



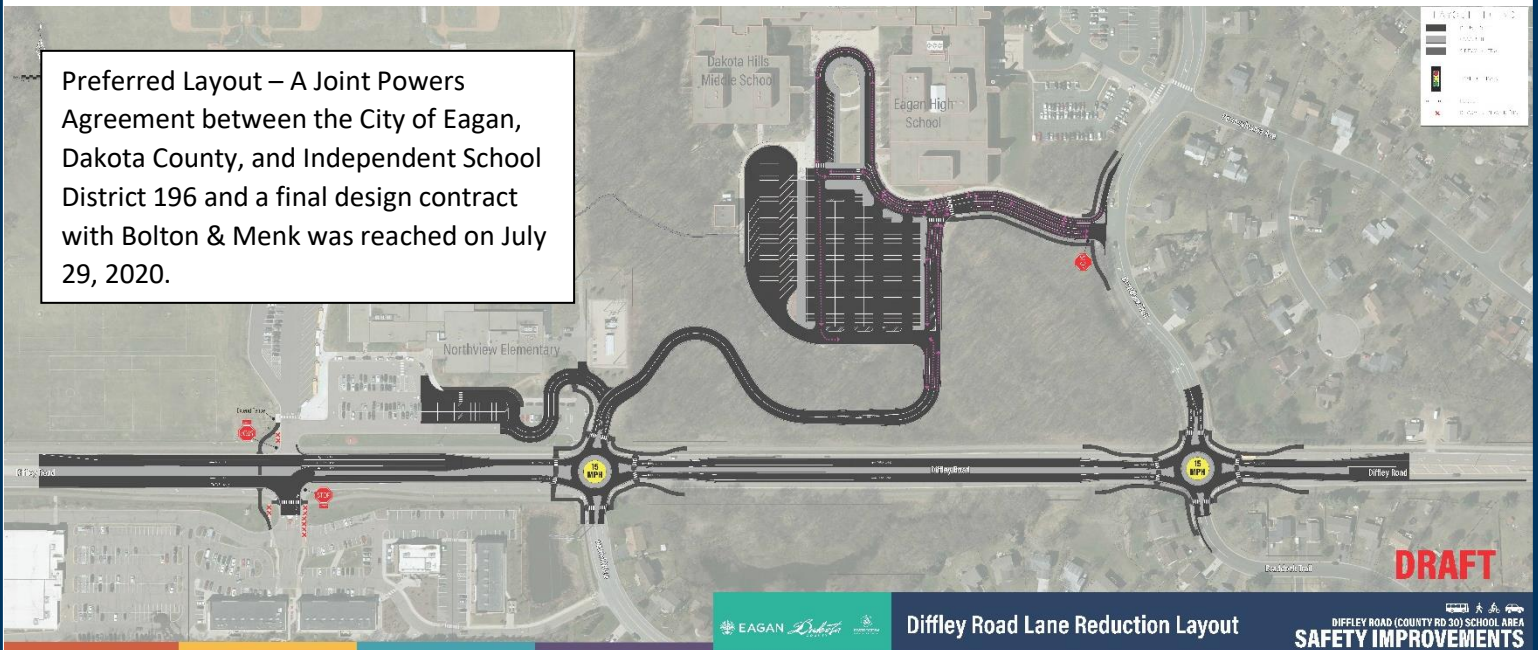
# Diffley Road (CSAH 30) School Area Improvements

## Final Study Report

City of Eagan, MN; Dakota County; Independent School District 196

June 2020

Preferred Layout – A Joint Powers Agreement between the City of Eagan, Dakota County, and Independent School District 196 and a final design contract with Bolton & Menk was reached on July 29, 2020.



**To:** Kristi Sebastian, Dakota County Traffic Engineer

**From:** Chris Chromy, Senior Principal, Bolton & Menk, Inc.  
Kelsey Retherford, Traffic Engineer, Bolton & Menk, Inc.

**Subject:** Final Study Report  
Diffley Road (CSAH 30) School Area Improvements  
City of Eagan, MN; Dakota County; Independent School District 196  
Project No.: CP3036 (Dakota County), 1339 (City of Eagan) T42. 116848 (Bolton & Menk)

**Purpose:** This report describes the key objectives, existing conditions analysis, and alternatives analysis that was used to make recommendations and reach the preferred layout for the Diffley Road School Area Improvements project. The report is organized into sections describing the key objectives that were used to inform analysis and recommendations, and overview of existing conditions, a preliminary traffic analysis, a detailed traffic analysis, and a comparison between the proposed concept and existing conditions.

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## Overview

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Diffley Road (CSAH 30) serves as a critical east-west urban minor arterial roadway in northern Dakota County, providing a vital connection to commuters and residents through the City of Eagan. Daily traffic levels range from 19,000 vehicles per day (vpd) near I-35E to 13,000 vpd near CSAH 43 (Lexington Avenue) to approximately 6,000 vpd on the far east end of the corridor near TH 3 (S Robert Trail). Much of the Diffley Road corridor is characterized by a wide right-of-way footprint, four-lane typical section, and pedestrian trails parallel to the roadway. East of Braddock Trail, the four-lane highway transitions into a three-lane (two-way left turn lane) section.

In 2018, Dakota County initially partnered with the City of Eagan to develop an intersection improvement project on Diffley Road (CSAH 30) at Braddock Trail. The City of Eagan was the lead on this project. The county and city held two open houses to discuss the project and gain input from the residents. Based on feedback from the public open house meetings on November 28, 2018 and February 11, 2019, the initial project anticipated for 2019 did not move forward. Rather, several initiatives were implemented, including the City of Eagan Bike & Pedestrian Plan, Dakota County School Safety Assessment, and the Diffley Road (CSAH 30) School Area Safety Improvements Study.

In November 2019, Bolton & Menk was hired by the City of Eagan to engage in a robust study of Diffley Road and Braddock Trail in the vicinity of Northview Elementary School, Dakota Hills Middle School, and Eagan High School. The Bolton & Menk team met with school district staff, elected officials, county staff, city staff, Eagan police, middle school teachers and students, high school students and teachers, and the school district's architect from November 2019 through March 2020 to build trust and develop communication with all project stakeholders. This led to shorter-term improvements that were implemented in winter 2019/2020 including a school zone speed limit with flashing beacons, school route signage, and adult crossing guards at the Diffley Road and Braddock Trail intersection as well as the middle school's south lot entrance at Braddock Trail. This multi-agency team also met through the study process to discuss the project development process, public engagement and develop a safe route to school grant application.

Bolton & Menk recently completed the Diffley Road (CSAH 30) School Area Safety Improvements Study which provided recommendations for future plans of the Diffley Road corridor between Lexington Avenue (CSAH 43) and Braddock Trail. The study recommendations identified a lane reduction of Diffley Road east of Lexington Avenue, single-lane roundabouts at Daniel Drive and Braddock Trail, a new access road from the Diffley Road and Daniel Drive intersection to the Dakota Hills Middle School/Eagan High School's south parking lot, and reconfiguration/expansion of the schools' parking lots.

This report describes the study key objectives, existing conditions, and alternatives analysis that was used to reach the preferred layout for the Diffley Road School Area Improvements project.

## Key Objectives

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Utilizing public feedback, the project team consisting of staff from Dakota County, The City of Eagan, Independent School District 196, and Bolton & Menk, developed the following key objectives early in the project. These objectives have since guided the study outcomes and analysis.

- Increase pedestrian safety and connections
- Increase awareness of the school area
- Provide safe facilities
- Lower vehicle speeds
- Reduce pedestrian and vehicle conflict points
- Reduce congestion and improve circulation

The existing issues map shown in the **Appendix** was used to provide framework and develop the key objectives.

## Existing Conditions

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An existing conditions analysis was completed prior to the evaluation of safety improvement options for the Diffley road school area. The project team analyzed turning and crossing counts at area's major intersections, the current speed limits on Diffley Road, existing trails, sidewalks, fencing, and lighting, bus travel times, and key pedestrians conflict points. The project team also asked the public to identify existing issues in the area. Based on public comments received, the project team compiled this list of existing issues:

- Pedestrian Safety
- Pedestrian/Vehicle Conflicts
- Facility Barriers
- Speeding
- Area Circulation

### ***Traffic Volumes and Turning Counts***

**Figure 1** and **Figure 2** display the traffic volumes, turning counts and number pedestrian crossings at the intersections throughout the project area. Counts were collected in 2019. The Braddock Trail and Diffley Road intersection also includes counts from 2018 and the Daniel Drive and Diffley Road intersection includes counts from 2015.



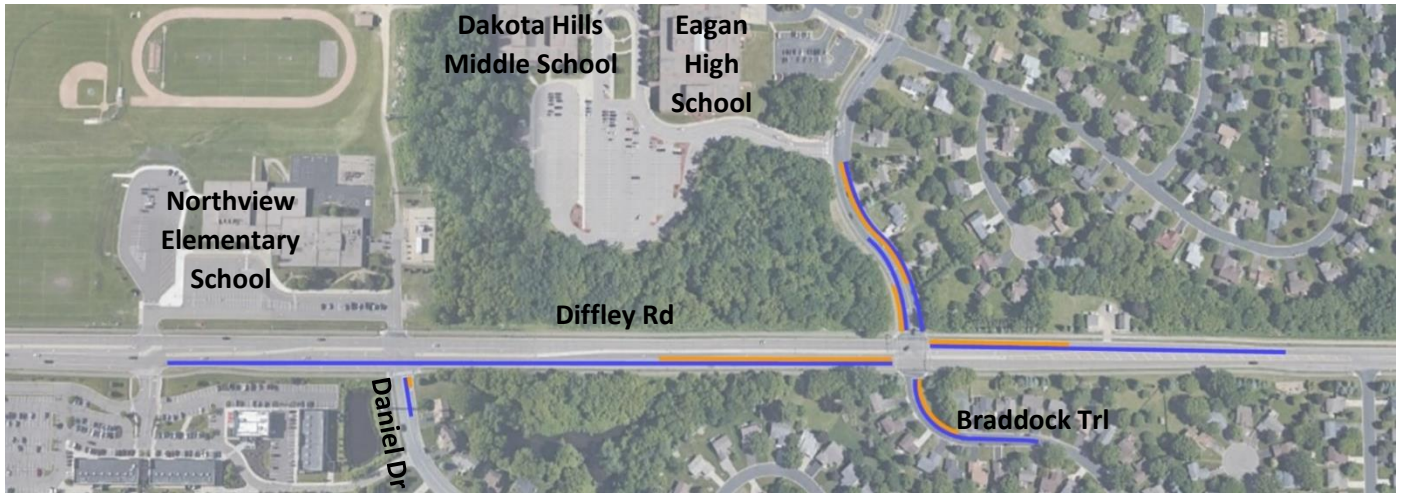
FIGURE 2: PEDESTRIAN CROSSING COUNTS



### **Traffic Queuing**

The Braddock Trail and Diffley Road intersection currently experiences excessive queuing during the AM peak hour. **Figure 3** below shows the existing traffic queues. The orange lines show the average queue length and the blue lines show the maximum queue length throughout the AM peak hour. The maximum queues indicate that traffic waiting to turn into the South Parking can queue beyond Daniel Dr at times during the AM peak hour.

FIGURE 3. EXISTING TRAFFIC QUEUING



### **Diffley Road Speed Limit**

The speed limit on Diffley Road is currently 45 mph. This was set through a speed study conducted in 1995. The 85<sup>th</sup> percentile speed in the study was 48 mph. Factors that are considered when setting a speed limit are:

- Road type and condition
- Location and type of access points (intersections, entrances, etc.)
- Sufficient length of roadway (1/4 mile minimum)
- Existing traffic control devices
- Crash history
- Traffic volume
- Sight distances
- Test drive results
- Speed study

Speed limits can be reviewed and potentially changed by conducting a new engineering and traffic investigation (speed study). Typically, speed limit alterations are caused by land use changes and roadway design changes over time.

### **Existing Trails, Sidewalks, Fencing, and Lighting**

**Figure 4** displays existing trails, sidewalks, fencing, and lighting in the project area. Sidewalk facilities and lighting are lacking at the Daniel Drive and Diffley Road, Braddock Trail and Diffley Road, Braddock Trail and Pennsylvania Ave, and Braddock Trail and Ventnor Ave intersections.

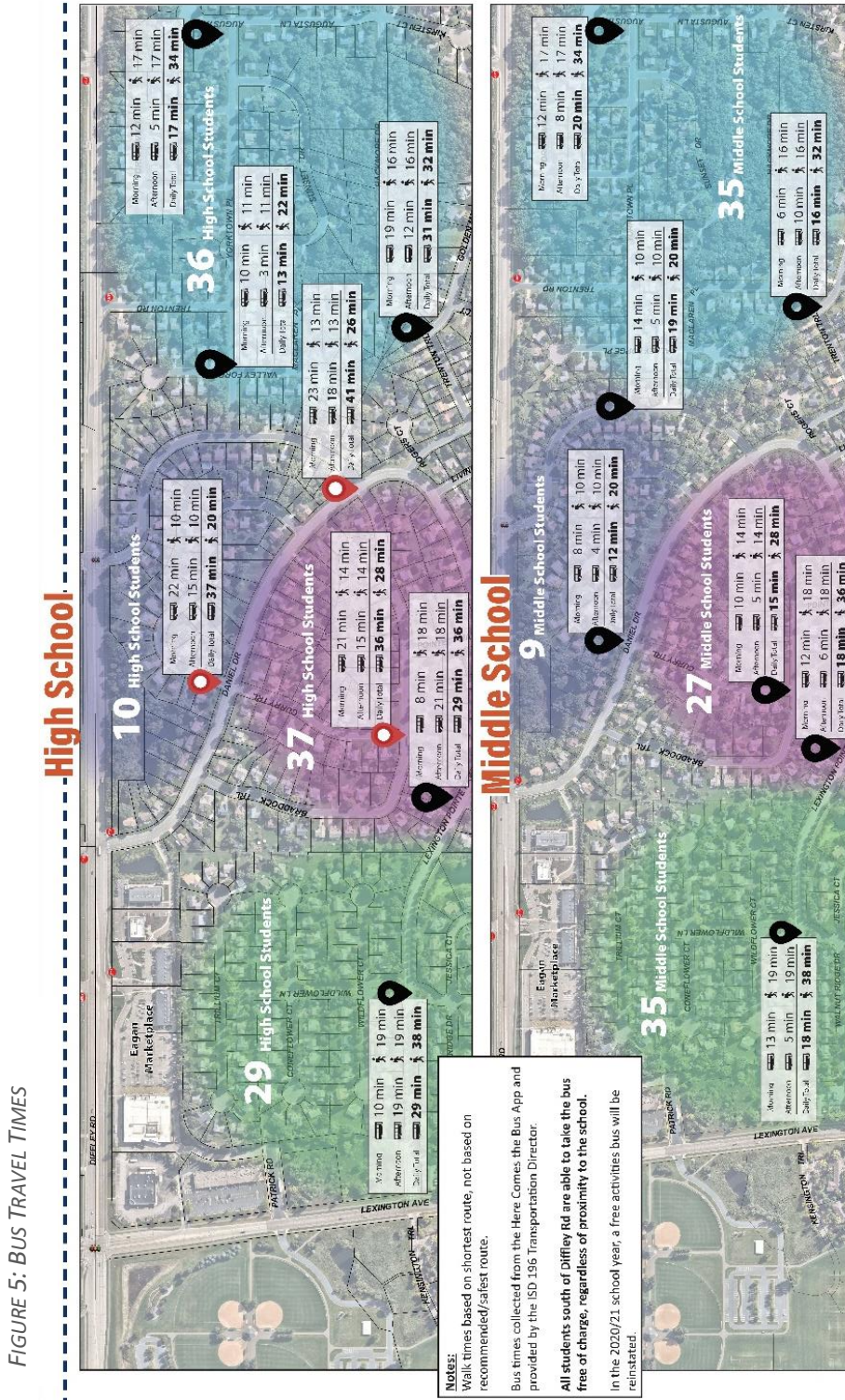


FIGURE 4: EXISTING TRAILS, SIDEWALKS, FENCING, AND LIGHTING



## Bus Travel Times

Figure 5 compares bus travel times and walking times for students travelling to Eagan High School and Dakota Hills Middle School from south of Diffley Road. The walks times included are based on the shortest available route, not based on the recommended or safest route. All students south of Diffley Road are able to take the bus free of charge, regardless of proximity to the school.



## ***Key Pedestrian and Vehicle Conflict Points***

Project team identified four key pedestrian and vehicle conflict points:

- Entrance to south parking lot of Eagan High School from Braddock Trail
- Braddock Tail and Diffley Road intersection
- Daniel Drive and Diffley Road intersection
- The Diffley Market Place crossing across from Northview Elementary School

These locations are identified on the existing issues map in the **Appendix**.

## **Alternatives Analysis**

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Many design alternatives for the Diffley Road School Area Improvements project were analyzed at various points throughout the project. The following section summarizes the analysis methods that were used to reach the preferred layout. The entire evaluation process was guided by the six key objectives identified by the project team.

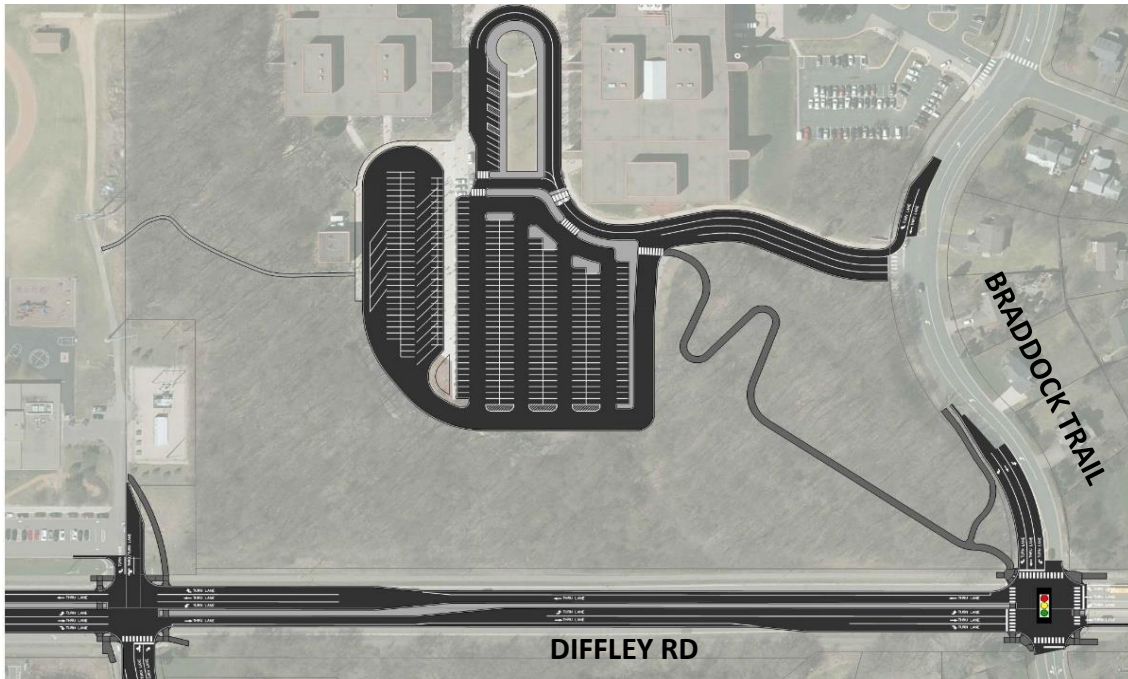
### **Preliminary Traffic Analysis**

This section is a summary of the alternatives analyzed to improve the safety and traffic operations surrounding Northview Elementary School, Dakota Hills Middle School, and Eagan High School. A “Preliminary Traffic Analysis” memorandum was completed in March of 2020. The memorandum reviews the alternatives analyzed, traffic volumes for each option, information on the rerouting of trips, and the detailed operational results. A summary of the analysis is included below.

Three options were analyzed to compare traffic operations with changes along Diffley Road and the South Parking Lot access. Each option is described below and depicted through **Figures 6** through **8**. The sub-options (Option 1A, 1B, etc.) describe additional modifications to access and traffic control that was also analyzed with each option. Operations were analyzed for the AM peak hour which occurs from 6:45-7:45 AM. The traffic volumes modeled with each option are shown in the **Appendix**.

## Option 1

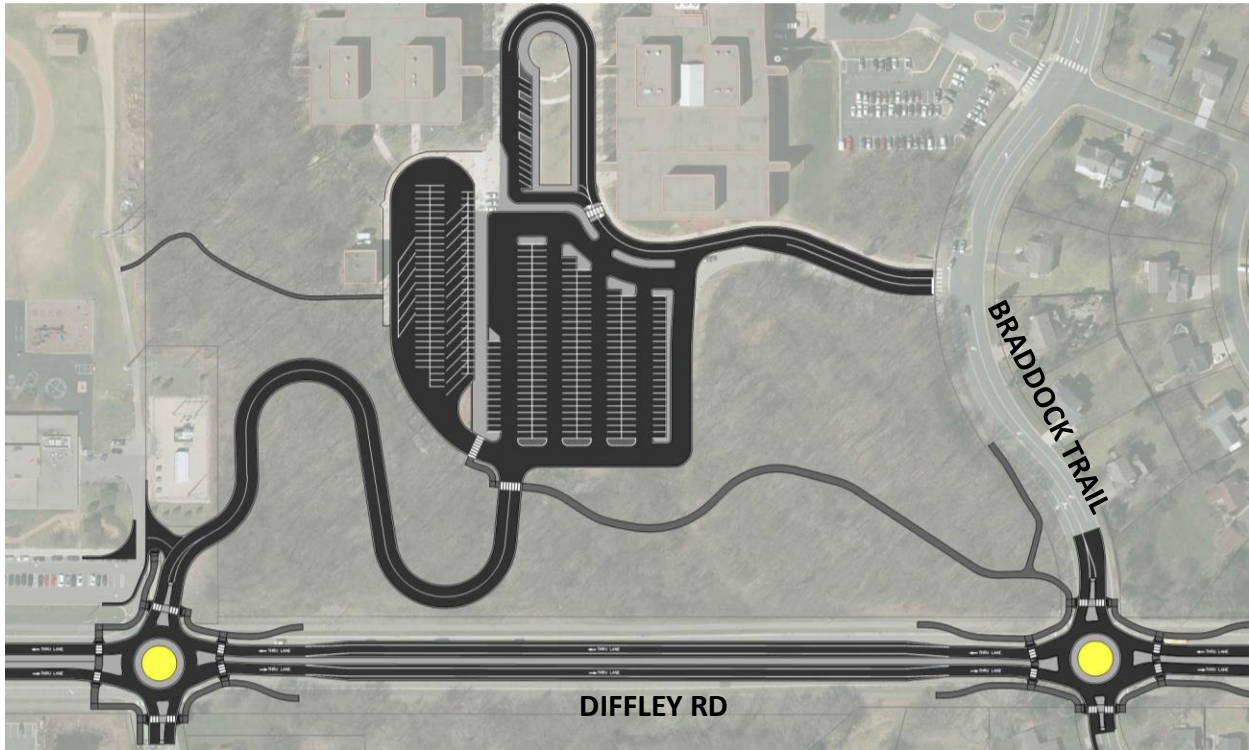
FIGURE 6: OPTION 1 GEOMETRICS



- Modify the South Parking Lot at the Middle/High School so that there is a dual lane parent drop off.
- Add a southbound right turn lane at the intersection of Braddock Trail and the South Parking Lot.
- Convert Diffley Road from a 4-lane divided roadway to a 2-lane divided roadway.
  - **Option 1A** keeps traffic control the same as existing and all intersections full access
  - **Option 1B** analyzes a roundabout at the intersection of Diffley Road and Braddock Trail
  - **Option 1C** analyzes the south leg of the Diffley Road and Braddock Trail intersection as a right-in/right-out
  - **Option 1D** analyzes the south leg of the Diffley Road and Braddock Trail intersection as a right-in/right-out and adds a pedestrian only phase
  - **Option 1E** analyzes the south leg of the Diffley Road and Braddock Trail intersection as a right-in/right-out, adds a pedestrian only phase, and adds a dual eastbound left turn lane

## Option 2

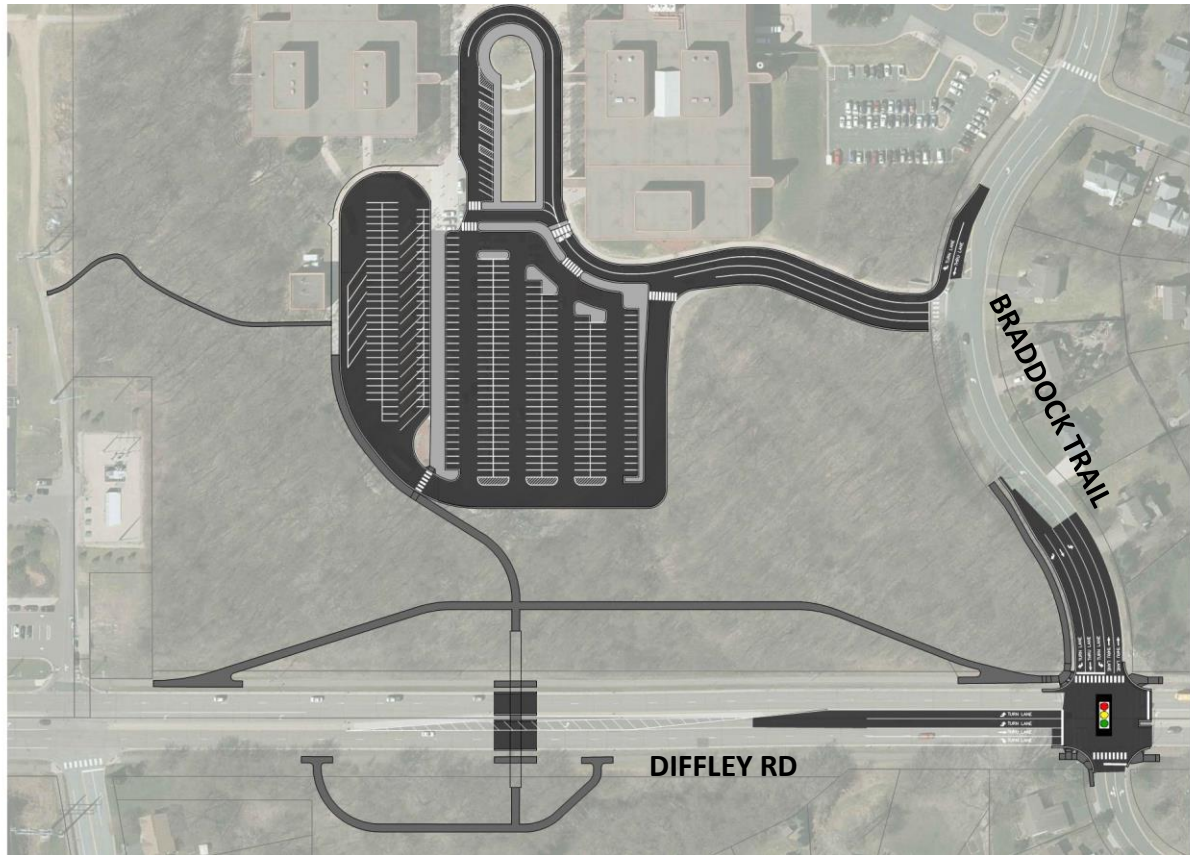
FIGURE 7: OPTION 2 GEOMETRICS



- Add roadway connecting the southern end of the South Parking Lot to the Daniel Drive and Diffley Road intersection. This gives traffic the option to enter/exit via the existing access off Braddock Trail or the new roadway connection.
- Modify the South Parking Lot at the Middle/High School so that there is a dual lane parent drop off. Make it so that traffic entering off Braddock Trail goes to one parent drop off location and traffic using the access from the new connecting roadway leads to a second parent drop off location.
- Convert Diffley Road from a 4 lane divided roadway to a 2 lane divided roadway.
  - **Option 2A** analyzes a signal at the Diffley Road and Daniel Drive intersection
  - **Option 2B** analyzes roundabouts at the intersections of Diffley Road and Braddock Trail and Diffley Road and Daniel Drive
  - **Option 2C** analyzes the south leg of the Diffley Road and Braddock Trail intersection as a right-in/right-out and a signalizes the Diffley Road and Daniel Drive intersection
  - **Option 2D** analyzes the south leg of the Diffley Road and Braddock Trail intersection as a right-in/right-out, adds a pedestrian only phase, and a signalizes the Diffley Road and Daniel Drive intersection

### Option 3

FIGURE 8: OPTION 3 GEOMETRICS



- Modify the South Parking Lot at the Middle/High School so that there is a dual lane parent drop off
- Add a southbound right turn lane at the intersection of Braddock Trail and the South Parking Lot
- Alter the southbound approach at the intersection of Diffley Road and Braddock Trail so that there is a left, through and right turn lane (no shared lanes)
- Diffley Road remains a 4-lane divided roadway
  - **Option 3A** keeps traffic control the same as existing and all intersections full access
  - **Option 3B** adds a dual eastbound left turn at the Diffley Road and Braddock Trail intersection
  - **Option 3C** adds a dual eastbound left turn and pedestrian phase at the Diffley Road and Braddock Trail intersection

### Previously Dismissed Alternatives

Earlier in the study there were two additional alternatives that were dismissed as they were unable to improve traffic operations. These include:

**Option 4:** Temporary closure (gate arm) of Braddock Trail north of Parent Drop-off/South Parking Lot during peak hour drop off times.

**Option 5:** Add roadway connection from southern end of the High School Parking lot to Daniel Drive

**Option 5A** - The new connecting roadway is one way. Traffic enters the parking lot/drop-off area via Braddock Trail and exits via the new roadway connection at Daniel Drive.

**Option 5B** - The existing entrance/exit to the parking lot/drop off area along Braddock Trail is closed. The new connecting roadway is the only way to enter/exit the parking lot/drop-off area.

### Operational Results of the Preliminary Traffic Analysis

The traffic operational analysis included an evaluation of intersection delay and Level of Service (LOS). LOS results are described using letters ranging from A to F. These letters serve to describe a range of operating conditions. Levels of Service are calculated based on the Highway Capacity Manual (6<sup>th</sup> Edition). **Table 1** below shows the travel conditions that correspond with each Level of Service.

TABLE 1. LEVEL OF SERVICE CRITERIA

Level of Service (LOS)	Travel Conditions for Vehicles
A/B	Under capacity, relatively free flowing, vehicles experience no or minimal delay
C/D/E	Approaching capacity, vehicles experience some delay
F	Over capacity, vehicles experience significant delay

From the traffic operational analysis completed, the issues with both Option 1 and 3 (no connecting roadway) are:

- Eastbound left movement at the Braddock Trail and the South Parking Lot intersection is anticipated to operate with LOS F
- The maximum northbound left queues at the Braddock Trail and the South Parking Lot intersection are anticipated to extend approximately 400 ft
- The maximum eastbound left queue at the Diffley Road and Braddock Trail intersection is anticipated to extend beyond the channelized turn lane unless a dual left turn lane is provided

In all of the Option 2 alternatives, none of these issues are present as having a second access to the South Parking Lot lessens the amount of traffic at Braddock Trail and the South Parking Lot and Diffley Road and Braddock Trail intersections.

The right-in/right-out analysis with Option 1C shows that delay is acceptable at the Diffley Road and Braddock Trail intersection. However, Option 1D shows that adding a pedestrian only phase would increase the delay of the eastbound left movement so it operates at LOS F, the southbound left movement would operate at LOS E,

and the westbound through movement would operate at LOS E. Option 1E shows that a right-in/right-out with a pedestrian phase would operate acceptably if a dual eastbound left turn lane was provided. The Option 2D analysis shows that a right-in/right-out would operate with LOS D or better for all movements with a pedestrian phase provided.

### ***Preliminary Traffic Analysis Summary***

The preliminary traffic analysis indicated that there were operational issues with the Option 1 and Option 3 concepts. Of the Option 2 concepts, Option 2B was determined to be the preferred concept as it addresses all key objectives. This concept was further analyzed in the detailed traffic analysis.

### **Detailed Traffic Analysis**

A more detailed traffic analysis of the intersections along Diffley Road was completed to ensure the preferred concept found in the preliminary traffic analysis was the best alternative for the study area. The “Detailed Traffic Analysis” memorandum was primarily completed in April of 2020 and finalized in August of 2020. The memorandum reviews the detailed operational results in addition to an analysis on the location of the lane drop, design speed along Diffley Road and pedestrian crossing treatments. A summary of the detailed traffic analysis is included below.

The operational analysis assumed the following:

- New access roadway is constructed between Daniel Drive and the South Parking lot to Eagan High School and Dakota Hills Middle School
- Single lane roundabout at Daniel Drive and the new access route and Diffley Road
- Reduced lane configuration along Diffley Road (one through lane each direction)
- Reduced access at Diffley Marketplace
- The signalized intersection at Lexington Ave was included for accurate traffic metering

Previously only the AM peak hour was analyzed, but the detailed traffic analyzed both the AM peak hour (6:45-7:45 AM) and PM peak hour (2:15-3:15 PM) to ensure the alternatives operate acceptably during both school peak hours. The existing and anticipated traffic distribution during both peak hours is shown in the **Appendix**.

The following options were analyzed at the intersection of Braddock Trail and Diffley Road:

- Roundabout
- Signalized Intersection
- Signalized Intersection with Right-In/Right-Out

### ***Roundabout Operational Analysis***

The roundabouts were analyzed using three different programs to ensure the results are accurate. These programs were Vissim, Arcady and HCS 7. The operational results at the intersections of Daniel Drive and Braddock Trail along Diffley Road are summarized below.

#### **Daniel Drive and Diffley Road**

- All three programs showing that a roundabout overall would operate with 15 seconds or less delay per vehicle during the morning peak hour and 10 second or less delay during the PM peak hour.



- The maximum queuing results were found to be worse in Vissim than Arcady or HCS 7.
  - Vissim:
    - 800 ft maximum queue along the eastbound approach
    - 650 ft maximum queue along the westbound approach
    - 125 ft maximum queue along the northbound approach
    - 300 ft maximum queue along the southbound approach
  - Arcady:
    - 225 ft maximum queue along the eastbound approach
    - 200 ft maximum queue along the westbound approach
    - 25 ft maximum queue along the northbound approach
    - 100 ft maximum queue along the southbound approach
  - HCS 7:
    - 150 ft maximum queue along the eastbound approach
    - 200 ft maximum queue along the westbound approach
    - 25 ft maximum queue along the northbound approach
    - 100 ft maximum queue along the southbound approach
- All three programs showed the average queues to be 75 ft or less along each approach during both peak hours which indicates that the excessive queues are not anticipated to last very long.

### **Braddock Trail and Diffley Road**

- All three programs showing that a roundabout overall would operate with 18 seconds or less delay per vehicle during the morning peak hour and 8 second or less delay during the PM peak hour.
- The maximum queuing results were found to be worse in Vissim than Arcady or HCS 7.
  - Vissim:
    - 300 ft maximum queue along the eastbound approach
    - 1125 ft maximum queue along the westbound approach
    - 125 ft maximum queue along the northbound approach
    - 250 ft maximum queue along the southbound approach
  - Arcady:
    - 50 ft maximum queue along the eastbound approach
    - 575 ft maximum queue along the westbound approach
    - 50 ft maximum queue along the northbound approach
    - 125 ft maximum queue along the southbound approach
  - HCS 7:
    - 75 ft maximum queue along the eastbound approach
    - 300 ft maximum queue along the westbound approach
    - 25 ft maximum queue along the northbound approach
    - 100 ft maximum queue along the southbound approach
- All three programs showed the average queues to be 125 ft or less along each approach during both peak hours

Additionally, an analysis was completed in Vissim to see the operational benefit of adding a westbound right turn lane to the roundabout at Braddock Trail. This movement would still yield to traffic in the roundabout and pedestrian crossing at the roundabout, but it would allow two westbound vehicles to enter the roundabout

when there is a gap in traffic verses one vehicle entering with the single lane approach. Only the AM peak hour was analyzed as the PM peak hour showed no issues with the single lane approach. The analysis indicates that delay and queueing would be significantly reduced with the added westbound right turn lane at the roundabout. However, the queuing with the single lane is only anticipated to be excessive for a couple minutes during the AM peak hour and adding a second lane along the westbound approach could make it harder for pedestrians to cross. Therefore, the single lane approach is recommended.

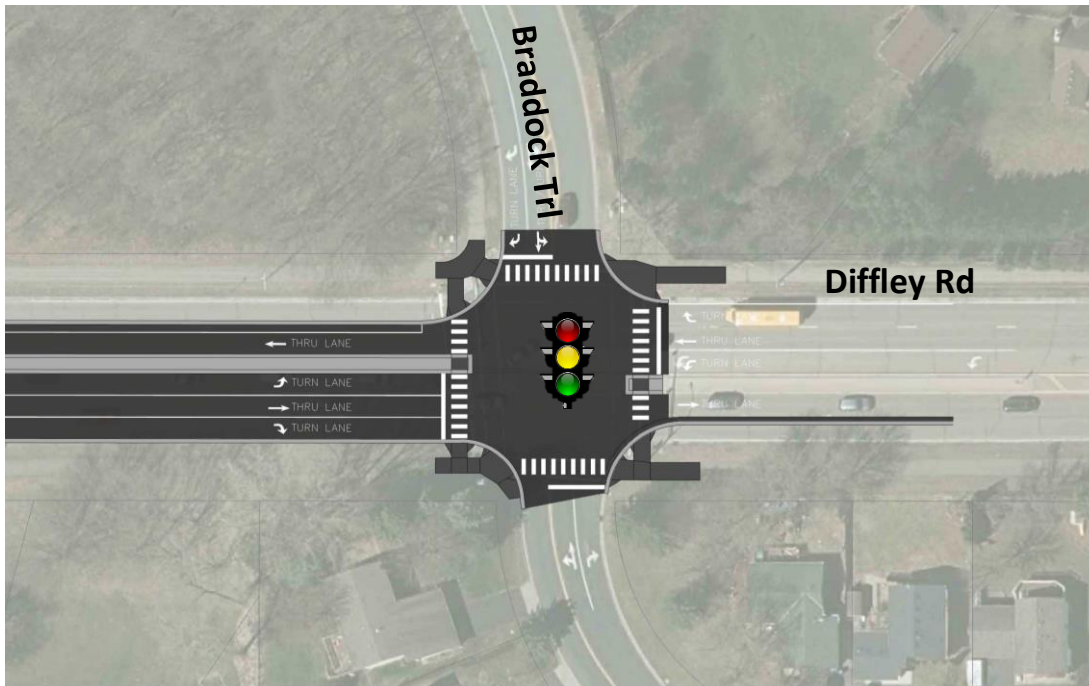
### Signal Operational Analysis

The signalized intersection at Braddock Trail and Diffley Road was analyzed in Vissim. Left and right turn lanes were provided along Diffley Road. Three options were analyzed along the Braddock Trail approaches, which are outlined below:

- Shared left/thru and channelized right turn lane (existing)
- Channelized left turn lane and shared thru/right turn lane (permitted left turn phasing)
- Channelized left turn lane and shared thru/right turn lane (protected left turn phasing)

Figure 9 show the intersection geometry with a signal at Braddock Trail and Diffley Road.

FIGURE 9. SIGNALIZED INTERSECTION



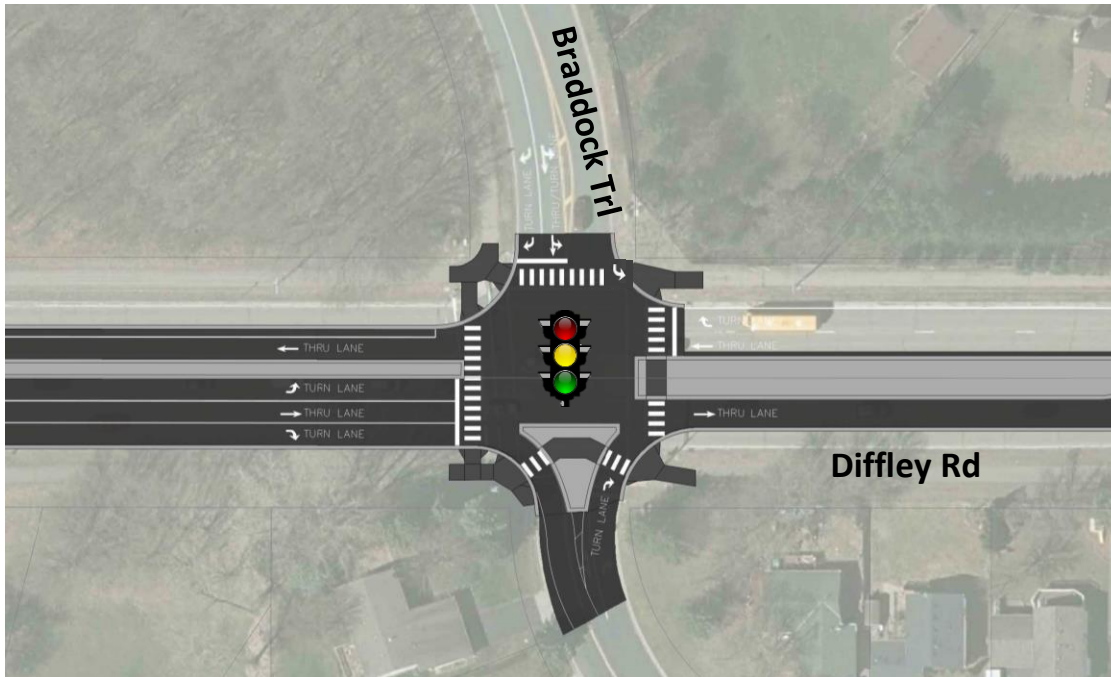
The operations were found to be acceptable for each signalized option with the intersection operating with 21 seconds of delay or less during the AM peak hour and 15 seconds of delay or less during the PM peak hour. While the overall delay is acceptable, the delay is higher than anticipated with a roundabout at this location. There was not a significant difference in operations between the signalized options analyzed, however the delay was found to be slightly higher with a protected left turn phase. Queues were acceptable with any of the lane configuration and signal phasing options analyzed.

Additionally, the intersections of Diffley Road with Daniel Drive and Braddock Trail were both analyzed as signals with a pedestrian only phase in Synchro SimTraffic. There is concern about the heavy southbound right turning movements at both intersections that conflicts with the pedestrian phase to cross Diffley Road. A pedestrian only phase would allow pedestrians to cross while all vehicular movements are restricted. A pedestrian only phase was found to cause excessive delay and queueing during the peak hours along Diffley Road. Traffic becomes nearly gridlocked during the AM peak hour with queues along eastbound Diffley Road extending 2425 ft from the Daniel Drive intersection (beyond the Lexington Ave intersection). Vehicles were found to wait on average over three minutes during the AM peak hour at the intersection of Braddock Trail and Diffley Road and over a minute and a half at the Daniel Drive and Diffley Road intersection. Queues along westbound Diffley Road extending 2700 ft (over half a mile) from the Braddock Trail intersection.

### **Signal with RI/RO and Pedestrian Only Phase Operational Analysis**

A signalized intersection with right-in/right-out and a pedestrian only phase was also analyzed in Vissim at Braddock Trail and Diffley Road. Left and right turn lanes were provided along Diffley Road. The northbound approach was converted to a right-in/right-out access which eliminates several movements at this intersection that were re-routed as described earlier in the report. This option assumed u-turns were accommodated 450 ft east of the intersection. **Figure 10** show the intersection geometry at Braddock Trail and Diffley Road.

*FIGURE 10. SIGNALIZED INTERSECTION WITH RIGHT-IN/RIGHT-OUT AND PEDESTRIAN ONLY PHASE*



The signalized intersection with right-in/right-out and pedestrian only phase was found to operate with 26 seconds of delay per vehicle during both peak hours which is higher than the roundabout and other signalized intersection options. The queue lengths were found to be acceptable, but the maximum westbound queue is anticipated to extend beyond the location of the u-turn.

## *Lane Drop Analysis*

Four lane drop options were analyzed to determine the optimal location of the lane reduction along eastbound Diffley Road.

Option 1: Lane drop east of Lexington Ave with 45 MPH design speed

- With this option the existing geometry of the right turn lane into Diffley Market is maintained, but due to the limited space between the end of the right turn lane taper and the intersection of Lexington Ave only 30 ft of the dual thru lane is possible after the intersection.

Option 2: Lane drop east of Lexington Ave with 35 MPH design speed

- With this option a 35 MPH design speed was assumed. With a lower design speed, the right turn length only needs to be 180 ft to meet the recommended deceleration length and the lane drop taper was drawn at a 10:1 rate instead of 15:1. These changes along with a faster lane drop taper length allows the dual through lane to be 310 ft.

Option 3: Lane drop west of Lexington Ave with 45 MPH design speed

- This option drops the second eastbound through lane prior to the Lexington Ave intersection. Due to the close proximity of Lexington Ridge to Lexington Ave the lane drop needs to be west of Lexington Ridge.

Option 4: Lane drop east of Lexington Ave with 35 MPH design speed and shared through-right turn lane at Diffley Market

- This is similar to Option 3, but no dedicated right turn lane was provided at the Diffley Market access. Instead a shared thru-right turn lane was analyzed. Without a turn lane the dual through lane length can be extended from 310 ft to 500 ft giving vehicles more time to merge.

## *Lane Drop Operations*

Each of the lane drop options were modeled to see the impact on operations for eastbound vehicles except Option 1. This alternative was not modeled as a 30 ft dual through lane does not encourage vehicles to utilize the second through lane at the Lexington Ave intersection. The existing operations are shown below in addition to the lane drop options analyzed. Please refer to **Table 1** on Page 12 for the defined operations with different Levels of Service.

**Existing:** The eastbound through movement operates with LOS C during both peak hours (23-26 seconds of delay on average).

**Option 2:** The eastbound through movement operates with LOS C during both peak hours (23-32 seconds of delay on average). Due to the short distance (310 ft) only 16-20% of the vehicles making the EBT movement will use the outside through lane. That leaves 87-90% of EBT vehicles using the inside lane.

**Option 3:** The eastbound through movement operates with LOS C during both peak hours (27-30 seconds of delay on average).

**Option 4:** The eastbound through movement operates with LOS C during both peak hours (23-28 seconds of delay on average). The increased dual through lane length slightly improves the lane distribution with 18-21% of the vehicles making the EBT movement using the outside through lane. That leaves 78-83% of EBT vehicles using the inside lane. The shared eastbound thru-right turn lane at Diffley Market operates well with only 1-3 seconds of delay on average during both peak hours. The maximum queue is only two vehicles. The minimal queuing and delay indicate that a shared thru-right turn lane would keep operations along Diffley Road acceptable.

The operational analysis indicates that all options would provide similar operations to the existing conditions at the Diffley Road and Lexington Ave intersection. Although Option 4 operates acceptably, the lane distribution is only slightly better than Option 2. Additionally, this option would eliminate the eastbound right turn lane into the Diffley Marketplace. Eastbound right turning traffic only accounts for 6% of the eastbound traffic during the AM peak hour, however eastbound rights account for 19% of the traffic during the school PM peak hour and 23% of the traffic during the PM peak hour. The high amount of right turning traffic could lead to a crash issue so this option is not recommended. Option 3 would construct a lane drop east of Lexington Ave, however, due to the vertical curve along Diffley Road, a lane drop in this location would not be ideal. Therefore, although the approaches are unbalanced along eastbound Diffley Road, Option 2 is recommended. This option keeps operations acceptable and allows for a right turn lane at the Diffley Marketplace.

### ***Design Speed***

The current speed limit along Diffley Road is 45 MPH. The design speed is recommended to be 35 MPH between Lexington Ave and Braddock Trail. This is recommended for the following reasons:

- Along eastbound Diffley Road the driving environment changes considerably as you reach the top of the hill and encounter the Lexington Ave signalized intersection. Drivers encounter more closely spaced intersections along with recreational and commercial land uses. As drivers move through the Lexington intersection, the lane drop further emphasizes the changed environment and drivers encounter the school zone. Lastly, the roundabouts at Daniel Drive and Braddock Trail solidify the lower operational speeds.
- Along westbound, the corridor is a 3-lane with residential backing up to corridor. Drivers first encounter a 4-way stop at Dodd Road and travel another  $\frac{3}{4}$  mile before encountering the Braddock Trail roundabout. The roundabouts at Braddock Trail and Daniel Drive, with  $\frac{1}{4}$  mile spacing, solidify the lower operational speeds.

### ***Pedestrian Crossing Considerations***

#### ***Signal vs Roundabout***

The pedestrian crossings of Diffley Road with a signal and a roundabout were analyzed to see which provides a safer crossing facility. The following measures were compared for the two traffic controls.

- New user comfort level
- Ability to address heavy southbound right turn conflict
- Pedestrian-vehicle conflict points
- Crossing distance/number of lanes
- Pedestrian crash data
- Vehicle speed

- Driver eyesight
- Driver yield rate

The matrix in the **Appendix** summarizes the analysis of each measure. This shows that new user comfort level and driver yield rates are the only measures that are better for a signal than a roundabout. All of the other measures show that a roundabout would provide a safety facility for pedestrians to cross at by increasing pedestrian visibility, reducing conflict points, reducing crossing distance and number of lanes, reducing speed, and reducing pedestrian injury crashes.

*Pedestrian Demand*

The current combined pedestrian and bicycle counts at the Diffley Marketplace, Daniel Drive, and Braddock Trail intersections from a count in September of 2019 are listed below. **Table 2** shows the number of pedestrians crossing each leg of the intersection along Diffley Road during the AM peak hour, PM peak hour and overall day. 2018 counts at the Braddock Trail intersection were completed for a previous project and are included in **Table 2** as well. This shows that most pedestrians are crossing Diffley Road along the west leg of the Braddock Trail intersection.

*TABLE 2. PEDESTRIANS CROSSING THE DIFFLEY ROAD INTERSECTIONS – AM (PM) [DAILY]*

<b>Intersection</b>	<b>East Leg</b>	<b>West Leg</b>	<b>North Leg</b>	<b>South Leg</b>
Diffley Market	0 (0) [1]	0 (2) [3]	1 (1) [20]	2 (17) [39]
Daniel Dr	0 (3) [4]	0 (1) [2]	0 (1) [11]	0 (4) [44]
Braddock Trl (2019)	0 (0) [3]	16 (21) [60]	2 (1) [4]	0 (1) [15]
Braddock Trl (2018)	0 (0) [5]	12 (23) [46]	1 (0) [10]	0 (0) [21]

The Bus Travel Time figure (Figure 5) shown on Page 7 indicates the number of students that live in each area south of Diffley Road and how long their estimated walk time is to and from the schools compared to the current bus travel times. Safe Routes to School (SRTS) states that infrastructure improvements combined with education and encouragement programs are likely to see increases of up to 43% in walking or biking over a five-year period. The existing pedestrian counts indicate that currently 15% of students within a walkable area south of Diffley Road walk or bike to school in the morning peak hour and 22% during the afternoon peak hour. Based on the SRTS findings, with education and encouragement programs in addition to infrastructure improvements, we assume a total of 40-50% of students that live in the walkable area south of Diffley Road would walk to school in the morning and 60-70% of students in the afternoon. **Table 3** on the next page shows anticipated number of students crossing Diffley Road with the improvements, education, and encouragement programs. These were estimated based on where students are shown to live.

*TABLE 3. ANTICIPATED DEMAND OF PEDESTRIANS CROSSING DIFFLEY ROAD*

<b>Peak Hour</b>	<b>Between Lexington Ave and Daniel Dr</b>	<b>Braddock Trl</b>
AM Peak (40-50%)	35-45	45-55
School PM Peak (60-70%)	55-65	70-80

### Pedestrian Level of Service

Pedestrian LOS was calculated at the Diffley Road crossings at Daniel Drive and Braddock Trail according to the methodology presented in the 6<sup>th</sup> edition of the Highway Capacity Manual (HCM). The anticipated demand listed in **Table 3** was assumed for the calculations. The HCM defines the LOS levels as shown in **Table 4**.

TABLE 4. PEDESTRIAN LEVEL OF SERVICE CRITERIA

LOS	Control Delay (sec/ped)	Comments
A	0-5	Usually no conflicting traffic
B	5-10	Occasionally some delay due to conflicting traffic
C	10-20	Delay noticeable to pedestrians, but not inconveniencing
D	20-30	Delay noticeable/irritating, increased chance of risk-taking
E	30-45	Delay approaches tolerance level, risk-taking likely
F	>45	Delay exceeds tolerance level, high chance of risk-taking

### Diffley Marketplace Pedestrian Crossing

An enhanced crossing on the west side of the driveway into Diffley Marketplace with the removal of the existing eastbound left turn was established in the study phase. A review of treatment options was started during this phase of the study but are primarily occurring in the design stage. Detailed evaluation work and discussions regarding the options considered will be included in the design memo.

### Sensitivity Analysis of Pedestrian Crossings at Roundabouts

With roundabouts proposed at the Daniel Drive and Braddock Trail intersections with Diffley Road an analysis was completed to see the anticipated pedestrian LOS and average delay with various yield rates. The National Cooperative Highway Research Program (NCHRP) Report 572 indicates that the expected yield rate of vehicles at a single lane roundabout is 83%. A sensitivity analysis was completed to see how the average delay would increase if the yield rate is not as high as expected. **Table 5** shows the pedestrian LOS and delay at various driver yield rates.

TABLE 5. PEDESTRIAN LOS AND DELAY AT DANIEL DRIVE

Yield Rate	Peak Hour	Location	Delay (seconds)	LOS
83%	AM	West Side	5	A
		East Side	6	B
	School PM	West Side	5	B
		East Side	6	B
60%	AM	West Side	7	B
		East Side	7	B
	School PM	West Side	7	B
		East Side	7	B
40%	AM	West Side	12	C
		East Side	9	B
	School PM	West Side	10	B
		East Side	8	B
20%	AM	West Side	19	C
		East Side	10	C
	School PM	West Side	13	C
		East Side	9	B
7%	AM	West Side	26	D
		East Side	11	C
	School PM	West Side	15	C
		East Side	9	B

Table 5 shows that unless the yield rate is 7% or less the delay to pedestrians is not inconveniencing. This indicates that the Daniel Drive roundabout will provide acceptable crossings for pedestrians.

The number of pedestrians crossing at the Daniel Dr roundabout was not seen to impact pedestrian delay (even with a 7% yield rate) since the crossing distance is shorter (only 15 ft per stage) even if all 218 students were to cross Diffley Dr at one of the Daniel Dr crossings.

Braddock Trail Pedestrian LOS with Roundabout

The pedestrian LOS/delay was also calculated at the Braddock Trail crossings of Diffley Road and is shown in Table 6.



TABLE 6. PEDESTRIAN LOS AND DELAY AT BRADDOCK TRAIL

Yield Rate	Peak Hour	Location	Delay	LOS
83%	AM	West Side	6	B
		East Side	5	A
	School PM	West Side	6	B
		East Side	6	B
60%	AM	West Side	7	B
		East Side	7	B
	School PM	West Side	7	B
		East Side	6	B
40%	AM	West Side	9	B
		East Side	8	B
	School PM	West Side	8	B
		East Side	6	B
20%	AM	West Side	11	C
		East Side	11	C
	School PM	West Side	9	B
		East Side	7	B
7%	AM	West Side	11	C
		East Side	13	C
	School PM	West Side	9	B
		East Side	7	B

**Table 6** shows that even with a yield rate of 7% or less the delay to pedestrians is not inconveniencing. This indicates that the Braddock Trail roundabout will provide acceptable crossings for pedestrians.

The number of pedestrians crossing at the Braddock Trail roundabout was not seen to impact pedestrian delay (even with a 7% yield rate) since the crossing distance is lower (only 15 ft per stage) even with all 218 students crossing Diffley Drive at one of the Braddock Trail crossings.

The sensitivity analysis indicates that the Diffley Road crossing at the Daniel Drive and Braddock Trail roundabouts are expected to operate with minimal delay even if the motorist yield rate is not as high as anticipated with a roundabout.

### **Detailed Traffic Analysis Summary**

The detailed traffic analysis reviewed the operational results in addition to an analysis on the location of the lane drop, design speed along Diffley Road and pedestrian crossing delay. The analysis indicated that roundabouts would provide a safer crossing for pedestrians while also operating with less vehicle delay than a signalized intersection. The lane drop analysis indicated that the preferred location is east of Lexington Ave with a 35 MPH design speed. Additionally, the pedestrian delay analysis at the two roundabouts indicated that the roundabout design would result in minimal delay even if motorist yield rates are not as high as expected.

## Comparison of Proposed Concept to Existing Conditions

This section provides an overview of the traffic inputs, modeling, and analysis that was completed to understand the difference in traffic and pedestrian operations between existing conditions and the proposed concept. Potential improvements were analyzed to ensure the design can effectively reduce traffic congestion, improve circulation, and better accommodate pedestrians crossing Diffley Road. The existing conditions are compared to the proposed operations in this document to illustrate the anticipated mobility improvements with the proposed concept.

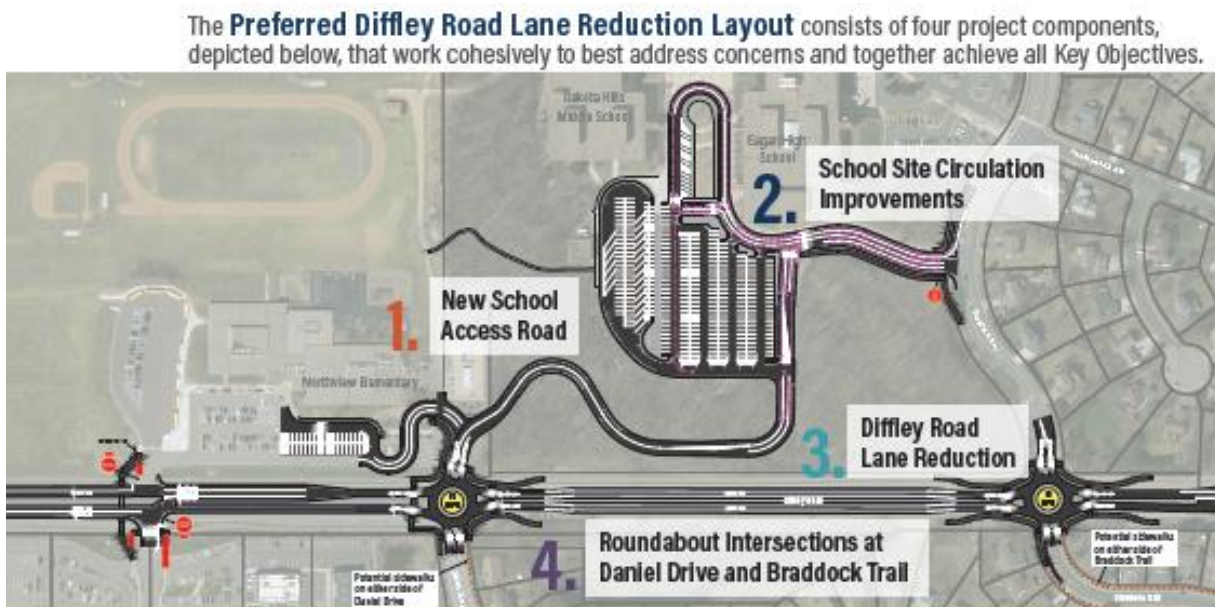
### Proposed Concept Overview

Through a comprehensive analysis of the transportation system surrounding the school sites and evaluation of key project objectives, the project team including Dakota County, City of Egan, and ISD 196 staff reached a proposed concept. The proposed concept includes:

- Reduced through lanes along Diffley Road (Existing roadway has two lanes each direction, proposed concept has one)
- Reduced turning conflicts at Northview Elementary School & Diffley Market Place intersection
- Adds a single lane roundabout at both Daniel Drive and Braddock Trail intersections along Diffley Road
- Creates a new access route to Dakota Hills Middle School and Egan High School south parking lot
- Increased number of entrance lanes into the south lot and increase parent drop-off storage areas within school parking lots

A layout illustrating these improvements is shown in **Figure 11**.

FIGURE 11: DIFFLEY ROAD PREFERRED LAYOUT



### Pedestrian Crossing Assessment

Diffley Road from Lexington Ave to Braddock Trail currently has two lanes in each direction in addition to turn lanes at intersections. The current conditions make crossing Diffley Road challenging with pedestrians needing

to cross a longer distance and multiple lanes of traffic coming from each direction at once. **Figures 12 and 14** below show the existing pedestrian crossings of Diffley Road at the Daniel Drive and Braddock Trail intersections. This shows how pedestrians currently need to cross a length between 90 and 100 ft and 5-6 lanes of traffic to get across Diffley Road. **Figures 13 and 15** show how with roundabouts, pedestrians only need to cross one lane of traffic at a time with a pedestrian refuge area provided between each direction of traffic and the length of each crossing is only 16 ft.

FIGURE 12. EXISTING PEDESTRIAN CROSSING AT DANIEL DR



FIGURE 13. PROPOSED PEDESTRIAN CROSSING AT DANIEL DR

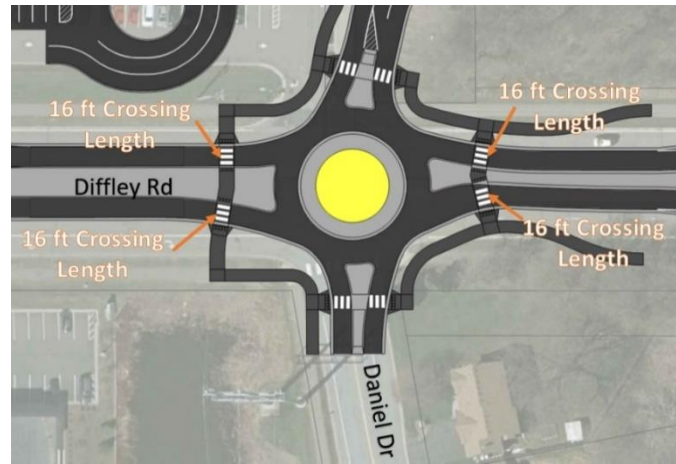


FIGURE 14. EXISTING PEDESTRIAN CROSSING AT BRADDOCK TRL

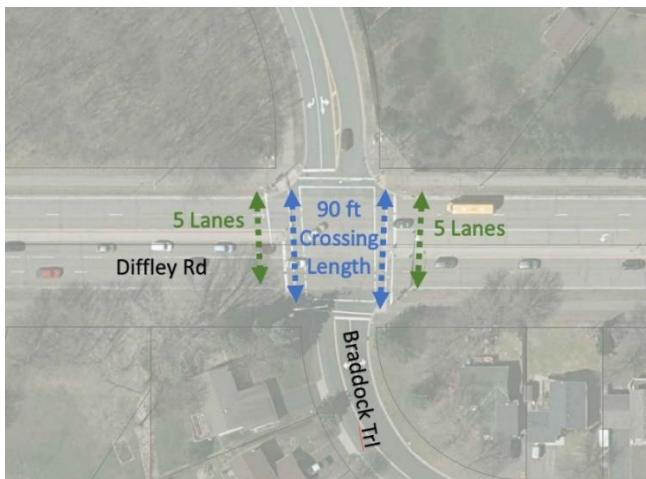
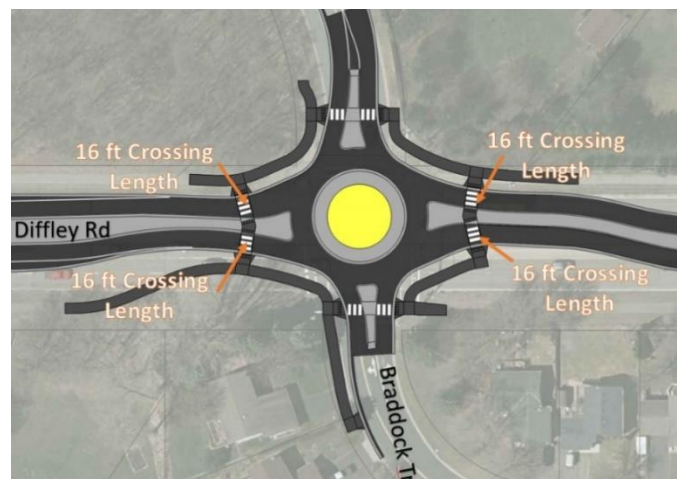


FIGURE 15. PROPOSED PEDESTRIAN CROSSING AT BRADDOCK TRL



Additionally, pedestrians are anticipated to wait a shorter amount of time before finding a gap in traffic with the proposed concept than with the existing conditions. **Table 8** below shows how pedestrians today may wait on average for more than 3 minutes\* to find a gap in traffic and cross both directions of Diffley Road at Daniel Drive during the morning peak hour. The existing wait time at Daniel Drive is long as pedestrians need to find an appropriate gap in both directions of traffic to cross all five or six lanes of traffic at once. With the proposed concept, pedestrians cross Diffley Road in two stages waiting to cross one direction/one lane of traffic at a time. Pedestrians are only anticipated to wait on average for 21 seconds to cross Diffley Road. This is the total wait time to cross Diffley Road entirely (not per stage). At the Braddock Trail and Diffley Road intersection, pedestrians currently need to wait on average for one minute at the existing signal to cross Diffley Road. With the proposed concept pedestrians are only anticipated to wait on average 9 seconds before being able to cross.

TABLE 8. CALCULATED AVERAGE WAIT TIME DURING MORNING PEAK HOUR TO CROSS DIFFLEY ROAD

<b>Crossing Diffley Road at Daniel Drive</b>	
Existing Conditions (Side Street Stop)	>3* minutes
Proposed Concept (Roundabout)	21 seconds
<b>Crossing Diffley Road at Braddock Trail</b>	
Existing Conditions (Signal)	60 seconds
Proposed Concept (Roundabout)	9 seconds

\*Based on typical capacity analysis assuming a pedestrian walking speed of 3.5 feet/second and a 30 second gap in traffic.

### Traffic Queuing Analysis

Vehicle queues with the proposed concept were compared to the existing conditions during the peak hour of a typical school day. The peak hour occurs in the morning between 6:45 AM and 7:45 AM before school starts. Currently, the Braddock Trail and Diffley Road intersection experiences excessive delay and queuing during the peak hour. **Figure 16** shows the existing queuing and **Figure 17** shows queuing with the proposed concept. The orange lines show the average queue length and the blue lines show the maximum queue length throughout the peak hour.

FIGURE 16. EXISTING TRAFFIC QUEUING

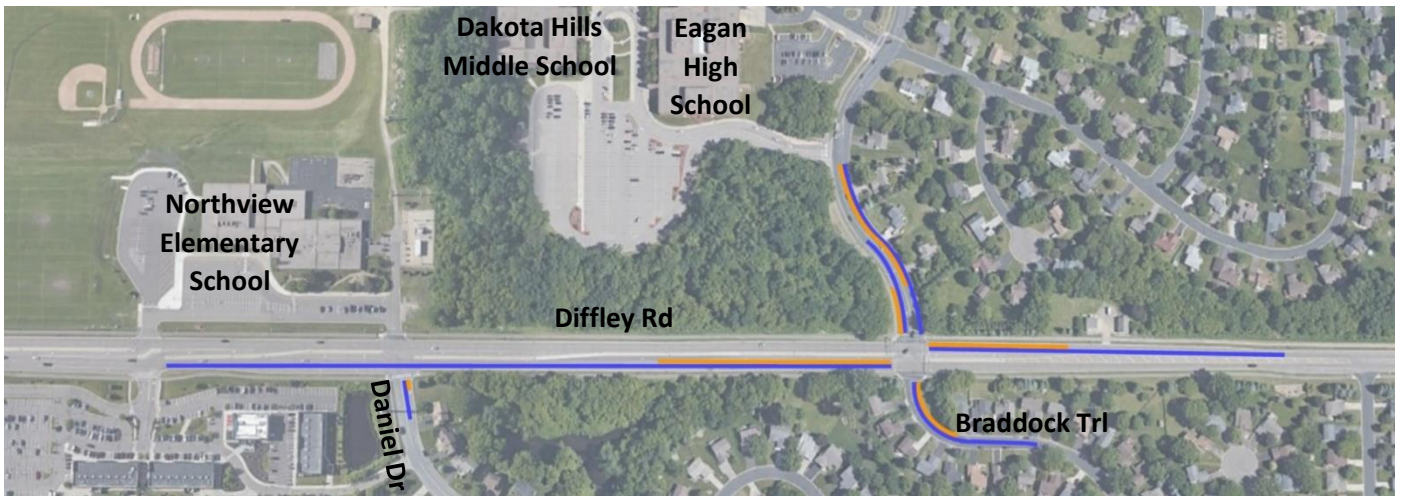
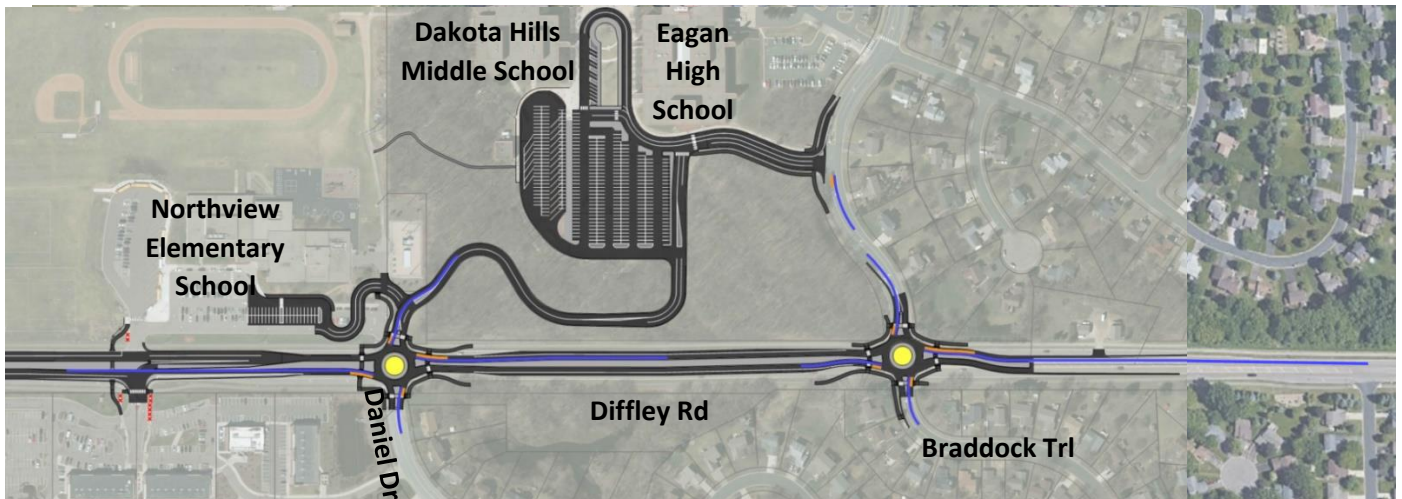


FIGURE 17. PROPOSED CONCEPT TRAFFIC QUEUING



**Figure 17** shows that on occasion vehicle queuing may become excessive with the proposed concept, however these excessive queues are only anticipated to last for a few minutes during the peak hour. The average queues with the proposed concept show that typically only a few cars will be queued up along each roundabout approach.

In addition, average vehicle delay will be lower with the proposed concept. Under the existing conditions a vehicle at the Braddock Trail and Diffley Road intersection is waiting on average for nearly 120 seconds (2 minutes). At the intersection of Daniel Drive and Diffley Road vehicles on average are waiting for 20 seconds. The proposed concept shows a decrease in delay with vehicles only anticipated to wait on average 12 seconds at each roundabout.

A video which shows pedestrians crossing Diffley Rd during the peak 15 minutes of the morning rush hour is linked [here](#). A video which shows how the corridor will operate during the peak 15 minutes of the morning rush hour with the proposed concept is linked [here](#). Both videos show how the traffic signal at the Diffley Rd and Lexington Ave intersection will help meter traffic, creating gaps to help pedestrians cross Diffley Rd and relieve vehicle queuing. Minnesota state law requires that motorists must stop for pedestrians within a marked crosswalk or at an intersection with no marked crosswalk. In addition to that requirement, the proposed new school access road at Daniel Drive and improved school site circulation will result in better distributed traffic and drastically reduced congestion and backups. Traffic modeling of roundabouts with a new school access shows that a change in traffic patterns will provide for safe and convenient pedestrian travel.

## Key Objectives Screening

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Based on the above technical analyses and input from the project team, elected officials, and the public, the concepts were evaluated comparing how each meet or do not meet the key objectives. The key objectives screening dismissed concepts that did not lower vehicle speeds, reduce pedestrian and vehicle conflict points, or reduce congestion and improve circulation. The evaluation of each improvement concept and components is depicted in **Table 7**.

TABLE 7: KEY OBJECTIVES ALTERNATIVES SCREENING











Concepts	Comparison to Key Objectives	Reason Dismissed
Diffley Road Lane Reduction with Roundabout Intersections	<i>Concept meets all key objectives.</i>	N/A – Preferred Concept
Diffley Road Lane Reduction with Signalized Intersections	<p><u>Concept does not meet the following key objectives:</u></p> <ul style="list-style-type: none"> <li>• Lower Vehicle Speeds</li> <li>• Reduce Pedestrian &amp; Vehicle Conflict Points</li> </ul> <p><u>Concept only partially meets the following key objectives:</u></p> <ul style="list-style-type: none"> <li>• Increase Pedestrian Safety &amp; Connections</li> <li>• Provide Safe Facilities</li> </ul>	<p>a) Long delays for pedestrians attempting to cross Diffley Road</p> <p>b) No decrease in pedestrian and vehicle conflict points</p> <p>c) No decrease in vehicle speeds</p>
Diffley Road Underpass	<p><u>Concept does not meet the following key objectives:</u></p> <ul style="list-style-type: none"> <li>• Lower Vehicle Speeds</li> <li>• Reduce Congestion &amp; Improve Circulation</li> </ul> <p><u>Concept only partially meets the following key objectives:</u></p> <ul style="list-style-type: none"> <li>• Increase Pedestrian Safety &amp; Connections</li> <li>• Reduce Pedestrian &amp; Vehicle Conflict Points</li> </ul>	<p>a) No decrease in vehicle speeds</p> <p>b) Does not reduce congestion or improve circulation</p>

### Improvement Concepts Evaluated





#### Key Objectives:

-  Increase Pedestrian Safety & Connections
-  Increase Awareness of the School Area
-  Provide Safe Facilities
-  Lower Vehicle Speeds
-  Reduce Pedestrian & Vehicle Conflict Points
-  Reduce Congestion & Improve Circulation

#### Diffley Road Lane Reduction/Road Diet

	Roundabout Intersections	Signalized Intersections
Increase Pedestrian Safety & Connections		
Increase Awareness of the School Area		
Provide Safe Facilities		
Lower Vehicle Speeds		
Reduce Pedestrian & Vehicle Conflict Points		
Reduce Congestion & Improve Circulation		

#### Diffley Road Underpass

Increase Pedestrian Safety & Connections	
Increase Awareness of the School Area	
Provide Safe Facilities	
Lower Vehicle Speeds	
Reduce Pedestrian & Vehicle Conflict Points	
Reduce Congestion & Improve Circulation	

\*Partially meets the Key Objective

## Conclusion

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The proposed concept provides the following benefits of which why it was selected as the preferred alternative:

- Dual lane entering both the South Parking Lot and both entrances to the East Parking Lot reduces queuing/delay along Braddock Trail
- Dual parent drop off at the both the East and South Parking Lot increases the drop-off capacity and site circulation
- The road diet along Diffley Road with roundabouts at the intersections of Diffley Road and Braddock Trail and Diffley Road and Daniel Drive addresses all key objectives as outlined below
  - Pedestrian safety and connections are improved
    - Pedestrians only cross one lane of traffic at a time at a roundabout
    - Median refuges allow pedestrians to cross only one direction at a time
    - Stop bars are pulled back at Diffley Market crossing to eliminate multi-lane threat with turn lanes
    - Slower vehicle speeds which gives drivers and pedestrians more time to react reducing the injury rate in a vehicle-pedestrian crash
  - Increase awareness of school area
    - Improve lighting
    - Slower vehicle speeds
  - Provide safe facilities
    - Slower vehicle speeds
    - Reduced risk of injury crashes
  - Lower vehicle speeds
    - 15-20 mph at roundabouts
  - Reduce conflict points
    - Vehicle- Pedestrian: 24 with signal vs 8 with roundabout
    - Vehicle-Vehicle: 32 with signal vs 8 with roundabout
  - Reduce congestion and improve circulation
    - Significant reduction in queuing and delay during peak hours
    - Adding the new access road and second parent drop-offs improve site circulation

# Diffley Road Improvements Project

## Appendix



# EXISTING ISSUES

Based on public comments and project team observations.



**PEDESTRIAN SAFETY**

**PEDESTRIAN/VEHICLE CONFLICT**

**FACILITY BARRIER**

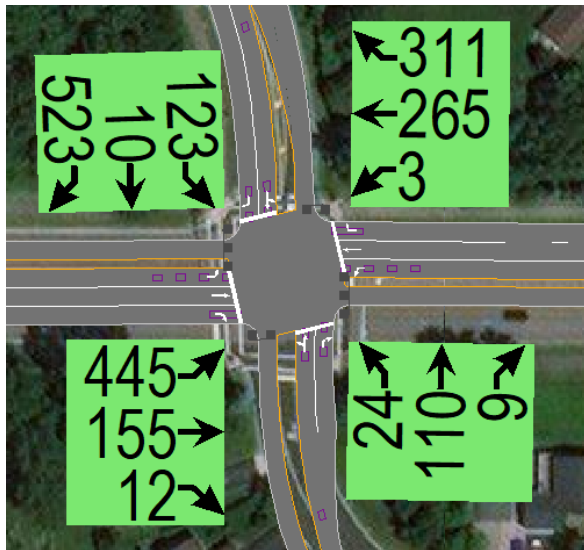
**SPEEDING**

**AREA CIRCULATION**

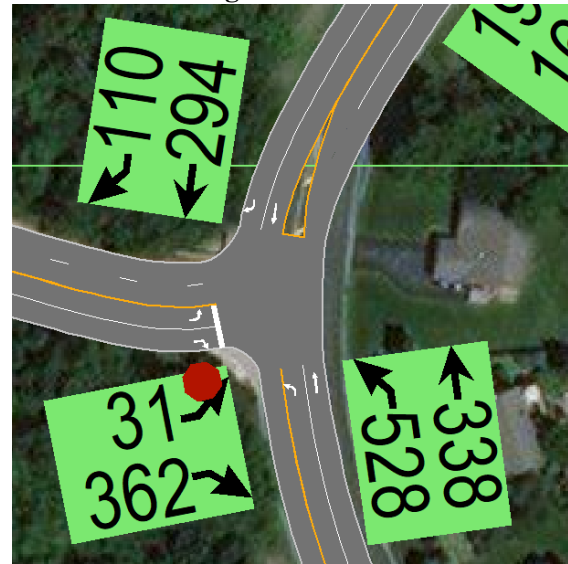
## Traffic Volumes – Options 1A/1B and Options 3A/3B/3C

The AM peak hour traffic volumes with Options 1A/1B and Options 3A/3B/3C are the same as existing. No traffic is re-routed. These volumes are shown below.

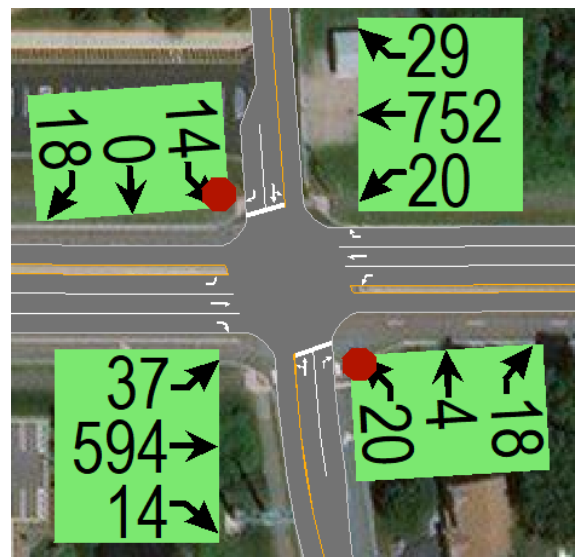
Diffley Road at Braddock Trail



South Parking Lot at Braddock Trail



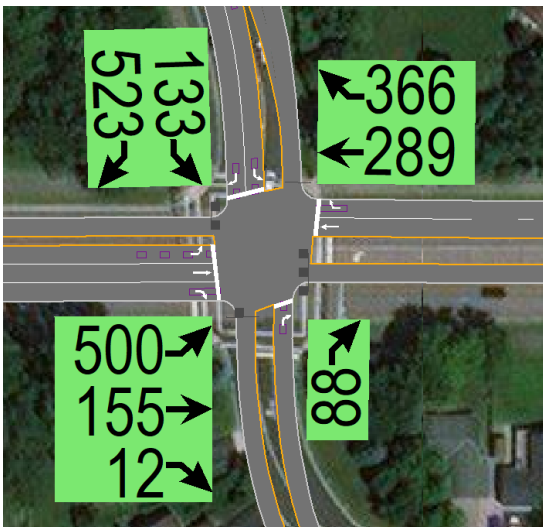
Diffley Road at Daniel Drive



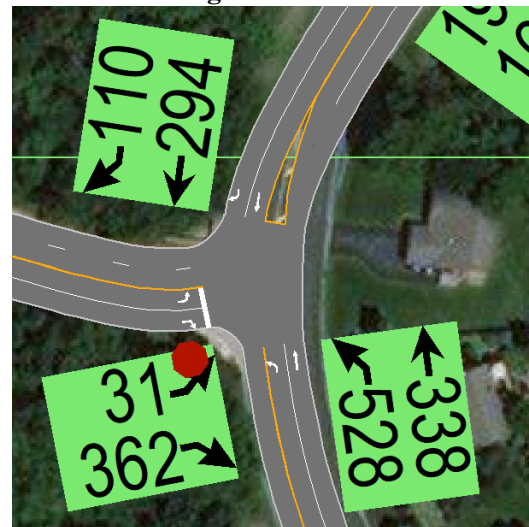
## Traffic Volumes – Options 1C/1D

The AM peak hour traffic volumes with Options 1C and 1D are shown below. The northbound left, northbound through, southbound through, and westbound left movements must be re-routed with the right-in/right-out (RI/RO) at the intersection of Diffley Rd/Braddock Trail. The westbound left turners were assumed to turn prior to the intersection at Trenton Rd. The southbound through traffic was assumed to make a southbound left turn at the intersection and then turn right at Trenton Rd. The northbound left traffic was assumed to turn right at the intersection and then make a U-turn east of the intersection. Half of northbound through traffic was assumed to turn right at the intersection, make a U-turn east of the intersection and the turn right at the intersection to get to northbound Braddock Trail. The other half was assumed to divert to Daniel Dr making a northbound right turn at Daniel Dr and an eastbound left at Diffley Rd/Braddock Trail.

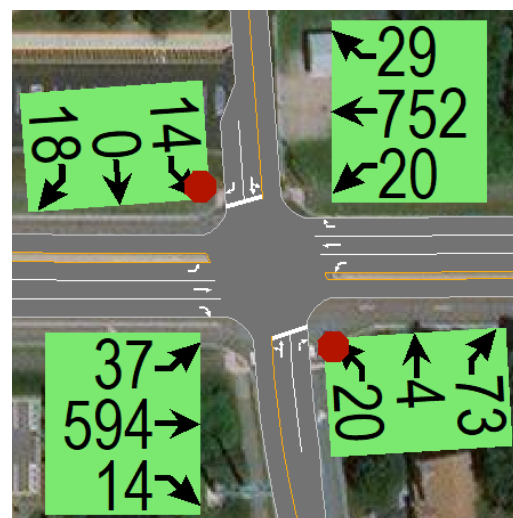
**Diffley Road at Braddock Trail**



**South Parking Lot at Braddock Trail**

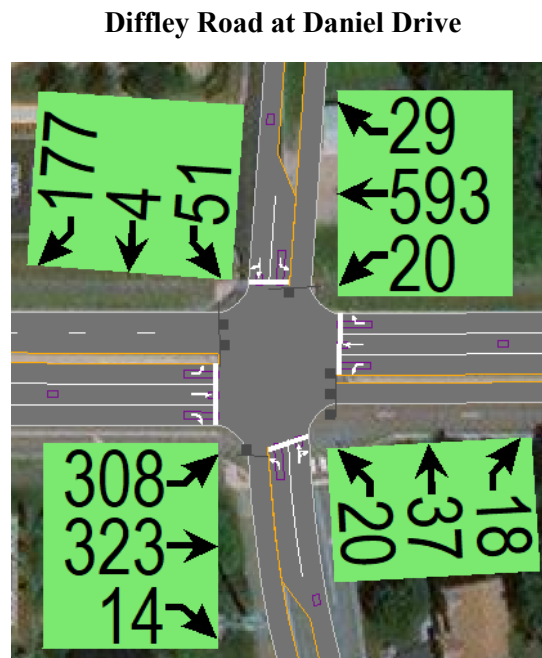
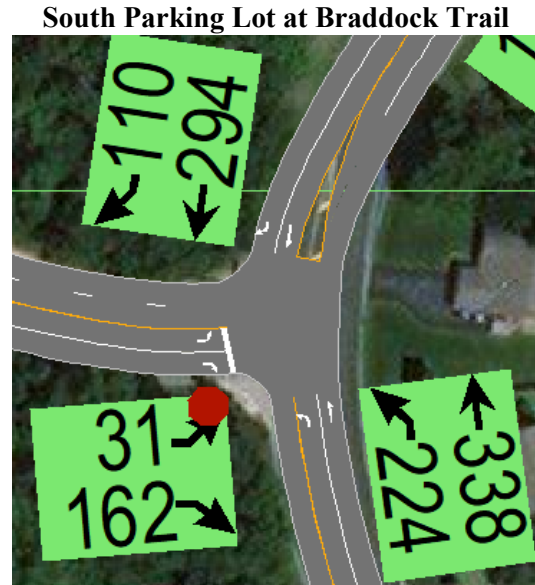
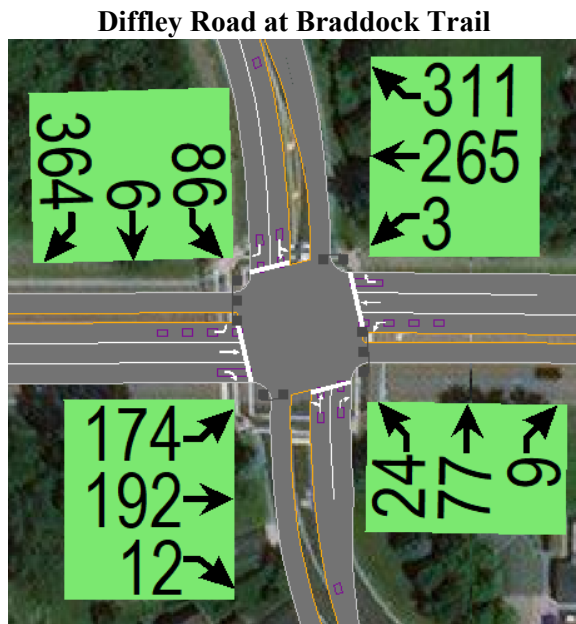


**Diffley Road at Daniel Drive**



## Traffic Volumes – Options 2A/2B

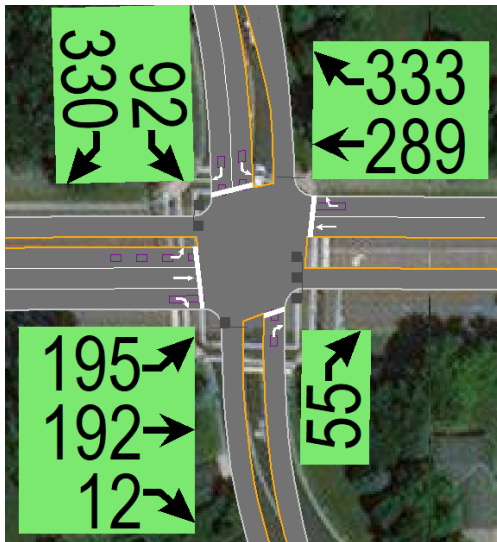
The AM peak hour traffic volumes with Options 2A and 2B are shown below. Traffic was re-routed with these options assuming traffic destined for the South Parking Lot that come from the west along Diffley Rd use the new connecting road. The northbound through traffic at the Diffley Rd/Braddock Trail intersection destined for the South Parking Lot was assumed to divert to the new roadway connection making a northbound through at Daniel Dr. Traffic coming from the north on Braddock Trail and from the east on Diffley Rd were assumed to continue accessing the South Parking Lot via Braddock Trail. Whichever access traffic enters the South Parking Lot from is the access they must exit so volumes were also changed for the traffic exiting.



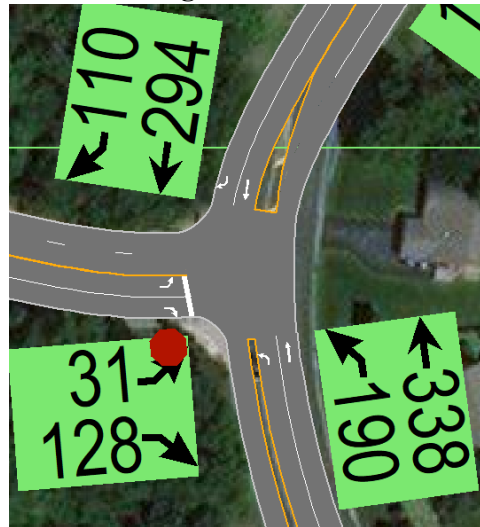
## Traffic Volumes – Options 2C/2D

With Options 2C and 2D, the same volume is re-routed as assumed in 2A and 2B in addition to traffic re-routed with the right-in/right-out (RI/RO) at the intersection of Diffley Rd/Braddock Trail. Northbound left, northbound through, southbound through and westbound left traffic need to be re-routed with a RI/RO. The westbound left turners were assumed to turn before the intersection at Trenton Rd. The southbound through traffic was assumed to make a southbound left turn at the intersection and then turn right at Trenton Rd. The northbound left traffic was assumed to turn right at the intersection and then make a U-turn east of the intersection. The northbound through traffic destined for the South Parking Lot was assumed to divert to the new roadway connection making a northbound through at Daniel Dr. Half of northbound through traffic that was not destined for the South Parking Lot was assumed to turn right at the intersection, make a U-turn east of the intersection and then turn right at the intersection to get to northbound Braddock Trail. The other half was assumed to divert to Daniel Dr making a northbound right turn at Daniel Dr and an eastbound left at Diffley Rd/Braddock Trail. These volumes are shown below.

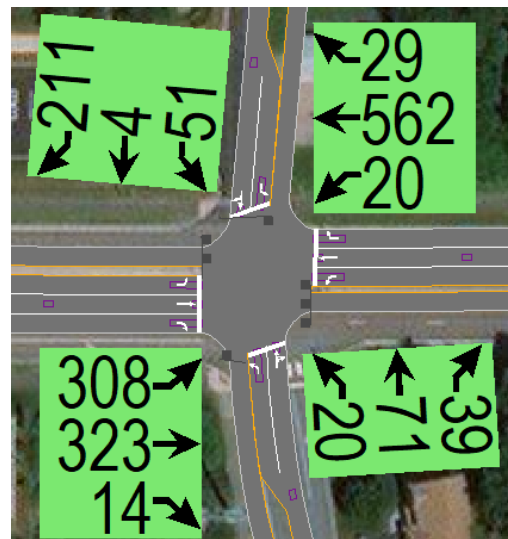
**Diffley Road at Braddock Trail**



**South Parking Lot at Braddock Trail**

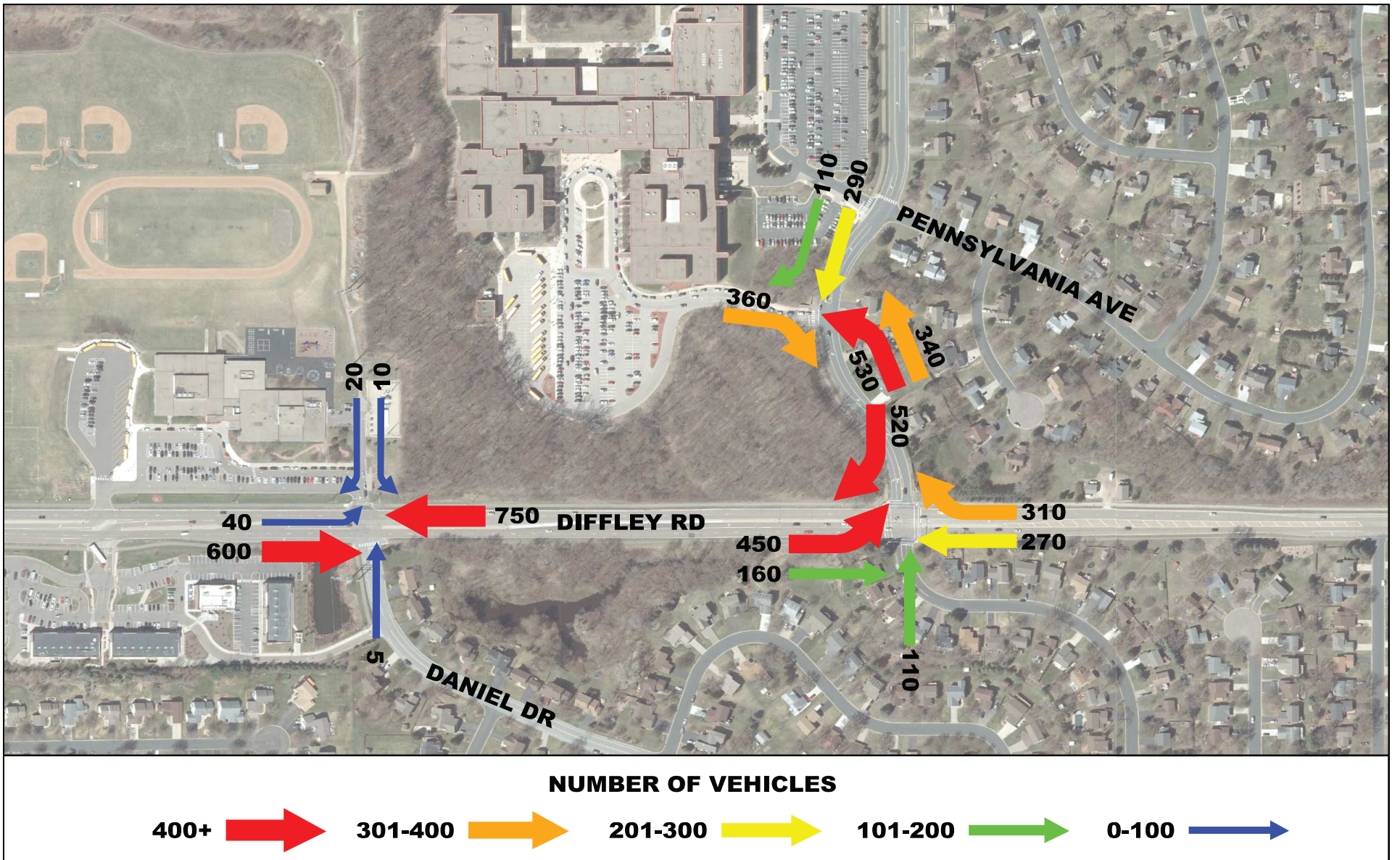


**Diffley Road at Daniel Drive**

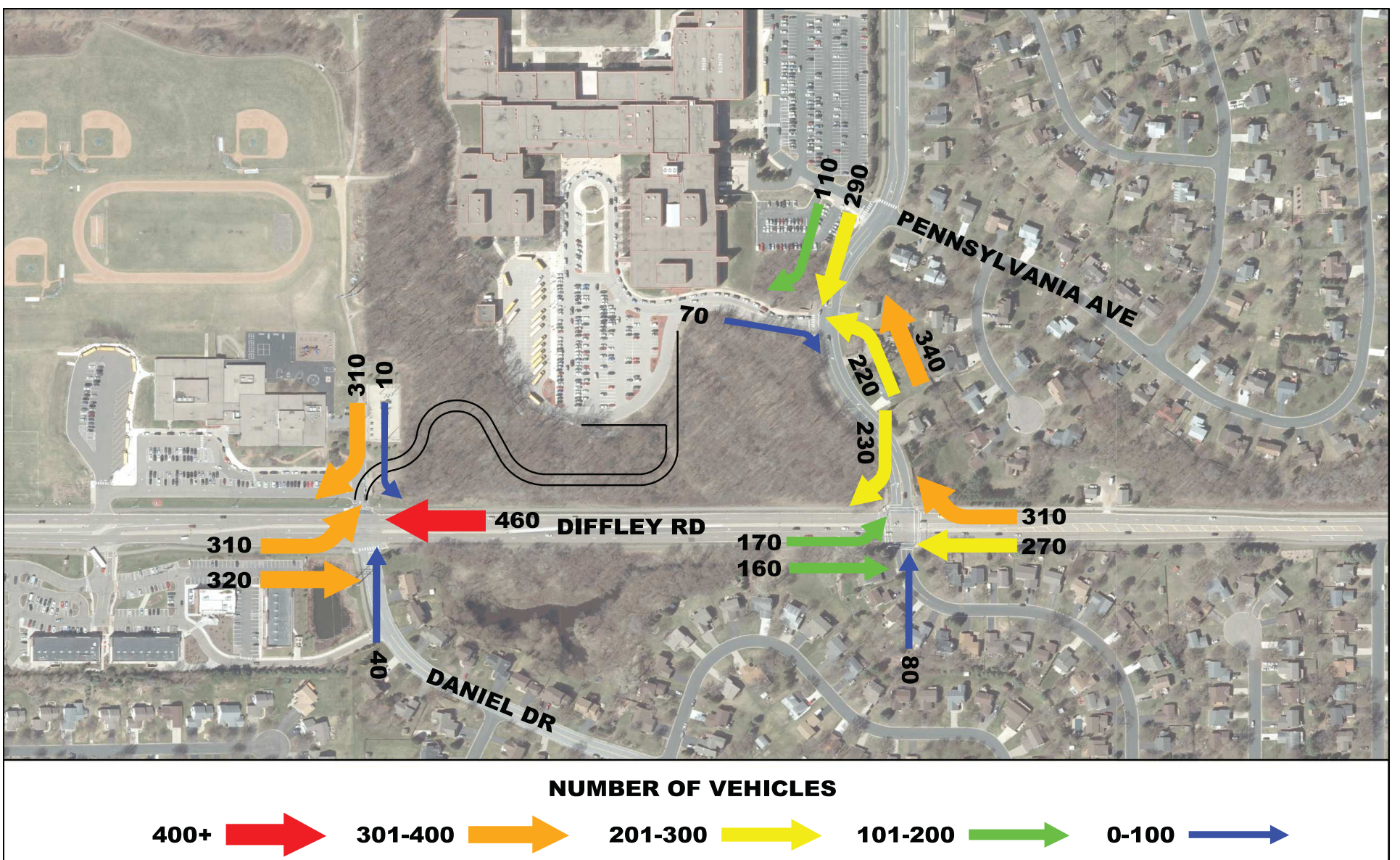


# NEW ROADWAY TRAFFIC DISTRIBUTION

## Existing Morning Traffic Distribution

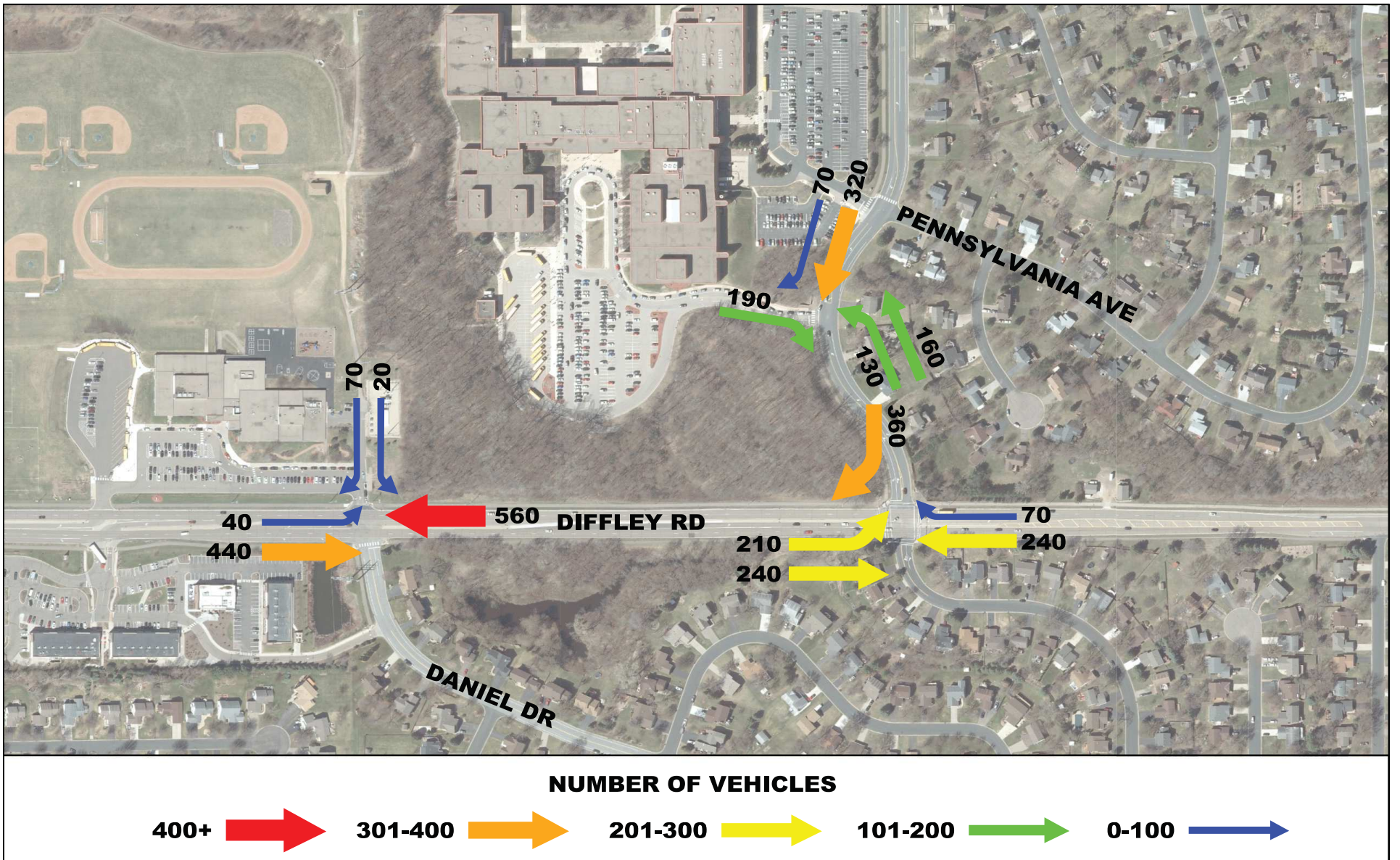


## Anticipated Morning Traffic Distribution

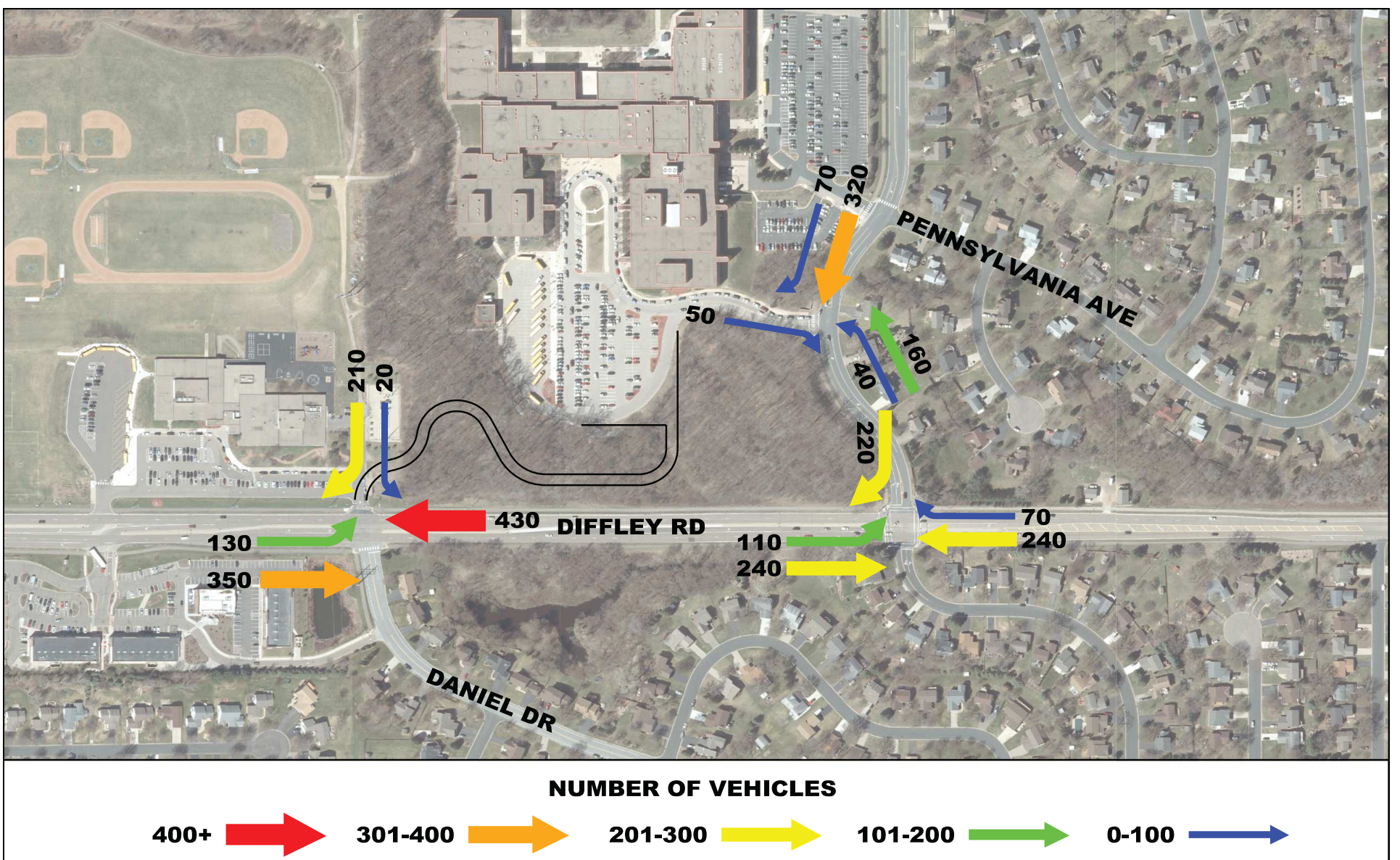


# NEW ROADWAY TRAFFIC DISTRIBUTION

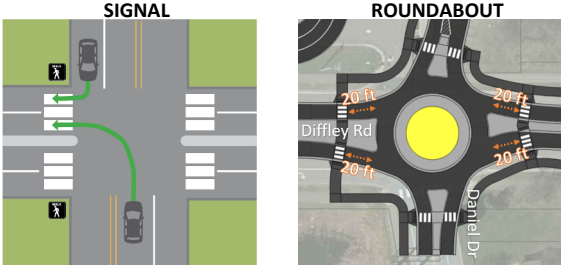
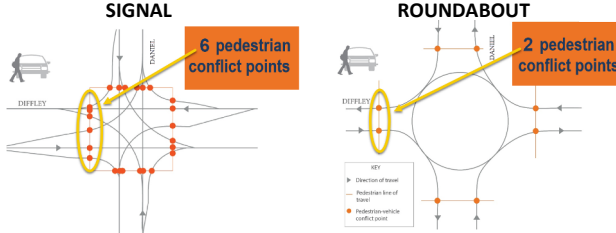
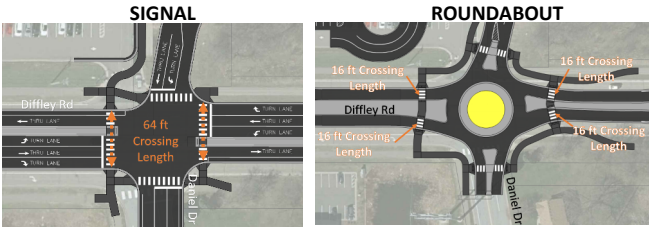
## Existing Afternoon Traffic Distribution



## Anticipated Afternoon Traffic Distribution



# Evaluation Matrix - Pedestrian Crossing Diffley Road (CSAH 30)

Measures	Traffic Control Alternatives				Notes
	Signalized Intersection		Roundabout		
<b>New User Comfort Level</b>	Provides pedestrian with crossing phase. Signals are commonly understood.	Good	Educational outreach needed to ensure roundabout navigation is understood.	Fair	Based on public outreach there are concerns with pedestrians crossing at a roundabout. Education and enforcement will aim to address these comments.
<b>Addresses Heavy Southbound Right Turn Conflict</b>	Vehicles are turning during green light which conflicts with the pedestrian walk phase.	Poor	Crosswalks are set back from the roundabout which simplifies decision making and increases the visibility of pedestrians	Good	
<b>Pedestrian-Vehicle Conflict Points</b>	6 conflict points	Poor	2 conflict points	Good	<p>Conflict points are locations where a pedestrian path crossing the roadway intersects with a vehicles path.</p> 
<b>Crossing Distance/Number of Lanes</b>	64 ft crossing (one stage) / 4 lanes	Poor	16 ft crossing (two stages) / 1 lane per stage, 2 lanes total	Good	<p>Both options assume lane reduction along Diffley Rd.</p> 
<b>Pedestrian Crash Data</b>		Poor	87% Fewer Pedestrian Injury Crashes at Roundabouts than Signals	Good	Preliminary Findings by MnDOT in an addendum to "A Study of Traffic Safety at Roundabouts in Minnesota - August 2018"
<b>Vehicle Speed along Diffley Rd at Crossing</b>	10-45 mph	Poor	15-20 mph	Good	Slower vehicle speeds give drivers and pedestrians to react increasing the survival rate in a vehicle-pedestrian crash 1/10 pedestrians survive when hit by a vehicle at 40 mph 9/10 pedestrians survive when hit by a vehicle at 20 mph
<b>Driver Yielding to Pedestrians</b>	85% of drivers yield to pedestrians at signalized intersections	Good	83% of drivers yield to pedestrians at single lane roundabouts	Good	Yield rates are from the National Cooperative Highway Research Program (NCHRP) Report 572, "Roundabouts in the United States". Even if vehicles do not yield to pedestrians as they should, a pedestrian is only anticipated to wait on average for 14 seconds to cross Diffley Rd at Daniel Dr before finding an adequate gap in traffic to safely cross.