



To: Steve Lillehaug, PE, PTOE, Public Works Director/City Engineer
City of Shakopee

From: Brent Clark, PE, Senior Engineer
Matt Pacyna, PE, Principal

Date: December 4, 2019

Subject: Trident Development Transportation Study

Introduction

SRF has completed a transportation study for the proposed Trident Development in the City of Shakopee. The development is located in the northeast quadrant of the County Road 15 and County Road 16 (17th Avenue) intersection and is adjacent to Jackson Elementary School (see Figure 1: Project Location). The main objectives of the study are to review existing operations within the study area, evaluate transportation impacts to the adjacent roadway network due to the proposed development, including access, circulation, and pedestrian crossings, and recommend any necessary improvements to ensure safe and efficient operations. The following information provides the assumptions, analysis, and study recommendations offered for consideration.

Project Background

Development and transportation within the project area has been discussed and evaluated over the past few years. The following studies have been conducted since 2016 that have reviewed various intersections and/or roadway segments within the study area.

- 1) *Hy-Vee Development Traffic Impact Analysis*, Kimley-Horn and Associates, (June 2016)
- 2) *The Bluffs at Marystown/Windermere Traffic Study Update*, Westwood (July 2018)
- 3) *Shakopee AUAR Transportation Analysis*, SRF Consulting (Draft – September 2019)

These studies evaluated various areas, timeframes, development scenarios, and improvement alternatives. As traffic growth and development in the area continues, it is important to gain an understanding of the timeline in which improvements may be needed. The *Shakopee AUAR Transportation Analysis* utilized the Hy-Vee and Windermere traffic studies and accounted for potential development in the Trident Parcel. However, the AUAR evaluated scenarios based on year 2040 projections and did not provide an understanding for near-term improvements. Thus, information from each of these studies was leveraged to aide in the development of the *Trident Development Transportation Study*.



The City of Shakopee's *Capital Improvement Plan 2019-2023* identified intersection and access control improvements for the Marystown Road/US 169 Ramp intersections; intersections that had recently been turned back to the City of Shakopee by Scott County. Additionally, the City of Shakopee has expressed interest in expanding the intersection and access control improvements to the adjacent intersections of Adams Street/Vierling Drive and County Road 15/County Road 16 (17th Avenue). The corridor improvement project is expected to improve vehicular and pedestrian safety, connect a regional trail, and address anticipated capacity issues that are expected as a result of area development. Based on the desire to improve intersection and corridor operations, SRF is completing Intersection Control Evaluation (ICE) reports, along with conceptual layouts and cost estimates as part of the *Marystown Road Corridor Study*. As the Trident Development moves forward, it is important to help identify when the need for these improvements may occur.

Existing Conditions

Existing conditions were reviewed to establish a baseline condition to compare and determine any future impacts. The evaluation of existing conditions includes various data collection efforts, including traffic data, roadway characteristics, school/pedestrian operations, and an intersection capacity analysis, which are summarized in the following sections.

Traffic Data

The *Shakopee AUAR Transportation Analysis* utilized a combination of newly collected data and historical traffic data in the study area. The traffic data was generally collected before the Windermere and Hy-Vee developments, and in some cases was three (3) years old or longer. Therefore, in conjunction with the *Marystown Road Corridor Study*, new data was collected at all study intersections. Turning movement counts were collected at the following study intersections on Wednesday, October 9, 2019, which included a combination of 13-hour and peak hour counts:

- Adams Street/Vierling Drive ⁽¹⁾
- Marystown Road/US 169 North Ramp ⁽¹⁾
- Marystown Road/US 169 South Ramp ⁽¹⁾
- County Road 15/County Road 16 ⁽¹⁾
- County Road 16/Lusitano Street ⁽²⁾
- Lusitano Street/Jutland Avenue ⁽²⁾

(1) 13-hour counts were collected at the intersection as part of the Marystown Road Corridor Study.

(2) Typical peak hour and the afternoon school departure peak hour counts were collected at the intersection.

Note that during data collection efforts, there was ongoing construction in the region that appears to have impacted travel patterns and traffic volumes at the study intersections. The Minnesota Department of Transportation (MnDOT) is in the process of constructing a new diverging diamond interchange (DDI) at the US 169/Mn Highway 41/CR 78 intersection in Jackson and Louisville townships in Scott County. During data collection efforts, CR 78 was closed from the US 169 intersection to the Louisville Road/Emery Way intersection. This closure resulted in vehicles rerouting through the CR 15/Marystown Road corridor. Therefore, adjustments were made to the existing turning movement counts to account for this construction condition in order to evaluate non-construction conditions.

To make the adjustments, recently collected turning movements as part of the *Shakopee AUAR Transportation Analysis* were utilized to determine the change in area travel patterns. The number of diverted trips due to the road closure was estimated to be approximately 150 northbound vehicles during the a.m. peak hour and 115 southbound vehicles during the p.m. peak hour at the CR 15/CR 16 (17th Avenue) intersection. In order to represent non-construction condition, these trips were removed from the existing traffic data collected as part of this study.

Roadway Characteristics

A field assessment was completed to identify various roadway characteristics within the transportation system study area, such as functional classification, general configuration, and posted speed limit. A summary of these roadway characteristics is shown in Table 1. Note that these are general characteristics and that there are some deviations within the area or segments of the roadways. For example, County Road 15/Marystown Road transitions from a 4-lane divided roadway into a 2-lane undivided roadway south of US 169.

Table 1. Existing Roadway Characteristics

Roadway	Functional Classification	General Configuration	Posted Speed Limit (mph)
Marystown Road/ County Road 15	A Minor Arterial	4-lane divided/2-lane undivided	55/45 ⁽¹⁾
County Road 16	A Minor Arterial	4-lane divided	45/25 ⁽²⁾
Vierling Drive	Collector	4-lane undivided	30
Lusitano Street	Local Road	2-lane undivided	Unposted
Jutland Avenue	Local Road	2-lane undivided	Unposted

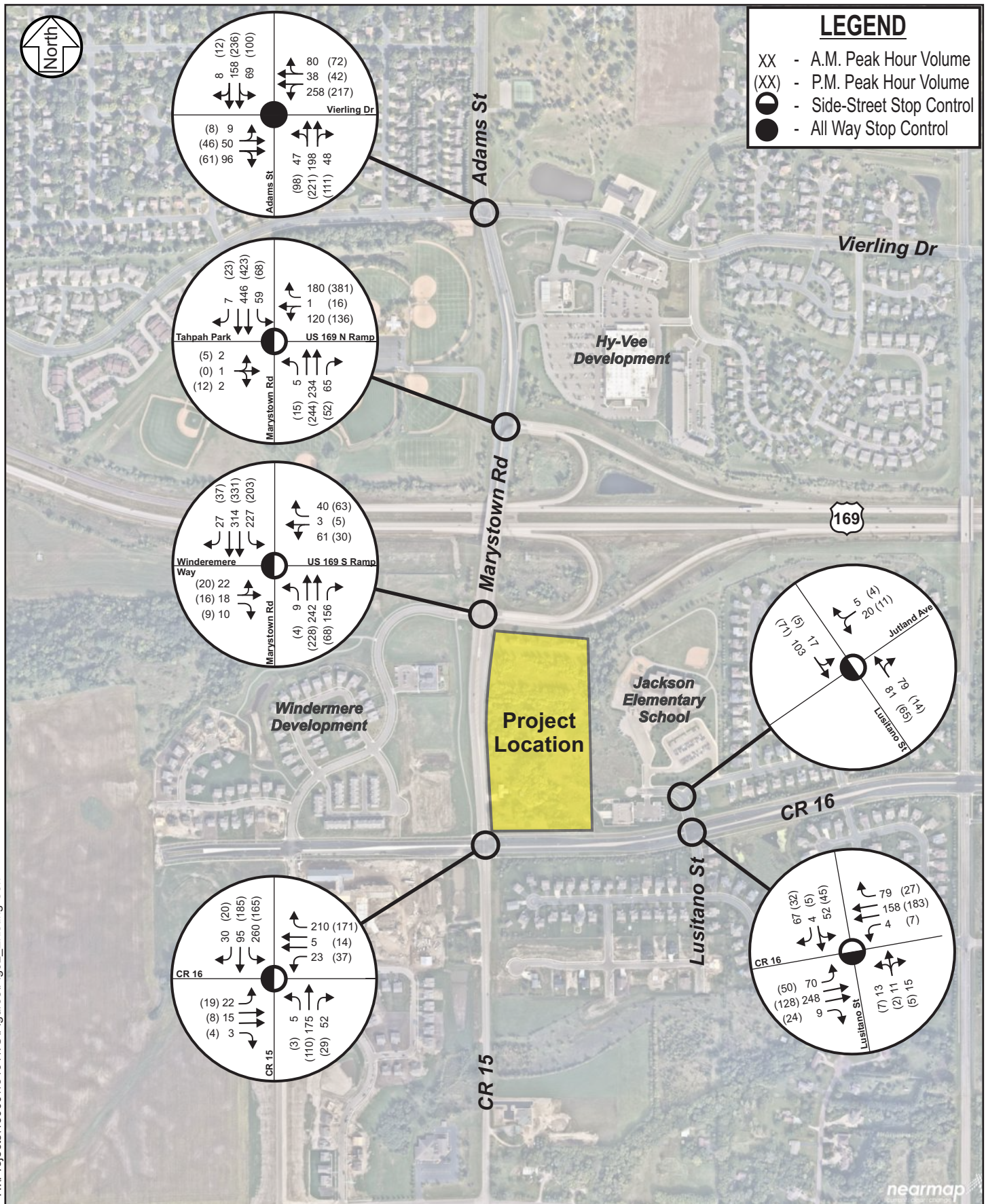
(1) Speed limit change occurs at the US 169 Ramp locations, with a posted speed limit of 55 mph south and 45 mph north of US 169.

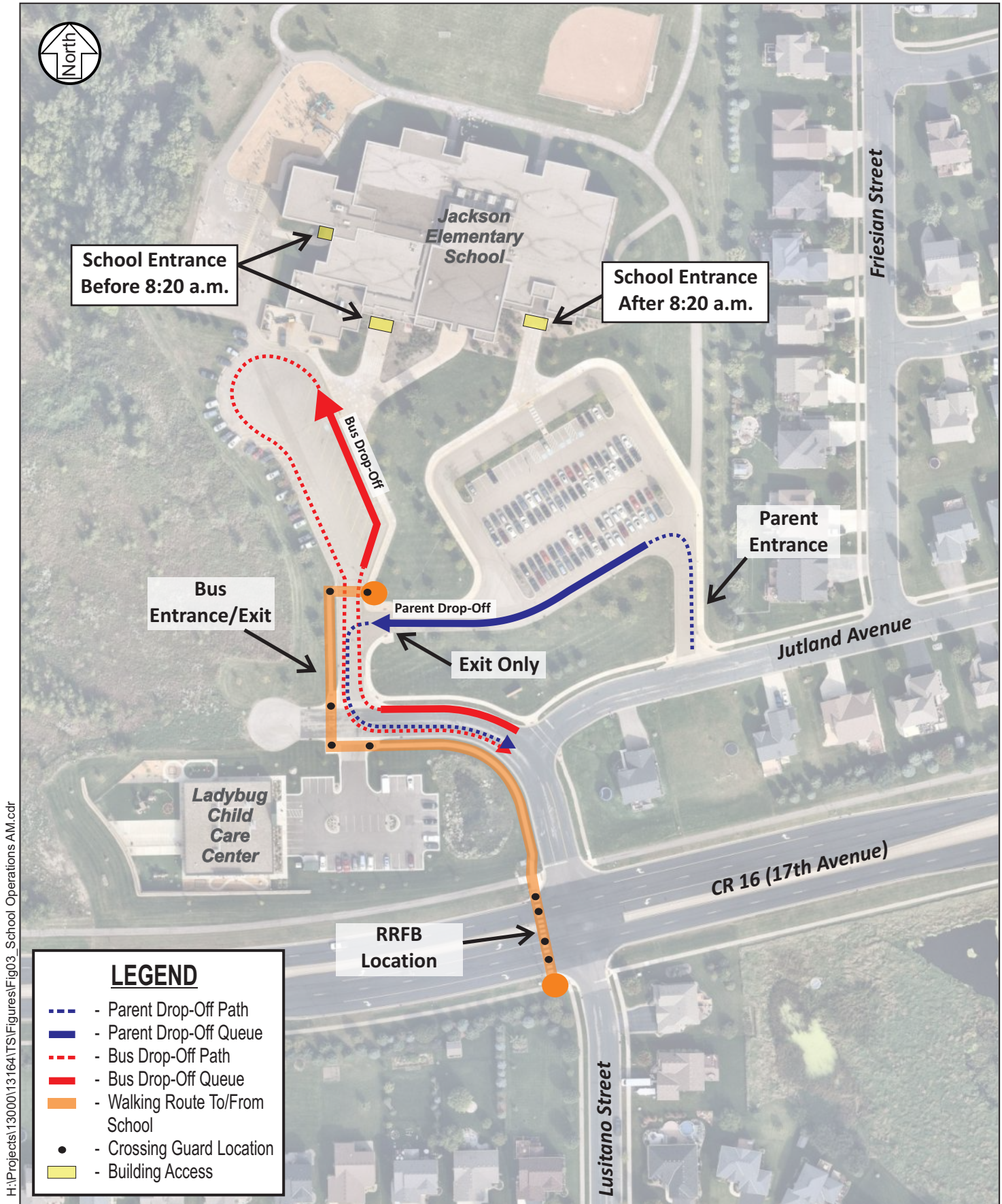
(2) School Zones are present throughout the corridor and have a speed limit of 25 mph when children are present.

From a traffic control perspective, the Adams Street/Vierling Drive intersection is all-way stop controlled. All other study intersections are side-street stop controlled. Existing geometrics, traffic controls, and traffic volumes in the study area are shown in Figure 2.

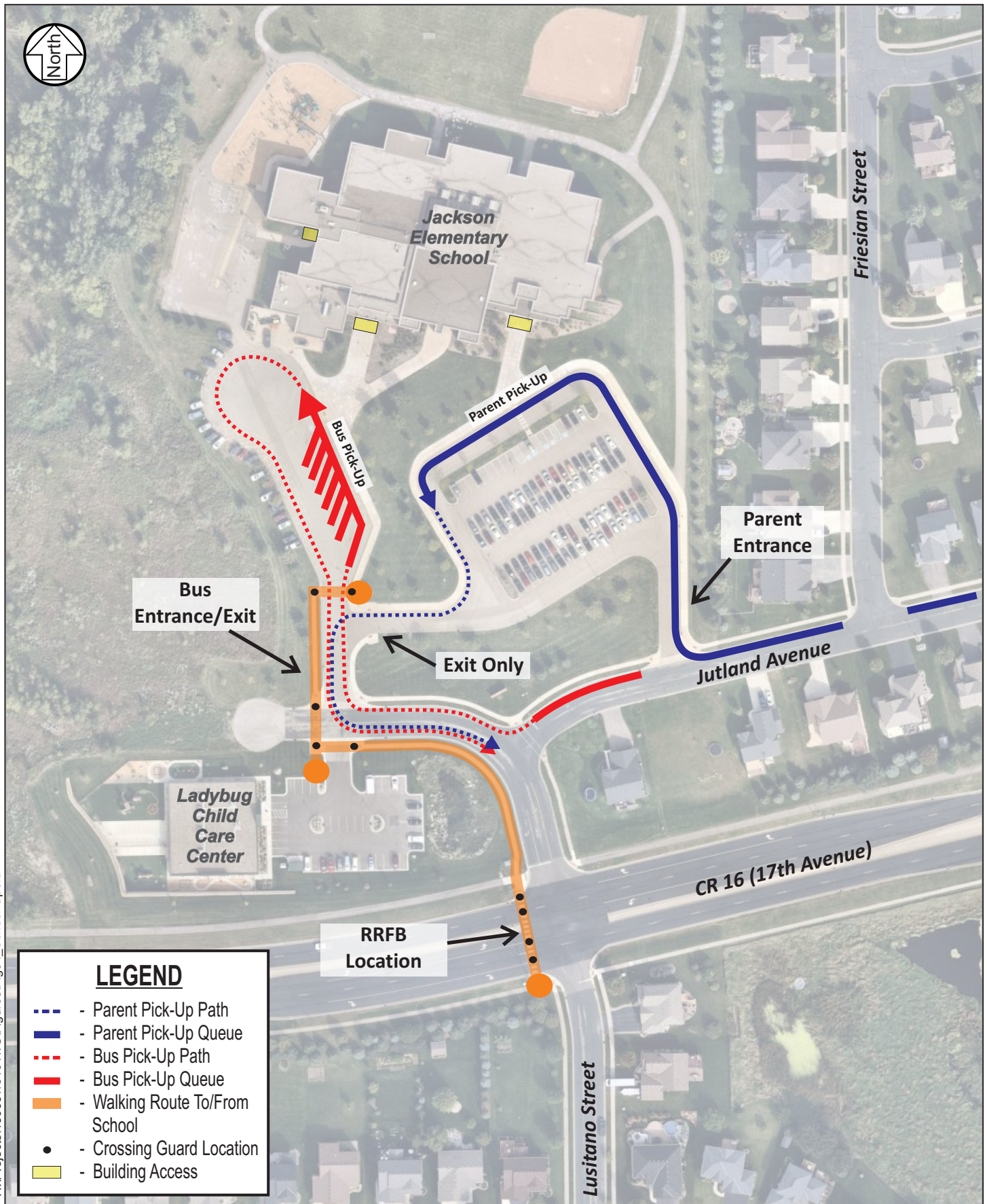
Jackson Elementary School Observations

As stated previously, the Jackson Elementary School is adjacent to the proposed development. The school hours of operations are currently between 8:30 a.m. and 3:10 p.m. In order to identify current travel patterns and any access, circulation, pick-up/drop-off, or pedestrian crossing issues, field observations were performed at the school. A summary of the elementary school operations during the a.m. and afternoon peak period are shown in Figure 3 and Figure 4, respectively.





H:\Projects\13000\13164\TSP\Figures\Fig03_School Operations AM.cdr



The elementary school has two access locations, one on Jutland Avenue, and another on Lusitano Street, which is adjacent to the recently constructed Ladybug Child Care Center. The Jutland Avenue access is generally utilized as an entrance for teachers and parent drop-off/pick-ups. The Lusitano Street access is the bus entrance/exit and also serves as the parent drop-off/pick-up exit. The connection between the school parking lot and the bus area is a westbound exit-only.

During morning drop-offs, all students are generally destined for the western school entrances, as these entrances are near the play area and are the primary entrance before 8:20 a.m. After 8:20 a.m. these entrances are locked, and the primary entrance is the main entrance, which is north of the school parking lot. Parents and buses start arriving to the school at 8:00 a.m. Bus drop-offs were observed to queue onto Lusitano Street from 8:05 to 8:15 a.m., and buses were gone by 8:20 a.m. Parent drop-off queues remained within the parking lot. In general, the school area was clear by 8:25 a.m.

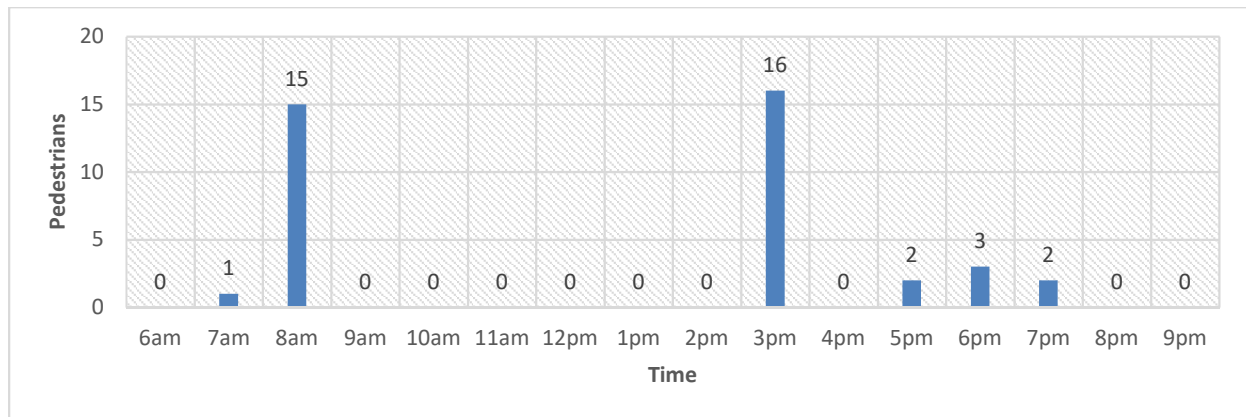
During afternoon pick-ups, queues on Jutland Avenue were observed to extend beyond Friesian Street. These queues consisted of a combination of buses and parents. Travel patterns were generally the same as the morning drop-off, except parents would pick-up students near the main entrance. Students were released at 3:10 p.m. and in general all students were picked up and the school area was cleared within 10 minutes.

Approximately eight (8) student crossing guards and one (1) teacher provide crossing assistance to students during a.m. and afternoon operations. The teacher, along with three (3) student crossing guards, help students crossing County Road 16 at the rectangular rapid flashing beacon (RRFB). The assistance consists of not only hitting the RRFB button, but also walking into the street in the through-lane locations to provide a safer crossing. During the morning, 15 students were assisted in crossing CR 16 in three (3) RRFB stages, while in the afternoon all students were able to cross in one (1) RRFB stage. During afternoon operations, the teacher would direct all students to their desired locations. Some students (approximately 10 to 15) were destined for the daycare across the street, while most (approximately 16 students) were destined to the neighborhood south of County Road 16.

In general, the overall operations during the school arrival and departure periods are efficient and safe. The student crossing guards along with the teacher assistance provides as safe as a walking environment to/from the school as possible, given the location.

RRFB Crossing Counts

School observations identified that the RRFB, along with student/teacher assistance provided a safe crossing environment across County Road 16. With the proposed development and the anticipated increase in traffic along CR 16, it is important to understand the utilization of the RRFB during non-school operations, and if there were any vehicle compliance issues with the crossing. Therefore, pedestrian counts at the RRFB were collected on Wednesday, October 9, 2019 from 6:00 a.m. to 10 p.m. and are summarized in Figure 5.

Figure 5. County Road 16 RRFB Pedestrian Crossings

Throughout the day, a total of 39 pedestrians used the crossing, 31 of which were during Jackson Elementary School exit/entrance times, and eight (8) were outside of the school peaks. It should be noted that out of the eight (8) crossings outside of school times, only four (4) pedestrians activated the RRFB. No vehicle compliance issues were observed.

Intersection Capacity Analysis

An intersection capacity analysis was conducted to determine how traffic is currently operating at the study intersections during typical weekday a.m. and p.m. peak hour conditions. All intersections were analyzed using Synchro/SimTraffic software.

Capacity analysis results identify a Level of Service (LOS) which indicates how well an intersection is operating. Intersections are graded from LOS A through LOS F. The LOS results are based on average delay per vehicle results from SimTraffic, which correspond to the delay threshold values shown in Table 2. LOS A indicates the best traffic operation and LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A through D is generally considered acceptable by drivers in the Twin Cities Metropolitan Area.

Table 2. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

For side-street stop-controlled intersections, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with side-street stop control can be described in two ways. First, consideration is given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support these volumes. Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, the majority of delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high-levels of delay (poor levels of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions.

Results of the existing intersection capacity analysis, shown in Table 3 and Table 4, indicate that all study intersections currently operate at an acceptable overall LOS B or better during the weekday peak hours. It should be noted that Table 3 represents the operations of the CR 15/Marystown Road corridor intersections during typical a.m. and p.m. peak hours, whereas Table 4 represents the intersections adjacent to Jackson Elementary School and the operations during the peak school arrival and departure hours, as well as the p.m. peak hour of the adjacent roadway.

Table 3. Existing Intersection Capacity Analysis

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Adams Street/Vierling Drive ⁽²⁾	B	13 sec.	B	14 sec.
Marystown Road/US 169 North Ramp ⁽¹⁾	A/A	9 sec.	A/B	12 sec.
Marystown Road/US 169 South Ramp ⁽¹⁾	A/C	20 sec.	A/B	13 sec.
CR 15/CR 16 ⁽¹⁾	A/B	12 sec.	A/A	8 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

(2) Indicates an intersection with all-way stop control and was analyzed using HCS 7.

Table 4. Existing School Intersection Capacity Analysis

Intersection	A.M. School Arrival Peak Hour		P.M. School Departure Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
CR 16/Lusitano Street ⁽¹⁾	A/A	8 sec.	A/A	6 sec.	A/A	7 sec.
Lustiano Street/Jutland Avenue ⁽¹⁾	A/A	5 sec.	A/A	5 sec.	A/A	4 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

The following information summarizes the operational and/or queuing issues identified as part of the existing capacity analysis:

- **Hy-Vee right-in/right-out on Marystown Road:** Based on discussions with City staff, there have been numerous complaints of improper vehicular movements in the study area. These movements result from vehicles exiting the Hy-Vee development at the right-in/right-out access along Marystown Road that are destined southbound. In order to reroute their trip southbound, vehicles perform one of two improper movements. The first movement is a northbound U-turn north of the Hy-Vee right-in/right-out access at the end of the raised median. This movement typically occurs during non-peak hours, as this is a difficult maneuver during peak hours. The other improper movement typically occurs only during peak hours. In this situation, vehicles will take a northbound left-turn at the Adams Street/Vierling Drive all-way stop intersection and turn around in the Quincy Circle neighborhood to head back to the south along Marystown Road.
- **Marystown Road/US 169 Ramps:** Sight distance issues occur on the westbound approaches when multiple vehicles are making turning movements at the same time. For example, when a westbound left- and right-turn movement are occurring at the same time, the vehicles can obstruct the sight distance for the adjacent vehicle.

2025 No Build Conditions

To understand how area planned developments and general background growth are expected to impact the study intersections, year 2025 no build conditions were reviewed. The year 2025 represents one-year post construction of the full-build out of the proposed development.

Adjacent Development

There are multiple known adjacent developments planned in the area. These include the Windermere Development, which is currently under construction, and the Bruggeman Development. The Windermere Development, which is generally bound by Marystown Road/CR 15, County Road 78, and CR 69, will consist predominantly of residential homes, with some neighborhood retail, office, and senior living. The Bruggeman Development, which is generally west of the Windermere Development and east of CR 69, is expected to be developed in conjunction with the CR 16 roadway extension to CR 69. The Bruggeman development is expected to consist of single-family homes.

Based on discussions with City staff, both developments are expected to be completed by 2025. Therefore, trip generation estimates for both developments from *The Bluffs at Marystown Rd/ Windermere Traffic Study Update* were utilized and adjusted to develop trips associated with these adjacent developments.

General Background Growth

The Scott County Regional Travel Demand Model, along with historical traffic volumes, were reviewed to help identify general background growth within the study area. The travel demand model has a base existing year of 2014. Therefore, socio-economic data for the Windermere, Bruggeman, Hy-Vee, and Trident development Traffic Analysis Zones (TAZs) were removed from the regional model to understand the general background growth expected on area roadways on an annual basis. This approach identified an annual growth rate of approximately one (1) percent for area roadways, which is consistent with historical growth in the study area based on MnDOT AADT volumes.

Intersection Capacity Analysis

To determine how the adjacent roadway network will accommodate the year 2025 no build traffic forecasts, an intersection capacity analysis was completed using Synchro/SimTraffic software. Year 2025 no build traffic forecasts, which include the adjacent developments and general background growth, are shown in Figure 6.

Results of the year 2025 no build intersection capacity analysis, shown in Table 5, indicate that all intersections are expected to operate at an overall LOS C or better during the peak hours. However, multiple side-street approaches are anticipated to operate over capacity (i.e. LOS F). Note that when side-street delays reach unacceptable levels, drivers may make aggressive movements, which presents significant safety risks on a 45/55-mph corridor.

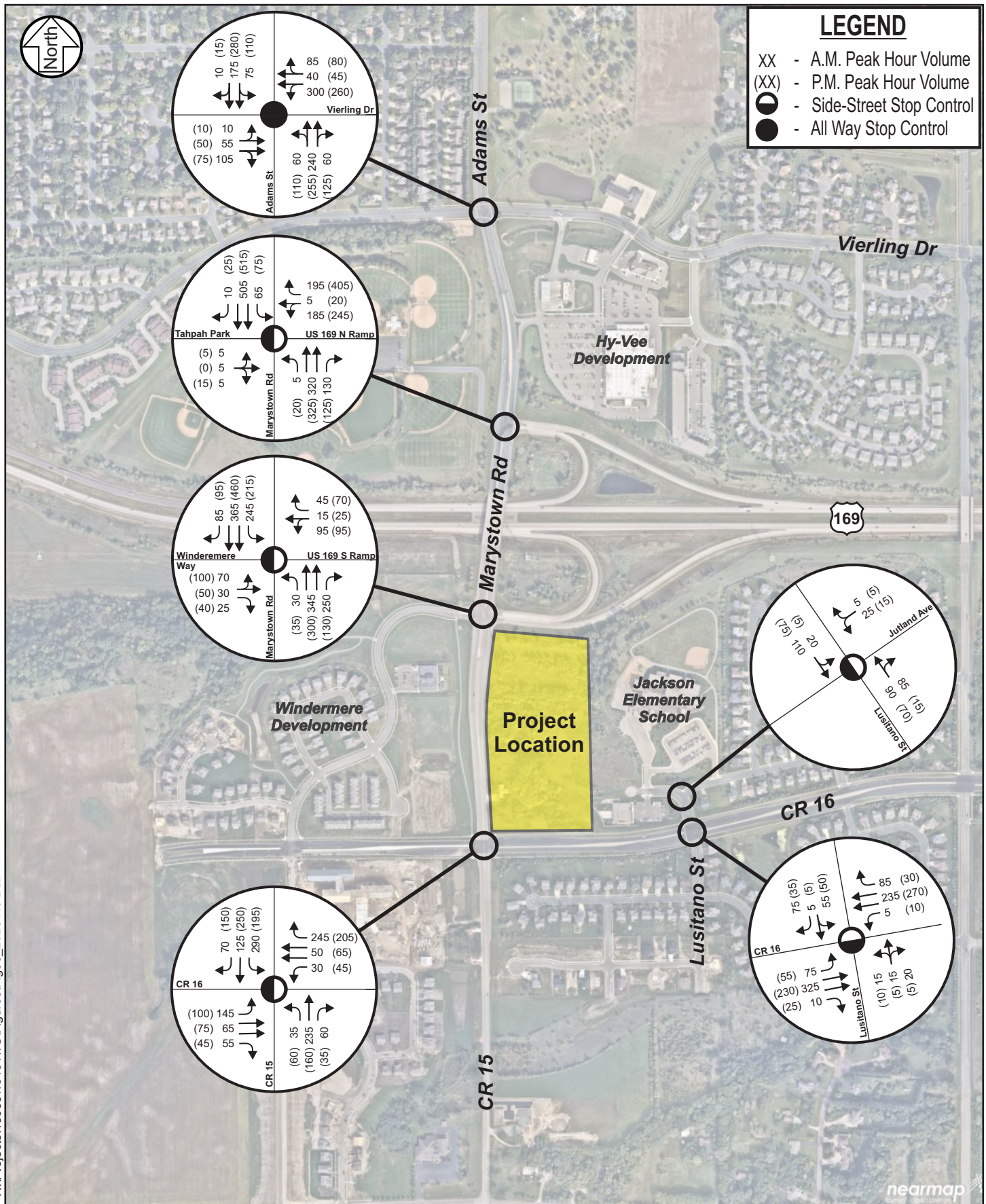
Table 5. 2025 No Build Intersection Capacity Analysis

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
Adams Street/Vierling Drive ⁽²⁾	C	16 sec.	C	18 sec.
Marystown Road/US 169 North Ramp ⁽¹⁾	A/C	18 sec.	C/F	58 sec.
Marystown Road/US 169 South Ramp ⁽¹⁾	C/F	105 sec.	C/F	~2 min
CR 15/CR 16 ⁽¹⁾	C/F	51 sec.	A/C	15 sec.
CR 16/Lusitano Street ⁽¹⁾	A/A	9 sec.	A/A	7 sec.
Lustiano Street/Jutland Avenue ⁽¹⁾	A/A	5 sec.	A/A	4 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

(2) Indicates an intersection with all-way stop control and was analyzed using HCS 7.

H:\Projects\13000\13164\TS\Figures\Fig06_2025 No Build Conditions.cdr



In addition to the operational and safety issues, the following information summarizes other operational and/or queuing issues that warrant consideration as development occurs.

- **Marystown Road/US 169 North Ramp:** The westbound 95th percentile queues during the p.m. peak hour are expected to extend 700 feet, and the westbound left-turn queue is expected to block access to the westbound right-turn lane approximately 35 percent of the p.m. peak hour.
- **Marystown Road/US 169 South Ramp:** Westbound left-turn queues are expected to extend approximately 325 feet and block the westbound right-turn lane approximately 10 percent of the a.m. peak hour. Eastbound 95th percentile queues are expected to extend 225 feet and 400 feet during the a.m. and p.m. peak hours, respectively. These queues are expected to block the eastbound right-turn lane approximately 25 to 40 percent of the a.m. and p.m. peak hours, respectively. Due to the poor operations and queueing, it is expected that eastbound exiting vehicles on Windermere Way will begin to reroute their trips to utilize CR 16 (17th Avenue) and other routes to avoid the congestion expected at the US 169 South Ramp intersection.

To address these capacity issues, geometric and/or traffic control improvements should be considered. Note that the on-going *Marytown Road Corridor Study* is expected to identify the appropriate traffic controls and geometric configurations. Therefore, as part of the *Trident Transportation Study*, one objective is to determine if there are any other transportation issues, as well as to identify the optimal access configuration for the Trident development. The year 2025 no build analysis indicates the need and approximate timeframe of when capacity and safety improvements are expected to be needed along the corridor.

Proposed Development

The proposed development is located in the northeast quadrant of the County Road 15 and County Road 16 (17th Avenue) intersection in the City of Shakopee. The proposed development includes 120 mid-rise multi-family residential units, a 17,300 square foot Veterans Affairs (VA) clinic, and a 24,000 square foot medical office building. The development is anticipated to be constructed in phases, with full build-out anticipated for 2024. Although commercial driveways are not permitted on an A Minor Arterial roadway, per the Scott County Comprehensive Plan, limited access is allowed at 1/8 mile spacing for local streets. Therefore, two (2) development access alternatives were identified for consideration. The following information provides an overview of the two access alternatives, which will both be evaluated as part of the future conditions.

Access Alternative 1

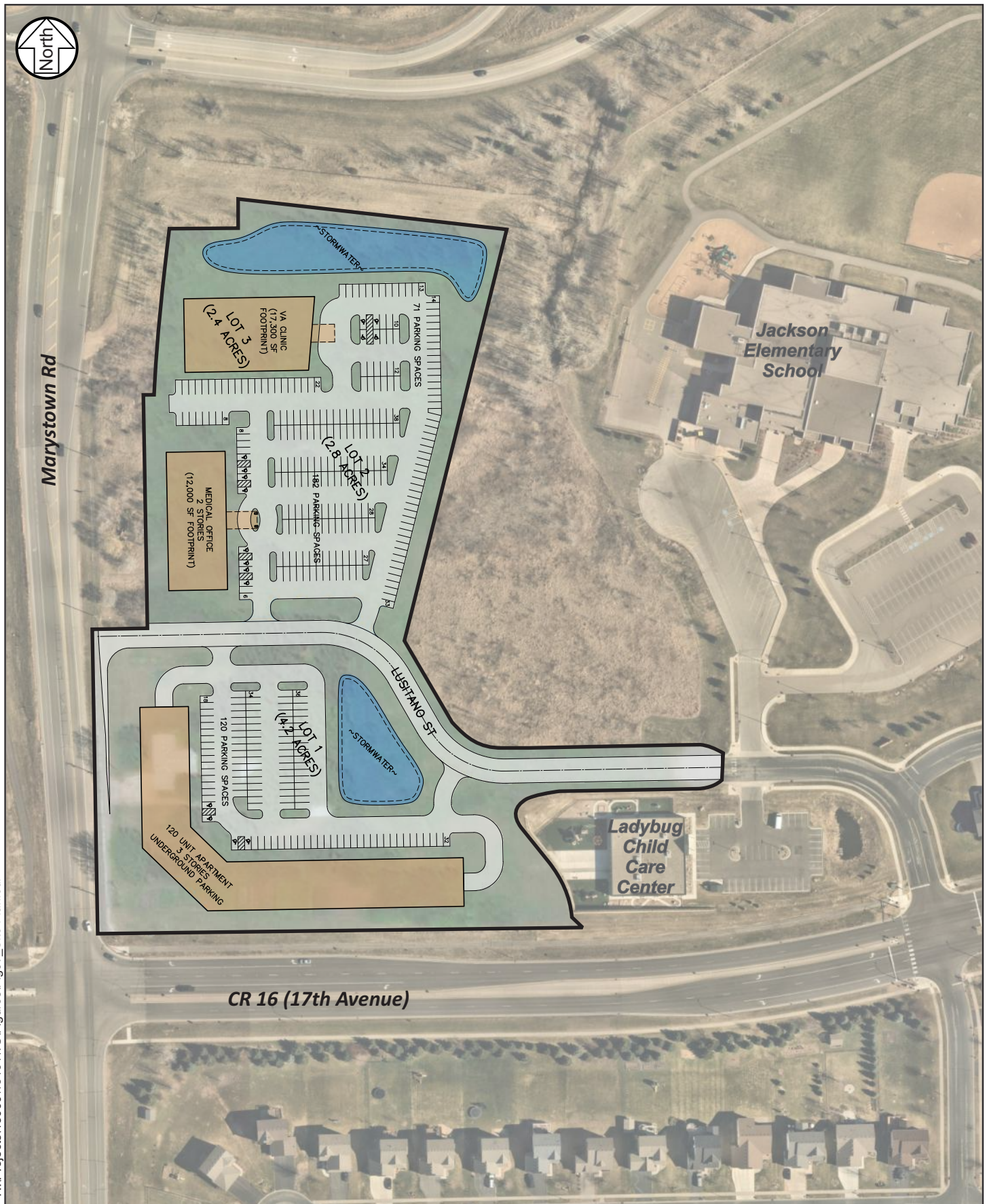
Alternative 1 provides one (1) full-access and one (1) restricted access. The full access would be provided at the existing County Road 16 (17th Avenue)/Lusitano Street intersection. The second location would be a right-in/right-out access along County Road 15, approximately 475 feet north of the CR 15/CR 16 intersection. Lusitano Street would be extended from the Jackson Elementary School Access to the proposed right-in/right-out, removing the existing cul-de-sac. A northbound right-turn lane is proposed along CR 15. The proposed development site plan showing Access Alternative 1 is shown in Figure 7.

Access Alternative 2

Access Alternative 2 provides one (1) full-access and one (1) restricted access. The full-access is provided at the existing County Road 15 (17th Avenue)/Lusitano Street intersection. The second location would be a right-in/right-out access along CR 16 (17th Avenue), approximately 600 feet east of the CR 15/CR 16 intersection. The existing Lusitano Street cul-de-sac is expected to be removed and Lusitano Street is expected to be extended from the Jackson Elementary School Access to the west to a newly constructed dead end/cul-de-sac west of the westernmost proposed development access.

2025 Build Conditions

To identify the impacts associated with the proposed development, traffic forecasts for year 2025 conditions (i.e. one-year after full-build) were developed. The year 2025 conditions take into account planned adjacent developments, general background growth, and traffic generated by the proposed development. The following sections provide detail on the proposed development trip generation, intersection capacity analysis, and potential improvements, including a traffic signal warrant analysis for intersections along the Marystown Road/CR 15 corridor.



Trip Generation

To account for traffic impacts associated with the proposed development, a trip generation estimate was developed for the a.m. and p.m. peak hours and a daily basis. The estimate, shown in Table 6, was developed using the *ITE Trip Generation Manual, 10th Edition*. Note that no multi-use or pass-by reductions were applied due to the type of land use planned (i.e. office, clinic, and apartments are destination type uses) within the proposed development.

Table 6. Proposed Development Trip Generation Estimate

Land Use Type (ITE Code)	Size	A.M. Peak Hour		P.M. Peak Hour		Daily Trips
		In	Out	In	Out	
Mid-Rise Multifamily (221)	120 DU	11	32	32	21	653
VA Clinic (630)	17,300 sf	50	14	16	40	660
Medical Dental Office (720)	24,000 sf	52	15	23	60	835
Total Site Trips		113	61	71	121	2,148

Results of the trip generation estimate indicate that the proposed development is expected to generate approximately 174 a.m. peak hour, 192 p.m. peak hour, and 2,148 daily trips. The trips generated were distributed throughout the area based on the directional distribution shown in Figure 8, which was developed based on information provided by the Scott County Regional Demand model, existing travel patterns, and engineering judgement. The resultant year 2025 traffic forecasts, including general area background growth, adjacent development trips, and traffic generated by the proposed development for Access Alternative 1 and Access Alternative 2 are shown in Figure 9 and Figure 10, respectively.

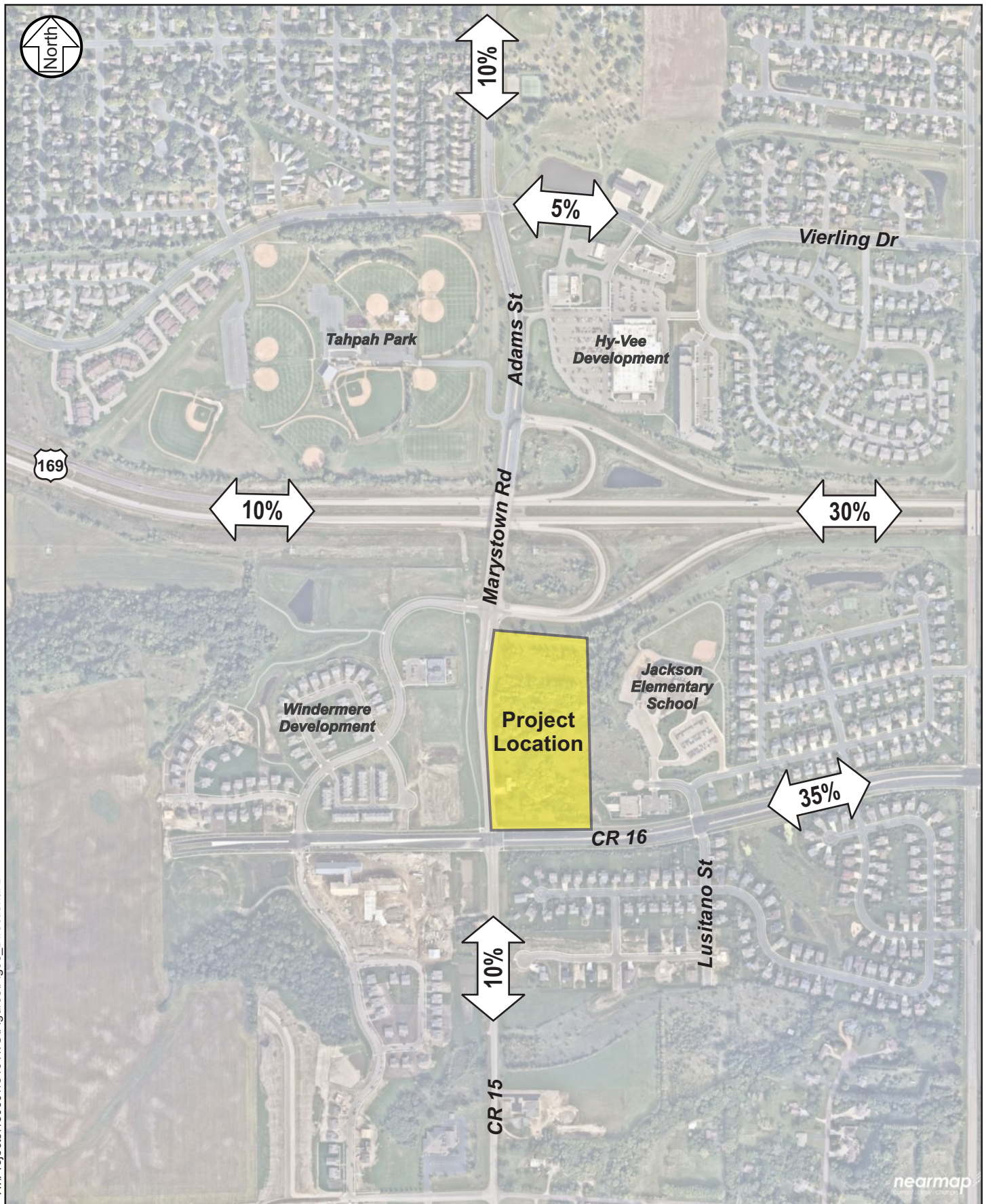
Intersection Capacity Analysis

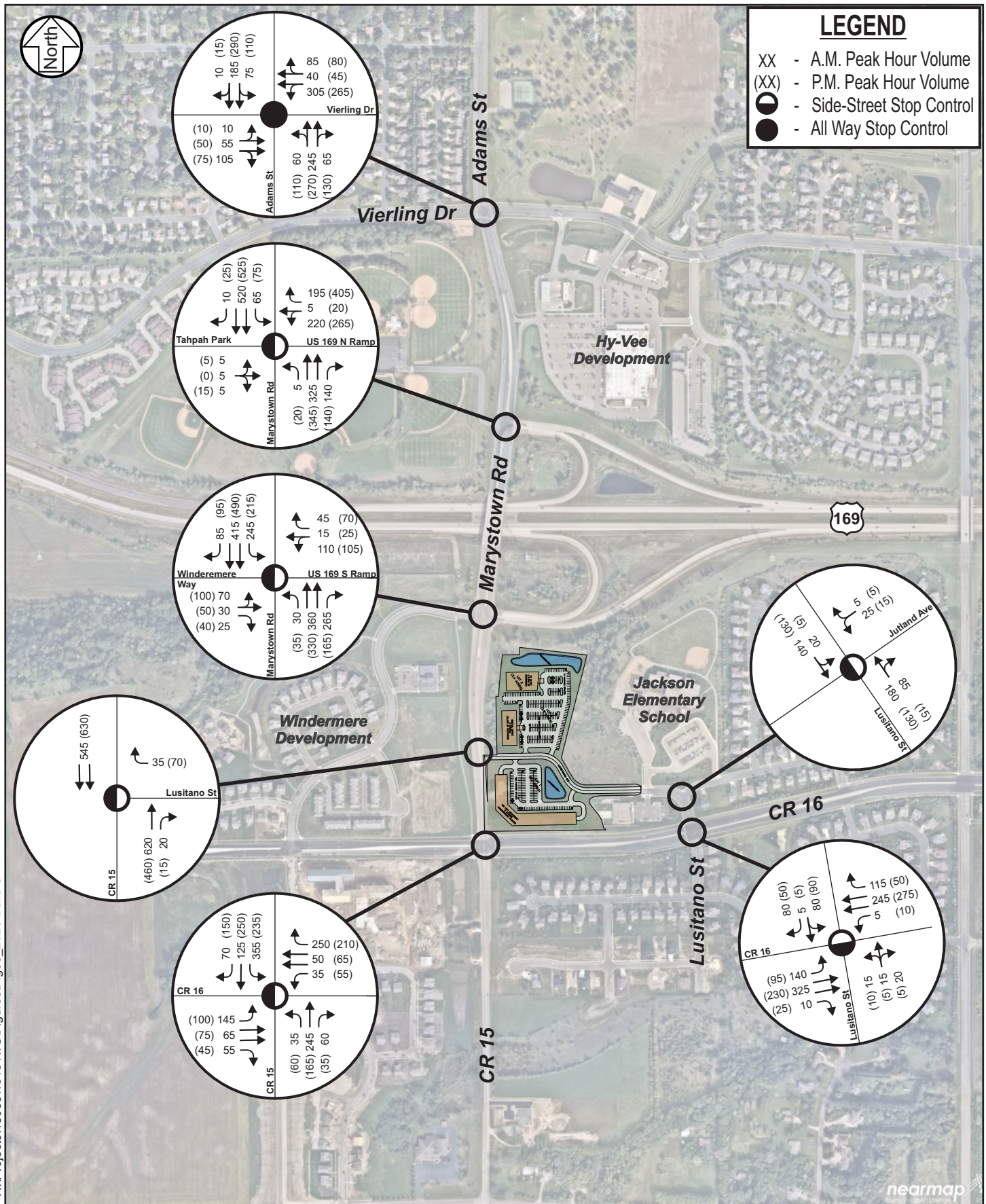
To understand how the existing roadway network is expected to operate under year 2025 build conditions, a detailed intersection capacity analysis was completed using Synchro/SimTraffic software.

Results of the year 2025 build intersection capacity analysis, shown in Table 7 and Table 8, indicates that the operational issues identified under the year 2025 no build condition are expected to degrade as development occurs. Given the level of adjacent development planned, construction of the proposed development is expected to accelerate the need for capacity improvements along the Marystown Road corridor.

Based on the capacity analysis, there is no significant intersection capacity difference between the two access alternatives reviewed. Therefore, for analysis purposes, only Access Alternative 1 was evaluated further as Access Alternative 2 is expected to result in similar operations from a capacity perspective. However, further discussion regarding the benefits and impacts associated with the two access alternatives is provided later in this document for consideration.

H:\Projects\13000\13164\TS\Figures\Fig08_Directional Distribution.cdr





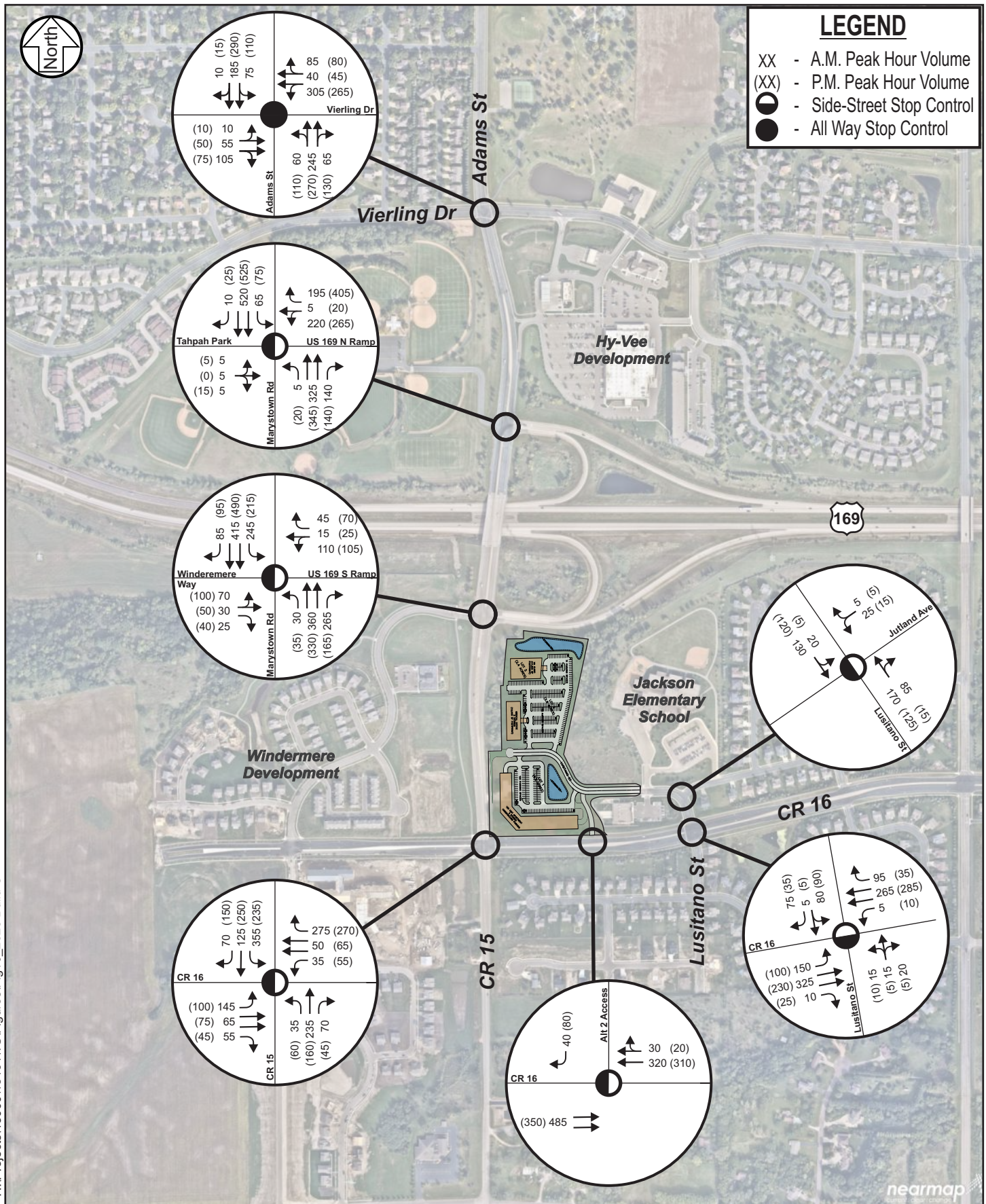


Table 7. 2025 Build Intersection Capacity Analysis

Intersection	LOS (Delay)			
	A.M. Peak Hour		P.M. Peak Hour	
	Alt 1	Alt 2	Alt 1	Alt 2
Adams Street/Vierling Drive ⁽²⁾	C (17 sec.)	C (17 sec.)	C (19 sec)	C (19 sec)
Marystown Road/US 169 North Ramp ⁽¹⁾	A/C (24 sec.)	A/C (24 sec.)	D/F (75 sec.)	D/F (75 sec.)
Marystown Road/US 169 South Ramp ⁽¹⁾	E/F (~3 min)	E/F (~3 min)	E/F (>3 min)	E/F (>3 min)
Alternative 1 - RIRO on CR 15 ⁽¹⁾	A/A (6 sec.)	---	A/A (5 sec.)	---
CR 15/CR 16 ⁽¹⁾	C/F (73 sec)	C/F (73 sec)	A/C (16 sec)	A/C (19 sec)
Alternative 2 - RIRO on CR 16 ⁽¹⁾	---	A/A (5 sec.)	---	A/A (5 sec.)

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

(2) Indicates an intersection with all-way stop control and was analyzed using HCS 7.

Table 8. 2025 Build School Intersection Capacity Analysis

Intersection	LOS (Delay)					
	A.M. School Arrival Peak Hour		P.M. School Departure Peak Hour		P.M. Peak Hour	
	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2
CR 16/Lusitano Street ⁽¹⁾	A/A (10 sec.)	A/A (10 sec.)	A/A (6 sec.)	A/A (6 sec.)	A/A (8 sec.)	A/A (8 sec.)
Lustiano Street / Jutland Avenue ⁽¹⁾	A/A (6 sec.)	A/A (5 sec.)	A/A (5 sec.)	A/A (5 sec.)	A/A (5 sec.)	A/A (5 sec.)

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst side-street approach LOS. The delay shown represents the worst side-street approach delay.

In addition to the operational and safety issues previously noted, the following information summarizes other operational and/or queuing issues that warrant consideration as development occurs.

- **Marystown Road/US 169 North Ramp:** The westbound 95th percentile queues during the p.m. peak hour are expected to extend approximately 925 feet, and the westbound left-turn queue is expected to block the westbound right-turn lane approximately 50 percent of the p.m. peak hour. This queue would extend over half of the off-ramp, which may cause safety issues as vehicles coming from US 169 may not expect these queues.
- **Marystown Road/US 169 South Ramp:** Westbound left-turn queues are expected to extend approximately 515 feet and block the westbound right-turn lane approximately 25 percent of the a.m. peak hour. Eastbound 95th percentile queues are expected to extend 350 feet and 650 feet during the a.m. and p.m. peak hours, respectively. These queues are expected to block the eastbound right-turn lane approximately 40 to 70 percent of peak hours.

- The westbound queue is expected to extend over half of the off-ramp, which may cause safety issues as vehicles coming from US 169 may not expect these queues.
- Due to the poor operations and queueing, it is expected that eastbound vehicles on Windermere Way are expected to reroute their trips and utilize CR 16 (17th Avenue) and other routes to avoid the US 169 South Ramp intersection.
- **CR 15/CR 16:** Eastbound left-turn queues are expected to extend beyond the turn-lane storage approximately 15 percent of the a.m. peak hour. Westbound queues are not expected to impact the proposed right-in/right-out access as part of Access Alternative 2.

Potential Long-Term Improvements

To address the future capacity and safety issues identified, the following improvements are offered:

- 1) Construct roundabouts or traffic signals at the Marystown Road/US 169 North Ramp, Marystown Road/US 169 South Ramp, and CR 15/CR 16 intersections prior to year 2025.
- 2) Consider constructing a roundabout at the Adams Street/Vierling Drive intersection to eliminate a multi-lane all-way stop condition and to help reduce any potential improper maneuvers that are occurring along the corridor from the Hy-Vee Access.

These improvements and traffic controls are being evaluated in more detail as part of the on-going *Marystown Road Corridor Study* to determine the optimal design for the area.

Potential Interim Improvements

Although the City is planning to reconstruct the Marystown Road Corridor within the next few years, depending on funding, there may be a need for interim improvements to ensure safe and efficient operations can be maintained until the long-term solution can be implemented. Interim improvement need is based on the level and pace of development over the next few years. The study intersections should continue to be monitored, particularly the Marystown Road/US 169 South Ramp intersection, to determine if/when interim improvements could be considered.

Potential interim improvements include implementation of a temporary signal or all-way stop control. To understand the overall impact of the potential interim improvements, the benefits and potential issues with each option are discussed as follows. Further discussion with area stakeholders should occur to determine the appropriate interim traffic controls, if needed.

Interim Improvement Option 1: Temporary Traffic Signal

Benefits	Potential Issues
• Provides Acceptable Operations • Fits driver expectations for corridor (i.e. the corridor is set-up for signalization)	• Cost / Maintenance • No Speed Reduction expected

Interim Improvement Option 2: Temporary All-way Stop Control

Benefits	Potential Issues
- Provides Acceptable Overall Operations - Opportunity to lower speeds along corridor - Less expensive than Temporary Traffic Signal	- Creates driver confusion – too many lanes for an AWSC – consider coning off/condensing turn lanes - Extensive ITS effort to provide notification/safety (LED Stop Signs, Traffic Control Change Warning Signs, Speed Feedback Signs) - Agency Approval (MnDOT, Scott County) - Approach operations are expected to be worse than a signal or roundabout

In addition, if Access Alternative 1 is carried forward, the median on Marystown Road at the US 169 South Ramp intersection should be extended beyond the right-in/right-out access along CR 15/Marystown Road. This median will ensure that right-in/right-out operations occur and minimize the potential for illegal maneuvers.

Marystown Road/CR 15 Warrant Analysis

Based on the future forecasts and resultant capacity and safety issues within the study area, a traffic control change at the Marystown Road/US 169 North Ramp, Marystown Road/US 169 South Ramp, and CR 15/CR 16 intersections are needed. Therefore, to determine if a traffic signal or roundabout is warranted, a cursory warrant analysis was performed under existing, 2025 no build, and 2025 build conditions. This included evaluating signal warrants 1 through 3 and the all-way stop control warrant outlined in the *Minnesota Manual on Uniform Traffic Control Devices* (MnMUTCD). If any of the signal warrants are met, the intersection is considered warranted for a signal, however, many agencies prefer an 8-hour warrant (warrant 1A, 1B, 1C) to be met before traffic control changes are implemented. It should be noted that if an intersection meets any traffic signal or all-way stop control warrants, a roundabout is also considered warranted.

The existing warrant analysis was based on the 13-hour counts along the corridor, in conjunction with the *Marystown Road Corridor Study*, with adjustments for construction traffic. Based on the existing warrant analysis, the only intersection that meets a signal and/or all-way stop control warrant is the existing all-way stop at the Adams Street/Vierling Drive intersection.

Future warrant analysis was performed at the intersections using the a.m. and p.m. peak hour volumes and estimated non-peak hour volumes based on the time of day patterns from the existing 13-hour counts. Results of the cursory warrant analysis indicate that multiple warrants are expected to be met under year 2025 no build and build conditions at all four study intersections along Marystown Road. A summary of the cursory warrant analysis is illustrated in Table 9.

Table 9. Marystown Road/CR 15 Warrant Analysis

Intersection	Existing	2025 No Build	2025 Build
Adams Street/Vierling Drive ⁽¹⁾	2, 3B, AWSC	1A, 2, 3B, AWSC	1A, 2, 3B, AWSC
Marystown Road/US 169 North Ramp	None	1B, 1C, 2, 3B	1B, 1C, 2, 3B
Marystown Road/US 169 South Ramp	None	1B, 2, 3B, AWSC	1B, 2, 3B, AWSC
CR 15/CR 16	None	2, 3B, AWSC	1A, 2, 3B, AWSC

(1) Currently an all-way stop controlled intersection.

2025 Build Conditions with Improvements

To illustrate how the potential long-term and interim improvements/traffic controls are expected to operate under year 2025 build conditions along the Marystown Road corridor, an additional intersection capacity analysis was conducted. Results of the analysis, shown in Table 10, indicates that all intersections are expected to operate at an overall LOS D or better during the a.m. and p.m. peak hours. Although the all-way stop control has acceptable overall operations, certain approaches may operate in the LOS E/F range during certain peak hours. Therefore, the all-way stop control should only be considered as an interim improvement. The signal and roundabout options provide better operations and are expected to provide the long-term capacity needed for the area. It should be noted that the roundabouts were analyzed as a single-lane approach, single-lane roundabout. Additional through-lanes and turn-lanes at the roundabout will provide additional long-term capacity. The optimal design of the traffic control improvements is being evaluated in more detail as part of the on-going *Marystown Road Corridor Study*.

Table 10. 2025 Build Intersection Capacity Analysis – with Improvements

Intersection	LOS (Delay)					
	A.M. Peak Hour			P.M. Peak Hour		
	RAB ⁽³⁾	Signal	AWSC ⁽⁴⁾	RAB ⁽³⁾	Signal	AWSC ⁽⁴⁾
Adams Street/ Vierling Drive	A (8 sec.)	B (11 sec.)	C (17 sec.)	B (11 sec.)	B (11 sec.)	C (19 sec.)
Marystown Road/ US 169 North Ramp ⁽¹⁾	A (11 sec.)	A (9 sec.)	C (18 sec.)	C (17 sec.)	B (11 sec.)	D (31 sec.)
Marystown Road/ US 169 South Ramp ⁽¹⁾	C (15 sec.)	B (11 sec.)	D (32 sec.)	B (15 sec.)	B (11 sec.)	D (34 sec.)
CR 15/CR 16 ⁽²⁾	B (11 sec.)	B (14 sec.)	D (26 sec.)	A (10 sec.)	B (11 sec.)	C (22 sec.)

(1) Under the all-way stop control, lane reductions were assumed on the mainline northbound/southbound lanes (i.e. left- and right-turn lanes were coned off to create a northbound/southbound thru-right and thru-left). All-way stop control was analyzed using HCS 7

(2) Under the all-way stop control, lane reductions were assumed on the eastbound/westbound approaches (i.e. left- and right-turn lanes were coned off to create an eastbound/westbound thru-right and thru-left) and on the northbound/southbound approaches (i.e. northbound/southbound right-turn was coned off to create a northbound/southbound thru-right).

(3) Roundabouts were analyzed as a single-lane approach, single-lane roundabout using HCS 7.

(4) Considered an interim improvement only.

School Pedestrian Route Alternatives

Current school operations and management during school arrival and departures are relatively efficient and appear to be as safe as possible, given the location. However, with the addition of the proposed development to the west, a closer look at the future school operations was conducted.

Both access alternatives for the proposed development provide a full-access at the CR 16/Lustiano Street intersection. Therefore, it is important to understand how the pedestrian crossing and routes to/from school are anticipated to operate with the proposed development, and if any safer alternatives should be considered. In addition to the current route for pedestrians to access the school, two alternatives (Alternative A and Alternative B) were also considered. A summary of the benefits and impacts of the existing and potential alternative school routes are summarized in the following section for consideration.

Route to School: Existing

Benefits

- Avoids bus and parent pick-up/drop-off operations
- In line with existing RRFB
- Relatively short walking distance

Potential Issues

- Crossing guards will need to be more cognitive of thru vehicles on Lusitano Street compared to the existing cul-de-sac



Route to School: Alternative A

Students would cross CR 16 on the east side of the CR 16/Lustiano Street intersection. This path would also cross the Jutland Avenue intersection and the parent pick-up/drop-off exit only.

Benefits

- Not crossing a through street on Lusitano Street
- Relatively short walking distance

Potential Issues

- Will be crossing parent pick-up/drop-off operations/more vehicles
- Requires removal/replacement of the RRFB
- Students destined for the daycare after school will still need to cross Lusitano Street (dashed line)



Route to School: Alternative B

Students would cross CR 16 at the Caspian Lane right-in/right-out. Students would then cross Jutland Avenue and remain on the north sidewalk that would lead them around the school to the west entrance.

Benefits

- RRFB would be located at a reduced access with a large pedestrian refuge island, not a full access intersection, which is recommended for RRFB's
- Would avoid parent pick-up/drop-off operations and development traffic

Potential Issues

- Would double the walking distance (add over 1,000 feet)
- Requires removal/replacement of the RRFB
- Students destined for the daycare after school will still need to cross Lusitano Street (dashed line)



Based on this evaluation, the current pedestrian route to/from school and management strategies should continue if/when the proposed development is constructed.

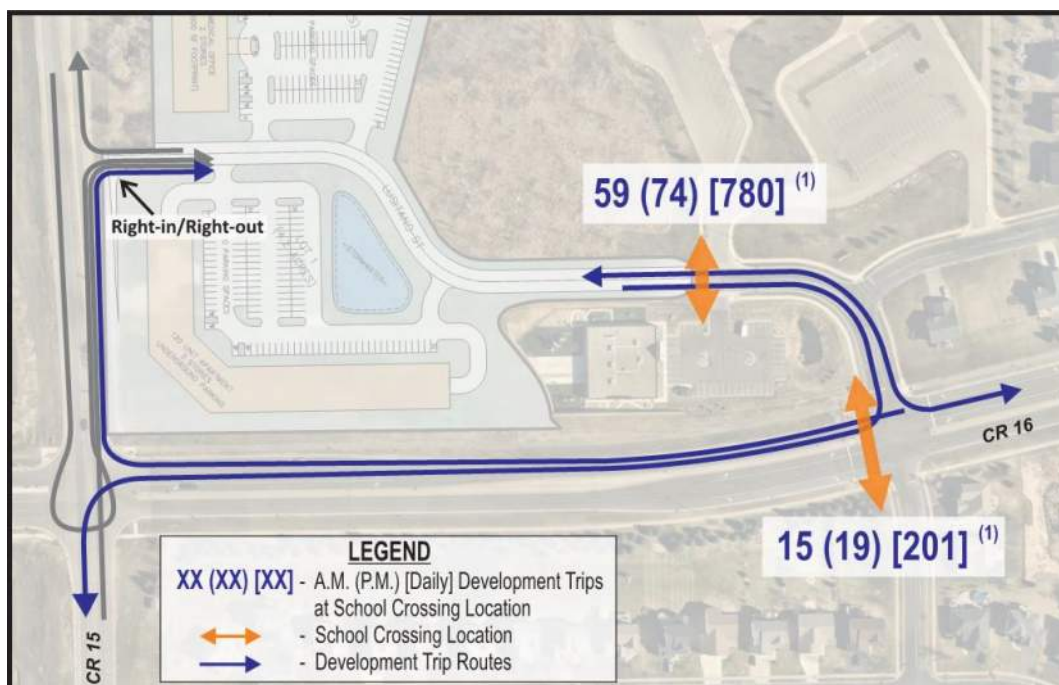
Site Plan Review

A review of the proposed site plan was completed to identify any issues and recommend potential improvements with regard to access, sight distance, and circulation. The following information provides an overview of the site plan review.

Access Alternatives

The two access alternatives are not expected to have a significant impact on operations within the study area. Although Alternative 2 would have more exiting vehicles using the CR 15/CR 16 intersection, these movements would be mostly westbound right-turns and would have minimal impact on overall operations and queueing. Therefore, benefits and potential issues with the two access alternatives were identified and are summarized in the following section. This evaluation focused on access spacing, internal site circulation, and the elementary school interaction. Further discussion with area stakeholders should occur to determine the preferred access alternative.

Access Alternative 1: Right-in/Right-out on CR 15



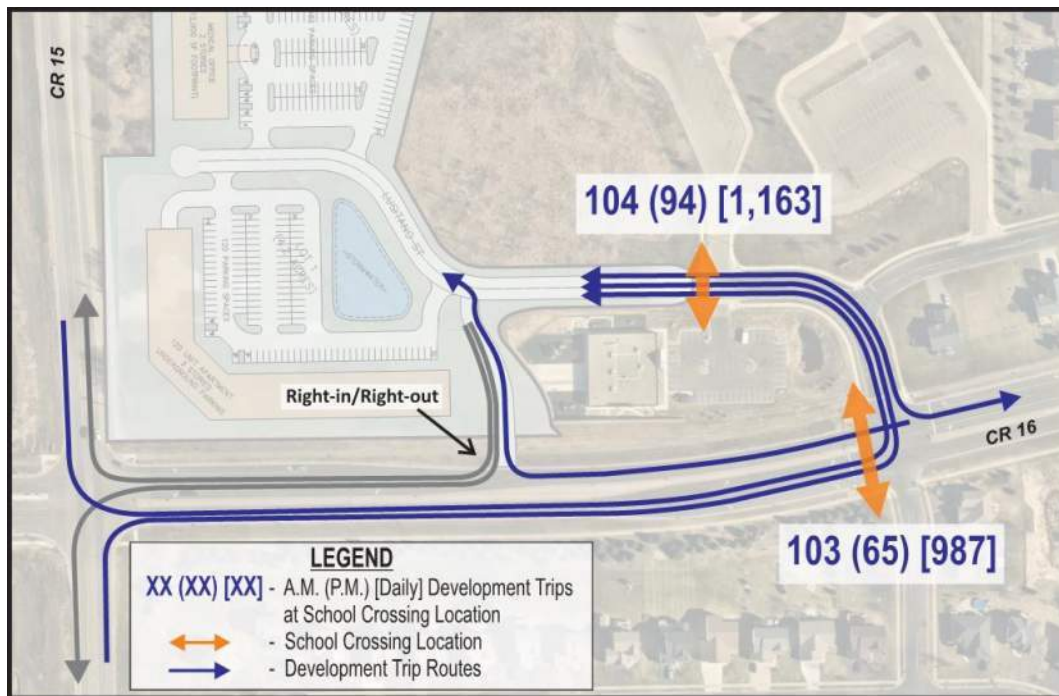
Benefits

- Less development/school interaction than Alternative 2 ⁽¹⁾
- Provides better internal site circulation
- Would not impact underground garage access to the apartment

Potential Issues

- Access is anticipated to be only 475 feet away from CR 16 and is not evenly spaced between CR 16 & the US 169 ramp.
- Vehicles to/from the school may utilize the Right-in/Right-out on CR 15

(1) Assumes roundabout control at the CR 15/CR 16 intersection and that all vehicles accessing the site from the north would conduct a U-turn at the roundabout and enter the site at the right-in/right-out along CR 15.

Access Alternative 2: Right-in/Right-out on CR 16**Benefits**

- Access is anticipated to be directly between CR 15 and Lusitano St with about 1/8 mile spacing
- Vehicles to/from the school would likely remain on their original routes

Potential Issues

- More development/school interaction than Alternative 1
- Likely have worse internal circulation than Alternative 1 due to internal T-intersection
- May impact underground garage access to the apartment

Other Considerations

Based on a review of the proposed site plan, the following site improvements should be considered:

- Align the westernmost apartment access across from the Medical Office/VA Clinic access to limit potential conflicts and avoid driver confusion.
- Align the easternmost apartment access from the structured parking area (for Access Alternative 1 only) directly to Lusitano Street and tie-in the surface parking lot access to the driveway aisle.
- Incorporate traffic controls, signing, and striping based on guidelines established in the Manual on Uniform Traffic Control Devices (MUTCD). In particular, install side-street stop signs on the Lusitano Street/Jackson Elementary School/Ladybug Child Care Access locations and consider installing a pedestrian crossing sign and pavement markings (existing pavement markings have faded) at the existing Lusitano Street school crossing location.
- If Access Alternative 2 is carried forward, consider making the right-in/right-out access street the mainline, and Lusitano Street as the side-street stop control of the potential T-intersection. This will help improve traffic circulation of the site and limit school impacts.
- Special consideration should be made to limit any sight distance impacts from future structures, landscaping, and signing.

Trip Proportional Share

Intersection improvements and considerations were identified in this report that are expected to be needed by year 2025 or before. Therefore, to identify the amount of trips the proposed Trident development contributes to the transportation system along Marystown Road under year 2025 build conditions, a trip proportional share analysis was conducted. The trip proportional share, which is shown in Table 11, was developed by taking the average of the expected a.m. and p.m. peak hour site trips from the proposed Trident development passing through a given intersection, divided by the total number of vehicles passing through the particular intersection under year 2025 build conditions.

The resultant proportional share of trips that the proposed Trident development contributes to the transportation system ranges from approximately two (2) percent to eight (8) percent of the total future traffic under 2025 conditions. It should be noted that Access Alternative 1, which has a proposed right-in/right-out on CR 16, has less trips routing through the CR 15/CR 16 intersection. Hence, there is a lower trip proportional share for the proposed Trident development at that CR 15/CR 16 intersection as compared to Access Alternative 2.

Table 11. Trident Development Trip Proportional Share (2025 Build)

Intersection	Alt 1	Alt 2
Adams Street/Vierling Drive	2.1 %	2.1 %
Marystown Road/US 169 North Ramp	4.0 %	4.0 %
Marystown Road/US 169 South Ramp	5.9 %	5.9 %
CR 15/CR 16	5.3 %	8.0 %

Summary

The following information provides a summary of the analysis performed as part of the Trident Development Transportation Study:

- All study intersections currently operate at an overall LOS B or better during the a.m., p.m. school departure, and p.m. peak hours. No significant queues or side-street delays were identified.
- Observations were conducted at Jackson Elementary School during a.m. and afternoon peak periods. Overall the operations during school arrival and departures are efficient and safe. The student crossing guards along with the teacher assistance provides as safe as a walking environment to/from the school as possible, given the location.
- To understand how area planned developments and general background growth are expected to impact the study intersections, year 2025 no build conditions were reviewed. Results of the year 2025 no build condition intersection capacity analysis indicates that multiple study intersection side-street approaches are expected to be operating over capacity, which results in queuing issues and safety concerns.
- The current development proposal consists of 120 units of mid-rise multi-family residential, a 17,300 square foot Veteran's Affairs (VA) clinic, and a 24,000 square foot medical-office building. As part of the development, two access alternatives were evaluated:
 - Access alternative 1 provides a full access at the CR 16/Lusitano Street intersection and a right-in/right-out access along CR 15.
 - Access alternative 2 provides a full access at the CR 16/Lusitano Street intersection and a right-in/right-out access along CR 16.
- The proposed development is expected to generate approximately 174 a.m. peak hour, 192 p.m. peak hour, and 2,148 daily site trips.
- Results of the year 2025 build condition intersection capacity analysis indicate that operational issues identified under the year 2025 no build condition are expected to degrade as development occurs. Given the level of development planned, construction of the proposed development is expected to accelerate the need for capacity improvements along the Marystown Road corridor.
- To address the future capacity and safety issues identified, the following improvements are offered;
 - Construct a traffic signal or roundabout at the Marystown Road/US 169 North Ramp, Marystown Road/US 169 South Ramp, and CR 15/CR 16 intersections prior to year 2025.
 - Consider constructing a roundabout at the Adams Street/Vierling Drive intersection to eliminate a multi-lane all-way stop condition and help reduce any potential improper maneuvers that are occurring along the corridor from the Hy-Vee Access.
 - The study intersections should continue to be monitored, particularly the Marystown Road/US 169 South Ramp intersection, to determine if/when interim improvements

could be considered. Potential interim improvements include implementation of a temporary signal or all-way stop control. If Access Alternative 1 is carried forward, the median on Marystown Road at the US 169 South Ramp intersection should be extended beyond the right-in/right-out access along CR 15/Marystown Road.

- To determine if a traffic signal or roundabout is warranted, a cursory warrant analysis was performed under the existing, 2025 no build, and 2025 build conditions. Results of the cursory warrant analysis indicate that multiple warrants are expected to be met during the year 2025 no build and build volumes at all four intersections.
- Alternative pedestrian routes to/from school were considered; however, it is recommended that the current route to/from school and management strategies should continue if/when development is constructed.
- The two access alternatives are not expected to have a significant impact on operations within the study area. Therefore, benefits and potential issues with the two access alternatives were identified. Further discussion with area stakeholders should occur to determine the preferred access alternative.
- A review of the proposed site plan was completed to identify any issues and recommend potential improvements regarding access, sight distance, and circulation. The following improvements are offered for consideration and are found in the site plan review section.
- To identify the amount of trips the proposed Trident development contributes to the transportation system along Marystown Road under year 2025 build conditions, a trip proportional share analysis was conducted. The resultant proportional share of trips that the proposed Trident development contributes to the transportation system ranges from approximately two (2) percent to eight (8) percent of the total future traffic under 2025 conditions.