Expanded Active and Safe Routes to School Infrastructure Toolkit

There are numerous infrastructure tools that can support active and safe routes to school. The application of these tools depends on the context, such as street classification, street functions, available right of way, vehicle volumes and speeds. This is not an exhaustive list, but a list of commonly applied street retrofit tools that better delineates space for all street users including pedestrians, cyclists, and vehicles.

Each tool supports one or more of the 5A Network Guiding Principles:

- **Separate people by their speed:** Providing separation between people travelling at different speeds improves safety, predictability and comfort. Where appropriate, people will be separated to improve their experience travelling on the 5A Network.
- **Improve visibility**: Lighting, signage and pavement markings encourage people to use public spaces and provides visibility on roadways, pathways and in parks. They help make people visible to each other, help identify hazards like water, ice, cracks and other debris along routes.
- **Make it reliable:** Well-maintained pathways and bikeways will encourage more people to use them throughout the year, regardless of the weather conditions.
- **Be accessible for everyone:** An accessible city benefits everyone. Accessible pathways and bikeways enable people of all abilities to travel around Calgary. Accessibility is improved by the removal of barriers that currently exist across the network. Barriers can be off-set gates, major roadways, waterways, steep hills and uneven surfaces. Reducing or removing these barriers improves accessibility.
- **Make it easy to use:** Signs and pavement markings help people make decisions about their route and confirm they are heading in the right direction. Improved signage and wayfinding will help Calgarians get to community destinations.

A summary of tools outlined in this attachment are as follows:

Separate People by their Speed	Improve Visibility	Make it Accessible
• Sidewalks • Multi-use Pathways • Bike Paths • Separated Bike Lanes	• Curb Extensions • Rectangular Rapid Flashing Beacons • Overhead Flashers • Speed humps	• Raised Crossings • Raised Intersections • Raised Medians/Pedestrian Median Refuges

Each of these tools is made reliable with ongoing maintenance such as snow and ice control (SNIC), gravel sweeping, and life cycle rehabilitation or replacement. These tools are also made easy to use with appropriate signage and wayfinding. Signage and wayfinding plans are generally determined during the detailed design stage.

Tools that Separate People by their Speed

Application	Description / Purpose	Average Cost	Application
Sidewalks  **Adaptive sidewalk**	Historically, some schools were built without sidewalks on every side of the perimeter. The City is addressing these missing links with traditional concrete sidewalk retro-fits or using adaptive sidewalks. Adaptive sidewalks are installed on the roadway to separate people walking from traffic using low concrete curbs and white posts. Often, they are an interim measure as an area is developed or to coordinate installation with a road repaving/adjacent project.	Traditional concrete sidewalk costs $300 per metre. Costs may increase as tree removal or if utility relocation is required.	All streets
Multi- Use Pathway 	A multi-use pathway is typically an asphalt pathway that is intended for people walking and wheeling. Multi-use pathways are wider than sidewalks to accommodate two-way walking and wheeling flows.	$250-$450 per metre of pathway depending on width of pathway and utility relocation or tree removal	Where there is limited right of way to add on-street facilities, or on streets with lower pedestrian and bicycle volumes and it is safe for these modes to mix

Application	Description / Purpose	Average Cost	Application
Bike Path 	A bike path can be a uni-directional (i.e. travel in the direction of traffic on each side of the road) or bi-directional (i.e. travel in both directions of traffic on one side of the road) raised bike lane that is at curb height. They are usually achieved by pushing the curb further out into the roadway or repurposing boulevard space. The separation from vehicle traffic comes from the vertical difference between the raised bike path and the lower vehicle lane.	$600-800 per metre of bike path, depending on width and utility relocation	All streets, including where there is limited right of way
Protected Bike Lane 	A protected bike lane is an on-street bike lane that is separated from vehicle traffic by a physical barrier. Bike lanes can be temporary (piloted) or permanent, depending on the materials used to define the bike lane. Physical barriers may include one or a combination of plastic delineators, pinned or poured curbs, and planters. Protected bike lanes can be uni- or bi-directional.	Temporary/pilot typically costs $175/m Permanent typically costs $400-450/m	All streets
Protected Intersections 	At protected intersections those wheeling through the intersection are given a dedicated path through and have the right of way overturning motor vehicles.	Variable, depends on size and scale of intersection and utility relocation	Intersections where there are protected bike lanes or bike paths on all legs

Tools that Improve Visibility

Application	Description / Purpose	Average Cost	Application
Curb Extension  **Permanent**  **Temporary**	Curb extensions visually and physically narrow the roadway, improving visibility between people walking, wheeling and driving. They create safer and shorter crossings for people walking and encourage people driving to travel at lower speeds, which reduces the number and severity of collisions. Generally two curb extensions are installed per intersection on the busier roadway at locations where drivers approach the intersection. Permanent curb extensions are constructed from concrete as a continuation of the boulevard and curb line. Temporary curb extensions use large, yellow concrete slabs which are placed on the road to provide temporary traffic calming. Temporary measures may be used when there is not enough budget to build permanent curb extensions right away, or to test efficacy of the measure before investing in a permanent build.	Permanent curb extension can range from $60,000 per intersection (at all corners) to $100,000 per intersection if catch basins need to be relocated. Temporary curb extension are typically $10,000 to 20,000 depending on how many traffic calming curbs are used.	Streets that have on-street parking
Rectangular Rapid Flashing Beacon (RRFB) 	RRFBs provide additional warning lights for people driving to slow down in advance of a pedestrian crossing. RRFBs are subject to a warrant analysis to justify their installation.	$35,000-$50,000 per location	Moderate to higher volume streets

Application	Description / Purpose	Average Cost	Application
Overhead Pedestrian Lights (Overhead Flashers) 	Similar to RRFBs overhead pedestrian lights, often called overhead flashers, place pedestrian activated flashing yellow lights overhead at marked crosswalks. Overhead flashers are subject to warrant analysis to justify installation.	$150,000 to $250,000 per location	Higher volume streets
Speed Humps 	Some streets may be lower volume and lower speed, and good candidates for shared streets where motorists and cyclist share the same roadway space. In these cases, traffic calming or traffic diversion tools are required to ensure speeds and volumes remain low. Lower vehicle volumes and speeds generally correlate with better ability to scan the roadway and better reaction time. Traffic calming tools like speed humps are a vertical traffic calming devices intended to slow traffic speeds on low volume, low speed roads without a lot of driveways. Speed humps can only be installed on streets that do not have regular transit service (buses) street, so they are not often the best traffic calming tool for schools located along collector or arterial streets.	Approximately $2,500 – $4,000 per speed hump, depending on the size and scale.	Lower-volume streets where there is no regular transit (bus) service

Tools that Make It Accessible

Application	Description / Purpose	Average Cost	Application
Raised Crossings 	Raised crossings are crosswalks raised to curb height. These have a similar effect to speed humps in that they are intended to slow vehicle speeds on low volume, low speed roads. They can be placed at intersections or mid-block. Similar to speed humps, raised crossings can only be installed roads that do not have regular transit service (buses), so they are not often the best traffic calming tool for schools located along collector or arterial streets.	Depends on size but approximately $8,000-$15,000 per intersection, depending on size and scale	Typically on lower-volume streets where there is no regular transit (bus) service
Raised Intersections 	A raised crossing is where an entire intersection is raised to curb height. This creates a level crossing for all legs of the intersection. Similar to speed humps or raised crossings, raised intersections should not be used on regular transit routes.	Depends on size and scale of intersection, materials used, and utility relocation, so can range from $50,000-$150,000 per intersection.	Typically on lower-volume streets where there is no regular transit (bus) service
Raised Medians / Pedestrian Median Refuge 	Median refuge islands are protected spaces placed in the center of the street to facilitate bicycle and pedestrian crossings. Crossings of two-way streets are facilitated by allowing bicyclists and pedestrians to navigate only one direction of traffic at a time. This space creates a safe waiting place for people waiting in the median and slows turning drivers. The City is piloting a precast concrete curb median has been successfully used in Canmore.	Depends on size and scale of median treatment. A pedestrian refuge mid-block or at an intersection costs approximately $8,000 per intersection	Streets with centre medians or wide intersections that would benefit from narrowing