Clarington

# Clarington Traffic Calming Manual

Municipality of Clarington
Public Works

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# 1. Introduction

## 1.1 Purpose

The Traffic Calming Manual (TCM) is formulated to assist the Municipality of Clarington (MOC) staff in addressing the growing number of requests concerning traffic speeds and conditions across the municipal road network. The TCM aims to provide guidance in analyzing and addressing traffic safety concerns efficiently and effectively through an equitable and fair screening process. Additionally, the purpose of the TCM is to offer tools which help alter driver behavior by encouraging safer and more responsible driving practices. This is achieved through the implementation of various traffic calming measures, such as speed humps, raised crosswalks, curb extensions, and signage, which are designed to reduce vehicle speeds, enhance pedestrian safety, and improve overall road conditions. By modifying driver behavior, the TCM contributes to creating safer streets for all users, including pedestrians, cyclists, and motorists.

## 1.2 Background

The municipality's growth and the subsequent increase in traffic volumes and speeds on municipal roads continue to raise concerns among residents. Traffic calming refers to the process and measures implemented by road authorities to address issues related to motor vehicle driver behavior on streets within their jurisdiction. These measures are typically applied in areas experiencing excessive vehicle speed or high volumes of cut-through traffic. The goal of traffic calming is to create a safe environment for all road users while preserving the specific function and classification of the roadway. When properly implemented, traffic calming measures can mitigate the adverse effects of motor vehicle use on other road users, promote safer driving behavior, and enhance conditions for non-motorized street users. However, inappropriate use of these measures can lead to unintended consequences. Therefore, careful consideration, planning, design, and implementation are crucial for the success of traffic calming initiatives.

## 1.3 Framework

The Clarington Transportation Master Plan (CTMP) offers guidance for developing the Traffic Calming Plan framework. Section 5.4.5 of the CTMP, titled "Road Network Policy Alternatives and Recommendations," includes the following directive:

Traffic Calming: This section outlines the strategy for implementing traffic calming measures to manage speeds on municipal roads, community safety zones, and pedestrian crossings. Currently, traffic calming issues are identified and addressed on an as-requested basis using industry-standard approaches to mitigation treatments. Clarington actively monitors and deters speeding, particularly in areas known to have recurring issues.

In the CTMP, Figure 5.19, titled "Road Network Policy Alternatives and Recommendations - Traffic Calming and Network Integration," presents three approaches to traffic calming: passive, moderate, and aggressive. These options form the foundation and direction for the recommended tools within the TCM and are illustrated in Figure 1 below.

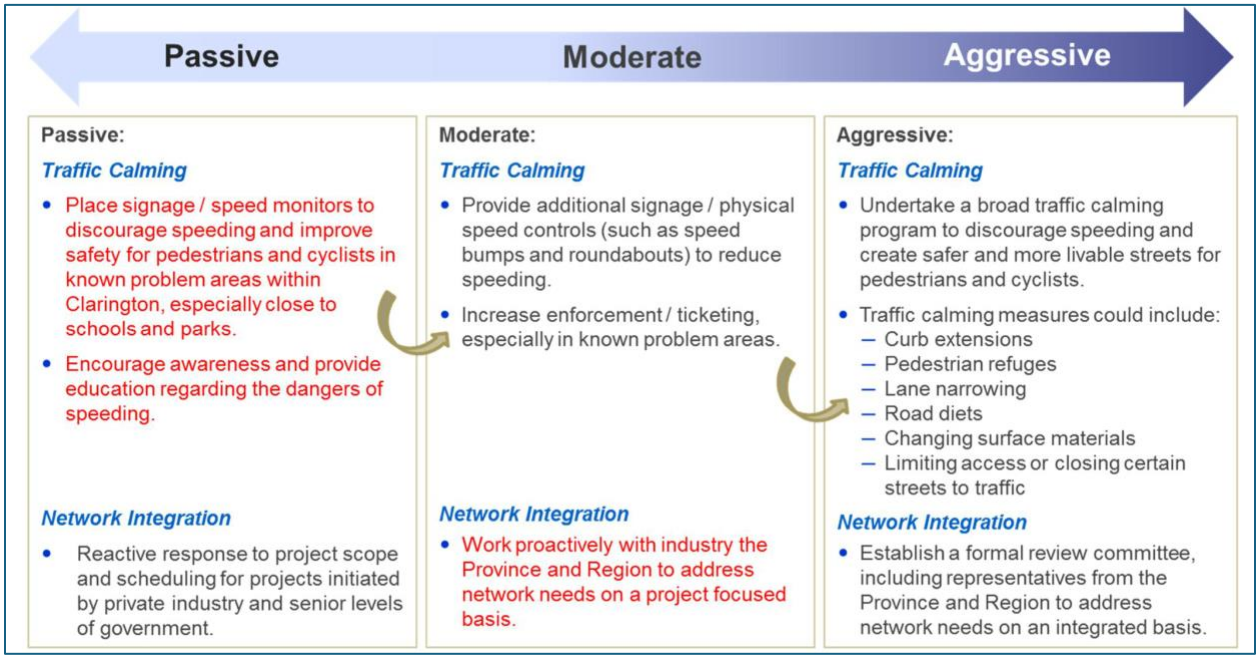


*Figure 1 - Road Network Policy Alternatives and Recommendations - Traffic Calming and Network Integration*

Section 3.3.1 (Existing Road Network) of the CTMP details the fundamental design and functional criteria for most of Clarington's roads. Certain roadways may deviate from their intended or typical use, necessitating a modified TCM application review process.

The roadway system serving Clarington comprises an interconnected network of rural and urban roadways, including Provincial highways and freeways, arterials, collector, and local roadways. Clarington is responsible for collectors and local roadways, while much of the arterial network is owned and maintained by Durham Region.

According to the Region of Durham classification and the Clarington Official Plan, there are three types of arterial roads, one type of collector road, and one type of local road, as outlined below:

1. **Arterial Roads**: These are the primary transportation corridors designed to accommodate high volumes of traffic, often connecting major urban centers and facilitating long-distance travel. Arterial roads are further divided into:
    - **Type A**: Major arterial roads with higher speed limits and limited access points to optimize traffic flow.
    - **Type B**: Arterial roads that balance traffic movement and access, connecting smaller communities or urban centers.
    - **Type C**: Roads that serve a mix of regional and local traffic, with slightly lower traffic volumes and speeds compared to Types A and B.
2. **Collector Roads**: These roads serve as intermediaries, connecting local roads to arterial roads. They are designed to handle moderate traffic volumes, providing access to residential areas, businesses, and local amenities while also facilitating short to medium-distance travel.
3. **Local Roads**: These roads primarily serve residential neighborhoods and local traffic. They are designed for low-speed travel and provide direct access to homes, parks, and community facilities, with minimal through-traffic.

This classification helps ensure an organized and efficient road network, tailored to varying traffic demands and land uses.

The TCM is intended solely for existing and future residential local, collector, and Arterial C class roads within urban areas and hamlets under Clarington's jurisdiction. Given the intended function and purpose of arterial roads as major transportation and commercial goods routes, the municipality will not entertain requests for traffic calming measures on arterial roads or rural roads outside of urban areas and hamlets.

The Ontario Traffic Manual (OTM), released by the Province of Ontario, serves as the primary policy and design guidance document for the Province, containing specifications, guidelines, and criteria for the use of traffic control, signage, and pavement markings in Ontario. The OTM is routinely utilized by transportation and legal professionals to ensure that roadways are designed predictably through the consistent and appropriate application of traffic control devices. Additionally, the OTM complements the Ontario Highway Traffic Act (HTA). The TCM relies upon and references the OTM and the HTA for any aspects related to the overall use of traffic control, signage, pavement markings, and as they apply to traffic calming contained within this manual.

## 1.4 Advantages and Disadvantages of Traffic Calming

Maintaining core road functions directly related to land use, combined with design speed limits on municipal streets, is an essential element for the safe and efficient operation of a roadway. Traffic moving at uniform, consistent, and predictable speeds typically result in increased safety and fewer accidents. Lowering speed limits to unreasonable levels, which do not correspond to the roadside environment or to the road design parameters, or to the road function, often produce a wider range of speed differentials between drivers and can result in a more dangerous operating environment for both drivers and pedestrians. In certain locations, education, increased police presence, and enforcement are more appropriate methods of addressing traffic concerns.

Like any tool, traffic calming provides specific advantages and disadvantages depending on its application.

**Advantages of traffic calming include:**

- Assists in reducing motor vehicle speeds;
- Lower speeds can lead to reduced fatal and injurious collisions;
- Discourages shortcutting and aggressive driving behavior;
- Reduces cut-through traffic volumes;
- Encourages use of alternative modes of travel (active transportation);
- Improves standard of neighborhood livability;
- Reduces conflicts between various types of road users;
- Enhances safety for vulnerable road users;
- Encourages active transportation;
- Improves accessibility.

**Disadvantages of traffic calming include:**

- Increases emergency vehicle response times;

- Increases or disrupts transit operating times, and reduces access to bus stops;
- Reduces or impedes access and egress from neighborhoods;
- Shifts or diverts traffic volumes or speeding concerns onto other roadways;
- Encourages more aggressive acceleration to compensate for 'lost time' due to the calming measures;
- Can become a visual distraction or safety issue, causing drivers to focus solely on the calming measure itself rather than the roadway and other road users;
- Increases maintenance costs due to collisions, vandalism, snow clearing, and curbside waste collection;
- May cause accelerated road surface deterioration and may contribute to the reduction of the lifespan of roadways
- Increases vehicle emissions and/or noise pollution;
- Results in visual unattractiveness; and
- Increases motor vehicle noise issues due to more frequent acceleration.

# 2. Traffic Calming Process

## 2.1 Site Verification Conditions

Upon receiving a traffic calming request, the initial step is to verify the site conditions to determine whether the request qualifies for further action. The verification process generally focuses on determining road jurisdiction, road length, a history of traffic assessments or land use changes in the vicinity, and the nature of the traffic concern. Criteria used to evaluate the request:

- The subject road falls under the jurisdiction of the MOC and is located within the urban boundary or part of a hamlet;
- The road segment has a minimum suitable length, allowing for potential speeding, and traffic calming treatments would not be placed within the operational proximity of stop signs or other traffic control devices;
- Any previous assessments and measures have been given sufficient time to take effect, ensuring equitable resource distribution across the municipality;
- Education, enforcement, and other traffic engineering efforts have been exhausted and have failed to produce the desired results; and
- The nature of the request can be addressed within the scope of traffic calming measures.

Appendix 1 to this manual contains Table 1, which will be used to conduct the initial site screening. All criteria must be met (responses are "yes") to pass. If any criteria are not fulfilled (response is "no"), the request and concern may need to be assessed under a different traffic engineering practice.

## 2.2 Technical Assessment Process

If a traffic calming request meets the criteria outlined in the initial Site Verification Checklist, it proceeds with the Technical Assessment Process. This assessment evaluates various factors that influence the suitability and applicability of traffic calming measures. Relevant factors may include traffic speed, different traffic volumes, road classification, existing pedestrian facilities, type of road cross section, impacts on public transit, and traffic infiltration thresholds. Table 3 in Appendix 2 details the steps and criteria used to evaluate potential locations for traffic calming measures.

## 2.3 Public Involvement - No Petition Approach

Many traffic calming policies in other municipalities require a lengthy petition process and a minimum threshold of public support before a project is implemented. However, staff do not recommend such a system for several reasons:

i. **Limited Action Based on Petitions:**

   Most residents seldom engage directly with their municipality. The petition process represents one of the first opportunities for many residents to actively participate in civic engagement. Speed studies conducted after successful neighbor petition submissions often do not meet the minimum criteria for changes. When residents are informed that their efforts will not result in modifications, it may lead to a negative interaction between the Municipality and the community.

ii. **Equity is not a major factor in decision making:**

Policies based on petitions tend to benefit communities that are highly engaged, which often coincide with higher socio-economic areas. Consequently, this practice leaves the most vulnerable road users with fewer enhancements and improvements.

iii. **Petitions only reflect feedback from residents directly adjacent to the area of interest:**

Petitions reflect the feedback of residents at the time of consultation but do not consider the perspectives of all road users, including cyclists, pedestrians, and drivers. Although the opinions of fronting residents should be given significant consideration, the Municipality's roads are funded by all residents, and decisions should be made in a fair and equitable manner.

## 2.4 Budget and Implementation

Projects will be prioritized and executed based on annual budget allocations, though additional funding may also be sourced from other capital improvements when shared objectives are identified. Besides individual traffic calming initiatives, such measures can be integrated into new developments. When planning a new development, the developer may be encouraged to include neighborhood enhancements that are identified as beneficial by Planning and Infrastructure. The cost of implementation during this stage is often significantly lower compared to retrofitting existing sites. Locations where permanent traffic calming is necessary along established road sections will be referred to the Planning and Infrastructure Department for consideration in the budgetary process and subsequent implementation. Given the complexity of some traffic calming methods, it is advisable to first deploy directly equivalent temporary solutions to assess their effectiveness and community acceptance. Examples may include temporary bumpouts or curb extensions using flexible bollards, temporary rubber speed cushions or bumps, temporary pavement markings, temporary planter boxes or landscape features. This approach enables staff and Council to ensure proper budgeting and equitable distribution of funds and resources across all municipal areas.

## 2.5 Reevaluation

Following the implementation of traffic calming measures, municipal staff will monitor the affected streets (and the entire study area in some cases) to evaluate their effectiveness and impact on the surrounding road network. The scope of this evaluation should align with the investigations conducted prior to implementation. Potential studies may include speed surveys (to assess changes in vehicle speeds), traffic counts (to determine changes in all modes of travel), and/or origin-destination surveys (to estimate the volume of traffic diverting to adjacent streets). The traffic calming plan should ensure there is no transference of traffic from the subject street to adjacent roadways, particularly those of lower classification. For example, if a traffic calming measure results in a reduction of traffic volume by 1000 vehicles on the subject roadway, no more than 500 vehicles is permitted to be transferred to an adjacent lower classification roadway. If the implementation evaluation reveals that traffic volumes on a parallel or adjacent roadway have increased by more than 50% of the volume reduced by traffic calming measures along the subject road section, the Municipality will consider corrective actions to address the situation and minimize the impact.

# 3. Toolbox

The subsequent sections detail various traffic calming measures, including renderings, examples, estimated implementation costs, advantages and disadvantages, and temporary solutions. These measures are designed to reduce vehicle speeds, decrease traffic volumes, and enhance comfort and safety by minimizing conflicts between motorized and non-motorized road users. The toolbox offers a variety of options that allow the MOC to tailor projects to meet the specific needs of the community.

Table 1 provides a summary of the recommended traffic calming measures. Each measure is categorized based on its traffic-calming mechanism, along with an indication of the eligible road classifications for implementation.

*Table 1 - Recommended Traffic Calming Measures*

| **Traffic Calming Tool** | **Effect Type** | **Suitable Road Class** |
|---|---|---|
| Flexible Bollards | Moderate | All |
| Speed Hump or Speed Table | Aggressive | Local and Collector |
| Speed Cushion | Aggressive | Local and Collector |
| Curb Extension (bump out) | Moderate | All |
| Raised Crosswalk or Intersection | Aggressive | All |
| Median or Refuge Island | Moderate | All |
| Closure/Diverter | Aggressive | Local |
| Lateral Shift/Chicane | Moderate | Local and Collector |
| Longitudinal Pavement Markings | Passive | All |
| Lateral Pavement Markings | Passive | All |
| Radar Message Boards | Passive | All |
| Roundabouts/Traffic Circles | Moderate | All |

## 3.1 Flexible Bollards (Moderate Effect)

**Purpose**

Flexible bollards or delineators are rubber-mounted devices that are bolted into the roadway surface. They are strategically placed across roads to deter high-speed travel by reducing the available road space, thus causing discomfort for drivers travelling at higher speeds. These bollards are designed to absorb impacts when struck by vehicles, thereby allowing emergency vehicles or heavy trucks to maintain access at necessary speeds, while minimizing serious damage to inattentive motorists' vehicles.

Flexible posts are typically deployed in sets of three, with one post on each side of the roadway along the edge lines and one larger post in the center, often featuring a graphic or logo. This configuration maintains the width of travel lanes but positions the posts such that their proximity prompts motorists to reduce speed or increase alertness. The recommended minimum width for narrowing is 3.0 meters. These posts are most effective upon initial deployment when drivers are unfamiliar with them. Over time, as drivers become accustomed, they may travel through at higher speeds. However, this disadvantage can be mitigated when vehicles approach the bollards in a platoon or a group of several vehicles, , where the mixed comfort levels among drivers slow down others behind them, achieving lower speeds collectively.

**Advantages:**

- Traffic Conditions: Suitable for all traffic volumes up to Arterial C Road class.
- Emergency Services: No impact on response times.
- Speed Reduction: Reductions of 2 km/h or more, with some locations observing reductions of up to 10 km/h.
- School Crossings: When strategically placed, these bollards can provide additional clear zones for crossing guards and pedestrians.
- Installation: Easy and affordable installation.

**Disadvantages:**

- Maintenance: Significant damage and/or loss of sign reflectivity over time, requiring frequent monitoring and maintenance.
- Effectiveness: Seasonal installations only (typically May to October) due to conflicts with winter maintenance operations.

**Application Locations**

- Existing roadways

**Cost**

- $

## Examples of Flexible Post installations

*Figure 2 – Flexible Posts (staff file photo)*

*Figure 3 - Flexible Posts (staff file photo)*

## 3.2 Speed Hump/Table (Aggressive Effect)

**Purpose**

Speed humps are vertical structures that span across the width of a roadway (excluding gutters) and are designed to reduce vehicle speeds. Typically installed in series, motorist discomfort varies based on the size of the speed hump and the travel speed.

Speed tables are similar to speed humps but feature an extended flat top capable of accommodating the length of a passenger vehicle. These structures have higher design speeds than speed humps and offer a smoother ride for larger vehicles, making them preferable on collector roads.

Both speed humps and tables generally extend across the roadway with gaps for drainage at the curbs. Proper consideration should be given to adjacent bike lanes by either extending the hump into the bike lane or providing physical separation through delineators or other barriers to protect cyclists from vehicles attempting to bypass the hump.

Temporary rubber speed humps are advisable as a preliminary evaluation phase before committing to permanent solutions.

**Advantages:**

- Speed reduction: between 6 km/h and 13 km/h on average.
- Volume reduction: more than 15% can be achieved.
- Year-round effectiveness with permanent installations, seasonal effectiveness with temporary installations
- Effective without the need for police enforcement.

**Disadvantages:**

- Impact on emergency services: reduces response times and can potentially damage larger vehicles.
- Impact on transit services: can potentially damage buses and school transportation vehicles.
- Maintenance challenges: can create constraints for snow plowing and snow removal; plow operators must exercise caution to avoid damaging the surface of speed humps/tables. Additionally, speed humps can damage plow trucks, raising maintenance costs. May require modifications to winter maintenance routines.
- Parking: may necessitate the removal of parking spaces.
- Traffic diversion: may result in unwanted traffic diversion to adjacent roads.
- Active transportation considerations: it is essential to maintain physical separation (e.g., median, delineator posts) to protect the bicycle lane from motorists avoiding the vertical deflection.
- Potential drainage issues and water ponding.

**Application Locations**

- Existing roadways

## Cost

- $$

## Examples of Speed Hump Installations

*Figure 4 – Speed Hump (Google Street View photo)*

*Figure 5 – Speed Hump (Sketch courtesy of NACTO)*

## 3.3 Speed Cushion (Aggressive Effect)

**Purpose**

Speed cushions are a narrower variant of speed humps, strategically placed in the center of each travel lane. They are engineered to reduce the speed of passenger vehicles while permitting vehicles with larger wheelbases (e.g., emergency vehicles and buses) to traverse without hindrance. Speed cushions should be preferred over speed humps on emergency response and transit routes. Additionally, they may be more suitable for collector roads. Temporary rubber speed cushions can serve as an evaluative measure prior to implementing permanent installations.

**Advantages**

- Speed Reduction: Can achieve an average reduction of up to 8 km/h along the treated stretch of road.
- Volume Reduction: Potentially more than 15% reduction in vehicle volume.

**Disadvantages**

- Emergency Services: May increase response times and could potentially cause damage to larger vehicles.
- Transit Services: Possible risk of damage to buses and school transportation vehicles.
- Maintenance: Snow plowing and removal pose challenges; operators must exercise caution to prevent damage to the speed cushion surface, which can also lead to increased maintenance costs for plow trucks.
- Parking: Installation may necessitate the removal of parking spaces.
- Traffic Diversion: Could result in undesired traffic diversion to adjacent roads.
- Active Transportation: It is advisable to maintain physical separation (e.g., median, delineator posts) to protect bicycle lanes from motorists attempting to avoid vertical deflection.
- Drainage Issues: Potential problems with drainage and water ponding.

Application Locations

- Existing roadways
- New roadways

Cost

- $$

## Example of Speed Cushion installation

*Figure 6 – Speed Cushions (Google Street View)*

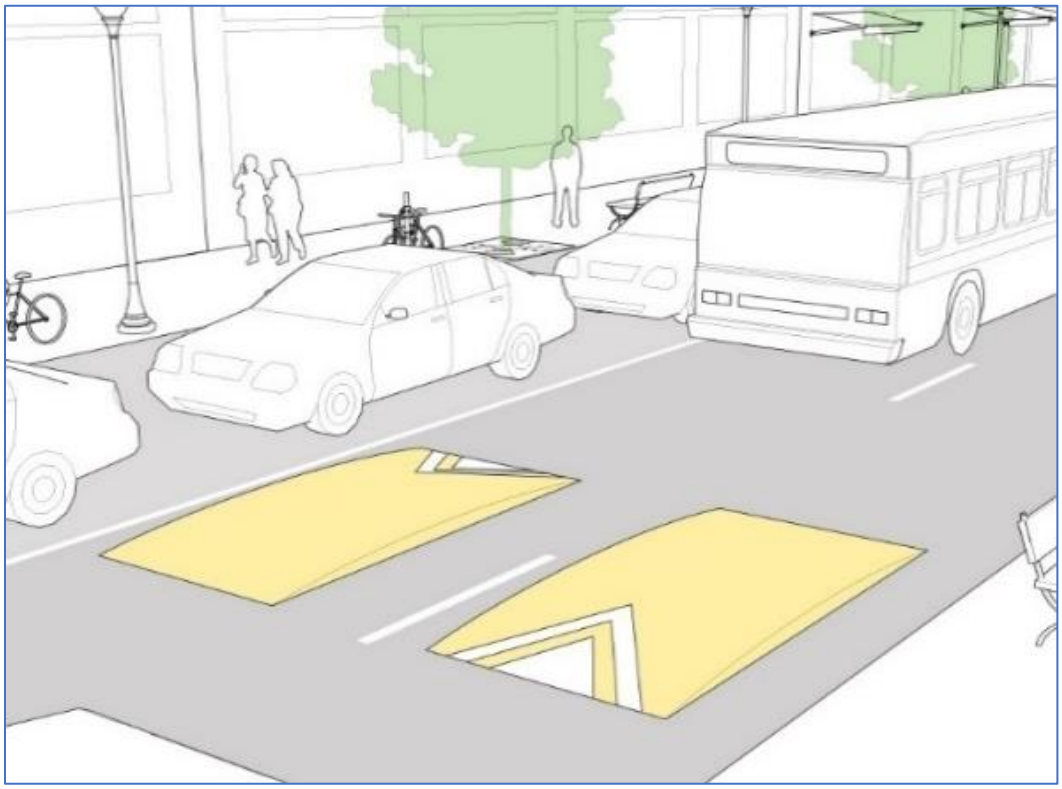

*Figure 7 – Speed Cushions (Sketch courtesy of NACTO)*

## 3.4 Curb Extension (Moderate Effect)

### Purpose

A curb extension is a horizontal protrusion into the roadway, creating a narrower section. This constriction causes drivers to feel confined, thereby reducing their speeds. The curb may be extended on one or both sides of the road to achieve this reduction in width. The primary objectives of curb extensions include lowering vehicle speeds, decreasing pedestrian crossing distances, enhancing pedestrian visibility, and preventing parking near intersections. Curb extensions are typically installed at intersections to narrow the roadways on one or both streets. They can also be placed midblock on one or both sides to reduce roadway width.

### Advantages

- Speed Reduction: Can reduce speeds by several kilometers per hour (km/h).
- Vulnerable Traffic: Increases visibility of pedestrians and other non-motorized users at crossings, reduces their crossing distance and time.
- Emergency Services: Does not negatively impact emergency response times.
- Traffic Conditions: Suitable for all traffic volumes and various types of road classes.
- Streetscaping: Landscaped curb extensions can enhance street aesthetics, though opportunities may be limited by extension scope and size.

### Disadvantages

- Maintenance: Can create challenges for snow plowing and removal, with potential damage to vegetation and increased winter maintenance costs.
- Effective Roadway Width: The roadway's effective width can be significantly reduced during winter months, dependent on design and snow control activities. Temporary parking restrictions may be considered to facilitate winter maintenance.
- Drainage Considerations: Existing drainage elements such as catch basins, concrete channels, gutters, inlets, and trench drains must be accounted for.
- Traffic Conditions: Large vehicles, including long trucks and buses, may need to enter oncoming lanes to turn at intersections with curb extensions.
- Active Transportation: Cyclists may feel constrained as motorists attempt to overtake them at narrowing points.

### Application Locations

- Existing roadways
- New Roadways

### Cost

- $$ - $$$

## Example of Curb Extension (Bumpout) Installation

*Figure 8 – Curb Extensions (Staff File Photo)*

*Figure 9 – Curb Extensions (Sketch courtesy of NACTO)*

## 3.5 Raised Crosswalk/Intersection (Aggressive Effect)

### Purpose

A raised crosswalk is a designated pedestrian crossing at an intersection or mid-block location, constructed at a higher elevation than the adjacent roadway. Raised crosswalks are designed to reduce vehicle speeds and enhance pedestrian visibility, thereby mitigating pedestrian-vehicle conflicts.

Raised crosswalks resemble speed humps but are typically wider and feature a flat top. The elevation and width of the raised crosswalk align with the sidewalk approaches on either side of the road. These measures are applicable for all types of crosswalks (unsignalized, midblock, and intersection).

A raised intersection is an intersection elevated above the surrounding roads to reduce vehicle speed and better delineate pedestrian crosswalk areas. Raised intersections have a flat, elevated area connecting all approaching roadways, similar to raised crosswalks and speed tables. However, the reduction in vehicle speeds is less pronounced compared to raised crosswalks, speed humps, and speed tables due to the greater distance between access and egress ramps. Raised intersections serve to alert drivers of pedestrians crossing through intersections.

**Advantages:**

- Speed Reduction: Achieves a speed reduction of up to 10 km/h. The degree of speed reduction depends on the use of other traffic calming measures along the roadway (minimal effect if used alone).
- Traffic Conditions: Suitable for all traffic volumes and road classes.
- Vulnerable Traffic: Enhances safety for vulnerable road users crossing within crosswalks or maneuvering through intersections due to reduced vehicle speeds and increased driver awareness.

**Disadvantages:**

- Emergency Services: May reduce response times and potentially damage larger vehicles.
- Transit Services: Can cause potential damage to buses and school transportation vehicles.
- Maintenance: Can create challenges for snow plowing and removal. Plow operators must exercise caution to avoid damaging the raised surface, which can also damage plow trucks, increase maintenance costs, and result in operator injuries.
- Traffic Diversion: May lead to unwanted traffic diversion to adjacent roads.
- Potential Drainage Issues: Raised surfaces can lead to drainage problems and water ponding.

**Application Locations**

- Existing roadways
- New Roadways

## Cost

- $$ - $$$$

## Examples of a Raised Crosswalk and a Raised Intersection

*Figure 10 – Raised Crosswalk (Google Street View)*

*Figure 11 – Raised Intersection (Sketch courtesy of NACTO)*

## 3.6 Median/Refuge Island (Moderate Effect)

### Purpose

A raised median island is a physical barrier positioned in the median between two directions of traffic, typically installed on two-way roadways. Median islands narrow the roadway, causing motorists to reduce their speed. They may also serve as a pedestrian crossing refuge. Additionally, median islands can incorporate landscaping elements, providing aesthetic and environmental benefits.

### Advantages

- Speed Reduction: A reduction in speeds by several kilometers per hour can be achieved, depending on the design and length of the median island.
- Traffic Conditions: Suitable for all traffic volumes and types of road classes.
- Emergency Services: Does not negatively impact emergency services response times.
- Vulnerable Traffic: When used as a pedestrian refuge, a median island can enhance pedestrian safety by creating a two-stage decision-making process.
- Streetscaping: Landscaped median islands can enhance the visual appeal of a street; however, opportunities for this may be limited by the scope and size of the median.

### Disadvantages

- Parking: Typically necessitates the removal of parking spaces in the vicinity of the median.
- Maintenance: Can pose constraints and challenges for snow plowing and removal.
- Effective Width: The effective width of the roadway can be significantly reduced during winter months, depending on the design and snow removal/winter control activities in the area.
- Active Transportation: Cyclists may feel constrained as motorists attempt to overtake them along the median islands.
- Traffic Conditions: May restrict access to driveways from one direction.

### Application Locations

- Existing roadways
- New roadways

### Cost

- $$-$$$$

## Examples of Median and Refuge Island Installations

*Figure 12 – Median Island (Google Street View)*

*Figure 13 – Refuge Island (Sketch courtesy of NACTO)*

## 3.7 Closure/Diverter (Aggressive Effect)

**Purpose**

Streets with reduced motor vehicle traffic promote a healthier and safer environment, offering greater flexibility in usage. Managing traffic volume is particularly crucial when altering the character of a street, such as converting it to a shared street or restoring its local character.

Private motor vehicle volume on a street can be minimized by making the street less attractive as a through route or by completely preventing through-travel. Significant reductions in volume can be achieved by restricting access exclusively for local vehicle users. This can be enforced through measures like installing median diverters or large curb extensions to channel vehicular traffic appropriately. Diverters may include cut-throughs to accommodate through-cycle traffic.

A directional closure involves placing a vertical barrier that obstructs or prohibits one direction of traffic, typically at the intersection of a local road with collector or arterial streets. The objective of this measure is to eliminate actual or potential traffic infiltration along a specific corridor. In contrast, a diverter extends through the entire length of an intersection.

Pedestrian crossings, cycle intersection markings, and openings in medians, curbs, or barriers facilitate safe foot and cycle crossings.

**Advantages:**

- Volume Reduction: Diverters can reduce traffic volumes by up to 60%, and directional closures can achieve up to 100% reduction in directional traffic.
- Vulnerable Traffic: Treated intersections or road sections provide a safer environment for vulnerable road users by reducing through traffic and lowering speeds at intersections.
- Streetscaping: Landscaped diverters or directional closures can enhance the appearance of a street, though opportunities may be limited by scope and size constraints.

**Disadvantages:**

- Maintenance: These measures can create challenges for snow plowing and removal.
- Emergency Response: Prior consultation with emergency services is essential, as these measures may increase response times.
- Local Vehicle Access: Vehicular traffic will be rerouted to adjacent locations, potentially increasing trip lengths for some residents.

**Application Locations**

- Existing roadways

**Cost**

- $$

## Examples of a Closure and a Diverter

*Figure 14 – Closure/Diverter (Google Street View)*

*Figure 15 – Closure/Diverter (Image courtesy of NACTO)*

## 3.8 Lateral Shift/Chicane (Moderate Effect)

**Purpose**

Chicanes and lateral shifts utilize alternating parking, curb extensions, or edge islands to create an S-shaped travel path, which effectively reduces vehicle speeds. This measure aims to discourage shortcutting or through traffic and lower overall speeds by causing lateral shifting of vehicles navigating the chicane or lateral shift.

A chicane involves a series of curb extensions on alternating sides of a roadway, narrowing the road and requiring drivers to steer from one side to the other. Multiple series of such extensions can be implemented. A lateral shift occurs in a straight section of roadway that has been redesigned with pavement markings or curb extensions, creating a curvilinear alignment similar to a chicane. This effect can also be accomplished using a central island or alternating parking.

**Advantages:**

- Speed Reduction: Can effectively reduce speeds by several kilometers per hour.
- Traffic Conditions: Suitable for all local and collector roads.
- Streetscaping: Landscaped curb extensions can enhance the appearance of a street, although opportunities may be limited by the scope and size of the extensions.
- Parking: Has the potential to organize and allocate parking, thus increasing consistency and meeting road user expectations.
- Vulnerable Traffic: Curb extensions or chicane areas can decrease crossing distance for pedestrians.

**Disadvantages:**

- Maintenance: The effective width of the roadway can be significantly reduced during winter months, depending on the design and snow removal activities in the area.
- Drainage Considerations: Existing drainage elements such as catch basins, concrete channels, gutters, inlets, and trench drains must be accounted for.
- Traffic Conditions: Large vehicles like long trucks and buses may need to enter oncoming lanes to navigate turns at intersections with curb extensions.
- Active Transportation: Cyclists may feel squeezed closer to vehicles as motorists attempt to overtake them at narrowing points.

**Application Locations**

- Existing roadways
- New Roadways

**Cost**

- $-$$$

## Example of a Chicane/Lateral Shift

*Figure 16 - Chicane/Lateral Shift (Staff File Photo)*

*Figure 17 - Chicane Using Landscape Components (City of Toronto/TCAT)*

## 3.9 Longitudinal Pavement Markings (Passive Effect)

**Purpose**

Longitudinal pavement markings serve several purposes, including the regulation of on-street parking and the implementation of road diets. Often, these applications necessitate the use of signage to enforce traffic or parking regulations.

On-street parking permits vehicles to park parallel to the curb, thereby effectively reducing the road's width. This reduction in width leads to decreased vehicle speeds and a reduction in through traffic. This effect is particularly pronounced when on-street parking is designed in conjunction with lateral shift measures such as bump-outs or corner curb extensions. Alternating side parking and bump-outs contribute to a less free-flowing travel experience, thereby reducing speeds and to some extent, discouraging unnecessary traffic.

A road diet, or lane narrowing, involves reducing lane widths using pavement markings or other features (e.g., bicycle lanes, street beautification projects, pavement texture). The objective is to make drivers perceive the roadway as less comfortable for high-speed travel, ultimately resulting in lower operating speeds.

**Advantages:**

- Traffic Conditions: Suitable for all traffic volumes and road classes.
- Maintenance: Minimal, no ground-level implications.
- Emergency Services: No impact on response times.
- Environment: Potential reduction in traffic noise due to lower speeds or reduced traffic volumes.
- Vulnerable Traffic: The treatment may provide separation between vehicles and vulnerable road users, such as pedestrians or cyclists.

**Disadvantages:**

- Maintenance: Winter operations and seasonal maintenance can be affected by parked vehicles.
- Maintenance: Higher costs associated with maintaining pavement markings.
- Access: Should avoid areas with limited sight distance, driveways, bus zones, school zones, and park zones.

**Application Locations:**

- Existing roadways
- New roadways

**Cost**

- $-$$

## Examples of Longitudinal Pavement Markings

*Figure 18 – Longitudinal Pavement Markings (Staff File Photo)*


*Figure 19 – Lateral Pavement Markings (City of New York)*

## 3.10 Lateral Pavement Markings (Passive Effect)

**Purpose**

Dragon's teeth are a series of triangular pavement markings placed along the edge of the travelled lanes. They can be painted with increasing size to create the visual impression of roadway narrowing, thereby alerting drivers that they are entering a rural community.

Full-lane transverse bars consist of parallel pavement markings that extend across the majority of the travelled lane width. These markings may be spaced progressively closer together to create the illusion of increased vehicle speed, prompting drivers to reduce their speed. Full-lane transverse bars are typically implemented on approaches to intersections, bridges, and deficient horizontal curves.

Peripheral transverse bars are similar to full-lane transverse bars but are positioned along the edge of the travelled lanes. They provide a comparable visual cue with the added benefit of requiring less maintenance.

On-road 'sign' pavement markings convey information traditionally provided through posted signage by painting it directly onto the roadway. This method provides a larger image within the driver's line of sight and can serve as a gateway to alert drivers they are entering a school zone, school crossing, or neighborhood. Examples include speed limits (e.g., 40 km/h), 'SLOW', and 'School Ahead'.

**Advantages**

- Traffic Conditions: Suitable for all traffic volumes and road classes.
- Speed Reduction: Helps reduce speeds at transitions into urban areas.
- Awareness: Enhances road user awareness and increases driver alertness.

**Disadvantages**

- Maintenance: Requires ongoing upkeep due to exposure to elements and placement within the roadway.
- Effectiveness: Over time, drivers may become desensitized to the markings.

**Application Locations**

- Existing roadways
- New Roadways

**Cost**

- $-$$

## Examples of Lateral Pavement Markings


*Figure 20 - Lateral Pavement Markings (Staff File Images)*

## 3.11 Radar Message Boards (Passive Effect)

**Purpose**

Also known as Radar Message Boards (RMBs), these digitalized signs actively monitor approaching vehicle speeds and display them back to the driver on a large LED display matrix. Depending on assigned parameters, these signs can exhibit vehicle speeds in various colors, flash the digits, activate a strobe light, and show different basic text or graphics. Additionally, RMBs possess basic data logging capabilities, allowing them to record the number of vehicles approaching the sign and their speeds upon initial detection.

Radar boards serve as an effective visual deterrent that can be utilized year-round without impacting winter maintenance activities. These boards can be strategically rotated to different locations throughout the year and can be powered by solar panels for longer-term deployments.

Studies have shown that these signs are effective in reducing the speeds of drivers who either mistakenly exceed speed limits or feel guilty about speeding past the sign. However, over time, the signs may lose their efficacy as drivers become accustomed to their presence. To maintain effectiveness, it is recommended to rotate radar boards across various locations every few weeks or months. Furthermore, these signs can complement other traffic calming measures.

**Advantages**

- Traffic Conditions: Suitable for all traffic volumes and road classes.
- Maintenance: Minimal, with no ground-level implications.
- Emergency Services: No impact on response times.
- Speed Reduction: Typically reduces speeds by 3 km/h or more.

**Disadvantages**

- Effectiveness: Decreases over time; regular rotations are recommended.
- Installation: Requires an existing wood signpost or utility pole.

**Application Locations**

- Existing roadways

**Cost**

- $

## Examples of Radar Message Boards


*Figure 21 – Radar Message Board in Use (Staff File Photo)*


*Figure 22 – Example of a Radar Message Board in Use*

## 3.12 Roundabouts and Traffic Circles (Moderate to Aggressive Effect)

**Purpose**

Roundabouts and traffic circles are circular intersection treatments designed to reduce vehicle speeds by requiring drivers to navigate a circular path. Unlike traditional intersections that use stop or signal controls, roundabouts apply yield-at-entry principles to manage right-of-way. They enhance safety by reducing conflict points and encouraging lower vehicle speeds through the intersection. Roundabouts are generally larger and intended for higher-capacity roadways, while traffic circles are smaller and suited for residential streets or low-volume intersections.

Roundabouts are advantageous for intersections where traffic flows are moderate to high, as they decrease severe collisions and can accommodate higher traffic volumes. Traffic circles are suitable for lower-volume intersections and can be employed in residential neighborhoods to discourage speeding and reduce cut-through traffic.

**Implementation:**

Roundabouts and traffic circles can be installed at intersections, with their design contingent upon the road classification and traffic volume. These treatments may include landscaping or pedestrian refuge islands for aesthetic enhancement and pedestrian safety. They can also incorporate bicycle lanes or shared lanes within the circular configuration.

**Advantages:**

- Safety: Reduces the number of conflict points, lowering the potential for severe collisions.
- Speed Reduction: Encourages lower speeds, particularly effective at calming traffic in areas where stop signs or traffic lights may be less suitable.
- Improved Traffic Flow: Enhances traffic flow by reducing wait times associated with stop signs and traffic signals.
- Aesthetics and Environmental Benefits: Landscaping in the center island can improve neighborhood appearance and provide green space.
- Mini roundabouts or Traffic Circles: Due to their purposely reduced size, they can be retrofitted into established neighborhoods and road allowance limits

**Disadvantages:**

- Land Requirements: Roundabouts require more space than traditional intersections, which may limit their application in constrained urban areas.
- Pedestrian Safety Concerns: Pedestrians may need to cross longer paths around roundabouts, which can be mitigated by adding marked pedestrian crossings and refuge islands.
- Emergency Vehicle Navigation: While roundabouts are generally navigable by emergency vehicles, larger vehicles may face challenges in smaller traffic circles.

**Application Locations**

- Existing roadways
- New Roadways

**Cost**

- Roundabouts: $$$$
- Traffic Circles: $$-$$$

### Examples of Roundabouts/Traffic Circles

*Figure 23 - Example of a Mini Roundabout (Google Street View)*

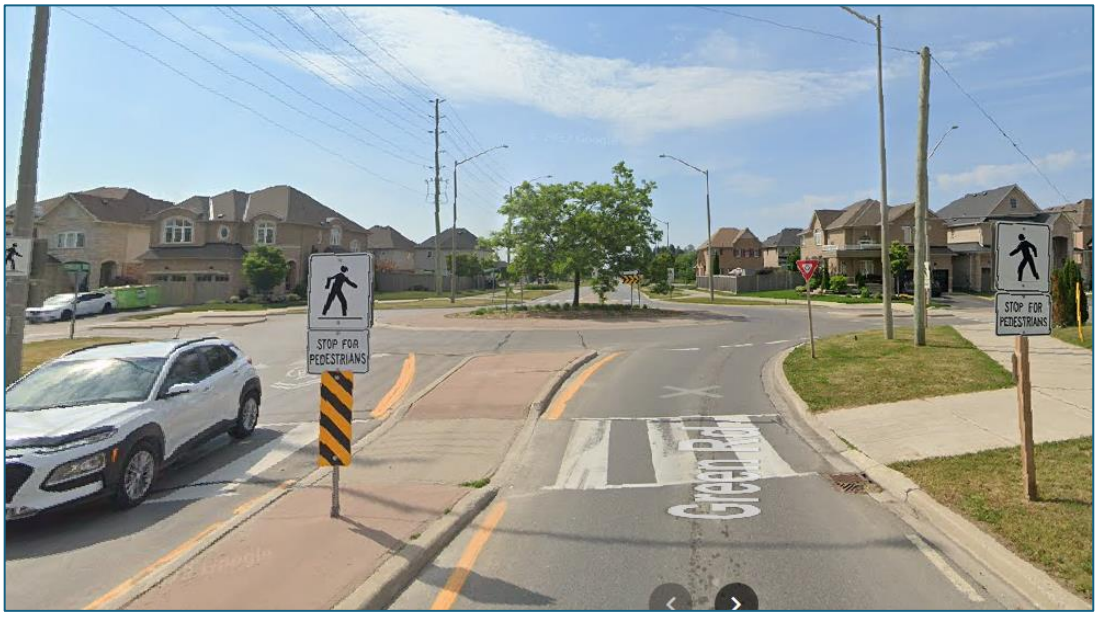


*Figure 24 - Example of a Full Roundabout (Google Street View)*

# 4. Other Considerations

Traffic control installations such as all-way stops, traffic signals, pedestrian crossovers, and reduced area speed limits are types of features designed and governed by provincially regulated frameworks and related legislative requirements, including specific Provincial or Ontario Highway Traffic Act Regulations and local by-laws. Their primary purpose is to control traffic effectively, with the support of necessary law enforcement to ensure they function as intended. While these measures are not designed to calm traffic, they are often perceived by the general public to do so. Traffic requests involving any of these traffic control devices and methods will be appropriately reviewed by staff according to their respective provincial regulations and standards, while analyzing the potential of their suitability or combined effect with any of the traffic calming measures.

Certain regulatory devices complement other traffic calming methods by filling gaps to create a more comprehensive assembly of traffic management measures. As each case should be assessed individually, these regulatory devices may be considered conditionally on a case-by-case basis. Studies indicate that careful consideration is required when selecting traffic calming methods to avoid causing drivers to behave irrationally, such as stopping too frequently or driving too slowly on open roadways. This can result in drivers disregarding traffic controls, rolling through stop signs, running yellow and red lights, and speeding between traffic controls to compensate for lost time. Although speeds may still decrease in the immediate vicinity of a stop sign or speed limit change, drivers might adopt bad habits of intentionally ignoring or bending rules, leading to potentially hazardous outcomes.

## 4.1 Hamlet Entrance Signs

The Municipality of Clarington encompasses a blend of urban and rural areas, including several hamlets intersected by a traditional grid network of higher-speed rural roads. This layout presents challenges, particularly the high-speed, straight, and direct entry points to the hamlets. The roadside environment infrastructure often lacks elements that would promote effective speed reductions, such as adequate illumination, wide shoulders, and continuous or sufficient sidewalks or other facilities for vulnerable road users.

Although transitional speed limit signage is installed at the entrances to these hamlets, the standard sizes, shapes, colors, and placements of these signs are not very effective in influencing a behavioral change among incoming drivers. Additionally, many drivers passing through the hamlets are experienced commuters or locals who have become accustomed to the conditions without experiencing any significant adverse consequences, thus feeling no compelling reason to reduce their speed.

After extensive reviews of gateway and entrance signage globally, and adhering to current provincial regulations, Staff have developed a modified hamlet speed limit sign. This new sign design integrates symbology relevant to the general conditions or activities within the hamlet. Figure 28 illustrates an example of these hamlet entrance signs overlaid onto a rural hamlet entrance.

The primary purpose of these signs is to be installed on both sides of the entering rural roadway into the hamlet to raise driver awareness about the variety of potential vulnerable users and their activities within the hamlet. These signs should not be used where the speed limit of the rural roadway passing through the hamlet or built-up area matches the speed limit of the same roadway outside the hamlet.

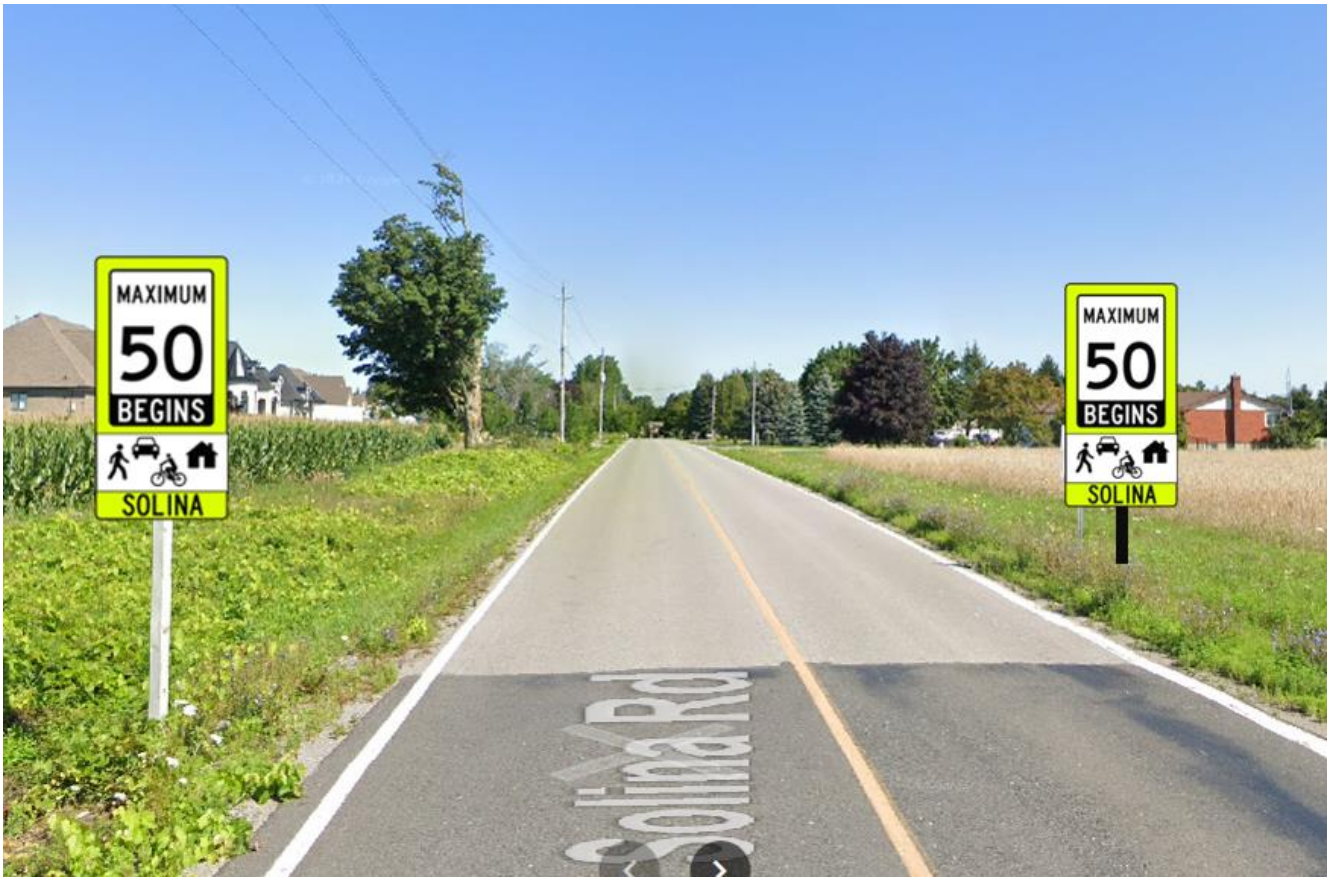


*Figure 25 - Rendering of a hamlet entrance using the modified speed signs.*

## 4.2 All Way Stops

The Ontario Traffic Manual (OTM) Book 5 – Regulatory Signs provides comprehensive guidance on the use of regulatory traffic controls, signs, and pavement markings. It specifically states that the purpose of a stop sign is to assign right-of-way between vehicles approaching an intersection from different directions when traffic signals are either not warranted or yet to be installed. The document also explicitly stipulates that all-way stop control should not be employed in the following scenarios:

- When the primary concern is the protection of pedestrians, especially schoolchildren, as this can usually be addressed through other means.
- As a mechanism for speed control.
- As a method to deter through traffic in residential areas.

Indiscriminate use of all-way stops can lead to increased driver delay and frustration, heightened speeding between intersections, and reduced compliance with all-way stop control at both the subject location and elsewhere. Even when properly warranted, all-way stops may increase the risk of certain collision types, most notably rear-end collisions.

The Ontario Traffic Manual outlines an All-Way STOP justification warrant based on the function of non-major roadways. For a Collector or Rural type roadway, the minimum required volume is 350 vehicles for the highest volume 8 hours of the day. For a Local type of roadway, the minimum required volume is 200 vehicles for the 4 highest volume hours of the day. Clarington uses a reduced warrant to better reflect mixed community conditions. The current Clarington All-Way STOP

justification requires 300 average vehicles per hour for 4 hours at Rural or Collector Road intersections and 200 average vehicles per hour for 4 hours at Local Road intersections.

For new areas, it takes time for vehicle and pedestrian traffic patterns to establish before they provide reliable data for analysis. Due to the phased design and construction of new subdivisions and evolving traffic patterns over time, some intersections may operate differently than initially anticipated with the typical two-way stop control. Therefore, All-Way Stop warrants should be carefully considered and triggered by this manual only when the proportion of combined vehicle and pedestrian volume entering from the minor street to the main street volume is 50/50 or higher, and where the total required intersection volume reaches at least 80%, or at locations where physical restrictions prohibit the use of alternative traffic calming measures.

## 4.3 Pedestrian Crossovers

Pedestrian crossovers (PXO) are traffic control devices governed by the Highway Traffic Act. Drivers are required to stop for pedestrians using a PXO and wait until all pedestrians have completely exited the roadway. The specifications and justification warrants for PXOs are outlined in the OTM Book 15. Due to specific conditions regarding their usage, location, warrants, and installation criteria, this manual will exclude PXOs from the traffic calming toolbox. Nevertheless, common components of PXOs, such as curb extensions, raised intersections, and refuge islands, can contribute to traffic calming effects. Thus, the implementation of PXOs should be encouraged where feasible, as a supplementary element in the design of traffic calming corridors.

## 4.4 Community Safety Zones

Regulatory signs aimed at reducing vehicle speeds (such as speed limits and Community Safety Zones) or restricting movement (such as turn prohibitions and one-way streets) generally *require continuous enforcement* to ensure driver compliance and effectiveness. Consequently, the Canadian Guide to Traffic Calming advises that these signs should only be used to supplement and reinforce desired driver behavior, rather than serve as standalone traffic calming measures. Therefore, according to their design and purpose criteria, Community Safety Zones are not included in the traffic calming toolbox.

## 4.5 Traffic Signals

Traffic signals represent a sophisticated method of traffic control. Their primary function is to allocate and manage the right of way at road intersections or crossings between roadways and pedestrian paths. The criteria for warranting traffic signals and their operation are detailed in the OTM Book 12. In Clarington, the design, construction, operation, and maintenance of all traffic signals are undertaken by the Region of Durham. Consequently, they will not be included in the manual's toolbox.

## 4.6 Reduced Speed Limit Area Signs

The amendment to the Ontario Highway Traffic Act, enacted in May 2018, permits local municipalities to reduce speed limits within entire bounded areas, as opposed to the previous procedure of modifying each road segment separately. This approach is designed for entire neighborhoods or multiple sections of a road network, with signage required only at entry points to the reduced speed area. There is no provision for additional signage within the area, regardless of its size.

While this speed limit reduction method initially appears cost-effective and affordable, it has generally proven ineffective in reducing vehicle speeds within the targeted areas. Numerous pilot projects and permanent implementations across various municipalities in Ontario have demonstrated minimal impact on speeds when area speed limits were lowered from 50 km/h to 40 km/h. The effectiveness of this approach heavily relies on significant police enforcement. Additionally, the absence of modifications to the surrounding road environment or traffic calming measures which would encourage adjustments in driving behavior, further contributes to its ineffectiveness. Consequently, the Reduced Speed Limit Area Signs will not be incorporated into this manual.

## 4.7 Automated Speed Enforcement (ASE)

Automated Speed Enforcement (ASE) in Ontario operates under a regulatory framework outlined in the Highway Traffic Act, specifically Ontario Regulation 398/19. This regulation authorizes the installation of ASE systems in designated school zones and community safety zones (CSZ) where speed limits are below 80 km/h. The primary objective of ASE is to enhance road safety by encouraging adherence to posted speed limits and reducing speed-related collisions. ASE systems utilize cameras and speed measurement devices to automatically detect and penalize speeding vehicles without requiring on-site human intervention.

The criteria for ASE location and deployment in Ontario are stringent. ASE can only be implemented in areas that meet specific risk assessments, which include low speed compliance, high collision frequency, and a significant presence of vulnerable road users. These systems must be clearly marked with signage indicating the presence of ASE and the applicable speed limit. Furthermore, ASE is not permitted in transition zones where speed limits change abruptly, ensuring fairness and clarity for drivers.

ASE should have a policy distinct from traffic calming measures due to their differing objectives and methods. While ASE focuses on enforcing speed limits through penalties, traffic calming seeks to physically alter road conditions to reduce vehicle speeds and improve safety through design modifications such as speed bumps and road narrowing. By maintaining separate policies, ASE can be strategically employed to complement traditional enforcement and traffic calming efforts, rather than replacing them. This separation also helps address public concerns regarding privacy and fairness, ensuring that ASE is perceived as a safety measure rather than a revenue-generating tool. Consequently, ASE will not be included in the traffic calming manual.

*Appendix 1 - Table 2 - Site Verification Checklist*

| Step 1 - Site Verification Checklist | | |
|---|---|---|
| Location: | | |
| Condition | Condition Description | Yes / No |
| 1 – Road Jurisdiction | Is the road under the jurisdiction of the Municipality of Clarington? | |
| 2 – Road Classification | Is the road a Local, Collector or Arterial C? | |
| 3 – History | There have been no previous TCM assessments in the last 3 years? Have any significant changes occurred along the road section within the 3 years, which justify an earlier review? | |
| 4 – Road Length | Is the road section uninterrupted for at least 150 meters? This includes any regulatory traffic control devices, such as Stop, Yield, PXO, traffic Signal, School Crossing | |
| 5 – Posted Speed limit | Is the posted speed limit 60 km/h or less? | |
| Are all conditions met? If yes, proceed to the Technical Assessment Process. If not, conduct a more detailed site assessment, including considerations for alternate or modified solutions. | | |
| Comments | | |

*Appendix 2 - Table 3 – Technical Assessment Process Table*

<table>
<tr><td colspan="6">Step 2 – Technical Assessment Process</td></tr>
<tr><td colspan="2">Location Description</td><td colspan="4"></td></tr>
<tr><td colspan="2">Condition</td><td>Condition Description</td><td>Requirement</td><td>Result</td><td>Satisfied ? Yes/No</td></tr>
<tr><td rowspan="4">Traffic Trigger (A or B)</td><td rowspan="3">A. Speed</td><td rowspan="3">Is the operating (85th percentile) speed higher than the minimum required</td><td>Greater than 10 km/h over speed limit on Local roads</td><td></td><td></td></tr>
<tr><td>Greater than 10 km/h over speed limit on Collector roads</td><td></td><td></td></tr>
<tr><td>Greater than 15 km/h over speed limit on Arterial C roads</td><td></td><td></td></tr>
<tr><td rowspan="2">B. Cut Through Traffic</td><td rowspan="2">Is the percentage of cut through traffic higher than the minimum required, as documented through proper studies (cut through traffic criteria does not apply to arterial roads due to their intended function)</td><td>Greater than 30% on a Local road</td><td></td><td></td></tr>
<tr><td>Greater than 50% on a Collector road</td><td></td><td></td></tr>
<tr><td colspan="6">Additional Criteria and Conditions</td></tr>
<tr><td rowspan="2">Traffic Volume (AADT)</td><td colspan="2" rowspan="2">Is traffic volume higher than the minimum required (traffic volume criteria does not apply to arterial roads due to their intended function):</td><td>Greater than 1000 on a Local road</td><td></td><td></td></tr>
<tr><td>Greater than 5000 on a Collector road</td><td></td><td></td></tr>
<tr><td rowspan="2">Pedestrian Facilities</td><td colspan="3">Local road does not have a continuous sidewalk</td><td></td><td></td></tr>
<tr><td colspan="3">Collector or arterial C road does not have continuous sidewalks on both sides</td><td></td><td></td></tr>
<tr><td>Transit Route</td><td colspan="2">Is a transit route directly affected? Certain traffic calming measures will not be considered for transit routes.</td><td>The road section is not used for public transit</td><td></td><td></td></tr>
<tr><td>Road Cross-section</td><td colspan="2">Some urban area roads have a non-urbanized cross section, meaning no curb and gutter or shoulders. Certain traffic calming measures will not be considered for non-urbanized roads.</td><td>The road section is urbanized<br>(has curbs and gutters)</td><td></td><td></td></tr>
<tr><td rowspan="2">Emergency Access</td><td colspan="2" rowspan="2">Has the site been consulted with various emergency services agencies?</td><td>No opposition from emergency services agencies</td><td></td><td></td></tr>
<tr><td>There are conditions provided by emergency services agencies</td><td></td><td></td></tr>
<tr><td colspan="6">Assessment Results and Comments:</td></tr>
</table>