



City of
Peterborough

To: Members of the General Committee

From: Blair Nelson, Commissioner, Infrastructure, Planning and Growth Management

Meeting Date: March 10, 2025

Report: Bensfort Road and Otonabee Drive Traffic Signal and All-Way Stop Review, Report IPGENG25-007

Subject

A report to present the findings of the Bensfort Road and Otonabee Drive Traffic Signal and All-Way Stop Review.

Recommendation

That the General Committee approve the recommendation outlined in Report IPENG25-007, dated March 10, 2025, of the Commissioner of Infrastructure, Planning and Growth Management as follows:

- a) That the following recommended improvements at the intersection of Bensfort Road and Otonabee Drive be approved:
 - i. Relocation of the stop sign and stop bar on Otonabee Drive at Bensfort Road.
 - ii. Implementation of a painted median island, painted edge lines, and painted curb radii.

Executive Summary

- In response to a motion of Council, staff undertook a traffic study to review the need for traffic signals or an all-way stop at the intersection of Bensfort Road and Otonabee Drive.
- Results of the technical assessment and warrant review showed that neither traffic signals nor all-way stop control are warranted at this time.
- With the rejuvenation of Denne Park, staff recognize there may be increased pedestrian activity crossing at the intersection outside of the existing school crossing guard times. For this reason, staff reviewed the need for Intersection Pedestrian Signal (IPS), the results of which concluded that an IPS is not warranted at this time.

Background

Council at its meeting on April 29, 2024, passed the following motion:

“That staff be directed to report back to Council in 2024 on the need for an all-way stop or traffic signal at the intersection of Bensfort Road and Otonabee Drive.”

Site Details

Bensfort Road is a two-lane medium-capacity arterial road running north-south from the Otonabee River to the southern City limit. Otonabee Drive is a two-lane high-capacity collector road running east-west between Corrigan Crescent/Ashburnham Drive and Bensfort Road. The two-way vehicle volume on Bensfort Road is approximately 6,100 vehicles per day, and there are approximately 2,400 vehicles per day on Otonabee Drive. The intersection of Bensfort Road and Otonabee Drive is currently operating with stop control on Otonabee Drive. The posted speed limit on both roads in the vicinity of the intersection is 40 km/h. Concrete sidewalk is located on the west side of Bensfort Road and on the south side of Otonabee Drive and there is a transit stop on the east side of Bensfort Road just north of Otonabee Drive. A school crossing guard is located on the south leg of the intersection during school admission and dismissal times to assist students crossing Bensfort Road to and from St. Patrick Catholic Elementary School. Both Bensfort Road and Otonabee Drive have a rural cross-section with gravel shoulders and roadside ditches. A map of the subject area is shown in Appendix A.

Traffic Operational Review

The traffic operational review at the intersection of Bensfort Road and Otonabee Drive included the following data collection and analysis:

- Vehicle Volume;
- Pedestrian Volume;
- Collision History;
- Speed Study;
- Sight Line Review; and
- Site Observations.

Vehicle Volume

A 12-hour traffic movement count (TMC) was conducted at the intersection of Bensfort Road and Otonabee Drive from 7 a.m. to 7 p.m. A total of 6,154 vehicles were recorded entering the intersection during the 12-hour period, of which 15% (930 vehicles) were on Otonabee Drive.

Pedestrian Volume

A 12-hour pedestrian volume count was conducted at the intersection of Bensfort Road and Otonabee Drive from 7 a.m. to 7 p.m. A total of 84 pedestrians were recorded crossing the intersection during the 12-hour period, of which 75 pedestrians crossed Bensfort Road and 9 crossed Otonabee Drive.

Collision History

There have been 2 reported motor vehicle collisions at the intersection of Bensfort Road and Otonabee Drive over the past three years. Records show both collisions involved vehicles turning left from Otonabee Drive.

Speed Study

The operating speed (85th percentile speed) is the speed at or below which 85% of vehicles are travelling on a roadway. On Bensfort Road, 85% of vehicles were recorded driving at or below 58 km/h, while the average speed was 51 km/h.

Sight Line Review

Stopping sight distances were measured for vehicles travelling north and southbound on Bensfort Road approaching the intersection at Otonabee Drive. Sightline distances were also measured for vehicles stopped on Otonabee Drive waiting to turn onto Bensfort Road.

The stopping sight distance is the minimum distance required for a driver to perceive the need to stop plus the reaction and deceleration time to bring the vehicle to a

complete stop for the prevailing operating speed. The measured stopping sight distance for vehicles travelling south and northbound on Bensfort Road is greater than the minimum stopping sight distance of 85 metres specified in the Transportation Association of Canada (TAC) Guidelines based on a design speed of 60km/h.

The sight line distance is the minimum distance required for a driver stopped on the side road to perceive a gap in traffic plus the reaction and acceleration time necessary to cross the intersection or turn onto the intersecting roadway and then accelerate to the normal operating speed without interfering with through traffic. The measured sight line distances for vehicles on Otonabee Drive turning left and right from the stop bar are 150 metres and 145 metres respectively. The intersection sight lines meet the minimum requirements as set out by the TAC Design Guidelines, being 130 metres and 110 metres clear sight distances for left and right turning vehicles.

Site Observations

A site visit was conducted to better assess the existing driving and environmental conditions. The geometric layout of the intersection is a conventional T-intersection with stop control on Otonabee Drive. The stop sign on Otonabee Drive is placed within a grassed area behind the shoulder, approximately 9.0 metres back from the edge of pavement on Bensfort Road. From the stop bar location, drivers have a clear view of vehicles approaching the intersection, however; their view maybe improved by relocating both the stop sign and the painted stop bar towards the west closer to Bensfort Road. Trimming of overgrown vegetation along the east limits of the Bensfort Road right-of-way would also improve sight lines.

In addition to reviewing the geometric layout of the intersection, staff noted the planned rejuvenation at Denne Park on the west side of the intersection. These works include the construction of playground equipment, shade shelter, picnic tables and formalization of existing walking paths connecting the park to Denne Crescent and Bensfort Road. With the location of the park being adjacent to the intersection, staff undertook a review for the need for an Intersection Pedestrian Signal (IPS).

Signal Warrant Analysis

The City of Peterborough uses a standardized warrant procedure to determine if traffic signals are needed at an intersection. The warrant procedure outlined in the Ontario Traffic Manual Book 12: Traffic Signals was developed by the Ontario Ministry of Transportation and a Technical Working Group comprised of members from several Ontario Municipalities. It is used by road authorities across the province to assess the need for signalization.

The function of a traffic control signal is to alternate the right-of-way between conflicting streams of vehicular traffic, or vehicular traffic and pedestrians crossing a roadway. Accordingly, the traffic signal warrant process assesses the volume of traffic on both roadways, the volume of traffic and number of pedestrians trying to cross the main

roadway and considers the collision history for the types of incidents that are susceptible to correction by the installation of a traffic signal. Data collected at the intersection is compared to standard criteria to determine the degree to which the criteria is satisfied. The minimum vehicle volume warrant assesses the overall delay from a large volume of intersecting traffic to determine if signals are justified. The delay to cross traffic warrant reviews the minor road traffic delay specifically. Where there are excessive delays for minor road uses or the major road volume is so heavy that crossing the main road is hazardous, signals may be justified. The four-hour volume warrant takes into consideration intersections that experience commuter traffic volumes or commercial area peak hour traffic that otherwise may not meet the 8-hour volume warrants.

Table 1 below, summarizes the warrant criteria required for traffic signals to be justified as well as the percentage of compliance of the actual traffic volumes and collisions for the Bensfort Road and Otonabee Drive intersection.

Table 1: Signal Warrant Results

Justification	Sub Justification	Required	Compliance Percentage ***	Warrant Criteria Met or Failed?
1. Minimum Vehicular Volume	1A. Total Volume	Total volume exceeds 720 vph* for highest 8 hours 100% compliance	78%	Failed
	1B. Crossing Volume	Minor street volume exceeds 255 vph* for highest 8 hours 100%compliance	33%	
2. Delay to Cross Traffic	2A. Main Road	Major street volume exceeds 720 vph* for highest 8 hours 100% compliance	67%	Failed
	2B. Crossing Road	Minor street traffic crossing major street exceeds 75 vph* for highest 8 hours 100% compliance	69%	
3. Combination	3A. Justification 1 Minimum Vehicle Volume	If Justifications 1A and 1B do not meet 100%, but are at least 80%, the lesser fulfilled	33%	Failed

		justification is used for assessment 80% minimum for compliance		
	3B. Justification 2 Delay to Cross Traffic	If Justifications 2A and 2B do not meet 100%, but are at least 80%, the lesser fulfilled justification is used for assessment 80% minimum for compliance	67%	
4. Four-hour Volume		Minor street volume and major street volumes exceed justification threshold ** 100% compliance	40%	Failed
5. Collision Experience		Fifteen or more reportable collisions, susceptible to correction with implementation of signalization, over a 36-month period. 100% compliance	13%	Failed

*vph= vehicles per hour

** based on OTM Book 12, Fig. 21 – Minimum 4 Hour Justification (Restricted Flow Graph)

*** actual percentage of warrant criteria met for traffic volumes and collisions based on OTM Book 12 Section 4.3 Principles of Justification

The Benfort Road and Otonabee Drive intersection failed to meet the minimum threshold for total vehicle volume, delay to cross traffic, four-hour volume and collision experience, and signalization of the intersection is not recommended at this time.

All-Way Stop Warrant Analysis

The key factors used to assess the need for the implementation of all-way stop control include collision history, minimum vehicle volume and traffic flow. Special consideration for visibility constraints may also warrant the implementation of all-way stop control. The technical justification for the installation of an all-way stop is broken down into three main warrants based on the Ontario Traffic Manual Book 5: Regulatory Signs. Warrant

A, Warrant B or Warrant C must be completely satisfied to consider the implementation of an all-way stop.

Warrant A: Collision History Warrant for Arterial Roads

The Collision History Warrant for Arterial roads requires an average of four or more collisions per year over a three-year period. Only collisions susceptible to improvement through all-way stop control should be considered.

Warrant B: Volume Warrant for Arterial Roads

B1 The total volume on all intersection approaches exceeds 500 vehicles per hour for each of the highest eight hours of the day.

B2 The combined vehicle and pedestrian volume on the minor street exceeds 200 units per hour for each of the same eight hours as the total volume; OR

The combined vehicle and pedestrian volume on the minor street exceed 150 units per hour for each of the same eight hours as the total volume, with an average delay to all minor street traffic of greater than 30 seconds for the entire eight-hour period.

B3 The volume split does not exceed 75/25 (for three-legged intersections) as measured over the entire eight-hour count period.

Note: B1, B2, and B3 all need to be satisfied for the warrant to be met.

Warrant C: Visibility Warrant for all Road Types

The Visibility Warrant allows an all-way stop control to be considered at intersections that might not otherwise meet the collision or volume warrants, where the existing intersection geometrics cause insufficient sight distances and all other means to improve the sight distances have been exhausted, an all-way stop control may be considered.

Table 4, below, shows the results of the warrant analysis for the intersection of Bensfort Road and Otonabee Drive.

Table 4: Bensfort Road and Otonabee Drive All-Way Stop Warrant

Arterial Roads Warrant Type		Warrant Requirements		Actual		Met or Failed
Warrant A	Collisions	4 per year over 3 years		2 recorded collisions over past 3 years		Failed
Warrant B	B1: Total Intersection Volume	500 vehicles per hour		Only 5 of the peak 8 hours had vehicle volumes over 500		Failed
	B2: Minor Street Volume and Delay	200 vehicle and pedestrians on minor street for peak 8-hours OR 150 vehicle and pedestrians on minor street with average delay of greater than 30 seconds for the peak 8-hours		Highest hour of the eight-hour volume recorded for combined vehicle and pedestrian volume was 173 on the minor street, the second highest hour was 101		Failed
	B3: Volume Split	Ratio 3 Way 4 Way 75/25 70/30		Ratio 3 Way 4 Way 85/15		Failed
Warrant C	Visibility	insufficient sight distances		TAC sight distances met		Failed

Appropriate use of an all-way stop control condition creates delay to all drivers using the intersection and should only be considered at intersections of two roadways having comparable volume and roadway characteristics. The volume warrant review for Bensfort Road and Otonabee Drive intersection shows there is no existing issue with respect to delay on Otonabee Drive. Bensfort Road being a medium-capacity arterial road serves intra-municipal and inter-regional traffic between major land use areas, whereas Otonabee Drive is a high-capacity collector which serves intra-municipal traffic only for medium distances between arterial and local streets.

The Ontario Traffic Manual specifies various scenarios where the use of an all-way stop control would be considered inappropriate including the following:

- As a means of deterring the movement of through traffic in a residential area; and
- As a speed control device (or a traffic calming tool).

The implementation of an all-way stop control that has not met warrant criteria has the potential to negatively affect the intersection's safety. An unwarranted all-way stop control promotes non-compliance due to the lack of vehicle conflicts within the intersection, which allows drivers to feel more comfortable not coming to a complete stop and instead roll through the stop control.

There are also environmental factors that are impacted by unwarranted all-way stop controls. The additional deceleration and acceleration of vehicles increases fuel consumption as well as greenhouse gas emissions. This is accentuated with larger vehicles like City buses and can also impact timing schedules.

Studies have shown that implementing unwarranted all-way stop at intersections creates delay to drivers which, in-turn, causes drivers to accelerate to higher speeds between intersections to make up the lost time. This pattern has also been observed at some all-way-stop intersections in Peterborough. Installing an unwarranted all-way stop at this location may in fact increase vehicle speeds on Bensfort Road.

Intersection Pedestrian Signal Review

Intersection Pedestrian Signals (IPS) and Mid-block Pedestrian Signals (MPS) are pedestrian activated traffic signals designated solely to provide a gap in traffic to assist pedestrians in safely crossing a major roadway.

The key elements for a City of Peterborough Intersection Pedestrian Signal Warrant include:

- Pedestrian Crossing Volume converted to Equivalent Adult Units (EAU's)
- Total Safe Gaps (Safe Crossing Opportunities)

A pedestrian count was conducted. The peak hour pedestrian counts crossing Bensfort Road, in the vicinity of Otonabee Drive, were converted to Equivalent Adult Units (EAU) which accounts for slower walking speeds and reaction times for vulnerable pedestrians.

The adjusted pedestrian crossing demand for the AM Peak and the PM Peak are shown below in Table 2 and Table 3, respectively:

Table 2: AM Peak Equivalent Adult Units

AM Peak	Counted Pedestrians		EAU Factor		Total EAU
Adults	5	x	1	=	5.0
Children (<12 years)	12	x	2	=	24.0
Persons with a Disability	0	x	2	=	0.0
Senior (>65 years)	0	x	1.5	=	0.0
Total EAU's = 29.0					

Table 3: PM Peak Equivalent Adult Units

PM Peak	Counted Pedestrians		EAU Factor		Total EAU
Adults	4	x	1	=	4.0
Children (<12 years)	11	x	2	=	22.0
Persons with a Disability	0	x	2	=	0.0
Senior (>65 years)	0	x	1.5	=	0.0
Total EAU's = 26.0					

A gap study records the number of safe gaps that exist in the traffic flow that would allow the average pedestrian to safely cross the road. The average pedestrian crossing time on Bensfort Road is 20 seconds, based on an average walking speed of 1.0 m/sec plus a 4 second reaction time.

The gap study showed there were 24 gaps in the AM Peak hour and 19 gaps in the PM Peak hour large enough to cross Bensfort Road.

The data from the pedestrian count and the gap study was evaluated in accordance with the City of Peterborough Intersection Pedestrian Signal Warrant (Appendix B). The warrant analysis shows that an IPS is not warranted.

Discussion

The Bensfort Road and Otonabee Drive intersection does not meet the traffic signal, all-way stop or IPS warrants. A sightline review confirmed that the existing sight lines and the stopping sight distance meet or exceeds TAC guidelines. Sight line improvements may be further improved by relocating the stop sign and painted stop bar location and by trimming overgrown vegetation along the east limits of the Bensfort Road right-of-way.

While the posted speed limit for this section of Bensfort Road at Otonabee Drive is 40 km/h, the operating speed is 58 km/h. Staff recommend changes to the existing pavement markings in the area to encourage lower vehicle speeds on Bensfort Road at Otonabee Drive which also reduces the required sight distances for turning movements at the intersection. With the lack of curb and gutter in the area, the wide rural cross-section may inadvertently be contributing to higher vehicle speeds. The proposed painted centre median and painted edge lines shown in Appendix C will provide clear guidance to drivers while narrowing lane widths to promote lower speeds.

Strategic Plan

Strategic Pillar: Community & Well-being

Strategic Priority: Promote and enforce traffic safety on City roads

Implementing the proposed pavement marking changes will encourage reduced vehicle speeds as well as improve sightlines for vehicles turning from Otonabee Drive.

Strategic Pillar: Governance & Fiscal Sustainability

Strategic Priority: Support a culture of continuous improvement, safety, and innovation to enhance cost-effective delivery of City programs and services.

The recommended pavement marking improvements enhance road safety while also being cost-effective; using the industry standard warrant analysis for traffic signal, all-way stop and intersection pedestrian signal ensures traffic improvements are only recommended when justified.

Strategic Pillar: Infrastructure

Strategic Priority Invest in infrastructure to ensure that it meets the future needs of our growing City.

Recommending the intersection for inclusion in the future Arterial Road Pedestrian Crossing Program acknowledges the importance of this area in promoting active transportation and road safety.

Engagement and Consultation

The intersection review was conducted in consultation between various Divisions including Public Works, Recreation and Parks, Facilities and Property Management, and Asset Management and Capital Planning.

Budget and Financial Implications

The implementation of the recommendations will cost approximately \$20,000, funds for which are available in the 2025 Capital Budget for Traffic Improvements (Project Reference 17-154).

Conclusion

A traffic signal, all-way stop, and intersection pedestrian crossing warrant study was undertaken at the intersection of Bensfort Road and Otonabee Drive. Analysis has shown that these traffic control devices are not warranted at this time. The study also identified higher vehicle speed on Bensfort Road. To encourage lower vehicle speed and improve the sight lines at the intersection, staff recommend minor upgrades to the intersection including the implementation of additional pavement markings and the relocation of the stop sign.

Attachments

Appendix A: Bensfort Road / Otonabee Drive Intersection Area Diagram.

Appendix B: Intersection Pedestrian Signal Warrant.

Appendix C: Proposed Pavement Marking.

Submitted by,

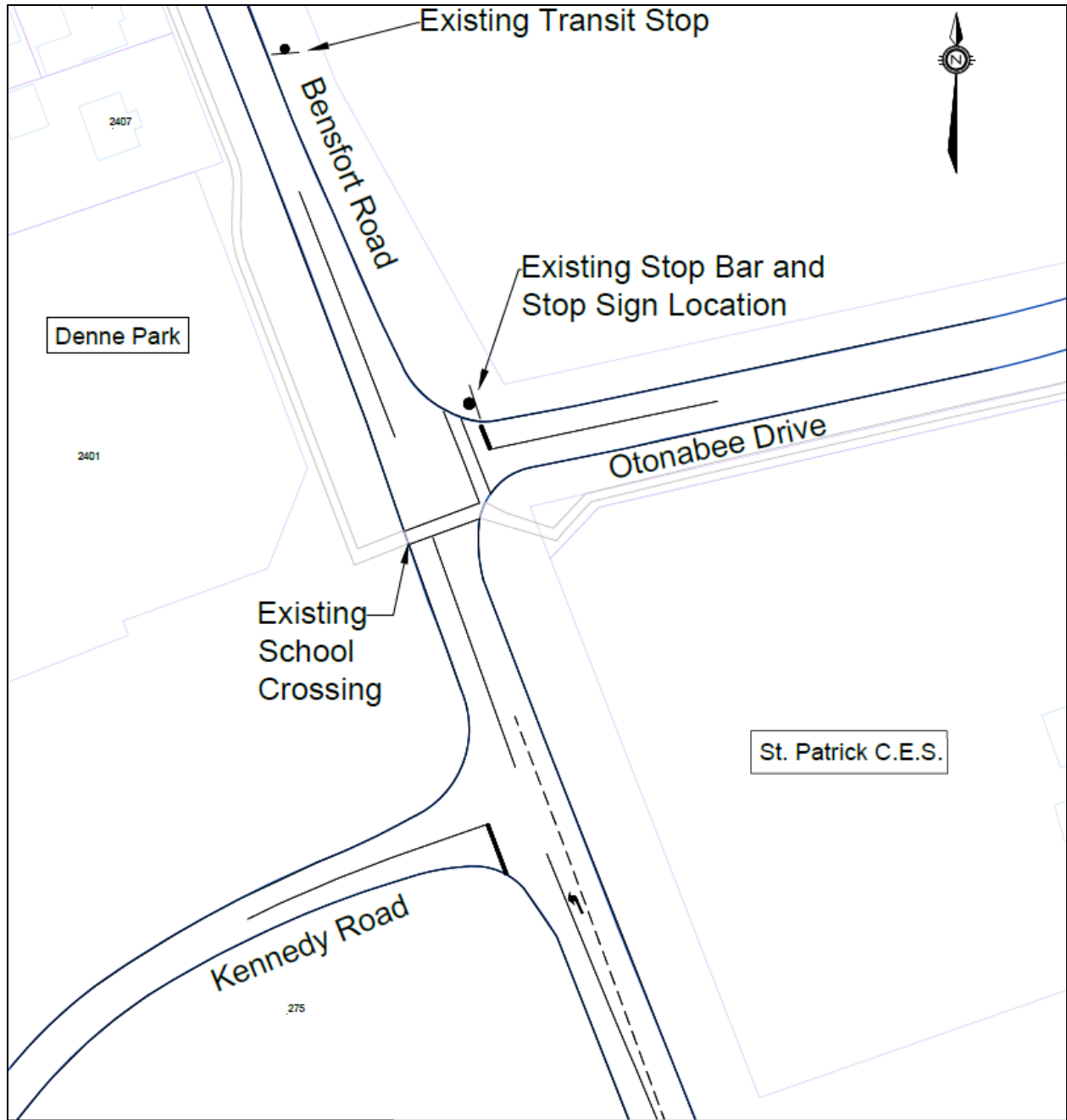
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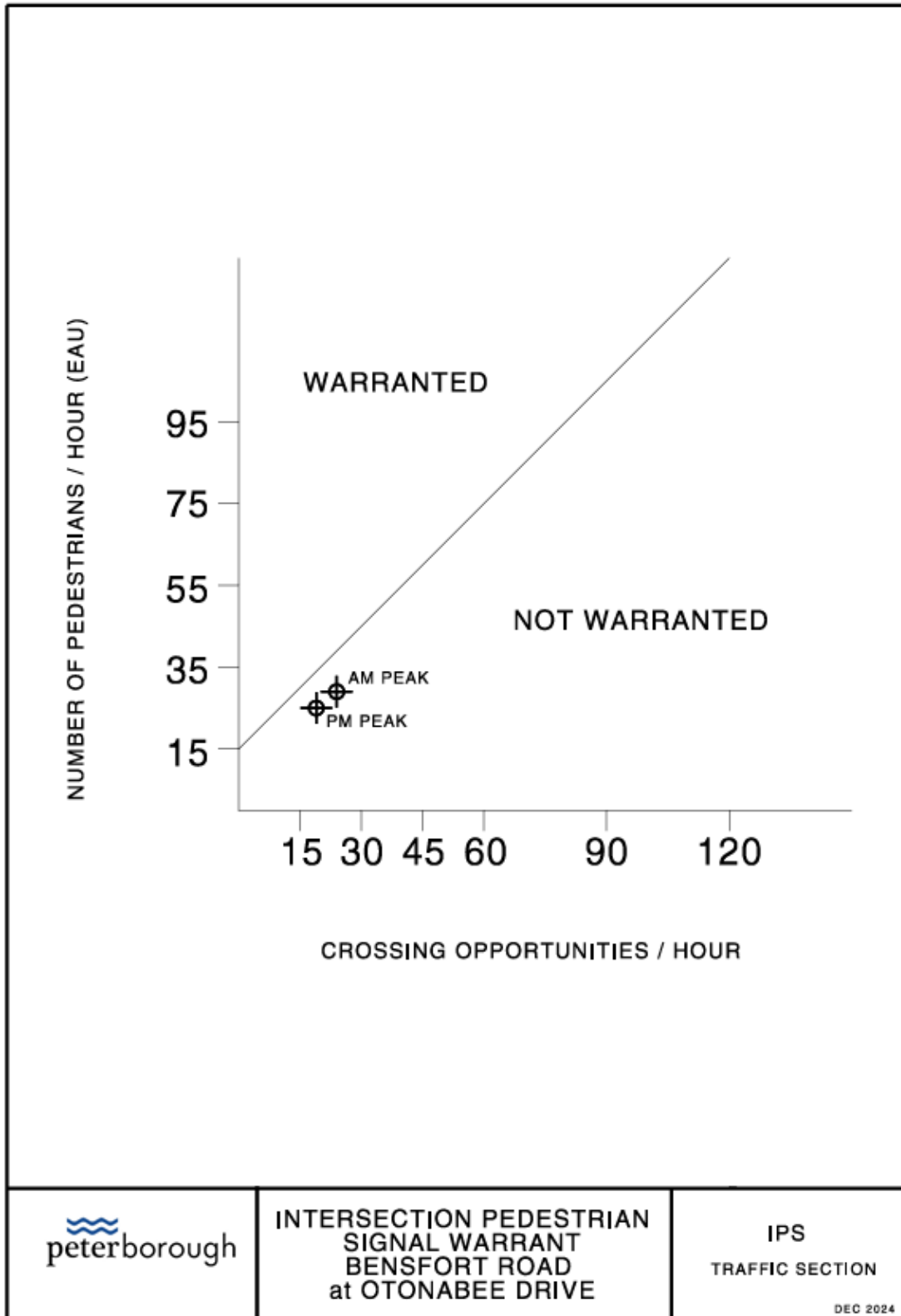
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Appendix A: Bensfort Road / Otonabee Drive Intersection Area Diagram

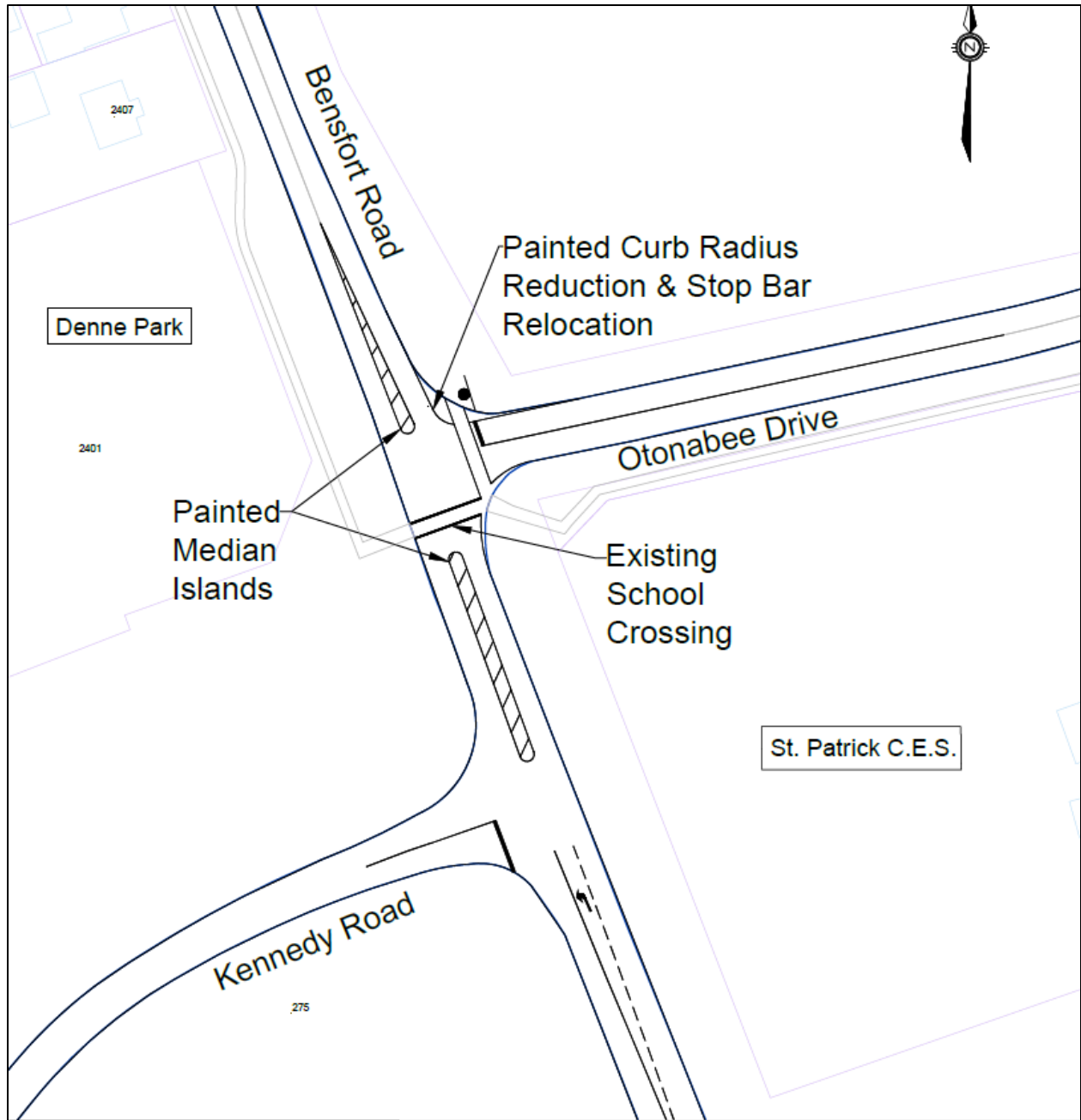



	BENSFORT RD / OTONABEE DR AREA DIAGRAM	1 DRAWING NUMBER:	IPGENG25-007 REPORT NUMBER
		L.M DRAWN BY:	P.M REVIEWED BY:
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Appendix B: City of Peterborough Intersection Pedestrian Signal Warrant



Appendix C: Proposed Pavement Marking.



	BENSFORT RD / OTONABEE DR PROPOSED PAVEMENT MARKINGS	2 DRAWING NUMBER:	IPGENG25-007 REPORT NUMBER
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