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OUTDOOR BROADCAST NETWORK
SEARS
Eaton Centre
SEARS
DOWNTOWN

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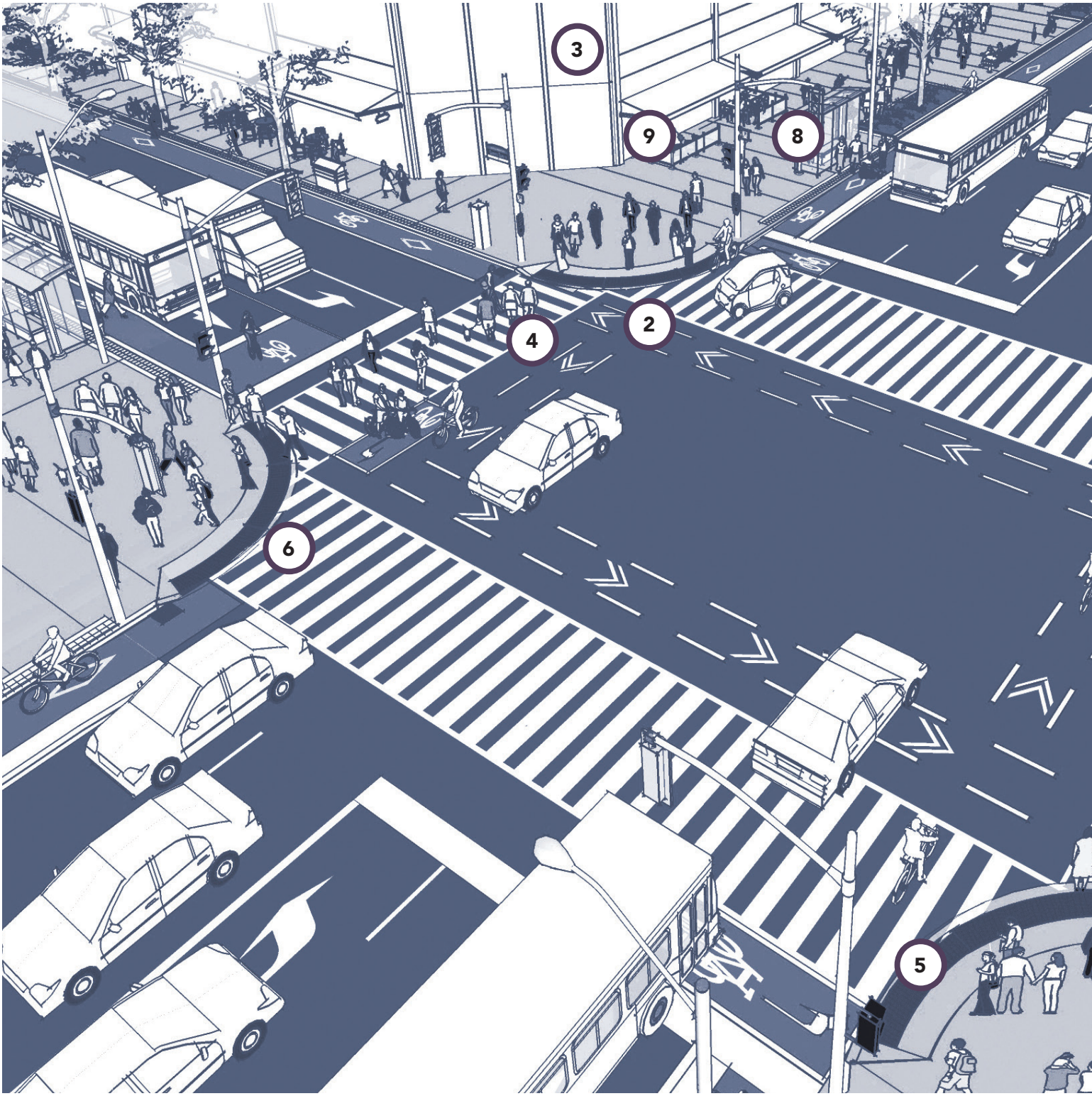
Intersections are where streets meet – these locations generate a lot of interaction and potential conflict among all modes. The principles outlined in this section enable the design of intersections to function well for everyone, to create an environment that is safe and predictable. A key starting point is to understand the primary needs of each modal user. Some street elements that improve the conditions for one mode may reduce the comfort or convenience of another, but these should never supersede the need for safety of all road users, especially of the most vulnerable. Street context will inform intersection design, including the physical space and budget constraints. The street design process will ensure full consideration of the needs of various users and help to weigh the benefits and drawbacks of different intersection features.

9.0 STREET DESIGN FOR INTERSECTIONS

9.1 INTERSECTION DESIGN PRINCIPLES



For illustrative purposes.

1. Safety first: Intersections are where the most points of conflict occur between different street users. The design of intersections should first ensure safe crossing for the most vulnerable users.

2. Predictability: Provide clear guidance for all users on where crossing movements are expected and the correct path of permitted movements. Simplify complex intersections where possible.

3. Visibility: Ensure unobstructed sightlines among road users at intersections. Locate crosswalks close to the intersection to improve the visibility of pedestrians to drivers. Reduce physical barriers and visual clutter.

4. Multi-modal: Select traffic controls based on equitable consideration of all street users, the street's context and role in the network. Analyze capacity from a multi-modal perspective, focusing on movement of people, rather than vehicles.

5. Accessibility: Incorporate accessible design at intersections, such as tactile walking surface indicators, curb ramps or depressed curbs, accessible pedestrian signals, walk speeds at crossings for all ages and abilities, and access to transit stops, etc.

6. Compact design and shorter crossings: Compact intersections tend to lower motor vehicle operating speeds and enable more eye contact, which increases safety. They also minimize pedestrian crossing distances and exposure to risk for vulnerable road users. They can also shorten signal cycle lengths which benefits all modes by reducing delay and improving convenience.

7. Active transportation: Observe and anticipate pedestrian and cyclist desire lines to inform design based on street context. For example, provide depressed curb ramps and wider crosswalks in locations with higher pedestrian volumes, and bike boxes where needed to enhance safety for cyclists making turns.

8. Transit: Incorporate transit stops at intersections to allow for convenient transfers for transit users. Consider transit priority measures based on street context.

9. Placemaking: Depending on street context and width, repurpose space to enhance quality of life with greening, street furniture, or public art gateways, especially to define the entrance to unique neighbourhoods.

10. Maintenance and operations: Intersections should function well for all users all year, e.g. design to prevent ponding at ramps and snow from blocking access to pedestrian push buttons.

11. Manage stormwater: Incorporate green street elements depending on street context and width, such as on curb extension to reduce stormwater runoff and recharge ground water, improve air quality and beautify.

9.2 KEY NEEDS AND PERSPECTIVES OF EACH ROAD USER

The principles outlined in this chapter enable the design of intersections to function well for everyone, to create an environment that is safe and predictable. A key starting point is to understand the primary needs of each modal user. Keep in mind that some street elements that improve the conditions for one mode may reduce the comfort or convenience of another, but these should never supersede the need for safety of all road users, especially the most vulnerable.

PEDESTRIANS

- Lower motor vehicle speeds, by rightsizing vehicle lanes and curb radii, and traffic calming on local or side streets such as installing curb extensions or raised intersections.
- Reduced exposure to risk and conflicts, with clear sightlines and visibility, shorter crossing distances, adequate pedestrian space on corners, and adequate crossing time.
- Accessibility and universal design for all, with curb ramps or depressed curbs (for people using assistive devices or people with shopping carts or strollers), tactile walking surface indicators (for persons with low or no vision), accessible pedestrian signals, dedicated space (away from mixing with cyclists and vehicles), sufficient walk time for all ages and abilities, and adequate sidewalk and crosswalk widths given pedestrian volumes and the street context.
- Adequate signalized crossing opportunities.
- Desire lines inform crossings, so that crosswalks align with the path of travel.
- Placemaking considerations, based on street context, such as buildings that front on the street or have transparent storefronts (for "eyes on the street"), transit shelters and benches.

CYCLISTS

- Lower motor vehicle speeds, by rightsizing vehicle lanes and turning radii, and traffic calming on local or side streets such as installing curb extensions or raised intersections.
- Reduced exposure to risk and conflicts, with clear sightlines, shorter crossing distances, and dedicated space, separation and signal design for cyclists that are context sensitive.
- Guidance for safe streetcar track crossings, by providing markings at safe angles.
- Wayfinding on cycling routes and how to stay on the network and navigate routes, especially at complex intersections.
- Maintenance and materials to have pavement quality that reduces vibrations for cyclists.
- Nearby bicycle parking and Bike Share stations to support cycling options for people, especially at transfer points like transit or major destinations.

TRANSIT USERS

- Good pedestrian and cycling connections (see the previous sections), with sidewalks, transit shelters benches, nearby bicycle parking, and Bike Share stations, wayfinding, cycling route information, and regular maintenance (e.g., snow removal).
- Reduced exposure risk and conflict, such as curb extensions at bus stops, transit-only lanes and far-side bus stops.
- Accessibility for all with context-specific stop spacing, platforms, bus pads and sidewalk ramps with tactile walking surface indicators, and well-lit transit stops and adequate pedestrian clearway widths.

Pedestrians crossing a busy intersection in North York.

- Reliable and improved travel times and schedules, with context-specific measures such as frequent headways, signal priority, queue jump lanes, and seamless connection to other transit.
- Placemaking considerations, based on street context, such as buildings that front on the street or have transparent storefronts (for "eyes on the street"), safe, comfortable waiting areas and transit-supportive developments.

MOTORISTS (e.g. TRANSIT, CARS AND TRUCKS)

- Reduced conflicts and severity of crashes, with clear sight lines and visibility, dedicated space for all modes, and predictability of expected movements (e.g. using pavement markings, signage and signals/traffic controls).
- Safe turning options, with context-specific measures such as phase-separated turning movements, placement of advanced stop bars, and clearly marked turn lanes.
- Well-maintained intersections such as good pavement quality, pruned vegetation, and adequate levels of lighting.
- Wayfinding, with large visible street name signs and other wayfinding information to help people navigate the city, e.g. to locate reliable parking options.
- Reliable and improved travel times, using coordinated signal timing, responsive vehicle detection and signals, real-time information, traffic regulations and congestion reduction by shifting more trips to walking, cycling and transit.

Cycling facility is at sidewalk level for accessible boarding on transit at the intersection.

Cycling infrastructure in Toronto that promotes multi-modal mobility and safety.

9.3 ACCESSIBILITY AND UNIVERSAL DESIGN OF INTERSECTIONS

Intersection design is an important component of providing accessible and barrier-free environments for everyone. The following are some examples of accessible and universal design strategies to provide access, predictability, safety and convenience for people of all ages and abilities at intersections.

Depressed curbs smooth the transition from sidewalks to roadways.

Tactile Walking Surface Indicators are detectable underfoot and used as a warning for people with low or no vision.

CURB RAMPS OR DEPRESSED CURBS

To eliminate the need to step down from a curb to the roadway to cross at intersections, design intersections with adequately wide and properly designed curb ramps and depressed curbs at intersections. A curb ramp or depressed curb is needed for people with physical disabilities or even people using shopping carts or strollers. A fully depressed curb has the benefit of removing trip hazards (e.g., the section of curb between crosswalks), especially with high volumes of pedestrians. Curb ramps can also be found at transit stops, such as for the Light Rail Transit stops.

TACTILE WALKING SURFACE INDICATORS (TWSIs)

These are the flat-topped bumps detectable under foot that are used as warning or attention indicators for persons with low or no vision. TWSIs help warn someone with low or no vision that they are approaching a hazard such as moving traffic or the edge of a transit platform.

ACCESSIBLE PEDESTRIAN SIGNALS (APS)

These have an audible locator tone and also a walk indicator tone to indicate to persons with low or no vision when it is safe to cross the roadway and in which direction. APS may be activated automatically, or by push-button that has a tactile arrow aligning with the direction of crossing. This button vibrates when the pedestrian can cross for persons who are deafblind.

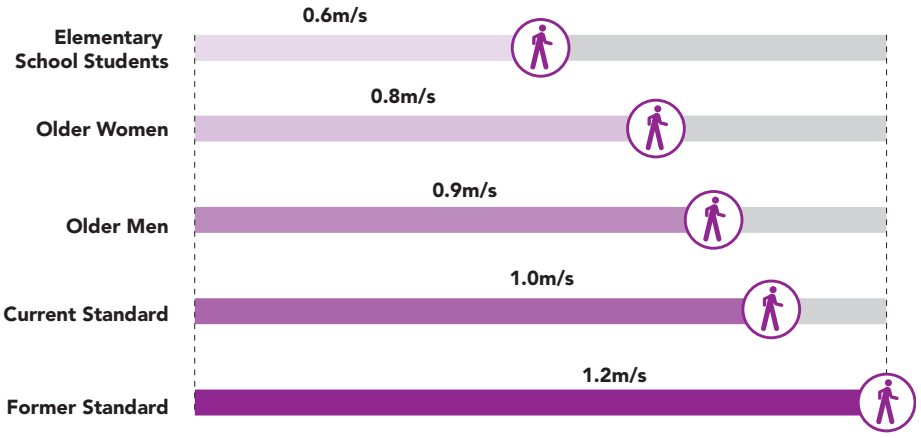


Figure 9-1: Not all pedestrians are able to cross the street at the same pace. Signal timing should consider context and most likely users.

c. L. Asher, M. Aresu, E. Falaschetti, J. Mindell (2012). Most older pedestrians are unable to cross the road in time: a cross-sectional study. Age and Ageing, Oxford Press; L. J. H. Schulze (2006). Evaluation of cross-walk timing and the application of a standard crossing light timing formula, International Ergonomics Association

WALK SPEEDS AT CROSSINGS CONSIDERING ALL AGES AND ABILITIES

Typical walk speeds when crossing the street are 1.0 to 1.2 metres per second (m/s), but this walking speed could exclude one-third of older pedestrians and 90 per cent of pedestrians using an assistive device such as a walker or cane. Where there are higher pedestrian volumes and the expectation of pedestrians with disabilities based on demographics and land use context, the walk speed for traffic signals should be in the range of 0.8m/s to 1.0m/s to enable safe crossings for people of all ages and abilities.

DEDICATED PEDESTRIAN SPACE (AWAY FROM MIXING WITH CYCLISTS AND MOTOR VEHICLES)

The hierarchy of vulnerable users has pedestrians at the top, because they are unprotected when encountering faster-moving road users such as cyclists, motorcyclists and drivers. At intersections and mid-block locations, it is important to provide dedicated space for pedestrians, and separation from cyclists and motor vehicles, whether on the sidewalk, at transit stops, and at intersections – on street corners and crosswalks.

ADEQUATE SIDEWALK AND CROSSWALK WIDTHS FOR THE STREET CONTEXT

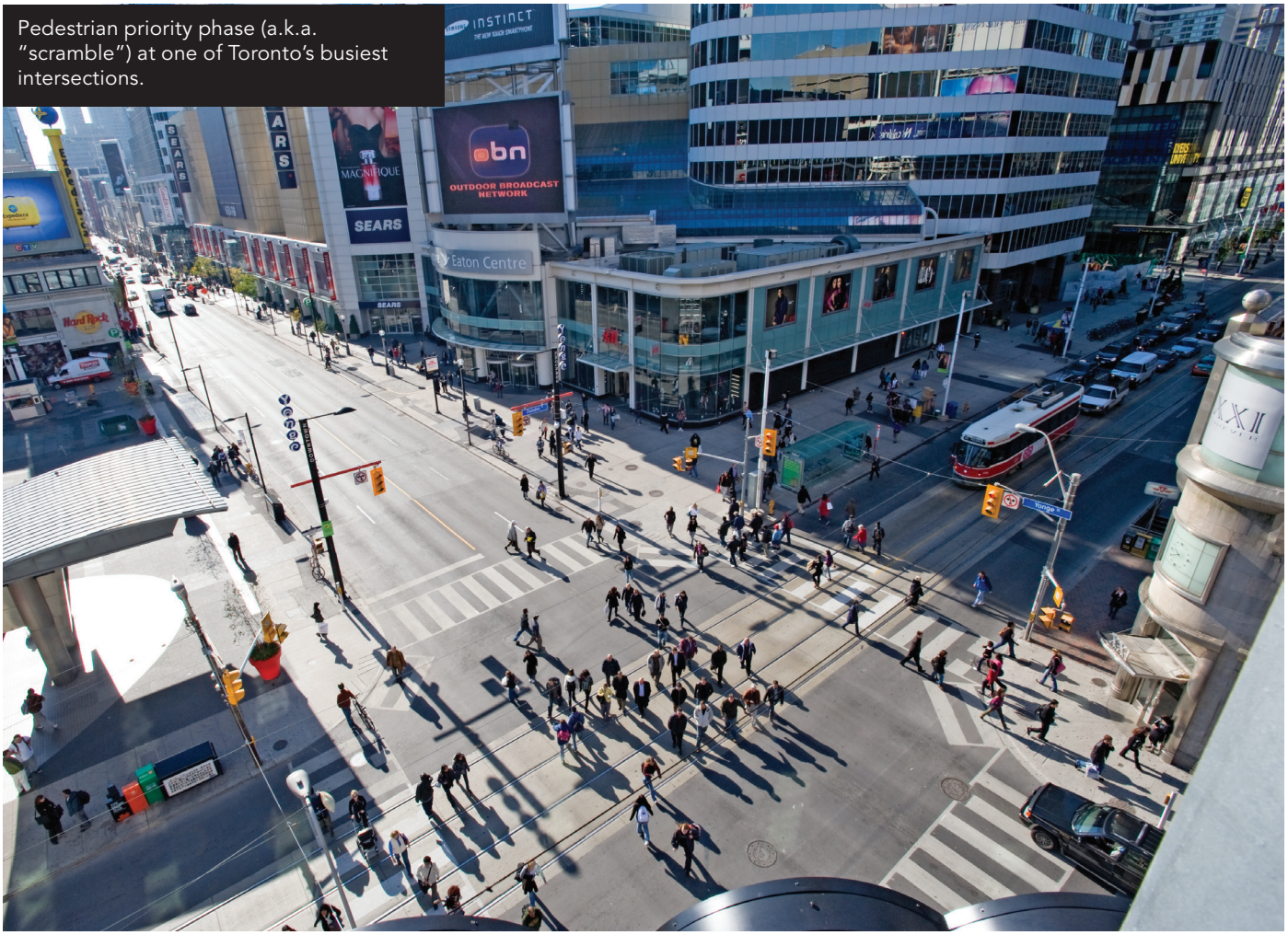
Safe, passable space is needed to accommodate persons using assistive devices and the context-specific pedestrian volumes at intersections. Sidewalk and crosswalk widths should be commensurate with the intensity of pedestrian activity and volumes at intersections, to minimize crowded conditions, and potential conflicts among modes.

9.4

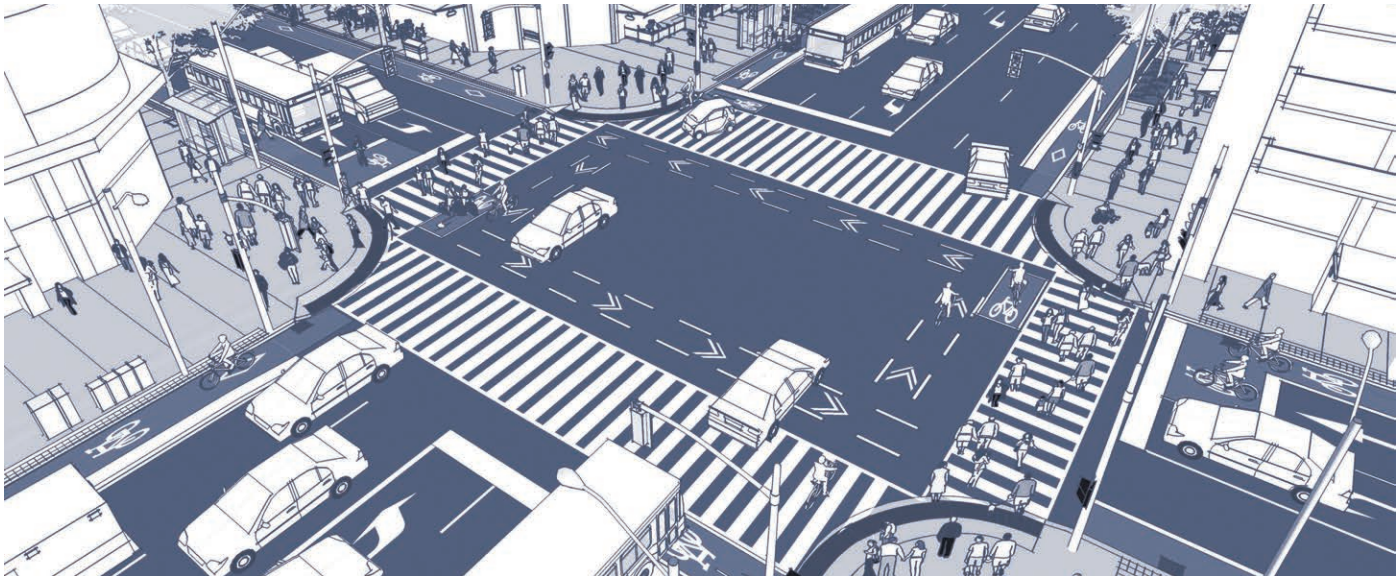
CONTEXT-SENSITIVE INTERSECTION DESIGN

Intersection design will depend on street context including nearby land uses, users of the street, and role in the network. The variety of Toronto's intersections is vast, and local conditions play a key role in the design and selection of elements. The street design process will ensure full consideration of the needs of various users and help to weigh the benefits and drawbacks of different intersection features.

Following are some examples of common types of intersections and their considerations for complete streets design.



Pedestrian priority phase (a.k.a. "scramble") at one of Toronto's busiest intersections.

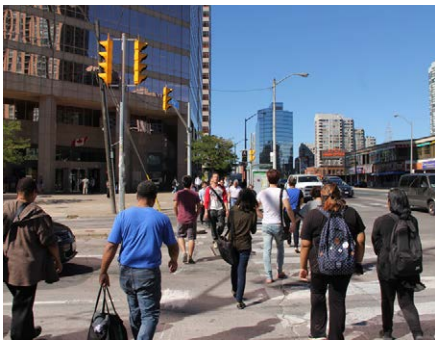


For illustrative purposes.

MAIN STREETS OR MIXED-USE CONNECTORS

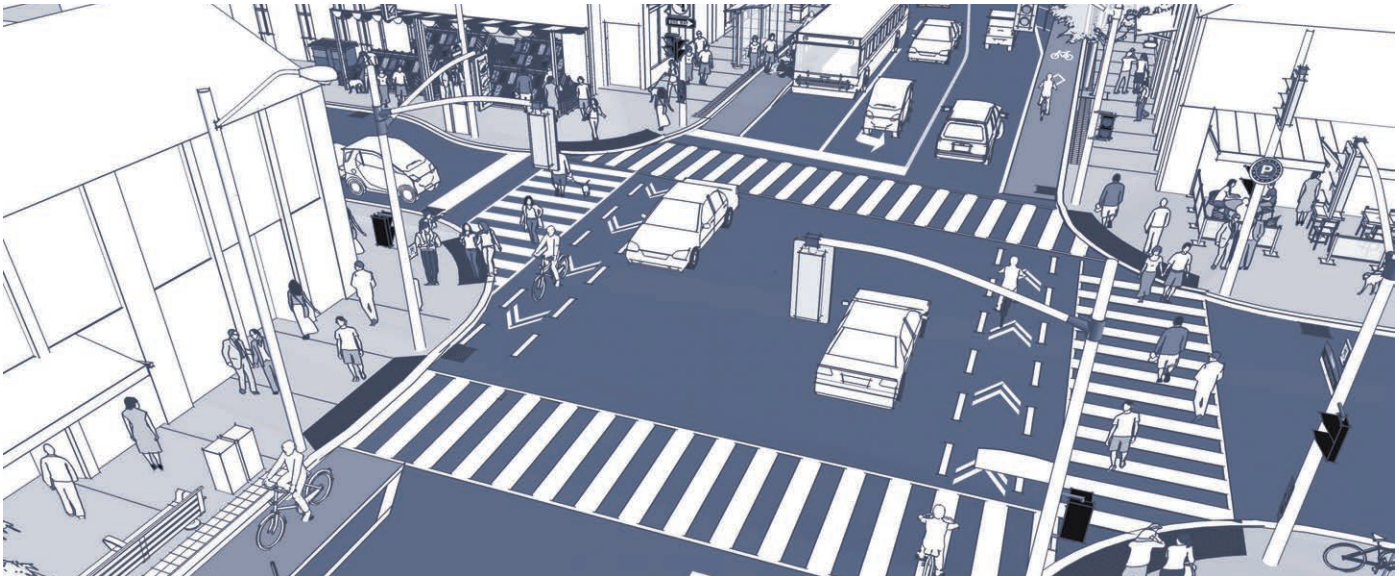
Main Streets or Mixed-use Connectors often have a combination of high traffic volumes, high approach speeds, transit stops and pedestrian and cycling activity. The challenge becomes balancing the need to reduce risk to all road users, while accommodating traffic capacity and turning movements for larger vehicles. Consider the following design treatments:

- Due to the size of these intersections, clear alignments and pavement markings are needed to guide the paths for all road users and to provide predictable and visible movements.
- To help pedestrians of all ages and abilities to safely cross wide roadways, consider pedestrian crossing islands, zebra crosswalk markings, the City's standard curb radii, leading pedestrian interval (LPI) signals, adequate space for pedestrians waiting on street corners (e.g., declutter corners, rightsize corner, set back buildings, etc.), and other pedestrian safety measures.
- To make cyclists more visible to other road users, mark bicycle facilities through the intersection, including bike boxes or queue boxes, providing designated bicycle signal phases where appropriate, and regulatory and warning signs for motorists where notable conflicts exist.
- Analyze intersection capacity from a multi-modal perspective and focus on moving people, such as by prioritizing transit, in order to reduce traffic congestion as intersections become busier with residential and employment growth. Consider planned land uses, anticipated mode split shifts, and latent demand for pedestrian, cyclists and transit users during the design process.



Crossing at a major intersection in North York.

A main street intersection in Scarborough.

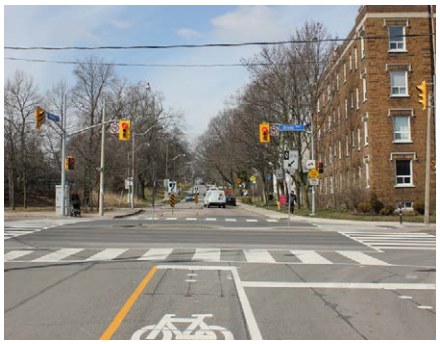


For illustrative purposes.

INTERSECTIONS BETWEEN RESIDENTIAL STREETS WITH MAIN, CIVIC AND CONNECTOR STREETS

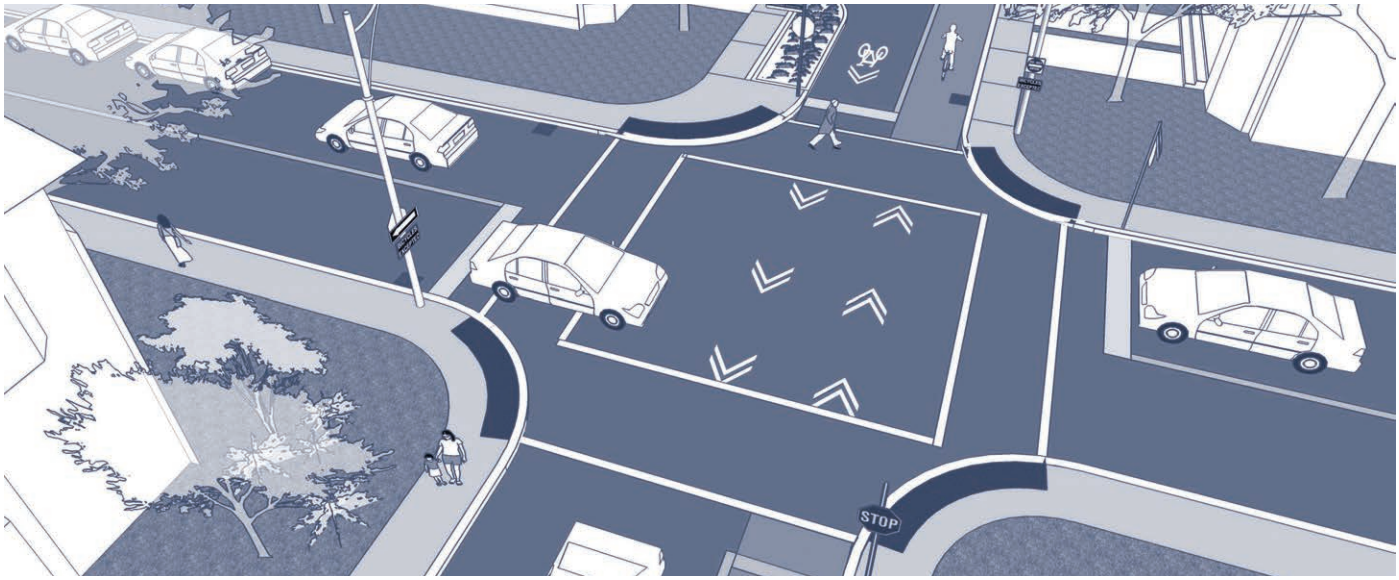
Design becomes complex for situations where lower volume streets intersect with higher volume streets, because traffic flow and capacity will focus on the busier street, yet side streets and their users also need to be accommodated. These intersections may be signalized or have two-way stop control such as stop signs. Consider the following design treatments:

- Clearly mark controlled pedestrian and cyclist crossings (i.e. with stop control, PXOs with flashing lights, or signals) wherever they exist.
- Analyze and design intersections taking into account the transportation network. It may not be possible or practical to accommodate all movements at all times (e.g. through or left-turn movements from the side street) at a two-way stop-controlled intersection.
- If there is heavy traffic on the Main, Civic or Connector Street, with insufficient gaps in traffic for safe turns, consider access management strategies such as consolidating and limiting driveways, laybys or other conflict points, and potential turn prohibitions from side streets.



Pavement markings indicate actuated signals for cyclists.

Streetcar at Kingston Road and Scarborough Road.



For illustrative purposes.

INTERSECTIONS AT RESIDENTIAL STREETS

Residential street intersections are characterized by low traffic volumes and slower speeds. In addition, people of all ages and abilities may be on foot in the neighbourhood for various activities such as getting to school, transit or nearby destinations. Consider the following design treatments:

- Enhance pedestrian safety with crosswalks, all-way stop control, curb extensions, raised intersections, and rightsizing corner radii as well as complementary mid-block measures (e.g., chicanes, mid-block curb extensions, etc.).
- In general, delay and capacity are not key factors for residential intersections as they have low volumes and speeds. Design of these intersections focuses on pedestrian accessibility and connectivity to homes, parks, community centres, and the pedestrian network to transit and other streets. Cyclists are often accommodated in a similar manner to motor vehicles or are supported by bicycle-friendly street designs noted in the Cycling chapter of this document (e.g., adequately wide curb lanes, bicycle detection at actuated signals, etc.).
- While larger vehicles such as fire, waste collection and snow plow trucks are important to consider, the turning movements for these vehicles will typically use the width of the roadway to negotiate turns.

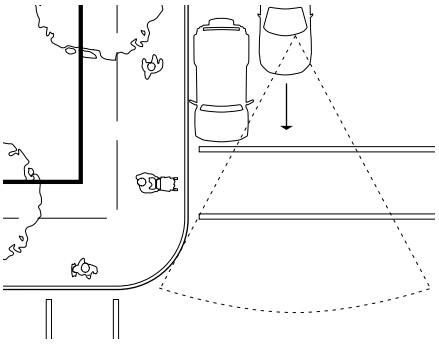
Multi-modal intersection of residential streets.

Residential street intersections may include curb extensions.

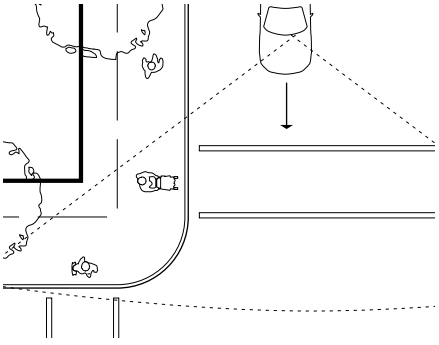
9.5

INTERSECTION ELEMENTS AND GEOMETRIC DESIGN

Various street elements and design features contribute to complete streets strategies for intersections. The selection of features will depend on street context such as land uses, networks, type of intersection, alignment, number and type of lanes, speed, right-of-way widths, and existing and projected volumes of different modal users. The following illustrates some key examples of these features, but is not meant to be an exhaustive list.



Sight line obscured by a parked car.



Improved sight line due to parking prohibition near the corner.

FOR ALL ROAD USERS

PAVEMENT MARKINGS & VISIBLE CROSSINGS

Visible pavement markings such as stop bars, and pedestrian crosswalks (a.k.a. zebra pavement markings or parallel line markings) to indicate where vehicles are to stop and where pedestrians and cyclists cross a roadway at controlled crossings.

SIGHT LINES

A clear view of people, activities and objects. (a.k.a. "daylight triangles" near intersections and driveways). Ensuring good sight lines reduces the risk of conflicts between all street users and promotes safety for all. Regulations that prohibit parking at the corner can also improve blocked sight lines.

CURB RADII

The curved section of a curb that connects two intersecting streets. Its size affects the turning speed of vehicles, pedestrian crossing distances, visibility, and space available for pedestrians waiting to cross the street.

Simple placemaking can be combined with curb extensions, like this example in Etobicoke-York.

PEDESTRIAN-RELATED FEATURES

CURB EXTENSIONS

Curb extensions (a.k.a. bump-outs or bulb-outs) are enlarged sidewalk or boulevard areas at corners. A common complete streets measure that reduces pedestrian crossing distances and signal cycle lengths, and improves visibility and pedestrian waiting areas on corners.

PEDESTRIAN CROSSING ISLANDS

An area protected by curbs where pedestrians can wait or rest while crossing streets. They must have accessible features (e.g. curb ramps, APS and TWSIs) and may be considered for high volume intersections with six or more lanes of traffic. The decision to include islands or medians should be weighed against using that space instead for adequately wide sidewalks, cycling facilities, and planting and furnishing zones.

RAISED CROSSWALKS OR INTERSECTIONS (A.K.A. TABLE TOPS)

These are raised areas of the roadway at intersections. They improve the visibility of pedestrians crossing and increase the awareness of drivers travelling at inappropriate speeds.

PLACEMAKING AT INTERSECTIONS

Depending on street context, there may be features that enhance the sense of place while balancing the need for safety and clear sightlines. Features used at intersections include but are not limited to: wayfinding signs, maps or information pillars; landmarks; gateway features; meeting locations with seating; pedestrian lighting; pedestrian crossing islands with landscaping; decorative pavers; and carefully selected street furniture and/or street art.

Raised crosswalk in Toronto.

Placemaking at intersections may include cafés or other seating.

Left-turn queue boxes indicate a designated area for cyclists to make a left turn.

Arrows indicate the path of cyclists through an intersection.

Skip lines indicate cycling infrastructure through an intersection.

CYCLIST-RELATED FEATURES

BICYCLE LANE MARKINGS

Pavement markings indicating the paths of cyclists, e.g., a bicycle lane through the intersection or between vehicle through-lanes and right-turn lanes at intersections, to increase awareness at conflict points.

CROSS RIDES

Cross rides indicate where cyclists may ride to cross a roadway at controlled crossings, alongside pedestrians. Adequate width and attention to design are required for the crosswalk and cross ride to prevent conflicts among cyclists and more vulnerable pedestrians of all ages and abilities.

LEFT-TURN QUEUE BOX

Pavement markings indicating a safe and designated area for cyclist making a left-turn maneuver. May be accompanied by a right turn on red restriction if the queue box is in the path of vehicular right turns.

BICYCLE QUEUE BOXES

A marked area where most cyclists are anticipated to make two-stage crossings to make a left turn. For pedestrian safety and clear sightlines, avoid pushing crosswalks far back from the intersection.

Cyclists yield to pedestrians boarding a streetcar on Roncesvalles Ave. in Toronto.

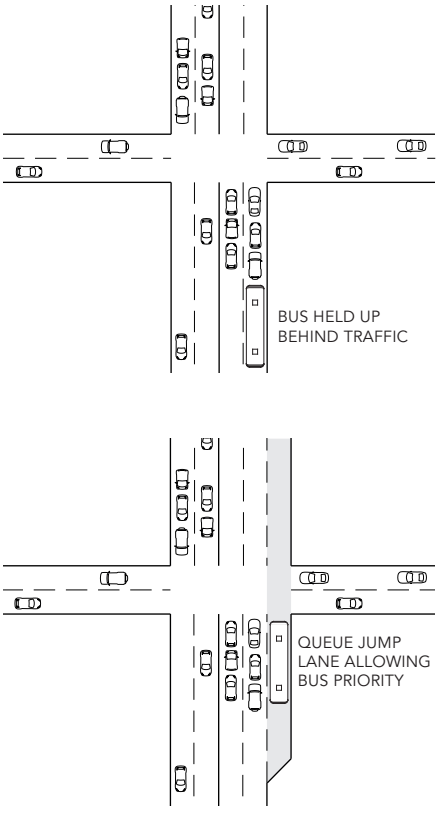
TRANSIT-RELATED FEATURES

TRANSIT LANES
Dedicated lanes for public transit, such as HOV or bus lanes and designated transitways for buses, streetcars or light rail vehicles. These enable greater frequency and reliability of transit service.

TRANSIT STOPS (STOPS, PLATFORMS, AND CROSSINGS)
Locations where transit riders wait for, board, and leave transit vehicles. Transit stops may be curbside or on platforms in the middle of the roadway. They may also include transit branding/signs, transit shelters/benches, wayfinding, schedule or real-time information and transit payment systems.

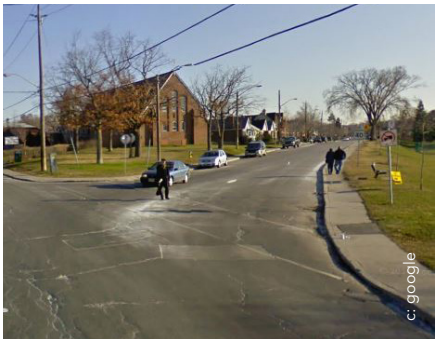
TRANSIT QUEUE JUMP LANES
Queue jump lanes are typically extended right turn lanes that provide opportunities for buses to move to the front of the queue. Considered where heavy volumes of mixed traffic negatively impact transit service, depending on space and impacts to other road users.

TRAFFIC REGULATIONS
Stopping, parking or turn restrictions, as this can improve performance of through movements for transit and other vehicles.



Before and after Queue Jump Lanes are added.


Pavement markings show the path vehicles should take through a skewed intersection.



Before.

After an intersection in Scarborough is normalized.

OTHER INTERSECTION DESIGN STRATEGIES

NORMALIZE OR RE-ALIGN INTERSECTIONS

Reconfigure an irregular intersection (e.g., skewed, offset or complex) that is confusing to road users.

LANE ALIGNMENTS

The path of vehicles as indicated by pavement markings and the physical design and curvature of the road. The desired path for vehicles should be clear and easy to follow, especially where there are transitions in the number of lanes or where there are turn lanes.

RIGHT-TURN CHANNELS (A.K.A. 'PORK CHOPS' BECAUSE THEY LOOK TRIANGULAR)

A triangular island used to channel turning traffic. These dedicated turn channels present safety concerns for all road users as they result in poor sightlines, and significant barriers to persons with disabilities. The City of Toronto's policy is to remove right turn channels if possible and not to build new ones. Decisions to maintain existing channels require careful consideration and engineering judgment.

HIGHWAY INTERCHANGES

Interchanges intersect city streets in urban areas and must be designed to accommodate vulnerable road users, including pedestrians of all abilities and cyclists, to ensure safety, accessibility and connectivity with adjacent communities. Review best practices for context-sensitive design options for interchanges intersecting urban areas to support Complete Streets goals.

GRADE SEPARATED FACILITIES

Roads that run overhead or underground are called grade separated. Such facilities create significant barriers between neighbourhoods and for vulnerable road users. Review best practices for context-sensitive design options for addressing safety, multi-modal and placemaking needs so that grade separated facilities support Complete Streets goals.

Multiple users at a downtown Toronto intersection.

Greening of an intersection in Scarborough.

Zebra markings at an intersection in Etobicoke.

9.6 INTERSECTION SIGNALS AND OTHER TRAFFIC CONTROLS

The City of Toronto uses various intersection signals and other traffic control devices to facilitate safe movement of all road users, guided by the recent Traffic Signal Operation Policies and Strategies (2015). These policies align with the complete streets approach and are based on industry standards, guidelines, and best practices, including the Ontario Traffic Manual (OTM) Book 12, the Ontario Highway Traffic Act (HTA), the Manual for Uniform Traffic Control Devices (MUTCD) for Canada, and the Transportation Association of Canada (TAC) Guidelines.

The choice of signal or device is often determined by technical warrants that get updated from time to time by the City to account for best practices. Technical warrants often use numeric inputs and data, such as volumes, collision history, conflict data/near misses, speed, delay and environmental/site audits. What follows is a list of examples of intersection signals and traffic control devices used in the City of Toronto.

INTERSECTION SIGNALS

PEDESTRIAN COUNTDOWN SIGNALS

Device shows the number of seconds left for crossing a street. Pedestrians should begin crossing with the WALK signal and finish crossing by zero.

LEADING PEDESTRIAN INTERVAL

WALK signal is about 5 seconds ahead of the green traffic signal to give pedestrians time to become visible in the crosswalk to drivers.

PEDESTRIAN PRIORITY PHASE ("SCRAMBLE")

Vehicular traffic is stopped on all approaches and pedestrians can cross in any direction, including diagonally. Typically used where there is a large volume of pedestrians, lack of space for pedestrians, and issues with wait times, crowding and safety.

BICYCLE DETECTION AT SIGNALS

Detection technology that allows cyclists to trigger a 'green light' at an intersection and not wait for a larger or heavier vehicle in order to navigate an intersection.

BICYCLE SIGNALS (E.G., TRAIL CROSSINGS)

Electronic signals for cyclists to guide and coordinate their movements with other traffic (e.g., cars, transit and pedestrians) and may indicate bicycle signal phases or other bicycle-specific timing strategies.

LEADING CYCLING INTERVAL

An advanced green for cyclists to give priority to bicycle movements at an intersection.

TRAFFIC SIGNAL PROGRESSION

Modification of signal timing to have coordinated 'green lights' for better traffic flow.

TRANSIT SIGNAL PRIORITY

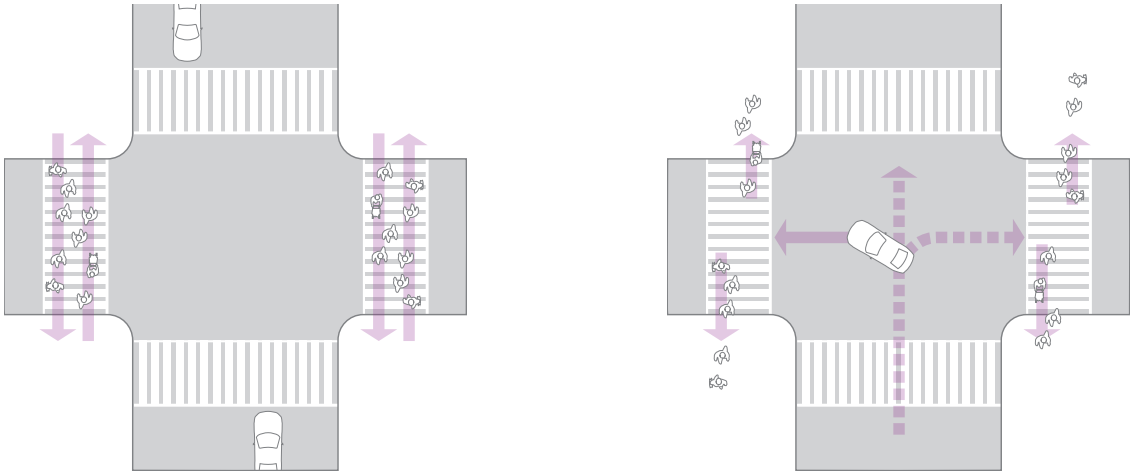
Modification of signal timing for transit vehicles such as extending 'green light'.

BLANK-OUT NO LEFT TURN SIGN

Electronic sign (a.k.a. LED Blank-Out Sign) that is well-illuminated to indicate time-of-day restrictions for left turns at intersections. Its purpose is to help drivers recognize turn restrictions to improve compliance and traffic flow.

DEDICATED OR SEPARATED LEFT TURN SIGNALS

Also called a fully-protected left-turn phase, vehicles may turn left only while facing a left turn green arrow, and have the right-of-way with no conflicting movements with other road users permitted.



A Leading Pedestrian Interval gives pedestrians a five second head start, making them more visible to turning motorists.

OTHER TRAFFIC CONTROLS

STOP SIGNS (OR STOP CONTROLS)

A sign that indicates to vehicles to come to a complete stop (at the stop line or crosswalk) and wait until the way is clear before entering the intersection.

PEDESTRIAN CROSSOVERS (PXOS)

Designated areas for pedestrians to cross where there are no traffic signals. Drivers and cyclists are to watch for pedestrians at these crossings and must yield the right-of-way to pedestrians in the crosswalk. Pedestrian crossovers are indicated by signs, markings, and yellow lights. It is against the law to pass any vehicle within 30m of the pedestrian crossover.

SCHOOL CROSSWALKS

Designated areas for pedestrians to cross where there are no traffic signals, and located on the route to or in the vicinity of schools. School crosswalks are indicated by signs and markings, and/or where a school crossing guard is present.

YIELD TO PEDESTRIANS

A sign that indicates to vehicles to let pedestrians go first, and to stop and wait for any pedestrians to fully cross the road at the crosswalk.

YIELD SIGN

A sign that indicates to vehicles to let traffic in the intersection or approaching the intersection to go first, and to stop if necessary and proceed only when the way is clear.

RIGHT TURN ON RED RESTRICTION

A sign that indicates to vehicles that they are not allowed to turn right when facing a red traffic light. No Right Turns On Red are implemented for various safety reasons, including to reduce collisions of right-turning vehicles with vehicles proceeding on their green light, and also between right-turning vehicles and pedestrians crossing with their WALK signal.

Signals and traffic control devices are often combined with physical, built environment features, such as rightsized traffic lanes, curb radii/ extensions, and cycling facilities to create safer streets.

Seniors crossing at a major intersection in Scarborough.

GENERAL GUIDANCE ON INTERSECTION SIGNALS AND TRAFFIC CONTROL DEVICES

When reviewing or making decisions about signals or traffic control devices, there are some key considerations to keep in mind for the safety and comfort of all road users regardless of age and ability:

- **Key principles of complete streets:** Provide equitable consideration of all road users, and consideration of a street's context in the design of the street and the selection of traffic control devices.
- **Safety first:** Consider the use of a combination of physical design (e.g., rightsized traffic lanes and corner radii) and traffic control features to achieve the desired 'target speed' for the street's context.
- **Use future, not past data:** Use projected future volumes and not past or existing data for all modes in the analysis and review of future infrastructure, new developments and environmental assessment studies.
- **Connectivity in Networks & Desire Lines:** Understand existing and aspirational pedestrian and cyclist desire lines and active transportation networks to identify opportunities to introduce safe crossings, such as PXOs or Traffic Control Signals.
- **Spacing between controlled crossings:** Consider land uses, density, pedestrian volumes and demographics when looking at spacing of controlled crossings. All pedestrians, especially persons with disabilities benefit from having more closely spaced crossing opportunities. The desire for widely spaced intersections for faster motor vehicle movements needs to be weighed against the impacts on safety, connectivity and accessibility of pedestrians and cyclists.
- **Adequate crossing times and walk speeds accounting for all ages and abilities:** Consider how to best accommodate slow walkers through the provision of the shortest possible crossing distance and adequate signal time. Long crossing distances not only increase pedestrian exposure to risk of collision in the street, they also require longer signal cycles to give enough time to safely cross the street.
- **Reduce need to push buttons (use fixed-time mode)**: Fixed time or automated walk signals are appropriate in locations with moderate and higher pedestrian volumes, such as downtown and main street shopping areas, and in the proximity of pedestrian trip generators.
- **TTC or Fire pre-emption:** Identify if there is currently or potentially the need to operate with TTC or Fire pre-emption and weigh the needs and benefits given the street context and network.

Street and intersection design must consider the roles of streets at different times of the day and night.

- **Coordinated signal timing:** The purpose of coordinated signal timing is to help manage traffic flow along a corridor. In addition, balancing the traffic volumes between intersections helps to prevent or reduce queued up traffic. In real life conditions, however, there are numerous disruptions that may make it difficult to perfectly meter traffic.

- **Short signal cycles:** In general, short signal cycles (60-90 seconds) are preferred as they provide predictable and regular crossings, and generally minimize overall delay for all users. While short cycles tend to encourage people to obey the signals compared with locations with longer delays, the short cycle length needs to be weighed against the safety benefits of separated signal phases, such having dedicated left-turn signals.

- **Different times of day and night:** Consider the changing nature and role of a street throughout the course of the day, as demand may change by mode and by direction during different times. Traffic signal timing should be adjusted to meet various modal and directional demands to optimize people-moving capacity and convenience.

MORE INFORMATION:

- City of Toronto. Accessibility Design Guidelines. 2004.
- City of Toronto. Complete Interchanges: Urbanization of Grade Separated Facilities. Anticipated 2017.
- City of Toronto. Criteria for Evaluating Request for Queue-Jump Lanes. Updates underway (in use internally).
- City of Toronto. Curb Radii Guidelines. 2015.
- City of Toronto. Traffic Signal Operations Policies and Strategies. 2015.
- "Highway Safety Manual." American Association of State Highway and Transportation Officials. 2016.
- Institute of Transportation Engineers and Congress for the New Urbanism. Designing Walkable Urban Thoroughfares: A Context Sensitive Approach. 2010.
- Ministry of Transportation of Ontario. Ontario Traffic Manual Book 11: Pavement, Hazard and Delineation Markings. 2000.
- Ministry of Transportation of Ontario. Ontario Traffic Manual Book 12: Traffic Signals. 2012.
- Ministry of Transportation of Ontario. Ontario Traffic Manual Book 15: Pedestrian Crossing Facilities. 2016.
- Ministry of Transportation of Ontario. Ontario Traffic Manual Book 18: Cycling Facilities. 2013.
- National Association of City Transportation Officials. Urban Street Design Guide. 2013.
- New York City Department of Transportation. Making Safer Streets. 2013.
- Transportation Association of Canada. Pedestrian Crossing Control Guide. 2012.
- Welle, Ben. "Cities Safer by Design: Guidance and Examples to Promote Traffic Safety through Urban and Street Design". World Resources Institute. 2015.