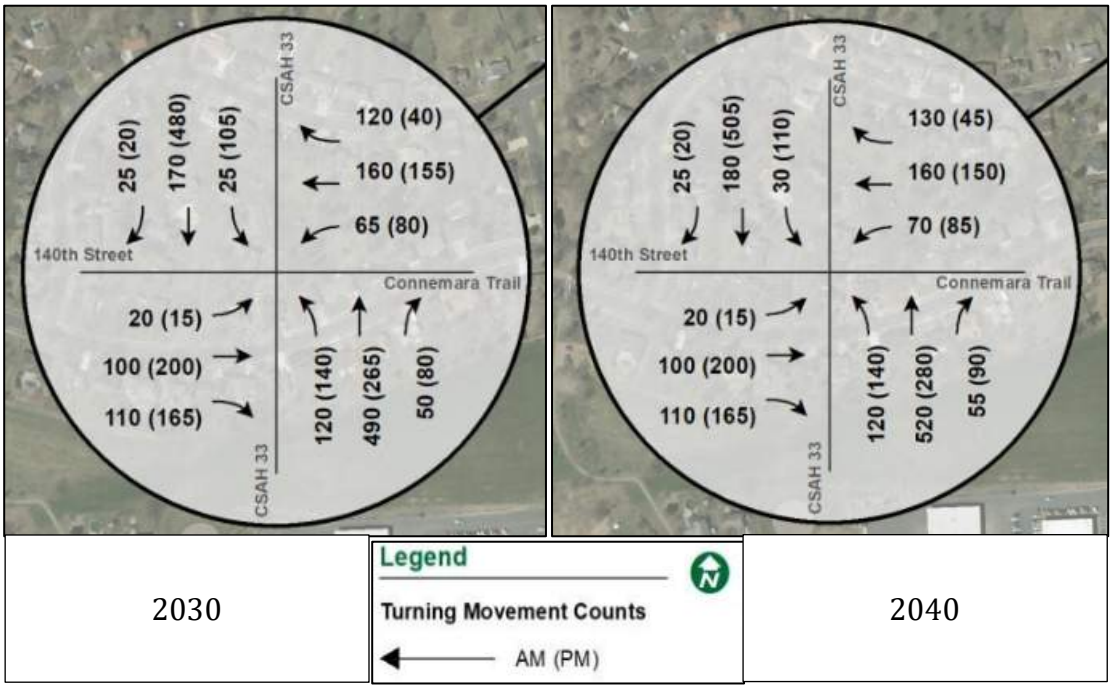


Figure 2. Forecasted 2030 and 2040 Turning Movement Volume Counts

C. Operations Review

The operations of the existing intersection with all-way stop control was evaluated using the methods within the Highway Capacity Manual (HCM) to determine Level of Service (LOS), average vehicle delays, and queue lengths, and is summarized in **Table 3**.

Table 3. Existing Operations

Approach	AM Peak Hour					PM Peak Hour				
	Approach		95% Queue (veh)	Intersection		Approach		95% Queue (veh)	Intersection	
	Delay	LOS		Delay	LOS	Delay	LOS		Delay	LOS
140th St EB	7	A	4	10	B	11	B	5	13	B
Connemara Tr WB	8	A	4			12	B	5		
CSAH 33 NB	11	B	5			11	B	4		
CSAH 33 SB	10	B	4			16	C	7		

Under the existing traffic volumes, the intersection operates with acceptable levels of vehicular delay during both peak hours. Average queues on all approaches are typically 2-3 vehicles long, with maximum queues of 150 feet. Visual observations indicate that queues of vehicles do form and there is hesitation by motorists to determine which vehicle is to proceed next, likely due to the numerous travel lanes from multiple directions.

Traffic operations for 2030 and 2040 under the existing all-way stop traffic control is provided in **Table 4**.

Table 4. Future Operations with Forecasted Traffic Under All-Way Stop Control

Approach	AM Peak Hour					PM Peak Hour				
	Approach		95% Queue (veh)	Intersection		Approach		95% Queue (veh)	Intersection	
	Delay	LOS		Delay	LOS	Delay	LOS		Delay	LOS
2030										
140th St EB	8	A	4	10	B	12	B	5	14	B
Connemara Tr WB	9	A	4			13	B	5		
CSAH 33 NB	12	B	5			12	B	4		
CSAH 33 SB	10	B	5			17	C	7		
2040										
140th St EB	8	A	4	11	B	12	B	5	14	B
Connemara Tr WB	9	A	5			13	B	5		
CSAH 33 NB	13	B	7			12	B	5		
CSAH 33 SB	11	B	4			18	C	7		

The slight increase in traffic volume results in a slight increase in overall and movement delays at the intersection. However, due to the relatively low levels of forecasted traffic growth, the all-way stop control is anticipated to continue to provide acceptable delays and queues on all approaches during both peak hours.

Additional information on the operations can be found in **Appendix A: Roundabout Justification Report**.

D. Safety Review

Crash data from 2016-2018 was provided by Dakota County. There have been 14 crashes recorded at this intersection between 2016 and 2018. Three of the crashes were classified as minor or possible injury crashes, and the remainder categorized as property damage only crashes. Of the total crashes, six were right angle, one was a mainline left turn crash, six were rear-end crashes, and one involved a right turning vehicle. A crash collision diagram is shown in **Figure 3.**

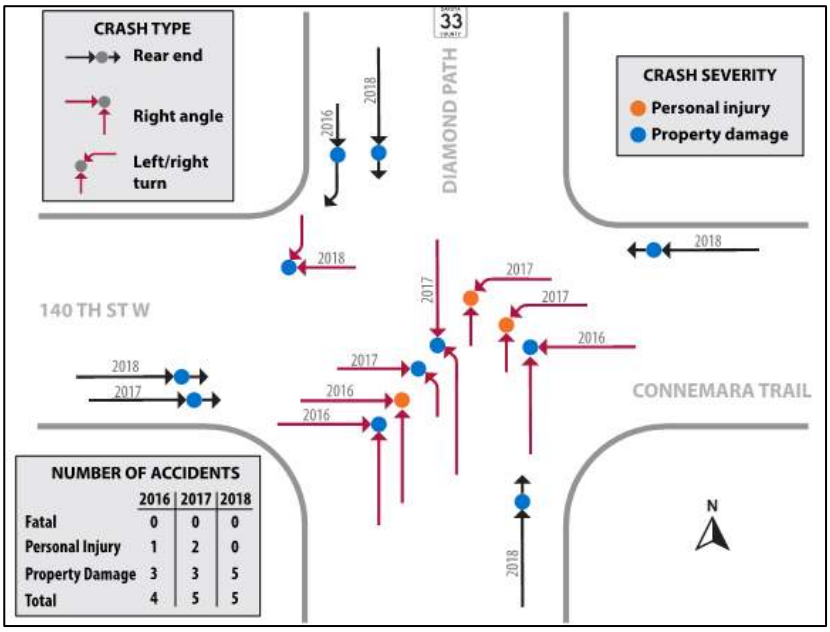
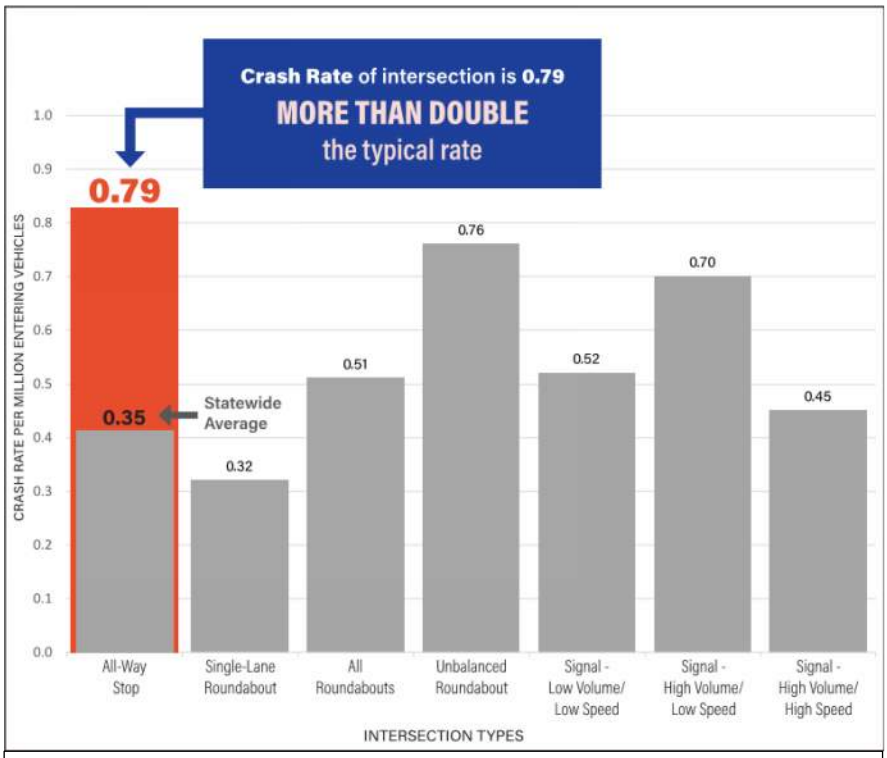


Figure 3. Crash Diagram

The intersection is experiencing an overall crash rate of 0.79 crashes per million entering vehicles. The crash rate is over two time the statewide average crash rate for all-way stops as indicated in **Figure 4**. In addition, the intersection is shown to have a Critical Index of 1.08, indicating that the intersection is operating above the expected normal range (critical index >1.0) when compared to other similar intersections statewide. The intersection is statistically considered to be operating outside the expected, normal range.

MnDOT provided additional crash data that included crashes occurring in 2019. Five crashes have been reported in 2019. Two of the crashes were reported as possible injury while the other three were property damage only crashes. Most importantly, all five crashes were reported as right-angle collisions, unusual for an all-way stop controlled intersection.

The intersection may be experiencing an elevated crash rate due to the multi-lane approaches to the all-way stop control and motorists running the stop signs (not coming to a full stop and checking all lanes for opposing traffic). The large total number of lanes approaching the intersection may cause confusion to drivers in determining who has the right-of-way to enter the intersection. A change in traffic control or change in geometry may reduce these crashes caused by driver confusion.



Source: A Study of the Traffic Safety at Roundabouts in Minnesota, Office of Traffic, Safety, and Technology, Minnesota Department of Transportation, 2017

Figure 4. Crash Rate Comparison

Fortunately, there have been no fatal or serious injury crashes at the intersection, but we must consider the risks. The number of personal injury crashes (not serious) is a concern for the future, resulting in a crash severity rate that is double the statewide average as indicated in **Figure 5**.

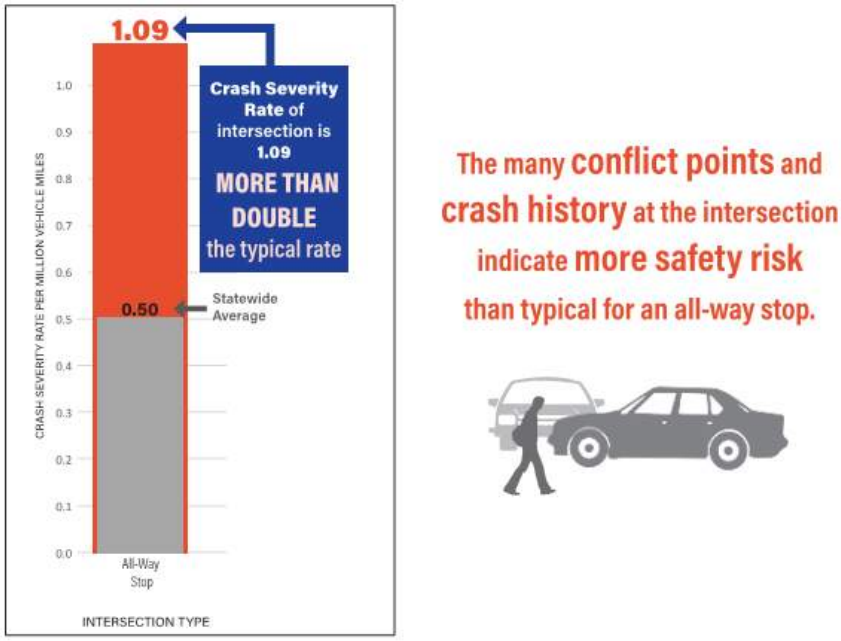


Figure 5. Crash Severity Comparison

Since the safety analysis was completed prior to the end of 2019, the crashes were not included in the initial analysis. Since then crash data for 2019 has been published. Five crashes have been reported in 2019. Two of the crashes were reported as possible injury while the other three were property damage only crashes. Most importantly, all five crashes were reported as right-angle collisions. The crash rate for the most recent three years using this data is 0.85 crashes per million entering vehicles, while the critical index is 1.16, slightly higher than shown above.

The intersection may be experiencing an elevated crash rate due to the multi-lane approaches at the all-way stop controlled intersection. The large total number of lanes approaching the intersection may cause confusion to drivers to determine who has the right-of-way to enter the intersection. A change in traffic control or change in geometry would likely reduce these crashes caused by driver confusion.

IV. TRAFFIC CONTROL ALTERNATIVES

The traffic control alternatives for this intersection include an all-way stop, roundabout, and a traffic signal. A thru-stop was not considered due to the longer sight lines required when vehicles do not have to stop and the traffic volumes.

A. All-Way Stop Control

The intersection currently operates under all-way stop control. All-way stop control can be useful as a safety measure at intersections with moderate traffic volumes that are relatively balanced on all approaches. The Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD) identifies criteria that should be considered for an all-way stop control installation including crash history and traffic volumes. The intersection meets the all-way stop warrant based on traffic volumes.

B. Roundabout

A roundabout is a one-way circular intersection where traffic flows around a center island. At entry, drivers yield to traffic in the roundabout. All drivers must yield to pedestrians in crosswalks. Advantages of roundabouts include fewer injury crashes and fatalities, increased pedestrian safety, and reduced vehicle delay. They are appropriate with moderate traffic volumes that are relatively balanced on all approaches. Challenges include the footprint of the intersection and driver understanding of yield upon entry.

A large reason for the inherent safety benefit that roundabouts provide is the reduction of intersection conflict points as illustrated in **Figure 6**. Conflict points are locations where two vehicle movement paths intersect. Where these paths intersect perpendicularly, collisions are more likely to be severe and are identified as Major Conflict Points. Where vehicle paths intersect in a merging or diverging nature, collisions tend to be less severe, injuries are unlikely, and are termed Minor Conflict Points. Finally, locations where a vehicular path intersects with a pedestrian crossing are pedestrian conflict points. At the Diamond Path and 140th Street/Connemara Trail intersection, many conflict points are present due to the number of lanes. The conflict points associated with a single-lane roundabout is vastly reduced for minor and pedestrian conflict points, while major conflict points are eliminated.

Additional information on the benefits and challenges of roundabouts can be found in **Appendix B: Public Engagement Materials**.

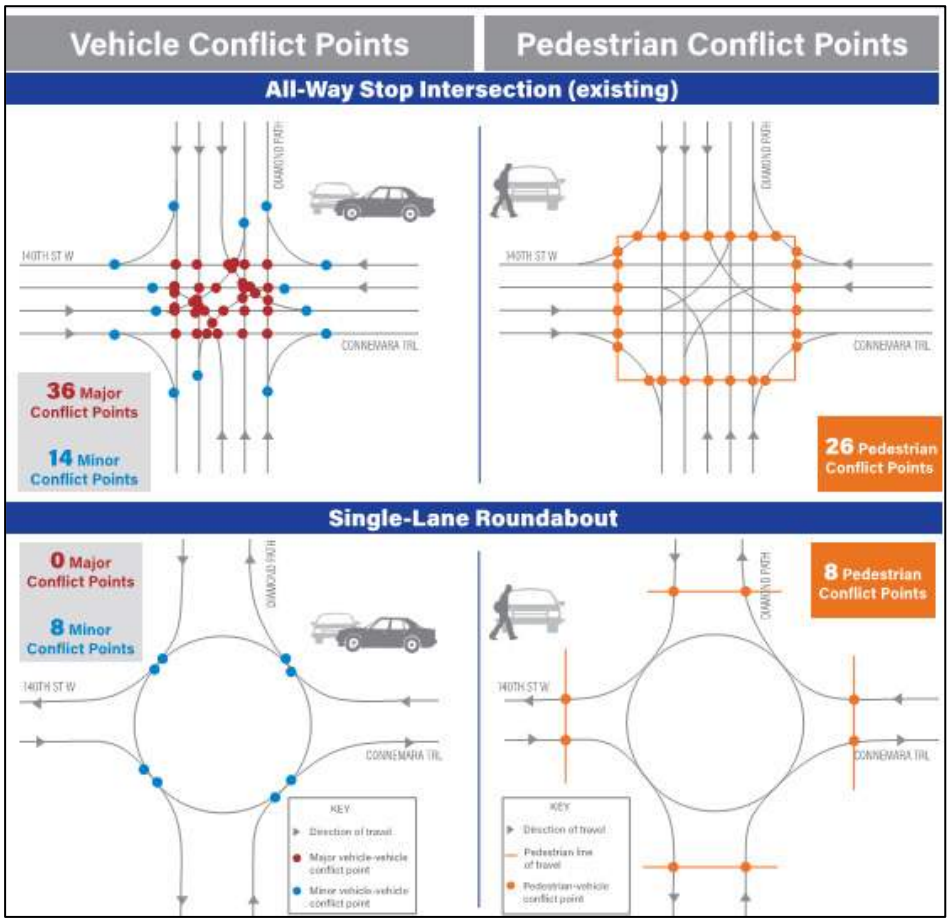


Figure 6. Intersection Conflict Points

Similarly, pedestrian safety is improved with the lower speeds and the roundabout geometry due to the implementation of two-staged crossings. The lower speeds approaching and leaving a roundabout typically result in less serious injuries as indicated in **Exhibit 2**. Rather than crossing up to five lanes of traffic traveling in two directions at one time, roundabouts allow pedestrians to cross one lane of traffic traveling in a single direction at one time. Splitter islands provide refuge areas for pedestrians to safely wait for acceptable gaps in traffic and shorten the physical crossing distance therefore limiting pedestrian exposure to traffic.

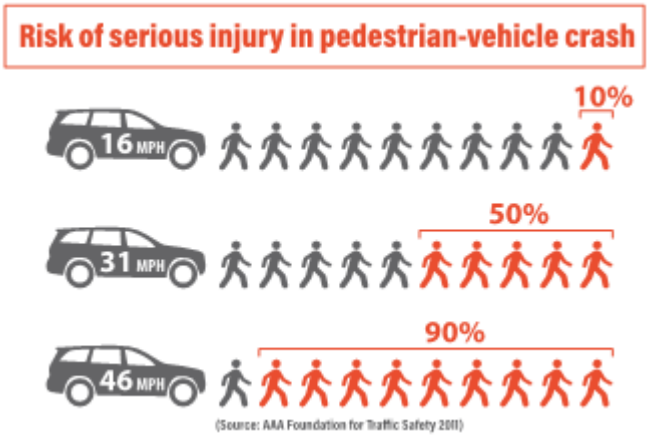


Exhibit 2. Vehicle Speed Versus Pedestrian Serious Injury Risk

A roundabout is considered to be warranted if the intersection meets warrants for either a traffic signal or an all-way stop.

C. Traffic Signal

Traffic signals on Dakota County highways are primarily located on higher speed and higher volume roadways. They introduce additional decision-making, an increased crash risk when the control is disregarded (running a red light), and they create delay. Traffic signal warrants have been developed as national guidelines to promote continuity of traffic control devices to ensure that traffic signals are installed at intersections that would benefit from their use. A traffic control signal should not be installed unless one or more of the warrants can be met, however the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic signal. Furthermore, a traffic control signal should not be installed unless an engineering study indicates that the traffic control signal will improve the overall safety and operation of the intersection. Finally, the signal should not disrupt the progressive flow of traffic.

The delay implications typical at signals, the traffic speeds, and traffic queues with a traffic signal are considered to be detrimental to the intersecting roadways with Diamond Path. Additionally, longer queues on Connemara Trail and the safety implications of the close intersection spacing are likely to impact the intersection of Delta Avenue/ Delta Place. There are also sight line considerations at this intersection if traffic travels at higher than posted speeds. Due to the neighborhood context, a traffic signal is not considered further in this study. The intersection does have volumes that meet the signal warrant, but a traffic signal is not considered to be the best approach to a traffic control option in this location.

V. TRAFFIC ANALYSIS

The intersection currently operates acceptably in terms of operations but as identified above, the intersection is experiencing unacceptably high crash trends. The feasibility of a roundabout in terms of operations and safety is evaluated under existing and future conditions. Additionally, with the potential of a roundabout and in consideration of the traffic volumes on the intersection legs, there the lane configuration on 140th Street is analyzed.

A. County Road 33 Roundabout

The traffic analysis of the roundabout will be used to determine how a roundabout would operate at the intersection and determine what size the roundabout should be. Traffic analysis of the intersection with a single-lane roundabout was completed and provides acceptable operations through 2040 as identified in Table 5, operating similar to the current all-way stop control. A larger roundabout with more lanes was determined to be unnecessary to provide acceptable operations.

Table 5. Operations Under Roundabout Control										
Approach	AM Peak Hour					PM Peak Hour				
	Approach		95% Queue (veh)	Intersection		Approach		95% Queue (veh)	Intersection	
	Delay	LOS		Delay	LOS	Delay	LOS		Delay	LOS
2019										
140th St EB	5	A	2	8	A	10	B	4	9	A
Connemara Tr WB	8	A	3			6	A	2		
CSAH 33 NB	10	B	7			8	A	4		
CSAH 33 SB	5	A	2			11	B	6		
2030										
140th St EB	5	A	2	10	B	11	B	5	11	B
Connemara Tr WB	9	A	4			6	A	3		
CSAH 33 NB	13	B	9			9	A	6		
CSAH 33 SB	6	A	2			14	B	10		
2040										
140th St EB	5	A	2	11	B	11	B	4	11	B
Connemara Tr WB	10	B	4			6	A	2		
CSAH 33 NB	14	B	10			9	A	6		
CSAH 33 SB	6	A	2			15	C	9		

The intersection is anticipated to operate at LOS B or better for the overall vehicular delay under single-lane roundabout control. Delays and queues are shown to increase as traffic volumes increase at the intersection. Approach delays are anticipated to operate at LOS C or better during the peak hours. Maximum queues are anticipated to be a few vehicles longer than anticipated under AWSC, with a maximum queue reaching up to 250 feet during the AM peak hour peak hour with 2040 forecasted volumes.

Overall, the single-lane roundabout alternative is anticipated to operate similar to the all-way-stop-control under the existing and forecasted traffic volumes.

1. Adjacent Intersection Impacts

   The adjacent intersection of Delta Avenue/Delta Place is located east of Diamond Path on Connemara Trail. Any change in traffic control or increase in traffic volume is anticipated to impact the operations at the intersection due to its close proximity. Analysis was completed to determine the impacts of a roundabout to the Delta Avenue/Delta Place intersection in 2040. Analysis determined that backups from Diamond Path, with the roundabout, could back up to Delta Ave/Delta Pl for up to eight non-consecutive minutes of the AM peak hour and one minute of the PM peak hour. This backup is not considered to be detrimental to the overall operations since the blockage clears in minimal time.

2. Safety Impacts

   A single-lane roundabout is anticipated to increase the safety of the intersection by reducing the number of vehicle conflict points from 50 to 8 and reducing the number of

vehicle-pedestrian conflict points from 26 to 8 as previously identified in **Figure 6**. More specifically the roundabout is anticipated to eliminate the right angle and left turn collisions that occur at the intersection under the existing traffic control. High severity crashes are also anticipated to be reduced.

Analysis of a single-lane roundabout shows a roundabout treatment would be anticipated to mitigate potential traffic operations issues due to area traffic growth as well as provide significant safety benefits. The roundabout effectively eliminates the potential for right-angle and left turn crashes that are being experienced at the intersection. Similarly, pedestrian safety is better accommodated by creating two-stage crossings and decreasing the crossing distances on each leg of the intersection. The County has implemented roundabouts in similar environments in numerous locations across the County and strongly supports the installation of a roundabout intersection at CSAH 33 and 140th Street/Connemara Trail.

Additional information on the roundabout considerations can be found in **Appendix A: Roundabout Justification Report**.

B. 140th Street, West of CSAH 33 in Apple Valley

Connemara Trail was recently converted from a 4-lane undivided roadway to a 3-lane roadway in the fall of 2019. 140th Street is currently a 4-lane undivided roadway but traffic volumes are compatible with a 3-lane roadway section. A three-lane section can typically operate acceptably with up to 16,000 vehicles per day and provide benefits to safety than a 4-lane undivided roadway. The improvement in safety is tied to the reduction in conflicts, safer street crossings, traffic calming, and improved emergency response time as shown in **Exhibits 3 and 4**.

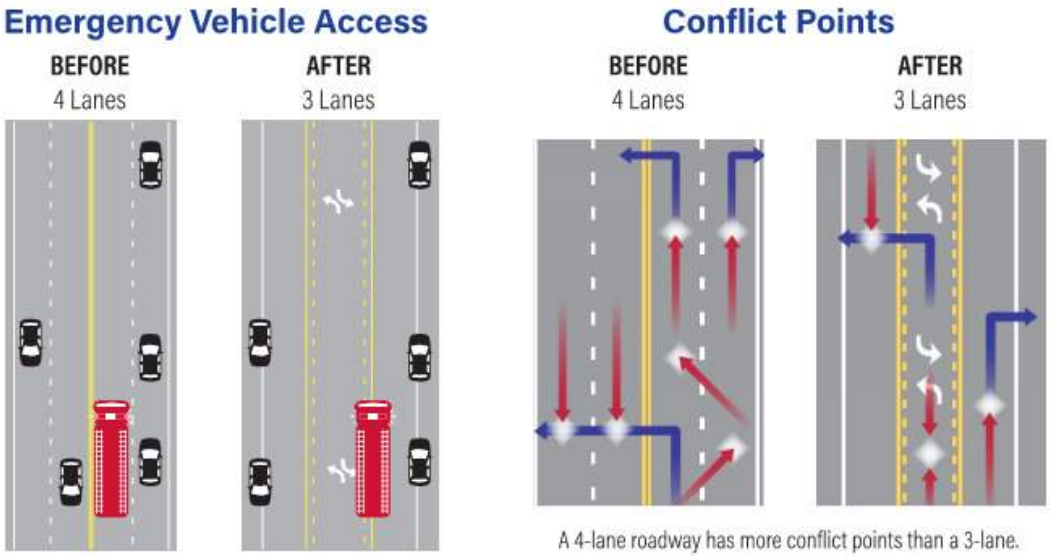


Exhibit 3. 4 to 3 Lane Impacts

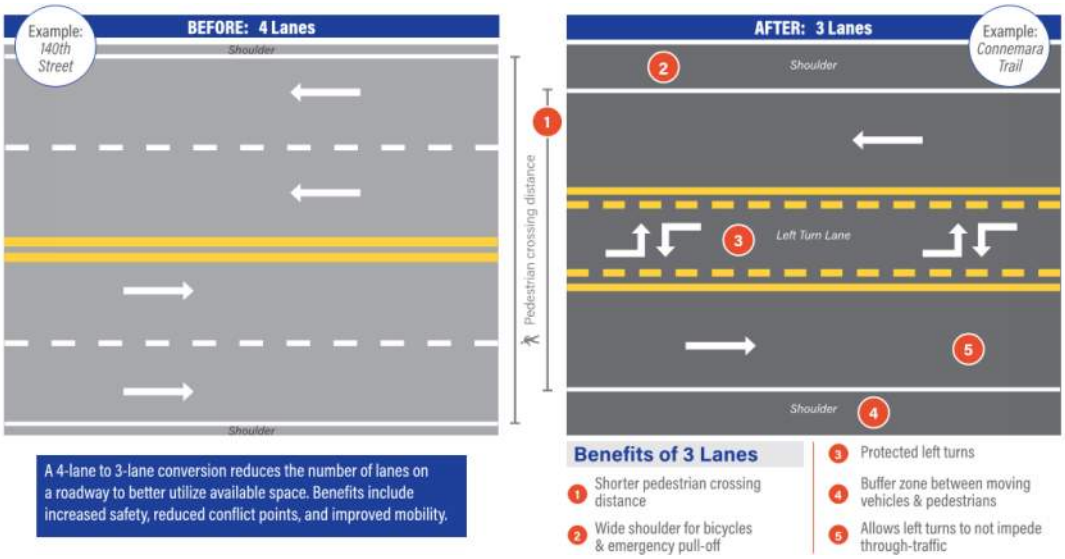


Exhibit 4. Benefits of a 3-Lane Roadway

Additional information on the benefits and challenges of a 4 to 3 lane conversion can be found in **Appendix B: Public Engagement Materials**.

1. Operations

   Five intersections were evaluated along the corridor. The corridor is anticipated to operate effectively under both a four-lane and three-lane option. All intersections operate with minimal delay and Level of Service A under both lane options. A three-lane section provides notable vehicle and pedestrian safety improvements when compared to the existing four-lane section as there are fewer lanes of traffic for pedestrians to navigate and fewer conflict points at intersections. Additional information on the benefits and challenges of a four to three lane conversion can be found in **Appendix C: 140th Street Traffic Analysis.**

2. Safety

   A safety review of the crash data along 140th St W from 141st St W to Diamond Path was completed. Ten crashes have occurred along the corridor from 2016 to 2018. Five of the crashes were rear-end, two were right angle, and one was a sideswipe opposing crash, meaning that one driver crossed the centerline of the roadway. One crash was a run-off-road crash. Two of the crashes resulted in minor injuries, two resulted in possible injuries, and the other six resulted in property damage only. As identified above, a three-lane section would be anticipated to reduce the number and severity of the crashes.

C. Diamond Path (CSAH 33) from 140th to 150th Street

From CSAH 42 (150th Street) to 145th Street, Diamond Path is a two-lane divided roadway. From 145th Street to 140th Street/Connemara Trail, Diamond Path is a five-lane undivided roadway with two thru lanes in each direction and a center left turn lane. North of 140th Street/Connemara Trail, Diamond Path is a two-lane undivided roadway. With a preferred single-lane roundabout design at the intersection of Diamond Path and 140th Street/Connemara Trail, a review of the configuration of Diamond Path is needed. Based on the traffic volumes, the roadway should be configured as a three-lane undivided roadway with right turn lanes.

1. Operations

   Operations analysis of the corridor north and south of the roundabout was not completed but visual observations indicate that the outer southbound right lane is used almost exclusively as a right turn lane, especially during the school start and dismissal times. Operational analysis to determine the length of turn lanes and final configuration should be completed during preliminary design.

2. Safety

   A safety review from 145th Street to 140th Street/Connemara Trail was completed. No crashes have occurred on Diamond Path north of 145th Street between 2016 and 2018, while six crashes have occurred at 145th Street. Five were right angle crashes while one was a left turn crash. Public comments and crash reports indicated a concern with sight lines, use of the northbound right turn lane as a through lane, motorists using the southbound left turn lane as a through lane and merging within the intersection, and difficulty in determining how fast traffic is approaching. Crash review indicates that sight lines should be improved if possible based on the types of crashes that occurred, crash report information, and public comments. This relates to the horizontal curve to the north and the vertical curve to the south. The low number of crashes indicates the importance of providing a center left turn lane that should be maintained. The change to one through lane in each direction is not anticipated to decrease safety along the corridor.

Dakota County is also in the process of completing a School Assessment Study for all schools adjacent to Dakota County and State Highways within Dakota County. The assessment will focus on pedestrian safety. Recommendations for this area should be considered for incorporation into this project.

VI. ROUNDABOUT DESIGN

Roundabout design concepts were developed to provide for trucks and buses using the intersection, decrease speeds, and to minimize impacts to adjacent properties and utilities. Two primary locations for roundabout placement were developed, centered on the existing intersection or shifted to the northwest. The roundabout that was shifted to the northwest was determined to be the preferred concept. The design and placement minimizes property impacts, provides the most space between Diamond Path and Delta Avenue/Delta Place, and is able to accommodate an eastbound left turn lane at Delta Place. The left turn lane developed is better configured for access and delineation of movements. The preferred concept in shown in **Exhibit 5**. In addition, there is an alternative that shows trail instead of sidewalk on the NE corner to the east on Connemara Trail, which would accommodate bicyclists on Connemara to access the trail along Diamond Path or cross Diamond Path without entering the roundabout. Concepts included in **Appendix D: Roundabout Concepts**.

Exhibit 5. Preferred Roundabout Concept

Specific features and impacts of the roundabout design include:

- Connection between the trail and the existing shoulder north of the roundabout
- Left turn lanes developed at Delta Avenue/Delta Place
- Raised median between Diamond Path and Delta Avenue/Delta Place
- Short retaining wall on the NW corner
- Bus pullouts for the MVTA stops on the south side of the roundabout
- Impacts to neighborhood monuments on the NE and SE corners
- Impacts to the utility control box location and fence impacts on the SW corner

VII. 140th STREET DESIGN

The 4 to 3 lane conversion striping configuration for 140th Street is shown in **Appendix C: 140th Street Traffic Analysis**. The configuration includes one 11 ft through lane in each direction, a center 12 ft left turn or two-way-left-turn-lane in the center of the roadway and a 5 ft shoulder on

the outside of each direction of travel. The lane widths for 140th Street are designed to promote lower speeds and are appropriate for the largely residential and auto-orientated traffic along the corridor. A three-lane section along this corridor, east of Pilot Knob Road (CSAH 31) would match into a single-lane roundabout design at Diamond Path. The five-lane section at Pilot Knob Road (CSAH 31) would be maintained.

As part of the design, improvements to the "pedestrian crossing" associated with the Barbara Savanick Trail and Drommond Trail should be reviewed for appropriate configuration, location, signing, and striping.

VIII. COUNTY ROAD 33 (DIAMOND PATH) DESIGN

A. North of 140th Street/Connemara Trail

A new trail and other roadway improvements on County Road 33 (Diamond Path) between Pilot Knob Road and 140th Street/Connemara Trail will be considered in a study beginning in 2024. This study provided a preliminary review of the options available. The right-of-way width, which ranges from 90 to 125 feet wide, and other conditions along the corridor will determine the type of facility that is appropriate. Current wetlands, lakes, and ditch grades will be a consideration in determining the appropriate configuration considering wide shoulders, off-road multi-use trail, urban or rural, and two or three lane roadway section, especially as there is access off of Diamond Path. Some typical options for the roadway and trail section are included in **Appendix B: Public Engagement Materials**.

B. South of 140th Street/Connemara Trail

As identified above, Diamond Path from 140th Street to 145th Street should be restriped and signed as a three-lane roadway in conjunction with the roundabout project. An option for the striping configuration that would match into the section south of 145th Street and the single-lane roundabout at 140th Street/Connemara Trail is shown in **Appendix E: Diamond Path Striping.** The specific turn lane lengths and configuration will need to be verified during preliminary and final design.

IX. PRELIMINARY ENVIRONMENTAL REVIEW

This report includes a preliminary environmental review, for the CSAH 33 (Diamond Path) at 140th Street/Connemara Trail proposed single-lane roundabout.

The objectives of the environmental review are to provide content for later formal project environmental and permit documentation, to identify potential environmental impacts, to recommend an approach for environmental documentation and future permitting, and to identify potential project needs.

A. Project Information

The project takes place in the cities of Apple Valley (west) and Rosemount (east) within Dakota County. The project is within the following townships, ranges, sections, and quarter-quarter sections:

- T115N, R20W, S24 SE ¼ SE ¼ & S25 NE ¼ NE ¼
- T115N, R19W, S19 SW ¼ SW ¼ & S30 NW ¼ NW ¼

B. Background

The intersection of CSAH 33 (Diamond Path) and 140th St/Connemara Trail has been the subject of analysis by Dakota County periodically since 2008. While the intersection currently provides efficient operations and is anticipated to sufficiently accommodate forecasted traffic growth, the intersection is operating outside of the expected safety range.

Currently, over 16,000 vehicles pass through the intersection daily. Traffic volumes are expected to increase between 10 and 15% by 2040. 140th St/Connemara Trail provides two east-west through lanes while CSAH 33 (Diamond Path) has two north-south through lanes, along with dedicated left-turn lanes northbound and southbound. The current intersection configuration creates multiple conflict points between vehicles and between crossing pedestrians and vehicles.

C. Purpose and Need

1. Purpose

The purpose of the CSAH 33 (Diamond Path) at 140th St/Connemara Trail Intersection-Roundabout Design is to resolve the safety and operational issues identified at the intersection. These issues are mostly attributed to the large number of lanes approaching the intersection which create multiple conflict points between vehicles. Another purpose of the project is to provide nonmotorized connections through the intersection.

A roundabout justification report (RJR) included traffic analysis and forecasting, warrant analysis, safety analysis, and sensitivity analysis. A roundabout treatment was found to mitigate potential traffic operation issues due to area traffic growth as well as provide significant safety benefits. The single-lane roundabout effectively eliminates the potential for right-angle and left turn crashes that are typically at the intersection. Similarly, pedestrian safety is better accommodated by creating two-stage crossing on each leg of the intersection. In addition, the County has implemented roundabouts in similar environments across the county. Installation of a roundabout intersection at CSAH 33 and 140th Street/Connemara Trail is the most appropriate approach to control traffic safely.

2. Need

The need to address safety at the intersection is demonstrated by a crash rate over two times greater than that of statewide all-way stops. Of 14 crashes recorded over three years from 2016 to 2018 at the intersection, seven of these were reported as right angle or left turn collisions. The crash rate of the intersection is 0.79, more than double over the statewide average of 0.35 for all-way stops. This elevated crash rate may be due to the multi-lane approaches to the all-way stop control. The large total number of lanes approaching the intersection causes confusion to drivers determining who has the right-of-way to enter the intersection as observed through field observations and based on public comment.

D. Alternatives Considered

1. No-Build

Under the No-Build Alternative the all-way stop control would remain at the intersection. The intersection is anticipated to maintain acceptable operations until 2040. This alternative fails to address the purpose and need of the project, to reduce conflicting traffic movement points and improve safety.

2. Roundabout Concept 1

Concept 1 is a single-lane roundabout centered over the existing CSAH 33 and 140th St/Connemara Trail intersection (see **Appendix D: Roundabout Concepts**). This alternative would require permanent right-of-way acquisition from privately-owned parcels as indicated in **Table 6**:

Table 6. Alternative 1 Right-of-Way Acquisition Estimate			
Parcel	Acquisition (sf*)	Parcel	Acquisition (sf*)
013220001040	1,467	341830101010	1,696
013101104040	1,565	341830001010	1,554
6,282 sf total (0.14 acres)			

*sf = square feet

The single-lane roundabout includes pedestrian crossings and trails that tie into existing trails/sidewalks along 140th St/Connemara Trail and south along CSAH 33. This alternative would require approximately 3,000 sf of tree removal. A total of 4,346 sf of additional impervious surface relative to existing conditions would be added under this alternative.

3. Concept 2 (Preferred)

Concept 2/Preferred Alternative is a single-lane roundabout shifted to the northwest at the CSAH 33 and 104th St/Connemara Trail intersection (see **Appendix D: Roundabout Concepts**). This alternative would require permanent right-of-way acquisition from privately-owned parcels as indicated in **Table 7.**

Table 7. Preferred Alternative Right-of-Way Acquisition Estimate			
Parcel	Acquisition (sf*)	Parcel	Acquisition (sf*)
013220001040	2,275	341830101010	990
013101104040	1,300	341830001010	446
5,011 sf total (0.11 acres)			

*sf = square feet

The single-lane roundabout includes pedestrian crossings and trails that tie into existing trails/sidewalks along 140th St/Connemara Trail and south along CSAH 33. This alternative would require approximately 3,050 sf of tree removal. A total of 4,715 sf of additional impervious surface relative to existing conditions would be added under this alternative.

E. Anticipated Environmental Document Type

Since the project is anticipated to use local funding only, and the project appears to not trigger a State Environmental Assessment Worksheet, no environmental compliance documents will be required. Standard permits may be required such as NPDES-SWPPP, construction permit, etc. If the project receives federal funding, environmental compliance documentation may be needed such as a Project Memorandum (PM) through MnDOT's State Aid office.

F. SEE Categories Preliminary Environmental Analysis

1. Environmental Categories with Possible Impacts

a) Right-of-Way

The preferred alternative will require 0.11 acres of right-of-way to be acquired from private residences for the project.

b) Wetland Protection

There are no USFWS mapped wetlands within the immediate project area (see

Public/Impaired Waters figure). A wetland delineation will be required for the project. Wetlands, if present, are likely Wet Ditches (incidental) which may qualify under the MN Local Government Road Wetland Replacement Program (LGRWRP). This permitting path can be taken if a project is a repair, rehabilitation, reconstruction, or replacement of a currently serviceable road to meet state/federal design or safety standards/requirements.

c) Section 404 of CWA

If wetlands are present US Army Corps of Engineers (USACE) coordination will be required for a Section 404 permit, meeting the requirements of the Clean Water Act (CWA).

d) Water Pollution/Minnesota Pollution Control Agency-National Pollutant Discharge Elimination System

While the project involves a minimal increase in imperious surface (0.02 acres under the Preferred Alternative), a National Pollutant Discharge Elimination System (NPDES) permit will likely be required for the project given disturbance of more than one acre.

The nearest MPCA listed impaired water is Farquar Lake (AUID 19-0023-00), located approximately 0.65 miles northwest of the project area (see **Appendix F: Environmental** for Public/Impaired Waters figure). Another impaired water, Long Lake (AUID 19-0022-00), is 0.80 miles northwest of the project area. These are the only two impaired waters within a one-mile radius of the project area. The nearest public waters are Birger Pond (AUID 19-0224-00) and Copper Pond (AUID 19-0453-00), both approximately 0.5 miles from the project area at the nearest point. Given the distance to these waters, no impacts are anticipated.

e) Environmental Justice

A preliminary screening of the project area using the US Environmental Protection Agency's (EPA) Environmental Justice (EJ) Screening and Mapping Tool (EJScreen) reveals EJ populations may exist within ¼ mile of the project area, given a comparison of the region to state data (see **Appendix F: Environmental**). This tool utilizes 2013-2017 American Community Survey (ACS) data. There is more recent, 2014-2018, ACS data available by the Metropolitan Council. An in-depth EJ analysis should be completed for the project at the level of the smallest available analytic unit (Block Group) and compared to the City (Apple Valley and Rosemount) and County (Dakota) data. The analysis should also include detour routes if required during project construction.

f) Public and Religious Institutions [No Section 4(f) Use Anticipated]

The public/religious/educational properties near the project include The First Baptist Church & School located south of the intersection. Two schools are also located south of the intersection within one mile: Dakota Valley Learning Center and Diamond Path Elementary School. Based on the project's Feasibility Study and its design conclusions, the roundabout project may be expanded to include the restriping and minor reconstruction of CSAH 33 south to the intersection of 145th Street. While design details will determine impacts, no work outside of the current right-of-way should be expected, resulting in no anticipated Section 4(f) use. The impacts of the completed transportation improvements in this area would also be positive in nature, improving safety and mobility for all modes of travel.

2. Environmental Categories with No Anticipated Impacts

a) Section 4(f) Properties

There exist numerous parks within 1 mile of the CSAH 33 and 140th St/Connemara Trail intersection (see **Parks/Recreational Properties** figure in **Appendix F: Environmental**). Section 4(f) properties within ½ mile include Tintah/Upper Tintah Park, Erickson Park, Connemara Park, Innisfree Park, and Summerfield Park. 4(f) properties within 1 mile of the project include Farquar Park, Carroll's Woods, Diamond Path Park, Delaney Park, and Dellara Park. The nearest property (Upper Tintah Park) is roughly 0.15 miles from the project area. No Section 4(f) involvement or "use" of any such property is anticipated.

b) Section (f)/Land & Water Conservation Fund/Grant Restricted Properties

There are two properties that were funded with Land and Water Conservation Funds (LWCF) or are otherwise grant restricted properties within 1 mile of the intersection: Farquar Park and Carroll's Woods. These properties are colloquially referred to as "Section 6(f)" properties (see **Parks/Recreational Properties** figure in **Appendix F: Environmental**). These are also 4(f) properties, as previously noted. No Section (f)/LWCF/Grant Restricted Properties involvement is anticipated.

c) Section 106

The nearest previously recorded archaeological site is roughly 1.5 miles to the southeast of the project area. Site 21DK0085 (Philip Caron Residence) is a Historic habitation site that was ultimately recommended to be considered not eligible for listing on the National Register of Historic Places (NRHP) following the excavation of formal units (Phase II). The early coordination process with the State Historic Preservation Office (SHPO) will determine the need for an archaeological survey.

d) Endangered Species Act (US Fish & Wildlife Service/Office of Environmental Stewardship)

Minimal tree removal is required for the project. According to the Minnesota Department of Natural Resources (MnDNR) information regarding recorded Long-Eared Bat (NLEB) roost trees and hibernacula in Minnesota, neither of these are present within the township and ranges in which the project occurs (T115N).[1] The nearest recorded NLEB hibernacula are associated with the Minnesota River Valley, is approximately nine miles north of the project area.

If, however, habitat is present that is suitable to NLEB, the same requirements of winter tree removals will typically apply. It is possible that other rare features and/or habitats may be present in the project area, such as habitat suitable for the Rusty-Patched Bumblebee. Early coordination with the Office of Environmental Stewardship (OES) and MnDNR will reveal the presence of other rare natural features.

e) Hazardous Materials

The nearest potentially contaminated site listed by the Minnesota Pollution Control Agency (MPCA) on the What's in My Neighborhood (WIMN) data is a leak site associated with Independent School District (ISD) 196 (ID 39290), over 1,300 feet south of the project area (see **Potentially Contaminated Sites** figure in **Appendix F: Environmental**). It is not anticipated that the project will encounter contaminated materials.

f) Farmland

No soil types classified as prime farmland by the Natural Resources Conservation

[1] 2019. Townships Containing Documented Northern Long-Eared Bat (NLEB) Maternity Roost Trees and/or Hibernacula Entrances in Minnesota. MnDNR/USFWS Service. Document dated April 1, 2019. Electronic resource: http://files.dnr.state.mn.us/eco/ereview/minnesota_nleb_township_list_and_map.pdf, accessed April 2020.

Service (NRCS) are within the project footprint. It is not anticipated that the project will involve farmland.

g) Air Quality

The project is not anticipated to significantly impact air quality.

h) Highway Traffic Noise

The project is not a Type 1 project. Procedures for the abatement of highway traffic noise do not apply in accordance with 23 CRF 772.

i) Construction Noise

Night construction activities are not anticipated for the project and no impact is anticipated.

j) Floodplain Management

The project is not within a floodplain based upon Federal Emergency Management Agency (FEMA) data (Zone X); no impacts to floodplains are anticipated as a result of the project.

k) Airport Area Of Influence

The project is not within an airport Area of Influence (AOI); no impacts are anticipated.

l) Railroad

The project is not near/parallel to any railroads; no impacts are anticipated.

G. Summary

This preliminary environmental screening provides information about potential environmental impacts given the preferred alternative of a single-lane roundabout at the intersection of CSAH 33 and 140th Street/Connemara Trail. The anticipated document type will be a Project Memorandum. A table of anticipated permits/approvals required for the project are listed in **Table 8** below.

Table 8. Permits and Approvals Anticipated

Unit of Government	Type of Application	Comment
Federal		
U.S. Army Corps of Engineers	Section 404 Permit	Based upon wetland delineation
	Wetland Application	Based upon wetland delineation
State		
Minnesota Pollution Control Agency (MPCA)	National Pollutant Discharge Elimination System (NPDES) Construction Storm Water Permit	Disturbance of more than 1 acre requires a NPDES permit
	Section 401 Certification	Based upon wetland delineation (not likely)
Minnesota Board of Water and Soil Resources (BWSR)	Minnesota Wetland Conservation Act (WCA) Notification and Permitting	Based upon wetland delineation
Regional/Local		

Dakota County	Permit for Work in Public ROW	Likely required
Cities of Apple Valley & Rosemount	Utility Relocation	Not likely

X. UTILITIES

Surveyed utilities in the project area are shown in the concepts and also identified in figure in **Appendix G: Identified Utilities**. The facility operators within the vicinity as identified through the project survey are summarized in **Table 9**.

Table 9. Utility Contacts

Name	Phone Number	Contact and email address
City of Apple Valley	952-953-2441	Tim Biberdorf tbiberdorf@ci.apple-valley.mn.us
City of Rosemount	651-322-2022	Brian Erickson brian.erickson@ci.rosemount.mn.us
Dakota Electric	651-463-6268	Sue Aadalen SAadalen@dakotaelectric.com
Gigabit Minnesota	763-222-1099	No response
Frontier Communications	800-778-9140	No response
Independent School District 196	320-963-2400	No response
Flint Hills Resources, LC	800-688-7594	Ryan Nilson Ryan.Nilson@fhr.com
Minnesota Energy Resources	800-778-9140	Alan Braith alan.braith@minnesotaenergyresources.com
Center Point Energy	763-559-5185	Cathy Frautschi Cathy.Frautschi@centerpointenergy.com
Charter Communications	800-778-9140	Charles Snyder Charles.Snyder@charter.com
Magellan Midstream Partners	918-574-7098	Adrian Reents Adrian.Reents@magellanlp.com
Xcel Energy	651-229-2552	No response
Velocity Telephone		Barb privloc@yahoo.com

Anticipated utility issues or concerns:

- Service and control cabinets on SW corner will need to be relocated
- Force Main on 140th Street to North Diamond Path – City of Apple Valley

- Fiber Optic connections on SE corner may need to be relocated

XI. MINNESOTA VALLEY TRANSIT AUTHORITY

The Minnesota Valley Transit Authority (MVTA) has two transit lines that start and end at the intersection. These include routes 476 and 478. Current stops are at the intersection on the south side. The preferred concept includes bus pullouts/use of shoulder south of the roundabout as shown in the Preferred Concept in **Appendix D: Roundabout Concepts.**

The bus stops should accommodate at 45 ft bus. Other bus stop locations provided by MVTA include approximately 110 ft between the start of any taper and the front bus door stop location. Continued coordination with MVTA will be necessary during preliminary and final design.

Contacts:

Aaron Bartling, Planning Manager, abartling@mvta.com

XII. POTENTIAL DESIGN NEEDS

As the concept was developed there are some design needs or changes that may be of consideration:

- Retaining wall on NW corner: retaining wall is for the current hill, preferred design is to keep this retaining wall to no higher than four (4) feet exposed (plus 2 ft below grade). The boulevard can be reduced, and the trail moved closer to the roundabout.
- Sidewalk/trail configuration on NE corner: as designated in the design concepts, the pedestrian facility on the north side of Connemara Trail, east of Diamond Path can be either sidewalk or trail. The trail would provide an opportunity for bicyclists to exit off the roadway shoulder prior to the roundabout, consistent with the other intersection legs with bicycle ramps.
- Bus stop length and taper design: current design shows a paved bus stop of 40-50 ft in length. Based on most recent information, the bus length is 45 ft. Taper access into and out of the bus stop location may also need to be revised.
- Median between Diamond Path and Delta Avenue/Delta Place: Median may need to be cut back from the Delta intersection and be surmountable to allow for longer vehicles or vehicles with trailers to comfortably make the turn onto Connemara Trail toward Diamond Path.
- Neighborhood Monuments and Fencing: The neighborhood association paid for and maintains the monuments in the NE and SE corners, and the white fencing along Connemara Trail. The neighborhood would like to keep the metal neighborhood signs placed on the monuments and reinstall them at the corners. The fencing was recently replaced and the neighborhood would like to keep them on Connemara Trail.
- School Assessment Study: Dakota County is currently in the process of completing a School Assessment Study for all schools adjacent to county and state highways within Dakota County. The assessment will focus on pedestrian safety. Recommendations for this area should be considered for incorporation into this roundabout project.

XIII. PRELIMINARY COST ESTIMATES

Cost estimates for the roundabout and restriping along 140th Street and Diamond Path, south of 140th Street/Connemara Trail are summarized below and are also included in **Appendix H: Cost Estimates.**

Table 10. Cost Estimates		
Intersection/Roadway	Location/Segment	Cost Estimate
CSAH 33 Roundabout	140th Street/Connemara Trail	$2,290,000
CSAH 33 (Diamond Path)	140th Street to 145th Street	$10,000 (signing and striping only) $380,000 (mill and overlay)
140th Street	Pilot Knob Road (CSAH 31) to Diamond Path (CSAH 33)	$30,000 (signing and striping only)

XIV. CONCLUSIONS AND RECOMMENDATIONS

The existing crash history reveals the need for safety countermeasures to reduce the high number of observed left turn and right-angle crashes, which are uncommon at typical all-way stop controlled intersections and seem to be increasing based on the latest data. In addition, the existing all-way stop control is not anticipated to be able to efficiently serve the forecasted traffic at the intersection.

Analysis of a single-lane roundabout shows that it would be anticipated to mitigate the existing and potential traffic safety and operational issues due to area traffic growth. The roundabout effectively eliminates the potential for right-angle and left turn crashes that are being experienced at the intersection. Similarly, pedestrian safety is better accommodated by creating two-stage crossings and decreasing the crossing distances on each leg of the intersection.

The County has implemented roundabouts in similar environments in numerous locations across the County and supports the installation of a single-lane roundabout intersection at CSAH 33 (Diamond Path) and 140th Street/Connemara Trail. The preferred roundabout is located offset to the northwest to provide for improved geometry and decrease property impacts. The design includes adjacent multi-use trail, bus stops for MVTA, and bike ramps.