

## 4.4 Intersection Design

### Keep It Compact

The overarching principle for intersection design in urban areas is to keep them as compact as possible to better prioritize pedestrian and cycling movement. Intersections are shared spaces and should be designed to ensure users are aware of one another and move predictably to reduce the number and severity of collisions.

#### Objectives

The intersection guidelines in this section support a clear hierarchy of modes in urban areas.

1. Pedestrians
2. Bicycles
3. Public transport
4. High occupancy vehicles
5. Single occupancy vehicles

These guidelines recognize the benefits of slower design speeds and constrained streets in urban contexts. Urban areas should reward proximity and short trips at the expense of long trips and capacity.

The following design guidelines aim to:

- Keep intersections compact
- Create a sense of shared space at intersections, so users are aware of each other and can make predictable movements
- Prioritize pedestrian movement and accessibility, as well as safe turning movements for cyclists and vehicles
- Pursue the systematic slowing of motorists to context-sensitive speeds through traffic calming/self-enforcing intersection design
- Prioritize safety and access for users of all ages and abilities, as appropriate to the street typology
- Provide intersections allowing all movements

#### Further Details

- [York Region Pedestrian and Cycling Planning & Design Guidelines](#)



Create safe, shared spaces for multiple modes of movement at intersections

## Reduced Curb Return

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Curb returns guide vehicles in turning corners and separate vehicular traffic from pedestrian areas at intersections. The curb return radius impacts the function of the intersection, with tighter curb returns being better for pedestrians and longer returns being better for large trucks and buses.

### Objectives

The curb return radius on all urban road typologies should be reduced to the greatest extent possible to increase walkability and pedestrian safety. A tighter curb return results in safer intersection/crosswalk design, slows right-turning vehicles at crosswalks, improves visibility between motorists, pedestrians and cyclists, reduces crossing distances and prevents high speed turns. Larger curb return radii may be considered only on roads with higher right-turn truck movements to address the potential conflict between pedestrians and the rear wheels of the trucks.

### Guidelines

- The designer should keep in mind the effective turning radius will be larger than the actual curb radius when considering the effect of parking and cycling lanes in the roadway cross-section
- On City Centre Street and Main Street typologies that intersect with other roadway classifications, and where there is significant pedestrian activity, moderate traffic volumes and a large percentage of passenger vehicles, a curb radius of 6.0 metres to 7.5 metres should be considered
- To avoid oversized curb radii, determining the appropriate design vehicle early in the process is important. The curb radii should

be designed to accommodate the largest vehicle type frequently turning the corner. This approach assumes the occasional large vehicle can encroach into the opposing travel lane. Selecting a curb radius that is too small where right turns by buses or larger trucks are frequent can jeopardize safety and degrade the curb. In some cases, the placement of bollards at curbside could be considered as an additional level of safety for pedestrians

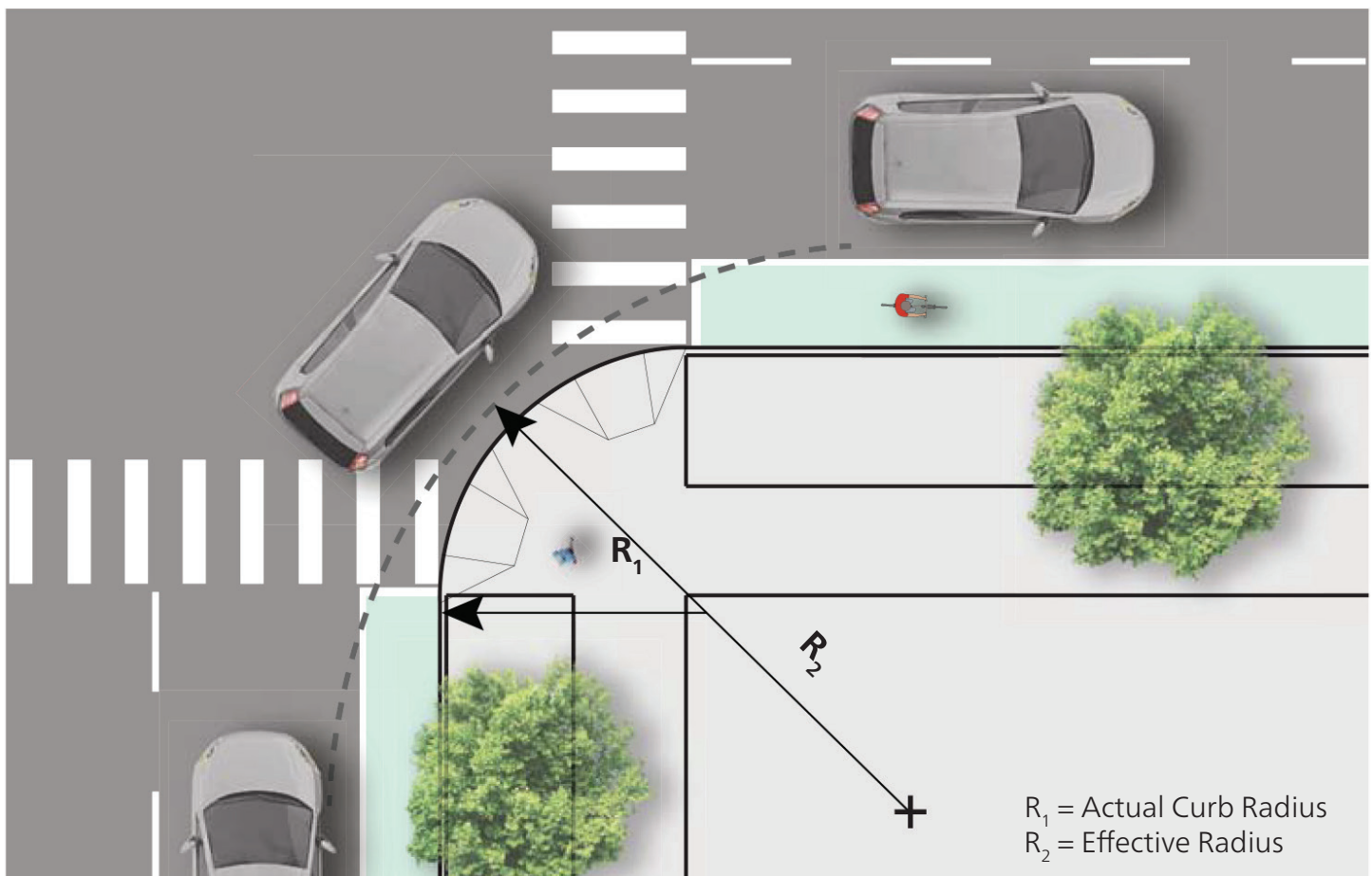
- Generally, a curb radius of 7.5 metres to 9 metres will accommodate most turns on the Avenue typology, particularly on roads with less than 5 per cent trucks. A curb radius of 7.5 metres with a parking lane should permit a single unit truck to turn without encroachment
- Implementing a more walkable community may require that large vehicles encroach entirely into adjacent same-direction travel lanes. If encroachment into an opposing lane is required, the stop line for opposing traffic should be recessed farther from the intersection to permit turns. In some cases, trucks may encroach into the second lane in a four lane condition however should not encroach into an oncoming traffic lane
- For intersections on typologies with a significant number of larger vehicles, the designer should consider the following:
  - Identify the design turning vehicle for the intersection
  - Select curb radii to suit the turning needs of the design turning vehicle
  - Evaluate the benefit of tapered compound circular radii



- Transit Supportive considerations:
  - Avoid using right-turn channels that enable higher vehicle speeds and increase crossing points
  - Maintain the minimum curb radii required to accommodate turning vehicles in order to reduce speed and minimize crossing distances for pedestrians
- Cycle Facility considerations
  - Changes to curb radii should have a neutral impact on the operation of cycling facilities
  - Reduction in curb radii should also be considered at residential and commercial driveways to promote urbanization and provide a safer boulevard/sidewalk

#### Further Details

- [York Region Road Design Guidelines](#)
- [York Region Access Guidelines for Regional Roads](#)



Reduce curb returns on urban typologies to ensure safer crosswalk design and reduce crossing distances

## Sight Triangles

Sight triangles are an important component of intersection design. Their purpose is to ensure sufficient sight distance for the driver of a vehicle to perceive potential conflicts and carry out the necessary action to avoid the conflict and negotiate the intersection safely.

### Objectives

Sight triangles provide clear visibility between motorists, pedestrians and cyclists and enhance walkability. The implementation of a properly designed sight triangle will mitigate the risk of potential conflicts between all modes of travel and increase public safety.

### Guidelines

- In urban areas when buildings are located at the property line, lack of sight triangles is best addressed by means of "4 way stop" conditions or "no right turn on red" for signalized intersections
- The area within the sight triangle as defined in Section 2.3.3.2, Sight Triangles, of the TAC Geometric Design Manual, should be free of obstructions that block a motorist's view of potentially conflicting vehicles, pedestrians and cyclists entering the travel lanes
- Ensure there is adequate space for a refuge area adjacent to the crosswalk by removing / relocating obstructions to facilitate the clear and unobstructed view of on-coming vehicles
- Ensure that vegetation is set-back from the crosswalk and that there is sufficient space for snow storage during the winter months
- Ensure the area within the sight triangle is well lit
- If the sight triangle for the desired operating

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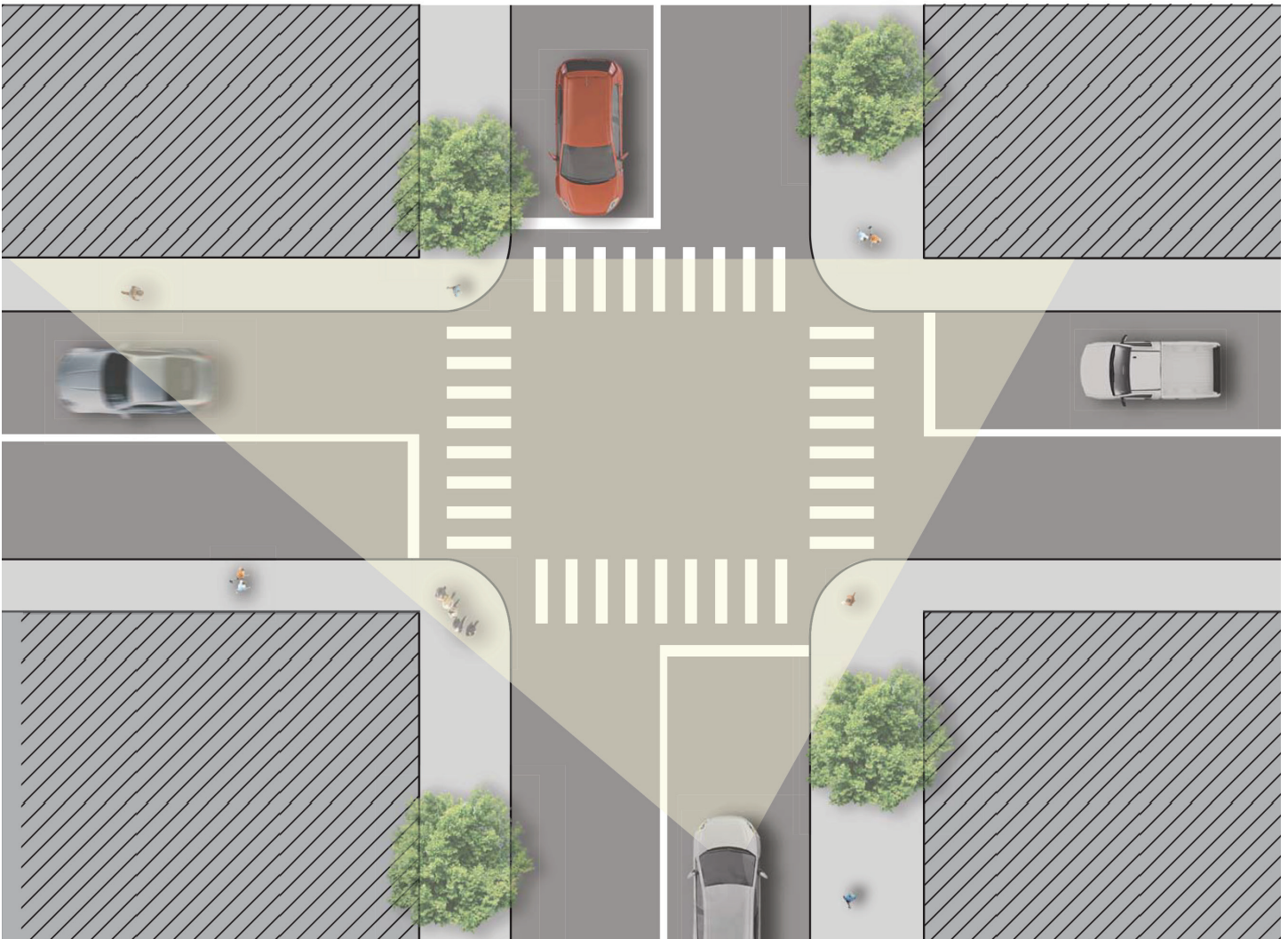
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speed and intersection control is obstructed, efforts should be made to eliminate, move or mitigate the obstruction

- To improve sight lines, restrict parking near intersections, properly trim vegetation, move stop lines back from crosswalks and use curb extensions
- Mature trees should be trimmed when branches encroach into the sight triangle area. Planting of new trees in the sight triangle area is discouraged
- Refer to York Region Transit Drawings and Specifications for location of transit stops in relation to sight triangles
- Avoid the placement of utilities, road signs, transit stops and other similar boulevard elements in the sight triangle

### Further Details

- [York Region Sight Triangle Manual](#)
- [York Region Access Guidelines for Regional Roads](#)
- York Region Transit Drawings and Specifications (Latest versions available through the YRT Capital Assets group.)
- [TAC Geometric Design Manual](#)



Sight triangles ensure sufficient sight distance at intersections to avoid conflicts and improve safety

# Roundabouts

A roundabout is a circular-shaped intersection where traffic continuously flows through the intersection in a counterclockwise direction. Although a roundabout is similar to neighbourhood traffic circles and old-style rotary intersections, its geometric features allow it to provide superior traffic carrying capacity and exhibit better safety performance than other types of circular intersections.

## Objectives

Roundabouts accommodate the volumes of traffic generally experienced on Regional roads and typically outperform, in terms of delays and queues, similar sized All-Way Stop Control or signalized intersections. They also provide a greater level of safety for motorists than other types of intersections, lower negative environmental impacts because of reduced delays and provide opportunities to improve roadway aesthetics.

## Guidelines

- Undertake an Intersection Control Study to assess the feasibility prior to implementing a modern roundabout
- Design of roundabouts should conform to the general design principles of good composition and speed control through adequate deflection for entering traffic
- Roundabouts should be designed to accommodate buses, farm equipment in rural settings, and large trucks such as fire department ladder trucks and tractor trailers
- Include marked crosswalks around the perimeter of the roundabout for pedestrians and discourage pedestrian crossing to the central island

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- Only paint hatching where required to visually increase the diameter of the centre island
- Crosswalks at roundabouts should generally be zebra markings (2.5 metres x 0.45 metres), unless there are very low pedestrian volumes (less than 20 pedestrians in eight hours)
- Where there are very low pedestrian volumes at the roundabout, then parallel striped crosswalks are acceptable. The curb cut should be 2.5 metres wide
- Consult with the Region's Streetscaping team regarding landscaping of roundabouts
- Refer to York Region Pedestrian and Cycling Planning & Design Guidelines (2018) for further information on cycling and pedestrian facilities in roundabouts

## Further Details

- [NCHRP Report 672 Roundabouts: An Informational Guide \(Oct 2010\)](#)
- [York Region Pedestrian and Cycling Planning & Design Guidelines](#)



Keele Street and Lloydtown-Aurora Road Roundabout, York Region Roundabouts may reduce delays and queues on Regional roads



# Crosswalk Treatment

Crosswalks assist pedestrians in safely crossing streets by signifying the crossing point for vehicles approaching an intersection. The design of a crosswalk can greatly influence a crossing's safety and effectiveness.

## Objectives

Crosswalks at controlled intersections on the urban street typologies should be designed to minimize the distance traveled by pedestrians. On wider intersections, a refuge area on a median should be provided to increase pedestrian safety. Crosswalk markings on all street typologies should be consistent wherever possible to eliminate uncertainty for users.

## Guidelines

- Crosswalks must be controlled, easily understood, clearly visible and incorporate realistic crossing opportunities for pedestrians
- Crosswalks should be oriented at 90 degrees to the curb for shortest crossing distance
- Crosswalks may incorporate unique pavement treatments or markings that alert drivers and indicate pedestrian priority
- Pavement treatments or markings must be non-slip/non-skid, durable and long-wearing so they remain highly visible for many years
- Introduce zebra markings at crosswalks at signalized intersections for increased visibility
- Consider unique crosswalk treatments to reflect the character of the neighbourhood
- Locate catch basins outside the crosswalk that provides for safe movement across the street
- School route crossings should be considered for additional safety measures
- Consider raised crossing almost to sidewalk height to eliminate ramps for pedestrians,

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increase the visibility of the crossing and to slow motorists to the desired speed in urban areas. Ramp slopes should be gentle enough to allow for easy plowing and easy access for older residents and those who use assistive devices (motorized and non-motorized). Refer to OTM Book 15 for further specifications

- Transit supportive considerations:
  - At signalized intersections with high pedestrian traffic, consider the use of a pedestrian priority phase to enable simultaneous pedestrian crossings in all directions
  - Consider two stage crossings with pedestrian push buttons for long crossings and/or in areas of high senior/child traffic areas

## Further Details

- [York Region Enhanced Zebra Pavement Marking Detail at Signalized Intersections](#)
- [Accessibility for Ontarians with Disabilities Act, 2005, S.O. 2005, c. 11 \(Cons. 2016\)](#)
- [OTM Book 15](#)
- [York Region Road Design Guidelines](#)
- [York Region Pedestrian and Cycling Planning & Design Guidelines](#)



Zebra markings at crosswalk enhance visibility



## Right- / Left-Turning Lanes

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Right- / left-turn lanes are exclusive lanes that dedicate space to vehicles making turning movements, removing them from through-lanes.

### Objectives

Turn lanes contribute to an efficient transportation network by providing additional motor vehicle capacity and improving the level of service for motorists, as well as reducing collisions from unsafe lane changes at intersections. They also contribute to efficient transit operations when used as a near-side bus bay/queue jump lane.

### Guidelines

- City Centre Street and Main Street typologies:
  - Exclusive right-turn-only lanes should not be implemented as they increase pedestrian crossing time. The curb lane should be a shared through-right-turn lane for these typologies
  - Consider prohibiting left turn movements. In general, where left turn movements are permitted an exclusive left turn lane should be limited to single lane.
- Avenue typology
  - Exclusive right-turn lanes should only be considered when the surrounding road network does not have the capability or capacity to manage traffic without the right-turn lane
  - In general, where left turn movements are permitted an exclusive left turn lane should be limited to single lane.
- Left-turn lanes at signalized intersections:
  - At existing signalized intersections, the need for turn lanes should be based on signalized motor vehicle capacity analysis
  - For new signal installations on streets with

posted speed of 50 or 60 km/h, the need for exclusive lanes is based on signalized motor vehicle capacity analysis

- Permit U-turns only when pedestrian safety will not be negatively impacted
- Discourage the use of channelized right-turn islands
- Consider rapid transit infrastructure needs on VivaNext Expansion Plan routes
- Consider the dual use of a right-turn lane as a bus bay/queue jump lane for transit

### Further Details

- [York Region Road Design Guidelines](#)



Left-turn lanes can reduce delays at intersections

## Cycling Facilities at Intersections

Cycling facilities at intersections may include lane delineations, turning facilities, signage, signalization and markings. Appropriate bike facilities through intersections depend on the road typology. Road designers should refer to the York Region Pedestrian and Cycling Planning & Design Guidelines for more information.

### Objectives

York Region promotes the safe and comfortable year-round operation of cycling routes through design, signage, enforcement and maintenance, and encourages people to cycle more often for both utilitarian, recreation and health purposes. As one of the most common areas of conflict between cyclists and other modes of movement, intersections need to be designed so the interaction of motorists, cyclists and pedestrians is consistent, predictable and safe.

### Guidelines

- Delineations, turning paths, pavement symbols, signage and road surface should be clearly visible to cyclists and motorists. Visibility is especially important at intersections where various modes of transportation interact and cyclists are most likely to get into accidents
- Conflict between cyclists and other modes of travel should be kept at a minimum by separating uses, having cyclists travel in the same direction as automobile traffic and providing appropriate facility widths with sufficient space for encounters, passing and evasive maneuvers
- Bike boxes (example provided in image below) should be considered on roads with designated cycling facilities, significant volumes of cyclists

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and wide intersections to enable cyclists to complete difficult left turn, increase cyclist visibility, improve motorist behaviour and reduce the risk of “right hook” collisions after a green signal.

### Further Details

- [York Region Pedestrian and Cycling Planning & Design Guidelines](#)
- [OTM Book 18](#)



A bike box at an intersection improves cyclists' visibility and allows them to proceed first