



# Guidelines for the Installation of New Traffic Signals 2009



Engineering Department  
City of Kingston

## Introduction and Background

The Engineering Department regularly receives requests for traffic signals to be installed at a variety of locations in the City. The requirement to assess the need for a new traffic signal typically arises after a technical analysis or concerns regarding delay, congestion, safety or pedestrian crossing issues.

When **properly** located, designed, operated and maintained, traffic signals can provide for the orderly movement of traffic, reduce the frequency of certain types of collisions (i.e. right-angle, pedestrian and left-turn), increase the capacity of the minor street and interrupt heavy traffic flows to allow other traffic to enter or cross the intersection.

When **improperly** located, designed, operated and maintained, traffic signals can increase delay and fuel consumption, increase the frequency of certain types of collisions (i.e. rear-end, lane change), cause driver frustration and disrespect for traffic control and may encourage motorists to short-cut through residential areas.

It is therefore important that new traffic signals only be installed after a thorough analysis and careful consideration. The City of Kingston's "Guidelines for the Installation of New Traffic Signals" are intended to provide information regarding the framework currently being used to determine where new traffic signals should be installed.

## Ministry of Transportation Traffic Signal Warrants

Until the 1990's, funding for new traffic signals was subject to a cost-sharing agreement between the Ministry of Transportation Ontario (MTO) and each individual municipality. Provincial funds were only provided if the MTO traffic signal warrants were met. Although the Province no longer provides funding for municipal traffic signals, the MTO traffic signal warrants are still widely used across Ontario.

The City of Kingston generally follows the Ministry of Transportation Ontario's (MTO) warrants to determine if a traffic signal could be installed. A detailed study of the traffic conditions and the physical characteristics are key components to assess whether or not a traffic signal is justified.

The assessment to determine whether or not a traffic signal is justified is made using the following criteria:

- Justification 1 – Minimum Vehicle Volumes
- Justification 2 - Delay to Cross Traffic
- Justification 3 - Collision Experience
- Justification 4 – Combination Experience
- Justification 5 – Pedestrian Experience

The justifications for traffic signals contain minimum required traffic volumes for both “Restricted Flow” and “Free Flow” conditions. The City of Kingston adheres to the MTO definitions for these two flow conditions as follows:

### ***Restricted Flow (Urban) Conditions***

*“Normally encountered in urban areas where the traffic volumes approach or exceed the practical working capacity of the roadway and operating speeds are generally less than 70 km/h.”*

### ***Free Flow (Rural) Conditions***

*“Normally encountered in rural areas and in communities of less than 10,000 population. The operating speeds are generally greater than 70 km/h. Even if the operating speed is less than 70 km/h, treatment of the situation as a free flow case recognizes that the driving characteristics in small communities are different than those in large urban areas.”*

For the above-noted reasons, the large majority of intersections in the City are analyzed as restricted flow. The City will only assess intersections as “free flow” if they are clearly located in a rural area.

The traffic volumes used in the warrant analysis should be collected on a typical day representative of the problem that the signal is expected to address. The eight hours counted during the day should reflect the volumes experienced when the lack of a traffic signal may be an issue.

A traffic signal would be considered warranted if any **ONE** of the justifications are met. The detailed warrant tables and a sample intersection are shown in Appendix A. A description of each justification is as follows:

### **Justification 1 – Minimum Vehicle Volumes**

A traffic signal would be considered warranted if 1A **AND** 1B are **BOTH** 100% fulfilled.

- 1A – total traffic volume on all roadway approaches
- 1B – total traffic volume on the minor road

When applying Justification 1B to **three-legged** (T-intersections), the minimum required values for the minor street are increased by 50%. This higher number is indicative of the fact that with one of the approaches eliminated, the number of potential conflicts between left turns and through movements on the minor road is reduced.

### Justification 2 - Delay to Cross Traffic

The traffic signal would be considered warranted if 2A **AND** 2B are **BOTH** 100% fulfilled.

- 2A – total traffic volume on the main road
- 2B – total crossing traffic volume
- Ø includes the number of pedestrians crossing the main road PLUS total left-turning vehicles from both side road approaches PLUS the highest through vehicle volume from one side approach

### Justification 3 - Collision Experience

A traffic signal would be considered warranted if **ALL** of the following conditions are satisfied:

- The occurrence of an average of **five or more reported collisions per year for the past three years** that most likely would not have occurred with a traffic signal in place.
- Adequate trial of other measures failed to reduce the collision history.
- Justification 1 **OR** Justification 2 satisfied to a minimum of 80%.

### Justification 4 – Combination Experience

A traffic signal would be considered warranted if **TWO OR MORE** of the following conditions are satisfied:

- Justification 1A & 1B are both satisfied to a minimum of 80%.
- Justification 2A & 2B are both satisfied to a minimum of 80%.
- The occurrence of an average of **four or more reported collisions for the past three years** that most likely would not have occurred with a traffic signal in place **AND** adequate trial of other measures failed to reduce the collision history.

**Justification 5 – Pedestrian Experience**

In 2008, Council approved the adoption of the City of Kingston’s Pedestrian Crossing Guidelines. These Guidelines were developed in order to provide direction with respect to the installation of pedestrian crossings in the City. The City of Kingston does not adhere to the MTO warrants for traffic signals for pedestrians.

A traffic signal for pedestrians may be considered when a reasonable number of conditions in Table 1.0 are met.

**Table 1.0 – Assessment for a Pedestrian Signal**

	Actual	Required*	Condition Met
Pedestrian Volume (average/h)	x	80**	Yes/No
Vehicle Volume (AADT)	x	greater than 15,000	Yes/No
Vehicle Speed (km/h)	x	greater than 60	Yes/No
Number of Lanes	x	2 or 4	Yes/No
Sidewalks Present	x	Yes*	Yes/No
Traffic Control within 200 meters	x	No	Yes/No
<b>Number of conditions met:</b>		<b>x</b>	
<b>Recommendation:</b>		<b>Install/do not install pedestrian signal</b>	

\*These conditions must be met for safety-related reasons.

\*\* Pedestrian volume is greater than an average of 80 per hour over the peak **6 hours** of the day. If adjacent to a **school**, pedestrian volume is greater than an average of 80 per hour over the peak **3 hours** of the day

## Ranked and Prioritized List of Local Intersections

The Traffic Division maintains a ranked and prioritized list of intersections in the City that have been assessed for new traffic signals. The ranking system includes a score for each intersection based on the total number of points derived from the traffic signal warrants along with a column for the collision history. Traffic signals will not necessarily be installed at the intersection with the highest warrant score. Other factors such as operational desirability must be considered. This list will be revised on an on-going basis as traffic counts are updated and specific requests received.

The Traffic Division will continue to maintain this ranked and prioritized list of intersections for the consideration of all future new traffic signals. New traffic signals will be installed on a priority basis as schedule and budget permits.

## Special Conditions for Traffic Signal Installation

It is important to note that warrants are guidelines and as such, **there are occasions when a traffic signal may be installed that does not meet the MTO warrants.** For special circumstances, engineering judgement may be used to support the installation of a traffic signal. Similarly, there is no requirement to install a traffic signal at a location that meets the warrants.

*“Justifications should be used as a guide to determining the need for traffic control signals rather than as absolute criteria. The fulfillment of a traffic signal justification or justifications shall not in itself **require** the installation of a traffic control signal; the justifications must be used in combination with experience, professional judgment and economic analysis. The satisfaction of the signal installation justifications is only one criterion for determining the suitability of traffic control signals for any location.”*

*Source: Book 12, Ontario Traffic Manual, 2001*

The City will consider the installation of a traffic signal at a location that **does not meet the warrants**, under the following circumstances:

- Existing sight distance issue exists that could be improved with the installation of a traffic signal.
- Traffic signal is required for transit operations.
- A neighbourhood shortcutting issue could be mitigated.
- Traffic signal(s) is required to facilitate a development. *(Note: these traffic signals are typically wholly funded or cost-shared with the developer)*
- In conjunction with planned roadway construction; if the traffic signal is expected to meet the warrants in the near future.

The City will **NOT** consider the installation of a traffic signal that meets the warrants, under the following circumstances:

- The proposed location is too close to an existing intersection that may or may not be controlled by a traffic signal.
- Existing sight distance issue that could be worsened with the installation of a traffic signal.
- The traffic signal would seriously disrupt traffic flow.
- There may not be enough space for an appropriate length of left-turn lane on major approach

## Conclusions

When the requirement to assess the need for a new traffic signal arises, the City will adhere to the "Guidelines for the Installation of New Traffic Signals" in order to determine if a traffic signal is warranted. The justifications will be used as a guide to determining the need for traffic control signals rather than as absolute criteria. The fulfillment of a traffic signal justification or justifications will not in itself **require** the installation of a traffic control signal. The justifications will be used in combination with experience and professional judgement. Traffic signals will only be installed after a thorough analysis and careful consideration.

The Traffic Division will continue to maintain a ranked and prioritized list of intersections that have been assessed for all future new traffic signals. New traffic signals will be installed on a priority basis as schedule and budget permits.

## References

Book 12, Traffic Signals, Ontario Traffic Manual, July 2001, Ministry Transportation Ontario

City of Kingston's Pedestrian Crossing Guidelines, April 2008

## APPENDIX A

**4-LEGGED INTERSECTION**  
**Warrant #1: Minimum Vehicular Volumes**

**A. All Approaches**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		480	720	600	900	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		385	575	480	720	score	score	score	score	score	score	score	score
		100% fulfilled				score	score	score	score	score	score	score	score
		80% fulfilled				score	score	score	score	score	score	score	score
		Actual percentage if less than 80%				score	score	score	score	score	score	score	score

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

**B. Minor Street Both Approaches**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		120	170	120	170	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		95	135	95	135	score	score	score	score	score	score	score	score
		100% fulfilled				score	score	score	score	score	score	score	score
		80% fulfilled				score	score	score	score	score	score	score	score
		Actual percentage if less than 80%				score	score	score	score	score	score	score	score

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

**3-LEGGED INTERSECTION**  
**Warrant #1: Minimum Vehicular Volumes**

**A. All Approaches**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		480	720	600	900	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		385	575	480	720	score	score	score	score	score	score	score	score
		100% fulfilled				score	score	score	score	score	score	score	score
		80% fulfilled				score	score	score	score	score	score	score	score
		Actual percentage if less than 80%				score	score	score	score	score	score	score	score

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

**B. Minor Street Both Approaches**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		180	255	180	255	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		143	203	143	203	score	score	score	score	score	score	score	score
		100% fulfilled				score	score	score	score	score	score	score	score
		80% fulfilled				score	score	score	score	score	score	score	score
		Actual percentage if less than 80%				score	score	score	score	score	score	score	score

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

**3 OR 4-LEGGED INTERSECTION  
Warrant #2: Delay to Cross Traffic**

**A. Major Street Both Approaches**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		480	720	600	900	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		385	575	480	720	score	score	score	score	score	score	score	score

100% fulfilled	score						
80% fulfilled							
Actual percentage if less than 80%							

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

**B. Traffic Crossing Major Street**

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
Required min. volume for 100% score		50	75	50	75	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume	actual volume
Required min. volume for 80% score		40	60	40	60	score	score	score	score	score	score	score	score

100% fulfilled	score						
80% fulfilled							
Actual percentage if less than 80%							

Total score for 8 hours = x

**Total average score for 8 hours = x/8**

## EXAMPLE: Taylor Kidd Boulevard & Old Colony Road Warrant #2: Delay to Cross Traffic

### A. Major Street Both Approaches

1 lane each way			Highest 8 Hours of the Day								
			2 lanes each way		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7
Free Flow	Restricted Flow	Restricted Flow	Free Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
480	720	720	600	1010	1466	1129	1025	1134	1205	1276	1593
385	575	575	480								
Required min. volume for 100% score				100	100	100	100	100	100	100	100
Required min. volume for 80% score				100% fulfilled							
				80% fulfilled							
				Actual percentage if less than 80%							

Total score for 8 hours = 800

**Total average score for 8 hours = 100%**

### B. Traffic Crossing Major Street

1 lane each way			Highest 8 Hours of the Day								
			2 lanes each way		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7
Free Flow	Restricted Flow	Restricted Flow	Free Flow	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8
50	75	75	50	121	204	90	72	91	90	86	79
40	60	60	40								
Required min. volume for 100% score				100	100	100	100	100	100	100	100
Required min. volume for 80% score				100% fulfilled							
				80							
				Actual percentage if less than 80%							

Total score for 8 hours = 780

**Total average score for 8 hours = 98%**

**EXAMPLE: Taylor Kidd Boulevard & Old Colony Road  
(3-LEGGED INTERSECTION)**

**Warrant #1: Minimum Vehicular Volumes**

**A. All Approaches**

	1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
	Free Flow	Restricted Flow	Free Flow	Restricted Flow	8:00	9:00	10:00	12:00	13:00	14:00	16:00	17:00
					11:00	12:00	13:00	14:00	15:00	16:00	17:00	
Required min. volume for 100% score	480	720	600	900	1163	1755	1269	1156	1278	1356	1428	1744
Required min. volume for 80% score	385	575	480	720								
	100% fulfilled				100	100	100	100	100	100	100	100
	80% fulfilled											
	Actual percentage if less than 80%											

Total score for 8 hours = 800

**Total average score for 8 hours = 100%**

**B. Minor Street Both Approaches**

	1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
	Free Flow	Restricted Flow	Free Flow	Restricted Flow	8:00	9:00	10:00	12:00	13:00	14:00	16:00	17:00
					11:00	12:00	13:00	14:00	15:00	16:00	17:00	
Required min. volume for 100% score	180	255	180	255	153	289	140	131	144	151	152	151
Required min. volume for 80% score	143	203	143	203								
	100% fulfilled				100							
	80% fulfilled											
	Actual percentage if less than 80%				60	55	51	56	59	60	59	59

Total score for 8 hours = 501

**Total average score for 8 hours = 63%**

# EXAMPLE: Taylor Kidd Boulevard & Old Colony Road

## Warrant #2: Delay to Cross Traffic

### A. Major Street Both Approaches

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	8:00	9:00	10:00	12:00	13:00	14:00	16:00	17:00
Required min. volume for 100% score		480	720	600	900	1010	1466	1129	1025	1134	1205	1276	1593
Required min. volume for 80% score		385	575	480	720								
		100% fulfilled		100		100	100	100	100	100	100	100	100
		80% fulfilled		80% fulfilled									
		Actual percentage if less than 80%											

Total score for 8 hours = 800

**Total average score for 8 hours = 100%**

### B. Traffic Crossing Major Street

		1 lane each way		2 lanes each way		Highest 8 Hours of the Day							
		Free Flow	Restricted Flow	Free Flow	Restricted Flow	8:00	9:00	10:00	12:00	13:00	14:00	16:00	17:00
Required min. volume for 100% score		50	75	50	75	121	204	90	72	91	90	86	79
Required min. volume for 80% score		40	60	40	60								
		100% fulfilled		100		100	100	100	80	100	100	100	100
		80% fulfilled		80% fulfilled									
		Actual percentage if less than 80%											

Total score for 8 hours = 780

**Total average score for 8 hours = 98%**