

Winter Maintenance



Ten Questions (and Answers) about Winter Maintenance of Walkways and Bikeways

Communities across North America are dedicating more space and priority to multimodal transportation infrastructure, and those in snowy climates often ask this question:

“How should we maintain sidewalks, bike lanes, and trails in the winter?”

Winter maintenance is an important component of creating a comfortable environment for walking and bicycling year-round. This area of practice is unique, requiring specific legal, technical, and design considerations to operate successfully. With thoughtful planning, clear policies, agency

coordination, and appropriate staffing and equipment, it's possible to perform the winter maintenance needed to keep people walking and biking year-round.

This resource guide was developed specifically to answer important questions about winter maintenance for pedestrian and bicycle facilities and to help communities take a holistic look at their winter maintenance practices. We also recognize that maintenance is one component of a bigger picture approach and that cities such as Edmonton, AB¹ and Winnipeg, MB² are leading the way in embracing a winter city culture that extends beyond snow and ice clearance on walkways and bikeways.

» **These are the 10 most frequently asked questions we hear as part of our work with communities across North America.** «

1 https://www.edmonton.ca/city_government/documents/PDF/TheLoveofWinter-ImplementationPlan.pdf

2 <https://www.tourismwinnipeg.com/winter-experiences>

1 Do people walk and bike in snowy and icy conditions?

Put simply, yes! There are many places with snowy winters where people continue to walk and bike year-round in significant numbers. For example, Figure 1 below shows that in Cambridge, MA, the bike lanes on Broadway near the Massachusetts Institute of Technology (MIT) are well used throughout the year.

In Madison, WI, counts show that walking often occurs at higher rates than bicycling. On the State Street pedestrian/transit mall between downtown and the University of Wisconsin, winter pedestrian counts are approximately 50% of peak summer counts (see Figure 2). Nearby, on the Capital City Trail, which is five blocks from State Street, winter bicycle counts are 10-20% of peak summer counts (see Figure 3).

Minnesota, which is the 4th-coldest³ and 11th-snowiest⁴ state in the United States, also tracks year-round walking and bicycling. Data collected by the Minnesota Department of Transportation between 2014 and 2017 revealed the following⁵:

- At 10 sites across the state, 18% of total annual pedestrian traffic is generated during the winter months (defined in the report as December through March) (see Figure 4).
- At four sites, the percentage of pedestrian volumes during the winter varied from 9% to 27% of the annual total pedestrian volumes.
- At 10 sites across the state, 7% of total annual bicyclists rode a bike during winter (see Figure 4).
- Across these same 10 sites, winter bicycling varied from 1% of total annual trips on a rural, recreational bike trail in Lanesboro to 18% on an urban street with bike lanes in Saint Paul.

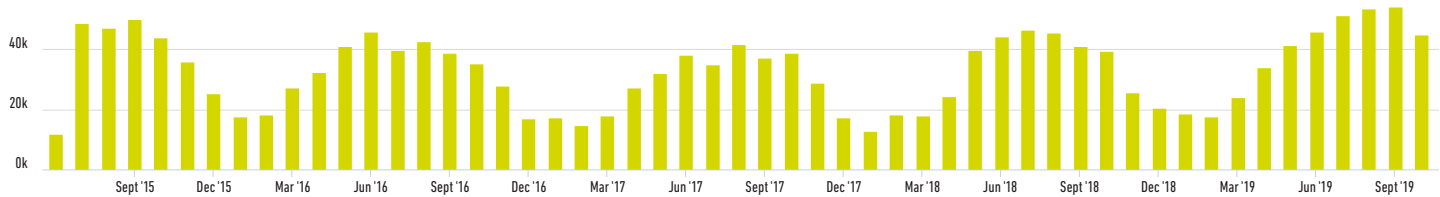


Figure 1. Bicycling on Broadway in Cambridge, MA by month, between the years 2015 and 2019.
Credit: Eco Counter <http://eco-public.com/public2/?id=100023038#>

3 <https://www.currentresults.com/Weather-Extremes/US/coldest-states.php>

4 <http://www.usa.com/rank/us--average-snow--state-rank.htm>

5 <http://www.dot.state.mn.us/bike/documents/planning-research/bike-ped-report.pdf>

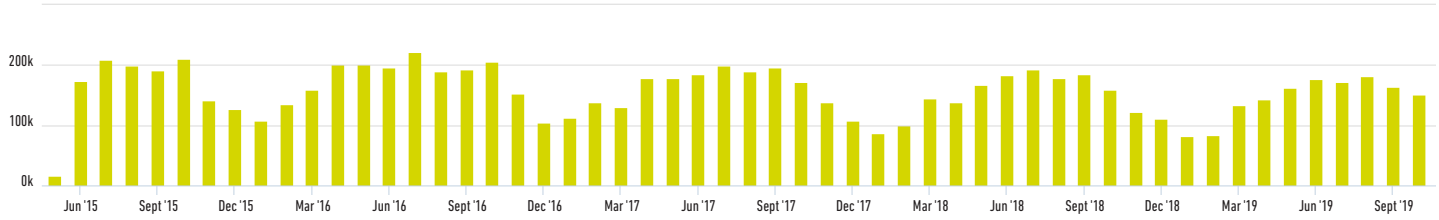


Figure 2. Pedestrian counts on the north side of State Street in Madison, WI by month, between 2015 and 2019.
 Credit: Eco Counter <http://www.eco-public.com/public2/?id=100021426#>

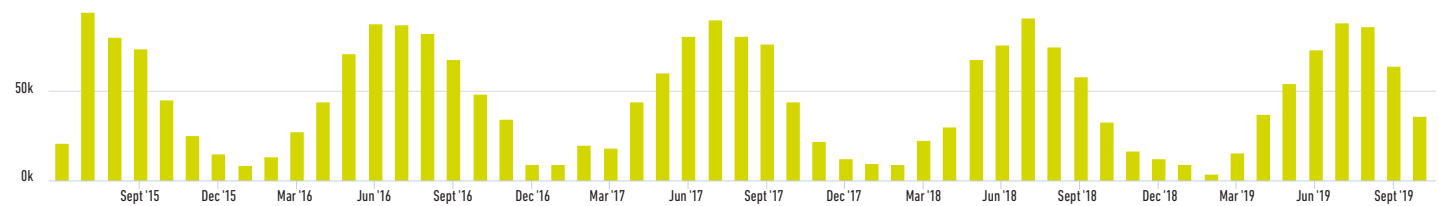


Figure 3. Bicycle counts on the Capital City Trail in Madison, WI by month, between 2015 and 2019.
 Credit: Eco Counter <http://www.eco-public.com/public2/?id=100020865#>

Total Traffic Volumes Across the Ten Reference Sites that Differentiate Between People Walking and Biking, 2014-2017

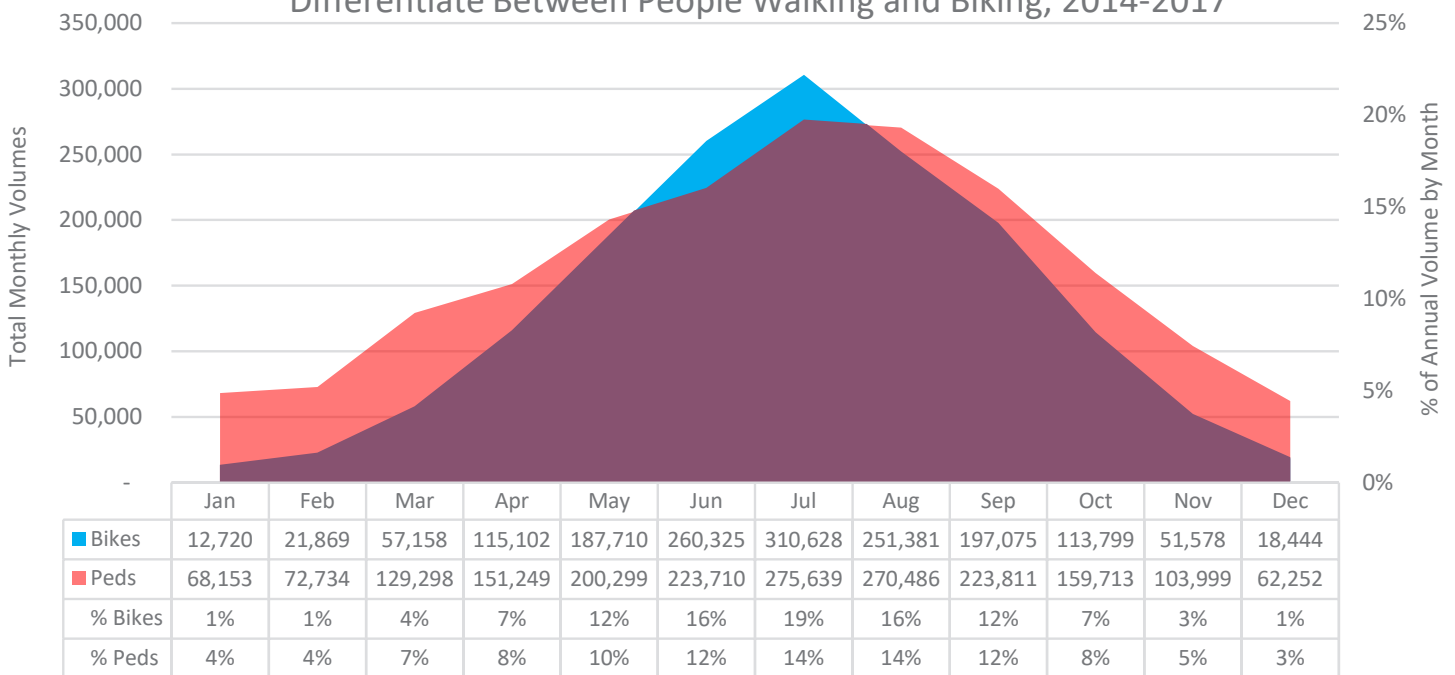


Figure 4. While winter walking and bicycling is less frequent at ten sites across Minnesota as compared to warmer months, data shows that people continue to walk and bike year-round. Credit: Minnesota Department of Transportation

2 Why do people walk and bike in the winter?

Some people walk and bike in the winter because they prefer to, while others do so because it is the most rational or economically viable option. More than 30% of U.S. residents⁶ do not have a driver's license, and close to 10% of U.S. households do not have a motor vehicle. These percentages are typically higher in urban areas, with numbers including 54% in New York City, 34% in Boston, 24% in Cleveland, 19% in Milwaukee, and 17% in Minneapolis.⁷

People walking and biking in winter are making the same kinds of trips as those they make during the rest of the year, and the same kinds of trips as people in cars. They

are getting to work or school, going to shop, visiting friends and relatives, accessing essential medical and social services, attending sporting events or worship services, or participating in a wide variety of other everyday activities. In addition, many people walking in winter are going to and from transit (i.e. bus, light rail, subway) services.

Also of note: many of those who walk and bicycle in winter are people with disabilities, older adults, and children. These people are typically among the most vulnerable road users even without the added challenge of winter conditions.



Figure 5. A bicyclist on the University of Minnesota - Twin Cities campus in Minneapolis.

⁶ <https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter4.cfm>

⁷ <https://www.governing.com/gov-data/car-ownership-numbers-of-vehicles-by-city-map.html>

3 Will more people walk and bike if infrastructure is clear of snow and ice?

Surveys have shown that a lack of winter maintenance contributes to lesser amounts of walking and biking.

- The *Hennepin County 2040 Bicycle Transportation Plan*⁸ (Hennepin County is home to Minneapolis) revealed that snow and ice removal factored heavily into the decision by nearly 50% of survey respondents who would not ride a bicycle during the winter.



Figure 6. Pedestrian travel in winter is often hindered by snow piled at curb ramps, as shown in this image from Madison, WI.

- A survey in Toronto found that the presence of snow and ice kept people from walking in winter, especially older adults, and that icy sidewalks and puddles at street crossings and curb ramps were key elements influencing their reticence⁹ (see Figure 6).
- Research for the 2013 Ottawa Cycling Plan found that 19% of respondents would use bike paths frequently if they were maintained in winter, and another 17% would use them sometimes.¹⁰ Ottawa subsequently created a winter-maintained cycling network and has seen an increase in winter-time use on these trails as a result.¹¹
- A study by Winters et al. indicated that icy or snowy conditions, glass or debris, and potholes or uneven paving have a statistically significant negative impact on cycling. Debris, snow, ice, overgrown vegetation, and poor-quality surfaces all pose hazards to people cycling and are potential causes for crashes.¹²

Another example of this effect comes from Arlington County, VA, which used to have a policy of not maintaining bike paths in the winter. While a considerable number of people continued to ride year-round regardless of temperature, ridership consistently disappeared as soon as snow or ice was present. Due to these trail counts, County policy was subsequently amended to identify a 10-mile/16-kilometer network of winter-maintained bike paths.¹³

8 <https://www.hennepin.us/-/media/hennepinus/residents/transportation/biking/bicycle-transportation-plan.pdf?la=en&hash=26ABAFD2C3476F5AD2CADF6EEB7DCDD509DE6295>

9 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3732686/>

10 https://documents.ottawa.ca/sites/documents/files/documents/ocp2013_report_en.pdf

11 <https://open.ottawa.ca/datasets/bicycle-trip-counters>

12 Winters, M., Davidson, G., Kao, D., Teschke, K., 2011. Motivators and deterrents of bicycling: comparing influences on decisions to ride. *Transportation* (38), 153-168.

13 <https://emergency.arlingtonva.us/weather/snow-ice/clearing-snow-on-trails/>

4

Who is responsible for winter maintenance—property owners or government agencies—and what are the challenges?

Bikeways (e.g. trails, side paths, separated bike lanes, standard bike lanes, shoulders, and bike boulevards¹⁴) are nearly universally maintained by government agencies. Not all agencies maintain bikeways in the winter, and some agencies only maintain priority facilities, such as trails.

When a separated bikeway (e.g. trails, side paths, separated bike lanes) is located along a county or state/provincial road, the road authority frequently develops an agreement with the local municipality to carry out the maintenance work. Sometimes these facilities are cleared before nearby motor vehicle lanes, depending upon priority level.

Snow clearance from non-separated bikeways (e.g. standard bike lanes, shoulders) should be done at the same time as snow clearance from motor vehicle travel lanes. However, due to lower prioritization, plow paths, wheel tracks from motor vehicles, ice and slush, and a lack of adequate physical separation, non-separated bikeways are often not maintained to a standard that provides a safe and comfortable bicycling experience after a winter storm.

Walkways (i.e. sidewalks, street crossings, curb ramps) are maintained by one or more of the following:

- Government agencies
- Individual property owners
- Special districts (a group of individual property or business owners with pooled resources)

In some cases, government agencies clear all walkways. Examples include Burlington, VT¹⁵; Montreal, QC¹⁶ (see Figure 7); and Rochester, NY (only when there is more than 4 inches/10 centimeters snow).¹⁷ Outside urban areas, this approach is usually limited to suburbs where walkway networks are concentrated on arterial roads; for example, Richfield, MN, a suburb of Minneapolis.¹⁸



Figure 7. Municipal crews clearing sidewalks in Montreal.

The more common approach to winter maintenance of walkways in the United States is to assign the responsibility to individual property owners that are adjacent to the walkway. Communities using this approach nearly always have an ordinance requiring snow removal from sidewalks within a designated timeframe, often 24 hours. Typically residents have the option to submit complaints about uncleared sidewalks with municipal staff. Enforcement varies by city, depending largely on specific policies and available staff resources. Madison, WI is an example of a city with an aggressive enforcement process that follows registered complaints, with no warnings given before fines are issued.¹⁹ Madison also has three full-time staff members who inspect sidewalk snow and ice clearance on high-priority corridors such as downtown and around schools.

14 https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwas18077.pdf

15 <https://www.burlingtonvt.gov/DPW/Snowfighting-Program>

16 <https://beta.montreal.ca/en/topics/snow-removal-sidewalks-and-streets>

17 <https://www.cityofrochester.gov/sidewalkplowing/>

18 <https://streets.mn/2019/02/20/municipal-sidewalk-clearing-in-richfield-an-interview/>

19 <https://www.cityofmadison.com/residents/winter/SnowIce/snowRulesFAQs.cfm>

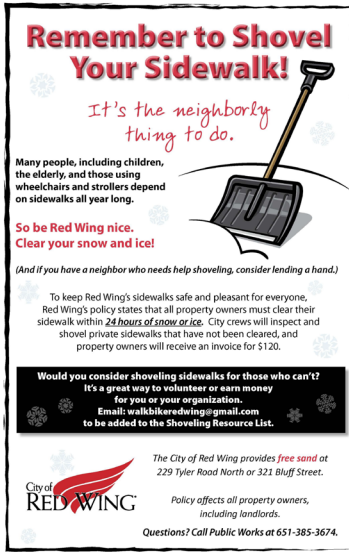


Figure 8. An educational flyer in Red Wing, MN notifies individual property owners of their responsibility to clear sidewalks.

Some communities create educational materials to notify property owners of their maintenance responsibility (see Figure 8)²⁰, but the individual property owner approach often results in a patchwork effect. Some sidewalks are cleared while others remain uncleared due to a lack of awareness, vacancies, vacationing property owners, and property owners with limited physical abilities; street plows that push snow onto walkways

create additional challenges. Also, many communities do not explicitly require snow removal at curb ramps, further contributing to the patchwork effect. Clearing street crossings and access routes to pedestrian push buttons are additional challenges. While these latter items remain the responsibility of the municipality, staff resources and training are often inadequate and may result in delayed or insufficient snow clearing.

Some communities employ a government agency/property owner hybrid approach, where priority winter walking routes are identified and cleared by municipal crews while the remaining sidewalks are cleared by individual property owners. In this scenario, the municipality uses a set of geographic destinations to identify pedestrian priority routes. These may include proximity to schools, parks, downtown areas, and transit routes. Duluth, MN and Bangor, ME are two American cities that employ this hybrid approach (see Figure 10²¹ and Figure 11).

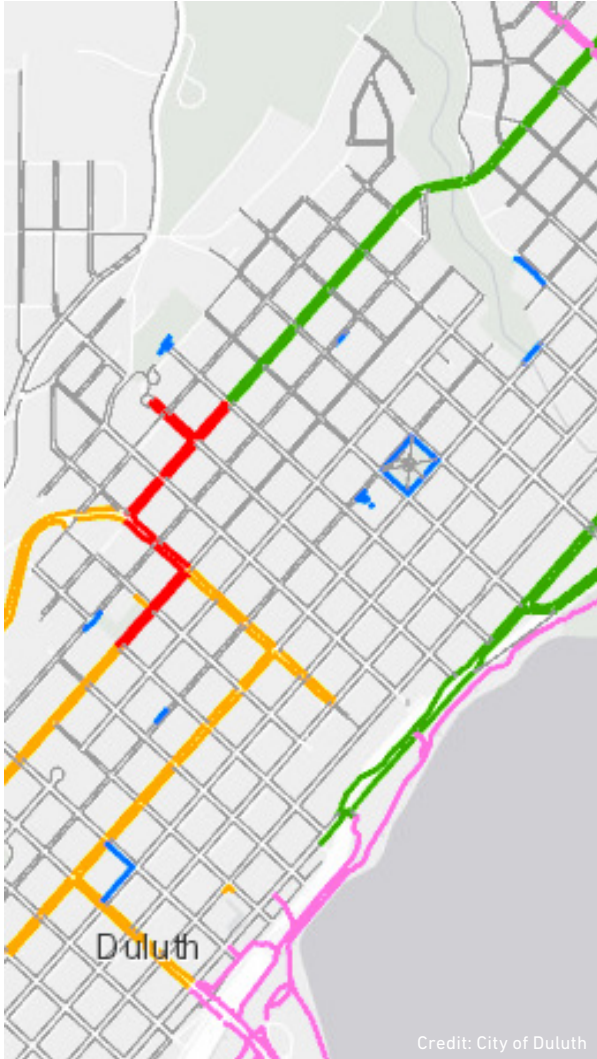
The final approach is districts, where individual property owners in close geographic proximity are charged annual service charges (a municipal tax) for special services, such as hiring private contractors to clear snow and ice from walkways. These districts are sometimes known as “business improvement districts” or “special service districts,” and are often located in downtown and neighborhood commercial areas. Downtown Fargo, ND is an example of a district that prioritizes winter walkway maintenance (see Figure 9).²² A more informal approach using donations has been developed in a residential neighborhood by a non-profit organization in Ann Arbor, MI.²³

Winter Sidewalk Maintenance Funding by District



Figure 9. Walkways are sometimes cleared by a district authority.

20 <https://www.red-wing.org/487/Shoveling-Your-Sidewalk>
 21 <https://duluthmn.gov/winterwatch/sidewalk-priority-maps/>
 22 <https://www.downtownfargobid.com/>
 23 <https://snowbuddy.org/>



Credit: City of Duluth

Figure 10. Duluth, MN has a 100-mile/160-kilometer priority walkway network cleared by city and county crews. These routes connect transit routes (shown in green), parks (blue), schools (red), high pedestrian traffic areas (pink), and medium pedestrian traffic areas (yellow).

Partial-Municipality Led Sidewalk Snow Clearing

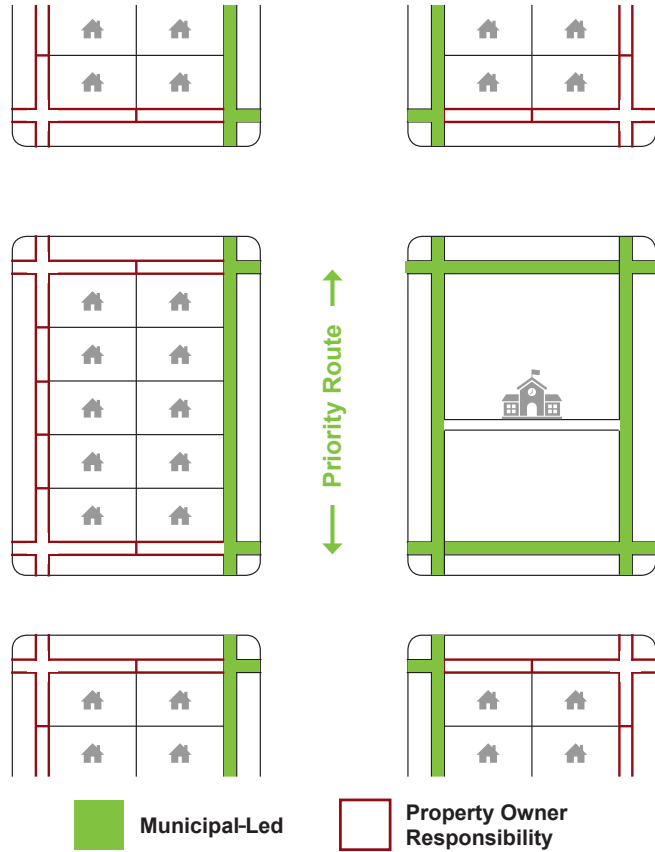


Figure 11. A detailed map illustrating the hybrid approach, where priority routes are cleared by government crews and non-priority routes are maintained by adjacent property owners.

5 What are the best ways to remove snow and ice from walkways and bikeways while also caring for the local ecosystem?

Like for motorists, the safest walking and bicycling surface for pedestrians and bicyclists is bare pavement. Achieving bare pavement may require action before, during, and after winter precipitation.

- **Before:** Pre-treating path, walkway, or street surfaces with salt brine will lower the temperature at which liquid freezes, often keeping pavement wet and reducing the formation of ice (see Figure 12).
- **During:** Clearing accumulated precipitation often prevents footsteps and bicycle tires from packing snow onto surfaces.
- **After:** Clearing snow and ice with equipment and spreading material (e.g., sand, small diameter gravel, salt) speeds melting and improves traction.



Figure 12. In this case, salt brine has been spread on a bike lane before winter precipitation.

More and more, government agencies are using liquid anti-icing mixtures such as salt brine to pre-treat roadways, bikeways, and walkways before a winter storm. Salt brine is commonly applied using “pencil spray nozzles” attached to the back of a truck or utility vehicle, leaving parallel lines of salt brine mixture (see Figure 12).

Pre-treating or anti-icing offers many benefits over de-icing (i.e. applying salt after a snow storm), including faster salt activation and quicker melting, lower melting temperature, better salt penetration, and reduced salt loss due to a lower “bounce and scatter” rate, which saves money and reduces environmental impacts by using less salt.²⁴

Applying too much salt can be very harmful to the local ecosystem as it eventually ends up in our lakes, rivers, streams, and wetlands. High levels of salt in waterways pollutes our water supply and is harmful to fish and other aquatic life. Once salt is in our waterways, it does not break down.²⁵

Timing of snow and ice removal efforts is also an important consideration. Sometimes winter precipitation begins with rain, and with a subsequent drop in temperature, ends with ice and/or snow. Cold air often follows winter precipitation, freezing liquid into ice on a walkway or bikeway. To achieve bare pavement in these scenarios, keep the following in mind:

- If rain falls before ice or snow, spreading salt is ill-advised because rain will wash it away. Furthermore, rain can push salt into storm sewers and bodies of water, causing unnecessary harm to the water supply.
- If rain and snow has turned to slush, remove the combination from walkways and bikeways before the temperature falls very far below freezing. Otherwise this precipitation will stay frozen in place as long as sub-freezing temperatures persist.

²⁴ http://epdfiles.engr.wisc.edu/pdf_web_files/tic/bulletins/Bltn_022_prewetting_antiicing.pdf

²⁵ <https://www.wisaltwise.com/Overview>

6 What type of equipment is needed?

Equipment for maintaining walkways and bikeways varies widely, from snow shovels to plows attached to pick-up trucks. Operators also vary, from pedestrians and tractor operators to licensed drivers. Unlike roads, walkways and separated bikeways (i.e. trails, side paths, separated bike lanes) are narrow facilities that often require smaller vehicles. The dump trucks and graders that clear streets are usually not practical for walkways and bikeways due to their width and weight.

Maintenance vehicle attachments such as plows, blowers, and brooms are vital pieces of winter equipment. Plows may be attached to many different types of vehicles and are used for pushing aside snowfalls of about 2 inches/5 centimeters or more. Blowers and brooms are attached to smaller pieces of equipment (see Table 1). Blowers move large snowfalls (6 inches/15 centimeters or more) and are also routinely used to move windrows, which are compacted piles of snow left over from road plows. Brooms are used to achieve a bare pavement surface and are typically used for snowfalls of 2 inches/5 centimeters or less. Brooms may also be used to achieve bare pavement after plows or blowers have passed. Salt and sand spreaders may be attached to a vehicle (see Figure 13).



Figure 13. A sand spreader on the back of a pickup truck.

Equipment varies in width, but should not be wider than a walkway or bikeway.



Pickup truck with plow

Approximate Width: 8.5 feet/2.6 meters

Walkway/Bikeway Facility Types: Trails, side paths, 2-way separated bike lanes



Skid loader with snow blower

Approximate Width: 4 feet/1.2 meters

Walkway/Bikeway Facility Types: Walkways, trails, side paths, 2-way separated bike lanes, 1-way separated bike lanes



Credit: City of Eden Prairie, MN

Miniature tractor with snow blower

Approximate Width: 4 feet/1.2 meters

Walkway/Bikeway Facility Types: Walkways, trails, side paths, 2-way separated bike lanes, 1-way separated bike lanes



Lawn mower tractor (converted to winter maintenance vehicle) with broom

Approximate Width: 4 feet/1.2 meters

Walkway/Bikeway Facility Types: Walkways, trails, side paths, 2-way separated bike lanes, 1-way separated bike lanes

7 Does the Americans with Disabilities Act (ADA) require snow removal on walkways in winter?

The Americans with Disabilities Act (ADA) requires access to walkways during winter, and the Federal Highway Administration has issued guidance that pedestrian routes must be open and usable throughout the year, with only isolated or temporary interruptions.²⁶ The minimum clear width for pedestrian routes is 4 feet, with 5 feet by 5 feet passing areas every 200 feet. Snow removal is also required on pedestrian facilities that have been constructed with federal funds.²⁷

An example of a winter maintenance policy influenced by ADA concerns comes from the State of Delaware. There, the Department of Transportation (DOT) adopted a sidewalk snow removal policy in 2013 that requires the agency to perform winter maintenance on walkways adjacent to its roads, due in large part to ADA requirements.²⁸



Figure 14. Snow piled in front of pedestrian push buttons prevents people with disabilities from activating the signal.

26 https://www.fhwa.dot.gov/civilrights/programs/ada/ada_sect504qa.cfm#q31

27 <https://www.fhwa.dot.gov/preservation/082708.cfm>

28 <https://deldot.gov/Business/ada/pdfs/SidewalkMaintenancePolicy.pdf>

8 How can walking and bicycling infrastructure be designed for easier winter maintenance?

Several preventative measures can be taken during the design phase of a project to make winter walking and bicycling more feasible. Through careful design, walkways and bikeways can be engineered to avoid issues such as poorly drained walkways and bikeways becoming icy and slippery as a result of the freeze/thaw cycle that often follows a winter precipitation event. Designers should ensure that the areas next to the bikeway or walkway are graded away from the walking or biking surface, and adequate drainage infrastructure should be provided to prevent standing water.

Whenever possible, curb ramps should be located at the high point of an intersection to avoid standing water, and if this isn't possible, ADA-compliant storm drain grates should be added near the base of the curb ramps.

When possible, snow should be stored in the space between a road and a sidewalk or trail. The dimensions will depend upon the given community's climate, but typically these areas range from 4 to 8 feet (1.2 to 2.4 meters) in width.



Figure 15. This sidewalk is lower than the adjacent yards, resulting in pools of standing water in the pathway of pedestrians.

Where there is no space for snow storage, designers should consult with the jurisdiction's maintenance staff to make plans for the off-site removal of snow.

Several communities have retrofitted separated bike lanes that are located at street-level between existing curbs. When these facilities are located down-slope from the crown of a road, snow often melts and re-freezes into icy patches across bike lanes. To prevent this from occurring, it is possible to remove the snow between the travel lanes and bike lanes instead of using this space for snow storage (see Figure 16). The preferred long-term solution is to redesign the street to drain snowmelt away from separated bike lanes.

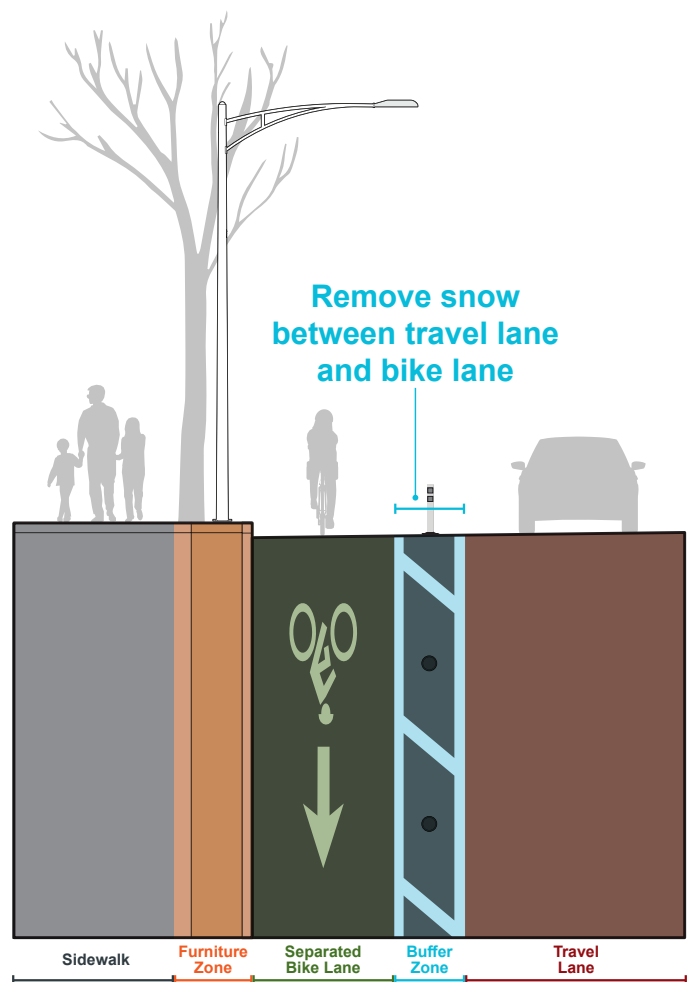


Figure 16. Removing snow from the buffer zone prevents snowmelt from refreezing into icy patches across the bike lane.

9 How should transit stops be maintained in the winter?

Transit (i.e. bus, light rail, subway) stops may see high amounts of foot traffic in winter, making snow and ice removal on nearby walkways critical. Good winter maintenance near transit stops improves safety by keeping pedestrians out of the street and other dangerous areas. The Massachusetts DOT recommends that bus stops have minimum 5-foot by 8-foot boarding and alighting areas cleared of snow and ice, with a minimum 4-foot-wide path connecting with nearby walkways.²⁹

Each community should have a clear idea of who is responsible for maintaining transit stops. The responsible party may be municipal crews, transit agency crews, or adjacent property owners. While some communities, such as Portland, ME, have volunteer programs,³⁰ the most important principle is consistent and reliable maintenance that allows transit users to walk to and from their stops.



Figure 17: A well-maintained bus stop in Minneapolis-Saint Paul. Credit: Metro Transit.



Figure 18: A poorly maintained transit stop will pose significant challenges for transit riders.

29 https://www.mass.gov/files/documents/2018/09/17/MunicipalResourcesGuideForWalkability_2018-08-24.pdf

30 <http://adopt-a-stop.org/>

10 What funding sources are available for winter maintenance?

Properly maintaining walkways and bikeways in the winter requires additional resources including staffing, equipment, and materials. As communities increase their networks of walking and biking infrastructure, it is important to think about the ongoing maintenance and operational costs associated with those facilities before they are built.

Most communities fund winter walkway and bikeway maintenance using general tax funds (sourced through property, sales, and income tax revenues). This is similar to how winter street maintenance is funded. However, if a municipality takes responsibility for winter maintenance of walkways, it is also possible to directly assess property owners for this service. For example, Rochester, NY charges an embellishment fee on property tax bills based on a property's front footage. The charge for sidewalk snow plowing for an average homeowner in Rochester is \$36 per year.³¹

Summary

Multimodal transportation infrastructure helps communities build streets that better serve people of all ages and abilities. As communities expand their walking and biking infrastructure, it is critical that they develop plans for maintaining these facilities throughout the winter to ensure that walking and biking remain viable modes of transportation year-round. Well-maintained walkways and bikeways strengthen confidence in the multimodal network and help provide everyone with equal access to the transportation system.

³¹ <https://www.cityofrochester.gov/article.aspx?id=8589936477>

More Resources

Several agencies have created resources that examine winter maintenance of walkways and bikeways in more detail. These may be helpful resources for communities interested in modifying their winter maintenance policies or practices.

[*Pedestrian and Bicycle Winter Maintenance Study, City of Minneapolis, 2018*](#)

[*Sidewalk Snow Clearing Guide, Minnesota Department of Health, 2018*](#)

[*Best Practices for Cycle Path Winter Maintenance Processes, Tampere University, 2014*](#)

[*A Guide for Maintaining Pedestrian Facilities for Enhanced Safety, Federal Highway Administration, 2013*](#)

[*Winter Maintenance of Pedestrian Facilities in Delaware: A Guide for Local Governments, Delaware Department of Transportation, 2012*](#)

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