04
RECOMMENDED BICYCLE NETWORK

Photo by Benjamin Pawlik
CHAPTER 4

An enhanced network of off-road and on-road bikeways is needed to truly create a multi-modal transportation system throughout the Buffalo Niagara Region. Building from the growing—but still fragmented—network of greenway trails, filling in gaps in the off-road network and planning new on-road bike facilities for a wide variety of users, was the primary thrust of the planning effort. The Plan has resulted in a prioritized list of recommended corridors that form the network, intended for implementation over a ten-year period.

4.1 NETWORK DEVELOPMENT METHODOLOGY AND RECOMMENDATIONS

4.2 BICYCLE TREATMENT DESIGN GUIDELINES
4.1 NETWORK DEVELOPMENT METHODOLOGY AND RECOMMENDATIONS

Development of the recommended bicycle network in the Buffalo Niagara Region stems from a variety of factors. Cumulatively, the various steps in the process lead to a fully-integrated bicycle network that aims to provide safe and direct connections between cities, towns, villages and other destinations. After incorporating the inventory of existing and funded off-road trails and on-road bicycle facilities, the project team used the four steps below to craft the recommended on and off-road network.

The recommended bicycle network provides a collection of off-road and on-road corridors that connect communities and regional destinations. While shared-use paths and greenway trails are the primary recommendation for off-road corridors, recommended improvements for the on-road corridors vary depending on land use context, traffic volumes, speed and proximity of nearby destinations. Some of the on-road corridors overlap with the local retail on main streets and combined with other streetscape improvements, can help them become an even more integral part of the community’s quality of life. The intent is for on-road corridors to ultimately provide a bicycle facility that offers a high level of comfort for riders of all ages and abilities. In some cases,
this may mean separated bicycle lanes, in others a sidepath alongside the roadway, while in others, shoulders with a painted buffer and rumble strips may be the desired configuration. The off-road network of greenway trails provides the foundation for the on-road bikeways and is the key to inducing new riders and to encourage an increase in bicycle tourism in the Buffalo Niagara Region.
Map 15 | Lower Niagara River Inset: Bicycle Network and Demand Analysis

Legend
- Proposed Off-Road Greenway Trails
- Proposed On-Road Bike Routes
- Existing Off-Road Greenway Trails
- Existing On-Road Bike Routes
- Canadian Bike Routes & Trails
- Recreation Area
- Composite Demand
  - Lowest Demand
  - Medium Demand
  - Highest Demand
A high priority for the Regional Bicycle Network development is to fill gaps in the Greenway Trail Network. The Buffalo Niagara Region is currently blessed with a number of local and regional trails that offer tremendous opportunities for bicycle commuting, utility trips and for recreation. These include:

- **Empire State Trail** that provides links east to Rochester, Syracuse and Albany
- **Shoreline Trail** that runs along the length of the Niagara River and Lake Erie, to Erie PA and Ohio
- **Peanut Line Trail/Clarence Pathways** that link east towards the Genesee Valley Greenway
- **Southern Tier Connector Trail** that will ultimately connect the region to Western Pennsylvania
- **Improved links to Ontario, Canada’s Friendship Trail and Niagara Parkway Trail**

The completion of these greenway trail corridors, will provide a nearly unparalleled network of off-road bicycle facilities in the U.S. and fit seamlessly into the National Bike Route System developed by the Adventure Cycling Association. Supplemented by an on-road network of bike lanes and enhanced road shoulders, the network will improve safety and promote economic development opportunities. With a strategic marketing and promotional campaign, the enhanced network can also induce a major increase in bicycle tourism in Western New York. In aggregate, these changes will improve livability and public health outcomes for the over one million residents in the region.
4.2 BICYCLE TREATMENT DESIGN GUIDELINES

OVERVIEW OF TIER TREATMENT OPTIONS

The Bicycle Treatment maps and Design Guidelines on the following pages are intended to be used by GBNRTC staff, along with county and municipal planners to improve the bikeability of roadways and ensure good design for all off-road greenway trails and paths.

The following are guiding principles for the Tier I, II and III bicycle facility treatments found on the maps and in the Design Guidelines:

- The bicycling environment should be safe and comfortable for riders of all ages and abilities
- Many of the treatments aim to calm motor vehicle traffic and promote safety for all users due to lower traffic speeds
- Tier I and II recommendations may, in some cases, be thought of as longer-term and aspirational, with Tier III being the appropriate option in the short term

The bicycle facility treatments are important because they represent the tools for creating bicycle-friendly, safe and accessible communities. The guidelines are not a substitute for a more thorough evaluation by transportation and traffic engineers, however. They are general in nature. In nearly all cases, further analysis and professional engineering judgment will be required per local conditions (topography, cost, right-of-way constraints) and community concerns. Most importantly, the guidelines are intended to complement other state and national design manuals that provide a higher-level of detail for the treatments developed for the GBNRTC region. Other manuals to be referenced include:

- Empire State Trail Design Manual (2017)
- FHWA Small Town and Rural Multimodal Network Guide (2016)
- FHWA Separated Bike Lane Planning and Design Guide (2015)

Proposed Design Guidelines:

- are not intended to be inflexible standards
- promote consistent design treatments for on-road and off-road corridors in urban, suburban and rural area
- should be considered for corridors that comprise the regional bike network AND other roadways for which municipalities are interested in improving for bicycling.
### SUMMARY OF TREATMENT OPTIONS

#### Table 2: Summary Table of Existing Bicycle Facilities and Proposed Corridors by Treatment Type

<table>
<thead>
<tr>
<th>EXISTING</th>
<th>PROPOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-Road Trails: 219 miles</td>
<td>Tier I Corridors: 208 miles</td>
</tr>
<tr>
<td>On-Road Bike Routes: 80 miles</td>
<td>Tier II Corridors: 394 miles</td>
</tr>
<tr>
<td>Tier I: Off-road bicycle/pedestrian facility with PHYSICAL separation from traffic (sometimes in a road ROW)</td>
<td></td>
</tr>
</tbody>
</table>

Tier II Urban: On-road bikeway with GENEROUS VISUAL separation from traffic

Tier II Rural: On-road bikeway with GENEROUS VISUAL separation from traffic

Tier III Urban: On-road bikeway with MINIMAL VISUAL separation from traffic

Tier III Rural: On-road bikeway with MINIMAL VISUAL separation from traffic
BIKEWAY DESIGN GUIDELINES

TIER I TREATMENT

Urban and Rural Contexts: Shared-Use Path

Typical shared-use path width along abandoned rail lines and utility corridors is 10 feet, with an acceptable width of 8 feet allowed in constrained areas. In high-volume locations near densely populated areas, a width of 12 feet is more comfortable for the larger volume and cross section of trail users. Shoulders 2 feet in width should be provided on both sides of the trail. The shoulder treatment should be grass or stonedust, depending on local conditions. A mowed area three feet wide should be maintained on either side of the trail, extending out from the shoulders. The minimum offset from the trail surface to utility poles and other equipment is 2 feet, with 3 feet preferred. The trail should meet minimum requirements of the latest version of the AASHTO Guide for the Development of Bicycle Facilities.

Additional considerations include:

- Trail design should accommodate H-20 loads for emergency and maintenance vehicles. Bridges constructed for the trail will be designed to H-5 loading criteria and signed appropriately.
- Trail entrances will be designed to discourage vehicular access while allowing free entry to emergency and maintenance vehicles. Bollards or gates should be avoided.
- Signage and other amenities will be located outside the shoulders and in areas which minimize conflicts with utility maintenance access.
- While asphalt is the preferred design standard, stone dust can be utilized to accommodate a more natural character in environmentally-sensitive zones.

Example of 10 foot standard shared-use path cross section. (Image: EST Design Guide)

Example of 3 foot offset from edge of trail to utility pole. (Image: EST Design Guide)

The Washington and Old Dominion Trail in Arlington, Fairfax and Loudoun Counties, Virginia runs adjacent to a utility line corridor.
Urban and Rural Contexts: Paved Sidepath

A sidepath is a bidirectional shared-use path located immediately adjacent and parallel to a roadway, typically within the roadway right-of-way. Sidepaths can offer a high-quality experience for users of all ages and abilities as compared to bicycle or pedestrian facilities within the roadway area.

Additional considerations include:

- Standard sidepath width at locations with mixed pedestrian and bicycle traffic is 12 feet.
- In constrained areas, the sidepath width can be reduced to 8 - 10 feet.
- The preferred roadway separation width is 6.5 feet, with a minimum recommended separation width of 5 feet.
- Where sidepaths cross driveways (especially commercial driveways), application of green pavement markings is strongly encouraged. The color treatment indicates the potential conflict zone to both motorists and path users.

Example of a sidepath that exists within the road right-of-way (Image: EST Design Guide)

Example of a sidepath that is separated from the road right-of-way by a landscaped median (Image: EST Design Guide)

Rue Drumond in Granby, Quebec features a typical sidepath, separated by a landscaped area. (Note that green pavement treatment at the driveways would have improved visibility of bicyclists at these conflict points.)
Bridge Crossings

Along bridges with existing or planned wide sidewalks/paths, the following should be considered:

- Crash barriers or guiderails should be included in the design or retrofit, especially when the sidepath is <10’ in width.
- Where sidewalks/paths lie on both sides of the bridge and where heavy pedestrian/bike traffic is expected, stencils and signs should be considered to help separate the two modes.
- Careful consideration at the transition zones at the ends of bridges is imperative, frequently requiring creative bike facility design.

Basic Path Crossings

At non-intersection areas, double markings must be used to establish a legal crosswalk. Well-designed mid-block crossings can provide many safety benefits to path user safety and comfort.

Typical Applications:

- Where shared-use paths intersect with collector or minor arterial streets.
- Path crossings should not be provided within approximately 400 feet of an existing signalized intersection. If possible, route path directly to the signal.

Design Guidelines:

- A: Crosswalk markings legally establish mid-block shared-use path crossing (FHWA 2009).
- B: Crossing assemblies draw attention to the crossing.

Path stencils can help separate pedestrian and bike traffic when paths exist or are planned for both sides of a bridge.

Example of basic path crossing treatment at Creekside Drive in Tonawanda.
TIER I TREATMENT

Median Crossings

Median safety islands are located at the mid-point of a marked crossing and help improve safety by allowing path users to cross one direction of traffic at a time and shortening crossing distance.

Typical Applications:

- Can be applied on any roadway with a left turn center lane or median that is at least 8’ wide, or where wide traffic lanes and/or shoulders can be narrowed enough to provide at least 8’ of space for crossing the road.
- Appropriate at signalized or unsignalized crosswalks. Where unsignalized, refuge areas are recommended when pedestrians cross two or more through traffic lanes in one direction.

Design Guidelines:

- **A**: The island must be accessible, preferably with at-grade passage through the island rather than ramps and landings. Detectable warning surfaces must be full-width and 2 ft deep to warn visually impaired pedestrians.
- **B**: Pair MUTCD W11-15 and W16-7P crossing sign assembly
- **C**: Requires 8’ width between travel lane and 20 ft length (40’ preferred). (AASHTO 2012)
- **D**: The path through the median should be the same width as the crosswalk. Minimum clear width of 4 ft required.

Example of a path crossing with median crossing treatment in Bozeman, Montana
**TIER I TREATMENT**

**Enhanced Crossings with Beacons**

Enhanced crossings feature user-actuated warning beacons to increase motor vehicle yielding compliance at crossings of multi-lane or high volume roadways. Types of active warning beacons include Rectangular Rapid Flashing Beacons (RRFBs) or pedestrian hybrid beacons (HAWK signals).

Typical Applications:

- Implemented at mid-block locations, or at intersections where signals are not warranted or desired.
- Where driver yield compliance at shared-use path crossings is low.

Design Guidelines:

- **A**: Includes MUTCD W11-15 and W16-7P signage
- **B**: Providing multi-beacon installations on mast arms or center islands improves driver yielding behavior
- **C**: Painted stop line markings with MUTCD R1-5 signage at yield location
- **D**: Pushbuttons should be easy to identify and access and be user-responsive.
Sidepath Crossings

Sidepath crossings provide a high degree of comfort on long uninterrupted roadway segments, but have operational and safety concerns at driveways and intersections with secondary streets. Crossings should be designed to promote awareness and facilitate proper yielding of motorists to bicyclists and pedestrians.

Typical Applications:

- At controlled and uncontrolled sidepath crossings of driveways or minor streets
- Used to provide for visibility and awareness of the crossing by motorist in advance of the crossing
- Increases the predictability of sidepath and road user behavior through clear, unambiguous right-of-way priority.

Design Guidelines:

- **A**: The sidepath should be given the same priority as the parallel roadway at all crossings.
- **B**: Provide clear sight triangles for all approaches of the crossing.
- **C**: Consider configuring crossings with a raised speed table
- **D**: Use high visibility crosswalk markings to indicate the through area of the crosswalk.
**Tier II Treatment**

**Urban Context: Street-Level Separated Bike Lane**

These bikeways are at street-level and use a variety of methods for physical separation from passing traffic. A striped buffer plus a motor vehicle parking aisle, flexible delineator posts*, or other vertical elements provide the visual and/or physical separation from motor vehicle traffic. A separated bicycle lane (SBL) treatment is one of the best ways to create an “all ages and abilities” bicycling environment on busy streets.

**Urban Context: Sidewalk-Level Separated Bike Lane**

These bikeways are vertically separated from motor vehicle traffic. Many are paired with a furnishing zone between the SBL and adjacent parking or travel lane. At intersections, the raised SBL can be dropped and merged onto the street or maintained at sidewalk level. Raised SBLs may be most beneficial along higher speed streets with few driveways and cross streets, along streets with multiple lanes, high speeds or volumes, or high parking turnover.

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**Trade-offs required with Separated Bike Lanes**

When planning SBLs in an urban or suburban context, it is important for officials to understand the trade-offs that are frequently required. Compared to a standard bike lane, SBLs require 3’-8’ of additional space for a painted or raised buffer from adjacent traffic or parked cars. To accommodate this important Tier II treatment option, the following may result:

- removal of an auxiliary left or right turn lane
- restriction of parking to one side of the street only
- a road diet that re-allocates a travel lane for bicycle use and/or continuous left turn lanes (typically a safety improvement for all road users)

While traffic studies and community engagement are important steps in the planning process, officials should not automatically remove the SBL as an option if either approach results in a less-than-ideal outcome. The desire to accommodate a wide variety of people that range from age 8 to age 80 and/or bicyclists who are both highly experienced or novices should always be in the forefront of the effort. Without that, many of the proposed Tier II treatments may result in bicycle facilities that are either non-existent—e.g. shared lane markings—or so poorly designed that they fail to encourage novice bicyclists, families and seniors to use them.

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* - Horizontal spacing of delineator posts should be 20’ on-center when adjacent to a parking lane and when adjacent to a travel lane, should correspond with the posted speed limit, e.g. 30’ spacing for a 30 mph roadway.
Urban Context: Two-Way Separated Bike Lane

Two-way separated bike lanes (aka cycle tracks) are bicycle facilities that allow bicycle movement in both directions on one side of the road. These facilities are within the roadway right-of-way, at sidewalk level or street level and physically separated by a vertical element. They share some of the same design characteristics as one-way separated bicycle lanes, but may require additional considerations at driveway and side-street crossings. When raised islands are used as a buffer for street level cycle tracks, breaks should be included to facilitate drainage to existing catch basins adjacent to the sidewalk curb.

Additional considerations include:

- Functions well to fill gaps in shared-use path corridors.
- Functions well on streets with few conflicts such as driveways or cross-streets on one side of the street.
- Standard bidirectional separated bike lane width is 12 ft (FHWA Separated Bike Lane Guide 2015). Reduced width is 10 ft (NACTO Bike Guide 2012).
- Minimum separation width next to parking is 3 ft to accommodate opening doors (NACTO Bike Guide 2012).
- In constrained conditions for short segments, minimum width can be 8 ft (AASHTO Bike Guide 2012).
**TIER II TREATMENT**

**Urban Context: Neighborhood Bikeway**

Cities and towns throughout Niagara and Erie Counties could designate a group of neighborhood streets as a Neighborhood Bikeway (aka “bicycle boulevard”). The goal is to create a low-stress bicycle route by reducing traffic volume and/or speed. Traffic calming elements that slow and divert through-traffic provide a more comfortable environment for a wider variety of bicyclists. A Neighborhood Bikeway utilizes a range of context-sensitive bicycle improvements for streets that are typically residential with low traffic volumes/speeds and run parallel to a busier roadway.

**Horizontal + Vertical Deflection**

Horizontal traffic calming devices cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering. Speed humps can also be used to slow traffic, though input from emergency services and plow operators should always be considered.

**Volume Reduction Strategies**

Maintaining motor vehicle volumes below 3,000 per day (1,000-1,500 is ideal) greatly improves bicyclists' comfort. To manage volume, physical or operational measures can be implemented on routes that have been identified as a bicycle boulevard.

**MUTCD R4-11:**

These signs encourage motorists to defer to bicyclists on low volume streets

**Branding**

Roadway stencils and street sign toppers help to distinguish a Bike Boulevard and give it a strong brand.

**Sign Topper**

**Stencil**

**Traffic Restriction Signage**

The most straightforward traffic volume reduction strategy are signs restricting motor vehicle through movement, including stop signs on side street approaches to favor bike boulevard traffic.

**Median Traffic Diverters**

Median traffic diverters restrict through motor vehicle movement while providing a refuge for bicyclists to cross the busier roadway in two stages.
Rural Context: Enhanced Shoulder

To provide more generous visual separation from roadway traffic, Enhanced Shoulders should be incorporated on Tier II corridors in rural contexts. In most locations, they may be used by both bicyclists and pedestrians. However, if a sidewalk is present, each side may be considered a striped bike lane instead. In both cases, the shoulder or bike lane width is to be a minimum of 8’ in width. Treatment options can include:

- 8”-12” wide edge line striping with adjacent rumble strip between travel lane and edge of pavement
- Pair of 4”-6” wide edge lines 3’ apart, connected with diagonal hatch lines (leaving a clear 5’-wide zone for bicycle and pedestrian use); rumble strip to be placed within the buffer zone

The addition of a wider edge line and rumble strip along Rt 18 in Porter would better accommodate bicyclists

Wide shoulders can enhance bicycle access and comfort by including a striped buffer area and rumble strips (photo from FHWA Small Town and Rural Multimodal Networks Guide)
Urban and Rural Context: Bridge Crossings

Because most of the bridges in the GBNRTC region have long lifespans, many of the likely bike facility improvements will involve retrofits. While longer-term bridge reconstruction projects should include Tier I paths separated from roadway traffic by a crash barrier, retrofit projects should aspire for Tier II treatment where space allows. More constrained bridge corridors will likely need to settle for a Tier III bike lane or shoulder as the minimally accepted bike facility.

Where bicycle facilities are desired on bridges without them, or with minimal shoulders, a number of options should be considered to improve bicycling comfort at relatively low cost, including:

- narrowing existing travel lane width to 10’-11’ in width
- reducing the number of travel lanes, sometimes resulting in an asymmetrical bridge configuration which works well in urban contexts in particular
- reducing or potentially eliminating a striped median

Other, more-costly options may include 1) shifting travel lane and/or shoulder width to an adjacent narrow sidewalk to provide a multi-use facility, or 2) cantilevering a wider sidewalk off the side of the bridge, provided that the additional weight is compatible with the structural capacity of the bridge.

No matter the bike facility along the length of the bridge, most critical is for transitions to be well designed so bicyclists aren’t led into a hazardous situation at the end of the bridge. Continuity of the treatment is ideal so those riding on a protected path on the bridge are connected to a shared-use path at the end of the bridge. This may not always be practical, so transitions need to be carefully considered when a path transitions to a bike lane, or vice versa. Roadway features such as bump outs, slip lanes, islands and green pavement treatment should be considered at the transition point.

Previously a 4’-wide shoulder, a wide bike lane with delineator posts was retrofitted onto the Longfellow Bridge in Boston by narrowing the adjacent travel lanes from 12’ to 10.5’

Curb extensions and ramps can ease the transition from a protected bridge path to striped bike lanes on the connecting roadway
BIKE BUFFALO NIAGARA

TIER III TREATMENT

Urban Context: Standard Bicycle Lane

Bicycle lanes designate an exclusive space for bicycles through the use of roadway striping and signage. Occasionally, reducing travel lane width to 10’ provides space for standard 5’-wide bicycle lanes. They may be added to roads with extra wide travel lanes or in replacement of a parking or a travel lane. The latter is typically part of a “road diet” project that is a viable option on four-lane roads with <20,000 daily vehicle trips. Where space is not available for bike lanes, a single “climbing lane” for bikes heading uphill with a downhill shared lane can be employed.

Urban Context: Buffered Bicycle Lane

Buffered bicycle lanes are conventional bicycle lanes paired with a striped buffer space separating the bicycle lane from adjacent travel or parking lane. The buffers provide an enhanced visual separation from passing traffic and/or protection from the opening of car doors (see photo at far right) in the adjacent motor vehicle parking aisle. Buffers are especially critical on roadways with a high volume of truck traffic or in business districts with high parking turnover.

Rural Context: Standard Shoulder

Along state and county highways and local arterial roads, a 5’-wide shoulder treatment provides a minimum bicycle facility. Where needed to improve both motorist and bicyclist safety, rumble strips can be incorporated but should be kept to the far left side of the shoulder area (adjacent to the white edge line). Although some segments of Tier III rural roads will feature much wider shoulders, 5’ should be considered the minimal width along the entire length of the corridor. Bicycle lane stencils should only be included if there is an adjacent sidewalk on at least one side of the road for pedestrian traffic.
Urban and Rural Context - Intersection Improvements and Crossing Markings*: Striping bicycle facilities at or through intersections can provide a more comfortable bicycling environment by providing guidance on where to wait for a signal to change or a well-marked route through the intersection to a continuation of the bikeway. By establishing a clear boundary, intersection lane markings effectively mark the paths of travel for through bicyclists and turning bicyclists, as well as through and turning motor vehicles. The use of green colored pavement raises awareness for all road users to potential conflict areas and is recommended. In rural contexts, these applications should be incorporated only where bike lanes are to be incorporated, not where bikeable shoulders are planned.

### Bike Box
A bike box places riders in a designated area ahead of queuing traffic during the red signal phase, also helping to reduce right-hook conflicts. Ideal for two-lane roadways.

### Two-Stage Turn Box
For bicyclists uncomfortable sharing lanes with turning traffic, a two-stage turn boxes offers a more comfortable left-turn option. Ideal for roadways with three or more lanes.

### Bicycle Signal
Bicycle signals facilitate bicyclist crossings of roadways by clarifying when to enter and by restricting other movements during the bicycle phase.

### Crossing Markings Design Features
- Durable, green pavement markings (thermoplastic or epoxy) through the intersection is the ideal treatment.
- Striping adjacent to motor vehicle travel lanes should be 6”-8” wide.
- Broken lane lines should be 2 foot-long lines with 2’ to 4’ spacing.
- Shared lane markings, chevrons and helmeted rider stencils may be used to increase visibility and awareness of an approaching conflict area and can be used across the entire intersection.
- Crossing lane width should match adjoining bicycle facility width.
BIKEWAY MAINTENANCE

No matter the Tier designation for a recommended corridor, regular maintenance for the bikeway is important to ensure a safe and well-used facility. Regular maintenance includes sweeping, maintaining a pothole-free and smooth roadway, installing bike-friendly drainage grates, repainting stencils and bike lane stripes, delineator post repair and snow and ice removal. Since roadway reconstruction is relatively rare, pavement overlay projects are typically the perfect opportunity to both add new bike facilities or improve existing facilities. The table to the right--from the 2015 Buffalo Bicycle Master Plan Appendix--highlights the frequency of typical maintenance activity for the region’s on-road bikeways and off-road trails.

<table>
<thead>
<tr>
<th>MAINTENANCE ACTIVITY</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspections</td>
<td>Seasonal - at beginning and end of Summer</td>
</tr>
<tr>
<td>Pavement sweeping / blowing</td>
<td>As needed, with higher frequency in the early Spring and Fall</td>
</tr>
<tr>
<td>Pavement sealing</td>
<td>5 - 15 years</td>
</tr>
<tr>
<td>Pothole repair</td>
<td>1 week – 1 month after report</td>
</tr>
<tr>
<td>Culvert and drainage grate inspection</td>
<td>Before Winter and after major storms</td>
</tr>
<tr>
<td>Pavement markings replacement</td>
<td>As needed</td>
</tr>
<tr>
<td>Signage replacement</td>
<td>As needed</td>
</tr>
<tr>
<td>Shoulder plant trimming (weeds, trees, brambles)</td>
<td>Twice a year; middle of growing season and early Fall</td>
</tr>
<tr>
<td>Tree and shrub plantings, trimming</td>
<td>1 – 3 years</td>
</tr>
<tr>
<td>Major drainage response (washouts, fallen trees, flooding)</td>
<td>As soon as possible</td>
</tr>
<tr>
<td>Flex post maintenance</td>
<td>As soon as possible</td>
</tr>
<tr>
<td>Snow / ice removal</td>
<td>See Snow Ice Removal Section (page 71)</td>
</tr>
</tbody>
</table>
BIKEWAY MAINTENANCE

Sweeping

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept. Guidance includes:

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the spring to remove debris from the winter.
- Perform additional sweeping in the fall in areas where fallen leaves accumulate.

Signage

Bike lanes, shared shoulders, Neighborhood Bikeways and paths all have different signage types for wayfinding and regulations. Such signage is vulnerable to vandalism or wear and requires periodic maintenance and replacement as needed. Guidance includes:

- Check regulatory and wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear.
- Replace signage along the bikeway network as needed.
- Perform a regularly-scheduled check on the status of signage with follow up as necessary.
- Create a Maintenance Management Plan.

Shoreline Trail bike route signage
BIKEWAY MAINTENANCE

Roadway Surface

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level and an uneven pavement surface can result due to settling over the course of days or weeks. Guidance includes:

- Maintain a smooth pothole-free surface.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼”.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.

Pavement Overlays

Pavement overlays represent good opportunities to improve conditions for bicyclists if done carefully. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects also offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes. Guidance includes:

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If the shoulder or bike lane pavement is of good quality, it may be appropriate to end the overlay at the shoulder or bike lane stripe provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼ inch of the finished pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property lines to prevent gravel from being tracked onto shoulders or bike lanes.
BIKEWAY MAINTENANCE

Drainage Grates

Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries. Guidance includes:

- Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.
- If one currently does not exist, create a program to inventory all existing drainage grates and replace hazardous grates as necessary – temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.

Construction Management Plan

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signage approaching each affected section (e.g., “Bike Lane Closed,” “Trail Closed”), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics and be signed. Guidance includes:

- Enforce speed limits and other rules of the road.
- Ensure safe access for bicyclists along roadways within the designated regional bicycle network using warning signs and detours as needed.

Temporary bike lane signage
BIKE BUFFALO NIAGARA

BIKEWAY MAINTENANCE

Delineator Posts

Flexible plastic delineator posts (aka “flexposts”) are an important part of the toolkit when it comes to separating Tier II bicycle facilities from motor vehicle traffic in an urban context. They are only effective if they remain upright and undamaged however. Careful maintenance is required as they can easily be bent over when struck by an automobile. Guidance includes:

- **Flex posts** typically fail in one of two ways: either the post can be bent over after multiple impacts -- or the base gets completely detached from the pavement.

- **Bent Posts**: Typically, taller posts support more post weight and are likely to bend after multiple impacts. The most cost effective way to repair bent flexposts is to cut them off above the bend with a utility knife or angle grinder, drill new holes in the base of the shortened post and reinstall. As noted shorter flexposts do a better job resisting bends, so as you shorten the post you should receive fewer maintenance calls.

- **Detached posts**: This is a simple case of re-installation of the base. In particular for initial and re-installation, be mindful that the street is clear of grit to achieve maximum adhesion.

In either case previously described, it’s important to not let damaged flexposts lay in the street as posts endure a lot more damage in the horizontal position than they do when upright. Developing internal policies to repair flexposts is a crucial piece of successful installations as missing, damaged and unsightly flexposts diminish the utility of the separated bike lane’s visual barrier and reflect poorly on the municipal authority tasked with maintaining them.

Flexposts in need of maintenance
BIKEWAY MAINTENANCE

Snow and Ice Removal

Winter maintenance of greenway trails and on-road bikeways is an important consideration for cities and towns that receive significant amounts of snowfall. Cities should expect bicycle activity year round, even in inclement conditions and providing safe conditions for bicyclists (and pedestrians) year round should be a top priority. Safe and comfortable accommodation of active transportation users during the winter months depends on thoughtful roadway design and a strategic snow removal and de-icing program that includes appropriate snow removal equipment and a snow removal prioritization schedule. Along greenway trails that may be currently used by Nordic skiers and/or those with a crushed stone surface, avoiding plowing during winter months may be the reality in some communities. See Appendix X for more information on maintenance of bike facilities during winter months. Guidance includes:

• Plan bike facilities with sufficient right-of-way to accommodate unimpeded travel, snow removal vehicles and storage space for snow. Buffered bike lanes and cycle tracks have the advantage of allowing for additional vehicle access and storage space.

• Parking restrictions offer additional space for maintenance of bike facilities between a parking lane and vehicle travel lane during snow events.

• Alternative off-street or parallel facilities are necessary when the clearing of bikeways on major routes is not possible. They should be clearly marked, well-maintained and facilitate at least the same level of access and connectivity.

• Municipalities should invest in smaller, more specialized snow removal vehicles to allow for better access to narrower bike facilities (see photo below). Due to their smaller size the vehicles have better maneuverability and may also be used for clearing sidewalks. ATV-mounted snow plows are one example of a specialized vehicle.

• Recessed thermoplastic pavement markings, protected flexible bollards, tapered curb edges and vertical delineators are among some of the additional measures employed to further protect bike facilities and maintenance equipment from wear or damage.

• Jurisdictions that experience significant snow events and have a de-icing program should employ a proactive or anti-icing strategy and have a plan for the removal of de-icing surface material debris that accumulates in and around bike facilities and sidewalks.

• A prioritization schedule for snow removal is necessary and should focus on primary routes and destinations that impact the highest volume of bicyclists immediately following snow events. These include routes to and from commercial centers and schools and key connections such as bridges.

Hamilton cycle track (source: Norma Moore)