

City of Cambridge

0 Grand Ridge Drive

Z0023198



TRAFFIC AND SAFETY STUDY



CIMA+ project number: Z0023198
17-03-2025 - Review 01



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1. Introduction

CIMA+ was retained by the City of Cambridge (the City) to conduct a Transportation Impact Study in support of a City initiated development application for 0 Grand Ridge in Cambridge, Ontario. The development scale is approximately 50 units and City Council has requested a traffic and active transportation operation and safety review of the intersection of Grand Ridge Drive and Cedar Street/Cedar Creek Road, and the potential site access to Grand Ridge Drive.

The study objective is to evaluate potential pedestrian crossing treatments, determine the traffic volumes anticipated to be generated by the proposed development during the AM and PM peak hour, assess the impact of this traffic on existing roadway network, and recommend changes to accommodate the projected traffic if needed.

1.1 Study Area

The study area consists of the existing three-legged signalized intersection of Cedar Street/Cedar Creek Road and Grand Ridge Drive with the following lane configuration per approach:

- South leg (Grand Ridge Drive): a shared left/right lane
- East leg (Cedar Creek Road): a dedicated left lane and through lane
- West leg (Cedar Street): shared left/through/right-turn lane, with an uncontrolled pedestrian crossing immediately to the west of the study intersection

The subject site is outlined in red in **Figure 1**, and the intersection is outlined in blue.



Figure 1: Subject Intersection

The City has requested an operational and safety review of this intersection to assess impacts from a residential development with 50 units, with a proposed site access located on Grand Ridge Drive near the south property line. In particular, there have been concerns expressed regarding the westbound left and northbound right movements, as well as pedestrian and cyclist safety.

The land use nearby the development site consists of a mixture of industrial, low and medium density residential units consisting of single detached homes, townhouses, and apartment buildings.

Traffic counts and speed data were conducted by Ontario Traffic Inc. (OTI) on Thursday January 30th, 2025. A copy of the existing traffic data is provided in **Appendix A**.

1.2 Study Methodology

This study evaluates existing and future traffic operations at study area intersections for the weekday AM peak period (7:00-900), and weekday PM peak period (15:30-18:30).

The study assessed traffic operations under existing (2025) conditions and a ten-year horizon without the proposed development (Future 2035 Background) and with the proposed development (Future 2035 Total).

Intersection operations were assessed using the Synchro 11 software which utilizes the Highway Capacity Manual (HCM) 2000 methodology published by the Transportation Research Board National Research Council. Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network considering the spacing, interaction, queues, and operations between intersections. Intersection operations performance metrics are reported in terms of Level of Service (LOS), volume to capacity (v/c) ratios.

Level of Service is based on the average control delay per vehicle for a given movement. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between 'A' and 'F', with 'F' being the longest delay. **Table 1** summarizes the LOS criteria for signalized and unsignalized intersections.

Table 1: Intersection Level of Service Criteria

Level of Service	Average Control Delay Per Vehicle (second/vehicle)	
	Signalized Intersection	Unsignalized Intersection
A	≤10	≤10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

SimTraffic software was used to calculate the 95th percentile queue length to analyze and assess the available storage capacity and whether queue spillback or lane blockages occur due to long queues. The available storage capacity was based on the best available data collected from aerial imagery.

For this study, critical intersections are established with accordance to the Region of Waterloo "Transportation Impact Study Guidelines":

- Level of Service of E or worse;
- Volume to Capacity ratio of 1.00; and
- 95th queue exceeds the available storage length.

It should be be noted that the peak hour factor (PHF) was calculated from the provided TMCs. The calculated PHF was used for all existing and future scenarios.

2. Existing Traffic Operations

The following section outlines existing conditions. Existing intersection operations were analyzed using the lane configurations illustrated in **Figure 2**.

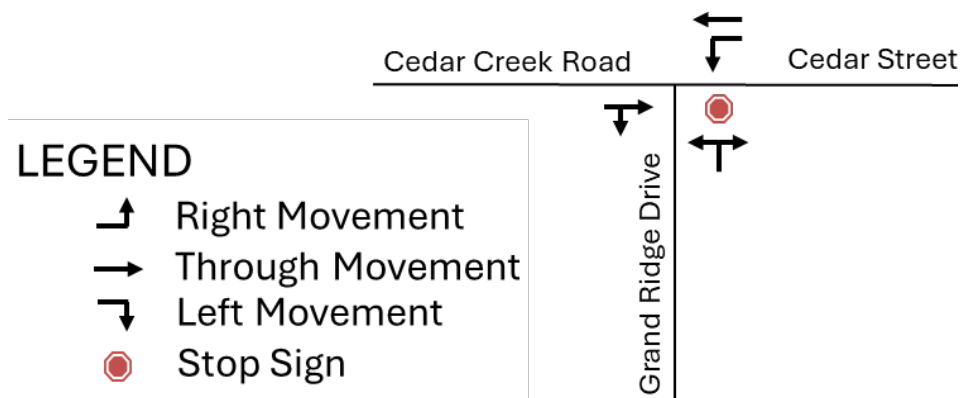


Figure 2: Existing Lane Configuration

2.1 Existing Traffic Volume and Operations

Turning movement counts (TMC) were collected on January 30, 2025, by Pyramid Traffic Inc. The counts reveal that the AM peak hours are 07:15 to 08:15 AM and the PM peak hours are between 16:30 to 17:30. The resulting existing traffic volumes are shown in **Figure 3**.

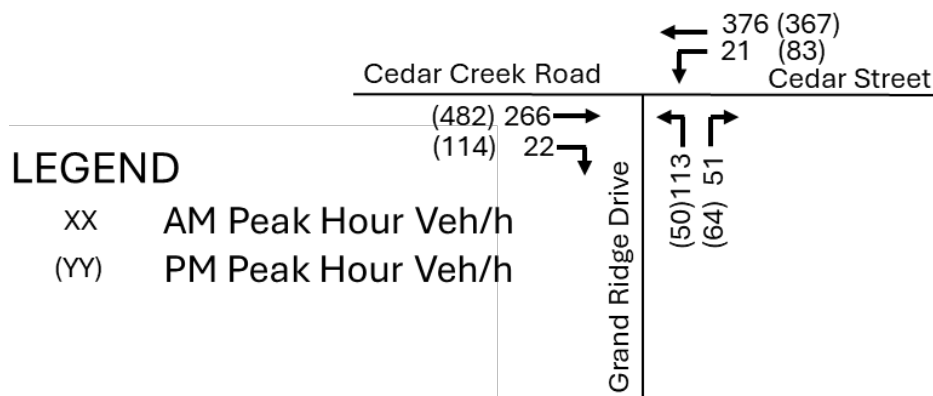


Figure 3: Existing 2025 Volume

Traffic operations were reviewed using Synchro 11 and SimTraffic software. Volume to capacity ratio (v/c), level of service (LOS) and delay, and 95th percentile queues were reviewed. The results are summarized in **Table 2**. Synchro outputs are available in **Appendix B**.

It should be noted that the available storage capacity is based on aerial imagery to measure storage lane length or distance from the subject intersection to the nearest upstream traffic-controlled intersection.

Table 2: Existing 2025 Traffic Operations

Direction / Movement	Storage (m)	v/c	Delay	LOS	95%ile Queue (m)
Grand Ride Drive and Cedar Creek Rd/Cedar Street					
EBTR	>100	0.23 (0.38)	0.0 (0.0)	A (A)	0.0 (1.9)
WBL	85	0.03 (0.13)	8.2 (9.4)	A (A)	7.0 (17.0)
WBT	>100	0.28 (0.24)	0.0 (0.0)	A (A)	0.0 (0.0)
NBLR	>90	0.53 (0.50)	25.8 (30.6)	D (D)	23.9 (22.0)
Overall	-	-	4.8 (4.0)	A (A)	-

All movements are operating at an acceptable level of service. All 95th percentile queues can be accommodated within existing storage capacity.

2.2 Active Transportation

2.2.1 Pedestrian and Cyclist Infrastructure

Sidewalks are provided on both sides alongside most streets in the study area. Existing sidewalks are illustrated in **Figure 4**. There are dedicated bike lanes within the study area road network along Cedar Street otherwise cyclists need to share the road with vehicular traffic.



Figure 4: Existing Sidewalks

2.2.2 Transit Services

The subject site is served by public transit provided by Grand River Transit. The bus route within the study area is Route 55 which operates on weekdays and weekends with service headway of sixty (60) minutes. There are two bus stops along Grand Ridge Drive on both sides. Both stops are within 10m north of the subject site.

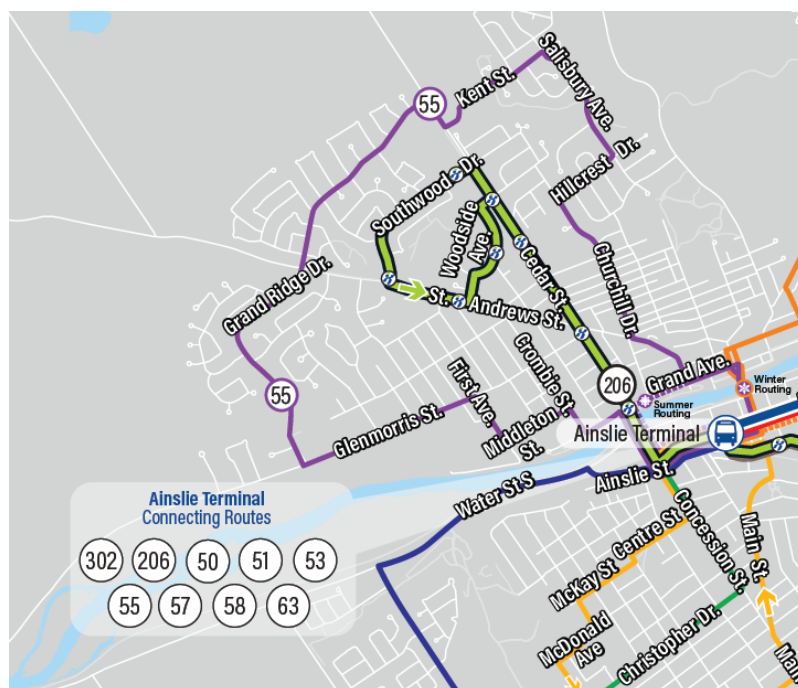


Figure 5: Grand Transit System Map

3. Collision Analysis

A collision analysis was conducted to identify any potential safety issues within the study area. A five-year span of historical collision data from 2017 to 2021 was provided by the Region of Waterloo, including collisions occurred at Cedar Creek Road and Grand Ridge Drive intersection as well as along Cedar Creek Road between Edworthy Side Road and Grand Ridge Drive. No additional collisions were recorded within 100m radius of the study area during the 2017-2021 timeframe. The collision analysis data is provided in **Appendix C**.

During the 5-year analysis period, there were a total of 26 collisions within the study area. There were 18 collisions that caused property damage only (PDO), seven collisions that caused non-fatal injuries and one non-reportable collision. The collisions were contrasted against the 2019 Ontario Road Safety Annual Report (ORSAR) results, which was used as a baseline for comparison.

The collision data was further examined for patterns that might point to underlying safety issues. The following collision characteristics were reviewed to find possible collision patterns:

- Severity.
- Prevailing Driver Action.
- Prevailing Impact Type.
- Lighting.
- Road Surface Conditions.

Table 3 summarizes the collision by prevailing driver action, impact type, and environmental conditions.

Table 3: Collision Type and Prevailing Conditions

Prevailing Driver Action	Manoeuvrer	Lighting		Surface Condition		
		Daylight	Non-Daylight	Clear	Rain	Snow
23 % Following too close	EBT	81%	19%	21	2	2

Out of the 26 collisions, three drivers were driving properly, one was exceeding the speed limit, one failed to yield right-of-way, five lost controls, six were following too close, one was due to improper passing, two improper turns, three instances of speed being too fast for conditions and two were noted as being at fault for other unspecified reasons.

Light Condition

5 out of 26 collisions (19%) occurred during non-daylight conditions. This statistic is below the 27.9% (dusk, dawn, and darkness) reported in the 2019 Ontario Road Safety Annual Report (ORSAR). The illumination seems not to have contributed to collisions.

Road Surface Condition

21 out of 26 (80.7%) collisions occurred on clear road conditions. There are two wet surface collisions (2/26=7.7%), this is lower than the 2019 ORSAR wet conditions are reported in 15.6% scenarios. The proportion of snow surface collisions (2/26=7.7%) is higher than the 5.2% reported in the 2019 ORSAR for loose snow conditions and the 3.3% reported in the 2019 ORSAR for packed snow conditions.

Prevailing Impact

The prevailing impact type was single motor vehicle (SMV) collisions (12/26=46.2%), and the second most common impact type was rear end collisions (8/26=30.8%). There were also 3 turning movement collisions, 2 approaching collisions and 1 sideswipe collision.

4. Speed Study

A speed study was conducted to understand the travel behaviour under the impact of speed transition from 80 km/hr to 50 km/hr and vertical curvature on the west approach of Cedar Street and Grand Ridge Drive intersection. Speed data was collected by Pyramid Traffic Inc. on January 30, 2025, from 7:00 am to 8:00 am (AM period) and from 3:00 pm to 4:00 pm (PM period).

The collected speed data are illustrated in **Figure 6**. The 85th percentile speed falls within 74 to 81 km/hr range in the AM period and within 82 to 89 km/hr range in the PM period. Comparing to the posted speed limit of 50 km/hr, the study results indicate that speeding issue exists at this location.

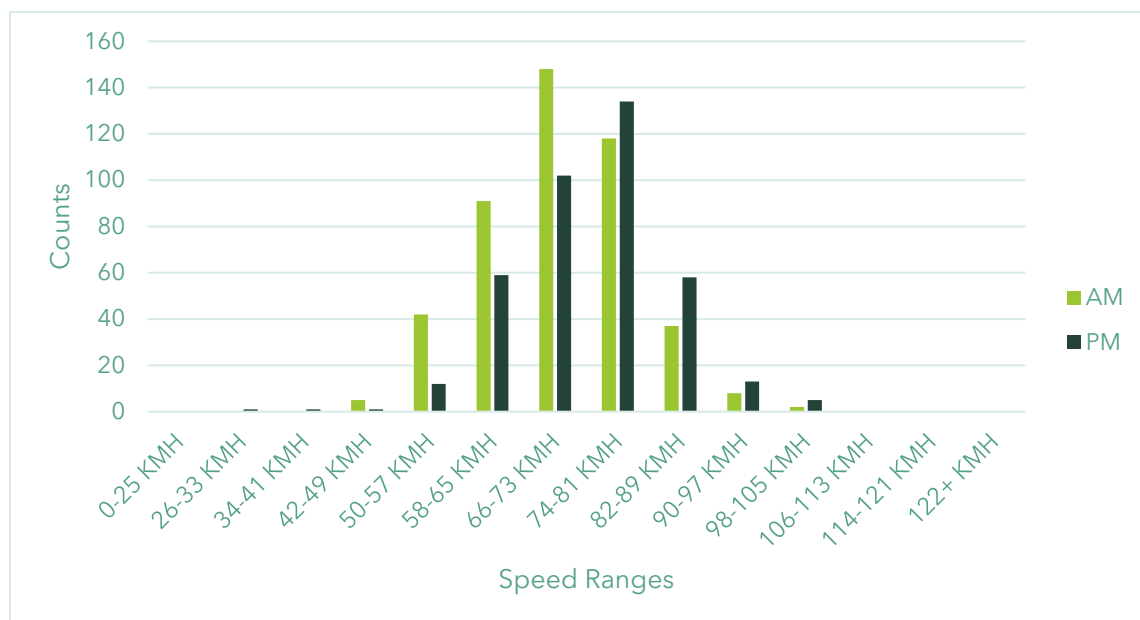


Figure 6: Speed Data Summary

5. Field Investigation

A field investigation was conducted from 2:30 pm to 4:30 pm on March 4, 2025, which consisted of a comprehensive review of the study area, examining roadway geometry, traffic operations, and roadway user behaviour and interactions. In particular, this review also focused on verifying if pedestrian crossing control is suitable on the west leg of Cedar Creek Road and Grand Ridge Drive intersection.

The following observations were made:

- Posted speed limit changes from 80 km/hr to 50 km/hr at roughly 100 metres west of Cedar Creek Road and Grand Ridge Drive intersection, with a “Maximum Speed Ahead” sign roughly 280 metres in advance in the eastbound direction. According to Ontario Traffic Manual (OTM) Book 5, if the speed reduction is greater than 20 km/h, transitional speed limits should be used in intervals of 20 km/hr maximum.
- Considering the significant speed differential, results from speed survey, and the proximity of the intersection to 80 km/h speed zone, a conservative design speed of 100 km/hr is considered when verifying adequacy of geometric design of the eastbound approach. The sight distance for the eastbound approach to the existing uncontrolled pedestrian crossing was measured at approximately 235 metres, exceeding the minimum stopping distance of 185 metres required for a design speed of 100 km/hr as per TAC Geometric Design Guide for Canadian Roads (GDG).
- Bike lanes are available on both sides of Cedar Creek Road, terminating 50 metres west of the study intersection. No buffer is provided between bike lane and vehicle lane.
- No pedestrian activities were observed at the study intersection, which is in line with the minimal pedestrian counts observed from the TMC collected at the intersection.
- In the eastbound direction approaching the intersection, due to large grade and speed differential, several sudden braking incidents were observed when vehicles attempted to stop behind vehicles turning right at Grand Ridge Drive. This observation is in line with the prevailing collision direction in the eastbound.
- Existing uncontrolled pedestrian crossing located on the west leg of Cedar Creek Road and Grand Ridge Drive intersection has AODA elements such as curb drop and tactile indicators, as shown in **Figure 7**.



Figure 7: Existing Pedestrian Crossing

Based on the above observations, the following recommendations are proposed.

- Advance High-Speed Roadway Identification signage for Grand Ridge Drive may be considered in accordance with OTM Book 8, especially on the eastbound approach. This would help, drivers prepare to decelerate in advance, reducing the likelihood of last-second braking, which can lead to rear end collisions (3/8 rear end collisions occurred in the eastbound direction).
- A few treatments may be considered targeting the speeding issue observed on the west approach and providing a safer crossing environment at the existing uncontrolled pedestrian crossing, including the following:
 - Extending the 50 km/hr zone further to the west. The existing “80 km/hr Begins” sign for the westbound approach is located 100 metres west of the intersection (80 metres west of the pedestrian crossing) as shown in **Figure 8**. Its visibility may encourage drivers to accelerate upon seeing the sign, potentially increasing the risk to turning vehicles at Grand Ridge Drive intersection and pedestrians using the crossing.
 - Establishing intermediate speed transition zone with posted speed of 70 km/hr between the 80 km/hr and 50 km/hr speed zones according to OTM Book 5 requirements.
 - Install “Pedestrians Yield to Traffic (Wc-36)” warning sign on the median island to alert pedestrians to wait for safe gaps.

- Implementing peripheral transverse bar pavement marking (**Figure 9**) in the speed transition zone as a speed management measure. Peripheral transverse bars are parallel pavement markings along the edges of the travel lane to alert the driver's awareness of the need to reduce speed. They are best suited to rural roadways with one lane per direction, particularly where edge line and centreline markings are provided. They are most effective when implemented within the perception-reaction area of the transition zone and have been shown to impact speeds, speed compliance, and speed variance. The TAC Canadian Guide to Traffic Calming offers design guidance for peripheral transverse bars.



Figure 8: WB 80 km/hr Signage Location Relative to Pedestrian Crossing



Figure 9: Peripheral Transverse Bar Pavement Marking¹

¹ City of Kingston. (n.d.). Traffic Calming Guidelines. Retrieved September 17, 2024, from https://www.cityofkingston.ca/media/iqjjsrru/transportation_guideline_trafficcalming.pdf

6. Pedestrian Crossing Treatment Selection

OTM Book 15 provides a Decision Support Tool (DST) for deciding on the requirement and type of crossing treatment. The DST includes two components: (1) Preliminary Assessment and (2) Pedestrian Crossing Selection tool.

The preliminary assessment is used to check whether a pedestrian crossing control of any type is required for a site and then the Pedestrian Crossing Selection tool assists in choosing a pedestrian crossing treatment for the site.

The preliminary assessment involves the following two steps:

- Check whether a traffic signal, meaning an Intersection Pedestrian Signal (IPS), is warranted at the subject location based on Justification 6 of OTM Book 12.
- If a traffic signal is not warranted, the flow chart in **Figure 10** assists in checking whether a pedestrian crossover (PXO) is warranted.

6.1 Traffic Signal Assessment

According to OTM Book 12 Justification 6, the installation of a traffic signal is warranted if the subject site exceeds both the minimum pedestrian volume and the minimum pedestrian delay criteria for a period of 8 hours.

The pedestrian volume criterion is defined as the total 8-hour pedestrian volume crossing the main road at an intersection or mid-block location during the highest 8-hour of pedestrian traffic. Similarly, the pedestrian delay criterion is defined as the total 8-hour volume of pedestrians experiencing delays of ten seconds or more in crossing the road during the highest 8-hour of pedestrian traffic.

One of the key criteria for justifying the installation of a traffic signal at a pedestrian crossing is the presence of significant pedestrian delays as per OTM Book 12 Justification 6. Given that our field observations and pedestrian counts from collected TMC did not indicate any notable delays for pedestrian at these locations, the installation of a traffic signal is not warranted. The full warrant analysis based on projected future volumes is further discussed in Section 7.2.1.

6.2 Pedestrian Crossover Assessment

The preliminary assessment for a PXO was reviewed based on the flow chart in **Figure 10**. According to the TMC, 4 pedestrians were recorded crossing in the north-south direction during the 8-hour period. Therefore, the subject location does not meet the minimum eight-hour pedestrian volume and traffic volume criteria required for implementation of PXOs. Considering the minimal pedestrian activity recorded in TMC and observed from field visit, this location does not fulfill the requirement for system connectivity and is not on pedestrian desire lines. Therefore, the subject site is not a candidate for pedestrian crossing control according to OTM Book 15.

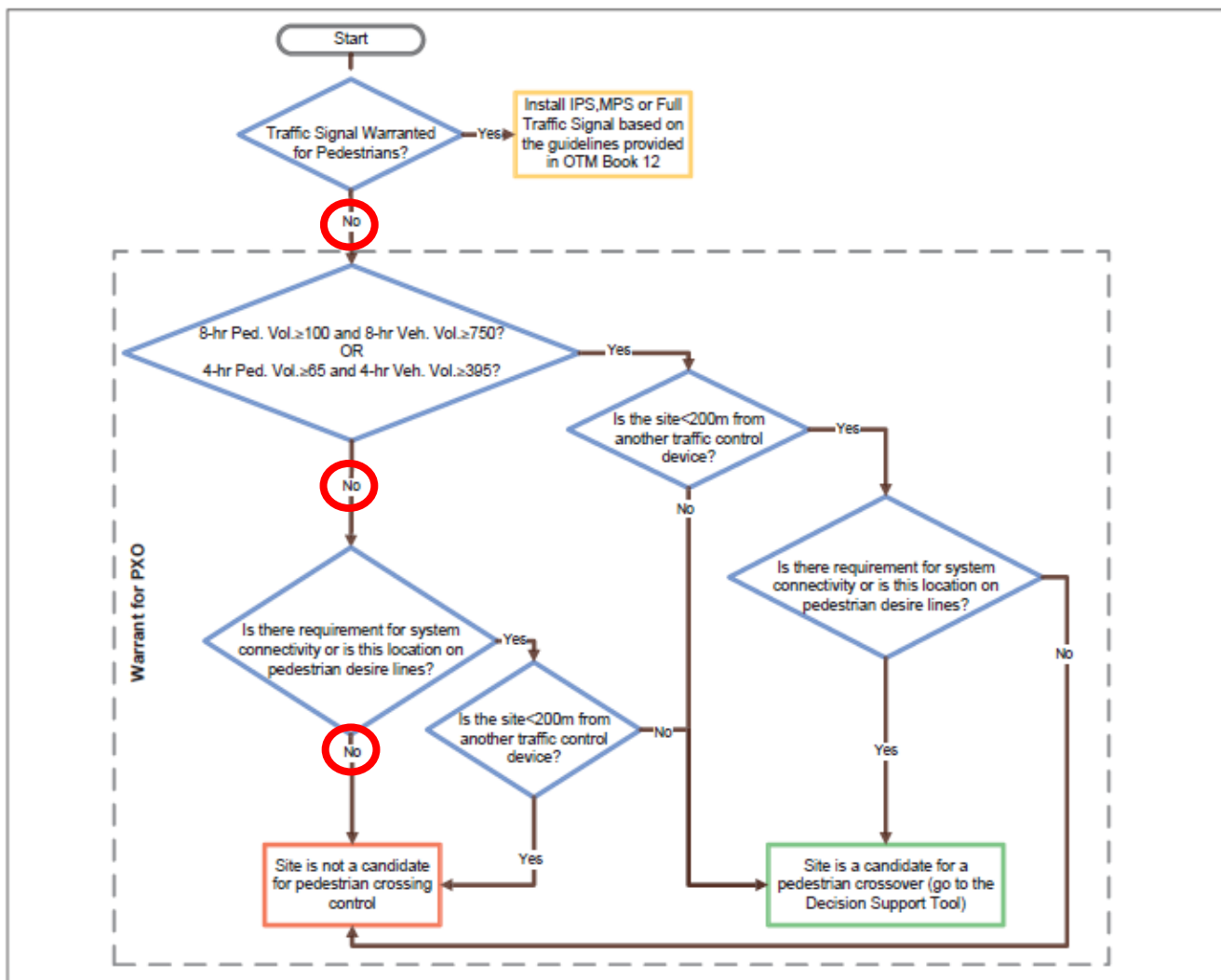


Figure 10: Decision Support Tool – Preliminary Assessment²

² Ontario Traffic Manual Book 15, Pedestrian Crossing Treatments, June 2016

6.3 Uncontrolled Crossing Improvement

Based on warrant results from previous sections, pedestrian crossing controls are not recommended at the existing pedestrian crossing on the west leg of Cedar Creek Road and Grand Ridge Drive intersection. However, a few recommendations can be considered to enhance safety for vehicles and potential pedestrians at the existing uncontrolled crossing:

- Implement speed management measures discussed in Section 5 to reduce vehicle operating speeds at the subject site.
- Install "Pedestrian Ahead (Wc-7)" advanced warning sign for both eastbound and westbound directions to alert drivers of potential pedestrian activities.
- "Pedestrians Yield to Traffic (Wc-36)" sign can be considered on the existing refuge island of the uncontrolled crossing to alert pedestrians to wait for safe gaps.

7. Future Background Operations

Future traffic volumes were estimated using a compound annual growth rate of 1.5% for the ten-year horizon year (2035). Background developments were accounted with the growth rate.

7.1 Future Traffic Growth

Future conditions analysis was conducted using projected future volumes for the ten-year future horizon (2035), considering two components: organic background traffic growth and additional traffic generated by other planned/approved developments in the vicinity of the study area.

A compound growth rate of 1.5% per annum was used in the analysis to estimate future traffic volumes. The 1.5% growth rate was a conservative assumption based on historical growth observed from previous turning movement counts at Cedar Creek Road and Grand Ridge Drive intersection provided by the City. The historical growths observed are summarized in **Table 4** and **Table 5**. As indicated by the City of Cambridge, there were no additional planned/approved background developments within the study area.

Table 4: Cedar Creek Road and Grand Ridge Drive Historical Volume Summary

Year	2010	2016	2022	2025
8-hour Total TMC	5,422	5,831	6,413	6,294

Table 5: Cedar Creek Road and Grand Ridge Drive Growth Summary

Period	2010-2016	2016-2022	2022-2025	2010-2025
Annual Growth	1.2%	1.6%	-0.6%	1.0%

7.2 Future Background Traffic Volume and Operations

The future 2035 traffic volumes are shown in **Figure 11**.

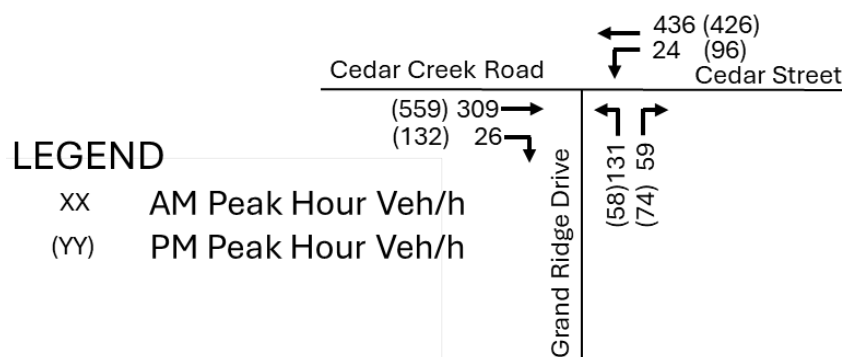


Figure 11: Future Background 2035 Volume

Traffic operations were reviewed using Synchro 11 and SimTraffic software. Volume to capacity ratio (v/c), level of service (LOS) and delay, and 95th percentile queues were reviewed. The results are summarized in **Table 6**. Synchro and SimTraffic outputs are available in Appendix D.

Table 6: Future Background 2035 Traffic Operations

Direction / Movement	Storage (m)	v/c	Delay	LOS	95 th ile Queue (m)
Grand Ride Drive and Cedar Creek Rd/Cedar Street					
EBTR	>100	0.26 (0.45)	0.0 (0.0)	A (A)	1.0 (2.9)
WBL	85	0.03 (0.16)	8.4 (10.0)	A (B)	7.7 (19.2)
WBT	>100	0.33 (0.28)	0.0 (0.0)	A (A)	0.0 (0.0)
NBLR	>90	0.74 (0.75)	44.8 (60.9)	E (F)	27.3 (27.3)
Overall	-	-	8.1 (7.2)	A (B)	-

All movements are operating at an acceptable level of service, except for the northbound left/right movement, which is operating at a level of service grade E in the AM peak period and a Level of service grade F in the PM peak period, but with an acceptable v/c ratio of 0.74 and 0.75, respectively. All 95th percentile queues can be accommodated within existing storage capacity.

7.2.1 Proposed Mitigation

The signal warrant was conducted following the traffic signal justification spreadsheet provided by the Ontario Ministry of Transportation. According to the OTM Book 12 there are seven justifications for a signal warrant:

- Minimum Vehicle Volume

- Delay to cross volume
- Volume/Delay Combination
- Minimum Four-Hour Vehicle Volume
- Collision Experience
- Pedestrian Volume and Delay
- Projected Volumes

No justification was met and a signal is not warranted. Signal warrant analysis is provided in **Appendix E**.

Section 9 of 2017 TAC Geometric Design Guide for Canadian Roads states “It is undesirable to have a two-lane entry from the minor roadway to the main roadway with stop control, except at certain low-speed urban locations. The possibility of an adjacent standing vehicle blocking the vision of a driver preparing to enter the major roadway may create an unsafe situation. Signalization should be considered for intersections with two-lane entry on the minor road. If signal warrants are not met, the intersection should be designed for one-lane entry only.” Therefore, an auxiliary lane would not be recommended on Grand Ridge Drive.

8. Future Total Operations

8.1 Trip Generation

The number of vehicle trips to be generated by the development located at 0 Grand Ridge Drive for the weekday AM and weekday PM peak hours has been determined based on type of use, residential units, and trip generation rates as per the ITE Trip Generation Manual 11th edition.

All Trip rates are based on the respective peak hour generators fitted curve equations. It was assumed that all trips generated by the proposed site will consist of auto trips (i.e., a conservative approach). The projected trip generation for the proposed development during the weekday AM and weekday PM peak hours are summarized in **Table 7**.

Table 7: Trip Generation Summary

ITE Land Use	Units	Parameter	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Affordable Housing (ITE Code 223)	50	Equation	$T=0.21(X)+17.97$			$\ln(T) = 0.75 \ln(X) + 0.53$		
		Gross Trips	7	21	28	19	13	32
		Non-Auto (0%)	-	-	-	-	-	-
		Total Trips	7	21	28	19	13	32

8.2 Trip Distribution

The trip distribution for the proposed development is based on the existing travel patterns. The resulting trip distribution is summarized in **Table 8**.

Table 8: Trip Distribution Summary

From/To	Via	AM Peak Period		PM Peak Period	
		Inbound	Outbound	Inbound	Outbound
East	Cedar Street	49%	31%	42%	56%
West	Cedar Creek Road	51%	69%	58%	44%
Total Trips		100%	100%	100%	100%

The resulting site generated trips are illustrated in **Figure 12**.

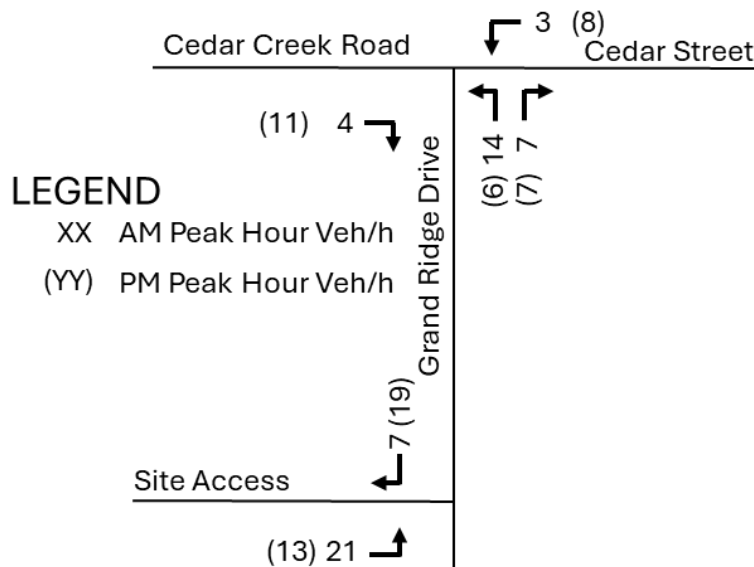


Figure 12: Site Traffic

8.3 Future Total Traffic Volume and Operations

Traffic operations under future 2035 total conditions were analyzed for the weekday AM and weekday PM peak hours. The traffic analysis and results for the future total conditions are discussed in this section.

Future (2035) total intersection operations were assessed using the existing lane configurations. The future (2035) total traffic volumes were estimated by adding the site traffic (**Figure 12**) to future (2035) background volumes (**Figure 11**) and the resulting future (2035) total traffic volumes are illustrated in **Figure 13**. The analysis results are provided in **Table 9**, and detailed calculations are provided in **Appendix F**.

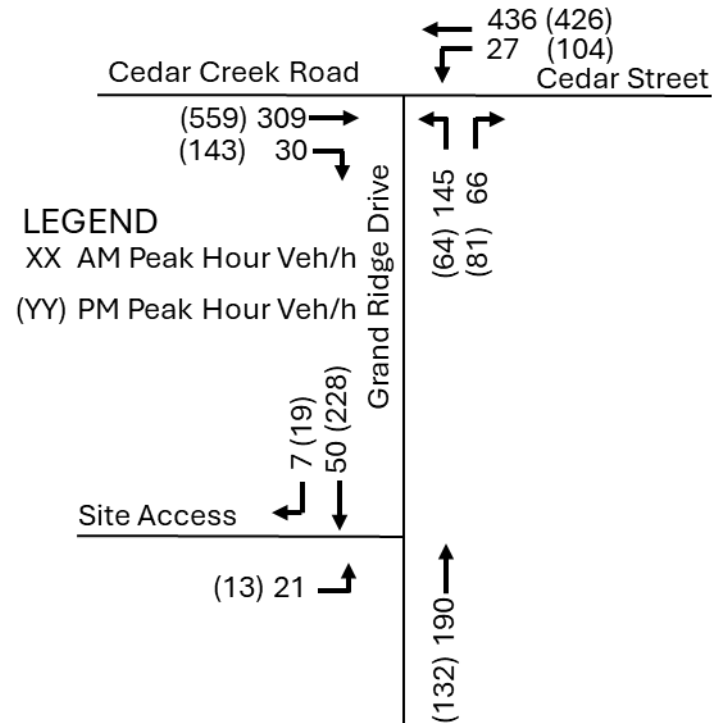


Figure 13: Future Total 2035 Volumes

Table 9: Future Background 2035 Traffic Operations

Direction / Movement	Storage (m)	v/c	Delay	LOS	95%ile Queue (m)
Grand Ride Drive and Cedar Creek Rd/Cedar Street					
EBTR	>100	0.27 (0.45)	0.0 (0.0)	A (A)	0.0 (3.9)
WBL	85	0.04 (0.18)	8.4 (10.2)	A (B)	10.5 (19.5)
WBT	>100	0.33 (0.28)	0.0 (0.0)	A (A)	0.0 (0.0)
NBLR	40	0.84 (0.87)	58.4 (82.3)	F (F)	30.5 (31.1)
Overall	-	-	11.4 (10.1)	A (B)	-
Grand Ridge Drive and Site Access					
EBLR	-	0.03 (0.02)	10.1 (11.1)	B (B)	11.2 (10.2)
NBLT	>100	0.00 (0.00)	0.0 (0.0)	A (A)	8.8 (11.5)
SBTR	40	0.04 (0.16)	0.0 (0.0)	A (A)	0.0 (0.0)
Overall	-	-	0.8 (0.4)	A (A)	-

Similar to future background scenario, all movements are operating at an acceptable level of service, except for the northbound left/right movement, which is operating at a level of service grade F in both peak periods due to slight increase in delay, but with an acceptable v/c ratio of 0.84 and 0.87, respectively. All 95th percentile queues can be accommodated within existing storage capacity. The movement that is critical in future total conditions, was already critical during future background conditions, therefore the additional development traffic volume is not the cause of the critical movement.

The proposed site access located near the south property line for the development is forecasted to operate with acceptable conditions and have negligible impact on the operations of Grand Ridge Drive.

8.3.1 Proposed Mitigation

As stated in section 7.2.1, a signal is not warranted, and an auxiliary lane is not recommended along Grand Ridge Drive. Considering the adequate v/c ratio and 95th percentile queues during both periods, no mitigation measures are proposed.

9. Conclusion

Based on the operational analysis results, the following conclusions can be made:

- The analysis results indicate that all movements at study intersections are operating with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under existing conditions.
- The site is expected to generate 28 new auto trips during the weekday AM peak hour and 32 new auto trips during the weekday PM peak hour.
- The analysis results indicate that all movements at study intersections are expected to operate with acceptable level of service and residual capacity during the weekday AM and weekday PM peak hours under future conditions except for the northbound left-right at Grand Ridge Drive and Cedar Creek Road/Cedar Street.
- Traffic operations mitigation measures are not recommended under all 2035 future total scenarios.

The issues identified through safety office review and field investigation were compared and further evaluated. Where applicable, the safety office review findings were referenced to determine if the issue was manifesting itself in the collision history. The results of the Synchro analysis were reviewed to identify any issues relating to any existing or potential future congestion, delay, or storage capacity being exceeded on any approach. Based on this analysis, the findings/identified issues and their corresponding mitigation measures are summarized in **Table 10**.

Table 10: Summary of Findings and Recommendations

Location	Finding/Issue	Countermeasure
Cedar Creek Road and Grand Ridge Drive intersection	- Drivers disobeying speed reduction from 80 km/hr to 50 km/hr in eastbound direction. - Speed data indicates 85th percentile speed within the range of 74 to 89 km/hr where posted speed is 50 km/hr.	- Establishing intermediate speed transition zone with posted speed of 60 km/hr between the 80 km/hr and 50 km/hr speed zones. - Implementing peripheral transverse bar pavement marking in the speed transition zone as a speed management measure to alert the drivers' awareness of the need to reduce speed.
	Westbound "80 km/hr Begins" sign is too close to uncontrolled crossing and may encourage drivers to speed up as signage becomes visible	Extending the 50 km/hr zone further to the west.
	Steep downhill slope approaching intersection, instances of sudden breaking observed. 3/8 rear end collisions occurred in the eastbound direction.	- Extending the 50 km/hr zone further to the west. - Provide advance street name signages to prepare drivers decelerate ahead of time.
	Existing uncontrolled pedestrian crossing.	- PXO and IPS are not warranted. - Install "Pedestrian Yield to Traffic" sign on the refuge island. - Install "Pedestrian Ahead" advanced warning signs in the eastbound and westbound directions

A

Appendix A Existing Traffic Data

Cedar St @ Grand Ridge Dr

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:15:00

To: 8:15:00

Municipality: Cambridge

Site #: 0000000001

Intersection: Cedar St & Grand Ridge Dr

TFR File #: 1

Count date: 30-Jan-2025

Weather conditions:

Cloudy/Dry

Person(s) who counted:

Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Cedar St runs W/E

East Leg Total: 714

East Entering: 397

East Peds: 0

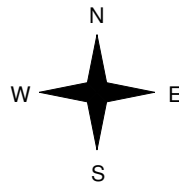
Peds Cross: X

Heavys	Trucks	Cars	Totals
8	8	473	489



Cedar St

Heavys	Trucks	Cars	Totals
26	8	232	266
0	1	21	22
26	9	253	



Grand Ridge Dr

Cars	Trucks	Heavys	Totals
------	--------	--------	--------

360	8	8	376
17	0	4	21
377	8	12	

Cedar St



Cars	Trucks	Heavys	Totals
280	8	29	317

Peds Cross: X
West Peds: 0
West Entering: 288
West Leg Total: 777

Cars	38
Trucks	1
Heavys	4
Totals	43



Cars	113	48	161
Trucks	0	0	0
Heavys	0	3	3
Totals	113	51	

Peds Cross: X
South Peds: 0
South Entering: 164
South Leg Total: 207

Comments

Cedar St @ Grand Ridge Dr

Mid-day Peak Diagram

Specified Period

From: 11:00:00

To: 14:00:00

One Hour Peak

From: 12:00:00

To: 13:00:00

Municipality: Cambridge

Site #: 0000000001

Intersection: Cedar St & Grand Ridge Dr

TFR File #: 1

Count date: 30-Jan-2025

Weather conditions:

Cloudy/Dry

Person(s) who counted:

Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Cedar St runs W/E

East Leg Total: 555

East Entering: 285

East Peds: 0

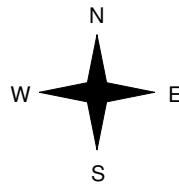
Peds Cross: X

Heavys	Trucks	Cars	Totals
23	7	256	286



Cedar St

Heavys	Trucks	Cars	Totals
23	6	191	220
0	0	28	28
23	6	219	



Grand Ridge Dr

Cars	Trucks	Heavys	Totals
213	7	22	242
41	1	1	43
254	8	23	



Cedar St



Cars	Trucks	Heavys	Totals
241	6	23	270

Peds Cross: X
West Peds: 0
West Entering: 248
West Leg Total: 534

Cars	Trucks	Heavys	Totals
69	1	1	71



Cars	Trucks	Heavys	Totals
43	0	1	44
50	0	0	50
93	0	1	

Peds Cross: X
South Peds: 0
South Entering: 94
South Leg Total: 165

Comments

Cedar St @ Grand Ridge Dr

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 16:30:00

To: 17:30:00

Municipality: Cambridge

Site #: 0000000001

Intersection: Cedar St & Grand Ridge Dr

TFR File #: 1

Count date: 30-Jan-2025

Weather conditions:

Cloudy/Dry

Person(s) who counted:

Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Cedar St runs W/E

East Leg Total: 996

East Entering: 450

East Peds: 0

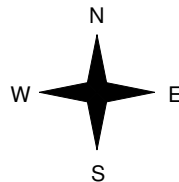
Peds Cross: X

Heavys	Trucks	Cars	Totals
16	5	396	417



Cedar St

Heavys	Trucks	Cars	Totals
7	0	475	482
0	0	114	114
7	0	589	



Grand Ridge Dr

Cars	Trucks	Heavys	Totals
346	5	16	367
82	0	1	83
428	5	17	



Cedar St



Cars	Trucks	Heavys	Totals
537	0	9	546

Peds Cross: X
West Peds: 0
West Entering: 596
West Leg Total: 1013

Cars	196
Trucks	0
Heavys	1
Totals	197



Cars	50	62	112
Trucks	0	0	0
Heavys	0	2	2
Totals	50	64	

Peds Cross: X
South Peds: 0
South Entering: 114
South Leg Total: 311

Comments

Cedar St @ Grand Ridge Dr

Total Count Diagram

Municipality: Cambridge
Site #: 0000000001
Intersection: Cedar St & Grand Ridge Dr
TFR File #: 1
Count date: 30-Jan-2025

Weather conditions:
 Cloudy/Dry
Person(s) who counted:
 Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Cedar St runs W/E

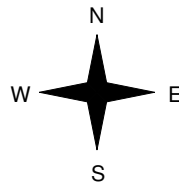
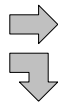
East Leg Total: 5429
 East Entering: 2741
 East Peds: 3
 Peds Cross: 8

Heavys	Trucks	Cars	Totals
148	55	2575	2778



Cedar St

Heavys	Trucks	Cars	Totals
140	29	2117	2286
2	3	411	416
142	32	2528	



Grand Ridge Dr

Cars	Trucks	Heavys	Totals
2133	50	146	2329
392	3	17	412
2525	53	163	



Cedar St



Cars	Trucks	Heavys	Totals
2502	31	155	2688

Peds Cross: 8
 West Peds: 1
 West Entering: 2702
 West Leg Total: 5480

Cars	Trucks	Heavys	Totals
803	6	19	828



Cars	Trucks	Heavys	Totals
442	5	2	449
385	2	15	402
827	7	17	

Peds Cross: 3
 South Peds: 1
 South Entering: 851
 South Leg Total: 1679

Comments

Study Date: 1/30/2025 America/Toronto
 Study Loca: Cedart St west of Grand Ridge Dr

DATE	TIME America/Toronto Per. End.	Speed Detail													
		0-25 KMH	26-33 KMH	34-41 KMH	42-49 KMH	50-57 KMH	58-65 KMH	66-73 KMH	74-81 KMH	82-89 KMH	90-97 KMH	98-105 KMH	106-113 KMH	114-121 KMH	122+ KMH
1/30/2025	7:15	0	0	0	1	6	6	5	4	2	1	2	0	0	0
1/30/2025	7:30	0	0	0	4	15	34	49	38	10	1	0	0	0	0
1/30/2025	7:45	0	0	0	0	19	31	41	36	9	2	0	0	0	0
1/30/2025	8:00	0	0	0	0	2	20	53	40	16	4	0	0	0	0
1/30/2025	15:15	0	1	1	0	3	13	37	32	15	1	0	0	0	0
1/30/2025	15:30	0	0	0	1	1	19	29	33	19	5	2	0	0	0
1/30/2025	15:45	0	0	0	0	5	15	22	35	9	5	2	0	0	0
1/30/2025	16:00	0	0	0	0	3	12	14	34	15	2	1	0	0	0

B

Appendix B Existing Traffic Operations

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

02-19-2025

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↘	↱	↘↙	
Traffic Volume (veh/h)	266	22	21	376	113	51
Future Volume (Veh/h)	266	22	21	376	113	51
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.69	0.66	0.78	0.86	0.85
Hourly flow rate (vph)	355	32	32	482	131	60
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			387		917	371
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			387		917	371
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		56	91
cM capacity (veh/h)			1161		296	673
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	387	32	482	191		
Volume Left	0	32	0	131		
Volume Right	32	0	0	60		
cSH	1700	1161	1700	359		
Volume to Capacity	0.23	0.03	0.28	0.53		
Queue Length 95th (m)	0.0	0.7	0.0	23.9		
Control Delay (s)	0.0	8.2	0.0	25.8		
Lane LOS		A		D		
Approach Delay (s)	0.0	0.5		25.8		
Approach LOS				D		
Intersection Summary						
Average Delay			4.8			
Intersection Capacity Utilization			35.8%	ICU Level of Service	A	
Analysis Period (min)			15			

Queuing and Blocking Report
Existing AM Peak

02-19-2025

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (m)	9.2	29.2
Average Queue (m)	1.5	15.1
95th Queue (m)	7.0	23.9
Link Distance (m)		29.9
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (m)	85.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

02-20-2025

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	482	114	83	367	50	64
Future Volume (Veh/h)	482	114	83	367	50	64
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.84	0.69	0.90	0.83	0.84
Hourly flow rate (vph)	518	136	120	408	60	76
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			654		1234	586
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			654		1234	586
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			87		65	85
cM capacity (veh/h)			938		172	510
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	654	120	408	136		
Volume Left	0	120	0	60		
Volume Right	136	0	0	76		
cSH	1700	938	1700	273		
Volume to Capacity	0.38	0.13	0.24	0.50		
Queue Length 95th (m)	0.0	3.5	0.0	20.7		
Control Delay (s)	0.0	9.4	0.0	30.6		
Lane LOS		A		D		
Approach Delay (s)	0.0	2.1		30.6		
Approach LOS				D		
Intersection Summary						
Average Delay			4.0			
Intersection Capacity Utilization			53.6%	ICU Level of Service		A
Analysis Period (min)			15			

Queuing and Blocking Report
Existing PM Peak

02-20-2025

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

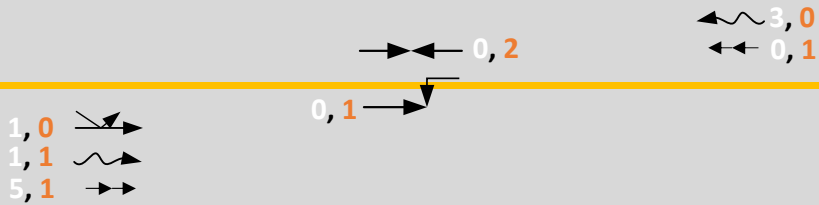
Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (m)	3.8	17.4	27.4
Average Queue (m)	0.2	8.8	12.8
95th Queue (m)	1.9	17.0	22.0
Link Distance (m)	685.9		29.9
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (m)		85.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

C

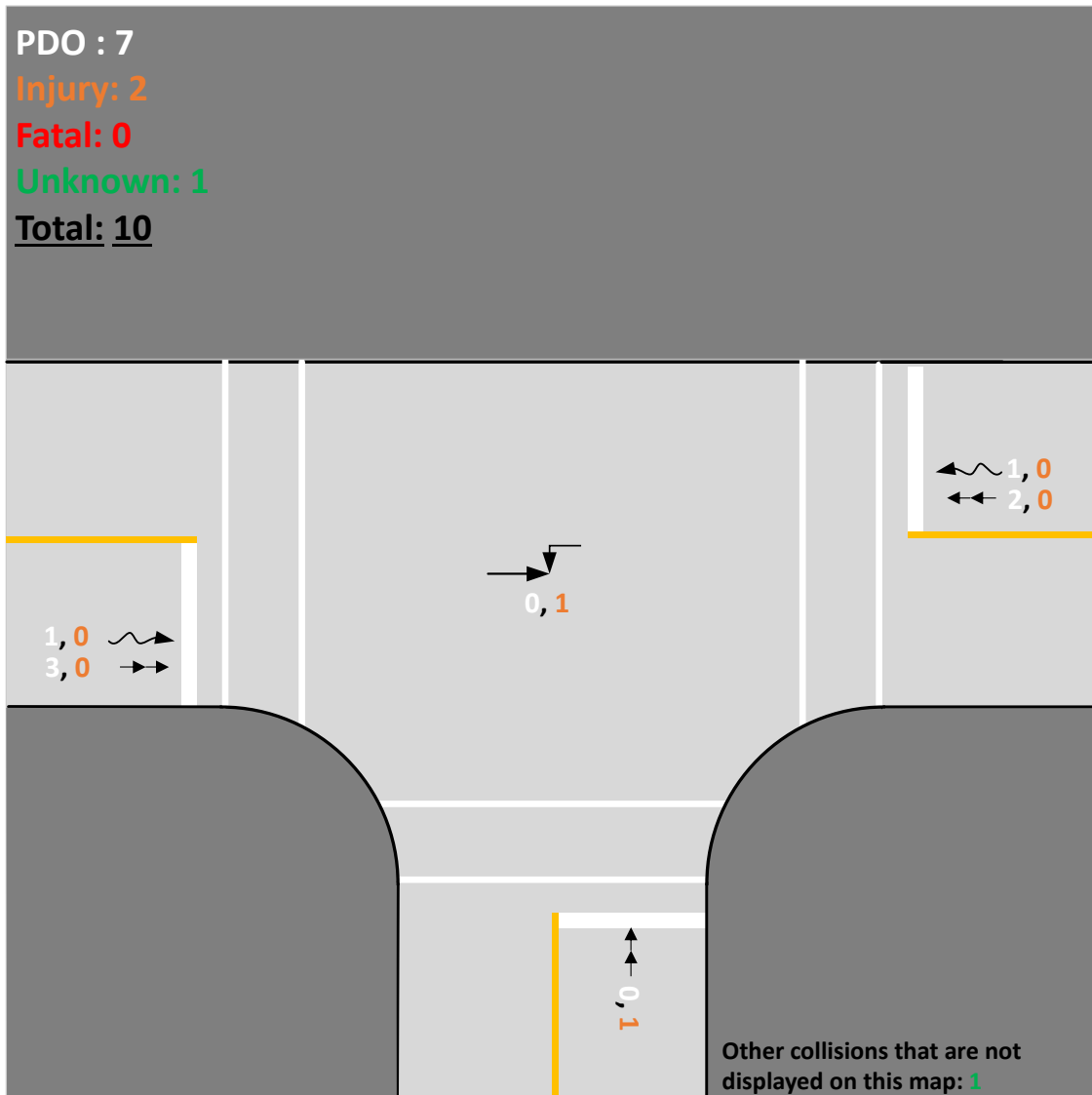
Appendix C Collision Analysis

PDO : 11
Injury: 5
Fatal: 0
Unknown: 0
Total: 16

Cedar Creek Road
Between Edworthy Sideroad and
Grand Ridge Drive



Other collisions that are
not displayed on this
map: 0



Cedar Street and Grand Ridge Drive

Geo ID	Street 1	Direction St. 1	Locate	Street 2	Direction St. 2	Municipality	Collision Date	Day of Collision	Time of Collision	Collision Location	Address #	Classification	Environment	Light	Rd. 1 Condition	Rd. 2 Condition	Rd. 1 Surface Condition	Rd. 2 Surface Condition	Impact Type	Veh. 1 Type	Veh. 1 Condition	Veh. 1 Direction of Travel	Veh. 1 Manoeuver	Driver 1 Age	Driver 1 Action	Driver 1 Condition	Pedestrian Action	Pedestrian Condition	Pedestrian 2 Action	Pedestrian 2 Condition	Veh. 2 Type	Veh. 2 Condition	Veh. 2 Direction of Travel	Veh. 2 Manoeuver	Driver 2 Age	Driver 2 Condition	Driver 2 Action	Bike 1 Action	Bike 2 Action	Pedestrian Age	
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	4-18-2018 WEDNESDAY	11:28:02				03	01	01	01	01	01	01	01	03	01	01	04	01	44	02	08						06	01	04	02	28	01	01			
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	6-5-2018 TUESDAY	11:44:03				02	01	01	01	01	01	01	01	05	01	01	04	04	71	08	08						03	01	03	01	79	01	01			
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	8-6-2018 MONDAY	19:00:02				02	01	01	01	01	02	02	03	03	01	01	01	01	18	02	08						01	01	01	10	56	01	01			
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	10-30-2017 MONDAY	17:58:02				03	02	05	01	01	02	02	07	01	01	01	04	04	24	06	08															
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	10-30-2017 MONDAY	18:09:02				03	99	99	01	01	99	99	07	13	01	01	03	05		00																
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	4-12-2018 THURSDAY	21:00:02				03	01	01	01	01	01	01	03	05	01	01	03	02	55	02	01					01		01	03	10	69	01	01			
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	9-25-2020 Friday	16:00:01				03	01	01	01		01		03	01	01	01	04	02	26	02	08					01	01	04	02	73	01	01				
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	2-3-2020 Monday	09:00:01				04	01	01	01		01		07	01	01	01	99	43	10	08					01	01	01	01	37							
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	3-28-2021 Sunday	13:49:03				03	02	01	01	01	02	02	03	01	01	03	01	38	02	08					01	01	03	05	42	01	01					
19776 CEDAR ST	EW	AT	Grand Ridge Dr	S	CAM	1-22-2019 Tuesday	09:45:03				03	01	01	01	01	06	06	05	04	01	01	03	05	40	01	01					01	01	03	05	46	01	01				
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	7-21-2019 Sunday	22:38:01				03	01	07	01		01	04	01	01	01	03	03	22	03	08					05	01	03	01	63	01	01					
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	10-27-2017 FRIDAY	07:56:01				02	01	01	01	01	01	01	03	01	01	01	51	02	08					01	01	03	10	52	01	01						
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	12-13-2017 WEDNESDAY	08:19:04			1229	02	01	01	01		01	03	01	01	01	04	01	31	04	08					05	01	04	10	30	01	01					
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	4-6-2018 FRIDAY	08:34:01			1376	02	03	01	01		06	01	01	01	01	03	01	21	04	08						04	01	04	01	45	01	01				
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	4-27-2021 Tuesday	16:08:01				07	01	01	01	01	01	07	01	01	01	04	01	43	10	08					04											
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	3-15-2017 WEDNESDAY	16:11:04				06	03	05	01	01	06	06	07	01	01	01	03	02	41	04	08															
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	5-8-2018 TUESDAY	16:45:01			1038	03	01	01	01	01	01	03	01	01	01	03	02	27	99	08					01		01	03	10		30		01	01		
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	5-18-2019 Saturday	14:47:01				03	01	01	01	01	01	01	07	01	01	01	04	01	44	99	08															
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	1-4-2018 THURSDAY	11:30:04			1311	03	01	01	01	01	02	05	01	01	01	04	04	48	06	01					01		01	03	01	36	01	01				
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	3-15-2017 WEDNESDAY	16:11:01				02	01	01	01	01	06	06	07	01	01	01	03	02	27	10	01															
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	12-30-2019 Monday	18:30:01				03	01	07	01	01	01	01	06	01	01	01	01	44	01	01																
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	4-13-2021 Tuesday	15:20:01				01	01	01	01	01	01	01	01	01	01	01	03	21	09	08					01		01	03	01		48		01	01		
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	6-20-2018 WEDNESDAY	15:00:01			1303	03	01	01	01	01	01	07	06	01	01	03	01	34	10	08																
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	7-10-2018 TUESDAY	22:00:01			1223	03	01	01	01	01	01	07	01	01	01	04	01	76	10	08																
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	5-12-2020 Tuesday	05:15:01				03	01	01	07	01	01	06	01	01	01	03	01	40	01	01																
20244 CEDAR CREEK RD	EW	BTWN	EDWORTHY SIDE & Grand Ridge		NDF	9-15-2017 FRIDAY	16:45:01				03	01	01	01	01	01			07	01	01	03	01	44	10	06															

REVISED ORIGINAL TEMPLATE (coloured text has been revised for data collection)

Collision Location On Highway 01-Non intersection 02-Intersection related 03-At intersection 04-At near private drive 05-At railway crossing 06-Underpass or tunnel 07-Overpass or bridge 08-Other 09-Frozen lake or river 10-Parking lot 99-Other			Road Jurisdiction 01-Municipal (excl. Twp. Rd.) 02-Provincial highway 03-Township 04-County or district 05-Regional municipality 06-Private property 07-Federal 99-Other					
Impact Location 01-Within intersection 02-Thru lane 03-Left turn lane 04-Right turn lane 05-Right turn channel 06-Two-way left turn lane 07-Passing lane 08-Left shoulder 09-Right shoulder 10-Not on roadway - left side 11-Not on roadway - right side 12-Off highway 99-Other			Classification of Accident 01-Fatal injury 02-Non-fatal injury 03-P.D. only 04-Non-reportable 99-Other					
Initial Direction of Travel 01-North 02-South 03-East 04-West			Initial Impact Type 01-Approaching (not at Roundabout) 02-Angle 03-Rear end 04-Sideswipe 05-Turning movement 06-Single motor vehicle - animal 07-Single motor vehicle - fixed object or unattended vehicle 08-Single motor vehicle - pedestrian 99-Other					
Environment Condition Multiple Choices Allowed 01-Clear 02-Rain 03-Snow 04-Freezing rain 05-Drifting snow 06-Strong wind 07-Fog, mist, smoke, dust 99-Other			Vehicle Maneuver 01-Going ahead 02-Slowing or stopping 03-Overtaking 04-Turning left 05-Turning right 06-Making "U" turn 07-Changing lanes 08-Merging (not at Roundabout) 09-Reversing 10-Stopped 11-Parked 12-Disabled 13-Pulling away from shoulder or curb 14-Pulling onto shoulder or toward curb 00-Unknown 99-Other					
Light 01-Daylight 02-Daylight, artificial 03-Dawn 04-Dawn, artificial 05-Dusk 06-Dusk, artificial 07-Dark 08-Dark, artificial 99-Other			Sequence of Events - Multiple Choices Allowed Movable Objects 01-Other motor vehicle 02-Unattended vehicle 03-Pedestrian 04-Cyclist 05-Railway train 06-Street car 07-Farm tractor 08-Animal - domestic 09-Animal - wild 97-Other					
Traffic Control 01-Traffic signal 02-Stop sign 03-Yield sign 04-Ped. crossover 05-Police control 06-School guard 07-School bus 08-Traffic gate 09-Traffic controller 10-No control 99-Other			Other Events 20-Ran off road 21-Skidding/sliding 22-Jacking 23-Load spill 24-Fire/explosion 25-Submersion 26-Rollover 27-Debris on road 28-Debris falling off vehicle 98-Other					
Traffic Control Condition 01-Functioning 02-Not functioning 03-Obscured 04-Missing/Damaged			Fixed Objects 50-Cable guide rail 51-Concrete guide rail 52-Steel guide rail 53-Pole (utility, tower) 54-Pole (sign, parking meter) 55-Fence/noise barrier 56-Culvert 57-Bridge support 58-Rock face 59-Snowbank/drift 60-Ditch 61-Curb 62-Crash cushion/treat. 63-Building or wall 64-Water course 65-Construction marker 66-Tree, shrub, stump 99-Other					
Road Character 01-Undivided - one-way 02-Undivided - two-way 03-Divided with restraining barrier 04-Divided - no barrier 05-Ramp 06-Collector lane 07-Express lane 08-Transfer lane			Fixed Object Offset 01-Right of Roadway 02-Less than 3.1 m 03-3.1 m to 6.0 m 04-6.1 m to 9.0 m 05-Greater than 9.0 m 06-Right of Roadway 07-Less than 3.1 m 08-3.1 m to 6.0 m 09-6.1 m to 9.0 m 10-Greater than 9.0 m					
Road Surface 01-Asphalt 02-Oil treated gravel 03-Gravel or crushed stone 04-Concrete 05-Earth 06-Wood 07-Steel 08-Brick/interlocking stone 99-Other			Vehicle Damage 01-None 02-Light 03-Moderate 04-Severe 05-Demolished					
Road Condition 01-Good 02-Poor 03-Under repair or construction			Location of Vehicle Damage or Area of Impact 01-Right front corner 02-Right front 03-Right centre 04-Right rear 05-Right rear corner 06-Back centre 07-Left rear corner 08-Left rear 09-Left centre 10-Left front 11-Left front corner 12-Front centre 13-Front complete 14-Right side complete 15-Back complete 16-Left side complete 17-Top 18-Undercarriage 19-No contact 00-Unknown Multiple Choices Allowed					
Road Surface Condition 01-Dry 02-Wet 03-Loose snow 04-Slush 05-Packed snow 06-Ice 07-Mud 08-Loose sand or gravel 09-Spilled liquid 99-Other								
Road Alignment 01-Straight on level 02-Straight on hill 03-Curve on level 04-Curve on hill			Special Studies Date Revised 2005 2007 2008 2011 2015					
Road Pavement Markings 01-Exist 02-Non - existent 03-Obscured 04-Faded			Vehicle Type 01-Automobile, station wagon 02-Motorcycle 03-Moped 04-Passenger van (SUV) 05-Pickup truck 06-Delivery van 07-Tow truck 08-Truck - open 09-Truck - closed 10-Truck - tank 11-Truck - dump 12-Truck - car carrier 13-Truck - tractor 14-Municipal transit bus 15-Intercity bus 16-Bus (other) 17-School bus 18-School van 19-Other school vehicle/bus 20-Motor home 21-Off-road 2 wheels 22-Off-road 3 wheels 23-Off-road 4 wheels 24-Off-road - other 25-Motorized snow vehicle 26-Farm tractor 27-Other farm vehicle 28-Construction equipment 29-Railway train 30-Street car 31-Snow plow 32-Ambulance 33-Fire vehicle 34-Police vehicle 35-Other emergency vehicle 36-Bicycle 37-Buggy (horse) 00-Unknown 97-Other Motor Vehicle 98-Other Truck 99-Other Non-motorized Vehicle			Bicycle Action 13-Cycling in crosswalk 14-Cycling in crosswalk against traffic 15-Cycling on sidewalk 16-Cycling on sidewalk against traffic 17-Cycling on roadway 18-Cycling on roadway against traffic 19-Cycling across roadway (not at intersection) 20-Cycling in Roundabout crosswalk with entering vehicle 21-Cycling in Roundabout crosswalk with exiting vehicle		
Towed Vehicle 01-Recreation trailer or semi-trailer - house, tent 02-Boat trailer 03-Small utility trailer 04-Wheeled device or apparatus 05-Large full trailer 06-Large semi-trailer 07-Double (semi-trailer-semi-trailer) 08-Double (semi-trailer-trailer) 09-Farm equipment 10-Towed motor vehicle 99-Other			Trailer Connection - Double Semi-Trailers Only 01-single drawbar dolly (A Train) 02-5th wheel connection only (B Train) 03-double drawbar dolly (C Train) 99-Other					
Vehicle Condition 01-No apparent defect 99-Defect			Apparent Driver Action 01-Driving Properly 02-Following too close 03-Exceeding speed limit 04-Speed too fast for condition 05-Speed too slow 06-Improper turn 07-Disobeyed traffic control 08-Failed to yield right-of-way 09-Improper passing 10-Lost control 11-Wrong way on one-way road 12-Improper lane change 13-Evasive Action 99-Other					
Driver/Pedestrian Condition 01-Normal 02-Had been drinking 03-Ability impaired, alcohol (over 0.08) 04-Ability impaired, alcohol 05-Ability impaired, drugs 06-Fatigue 07-Medical or physical disability 08-Inattentive 00-Unknown 99-Other			Pedestrian Action 01-Crossing with right-of-way 02-Crossing without right-of-way 03-Crossing - no traffic control 04-Crossing ped. crossover 05-Crossing marked crosswalk without right-of-way 06-Walking on roadway with traffic 07-Walking on roadway against traffic 08-On sidewalk or shoulder 09-Playing or working on highway 10-Coming from behind parked vehicle or object 11-Running onto roadway 12-Person getting on/off school bus 13-Person getting on/off vehicle 14-Pushing/working on vehicle 15-Crossing Roundabout with an entering vehicle 16-Crossing Roundabout with an exiting vehicle 99-Other					
Veh. No. Ped. No. 69 70 71			Involved Person's Name (Surname first) and Address _____ _____ _____					

Total number of vehicles involved in collision (TOTNOVEH)

Total number of injured persons in collision (INUTOTNO)

Docs # 2061837

D

Appendix D Future Background Traffic Operations

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

02-19-2025

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	309	26	24	436	131	59
Future Volume (Veh/h)	309	26	24	436	131	59
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.69	0.66	0.78	0.86	0.85
Hourly flow rate (vph)	412	38	36	559	152	69
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			450		1062	431
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			450		1062	431
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		37	89
cM capacity (veh/h)			1100		241	622
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	450	36	559	221		
Volume Left	0	36	0	152		
Volume Right	38	0	0	69		
cSH	1700	1100	1700	299		
Volume to Capacity	0.26	0.03	0.33	0.74		
Queue Length 95th (m)	0.0	0.8	0.0	43.7		
Control Delay (s)	0.0	8.4	0.0	44.8		
Lane LOS		A		E		
Approach Delay (s)	0.0	0.5		44.8		
Approach LOS				E		
Intersection Summary						
Average Delay			8.1			
Intersection Capacity Utilization			40.5%	ICU Level of Service		A
Analysis Period (min)			15			

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (m)	1.4	10.4	31.0
Average Queue (m)	0.0	1.7	16.4
95th Queue (m)	1.0	7.7	27.3
Link Distance (m)	685.9		29.9
Upstream Blk Time (%)			1
Queuing Penalty (veh)			2
Storage Bay Dist (m)		85.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

02-19-2025

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↘	↱	↘↙	
Traffic Volume (veh/h)	559	132	96	426	58	74
Future Volume (Veh/h)	559	132	96	426	58	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.84	0.69	0.90	0.83	0.84
Hourly flow rate (vph)	601	157	139	473	70	88
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			758		1430	680
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			758		1430	680
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			84		44	81
cM capacity (veh/h)			858		125	451
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	758	139	473	158		
Volume Left	0	139	0	70		
Volume Right	157	0	0	88		
cSH	1700	858	1700	210		
Volume to Capacity	0.45	0.16	0.28	0.75		
Queue Length 95th (m)	0.0	4.6	0.0	40.9		
Control Delay (s)	0.0	10.0	0.0	60.9		
Lane LOS		B		F		
Approach Delay (s)	0.0	2.3		60.9		
Approach LOS				F		
Intersection Summary						
Average Delay			7.2			
Intersection Capacity Utilization			60.5%	ICU Level of Service	B	
Analysis Period (min)			15			

Queuing and Blocking Report
Future Bkgd PM Peak

02-19-2025

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (m)	4.5	22.1	33.7
Average Queue (m)	0.4	9.8	15.5
95th Queue (m)	2.9	19.2	27.3
Link Distance (m)	685.9		29.9
Upstream Blk Time (%)			1
Queuing Penalty (veh)			2
Storage Bay Dist (m)		85.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

E

Appendix E Signal Warrant

Analysis Sheet

Input Sheet

Results Sheet

Proposed Collision

GO TO Justification:

Intersection: Cedar Street and Grand Ridge Drive

Count Date: 2025-01-30

Justification 1: Minimum Vehicle Volumes

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00		
1A	☐	☒	☐	☐										
	480	720	600	900	958	862	624	745	731	997	1,345	1,203		
	COMPLIANCE %				100	100	87	100	100	100	100	100	787	98
1B	180	255	180	255	194	177	93	122	100	106	149	134		
	COMPLIANCE %				76	69	36	48	39	42	58	53	422	53
Restricted Flow Signal Justification 1:					Both 1A and 1B 100% Fulfilled each of 8 hours Lesser of 1A or 1B at least 80% fulfilled each of 8 hours								Yes ☐ Yes ☐	No ☒ No ☒

Justification 2: Delay to Cross Traffic

Restricted Flow Urban Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW ☐	RESTR. FLOW ☒	FREE FLOW ☐	RESTR. FLOW ☐	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00		
2A	480	720	600	900	764	685	531	623	631	891	1,196	1,069		
	COMPLIANCE %				100	95	74	87	88	100	100	100		
2B	50	75	50	75	142	113	51	64	51	63	75	55		
	COMPLIANCE %				100	100	68	85	68	84	100	73		
Restricted Flow Signal Justification 2:					Both 2A and 2B 100% fulfilled each of 8 hours Lesser of 2A or 2B at least 80% fulfilled each of 8 hours								Yes ☐ Yes ☒	No ☒ No ☐

Justification 3: Combination

Combination Justification 1 and 2

Justification Satisfied 80% or More				Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES ☐	NO ☒	YES ☐	NO ☒
Justification 2	Delay Cross Traffic	YES ☒	NO ☐	NOT JUSTIFIED	

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main) X	Heaviest Minor Approach Y (actual)	Required Value Y (warrant threshold)	Average % Compliance	Overall % Compliance
Justification 4	8:00	764	194	163	100 %	96 %
	16:00	891	106	127	84 %	
	17:00	1,196	149	80	100 %	
	18:00	1,069	134	89	100 %	

Justification 5: Collision Experience

Justification	Preceding Months	% Fulfillment	Overall % Compliance
Justification 5	1-12	0 %	0 %
	13-24	0 %	
	25-36	0 %	

Justification 6: Pedestrian Volume

Pedestrian Volume Analysis

8 Hour Vehicular Volume V_8		Net 8 Hour Pedestrian Volume				
		< 200	200 - 275	276 - 475	476 - 1000	>1000
Justification 6A	< 1440					
	1440 - 2600					
	2601 - 7000	Not Justified				
	> 7000					

Pedestrian Delay Analysis

Net Total 8 Hour Volume of Total Pedestrians		Net Total 8 Hour Volume of Delayed Pedestrians		
		< 75	75 - 130	> 130
Justification 6B	< 200	Not Justified		
	200 - 300			
	> 300			

F

Appendix F Future Total Traffic Operations

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

03-07-2025

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↘	↗	↘	
Traffic Volume (veh/h)	309	30	27	436	145	66
Future Volume (Veh/h)	309	30	27	436	145	66
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.69	0.66	0.78	0.86	0.85
Hourly flow rate (vph)	412	43	41	559	169	78
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			455		1074	434
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			455		1074	434
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		28	87
cM capacity (veh/h)			1095		236	620
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	455	41	559	247		
Volume Left	0	41	0	169		
Volume Right	43	0	0	78		
cSH	1700	1095	1700	294		
Volume to Capacity	0.27	0.04	0.33	0.84		
Queue Length 95th (m)	0.0	0.9	0.0	57.1		
Control Delay (s)	0.0	8.4	0.0	58.4		
Lane LOS		A		F		
Approach Delay (s)	0.0	0.6		58.4		
Approach LOS				F		
Intersection Summary						
Average Delay			11.4			
Intersection Capacity Utilization			41.7%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Grand Ridge Dr & Site Access

03-07-2025

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	0	0	190	50	7
Future Volume (Veh/h)	21	0	0	190	50	7
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	0	0	207	54	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	265	58	62			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	265	58	62			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	724	1008	1541			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	23	207	62			
Volume Left	23	0	0			
Volume Right	0	0	8			
cSH	724	1541	1700			
Volume to Capacity	0.03	0.00	0.04			
Queue Length 95th (m)	0.8	0.0	0.0			
Control Delay (s)	10.1	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	10.1	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay		0.8				
Intersection Capacity Utilization		20.0%		ICU Level of Service		A
Analysis Period (min)		15				

Queuing and Blocking Report

Future Total AM Peak

03-07-2025

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (m)	14.3	33.3
Average Queue (m)	3.0	18.7
95th Queue (m)	10.5	30.5
Link Distance (m)		29.9
Upstream Blk Time (%)		2
Queuing Penalty (veh)		3
Storage Bay Dist (m)	85.0	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: Grand Ridge Dr & Site Access

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	8.9	13.1
Average Queue (m)	4.2	1.4
95th Queue (m)	11.2	8.8
Link Distance (m)	111.9	330.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 3

HCM Unsignalized Intersection Capacity Analysis

1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

03-07-2025

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	559	143	104	426	64	81
Future Volume (Veh/h)	559	143	104	426	64	81
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.84	0.69	0.90	0.83	0.84
Hourly flow rate (vph)	601	170	151	473	77	96
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			771		1461	686
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			771		1461	686
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			82		35	79
cM capacity (veh/h)			848		118	447
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	771	151	473	173		
Volume Left	0	151	0	77		
Volume Right	170	0	0	96		
cSH	1700	848	1700	199		
Volume to Capacity	0.45	0.18	0.28	0.87		
Queue Length 95th (m)	0.0	5.2	0.0	52.6		
Control Delay (s)	0.0	10.2	0.0	82.3		
Lane LOS		B		F		
Approach Delay (s)	0.0	2.5		82.3		
Approach LOS				F		
Intersection Summary						
Average Delay			10.1			
Intersection Capacity Utilization			62.4%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: Grand Ridge Dr & Site Access

03-07-2025

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	0	0	132	228	19
Future Volume (Veh/h)	13	0	0	132	228	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	0	0	143	248	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	402	258	269			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	402	258	269			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	605	780	1295			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	14	143	269			
Volume Left	14	0	0			
Volume Right	0	0	21			
cSH	605	1295	1700			
Volume to Capacity	0.02	0.00	0.16			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	11.1	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	11.1	0.0	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization		23.2%		ICU Level of Service		A
Analysis Period (min)		15				

Queuing and Blocking Report

Future Total PM Peak

03-07-2025

Intersection: 1: Grand Ridge Dr & Cedar Creek Rd/Cedar St

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (m)	7.3	23.5	32.8
Average Queue (m)	0.5	10.8	18.6
95th Queue (m)	3.9	19.5	31.1
Link Distance (m)	685.9		29.9
Upstream Blk Time (%)			3
Queuing Penalty (veh)			5
Storage Bay Dist (m)		85.0	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 2: Grand Ridge Dr & Site Access

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (m)	11.3	27.2
Average Queue (m)	3.2	1.6
95th Queue (m)	10.2	11.5
Link Distance (m)	111.9	330.4
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 5
