

# Roadway

Roadway design elements include the number and width of vehicular lanes, medians, traffic calming features, and mid-block crossings.

## Ensure Safety and Security

The design of the vehicle roadway can reduce traffic volume and speed, and can:

- ◆ increase people's willingness to walk and cycle,
- ◆ decrease pedestrian/cyclist collision risk with vehicles,
- ◆ increase the chance of surviving a crash, and
- ◆ decrease air and noise pollution from vehicular traffic.

### a. Street Width/Total Number of Lanes

A typical “road diet” consists of removing one lane in each direction of a four-lane street section. The road space previously assigned to the two removed lanes is then re-purposed for such things as a centre turn lane, landscaped median, cycle lanes, or wider sidewalks. In many cases, road diets occur where there is currently excess road capacity for motor vehicles. Collision rates tend to be higher for wider roads.

Appropriately applied road diets can:

- ◆ reduce vehicle speeds and collisions,
- ◆ increase cycling activity.

Minimizing road widths (crossing distances) is especially important for seniors and pedestrians with disabilities.

### b. Narrow Lane Width

Narrower lanes help to calm traffic and expand options for including cycle lanes, sidewalks, trees, etc. They have been found to:

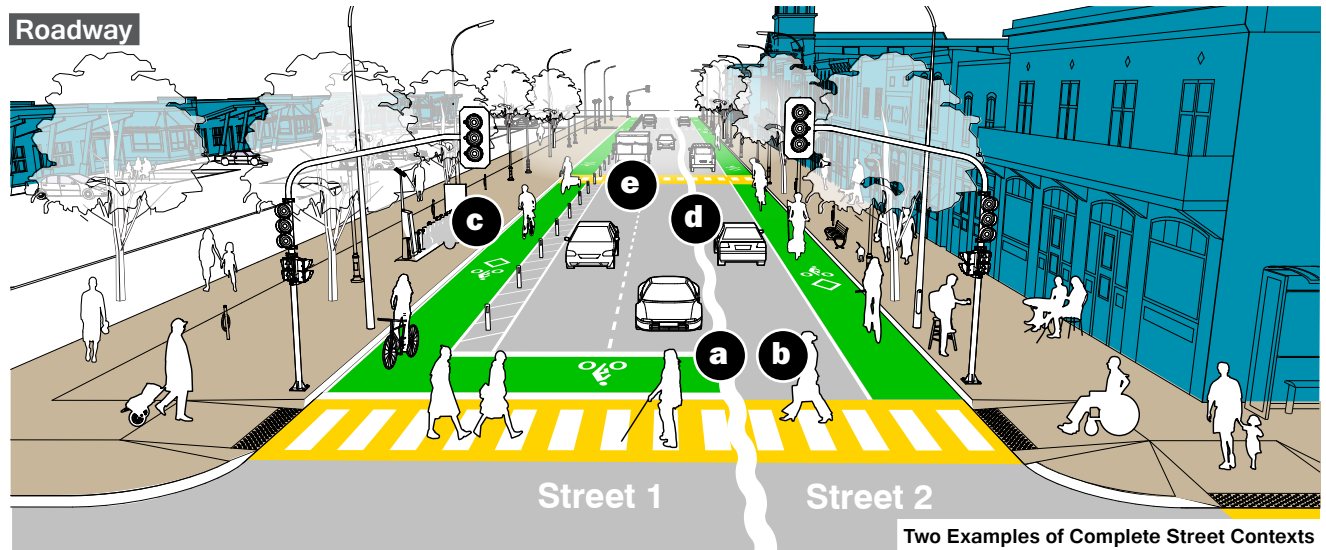
- ◆ reduce vehicular travel speed, as the constraints of the lane force drivers to operate more cautiously,
- ◆ decrease the likelihood of collisions, due to slower motor vehicle speeds, and
- ◆ reduce severity of injuries in the event of collisions.

“Enough research has been done to know that narrow traffic lanes are safer because they slow down traffic.”

Vineet Gupta, Director of Policy and Planning, Boston Transportation Department. Boston, Massachusetts



- a. Street Width / Total Number of Lanes
- b. Narrow Lane Width
- c. On-street Parking
- d. Median Inclusion
- e. Traffic Calming Features



Narrow Street, Toronto



On-street Parking, Portland



Narrow Lane Width, Amsterdam



Raised Median, Naples

### c. On-street Parking

When vehicle occupants open their doors unexpectedly, on street parking can create safety concerns for cyclists.

- ◆ Cyclists have expressed a preference for routes without on-street parking.
- ◆ In Vancouver and Toronto major streets with no bike infrastructure and no on-street parking were found to be significantly safer than those with on-street parking.
- ◆ In Edmonton the severity of mid-block cycling collisions was greater with on-street parking.

### “ Bike lanes also provide a buffer to the pedestrian.”

Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

### d. Median Inclusion

Raised medians reduce vehicular collisions because they enhance separation between vehicles and cyclists. They also help to reduce collisions between vehicles and crossing pedestrians. Raised medians can limit turning access.

### e. Traffic Calming Features

Traffic calming features can reduce:

- ◆ motor vehicle speeds,
- ◆ traffic volumes, in some cases, and
- ◆ collision frequency and severity.

The appropriate selection, design, and impact of traffic calming features can vary widely depending on traffic conditions and surrounding land use context.

Traffic calming features may include:

- ◆ speed limit reductions,
- ◆ warning signs and lighting,
- ◆ narrowed lanes,
- ◆ speed tables, rumble strips,
- ◆ pavement markings, and
- ◆ various forms of curb extensions that either narrow the lane (e.g. pinch point) or force a horizontal shift (e.g. chicane).



Speed Hump, British Columbia

## Enhance the Experience

After the installation of traffic calming features:

- ◆ Glasgow, Scotland residents reported engaging in more outdoor activity and improved physical health.
- ◆ People in San Francisco living on streets carrying less traffic volume reported less annoyance, lower noise, and better social conditions than residents living on streets carrying higher traffic volume.

It should be noted that while certain traffic calming features can generate excessive noise and exhaust due to the tendency of some drivers to accelerate rapidly after navigating a traffic calming feature, those problems are typically mitigated through the design of the features.



Pedestrian refuge in Median, Nottingham



Traffic Calming Features, Toronto



Traffic Calming Features, Aragon



Traffic Calming Features, Ancoats and New Islington - London

# Street Connectivity

Providing street connectivity is essential for minimizing travel distances, and promoting walking and cycling. Street connectivity elements include intersections, shorter street blocks between intersections, and more 4-way intersections relative to 3-way intersections.

## Improve Accessibility

a. Higher street connectivity is widely recognized as being very important for promoting physical activity in cities.

- ◆ Gridded street patterns with more frequent intersections, reduce travel distances.
- ◆ Gridded street patterns increase the number of destinations within a reasonable range of pedestrians and cyclists.
- ◆ Pedestrians and cyclists often say minimizing travel distance is the most important factor for route choice.

“Selecting active modes of transportation improves overall health for the public and the environment which begets better health as emissions are lower and therefore exposure to emissions is lower.”

Timothy Papandreou, Director, Strategic Planning & Policy, San Francisco Municipal Transportation Authority, City of San Francisco, California.

## Ensure Safety and Security

Higher intersection density is associated with fewer and less severe collisions due to overall network speed reductions. Evidence from Toronto suggests that the likelihood of jaywalking is higher for those living on streets with long blocks that provide limited crossing opportunities.

## Enhance the Experience

Street connectivity is an important predictor of walking attractiveness. In Toronto, children living in older neighbourhoods with well-connected street systems are more likely to walk to school when compared to those in newer suburban neighborhoods with disconnected street systems and high incomes.



## Intersections and Crossings

Design elements of intersection and mid-block crossings include traffic controls/signals, curb radii, and warnings and other safety features. While intersections represent a small portion of most trips, they can be a common point of conflict between all modes.

### Ensure Safety and Security

To improve visibility and the likelihood of drivers yielding to pedestrians, effective strategies include:

- ◆ advance stop lines that help keep drivers from encroaching on the crosswalk,
- ◆ flashing warning lights to help reduce vehicular speed, and
- ◆ high-visibility crosswalk markings, to warn drivers to be alert.

**a.** Midblock crossing signals that stop traffic to allow pedestrians to cross are highly effective at increasing driver yielding and reducing collision frequency.

**b.** Curb extensions, which widen the sidewalk at intersections, allow pedestrians and vehicle drivers to better see each other, especially when on-street parking exists. Increased visibility helps to:

- ◆ increase driver yielding at uncontrolled crossings,
- ◆ reduce pedestrian delay before crossing, and
- ◆ increase the distance between the crosswalk and the point where drivers yield to pedestrians.

Most cycling collisions with motor vehicles occur at intersections rather than mid-block. Intersection treatments shown to improve cycling safety include:

- ◆ pavement markings,
- ◆ warning signs/signals,
- ◆ raised bicycle crossings, or
- ◆ merging cyclists onto an on-street bike lane in advance of the intersection.

“Intersection design is more complicated with protected bike lanes but there is compelling evidence that these facilities are safer.”

Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

Narrow lanes and/or reduced curb radii:

- ◆ improve conditions for pedestrians (by narrowing the crossing distance, and reducing time spent exposed to oncoming traffic),
- ◆ can also make travel, and especially turning movements, more challenging for emergency vehicles, buses, and other large vehicles.

Large corner radii facilitate faster vehicular movement through the turn, but they also extend the crossing distance for pedestrians. Many design responses to these conflicts exist, for example:

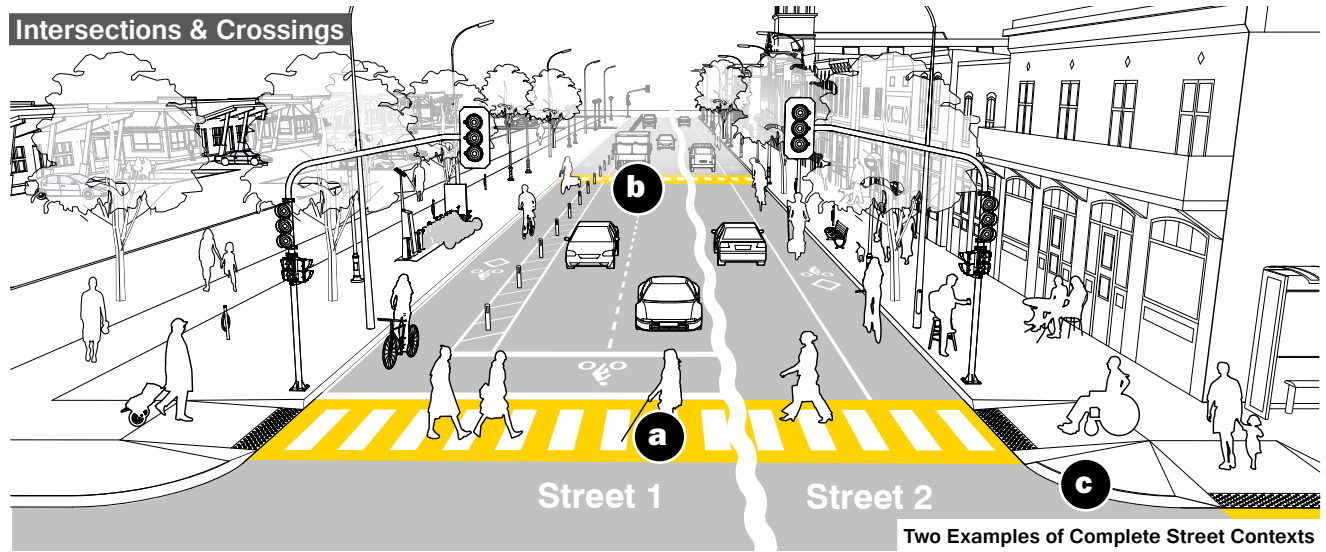
- ◆ stop bars can be placed far enough from the intersection to allow large vehicles to swing into the oncoming lane while turning,
- ◆ including on-street parking or on-street bike facilities will result in the travel lanes being further from the curb, thereby increasing the effective turning area, and
- ◆ lanes at the intersection can be widened to increase the effective turning area, and then they can be narrowed beyond the turning area.

**c.** Signalized intersections with pedestrian scrambles (an all- stop phase, where all vehicle movement is stopped and pedestrians can cross the intersection in any direction), improve pedestrian safety where there are crowding issues.

Increasing the crossing time for pedestrians can also reduce pedestrian collisions. Safety benefits are associated with:

- ◆ providing a leading pedestrian interval (where pedestrians are prompted to begin crossing before the vehicular signal turns green), and
- ◆ devices that prompt pedestrians to check for vehicular threats before crossing.

- a. Intersection Control
- b. Midblock Control
- c. Small Corner Radius and Other Curb Treatments





“ Changing the size of the design vehicle used - using a smaller delivery truck instead of a transport, for example - enables the road and intersection dimensions to be narrowed down.”

Suzanne Carlson, Pedestrian Program Manager, Milhouse Engineering at City of Chicago, Department of Transportation, Chicago, Illinois.

a. Roundabouts are a complex design consideration with varied impacts on the different modes. Impacts include:

- ◆ pedestrian crossing distances can be increased, especially at large intersections,
- ◆ reduced speed and conflict points, particularly in the case of single-lane roundabouts,
- ◆ crash reduction is most significant for vehicles, less significant for pedestrians, and the impact on cyclists is mixed,
- ◆ the slower vehicular speeds enforced by roundabouts reduces the speed differential between motor vehicles and cyclists, which should reduce injury severity, and
- ◆ depending on roundabout size, traffic volume and speeds, have reduced collision frequency and severity as compared to signalized intersections.

a. Bike boxes reduce the encroachment of bicycles and motor vehicles into the pedestrian crosswalk, and reduce the number of bicycle-motor vehicle conflicts at the intersections. A separate bike phase of the traffic signal is desirable for a bike box to function optimally allowing the cyclists to clear the bike box and intersection, before the motor vehicles proceed.

“ The typical approach in North America is to drop the bike facility as you approach the intersection so that you don't have to change anything and bikes mix with cars. This has to be resolved. If you want to get mode share above 5% it's not possible if you don't work out those design elements at intersections.”

Kornel Mucsi, Program Manager, Transportation Strategic Planning, City of Ottawa, Ontario.



Traffic Circle, Vancouver



Bike Box, Portland



a

Pedestrian Scramble, Toronto

## Adjacent Buildings and Land Uses

Land uses and buildings adjacent to the public right-of-way can influence the amount and visibility of activity along a street.

### Ensure Safety and Security

**a.** While building heights are not typically part of Complete Street design considerations, they are important due to their potential negative impacts on the pedestrian environment. In order to improve pedestrian comfort through increased exposure to sun and protection from wind a Toronto study recommended that the allowable height of buildings be limited. It also recommended establishing standards to protect pedestrians from strong building-induced wind forces.

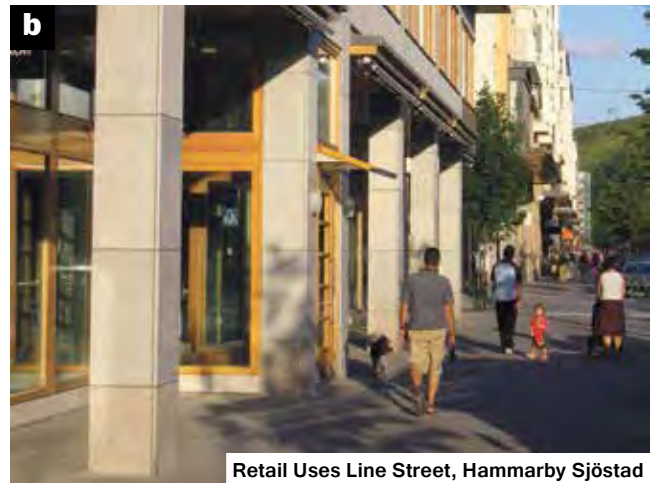
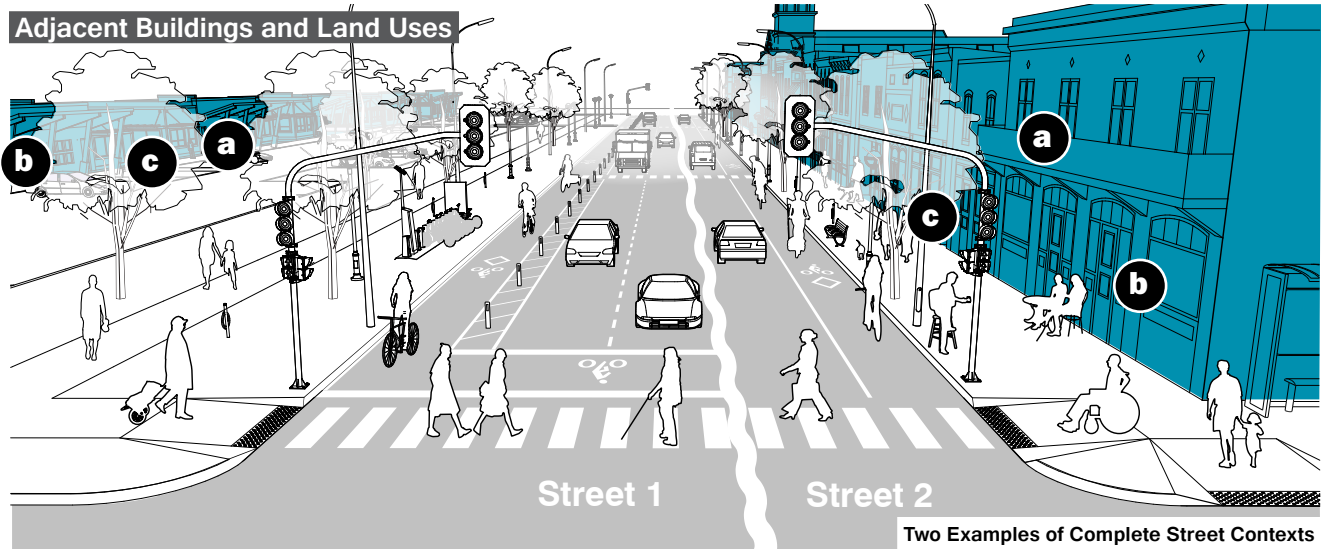
### Enhance the Experience

**b.** The presence of retail uses, such as shops and restaurants, encourages walking and cycling. Retail locations, such as coffee shops, book stores, restaurants, and public spaces, are important predictors of social activity, including talking, eating, sitting, or walking with other people.

Open spaces, including parks and plazas adjacent to the street can also positively impact physical activity.

**c.** More pedestrians walk where there are “continuous building facades forming a street wall” and “windows overlooking the street” than in areas without these characteristics. Attractive building façade design may also increase physical activity.

- a. Building Scale
- b. Retail Uses
- c. Building Facade Design



## Image Credits

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- a** Pedestrian Zone, Melbourne. Source: Panoramio [accessed Feb. 11, 2011 <[www.panoramio.com/photo/dsc01303.jpg](http://www.panoramio.com/photo/dsc01303.jpg)>] Credit: pozzy.
- b** Wide Pedestrian Clearway & Transit Shelters, Auckland. Source: Skyscrapercity [accessed Sept. 7, 2014 [<<http://www.skyscrapercity.com/showthread.php?p=67861391>>] Credit: oh.yes.melbourne.
- c** Pedestrian Lighting, New York. Source: AECOM, Credit: Angelique Sonnier.
- d** Tree-lined Boulevard, Amsterdam. Source: Flickr [accessed Sept. 7, 2014 [<<https://www.flickr.com/photos/daniduc/2645213057/>>] Credit: Daniel Duclos.

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- e** Street Trees line Buffer Zone, Vancouver. Source: Flickr [accessed Sept. 7, 2014 [<<https://www.flickr.com/photos/pwkrueger/5973056096/>>] Credit: Paul Krueger.

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- a** Separated Bike Lane, Montreal. Source: Flickr [accessed Sept. 7, 2014 [<<https://www.flickr.com/photos/torontocat/6395237975/>>] Credit: Toronto Centre for Active Transportation.

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- a** Bike Box at Intersection, Toronto. Credit: Chris Hardwicke.
- a** Cycle Track, New York. Source: Flickr [accessed Sept. 7, 2014 [<<https://www.flickr.com/photos/goodcough/5586278214/>>] Credit: Dmitry Gudkov.
- a** Bike Box at Intersection, Toronto. Credit: Chris Hardwicke.
- a** Separated Cycle Track, Vancouver. Credit: Paul Krueger, Paul Krueger

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- b** Bike Post, Toronto. Source: Wikipedia [accessed Sept. 7, 2014 [<[http://commons.wikimedia.org/wiki/File:A\\_bicycle\\_post\\_and\\_ring.jpg](http://commons.wikimedia.org/wiki/File:A_bicycle_post_and_ring.jpg)>] Credit: Hall Grimsson.
- b** Bike Shelter, Victoria. Source: Placescape.
- b** Bike Corral, Chicago. Credit: Kevin Zolkiewicz.

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- a** Road Diet Example. Credit: Chris Hardwicke.

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- b** Narrow Lane Width, Amsterdam. Credit: Chris Hardwicke.
- c** On-street Parking, Portland. Source: Flickr [accessed Sept. 7, 2014 [<https://www.flickr.com/photos/26321921@N04/3843075736/rkitekt318/>]] Credit: rkitekt318.
- d** Raised Median, Naples. Source: Placescape.

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- e** Speed Hump, British Columbia. Source: Wikipedia [accessed Sept. 7, 2014 [[http://commons.wikimedia.org/wiki/File:Speed\\_hump\\_on\\_8%25\\_grade.jpg](http://commons.wikimedia.org/wiki/File:Speed_hump_on_8%25_grade.jpg)]] Credit: Richard Drdul.

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- d** Pedestrian refuge in Median, Nottingham. Credit: Ben Webster.
- e** Traffic Calming Features, Toronto. Credit: Chris Hardwicke.
- e** Traffic Calming Features, Aragon, Spain. Credit: aldayjover.
- e** Traffic Calming Features, Ancoats and New Islington - London. Credit: Grant Associates.

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- a** Lower Network Connectivity: Parkwoods Donalda. Credit: Chris Hardwicke.
- a** Higher Network Connectivity: The Annex. Credit: Chris Hardwicke.

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- a** Mid-block Crossing, East Lansing. Source: Michigan Complete Streets Coalition [accessed Sept. 7, 2014 [<http://michigancompletestreets.wordpress.com/2014/01/21/mid-block-pedestrian-crossings-explained/>]].
- b** Curb Extensions, Portland. Source: Placescape
- c** Pedestrian Scramble, London. Source: Photobucket [accessed Sept. 7, 2014 [[http://i901.photobucket.com/albums/ac218/Aliraqi2/November%202009/world%20pix/3-11/oxford-circus\\_1515327i.jpg](http://i901.photobucket.com/albums/ac218/Aliraqi2/November%202009/world%20pix/3-11/oxford-circus_1515327i.jpg)]] Credit: Aliraqi2.
- c** Curb Radius, Toronto. Source: Flickr [accessed Sept. 7, 2014 [[https://www.flickr.com/photos/mcwidi\\_2/9681099810/](https://www.flickr.com/photos/mcwidi_2/9681099810/)]] Credit: rmcwidi\_2.

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- a** Traffic Circle, Vancouver. Credit: Chris Hardwicke.
- a** Bike Box, Portland. Source: Flickr [accessed Sept. 7, 2014 [<https://www.flickr.com/photos/59878729@N00/2631764977/>]] Credit: Jonathon Maus.

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- a** Pedestrian Scramble, Toronto. Credit: Gary Baker.

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- a** Mid-rise Building, Toronto. Credit: Chris Hardwicke.
- b** Retail Uses Line Street, Hammarby Sjöstad. Source: Placescape.
- b** Retail Use Provides Active Frontage, Versailles. Credit: Missy Nado.
- c** Continuous Street Wall, Toronto. Credit: Chris Hardwicke.