



Intersection Review

SRF No. 11376

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City of Chanhassen

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Subject: MN Highway 41/Minnetonka Middle School West Intersection Concept Review

Introduction

As requested, SRF reviewed the MN Highway 41/Minnetonka Middle School West intersection in the City of Chanhassen in Fall 2018. This intersection has been the subject of resident concerns, particularly related to school peak period operations. The main objectives of the review are to quantify current operations, evaluate potential intersection concepts, and develop preliminary concepts to understand potential right-of-way implications and costs. The following information summarizes the assumptions, methodology, and findings of the intersection review. Note that since completion of the review in the fall of 2018, recent roadway striping changes and management strategies have been implemented, which are discussed later in this document.

Existing Conditions

- 1) Intersection turning movement counts from October 2015 and June 2018 were provided by the Minnesota Department of Transportation (MnDOT) at the MN Highway 41/Minnetonka Middle School West intersection; school was in session during both counts.
 - a) The West Middle School hours of operations are from 9:15 a.m. to 3:55 p.m.; traffic volumes at the school peak from 8:15 to 9:15 a.m. and 3:45 to 4:45 p.m., primarily near start/end times.
 - b) The June 2018 p.m. counts appear higher than a typical day while the a.m. counts were similar between October 2015 and June 2018; the average of the two turning movement counts from 2015 and 2018 was used for the capacity analysis.
- 2) Crash history was reviewed between year 2011 and 2015, which represents the most recent five (5) years of crash data available from Minnesota Crash Mapping Analysis Tool (MnCMAT). This included the MN Highway 41/Minnetonka Middle School West intersection, as well as the MN Highway 41/Chaska Road intersection, where there is increased pedestrian activity due to the Rectangular Rapid Flashing Beacon (RRFB). The predominant crash statistics are as follows:
 - a) There was a total of 12 crashes near the Minnetonka Middle School West access during the five (5)-year study period. Two (2) crashes were at the Minnetonka Middle School West access, seven (7) crashes were at the Chaska Road intersection, and three (3) crashes occurred along MN Highway 41 between Chaska Road and the Minnetonka Middle School West access.

- b) 12 Total Crashes - eight (8) “property damage” and four (4) “possible injury”
 - c) Minnetonka Middle School West access - one (1) “run-off the road” and one (1) “rear-end”
 - d) Chaska Boulevard RRFB - one (1) “pedestrian-related” crash, with “possible injury”
- 3) The MN Highway 41/Minnetonka Middle School West intersection currently operates at an overall level of service C (LOS C) during both the school a.m. and p.m. peak hours. However, the Minnetonka Middle School West access approach operates at LOS F during these time periods.
- a) Southbound left-turn queues extend beyond the existing turn lane storage five (5) to ten (10) percent of the school peak hours.
 - b) Westbound left-turn maneuvers are difficult to complete; the average delay for the westbound left-turn movement is seven (7) to eight (8) minutes during the a.m. and p.m. peak hours; westbound queues currently extend 300 to 450 feet on average.
 - c) Synchro/SimTraffic software (version 9) was utilized to analyze existing intersection capacity; the capacity analysis focused on the school peak, not the peak of MN Highway 41.

Concepts

To understand how potential traffic control changes would impact intersection capacity and queuing at the MN Highway 41/Minnetonka Middle School West intersection, concepts were identified. These included a traffic signal and two roundabout concepts. The following information provides an overview of the concepts and associated capacity analysis results, while additional level of service and queuing information is summarized in Tables 1 and 2. Preliminary cost information is also included.

Traffic Signal Concept

- 1) Existing traffic volumes do not currently meet any traffic signal warrants at the MN Highway 41/Minnetonka Middle School West intersection; however, since the westbound left-turn maneuver is difficult, there may be other motorists that are currently avoiding this maneuver.
 - a) For warrant purposes, only the left-turn volume is considered for the minor approach; unless through volumes on the mainline are high enough to include a portion of right-turns; traffic volumes on MN Highway 41 are not high enough to justify including the right-turns.
 - b) If a traffic signal were installed at the intersection, it is expected that a portion of motorists currently making a westbound right-turn maneuver would divert to make a left-turn maneuver. If 50 percent of motorists currently making a right-turn divert to the left-turn, the intersection would be expected to meet the peak hour warrant criteria; no other signal warrants are expected to be met.

- 2) The MN Highway 41/Minnetonka Middle School West intersection, assuming a traffic signal was installed and no other turn lane changes, would be expected to operate at an overall LOS B during the school a.m. and p.m. peak hours.
 - a) A traffic signal would reduce the average westbound delay for motorists exiting the Minnetonka Middle School West access onto MN Highway 41 by approximately one (1) to two (2) minutes.
 - b) Southbound left-turn queues along Mn Highway 41 would be expected to extend beyond the existing turn lane storage approximately 25 to 35 percent of the peak hour during the school peak periods, although this turn lane could be restriped to avoid impacts to the through lane; MN Highway 41 queues would be expected to extend 300 feet or greater.
- 3) If a traffic signal is installed, restriping MN Highway 41 to provide additional turn lane storage should be considered; additionally, the RRFB at the Chaska Boulevard intersection may be removed since the signal will provide a reliable pedestrian crossing.
- 4) The planning level construction cost estimate to implement a traffic signal is \$350,000.

Roundabout Concepts

Two roundabout concepts were evaluated, which are illustrated in Figures 1 and 2. The primary difference between the two concepts are related to how the concepts tie into the adjacent roadway network. The first roundabout concept illustrates how a hybrid roundabout configuration would tie into the existing roadway network, while the second roundabout concept illustrates how a hybrid roundabout configuration would tie into a future 4-lane facility along MN Highway 41. The overall roundabout footprint does not change between these two roundabout concepts, rather the lane designations are the primary difference. The following information provides a summary of the two roundabout concepts, associated capacity analysis, and preliminary cost estimate.

- 1) Roundabout Concept 1 (see Figure 1) would be expected to operate at an overall LOS B during the school a.m. peak hour and an overall LOS C during the school p.m. peak hour.
 - a) Queues in the northbound shared thru/left-turn lane along Mn Highway 41 are expected to extend approximately 450 feet during the school p.m. peak hour.
- 2) Roundabout Concept 2 (see Figure 1) would be expected to operate at an overall LOS A during both the school a.m. and p.m. peak hours.
 - a) Northbound queues along Mn Highway 41 would be expected to be 100 feet or less during both the school a.m. and p.m. peak hours.
- 3) The planning level construction costs of both roundabout concepts is estimated to be \$1,400,000, which includes potential right-of-way costs associated with the approximate 12,500 square feet of right-of-way needed.

The following information provides an overview of the capacity analysis results, which identify level of service and queuing for each concept. Level of Service (LOS) indicates how well an intersection is operating. Intersections are graded from LOS A through F, where LOS A indicates the best traffic operation and LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A through D is considered acceptable based on MnDOT guidelines.

Table 1 – MN Highway 41/Minnetonka Middle School West Intersection Capacity Analysis

Condition/Concept	Level of Service (Delay)			
	School A.M. Peak Hour		School P.M. Peak Hour	
	Overall Intersection	Middle School Approach	Overall Intersection	Middle School Approach
Existing Conditions	C (16 sec)	F (75 sec)*	C (19 sec)	F (150 sec)*
Traffic Signal Concept	B (18 sec)	C (25 sec)	B (18 sec)	D (36 sec)
Roundabout Concept 1**	B (12 sec)	B (14 sec)	C (20 sec)	B (14 sec)
Roundabout Concept 2**	A (9 sec)	B (13 sec)	A (8 sec)	B (13 sec)

* The average delay for the westbound left-turn maneuver is seven (7) to eight (8) minutes during the a.m. and p.m. peak hours.

** The roundabout capacity analysis results are based on the Highway Capacity Software (HCS 7).

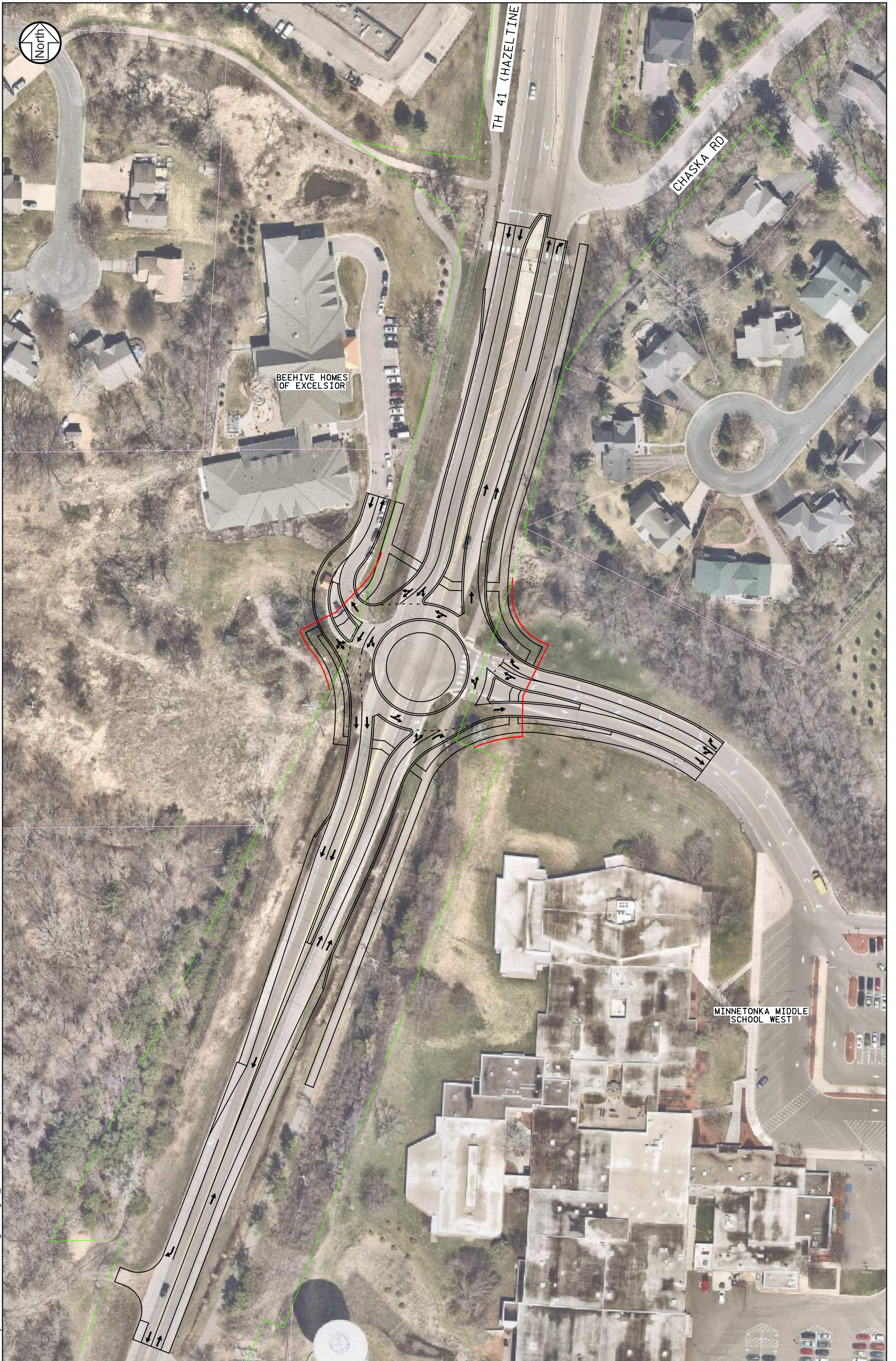
Table 2 – MN Highway 41/Minnetonka Middle School West Intersection Queuing Summary

Condition/Concept	95th Percentile Queue (feet)									
	School A.M. Peak Hour					School P.M. Peak hour				
	NBT	SBT	SBL	WBL	WBR	NBT	SBT	SBL	WBL	WBR
Existing Conditions	-	-	165	350	200	-	-	120	420	200
Traffic Signal Concept	325	325	225	75	225	375	235	185	100	185
Roundabout Concept 1	200	70	60	10	100	450	50	50	15	60
Roundabout Concept 2	75	70	55	10	85	85	50	50	15	50

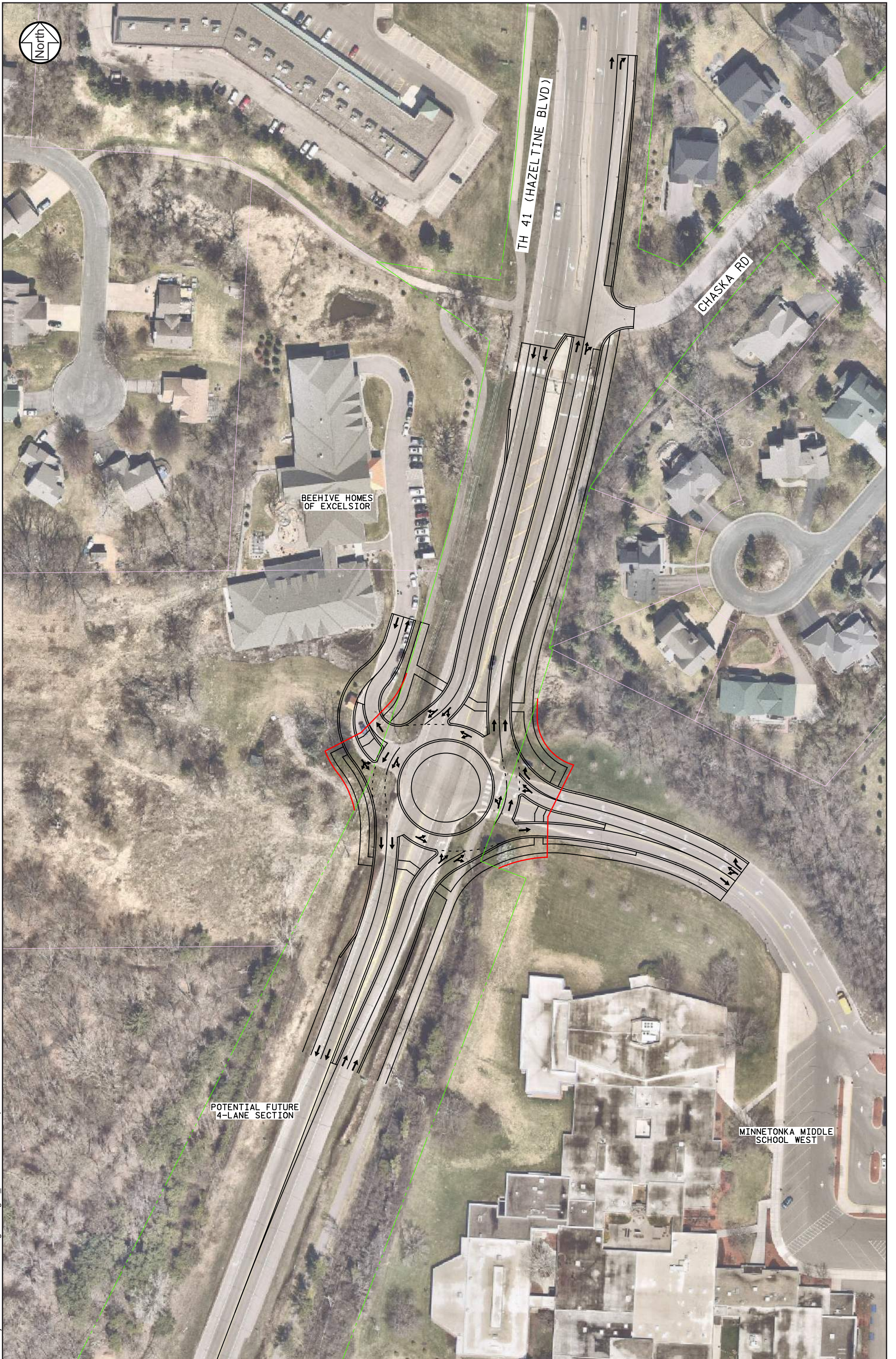
* Highlighted areas identify queues that exceed 300 feet.

Update

Since completion of the analysis in the Fall of 2018, MnDOT has implemented striping changes along Mn Highway 41 to increase the southbound left-turn lane length into the school, as well as to reduce the number of southbound travel lanes at the pedestrian crossing near Chaska Road. The School has also modified their management strategy, now requiring all exiting motorists during the morning and afternoon peak periods to make a right-turn maneuver out of the site and travel north along Mn Highway 41. However, these strategies and improvements are considered short-term changes and there are cooperative plans to pursue additional funding sources to implement a long-term solution at this location.



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