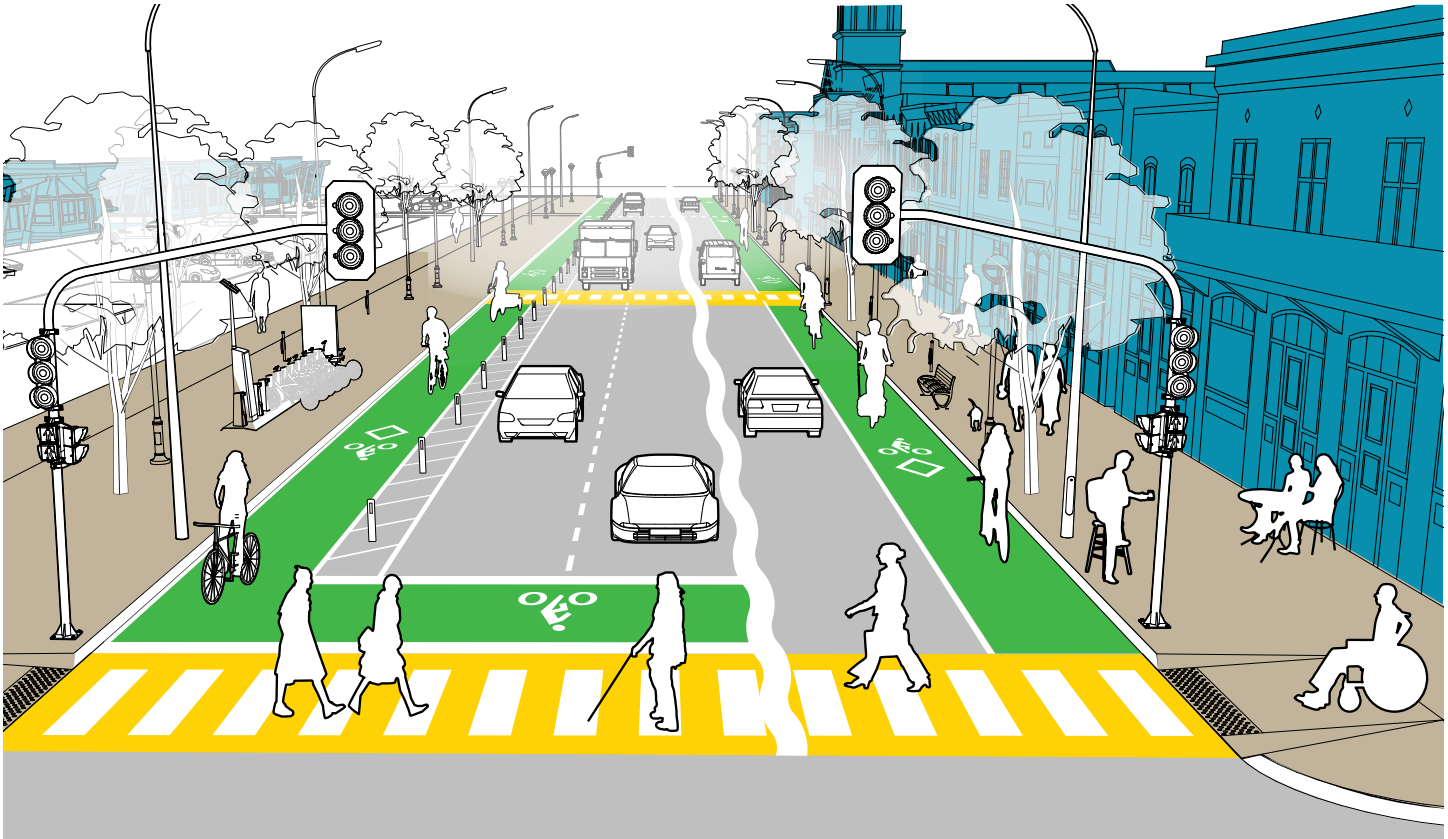
Healthy Streets

Design Features and Benefits

October 2014



416.338.7600 toronto.ca/health | Toronto Public Health

Reference

Toronto Public Health. Healthy Streets: Design Features & Benefits. October 2014. City of Toronto.

Copies

Copies of this report can be downloaded at: www.toronto.ca/health

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Most people know intuitively that our surroundings impact our health – clean water, safe housing, sanitary waste disposal, and clean air are all essential to any community that hopes to thrive. How we design our intersections, sidewalks, cycle ways and streets also impacts our health.

About this Document

This report highlights the health evidence and experiences of other cities as they shifted their focus from moving cars to moving people. Recognition that road ways are a finite urban resource has led to more egalitarian design decisions regarding the needs of pedestrians, cyclists, transit users and motorists. Complete Streets is a concept that guides road design for all ages, abilities and modes of travel. Expanded active transportation options enable residents to build physical activity into their lives every day, thereby reducing the risk of serious chronic diseases such as diabetes, stroke and heart attacks.

Complete Streets facilitate physical activity, improve traffic safety, and decrease exposure to harmful pollutants. This more encompassing role for streets includes not only moving people but also social, cultural, environmental and economic functions.

Toronto Public Health, in consultation with Transportation Services and City Planning, commissioned three reports about how the design elements of Complete Streets are associated with more active lifestyles and better health. A literature review examined the available health research. A jurisdictional review provided information from leading North American cities and their efforts in Complete Streets implementation. This document highlights the evidence and experience contained in these reports.

Toronto can learn from other major cities like New York City, Chicago, San Francisco and Boston that have embraced the concept of complete streets. They can inspire us by their examples of how they have re-invented their city environment from auto-oriented to more complete streets oriented, to bring vitality and social connectivity to their neighbourhoods. This report seeks to help all of us, whether the public, businesses, policy makers or elected officials to understand the impacts of a transformation to more complete streets.

For more detailed information and access to the full literature review, *Healthy Streets: Evidence Review* and *Healthy Streets: Jurisdictional Review* please go to:

www.toronto.ca/health/reports

Summary

Complete street policies dovetail with existing policies to provide universal accessibility or barrier-free travel.

People's decision to be physically active through walking and cycling can be influenced by the availability of streets and other facilities which allow for convenient routes to destinations in safe and enjoyable ways.

Complete Streets design decisions help to better accommodate pedestrians, cyclists, transit users, and other vulnerable users, rather than providing only for the needs of the automobile driver to the detriment of other groups.

Many positive health associations have been found between Complete Streets and:

- increased physical activity,
- increased traffic safety,
- lowered body weight, and
- improved physical, mental and social health.

Walking and cycling also produce no emissions, thereby contributing to healthier air.

Overall, high street connectivity has been linked to more physical activity and is widely recognized as being one of the most important features of an urban environment for promoting physical activity. Street connectivity, and the route directness it provides, increases the number of routes conveniently accessible to pedestrians and cyclists.

The choice of specific Complete Streets elements and their design characteristics to best promote health depends on the context of each specific street segment. It involves answering questions such as:

- Who are the current and expected future users?
- What are their needs?
- What health challenges exist or will exist?
- What existing opportunities can be leveraged for encouraging healthy living?

Urban design can influence health using three paths:

1. Improve Accessibility

Convenient access to destinations, such as residences, jobs, retail destinations, transit facilities, recreational amenities, and public services, is very important when making the choice to walk or cycle.

- Continuity of transportation, pedestrian and cycling facilities throughout the network is critical.
- Filling gaps where facilities are missing or inadequate is a key priority to improving accessibility.
- Providing street connectivity via short blocks and 4 way intersections or connections through existing long blocks is essential for minimizing travel distances.

2. Ensure Safety and Security

Having routes to destinations which are safe from motor vehicle collisions and crime is an important factor when deciding to walk or cycle.

- At a minimum, users need to have a safe, continuous network of sidewalks and cycle facilities, adequate lighting and safe intersection crossings.
- Depending on traffic and other locally specific conditions, other features should be considered to improve pedestrian/cyclist safety such as providing medians with pedestrian refuge, enhanced crosswalk and signalization treatment, curb extensions and other traffic calming features.

3. Enhance the Experience

Attractive street design and amenities encourage walking and cycling. Areas with good accessibility and safety can be further enhanced through the provision of wide sidewalks, commercial or public seating, trees, landscaping, human scaled buildings and attractive, transparent façade design.

> **About 80% of Toronto residents surveyed have a strong preference for street designs that allow them to walk, cycle or take transit even if means that there is greater foot and car traffic on their streets.**
>
> The Walkable City: Neighbourhood Design and Preferences, Travel Choices and Health, TPH 2012

Summary of Health Benefits

The three health paths are mutually reinforcing. Nearby destinations make walking and cycling more viable. Calmed traffic along the route to reach them further encourages increased activity and social interactions. In turn, additional activity has a further calming influence on traffic.

Improve Accessibility

The ability to access destinations within a convenient walking or cycling distance provides:

- more opportunities for physical activity, which in turn helps maintain a lower body weight and reduce risk for chronic diseases such as type 2 diabetes and cardiovascular disease,
- mental health benefits arising from regular physical activity for example: lower stress, depression and anxiety levels,
- neighbourhoods with improved accessibility can be linked to positive mental health, and
- health benefits are for everyone. Children who walk or cycle to school are more active during the day and are more fit, than those who do not.

Compact neighbourhoods with walkable streets and a variety of destinations within walking distance of housing are associated with:

- lower rates of obesity, and
- higher rates of physical activity.

Pedestrian and transit friendly environments enable people of all ages to have greater:

- travel independence, and
- possibilities for social interaction.

Ensure Safety and Security

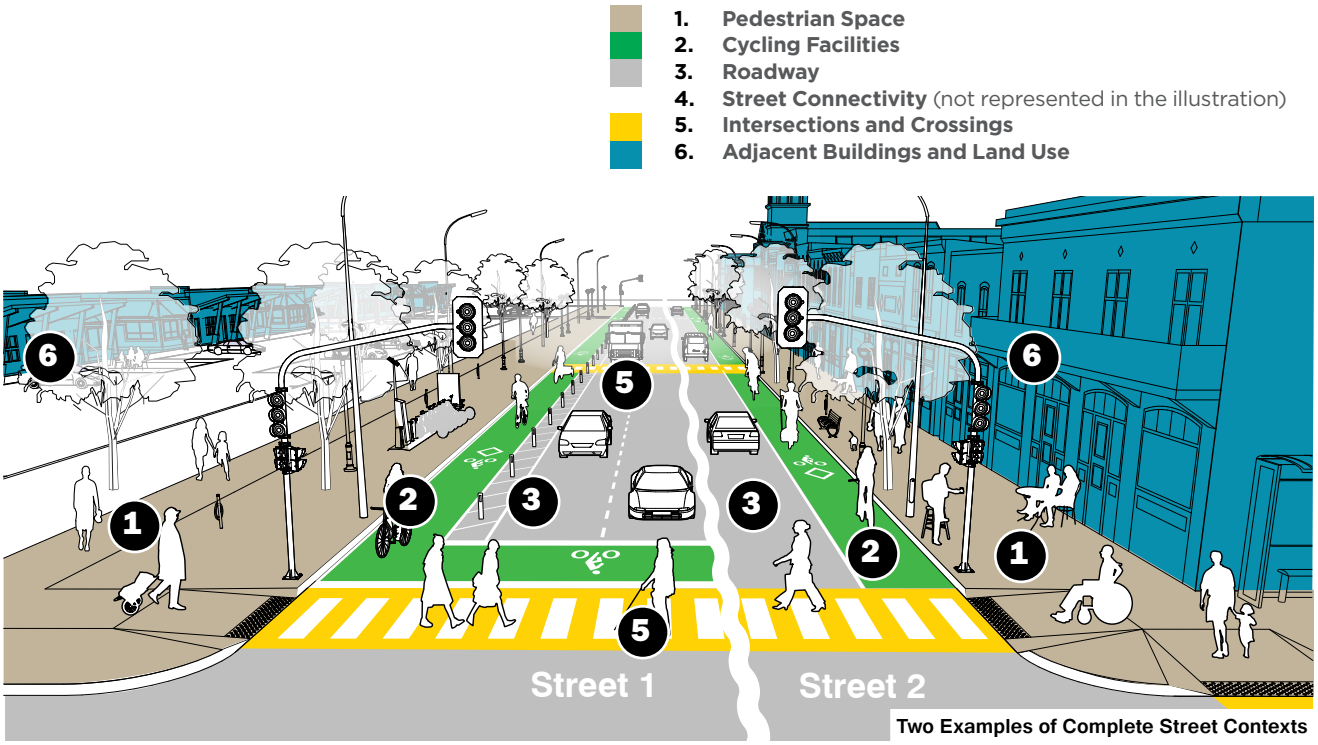
- People who feel safe and secure from automobile traffic, other pedestrians and/or cyclists, will be more likely to walk or cycle.
- Enhanced lighting can help reduce threats from criminal activity.
- Buildings, transit waiting areas, and public spaces should be designed to minimize dark corners, dead ends, and isolated areas.
- Street design can reduce motor vehicle speeds, which helps to decrease the likelihood of collisions and their severity.
- Streets with many cyclists and pedestrians may also cause drivers to move more slowly and cautiously. This can cause a positive feedback loop, where the slower traffic speeds encourage yet more walking and cycling.

> **There is a general awareness amongst the public at large about health issues and that makes it easier for them when they are in a community saying why they need a wider sidewalk or whatever at the expense of travel lane for cars.**
>
> Vineet Gupta, Director of Policy and Planning, Boston Transportation Department. Boston, Massachusetts.

Enhance the Experience

Good street design positively influences mental and social health. An attractive street with seating, interesting destinations, and minimal disturbances from vehicular traffic helps to encourages social activity on the street.

Trees and vegetation are calming and promote better mental health. Exposure to vehicular exhaust can be reduced through traffic control, adjacent building design, and providing vegetation.



Two Examples of Complete Street Contexts

Report

Although all forms of transportation can be stressful at times, research indicates that driving is more stressful, more consistently, than other forms of travel. The absence of stressors such as noise, air and visual pollution are consistent with better mental health and create a more enjoyable walking or cycling experience.

The remainder of this report provides illustrations of specific street design choices that evidence indicates support healthier outcomes. Images and illustrations are drawn from examples of best practice in Toronto and internationally. It is organized using the following major Complete Street design categories (see above figure), as well as the paths that reduce health impacts:

1. Pedestrian Space
2. Cycling Facilities
3. Roadway
4. Street Connectivity
5. Intersections and Crossings
6. Adjacent Buildings and Land Use

In the text the specific design elements are labelled alphabetically. The same labelling system is used for their related illustrations.

Pedestrian Space

The pedestrian space is between adjacent buildings and the street curb. Typical elements include sidewalks, landscaping, street trees or other buffers, lighting, street furniture, transit stops and similar amenities. The design of these features helps to ensure a safe and inviting space for pedestrians with adequate separation from nearby vehicles.

Improve Accessibility

a. Continuous sidewalks are critical in affecting people's choice to walk. Proper attention must be paid to ensure the sidewalk is designed for universal accessibility, including meeting proper standards for people with disabilities.

b. Providing sidewalks and transit service enhances regional accessibility and the health of commuters. Research studies have shown that:

- transit users engage in more physical activity than non-transit users, and
- more physical activity and lower body weight is associated with higher densities of transit stops/stations or shorter distances from home to the nearest stop/station.

> **"We know walkability is not just about the sidewalk, and that other elements, for example good connections to transit and local amenities, make a street more walkable."**
>
> Chris Hodgson, P. Eng., Senior Project Engineer, Active Transportation & LRT Integration, City of Waterloo. Ontario.

Ensure Safety and Security

a. Sidewalks which are free of tripping hazards and obstacles have a clear positive influence on pedestrian safety.

- Trip and fall hazards hamper the ability to walk safely, especially for someone with vision impairments or balance/strength problems.
- Vehicle-pedestrian collisions are reduced by providing a place to walk adjacent to the roadway, on sidewalks.

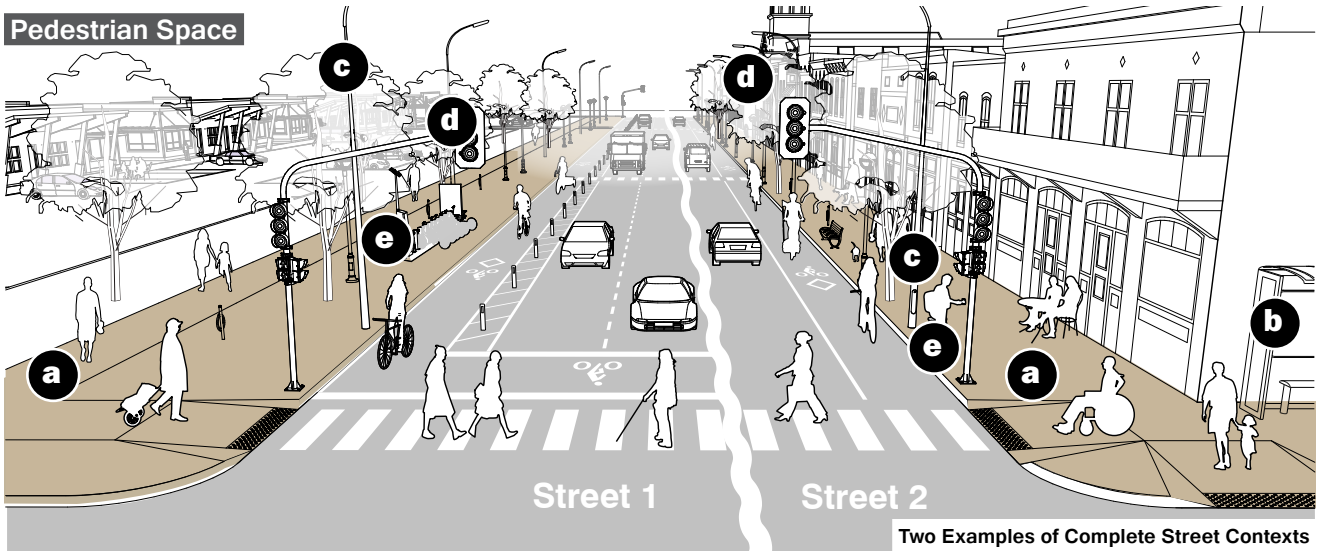
Maintenance is needed for the safe use of sidewalks, including addressing:

- uneven or broken sidewalk surfaces,
- narrowed areas due to the addition of sign posts, newspaper boxes and benches,
- untrimmed trees/bushes which hang over the sidewalk, and
- snow and ice clearing in the winter.

c. Lighting along street segments reduces pedestrian, bicycle and vehicle collisions at crosswalks, improves perceptions of safety and acts as a deterrent to criminal activity.

> **"Crime prevention can be achieved through environmental design and lighting. These are well established principles."**
>
> Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

a. Sidewalk Presence & Width
b. Public Transit Facilities
c. Lighting
d. Trees & Vegetation
e. Buffer Zone



Two Examples of Complete Street Contexts

Pedestrian Zone, Melbourne

Pedestrian Lighting, New York

Wide Pedestrian Clearway & Transit Shelters, Auckland

Tree-lined Boulevard, Amsterdam

d. Tree-lined streets have been found to have lower collision rates than sections without trees.

- Trees can provide a visual constraint that signals to the driver to slow down, whereas a wide open view shed may encourage a driver to speed up.
- It is also possible that the presence of trees conveys a calming effect, as well as adding interest for the driver, encouraging slower speeds.

> **"If you are designing an auto oriented street then limit the street trees, ... but if pedestrians are first, then street trees are essential for improving their environment."**
>
> Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

Urban trees are known to help reduce both gaseous and particulate air pollution. Individuals with more parks and tree-lined streets near their residence have been found to have a higher life expectancy.

Enhance the Experience

a. Sidewalk width and the presence of public seating are important predictors of social activity. Seniors have said that the presence of benches and other seating opportunities help facilitate more walking.

d. To increase people's comfort through the seasons, and to encourage walking and cycling, tree types should be selected to:

- maximize shading in the summer,
- allow sun penetration to sidewalks and open areas during the rest of the year, and
- reduce wind speeds year round.

In addition to providing shade and heat reduction, greater urban tree canopy can reduce harmful ultraviolet radiation exposure that leads to skin cancer.

e. Buffers between the sidewalk and the roadway are an important predictor of people's perception of walking attractiveness.

- Trees, benches, or other comfort amenities are associated with more walking.
- Access to nature and green space has a positive relationship with more physical activity and better physical, mental and social health.
- The quantity and quality of greenery visible along the streetscape have been shown to be both associated with better self-reported health, fewer acute health-related complaints, and better mental health status.
- Residents of tree-lined boulevards with landscaped medians have indicated less annoyance and better social conditions despite heavier traffic than residents on streets lacking these amenities.

Street Trees line Buffer Zone, Vancouver

Cycling Facilities

Cycling facilities include on-street cycle lanes and tracks, off-street paths, and parking. Cycle lanes are part of the roadway, but separated from traffic lanes by a painted stripe. Cycle tracks and separated bike lanes are part of the roadway, but physically separated from traffic lanes. Off-street paths are not part of the roadway, but they can be adjacent to it. They are often shared with pedestrians.

Improve Accessibility

a. A continuous and complete network of cycling facilities encourages cycling.

- It provides a means to use active transport to access local and regional destinations.
- When effectively connected with transit (through access to stops/stations, bike parking racks and the ability to transport a bicycle on transit vehicles) the distances which can be comfortably covered approach those of the automobile.

> "The focus is on creating safe and comfortable cycling facilities for users of all ages."
>
> Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

a Separated Bike Lane, Montreal

Ensure Safety and Security

a. Widespread bicycle network improvements (including the construction of bike lanes and cycle tracks, on the road, but separate from traffic and the sidewalk) contribute to increased cycling activity and a reduction in bicycle collisions.

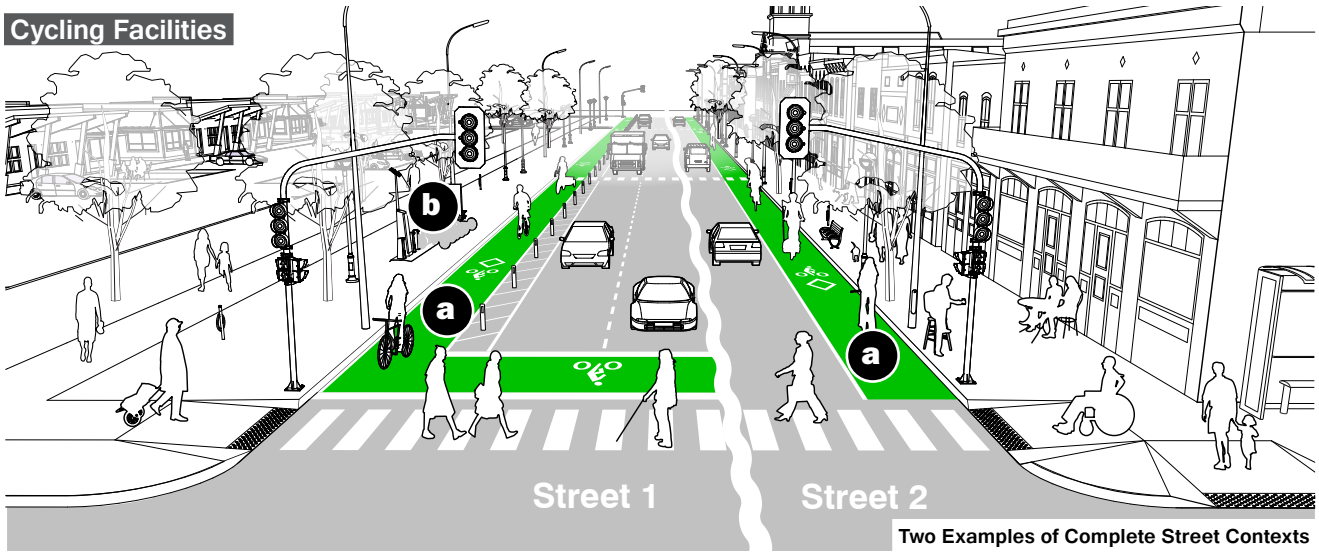
Most cycling collisions with motor vehicles occur at intersections when vehicles are turning, rather than at mid-block where vehicles are going straight.

- The number of vehicle turn lanes and the sight lines must be managed carefully as they contribute to how safe the intersection is for vulnerable road users.
- One-way cycle tracks have been found to be safer than two-way facilities.
- Cycle tracks have also been found to be safer for cyclists at non-intersection locations as compared to riding on streets with no cycling facilities.
- Among the least experienced cyclists, separated paths (such as multi-use trails) are often most preferred as they are perceived to be the safest. If the points at which the trails cross roadways are not managed properly, the trail users can be vulnerable to collisions.

> "There is now enough evidence to know that protected bike lanes (such as cycle tracks) are safer than conventional bike lanes."
>
> Paul Lippens, former Director of Planning, Active Transportation Alliance, City of Chicago, now Principal Planner, McKenna Associates. Chicago, Illinois.

Most cases of "dooring" (when a cyclist is struck by a car door being opened) occur on arterial roads in central Toronto with high-turnover curbside parking. Dooring can result in the cyclist falling into traffic, which can contribute to more serious injuries as compared with other types of collisions.

a. Cycle Tracks and Bike Paths
b. Bicycle Parking



Two Examples of Complete Street Contexts

Bike Box at Intersection, Toronto

Separated Cycle Track, Toronto

Cycle Track, New York

Separated Cycle Track, Vancouver

Enhance the Experience

A community's bikeability is positively impacted by:

- route and trail continuity,
- good surface conditions (e.g. no potholes, broken/rough/uneven pavement, or debris/litter),
- intersections with traffic signals providing sufficient time for cyclists to cross, and good visibility for oncoming traffic.

> "It's common sense that if you provide a well-planned network of bicycle facilities, people will use them and improve their health."
>
> Nick Peterson, Division of Traffic & Planning/Public Space, New York Department of Transportation

b. Bicycle parking can increase:

- the perceived convenience of cycling,
- the likelihood of cycling, especially for sheltered and secured bicycle parking.

Shifting travel from polluting modes to cycling helps reduce overall pollution levels.

- Cyclists can minimize their exposure by choosing low-traffic routes whenever possible.
- The physical activity benefits of cycling have been found to outweigh the health risks related to pollutant exposure and collisions.

> "Emission reduction is a key consideration to improve both the health of the environment and people and therefore motivates implementation of complete street designs that make choosing active transportation safer and more inviting."
>
> Timothy Papandreou, Director, Strategic Planning & Policy, San Francisco Municipal Transportation Authority, City of San Francisco, California.

Bike Post, Toronto

Bike Shelter, Victoria

Bike Corral, Chicago

Cycle Track, Toronto

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,
- descrease 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.

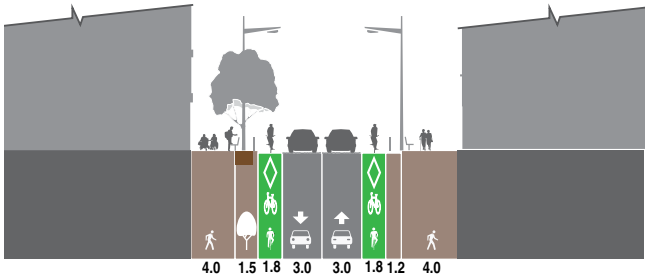
b. Narrow Lane Width
Narrower lanes help to calm traffic and expand options for including cycle lanes, sidewalks, trees, etc. They have been found to:

- 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

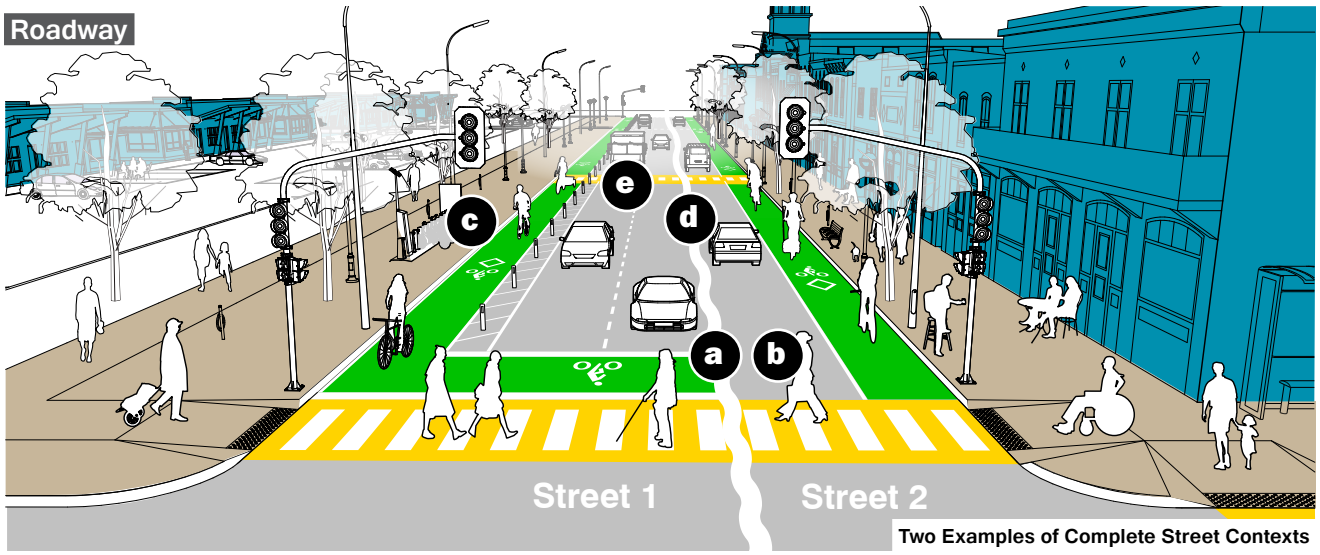
Before



After

Road Diet Example

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



Two Examples of Complete Street Contexts

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 Colombia

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 resonable range of pedestrians and cyclists.
- Pedestrians and cyclists often say minimizing travel distance is the most important factor for route choice.

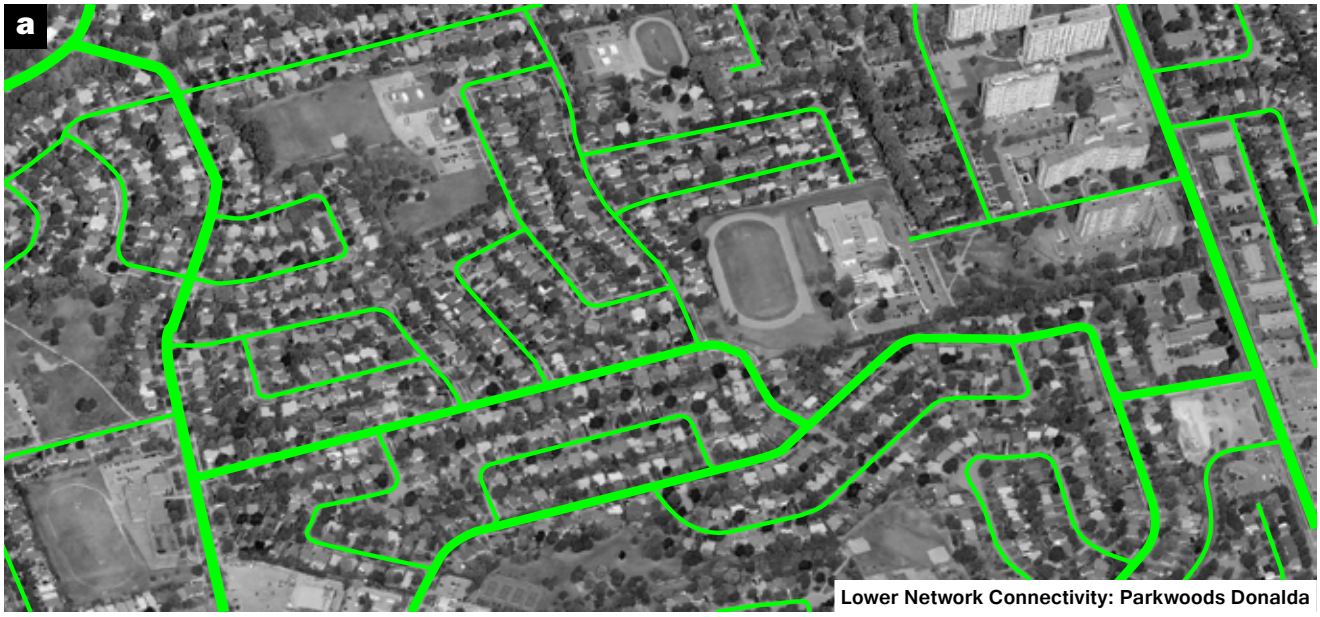
> **"Selecting active modes of transportation improves overall health for the public and the environment which begets better health as emissions are lower and therefore exposure to emissions is lower."**
>
> Timothy Papandreou, Director, Strategic Planning & Policy, San Francisco Municipal Transportation 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.



Lower Network Connectivity: Parkwoods Donalda

Higher Network Connectivity: The Annex

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:

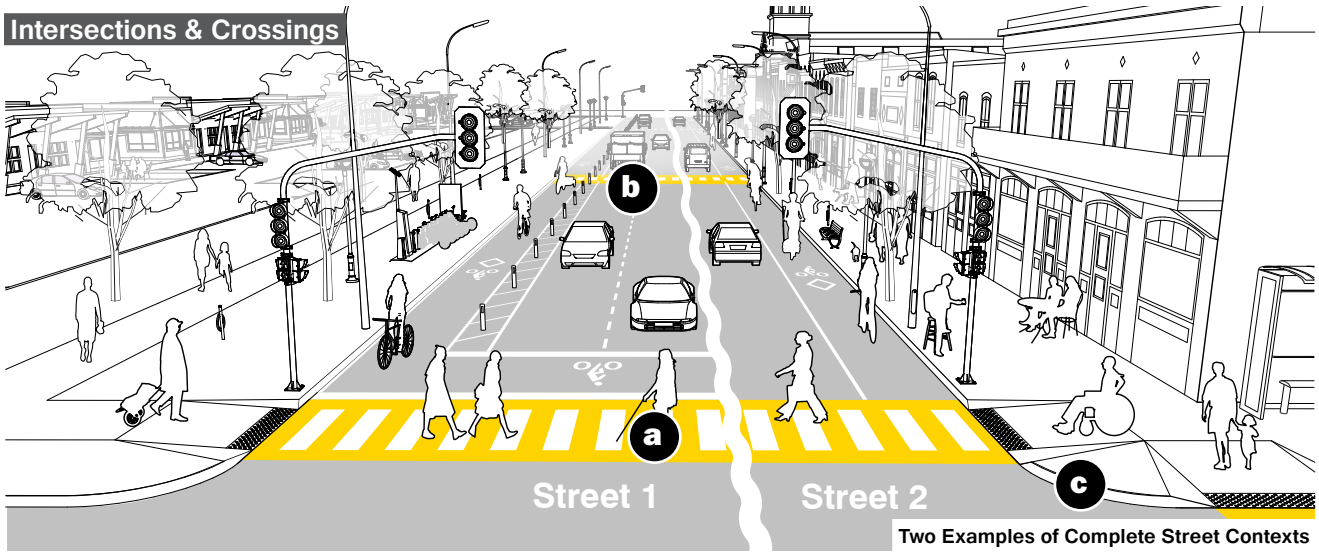
- stop bars can be placed far enough from the intersection to allow large vehicles to swing into the oncoming lane while turning,
- including on-street parking or on-street bike facilities will result in the travel lanes being further from the curb, thereby increasing the effective turning area, and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



Two Examples of Complete Street Contexts

Mid-block Crossing, East Lansing

Pedestrian Scramble, London

Curb Extensions, Portland

Curb Radius, Toronto

> **"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

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.

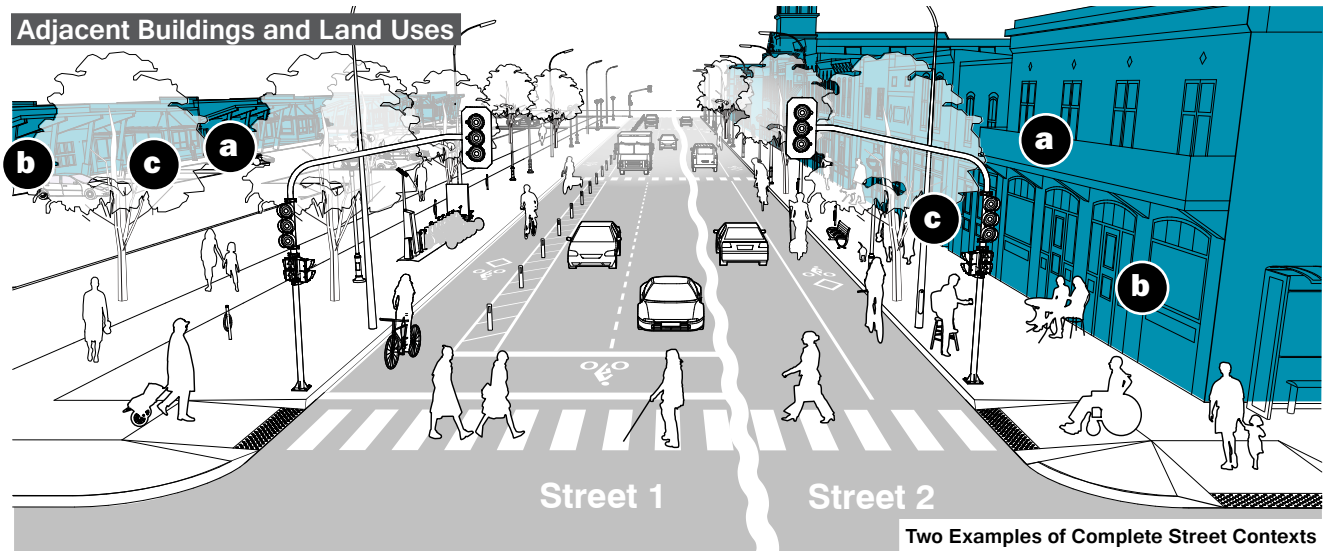
Enhance the Experience

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



Two Examples of Complete Street Contexts

Mid-rise Building, Toronto

Retail Uses Line Street, Hammarby Sjöstad

Retail Use Provides Active Frontage, Versailles

Continuous Street Wall, Toronto

Image Credits

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a Pedestrian Zone, Melbourne. Source: Panoramio [accessed Feb. 11,2011 <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>] Credit: Hall Grimsson.

b Bike Shelter, Victoria. Source: Placescape.

b Bike Corral, Chicago. Credit: Kevin Zolkiewicz.

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a Cycle Track, Toronto. Credit: Chris Hardwicke.

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a Road Diet Example. Credit: Chris Hardwicke.

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a Narrow Street, Toronto. Credit: Chris Hardwicke.

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 Colombia. Source: Wikipedia [accessed Sept. 7, 2014 [<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 [<hhttp://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>] Credit: Aliraqi2.

c Curb Radius, Toronto. Source: Flickr [accessed Sept. 7, 2014 [<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.